NGA-LTER Seward Line CRUISE PLAN
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Funding Source: NSF, NPRB, EVOS, AOOS, UAF

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Scientific Personnel:

3 Hannah Kepner	Zooplankton (nights), UAF
4 Emily Stidham	Zooplankton (nights), UAF
5 Alex Knobloch	Zooplankton (nights), UAF
6 Tom Kelly	Particle flux (days), UAF
7 Kerri Fredrickson	Phytoplankton/Microzoop, WWU
8 Kelly Bright	Phytoplankton/Microzoop, WWU
9 Sierra Llyod	Phytoplankton/omics, UAF
10 Addie Norgaard	Chemistry (Gases), UAF
11 Sydney Wilkinson	Chemistry (Nutrients, Iron), UAF
12 Emily Ortega	Chemistry (Nutrients, Iron, DIC), UAF
13 Isaac Reister	Physics (CTD), UAF
14 Daniel Cushing*	Seabirds/Mammals, FWS

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 third cruise 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 26th consecutive late-summer/fall cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 51st 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 (including drifting traps).
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 deep-water collections/lipid analysis for diapausing copepods at GAK15 and PWS2.
8. Determine carbonate chemistry (i.e. Ocean Acidification) at selected intensive stations
9. Check on GEO mooring
10. ***Provide at-sea experience for students***
11. ***Share the experience through outreach/media activities.***

SAMPLING

The overall approach of the cruise is to occupy only he Seward Line transect lines across the shelf and the 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 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 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 GAK1, GAK5, GAK9, GAK15, 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 (GAK15) 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.
9. Drifting sediment traps will be deployed at as many intensive stations as possible, ideally for 24 hrs.

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. A duplicate multinet is taken as intensive stations for molecular analysis.

2. A Methot Trawl will be deployed by forward crane for ~20 minutes while coming into or leaving stations. We are hoping to get every station with the Methot, but will reduce effort if needed.

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

Sampling Strategy

In general, we estimate 2 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 Multinets 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 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, and trying to deploy and recover sediment traps strategically to maximize their deployment duration.

Sampling personnel requirements (and times):

CTD: winch operator, 2-3 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 to watch towfish during towing and communicate with the bridge/science.

Multinet: 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. The multinet has a depth transducer to ensure we get close to, but not on the bottom when depths are less than 200m.

Calvets: 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, 3-4 scientists, launch, recovery, wash-down) – Ship speed: ~2.5 knots, surface trawl only**.**

Ship's Science Equipment Supplied:

- Underway sampling system (TSG, GPS) SBE21

Scientist's Equipment Needed:

- CTD (with deep-SUNA, UVP and LISST for integration)

- -40 freezer for macro-nutrient and genetic samples (in hold)
- Trace-metal clean towfish system (access to compress air) (Deck storage 3 palettes)
- Trace Metal Clean Van
- 10 cu ft refrigerator/freezer for chemical and preserved sample storage
- Fume hood for filtration of preserved samples
- CalVet [nets, flow-meters, frames, swivels, weights, spares]
- 2 Multinet systems (coarse and fine nets, spare cod ends/nets)
- Bongo nets (backup)
- Deckboard incubators (2) connected to ship's seawater system
- Filtration systems
- Fluorometers & Centrifuge
- Laptop computers
- 14 cases (24/cs) of 16-oz & 4 cases (12/cs) of 32-oz zooplankton sample bottles
- 2-3 cases of 24 Winkler bottles
- Several coolers with nutrient and TMC bottles
- Microscopes and supplies for sorting copepods
- Incubators: 4 cu ft. required near work area
- Refrigerated Circulator
- Milk Chocolate

Hazmat: (tentative)

Formaldehyde – 2x20L carboy
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

9/8 – Vehicles leave ONL 8-9am, arrive Seward around dinner time. WWU members are doing fly/drive with rental cars. Pizza party at SMC firepit. Motel: Breeze in shared rooms
9/9 – Begin setup at ~8am SMC dock, Tiglax will begin railway dock loading large items then return to SMC at ~10:00. Setup and depart sometime during evening or next morning.
9/18 – Return to SMC dock for offload by dinner time (worst case), hopefully earlier. Some members of science party may be shuttled to shore earlier to make flights. Offload all but largest items on 18th
9/19 – Most of science party departs for Anchorage to make early flights, other will remain for end-of-season pack-up. Tiglax will move to railway dock for unloading large items ~07:30, discharge reminder of science party, then head directly to Homer.

Berthing:
Russ (2-man main deck)
Kelly, Emily O., Kerri, Sierra (main deck)
Sydney, Addie (old library)
Emily S., Hannah, Alex P (below forward),
Tom, Dan, Isaac, Alex K (below aft)

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
Icy Bay				
60	16.3	148	21.7	IB0
60	14.5	148	20.1	IB1
60	16.3	148	14	IB2
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

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

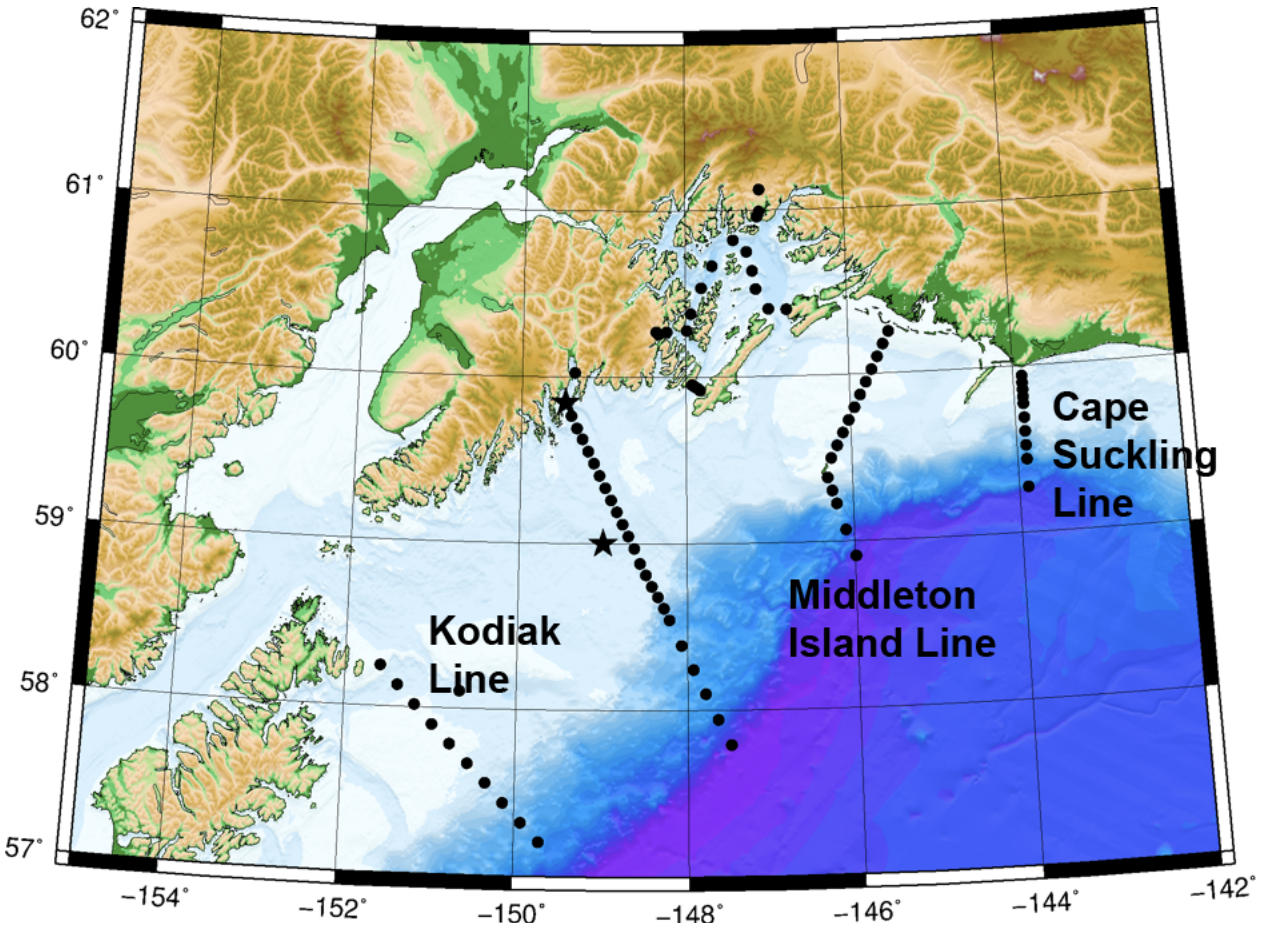

Fig. 1. NGA-LTER sampling stations highlighting new transects line near Kodiak, Middleton Island and Cape Suckling. Stars indicate GAK1 and GEO mooring locations.