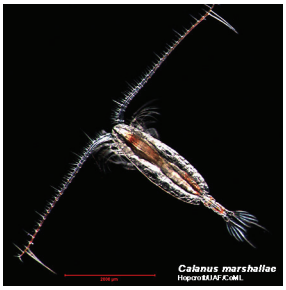
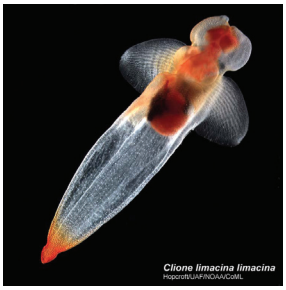
PROJECT PROFILE

The Seward Line: Marine Ecosystem Monitoring in the Northern Gulf of Alaska



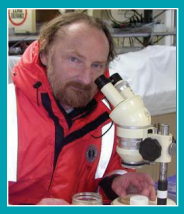


All photos by Russ Hopcroft

Left: *A copepod,* Calanus marshallae*, captured during sampling of the Seward line.* ***Middle:*** *Pteropods are a pelagic snail. Their name means "winged foot," a reference to the modification of their fleshy mollluscan foot that allows them to swim in the ocean. These animals, such as* Clione limacine *pictured here, are generally present in low numbers year round but can be the preferred prey of some species of fish.* ***Right:*** *Euphasids, such as this* Thysanoessa inermis *pictured here, generally rank second or third in abundance in most ocean waters below copepods. These animals are important prey items for fish, birds, and mammals.*

WHO WE ARE

Principal Investigators



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WHY ARE WE SAMPLING?

The Gulf of Alaska supports a diverse ecosystem that includes several commercially important fishes, as well as culturally and economically important mammals and plants. Historic observations suggest a connection between the Gulf of Alaska ecosystems and climate variations that range from interannual to interdecadal. The specific mechanisms by which climate variation causes ecosystem changes, however, are poorly understood. Sampling along the Seward line is producing a multi-year data set that will lead to a better understanding of the seasonal cycle and the variability that occurs from year to year in environmental conditions and biological productivity in the Gulf of Alaska.

WHERE ARE WE SAMPLING?

The Seward line is a transect of oceanographic survey stations that begins at the GAK1 mooring at the mouth of Resurrection Bay in the Gulf of Alaska (59°50.7'N, 149°28.0'W) and continues south across the Gulf of Alaska to past the outer edge of the continental Shelf, or "shelf break" (58°5.9'N, 147° W).

Location of the Seward line oceanographic survey transect in the Gulf of Alaska and Prince William Sound (red).

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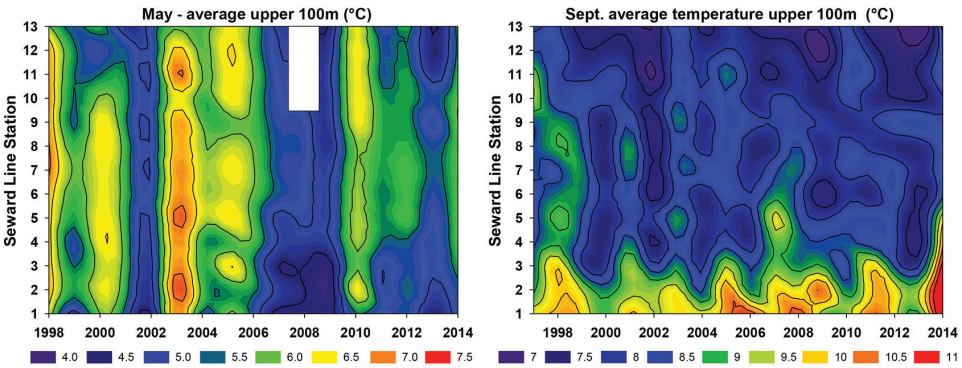
HOW ARE WE SAMPLING?

We sample the Seward line twice each year from a research vessel and collect data on a variety of environmental and biological conditions from salinity and temperature to plankton. The water column is sampled using a CTD (conductivity, temperature, depth) profiling instrument, plankton nets and instruments that sample the water from different depths. While physical data is read directly from instruments, chemical and biological data requires considerable post-cruise laboratory analyses.

WHAT ARE WE FINDING?

The Seward Line now represents the most detailed multi-disciplinary long-term oceanographic sampling program in the northern Gulf of Alaska, with sampling occurring early each May and mid-September. It is coordinated with other Gulf Watch Alaska oceanography projects that focus on Cook Inlet and Kachemak Bay, the Alaska Coastal Current, Prince William Sound, and still more broadly across the Gulf of Alaska through the CPR project. Among these projects, it is the only one that measures carbonate chemistry for ocean acidification monitoring. The Seward Line monitoring has allowed us to recognize that the Gulf of Alaska shelf undergoes alternating periods of warm and cold springs, each of which lasts for multiple years (see figure below). It allows us to capture extreme events such as the cold winters or ocean warming; for example, a very warm year occurred in 2014, where temperatures at some locations were as much as 2.6° C above the long-term average. The Seward Line time series is approaching sufficient duration that we might soon extract longer-term trends underlying these shorter-term cycles, as is now possible for the sampling station GAK 1 and for Prince William Sound.



The average temperature measured in the upper 100 m. of the Seward Line in early May and mid-September from years 1998-2014, showing the alernation of cold and warm spring periods and the general lack of such periods in late summer.

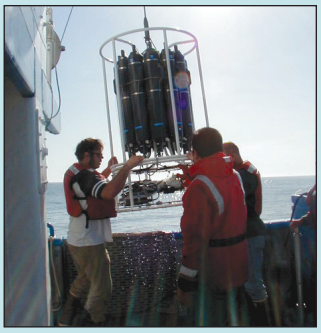


Photo courtesy of Seth Danielson

Deployment of the CTD and water collection system that measures salinity and temperature continuously during its vertical descent to the ocean floor, up to 2200 m below the vessel.

Copepods are major vectors, moving energy from primary producers (that they consume) to both middle and upper trophic levels when they, themselves, are eaten. Environmental conditions that enhance or depress copepod populations may impact the survival and abundances of commercially and culturally important marine fishes, birds, and mammals.

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