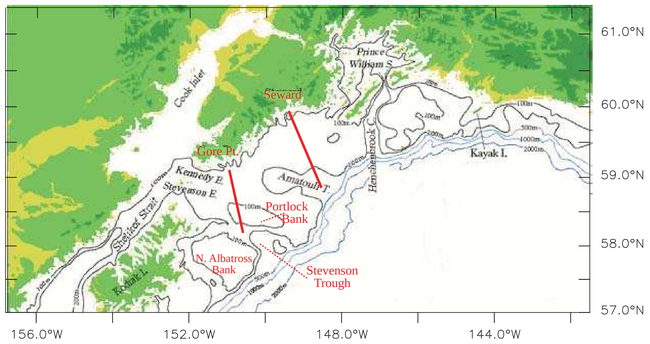
Mesoscale Variabiltiy Along the Kenai Peninsula

R. Reed[1], N. B. Kachel[2], C. W. Mordy[2],N.A. Bond[2], J.M. Napp[3], S.A. Salo[1], P. J. Stabeno[1]

[1] Pacific Marine Environmental Laboratory, NOAA, Seattle, WA, USA;
[2]Joint Institute for the Study of Atmosphere and Ocean, University of Washington, Seattle, WA, USA
[3] Alaska Fisheries Science Center, NOAA, Seattle, WA, USA



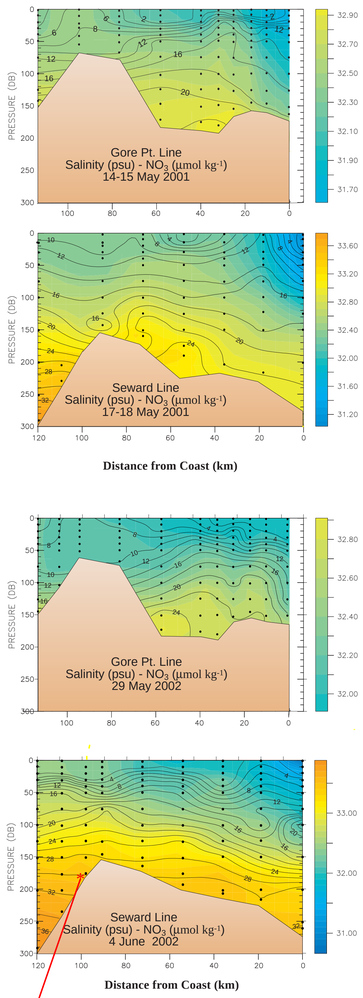
Hydrographic cruises consisting of 4 and 5 lines of CTD stations in the CGOA were conducted in May 2001 and 2002, and another, shorter one in September 2001. During the May 2002, we had opportunity to conduct of brief survey of an offshore eddy, and to survey Amatouli trough and Portlock Bank. These latter surveys provide a limited opportunity to investigate temporal variability in the distribution of water properties.
Our results illustrate spatial and variability in distributions of water properties and dynamic processes on several different scales. In spring, salinity gradients and baroclinic flows are weak and variable. The flow becomes more organized in the fall (not shown), when winds spin up the ACC.

- During all cruises the most dilute water was present near Resurrection Bay (~59.9°N, 149.5°W).
- Elsewhere, salinity gradients were small.
- Salinity gradients in the offshore region were considerably greater during May-June 2002 than in May 2001.
- The lowest-salinity/low nutrient water inshore on the Seward line is absent on the Gore Pt. line.
- The low salinity water is confined close to shore on the Seward Line, whereas it spreads out over the Gore Point line. Surface to bottom mixing was observed over Portlock Bank.
- Higher nutrient and salinity water was found in Amatouli Trough and may, through up-canyon flow, be a source of nutrients for the western portion of the CGOA.
- Spacing stations at 15-20km on hydrographyic surveys may fail to resolve scales of inportant processes.

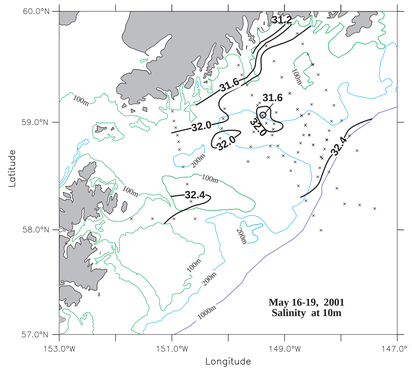
May 2001

On both the Gore Point and Seward lines, nitrate concentration and salinity contours are closely correlated. On the Seward line a core of fresher, nitrate-depleted water is confined near the coast. the site at 60km is associated with a lobe of high chlorophyll observed in the SeaWIFS chlorophyll image. At depth high salinity/high nitrate water is seen in Amatouli Trough (on the left hand side). On the Gore Point Line lower salinity surface water extends farther out along the transect than at Seward. Surface concentrations of nitrate and salinity are higher over Portlock Bank than elsewhere. Mixing is evident there.

Salinity/Nitrate

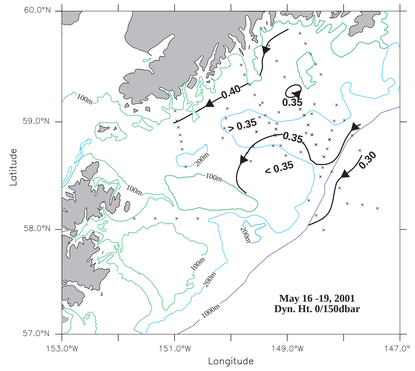


Salinity at 10m



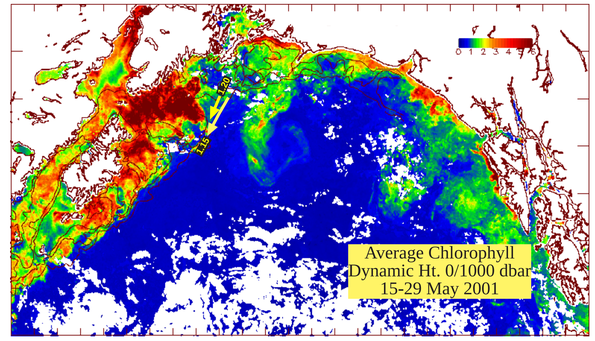
The distribution of salinity at 10m indicates that the most dilute water (31.2 psu) was present near Resurrection Bay (~59.9°N, 149.5°W). Elsewhere, salinity gradients were small. The 32.4 isohaline near the 1000m isobath parallelled the offshore, southwestward flowing Alaskan Stream.

Dynamic Height (0/150 dbar)



The sea surface dynamic height distribution (referred to 150dbar) indicates a rather weak southwestward flow nearshore and a convoluted, even weaker, flow near Amatouli Trough.

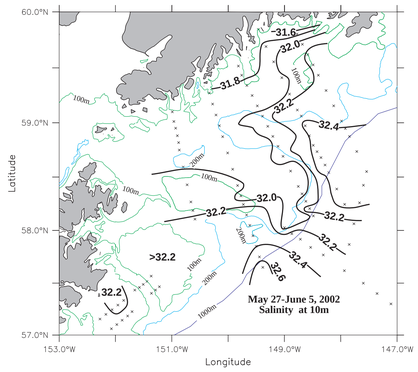
SeaWIFS Chlorophyll/ Dyn. Ht. 0/1000 dbar



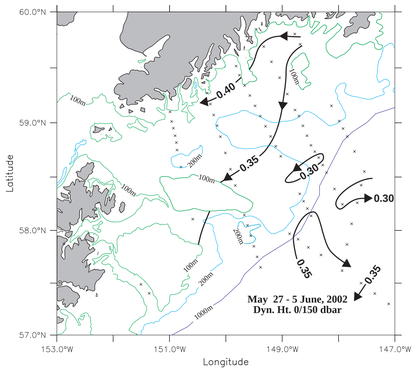
The dynamic height topography at the sea surface (referred to 1000dbar) indicates the offshore, southwestward flowing Alaskan Stream. The pattern of surface chlorophyll was derived from SeaWIFS images by averaging the values in each available pixel over a two week time period (see the poster by Mordy et al., "Timing and Mesoscale Variability of Phytoplankton Blooms in the Northern GOA"). High values near the coast (and particularly in Cook Inlet) are strongly influenced by turbidity. The Seward line is just to the east of high chlorophyll region between Amatouli Trough and Kodiak I.

May 2002

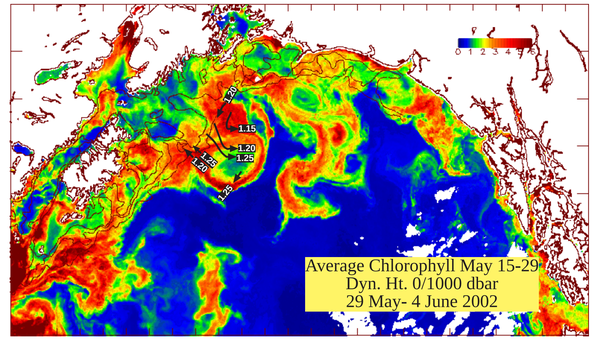
At depth, the core of low salinity/ low nitrate water along the Seward line is shallower than in 2001.On both the Gore Point and Seward lines, the surface waters were nearly depleted in nitrate except over Portlock Bank, and to a lesser extent, at 20 km along the Seward line. Along both transects,waters with higher salinity and nitrate are more extensive than in 2001. Once again, mixing from surface to bottom is evident over Portlock Bank.



Salinity gradients during this cruise were considerably greater than in the offshore region in May 2001. The low-salinity water extended out over the outer shelf. This is also an evident feature in the chlorophyll distribution..

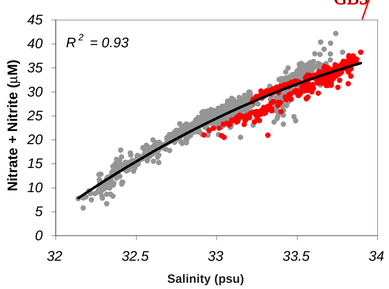


The surface dynamic height distribution (0/150 dbar) had weak gradients everywhere and a tendency toward offshore (southward) flow.



Large eddies are common to this area. In 2002, we had the opportunity to study a large anti-cyclonic eddy evident in sea- surface altimetry. So, we did a quick survey of the eddy. The eddy extended to a depth of ~1500m. Enhanced chlorophyll was associated with the eddy edge. The 0/1000 dbar topography shows complex flow in and behind the eddy in the offshore in contrast to the more organized southwestward flow of the Alaskan Stream during May 2001. Furthur analysis of the suite of variables measured is underway.

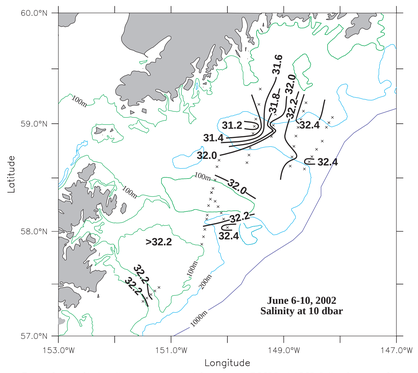
GB5



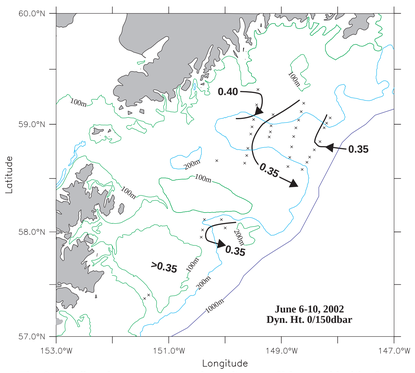
June 2002

Salinity/Nitrate Relationship

Salinity/ nitrate relationship derived from instruments moored during spring and summer of 2001 and 2002 at **185 and 192m at GB5** on the Seward line, as well as at 161m at the head of Amatouli Trough, 123m in Chiniak Trough, and 157m in Sequam Pass.



Complex salinity features are evident near 59°N, 149°W (in Amatouli Trough), where horizontal salinity gradient was >1.2 psu in 20 km. Salinity was higher toward the east and southwest. We did not close this feature to the north, due to lack of time.



The 0/150 dbar dynamic topography indicates offshore, eddy-like features with small gradients.

Scales of Variability:

On a large scale there is a marked difference between the primary productivity (in the SeaWIFS composite chlorophyll images) in the Kenai region compared to the area around Kodiak Island (see the poster by Mordy et al. "Timing and Mesoscale Variability of Phytoplankton Blooms in the Northern GOA"). On a slightly smaller scale, offshore eddies are prominent features that promote shelf/basin interchange of physical and chemical properties, and hence enhance chlorophyll production. On the shelf, there are sharp changes in chlorophyll distribution observed as filaments within larger features. Even in the 15day- averages of the SeaWIFS chlorophyll variability is evident, particularly over banks and troughs and at the edges of physical oceanographic features, such as eddies, filaments , and meanders. Conducting hydrographic surveys in this region requires attention to variability on all scales down to the order of 5-10km.

Acknowledgements: This research was funded by NP GLOBEC, Fisheries Oceanography Coordinated Investigations (NOAA) and Steller Sea Lion Program.