



Alongshelf Differences in the Lower Trophic Level in the Gulf of Alaska in 2011

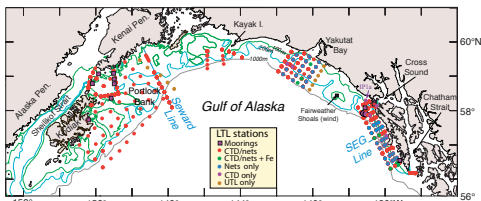


gulfofalaska.nprb.org

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CGOAIERP - Lower Trophic Level, Station Grid- 2011



As part of the GOAIERP- LTL program, the R/V *Thompson* and R/V *Tiglav* conducted hydrographic, zooplankton, larval and neuston sampling on this grid of stations in May 2011. In addition, the Thompson sampled dissolved Fe and conducted phytoplankton productivity experiments. The zooplankton and larval results are reported on a companion poster by Hopcroft et al.

Status of the Gulf of Alaska Spring 2011

ENSO: La Nina with a negative PDO.

SST: Temperatures were slightly (-0.5 to -1°C) below normal in March/April, off both Kodiak and Sitka. Seward Line temperature in May were ~ -0.5°C lower than normal.

Mean Cloud Cover: March and April had above average (~10-15%).

Net Short Wave Radiation: average.

Winds: Mean seasonal upwelling winds at Sitka during the winter were stronger than in any year since 1967.

Downwelling winds, were ~ average from fall 2010 through summer 2011.

Wind Mixing: Fall through spring ~ average, but summer was above average.

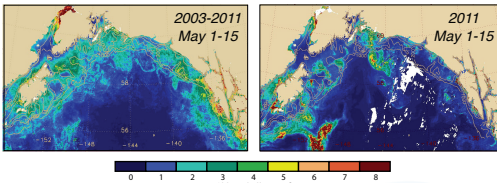
Mixed Layer Depth: mixing ~ normal (from ARGO drifters by F&O Canada).

Subarctic Gyre: The position of the dividing streamline of the West Wind Drift at 145°W in April and May was farther south than average. Since 2000, only 2005 was it farther south in spring.

The fraction of flow going to the GOA was below average.

Satellite Chlorophyll:

Comparison of 2011 to Recent Past



ABOVE: Satellite chlorophyll composites for early May 2003-2011 compared to 2011.

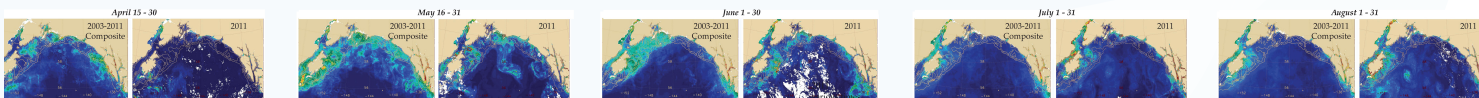
This is the usual time for the observed maximum of the spring bloom.

The Spring Bloom had not yet started over the Eastern GOA or the Seward Line.

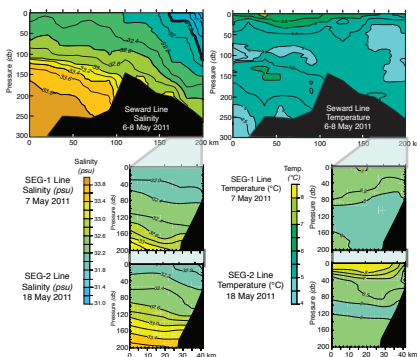
The chlorophyll composites were created using Modis Aqua data obtained from NASA's ocean color web site (oceancolor.gsfc.nasa.gov). It was processed to mapped files using NASA's SeaDAS processing suite of programs. For each year that Modis Aqua data are available, we then made composite images over 2 week periods in the spring and early summer, and for one month periods later in the summer. Multi-year means, for each of the above times, were created by calculating the average of each year's mean concentration.

BELOW: Other periods from mid-April through August.

Chlorophyll was low throughout the year, but highest in June. Note sustained production - near Chatham Strait and Cross Sound, as well as on Portlock Bank and in Shellick Strait.



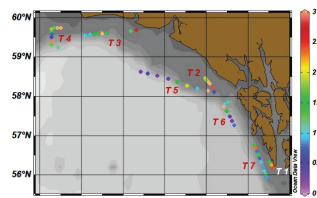
North-South Differences In Hydrography - May 2011



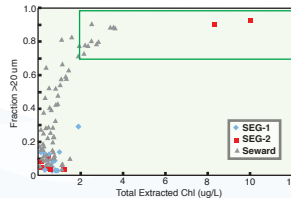
- The continental shelves off southeast Alaska are 10-15km wide; those of the central GOA are ~100-200km.
- Sampling occurred in pre-bloom conditions. The surface layers began to warm during the Seward and SEG-2 transects.
- Cross shelf exchange is more prevalent in Southeast.
- Coastal waters are fresher in the north.
- Other results show that intense mixing takes place in Cross Sound, Chatham Strait, and Kennedy-Stevenson Entrances, enabling sustained summer production to occur nearby.

Dissolved Iron

- Surface water over the Gulf of Alaska was Fe replete with respect to available nitrate.
- Concentrations of surface dissolved Fe ranged from 0.28 nM offshore to 4.50 nM inshore near Kayak Island (not shown in color bar).
- Shelf input was apparent on depth profiles (not shown).
- Reactive iron was elevated throughout the study region mainly as dissolvable particulate Fe.
- Dissolved Fe was 23% of the total dissolvable Fe.
- Limiting Fe concentrations were not observed during the spring of 2011.
- The delayed spring bloom was likely due to light limitation.



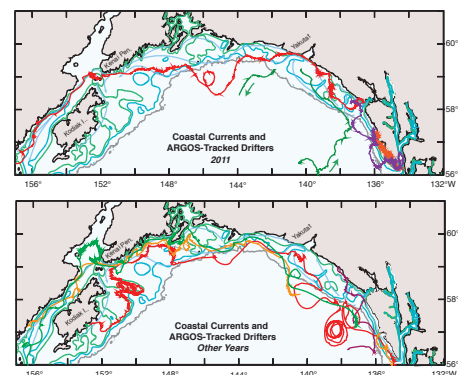
Phytoplankton Cell Size



- Phytoplankton cell size during May at SEG line (1&2) and on the Seward Line were remarkably low except for the two points in the surface. These are likely due to export of inland ford waters rather than in situ production and are associated with a lower salinity layer.
- The Seward Line was on a trajectory toward producing a bloom community in terms of biomass and size composition of the phyto.
- On the SEG line there was an extraordinarily high fraction of the community (generally >90%) in small cells.
- These cells are REALLY TINY - The dominant taxa are <2 um in size, which could only be eaten by protists (microzooplankton) or mucous net feeders such as salps and pteropods.

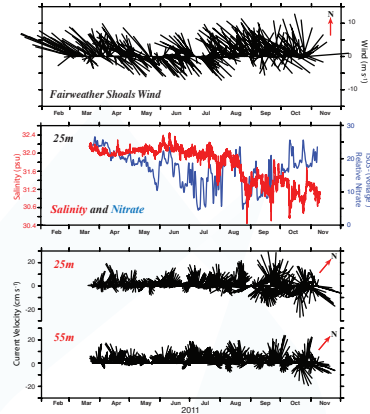
Acknowledgments: We would like to thank the officers and crews of the R/V *Thomas G. Thompson* and the R/V *Tiglav*, as well as the scientists who helped collect the data. Funding was provided by the North Pacific Marine Research Board (NPRB) and NOAA.

Currents and Cross Shelf Flow: Drifter Tracks



- Top: ARGOS-tracked drifters deployed in May 2011 in the EGOA.
- Bottom: Drifters deployed in previous years in May. Their patterns show the pathways of cross-shelf transports in the EGOA.
- Idealized current vectors shown in light blue illustrate the discontinuous nature of the coastal current.

Mooring Results near Icy Point (IP1a)



- Salinity decreased from spring to fall due to increased runoff from Cross Sound.
- There was a very slow draw-down of nitrate from spring to summer due to low levels of production.
- Northward winds confined freshwater towards the coast and deepened the freshwater lens along the coast.
- From spring to summer, flow was northwardward.
- In September, currents were stronger and more variable, with reversals, especially at 25m.