Climate Shift and Ecosystem Differences Observed in Alaskan Ferry Oceanographic Mesarurements

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http://www.pmel.noaa.gov/foci/GEM/alaska_ferry

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Figure 1
An EVOSTC-GEM-sponsored oceanographic monitoring system aboard the Alaska Marine Highway System ferry *Tustumena* measures the following oceanographic parameters at 4-m depth:
(1) Temperature and salinity - basic physical variables
(2) Nitrate - an essential phytoplankton nutrient
(3) Chlorophyll fluorescence - an indicator of phytoplankton concentration
(4) Colored dissolved organic matter fluorescence - an indicator of terrestrial runoff
(5) Optical beam transmittance - an indicator of suspended particle concentration

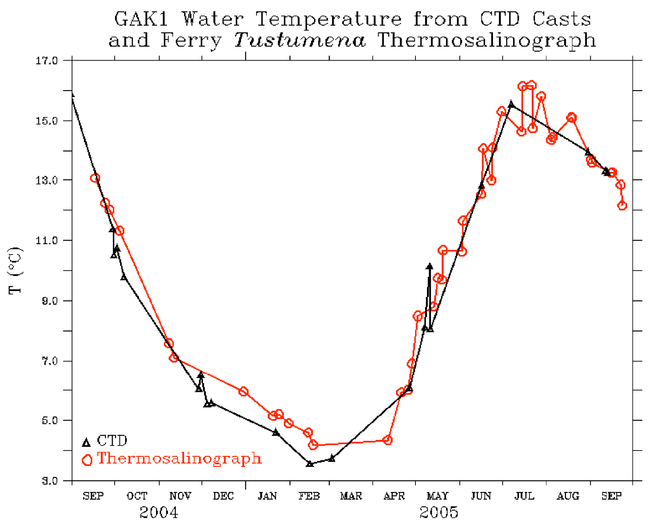


Figure 2
Temperature at the GAK1 site off Seward, Alaska. The ferry's thermosalinograph measurements compare well with CTD observations from oceanographic ships, providing a check on the instruments. Tides contribute to short-term variability.

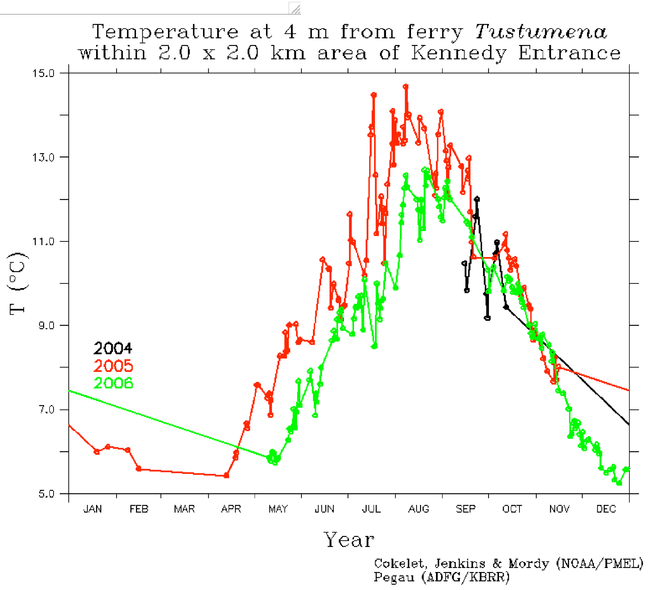
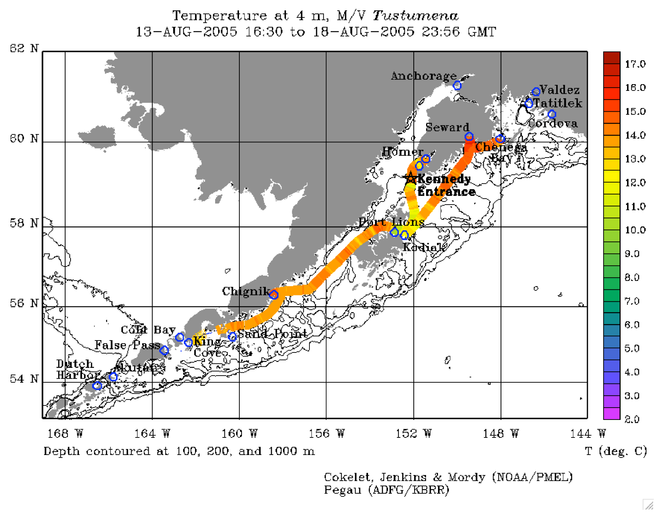
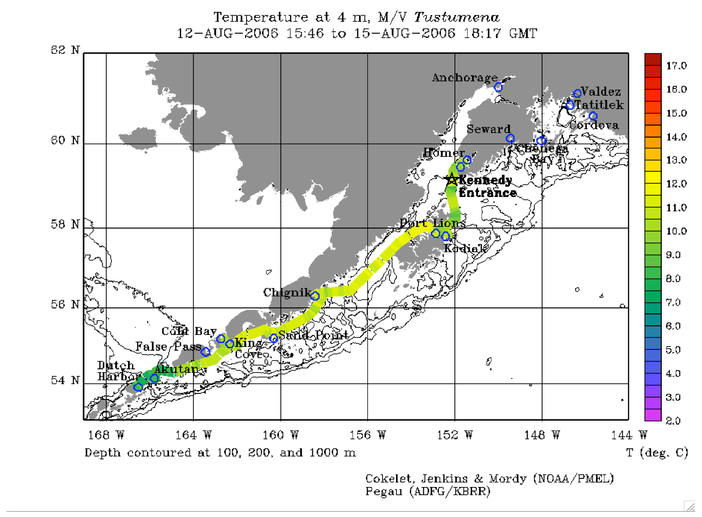


Figure 3
The ferry's instruments recorded on 262 transects across the Alaska Coastal Current (ACC) since September 2004. Spring and Summer temperatures in Kennedy Entrance, where most of the ACC flows into Shelikof Strait, were 1.5 to 2°C warmer in 2005 than in 2006. The near-surface ferry measurements can detect a climate signal.





Figures 4a & 4b
These maps show that the maximum August-2005-to-2006 temperature difference in the ACC persisted over 1000 km from Homer to Unimak Pass.

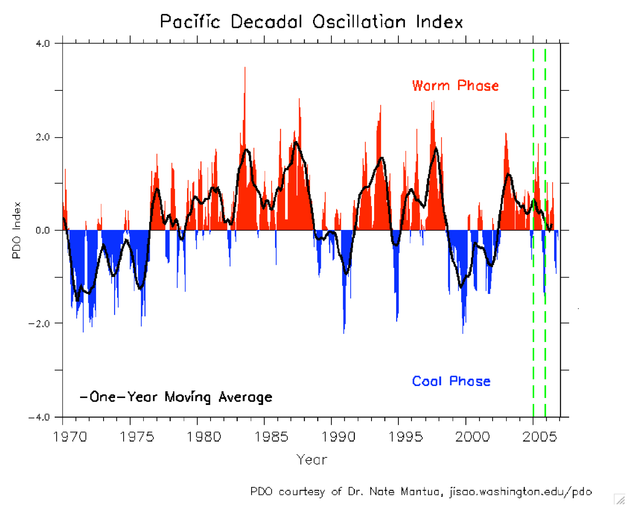
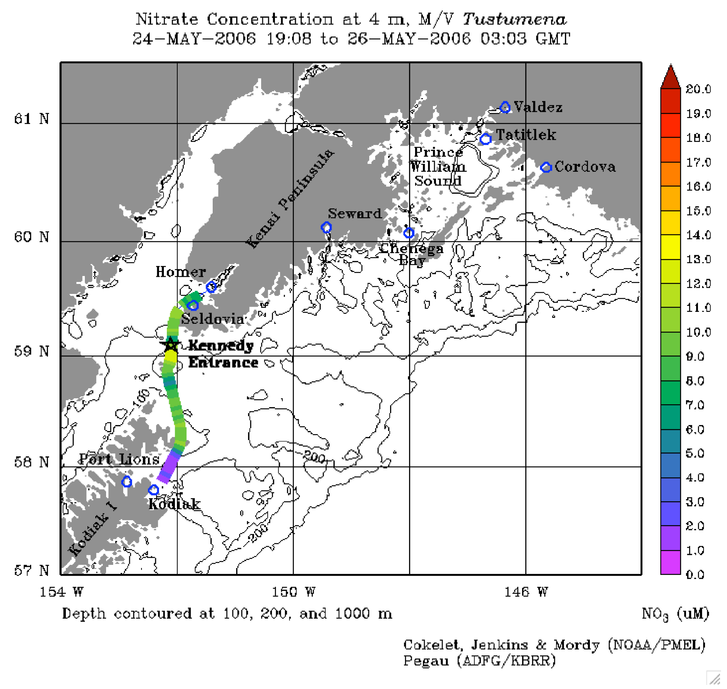
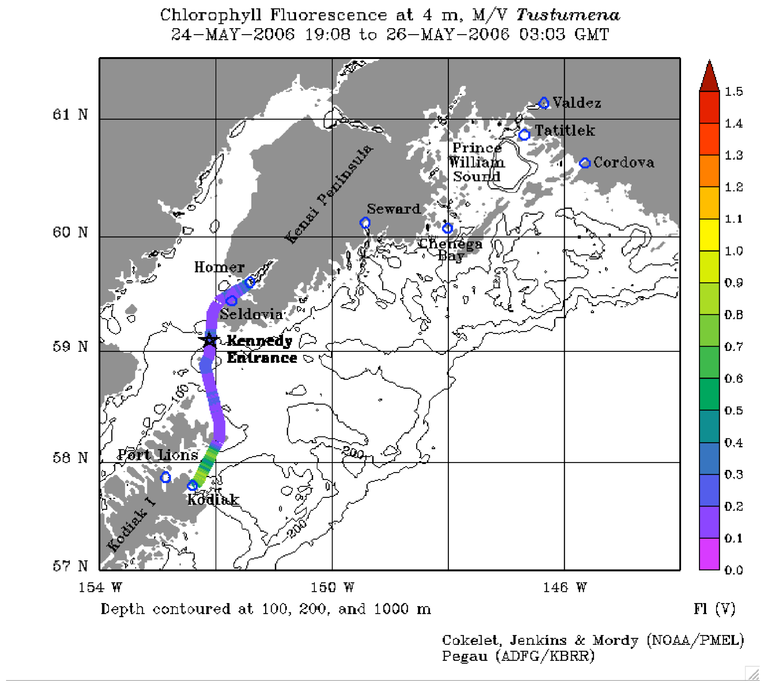


Figure 5
The interannual temperature differences in the ACC are consistent with longer-term climate variations in the context of the basin-scale Pacific Decadal Oscillation (PDO). The PDO index is somewhat warmer in 2005 than in 2006, but local effects also play a large role.





Figures 6a & 6b
Simultaneous measurements of nitrate and chlorophyll fluorescence show different regimes on the Kodiak-Homer route across the ACC. Near Kodiak, nitrate is low and chlorophyll is high. This implies that a phytoplankton bloom has depleted the nutrients. In the entrances to Shelikof Strait, nitrate is high and chlorophyll is low. This implies that vertical mixing has replenished the nitrate from deeper waters and impeded primary production by cycling phytoplankton cells into low-light conditions below the photic zone.