Seasonality in Planktonic Community Structure, Phytoplankton Growth and Microzooplankton Grazing in the Coastal Gulf of Alaska

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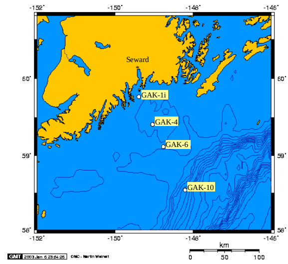
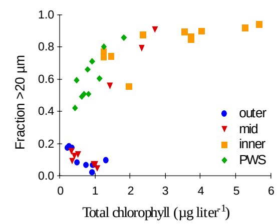
1) Phytoplankton community size structure in 2001 indicated two different primary production "domains":

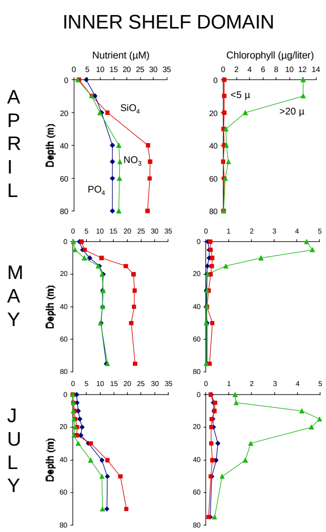


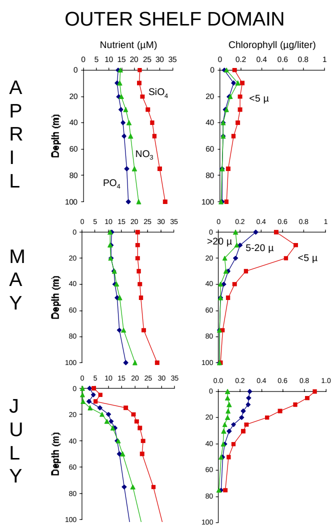
Inner shelf station: GAK-1i

Outer shelf station: GAK-10



2) Differences between the domains were seen in the seasonal progression of macronutrient and size-fractionated chlorophyll levels:





•In 2001 the inner shelf bloom was due to >20 µm chain diatoms *(Chaetoceros, Thalassiosira, Skeletonema);*

•Blooms led to high chlorophyll concentrations (5 to 15 µg/liter) and depletion of NO_3, SiO_4 in surface waters;

•High chlorophyll present as early as April, but also observed in July, possibly in response to upwelling event.

•A classic temperate spring bloom scenario?

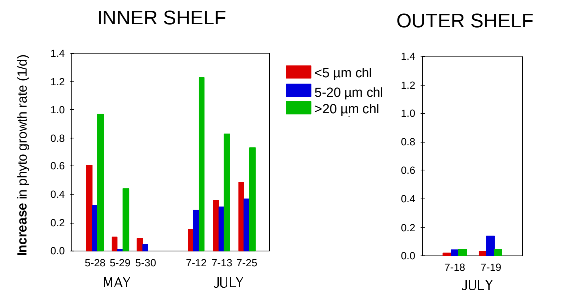
•In 2001 the outer shelf bloom was due to <5 µm phytoplankton cells *(Synechococcus*, cryptophytes, prymnesiophytes)*;*

•"Blooms" led only to moderate chlorophyll concentrations (1 to 1.5 µg/liter) with depletion of NO_3 (green) but not SiO_4 (red) in surface waters;

•Phytoplankton biomass (<5 µm) progressively accumulated from spring into summer.

•A situation intermediate between open subarctic HNLC condition and the inner shelf condition

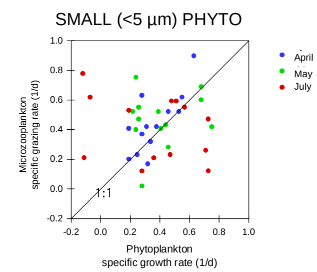
3) Nutrient limitation: Phytoplankton growth rate response to added NO_3 and PO_4 also indicated two production domains:

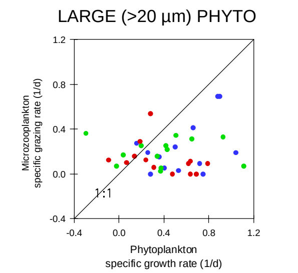


•In 2001 the inner shelf became macronutrient-limited in spring, possibly as early as April (see inner shelf nutrient profiles, left)

•The outer shelf was not macronutrient-limited even in July, although ambient nitrate levels were <0.5 µM

4) Microzooplankton grazing: Relationship with phytoplankton growth demonstrates differing fates for small- and large-cell production:





•On average, microzooplankton consumed all small phytoplankton production during 2001 cruises;

•Small phyto production is 2 or more trophic levels removed from copepods, but might be directlly available to larvaceans, pteropods (pink salmon prey species)

•Only a modest fraction of large phytoplankton production was consumed by microzooplankton;

•This fraction could still be larger than that consumed by other planktonic grazers (e.g. copepods)

5) Summary and Important Questions:

•**What processes partition the shelf into two domains?** Does Fe supply play a role in this partitioning?

•**What dictates the character of the mid-shelf**, which can look like either inner or outer domains depending on time and location?

•**What allows small phytoplankton on the outer shelf to accumulate** in the face of intense microzooplankton grazing pressure? Seasonally increasing top-down control of these microherbivores? Chemical or other defenses of small phytoplankton?

•**What processes supply nutrients to near-surface communities in summer,** allowing production events and sustaining high outer-shelf phytoplankton growth rates?