CMOP Paper Annotations

Herfort L, TD Peterson et al. (2012) Red Waters of Myrionecta rubra are Biogeochemical Hotspots for the Columbia River Estuary with Impacts on Primary/Secondary Productions and Nutrient Cycles. Estuaries and Coasts. 35:878-891

The authors found that *M. rubra* blooms in the CRE shift the estuary from net heterotrophy to net autotrophy. Red waters also showed an enhanced microbial secondary production and correlated with high DOM.

Other highlights:

-ammonium preferred by *M.rubra* (negative correlation)

-nitrogen is limiting nutrient in main channels, not in Baker Bay

-*M. rubra* in main channels and Baker Bay correlated with DON and DOP, but inorganic N is preferred

-POC is higher in red waters

Herfort L, TD Peterson et al. (2011) Myrionecta rubra (Mesodinium rubrum) bloom initiation in the Columbia River estuary. Estuarine, Coastal and Shelf Science. 95.4:440-446

This study (data from two summers) reveal biphasic *M. rubra* bloom development, with initiation happening potentially in Baker Bay (Ilwaco harbor). The second phase of the bloom was establishment in the main estuary, after a period of delay in both years.

Other highlights:

-detection of bloom in Baker Bay coincided with July neap tide in 2010

-ciliate more abundant at 0 or 1m than 3m

-correlation with neap tide “lend[s] further support to the idea that a decrease in water column turbulence plays an important role in the initial surface aggregation of large numbers of bloom-forming *M. rubra* cells”

-*M. rubra* growth rates measured are higher than highest growth rate in lab cultures

-ciliate in Ilwaco harbor did not grow during established phase of bloom

-growth rates higher in non-red waters suggest self-shading

L Herfort et al. (2011) Myrionecta rubra population genetic diversity and its cryptophyte chloroplast specificity in recurrent red tides in the Columbia River estuary. Aquatic Microbial Ecology. 62:85-97

The authors investigated the genetic variability of the Myrionecta/Mesodinium ciliate in the CRE, finding that there were at least 5 variants of M. rubra, though only one of them was associated with the formation of the yearly red-tide bloom. Additionally, analysis of the 16S RNA of the associated chloroplast revealed the ciliate’s prey to be the cryptophyte *Teleaulax amphioxeia*. Despite this, 18S DNA sequence analyses of the bloom patches in the CRE showed a virtual absence of free-living versions of this species of cryptophyte.

Other highlights:

-*Teleaulax amphioxeia* was detected as the prey species in samples from both 2007 and 2008 blooms

-still unknown is kleptoplasty vs. endosymbiont, but hypothesized to be determined by genetic variability

-cryptophyte nuclei is lost some time after ingestion (not karyoklepty)

-likely that cryptophyte ingestion happens in Baker Bay and Illwaco but not in main channel

T Peterson et al. (2012) Associations between *Mesodinium rubrum* and cryptophyte algae in the Columbia River estuary. Aquatic Microbial Ecology. 68:117-130

This study uses a combination of in situ observations of *M. rubrum* and laboratory experiments of the ciliate to investigate *M. rubrum’s* relationship with its cryptophyte prey. Though there were no actual measurements of grazing rates, the researchers focused on observations of cryptophyte attachment to *M. rubrum’s* cirri, a likely precursor to ingestion. They documented counts of *M. rubrum* (specifically noting % with attached cryptophytes) using FlowCAM at various locations in the CRE over the course of the 2011 bloom. In the lab, field samples were incubated with added cryptophytes, and the rate of attachement and *M. rubrum* growth was determined. From this data, the researchers hypothesize that the ability to gather cryptophytes is an important factor for *M. rubrum* growth, and thus the availability of prey itself also contributes to *M. rubrum* bloom dynamics.

Other highlights:

-abundances of cryptophytes were higher than *M. rubrum* only during bloom initiation in early September

-the peak of prey attachment occurred 1 week after peak of *M. rubrum* abundance

-in lab studies, there was an increase in attachment to saturation point after addition of prey

-max growth rate in Illwaco harbor was 7-11 fold higher than previously recorded Korean isolates of *M. rubrum*

-ciliate can capture up to ~50 cryptophytes