

NEP-CCS Progress Report 2004

GLOBEC: MICROZOOPLANKTON IN THE NORTHERN CALIFORNIA CURRENT SYSTEM

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PROJECT SUMMARY

The primary goal of this project is to determine the role of microzooplankton, mainly heterotrophic protists in the size category of 20 – 200 microns, in the pelagic food webs of the Northern California Current system that support salmon fisheries. Microzooplankton are well recognized as a central link between phytoplankton and mesozooplankton in marine food webs, and have been identified as a missing component of the GLOBEC NEP effort. Our intention with this study is to fill the data gap on microzooplankton in the GLOBEC California Current System program.

The main effort has been collection and analysis of microplankton abundance, biomass, and general taxonomic composition of heterotrophic protists on the GLOBEC Long Term Observation Program (LTOP) cruises in the California Current System (CCS). We participated in all seasonal cruises of the LTOP-CCS program in 2001, 2002, and 2003. On each cruise, six depths were sampled in the upper 70 – 100 m of the water column at most of the CTD stations. Two sets of samples were collected: a) liquid samples preserved with 10% acid Lugol's solution for Utermohl (inverted microscopy of settled samples) enumeration of ciliates, and b) samples preserved with a three step fixative protocol, stained with DAPI, settled onto 3.0 µm pore size black-stained membrane filters, mounted onto slides, and stored frozen for later inspection via epifluorescence microscopy. Microscopic analysis of filtered samples permits enumeration of ciliates, heterotrophic dinoflagellates, and other heterotrophic flagellates in the microplankton, and visualization of contents of food vacuoles. We have completed analysis of epifluorescence preparations for all cruises through December 2002, and analysis of Lugol's samples for all cruises in 2001 and all NH-Line samples through April 2003. A significant finding is that the distribution of ciliates, which are presumed to feed mainly on small phytoplankton, is not closely related to the distribution of small phytoplankton abundance in the CCS system. We are now speculating that there is strong top-down zooplankton grazing control of microzooplankton in CCS regions where < 5 micron sized cells dominate the phytoplankton biomass. Another finding is that frequently the highest microzooplankton abundance and biomass was observed in the upper 5 m of the water column, which to our knowledge has not been previously reported.

Image analysis system: We are continuing to archive images of common microzooplanktonic protists. During the final year of the project, we will work on identification of protist images in our collection, and a final product of this grant will be an image archive of protists in the Oregon upwelling system. We have posted some of our protist images on our website at: <http://bioloc.coas.oregonstate.edu/SherrLab/Microplankton.html>

Flow cytometric analysis of bacteria and phytoplankton in the CCS: The flow cytometric data on abundance distributions of small sized phytoplankton that we have collected along with the

microzooplankton samples has provided new insights into the structure of the upwelling ecosystem off the NW coast of the US. On the Newport Hydroline, which was sampled during every LTOP cruise, we have observed a persistent mid-shelf region of intense blooms of coccoid cyanobacteria (*Synechococcus*) and of pico- to small nano-sized (< 5 micron) eukaryotic phytoplankton. These blooms are just offshore of the upwelling front, based on sigma-t surfaces, and not in the region of highest in situ fluorescence. Microscopic inspection of plankton has shown that large diatoms dominate the high chl-a fluorescence zone in newly upwelled water on the shelf, that the plankton in the slope region is characterized by decaying diatoms and by high abundances of very small autotrophs and heterotrophic bacteria, and that the region seaward of the slope (deepwater gyre edge) has lower plankton abundances. The phytoplankton in the mid-shelf and slope regions included abundant pico-eukaryotic cells. Prasinophytes < 1 micron in size have been described off the California coast, and similar species are likely to occur in these waters. So far, we have found prochlorophytes only in a few samples taken at the outer stations of some transects in late summer. With respect to the abundance distribution of heterotrophic bacteria, we found only a slightly positive relation of log total bacterial abundance to log chlorophyll concentration for both eutrophic shelf and mesotrophic slope and basin systems.

Educational activities:

One graduate student and an undergraduate student participated in, and received training during this project. The results of this project were used in course material. We continue to update our website to include results of this project at:

<http://bioloc.coas.oregonstate.edu/SherrLab/GLOBEC.html>

PRESENTATIONS AND PUBLICATIONS

Presentations:

Sherr, B.F., Sherr, E.B. Distribution and potential grazing impact of microzooplankton in the California Current System in relation to distribution of large and small phytoplankton. (poster) Feb. 2002 Ocean Science meeting, Honolulu, Hawaii, USA.

Sherr, B.F., Sherr, E.B. 2002 Distribution in relation to phytoplankton, and potential grazing impact, of microzooplankton in the California Current System. (poster) NEP-CCS SI meeting, Corvallis, Oregon, USA.

Sherr, B.F., Sherr, E.B. Microzooplankton as a food resource for mesozooplankton. (talk) Feb. 2004, Ocean Science Meeting, Hawaii.

Publications:

In press:

Sherr, E.B., Sherr, B.F., Wheeler, P.A. 2004. Distribution of coccoid cyanobacteria and small eukaryotic phytoplankton in the upwelling ecosystem off the Oregon coast during 2001 and 2002. Deep-Sea Research II, in press.

In preparation:

Sherr, E.B., Sherr, B.F., Longnecker, K.L. Relation of high and low nucleic acid content bacteria to distribution of phytoplankton in the California Current system off Oregon, U.S.A. Submission by summer 2005

Sherr, B.F. and E.B. Sherr. Distribution of abundance and biomass of microzooplankton protists in the California Current System off Oregon. Submission by early 2006.

AVAILABLE DATA SETS

All data sets on distribution of microzooplankton, small sized phytoplankton, and bacterioplankton will be made available for on-line distribution in conjunction with publications resulting from this project.