

## EVOS ANNUAL PROJECT REPORT

**Project Number:** 070624

**Project Title:** Acquisition and Application of Continuous Plankton Recorder data

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**Time Period Covered by Report:** 1 September 2006-31 August 2007

**Date of Report:** 7<sup>th</sup> August 2007

### 1. Work Performed:

#### Data Collection

At this time we have completed 4 of the 6 planned sampling transects for 2007 with the final 2 scheduled for 11-15<sup>th</sup> August and mid-September. A mechanical failure occurred in May but the crew of the Horizon Kodiak repaired the instrument and the subsequent tow in June was successful. Preliminary analysis of April samples has been completed (May and June are underway) and the data will be included here.

2007 marks the 4<sup>th</sup> consecutive year of sampling on the Cook Inlet transect. In total, the EVOS TC has supported the collection of 5797 samples (to April 2007) of which ~ 2000 have been processed (and all are archived).

#### Data Analysis

In addition to the sampling funded by the EVOS TC a complimentary transect funded by the North Pacific Research Board crosses the Gulf of Alaska and the Aleutian shelf as the ship traverses Unimak Pass. This provides an opportunity to compare plankton variability 'downstream' of the EVOS sampling and because this transect has been sampled since 2000 it covers the span of EVOS sampling from south of Prince William Sound as well as the more recent Cook Inlet sampling. Figure 1 shows the time series of mesozooplankton data from these areas. Biomass is greatest on the shelf east of Unimak Pass, while levels south of PWS and within Cook Inlet are more comparable. The Aleutian shelf values are also higher than the adjacent oceanic Gulf of Alaska although this is not true south of PWS and Cook Inlet where the Gulf of Alaska values are often as high or higher than the shelf. The Unimak Pass time series shows that from 2000-2003 values were relatively stable, as they were south of PWS. Since 2004 they have been increasing off Unimak, and the Cook Inlet regions were higher in 2005 and 06 than in 2004, although the better temporal resolution from Cook Inlet sampling suggests that later in 2006 and in early 2007 values are decreasing again. This is almost certainly climate driven. Fig 2 shows the time series of sea surface temperature from the GAK-1 sampling. Prior to 2004 temperatures were relatively stable but in mid 2004 temperatures became quite warm and remained so until late in 2006 when temperatures have become very cool (outside the standard deviations in May 2007). Although the zooplankton biomass time series from the CPR are much shorter they appear to be tracking these temperature signals with high biomass in warm conditions and low biomass in cool conditions and compare well with data from the Seward Line sampling (Hopcroft, pers.comm.). CPR Data from 2000 to 2003 were quite stable, 2005 biomass was an order of magnitude greater than 2004, 2006 was generally lower than 2005 but higher than 2004 and although we only have data for April available so far in 2007, the values are the lowest we have measured for April, again by an order of magnitude (1.6 mg in 2007 compared with 11.6 in 2004, 22.2 in 2005 and 56.2 in 2006).

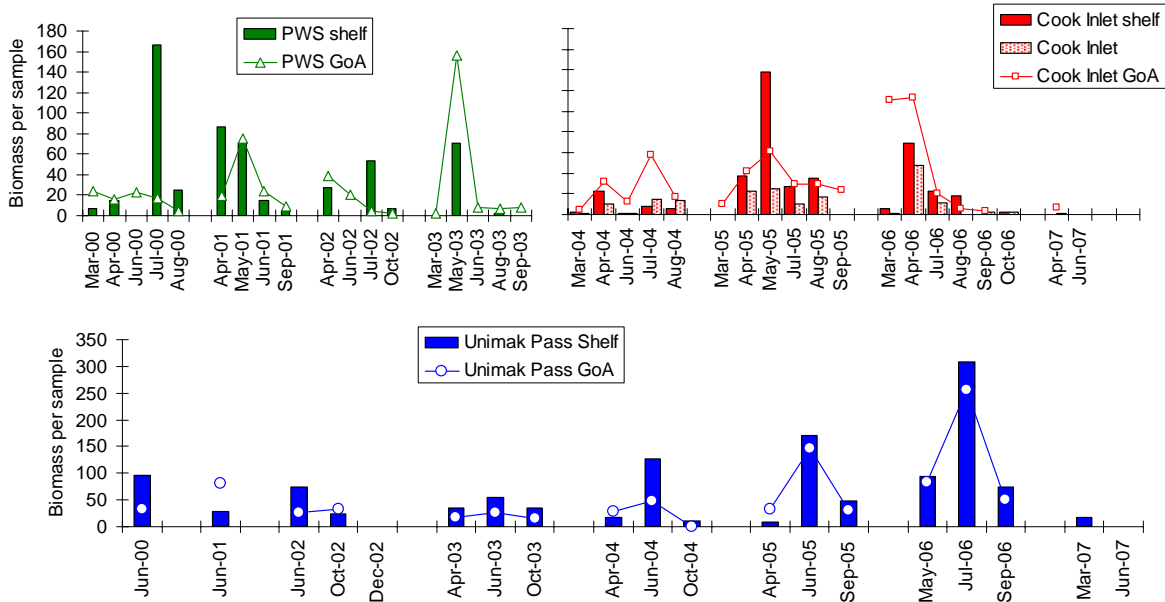


Fig 1. Time series of mean monthly mesozooplankton biomass for shelf regions around Alaska and corresponding offshore areas in the Gulf of Alaska. Cook Inlet has been distinguished from the shelf to the southeast (see map, right).

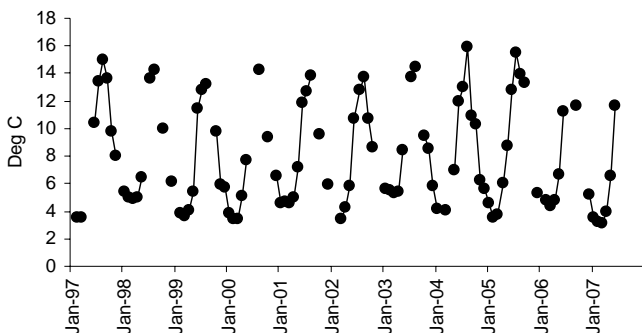
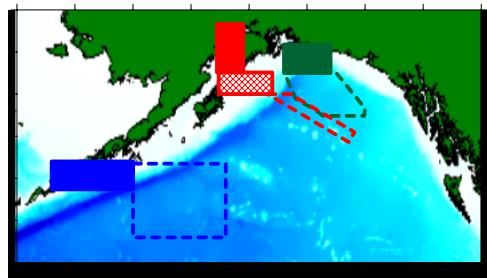


Fig 2. Monthly sea surface temperature data from GAK 1 sampling ([www.ims.uaf.edu/gak1/](http://www.ims.uaf.edu/gak1/)) showing the warm conditions of late 2004 to early 2006 and the very cool conditions since mid 2006.

In addition to total mesozooplankton biomass, which provides a useful summary index of the community, taxonomic data are also available. Fig 3 shows the mean annual contribution of the major groups to each area:

- All areas have a similar average composition – small copepods dominate, large copepods are generally next highest, followed by euphausiids and hyperiids. Pteropods, larvaceans and chaetognaths are usually no more than 7% each for the year (note, the CPR does not sample gelatinous plankton very well, so these taxa are underrepresented in this analysis)

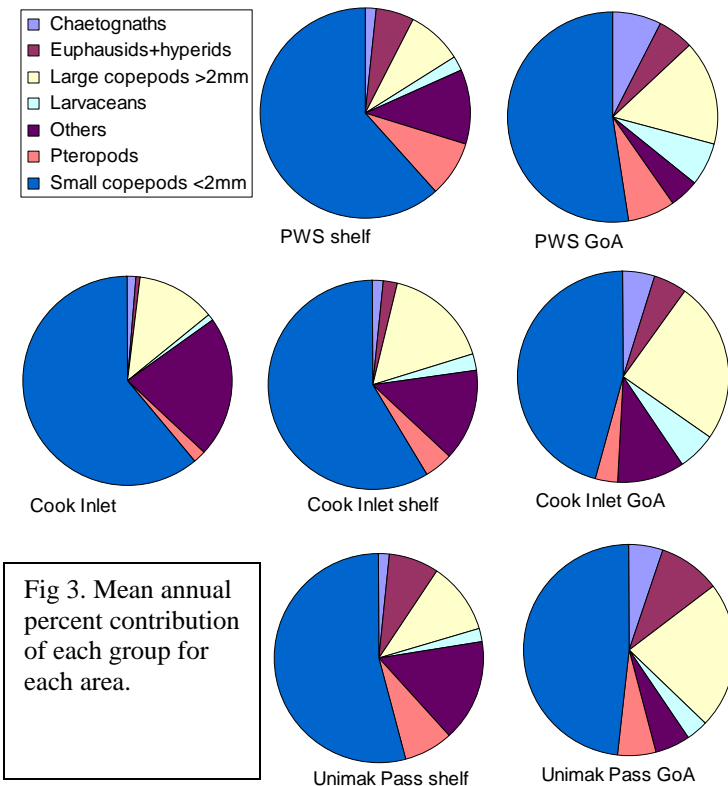


Fig 3. Mean annual percent contribution of each group for each area.

- The shelf regions have a higher proportion of small copepods, the Gulf of Alaska regions a higher proportion of large copepods.
- Euphausiids/hyperiid are more important off the Aleutians than they are in, or south of, Cook Inlet. Numbers are similar on and off the shelf in the Unimak regions but south of PWS and Cook Inlet numbers are higher off the shelf than they are on it.

Once the final data from 2006 have undergone quality control we can examine trends in the community composition in each area. As well as changes in total biomass we can expect to see a change in the ratios of various groups and species as ocean

conditions change. Smaller copepods may do better in warm conditions while cool conditions would favour the larger sub-arctic species for example.

## Conclusions

Although these are short time series, there does appear to be a degree of synchrony evident across the region and emphasizes that the CPR is best used as a large-area sampler. The transect through Unimak Pass has been sampled in each year, providing a comparison with both of the two shorter time series. Between 2000 and 2003 both the PWS and the Unimak time series showed relatively stable mesozooplankton biomass while biomass has increased in both Unimak and Cook Inlet areas since 2004. Since these regions are all linked by the shelf edge currents (Alaska Stream, Alaska Coastal Current) synchrony in the responses of the plankton to physical forcing would be expected. Patterns of stability and increase are generally evident in BOTH shelf and offshore regions suggesting strong cross-shelf interaction, or again, a similar response in both areas to the same forcing. Total biomass is also varying in accordance with an increase (2004-2006) and recent decrease (late 2006 onwards) in sea surface temperature. Changes in community composition that may correlate with changing ocean conditions will be examined once data are fully quality controlled

### 2. Future Work:

No changes to proposed work, sample and data analysis will be ongoing.

### 3. Coordination/Collaboration:

We continue to collaborate with scientists from around the north Pacific coast, mainly through PICES (North Pacific Marine Science Organisation) activities.

### 4. Community Involvement/TEK & Resource Management Applications:

Technicians from PWS Community College were trained in 2002 in CPR servicing/loading. Since then, they have been responsible for servicing the CPRs from the EVOS funded transect in Valdez and sending the unloaded samples to the Institute of Ocean Sciences, BC for processing. The crew of the Horizon Kodiak have been responsible for servicing the towing body and carrying out repairs as necessary. We are very grateful for the efforts of all concerned.

## 5. Information Transfer:

### a. Publications produced

- Lindley, J.A., and Batten, S.D. Distribution and seasonal cycles of decapod crustacean larvae in Continuous Plankton Records from the North Pacific Ocean. Accepted by *Journal of the Marine Biological Association, UK*.
- Mackas, D.L., Batten, S.D., and Trudel, M. (in press) Effects on zooplankton of a warming ocean: recent evidence from the Northeast Pacific. *Progress in Oceanography*.
- Batten, S.D. and Freeland, H.J. (in press). Plankton populations at the bifurcation of the North Pacific Current. *Fisheries Oceanography*
- Kirby, R.R., Lindley, J.A., and Batten, S.D. (2007). Spatial heterogeneity and genetic variation in the copepod *Neocalanus cristatus* along two transects in the North Pacific sampled by the Continuous Plankton Recorder. *Journal of Plankton Research*, 29, 97-106

### b. Conferences attended

A poster presentation was given at the January 2007 Marine Science in Alaska Symposium; “Zooplankton populations on the Alaskan Shelf and northern Gulf of Alaska” and an oral presentation given at the 4<sup>th</sup> Zooplankton Production Symposium in Hiroshima, Japan in May/June 2007 “Changes in oceanic northeast Pacific plankton populations: what may happen in a warmer ocean”.

### c. Data/information products

The website is currently being revised by PICES to enable users to manipulate the data to produce graphs of species abundances for various areas. It is hoped that this will be available by the end of August.

## 6. Budget:

On schedule

Report Prepared By:

\_\_\_\_\_Sonia Batten\_\_\_\_\_



Project Web Site Address: [http://www.sahfos.org/pacific\\_project.htm](http://www.sahfos.org/pacific_project.htm) and  
<http://www.pices.int/projects/tcprstnp/default.aspx>