

# ANNUAL REPORT

**Project Number:** G-030635

**Project Title:** Trophic dynamics of intertidal soft-sediment communities: interaction between bottom-up & top-down processes

**PI's:** Drs. Mary Anne Bishop & Sean P. Powers

**Time Period:** 24 April – 31 August 2003

**Date:** 1 September 2003

## **Work Performed:**

Vast expanses of intertidal sand/mudflats serve as a critical link in the food web of nearshore communities along the southcentral Alaska coastline. The rich abundance of benthic invertebrates residing within the sediments of intertidal flats provide a significant prey resource for numerous species of fish, crabs, birds, and marine mammals. One of the largest expanses of intertidal mud/sand flats occurs in the Copper River Delta and southeastern Prince William Sound (Orca Inlet). This large-scale field study examines the physical/chemical and biological factors that limit and/or regulate invertebrate community dynamics. The largely "bottom-up" approach supported by EVOS-GEM (physical/chemical parameters – phytoplankton/epibenthic production – invertebrate production) is balanced by the largely "top-down" focus of a companion project funded by the Prince William Sound Oil Spill Recovery Institute that examines predator dynamics and assesses their role in invertebrate community dynamics.

At the time of this report, field work for the 2003 field season is still being conducted. Sampling is scheduled to end in late October. Below we provide a summary of work performed to accomplish each objective outlined in our revised proposal.

*Objective 1: Characterize the spatial abundance of macrobenthic species inhabiting intertidal sediments within the Copper River Delta and Orca Inlet, Southeast Prince William Sound.*

We conducted our spring invertebrate sampling 26-27 April at our 3 study areas: near the outflows of the Copper River (Pete Dahl channel) and Eyak River (Eyak and Hartney Bay). We collected invertebrate core samples and sediment samples at high, mid, low elevations and a mid-mussel zone (Hartney Bay only). Our project's new technician was trained to pick and identify samples. As of this report, 81 of 90 cores from April have been identified and enumerated. The fall invertebrate core sampling is scheduled for the week of September 21. We anticipate that all analyses for the 2003 field sampling will be completed in early spring 2004. Sampling efforts in 2003 extend the temporal duration of invertebrate sampling to 4 years (2000-2003) at many of the sampling plots. A generalized diagram of the zonation of benthic invertebrates on the tidal flats of

the Copper River Delta is presented below. Additional results of earlier work can be found in Powers SP, Bishop MA, Grabowski JH, Peterson CH (2002) "Intertidal resources of the Copper River Delta, Alaska," *Journal of Sea Research* 47: 13-23.

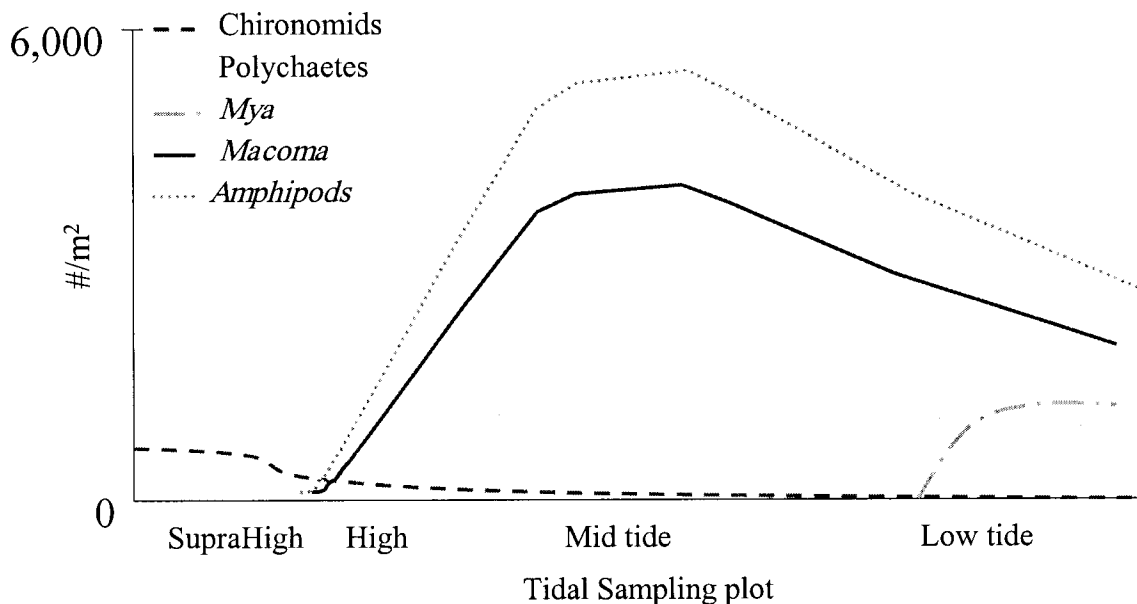


Figure 1. Generalized abundance pattern of benthic invertebrates along a tidal elevation gradient on the Copper River Delta. Low tide represents the 0.0 m elevation and SupraHigh a 3.5 m elevation.

**Objective 2:** Determine and quantify those factors that best serve as predictors for primary production in the overlying water and sediments of tidal flat communities.

Quadrat samples for benthic macroalage and core samples for benthic microalgae were sampled in April and June with a third sampling period planned for September 21. Quadrat samples for April and June have been processed and data entered. Core samples are currently being analyzed for chlorophyll a at the Dauphin Island Sea Lab. Concurrent with the otter trawl surveys (see below), we established sampling stations in estuarine waters from Orca Inlet to Pete Dahl Slough (11 sites) and along 5 major freshwater sloughs and rivers that feed into the delta (Fig. 2). Since late April we have collected monthly surface nutrient and chlorophyll a samples from each sampling station. These samples are currently being analyzed at the Dauphin Island Sea Lab. In addition, at estuarine stations we collected conductivity, temperature and depth profiles. These data have all been entered into our database. Two additional nutrient/chl a/hydrographic sampling trips are scheduled (late-September and mid-October).

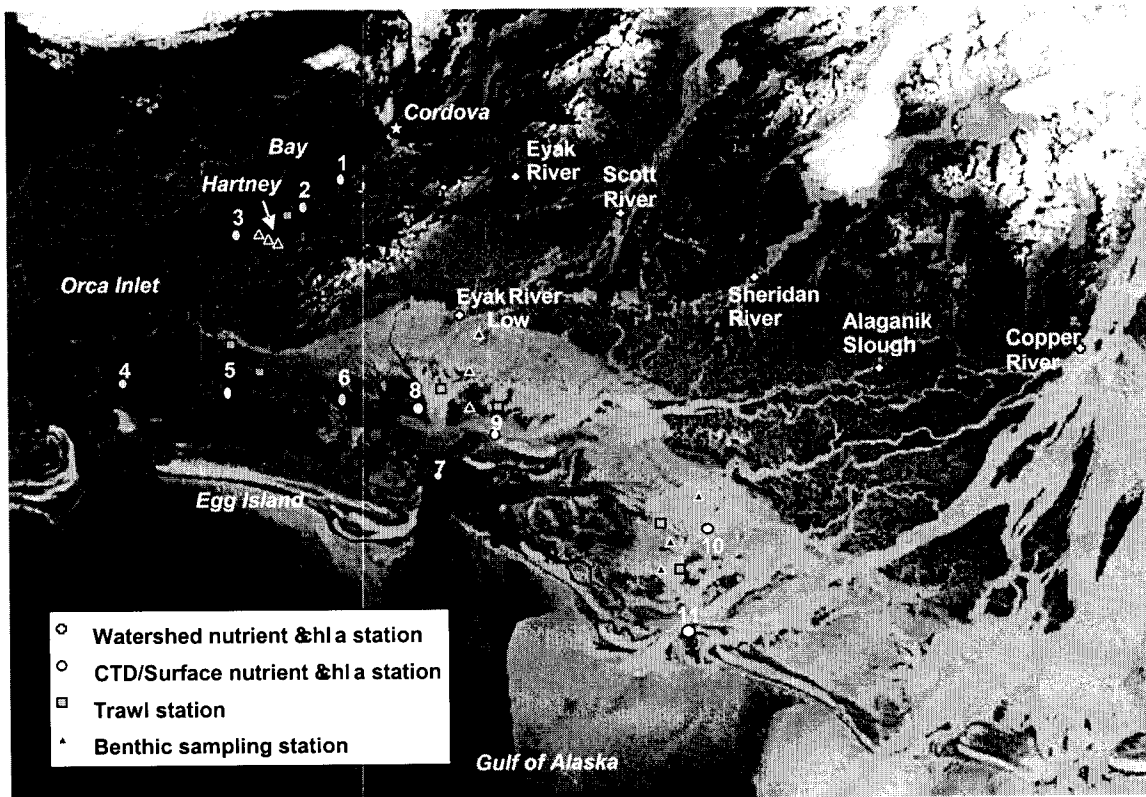


Figure 2. Satellite image of the western Copper River Delta showing the spatial extent of the Copper River outflow (cloudy, gray water vs. deep black water) and the network of mudflats throughout the brackish water portions of the Delta and Orca Inlet. Sampling station for CTD, nutrient and chlorophyll a water column measurements (numbered from 1 to 11), benthic invertebrates (triangle at different tidal elevations), demersal fish trawls (filled squares) and freshwater nutrient sampling stations (crosses) are indicated.

**Objective 3:** *Characterize the spatial and temporal abundance of demersal consumers and assess the role of epibenthic predation on recruitment of intertidal macroinvertebrates.*

Since the end of April 2003, we have conducted monthly otter trawl surveys at 7 stations in estuarine waters to document the demersal fish and invertebrate community and assess the role of epibenthic predation on recruitment of intertidal invertebrates. Surveys to date have found a large demersal-fish community, dominated by flatfish, *Crangon* shrimp, sculpin, snake prickleback and crabs (Figs. 3 & 4). Many of the species captured are of significant fisheries value (e.g., Pacific halibut, Dungeness crab, Lingcod). Five trips have been completed (April, May, June, July, and August). For each trawl survey, all fish and invertebrates collected are identified, enumerated, and weighed with a subsample of individuals for each species measured. Otter trawl surveys for September and October are planned. In addition, during late September, juvenile coho and sockeye will be sampled using mid-water trawl and fyke nets.

We anticipate that all analyses for the 2003 field sampling will be completed in early spring 2004.

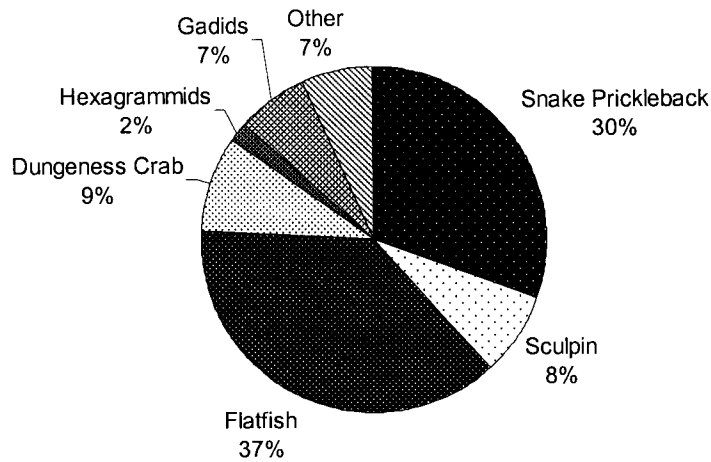


Figure 3. Percent composition of major demersal groups (excluding *Crangon* shrimp) captured in the trawl surveys conducted in 2002. Gadids include Pacific cod and Pacific tomcod. Hexagrammids include lingcod and a variety of greenling. Trawl sampling for 2003 is still being conducted.

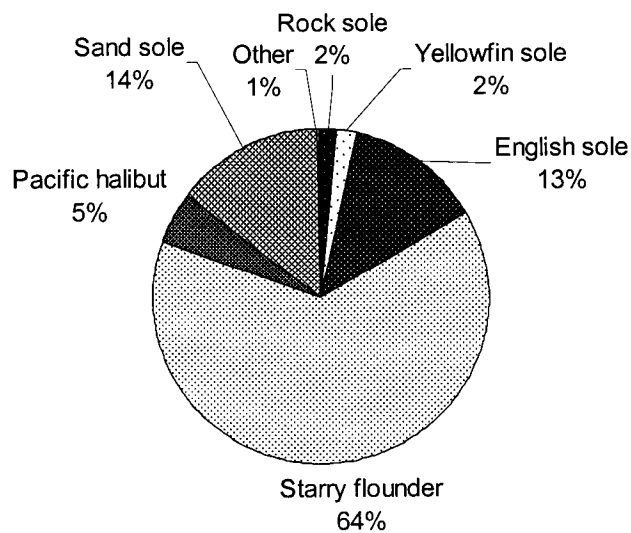


Figure 4. Flatfish species captured in the 2002 trawl survey expressed as percentage of total flatfish. Category labeled "other" include primarily Alaska plaice and Flathead Sole. Rock sole includes both northern and southern rock sole.

**Future work:**

September is a major field month for this project, with the fall invertebrate sampling scheduled, as well as the monthly otter trawl and ctd/nutrient sampling. The invertebrate cores will take approximately 2 months to process. For the FY 2004 the project has the same objectives and methods. As per our recently approved 2004-2006 proposal, we will be adding an additional study area around Egg Island for benthic invertebrate sampling.

**Coordination/Collaboration**

This project uses resources and funds from both EVOS and from the Prince William Sound Oil Spill Recovery Institute and, as of August 1 from the North Pacific Research Board (for juvenile salmon sampling). The Principal Investigators also lead the two complimentary projects so that collaboration and coordination is simplified.

**Community Involvement/TEK and Resource Management Applications:**

Because of the extensive knowledge of local fishers and the historic knowledge of native Alaskans, an interactive exchange with local fishermen is of great interest to the PI's. Direct input to the project by local fishermen is provided through their involvement in the otter trawl surveys as well as the mark and recapture study being conducted for flatfish. Since its inception this spring, the mark and recapture study has been advertised extensively to local fishers via newspaper advertisements, flyers delivered to fish processors, and flyers posted around the harbor and at key community bulletin boards. Additional input from the local fishing community will be solicited from the local fishing community via the EVOS-sponsored Prince William Sound Fisheries Research Application and Planning group (PWSFRAP).

**Information Transfer:**

In early June, Dr. Mary Anne Bishop made a presentation on this project to the EVOS Public Advisory Group as part of their semi-annual meeting in Cordova. Both Co-Principal Investigators attended the Prince William Sound Oil Spill Recovery Institute workshops on Nowcast-Forecast System and Biological Monitoring held in Anchorage during mid June 2003. A presentation on this project was made at the Biological Monitoring workshop. In September, Dr. Sean Powers will make a presentation at the Estuarine Research Federation Annual Meeting in Seattle, Washington. The presentation will present results of the coupled EVOS-GEM/OSRI research program.

Powers, S.P. and M.A. Bishop. 2003. Spatial and temporal variation in the food web of a subarctic estuary: implications for local and regional populations of nearshore fish and birds. Estuarine Research Federation, September 16.

Finally, development of a project web site is nearing completion. The web page should be online by mid-October and will be found at:

[www.disl.org/fishecology/EVOS-OSRI.html](http://www.disl.org/fishecology/EVOS-OSRI.html)

The page will also be available at [www.pwssc.org](http://www.pwssc.org).

Additional information will be available by 31 October on the Prince William Sound Ocean Observing System's web site (operated by the Prince William Sound Science Center): <http://www.pwsoos.org/BiologicalObservations.html> .

**Budget:**

No substantial changes to report.

**Signatures:**

/s/ Mary Anne Bishop, Principal Investigator, Prince William Sound Science Center, Cordova, Alaska

/s/ Sean Powers, Principal Investigator, Univ. S. Alabama Dauphin Island Sea Lab.

**Project Web Site Addresses:**

Both sites under construction; see above for tentative completion dates

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