EVOS ANNUAL PROJECT REPORT

Project Number: **NFFS5000-10-06795/ Contract No. AB133F10CN0066**

Project Title: **EVOS Project 10100574 - Re-assessment of Bivalve Recovery on Treated Mixed-Soft Beaches in Prince William Sound**

PI Name: **Dennis C. Lees**

Time Period Covered by Report: **10/1/2010 through 8/31/2011**

Date of Report: 9/7/2011

1. **Work Performed:** *Summarize work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Describe and explain any deviation from the original project objectives, procedural or statistical methods, study area, or schedule. Also describe any known problems or unusual developments, and whether and how they have been or can be overcome. Include any other significant information pertinent to the project.*

The following project tasks were proposed for this sampling period:

FY11, 1ˢᵗ quarter (1 October 2010 – 31 December 2010)
   October – December: Analysis of bivalve and sediment samples and photogrammetric data.
   20 December 2010: Submit quarterly report.
FY11, 2ⁿᵈ quarter (1 January 2011 – 31 March 2011)
   1 March 2011: Complete sediment and clam sample and photogrammetric analyses.
   5 March 2011: Commence statistical analysis for bivalve and sediment data and
         photogrammetric data.
   25 March 2011: Submit quarterly report.
   31 March 2001: Complete development of "armoring" metrics.
FY11, 3ʳᵈ quarter (1 April 2011 – 30 June 2011)
   1 May 2011: Complete statistical analysis for bivalve and sediment data.
   1 May 2011: Commence preparation of draft final report.
   25 June 2011: Submit quarterly report.
FY11, 4ᵗʰ quarter (1 July 2011 – 30 September 2011)
   1 September 2011: Submit annual report.

This phase of the project was not funded until midway through the 1at quarter of the fiscal year. This resulted in sample and data analysis being delayed and schedule slippage. We are just approaching a return to the projected schedule. All core and excavation samples have been analyzed, the data have been entered, and the first stage of quality assurance has been implemented. These data have been subjected to an initial analysis, and will be discussed in a preliminary manner briefly below. Final QA will be conducted in September.

Analysis of the sediment samples was completed on schedule and those data have been subjected to preliminary analysis.

In general, the geological/geomorphological patterns appear consistent with those observed in 2002. The sediments, strongly dominated by cobble and pebbles, are quite heterogeneous. An additional pattern demonstrated by these data is a consequence of the new vertically stratified sampling strategy. This approach confirmed that surficial sediments are coarser than deeper sediments, *i.e.*, largest quantities of coarse particles are observed in the upper few centimeters of the sediment column and largest quantities of silts and clays are found at deeper levels.

Processing of the photographs taken for photogrammetric analysis was completed with the PhotoModeler program in mid-August. This highly innovative element of the program is based on multiple photographs of specified areas at each sampling site. It is attempting to develop metrics that can quantify the degree of "armoring" or organization of the rocks concentrated on the surface of the sediments within which the clams live. The intent is to compare the metrics developed for each site with respect to treatment, i.e., whether the sites were washed or unwashed, or otherwise disturbed. The objective of this element of the program is to assess whether organization of the surficial clasts is an important factor associated with lagging recovery of the bivalve assemblage observed and reported for the 2002 study of the effects of shoreline washing on bivalve assemblages.

Development of this process has required substantially more processing time than could be anticipated since such an effort had never been attempted previously. The first step, converting the multiple stereophotos into a matrix of X-Y-Z coordinates representing the surface of the area photographed, was extremely time-consuming. The representative plot (Figure 1) illustrates the three-dimensionality of the surface of the sediment at one site. The surface depicted in the Detrended Data figure show the variation in the Z-coordinates with the entire plot converted to a completely horizontal surface from the sloping beach surface shown in the Original Data figure. The detrending process has eliminated the slope of the beach, which confuses determination of accurate Z-coordinates that can be compared across the X- and Y-axes. The units for all axes are millimeters (mm). The next step of developing the algorithms to be used computing the final metrics is well underway. The basic processed data are currently being re-processed with specially developed MATLAB scripts and routines to produce the final statistics for each site. We expect these analyses will be completed by the end of September.

Preliminary analyses of the bivalve fauna indicates that the structure of the entire infaunal assemblage has changed dramatically since we last sampled these locations in 2002. Overall, the abundance of the smaller size fraction of bivalves represented in the core samples has declined 45 percent. All six species with more than 20 specimens in 2002 were substantially less abundant in 2010, including both species of hard-shell clam. The average level of reduction in this subset was 63 percent. Littleneck clams (*Leukoma staminea*) declined by 96 percent. The larger, longer-lived butter clam (*Saxidomus gigantea*) declined the least (24 percent).

This pattern of decline in 2010 was observed in both the Treated (washed) and Untreated (unwashed) categories of locations. Bivalve abundance at Treated sites declined by 68 percent. Untreated sites fared somewhat better overall, with abundance declining only 29 percent. As above, the species that had more than 20 specimens in 2002 generally declined by 55 percent at the Untreated sites and 64 percent at the Treated sites. Tiny *Rochefortia tumida*, the most abundant clam in the core samples, actually increased 14 percent at the Untreated sites but

declined 72 percent at the Treated sites. If that species is omitted from the analyses, the reductions are basically equal (68 and 62 percent) in the two categories.
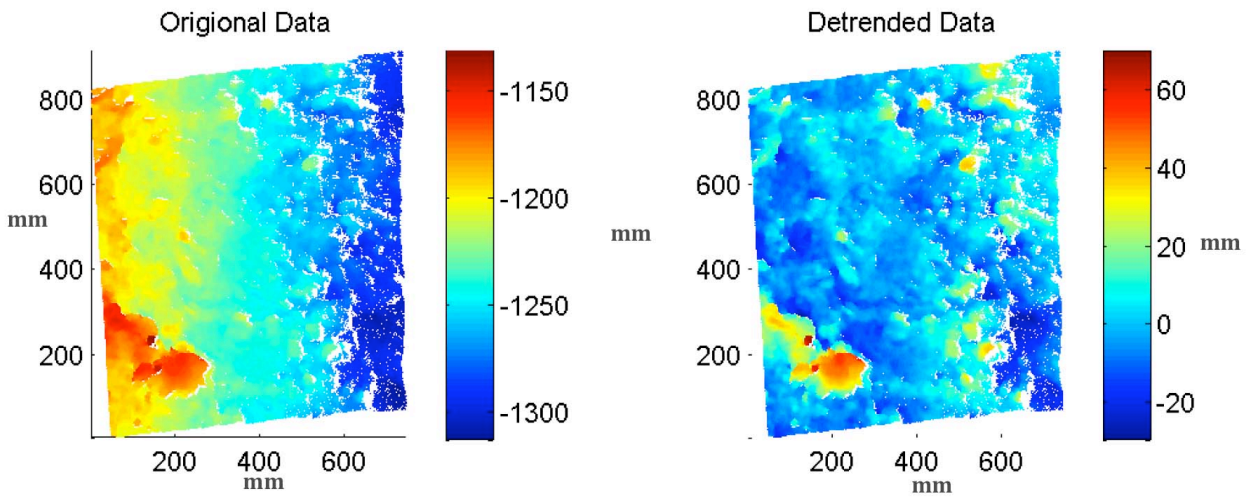

Figure 1. Three-dimensional representations of matrix of X- Y-, and Z-coordinates calculated from 10-20 photographs taken from different positions around the target sediment plot. The original data set has been detrended to remove the average slope of the beach from the matrix in order to facilitate calculating Z-coordinates from a consistent horizontal plane.

Overall, the abundance of the larger size fraction of bivalves in the excavation samples declined 62 percent. All five species with more than 20 specimens in 2002 were substantially less abundant in 2010, including both species of hard-shell clam. The average level of reduction in this subset was 60 percent. Littleneck clams (*Leukoma staminea*) declined by 94 percent. The larger, longer-lived butter clam (*Saxidomus gigantea*) declined the least (14 percent). The Baltic macoma (*Macoma balthica*), well adapted to disturbed conditions, increased in abundance by 247 percent.

As in the core samples, the pattern of decline in 2010 was observed in both the Treated (washed) and Untreated (unwashed) categories of locations. Bivalve abundance declined 23 percent in the Treated category. Untreated sites fared substantially worse, with abundance declining 80 percent. As above, the species that had more than 20 specimens in 2002 generally declined by 68 percent at the Untreated sites but only 24 percent at the Treated sites. The nestling clam *Hiatella arctica*, a well-known pioneer species and the most abundant clam in the excavation samples, actually increased 111 percent at the Treated sites but declined 75 percent at the Untreated sites. If that species is omitted from the analyses for the Treated sites, the reductions are similar (58 and 68 percent) in the two categories.

At this point in the analysis, it is unclear whether the differences observed between Untreated and Treated categories in the 2002 data will still be observed. Observations that the hard-shelled species were 37 and 46 percent less abundant at the Treated sites in the core samples suggest the pattern may still hold but that some recovery may have occurred. However, the observations for the butter and littleneck clam in the excavation samples are more ambiguous. The butter clam was 32 percent less abundant at Treated sites in the excavation samples, supporting the finding

from the 2002 survey. In contrast, the littleneck clam, which declined over 90 percent in both types of samples and treatment categories between 2002 and 2010, was 29 percent less abundant at the Untreated sites in 2010. It is unclear how the dramatic declines in abundance of both bivalves and the rest of the infaunal assemblage fit into this interpretation.

2. **Future Work***: Summarize work to be performed during the upcoming year, if changed from the original proposal. Describe any proposed changes in objectives, procedural or statistical methods, study area, or schedule. [**PLEASE NOTE***: Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]*

The scope of work has not changed from the original proposal. However, the schedule for the proposed activities for FY12 has slipped somewhat. The original schedule is listed below, with proposed amendments:

FY12, 1st quarter (1 October 2011 – 31 December 2011)
   15 October 2011: Complete draft preparation and submit draft final report.
At this point, we anticipate submitting the draft final report by 30 November 2011.
   20 December 2011: Submit quarterly report.
FY12, 2nd quarter (1 January 2012 – 31 March 2012)
   *January (dates not known): Attend Alaska Marine Sciences Symposium and present project
      results.*
   15 January 2012: Receive and address peer review comments on draft report.
We anticipate receiving peer-review comments to the draft final report by 15 February 2012, and addressing these comments by 1 April 2012.
   15 March 2012: Secure final approval, acceptance of final report.
   25 March 2012: Submit quarterly report.
FY12, 3rd quarter (1 April 2012 – 30 June 2012)
We anticipate securing final approval and acceptance of the final report by 1 May 2012.
   30 May 2012: Publication of final report complete, delivered to ARLIS.
We anticipate publication of the final report complete by 30 June 2012, with delivery to ARLIS.
   25 June 2012: Submit final quarterly report.

3. **Coordination/Collaboration:** *Describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.*

Not applicable.

4. **Community Involvement/TEK & Resource Management Applications:** *Describe efforts undertaken during the reporting period to achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.*

Not applicable.

5. **Information Transfer:** *List (a) publications produced during the reporting period, (b) conference and workshop presentations and attendance during the reporting period, and (c) data*

*and/or information products developed during the reporting period. [**PLEASE NOTE:** Lack of compliance with the Trustee Council's data policy and/or the project's data management plan will result in withholding of additional project funds, cancellation of the project, or denial of funding for future projects.]*

Data and information products and databases are currently being developed for the sediment, geomorphological, and benthic components of this program. Consequently, submittal is not applicable at this time.

The PI presented a paper (Comparison of Mixed-Soft and Traditional Homogeneous Sediments – Are These Sediments Characterized By Distinctively Different Paradigms?) at the annual meetings of the Geological Society of America in Denver in November 2010.

Preparation of a draft manuscript for submittal to the Journal of Coastal Research was completed in June and distributed to several colleagues for informal peer review. Review comments will be addressed in September and the manuscript will be submitted to JCR in October.

6. **Budget:** *Explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Also provide any new information regarding matching funds or funds from non-EVOS sources for the project. [**PLEASE NOTE:** Any request for an increased or supplemental budget must be submitted as a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]*

No changes.

Report Prepared By: Dennis C. Lees

Project Web Site Address: **None**