

EVOS PROPOSAL SUMMARY PAGE

Project No. G-030556
Date Received 9/4/02; TC approved 11/25/02

Project Title: High Resolution Mapping of the Intertidal and Shallow Subtidal Shores in Kachemak Bay

Project Period: 10/1/02 to 9/30/03

Proposer: Carl Schoch
Kachemak Bay Research Reserve
2181 Kachemak Dr.
Homer, AK 99603
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EVOS Funding: \$32,300

Matching Funds: \$30,000

Study Location: Kachemak Bay/Lower Cook Inlet

Trustee Agency: ADF&G

ABSTRACT

This is a continuation of the field mapping project started in FY02. This proposal seeks funding to complete the field mapping and begin building a database of the geomorphology and physical attributes of shallow subtidal and intertidal habitats for the greater Kachemak Bay/Lower Cook Inlet area. We regard this as the foundation for developing a monitoring program to detect changes in nearshore communities resulting from shifts in watershed and marine processes. Other map tools such as the NOAA Environmental Sensitivity Index (ESI), and the Shore-zone Classification were developed for oil spill response planning and do not contain the data necessary for resolving small spatial scale features of the shoreline needed in ecological studies where biophysical linkages often occur at scales of less than one meter.

I. INTRODUCTION

This proposal was funded by the EVOS Trustee Council late in the 2002 fiscal year. A condition of funding was to conduct the work over a two year period rather than the proposed single year effort. The Kachemak Bay Research Reserve agreed to conduct the field work during the first year of funding, and then in the second year, complete the field work and data analyses. Due to this funding delay, the first year of field work commenced July 1 and is still underway. At this time we have mapped about 65% of the Kachemak Bay shoreline and we expect to have about 85% completed by the end of the field season. As requested by the EVOS Trustee Council, we are submitting another proposal to complete this work in 2003. The remaining work consists of field mapping the remaining 15% of the shoreline, data entry, and GIS database development. The cost for this work is higher than estimated on the original proposal because 1) the start time was late and we had to hire and train field assistants, and 2) we will need to hire and train field assistants again in FY03. We are also requesting funds to present the results of this work at the ERF Conference in Seattle.

II. NEED FOR THE PROJECT

A Statement of Problem

The ecology of the nearshore benthos (from intertidal to 10 m depth) has been studied in detail at many coastal locations in the U.S. However, the processes that couple the intertidal regions with those in the nearshore ocean are poorly understood. For example, it is not apparent if production in some intertidal communities is regulated by the delivery of nutrients from the coastal ocean or by drainage from nearby rivers and estuaries. Such “edge” communities at the transition between one regime and another have rarely been studied as an integrated system. However, it is clear that there is strong physical and biological coupling between the nearshore and the intertidal. Prediction of how these communities will change over time or space is still a significant challenge. Map data of dominant habitats, as well as statistics about spatial frequency and abundance, are important to our understanding of how these systems interact and function and have many applications in resource management as well as basic research. Such understanding is especially critical as we try to make predictions about impacts of large-scale environmental phenomena, from coastal eutrophication, to oil spills, to shifts in weather patterns and wind driven processes (ENSO and global climate change).

B. Rationale/Link to Restoration

In establishing the GEM Program, the Trustee Council explicitly recognized that complete recovery from the oil spill may not occur for decades and that full restoration of injured resources will most likely be achieved through long-term observation and, as needed, restoration activities. The Council further recognized that conservation and improved management of injured resources and services will require substantial ongoing investment to improve understanding of the marine and coastal ecosystem that supports the resources, as well as the people, of the spill region. In addition, prudent use of the natural resources of the spill area

without compromising their health and recovery requires increased knowledge of critical ecological information about the northern Gulf of Alaska. This knowledge can only be provided through a long-term monitoring and research program that will span decades, if not centuries.

C. Link to GEM Program Document

Habitat mapping was one of the key components of the Nearshore monitoring strategy identified at a series of workshops sponsored by the EVOS trustee Council.

III. PROJECT DESIGN

A. Objectives

Our objective is to produce a spatially nested database of nearshore habitats in Kachemak Bay.

B. Procedural Methods

The proposed shoreline partitioning model relies on quantifying physical features known to have direct and indirect ecological responses, and uses these as criteria for partitioning complex shorelines into a spatially nested series of homogeneous segments. For example, at small spatial scales the quantified geophysical parameters include sediment grain size, wave energy, substrate dynamics, and sediment chemistry. At larger spatial scales water chemistry attributes such as salinity, chlorophyll and nutrient concentrations are used. These nested segments can be used to study between-segment and within-segment physical variability, which in turn will support studies of the biotic and abiotic processes that control variability in community structure. This nested segmentation approach allows large areas of shoreline to be classified based on relatively limited *in situ* sampling. The results of previous research by the principal investigator in Alaska (Lake Clark, Kenai Fjords, Katmai and Glacier Bay National Parks) have shown this to be a robust approach, despite the enormous complexity of these regions. An additional use of this database has recently been developed through an Olympic Coast National Marine Sanctuary initiative to establish a marine reserve network on the outer Washington coast.

The proposed study site will include all of Kachemak Bay and the smaller fjords and inlets along the more remote south shore. Homogeneous alongshore segments (10-100 meters in length) will be delineated and the physical component of the habitat characterized by up to ten geophysical parameters within each of three intertidal zones. These partitions include four intertidal polygons nested within each alongshore segment. Alongshore segments are grouped within oceanic cells to control for variations in salinity, temperature, nutrients and wave energy.

Methods Summary

1. At no cost to the project we will use a fixed array of instrumented moorings to measure salinity, temperature, D.O., pH, PAR, fluorescence and turbidity along and across the axis of the bay. This data will be augmented by a series of seven transects across the bay

using a caged CTD with PAR and chlorophyll sensors. These parameters will be used to identify the spatial and temporal variability of ocean and estuarine water in Kachemak Bay and determine the large spatial scale partitions of relative oceanic homogeneity.

2. At no cost to this project, we will partner with the Cook Inlet Regional Citizens Advisory Council to obtain low altitude oblique aerial videography of the coastal zone in Kachemak Bay, at extreme low tides, for large scale (100-1,000 m) partitioning of the shoreline based on shore geomorphology, geophysical and biological characteristics of the nearshore, and characteristics of the upland watershed.

3. Use existing NOAA high altitude vertical aerial photography and on-the-ground field measurements to map and partition the shoreline into geophysically homogeneous segments (10-100 m), quantifying the geophysical attributes known to force biological community structure.

4. We will produce a relational database linking the data acquired at the different spatial scales and resolutions. We will also build a GIS database using raster imagery and vector lines to represent the nearshore habitat segmentation. Intertidal polygons will then be linked to the relational database so that queries can be used to extract data and spatial patterns of interest to future research.

C. Statistical Methods

The proposed project is a data compilation and inventory of beach types. Statistical power to detect a change does not apply at this stage, however, future work will show the statistical rigor that can be generated when this database is used to identify replicate shore segments.

D. Description of Study Area

This project will take place in Kachemak Bay: the north shore from Anchor Point to the Fox River, then the south shore from Fox River to Nanwalek.

E. Coordination and Collaboration with Other Efforts

We are coordinating this project with ADFG Commercial and Sport Fish Division projects in Kachemak Bay focusing on clam bed research, with the Cook Inlet RCAC to map beaches for oil spill response planning, with The Nature Conservancy to map important conservation areas, and with the City of Homer to map high use beaches for potential land use zoning.

IV. SCHEDULE

A. Project Milestones and Endpoints

The project milestones are to synthesize existing intertidal habitat data and data under

development by other efforts, complete the high resolution mapping of nearshore habitats in Kachemak Bay, build a relational database of all the acquired nearshore attributes, and build a GIS database of raster imagery and vector coverages to represent the nearshore habitat segmentation.

B. Measurable Project Tasks

We intend to resume this project as soon as we are notified of a successful proposal. We anticipate 4 additional tide series to complete the field data collection, 2 months of data entry and analysis, and another 4 months of GIS database development and spatial data analysis.

| | |
|----------------|--|
| March 2003 | complete data synthesis and begin building relational databases |
| May 2003 | complete field work and draft relational database and begin GIS database |
| September 2003 | complete all work |
| November 2003 | submit final report |

V. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Knowledge (TEK)

The KBRR is an integrated research and education program. A goal of the KBRR education program is to provide for community involvement and conduct educational programs that will interpret and instruct the public on research projects conducted in the region. The KBRR will interpret research results by the following means:

- The KBRR web page;
- The KBRR interactive research and education programs;
- Conferences, workshops, and presentations on our programs to the community and schools;
- Display information on research projects at the new KBRR facilities in the Alaska Islands and Oceans Visitor Center.

B. Resource Management Applications

The project will benefit all the resource management agencies in the Bay, oil spill advisory councils, conservation agencies, and local governments (see letters of support submitted with the original proposal). The communities include the City of Homer and greater Homer area, Anchor Point, Seldovia, and the many small unorganized communities on the south shore or Kachemak Bay (e.g. Halibut Cove, Jakalof Bay, Bear Cove). Immediate resource management applications include using the database to quantify clam habitat to improve estimates of abundance. The database will also be used to quantify juvenile rockfish habitat and determine shores at risk to

oilspills and other development related stressors.

VI. PUBLICATIONS AND REPORTS

The product of this work is regarded as the foundation for further monitoring of the biological components of the ecosystem. As such, we do not expect to publish this data in a scientific journal until the biological data has also been collected and analyzed.

VII. PROFESSIONAL CONFERENCES

The principal investigator is professionally obligated to present the results of Kachemak Bay research projects at the annual NERRS Research Conference (travel funded by NOAA). Funding is requested for the PI to present the results of this project at the 2003 Estuarine Research Federation Conference in Seattle

VIII. PERSONNEL

A. Principal Investigator (PI)

Dr. G. Carl Schoch
Kachemak Bay Research Reserve
2181 Kachemak Drive
Homer, AK 99603
907-235-4799 (x 2)
907-235-4794
carl_schoch@fishgame.state.ak.us

B. Other Key Personnel

This grant will provide support for a GIS Analyst and a Research Assistant for field support, data entry, and analysis.

C. Contracts

Database design and development support will be contracted to a local consultant.

IX. PRINCIPAL INVESTIGATOR QUALIFICATIONS

G. Carl Schoch
Science Director, Kachemak Bay Research Reserve

Education

Ph.D., Biological and Geological Oceanography, 1999, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon 97331
MS., Oceanography, 1996, College of Oceanic and Atmospheric Sciences, Oregon State University
Post-baccalaureate in Arctic Hydrology, 1981-1984, University of Alaska, Anchorage, AK
BS Geology, 1977, Oregon State University

Academic Advisors

Post-doctoral:

Dr. Bruce Menge (mengeb@bcc.orst.edu)
Dr. Jane Lubchenco (lubchenj@bcc.orst.edu)

Doctoral:

Dr. Mark R. Abbott (biological oceanography, abbott@oce.orst.edu)

Masters:

Dr. Paul Komar (coastal and estuarine sediment processes, pkomar@oce.orst.edu)

Academic Fellowships

2000 - present: Senior Fellow for the Partnership for Interdisciplinary Study of the Coastal Oceans (PISCO: www.piscoweb.org).
1996 -1999: NASA Fellowship on the LEWIS satellite and hyperspectral imager project.
1995 -1996: NOAA, National Marine Sanctuaries Fellowship to study landscape scale ecological patterns in the marine nearshore of the Olympic Coast National Marine Sanctuary

Professional and Miscellaneous Experience

2002 - present: Assistant Professor of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks
2000 - present: Senior Research Fellow for the Partnership for Interdisciplinary Studies of the Coastal Ocean (PISCO: www.piscoweb.org)
2000 - present: Science advisor to the Marine Conservation Working Group on marine reserve design for the Olympic Coast Marine Sanctuary
1999 - present: Research Chair on the Olympic Coast Sanctuary Advisory Council
1994 -present: Coastwise Consultants, coastal ocean ecology, Homer, AK
1991 - 1993: Sailed the 30' ketch 'Elisabeth' around the world

Five Relevant Presentations and Publications

Allee, R.J., M. Dethier, D. Brown, L. Deegan, R.G. Ford, T.F. Hourigan, J. Maragos, C. Schoch, K. Sealey, R. Twilley, M.P. Weinstein and M. Yoklavich. 2000. Marine and Estuarine Ecosystem and Habitat Classification. NOAA Technical Memorandum NMFS-F/SPO-43 37p.
Schoch, G.C., M. N. Dethier, and H. Berry, 2001. Puget Sound intertidal biodiversity: scales of variability for invertebrate and algal communities on gravel beaches. *2001 Proceedings: Puget Sound Research Conference*, Seattle WA.

Schoch, G.C., G. Allison, B. Menge, and J. Lubchenco, 2000. Biogeographic patterns of community structure in Pacific Coast rocky intertidal communities. *2000 Proceedings: Ecological Society of America Meeting*, Snowbird, CO

Schoch, G.C., 1999. Untangling the complexity of nearshore ecosystems. Ph.D. dissertation, Oregon State University, 360 pp.

Schoch, G.C., 1996. The classification of nearshore habitats: a spatial distribution model. M.S. thesis, Oregon State University, 189 pp.

X. LITERATURE CITED

See original FY02 proposal

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

| Budget Category: | Authorized FY 2002 | Proposed FY 2003 | | | | | | |
|--|-------------------------------|-----------------------------|--|--|--|--|--|--|
| Personnel | | \$26.0 | | | | | | |
| Travel | | \$1.6 | | | | | | |
| Contractual | | \$2.0 | | | | | | |
| Commodities | | \$0.0 | | | | | | |
| Equipment | | \$0.0 | | | | | | |
| Subtotal | \$0.0 | \$29.6 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| General Administration | | \$2.7 | | | | | | |
| Project Total | \$0.0 | \$32.3 | | | | | | |
| Full-time Equivalents (FTE) | | 0.5 | | | | | | |
| Dollar amounts are shown in thousands of dollars. | | | | | | | | |
| Other Resources | | | | | | | | |
| <p>Comments: The cost for this work is higher than estimated on the original proposal because 1) the start time was late and we had to hire and train field assistants, and 2) we will need to hire and train field assistants again in FY03.</p> <p>Matching funds valued at \$30,000 come from the NOAA NERRS operations grant in providing Schoch with office and computer facilities, a support laboratory, a skiff, and oceanographic and meteorological instrumentation.</p> | | | | | | | | |

FY03

Prepared: 8/20/02

Project Number: G-030556 (TC approved 11/25/02)
 Project Title: High Resolution Mapping of the Intertidal and Shallow Subtidal Shores in Kachemak Bay
 Agency: ADFG

**FORM 3A
 TRUSTEE
 AGENCY
 SUMMARY**

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

| Contractual Costs: | | | Proposed |
|---|--|--|--------------|
| Description | | | FY 2002 |
| Fuel for Skiff | | | 1.0 |
| Contract for database design and development | | | 1.0 |
| When a non-trustee organization is used, the form 4A is required. | | | |
| Contractual Total | | | \$2.0 |
| Commodities Costs: | | | Proposed |
| Description | | | FY 2002 |
| | | | |
| Commodities Total | | | \$0.0 |

FY03

Prepared: 8/20/02

Project Number: 02556
 Project Title: High Resolution Mapping of the Intertidal and Shallow Subtidal Shores in Kachemak Bay
 Agency: ADFG

FORM 3B
 Contractual &
 Commodities
 DETAIL

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

| New Equipment Purchases: | | Number of Units | Unit Price | Proposed FY 2002 |
|---|--|-----------------|----------------------------|------------------|
| Description | | | | |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| | | | | 0.0 |
| Those purchases associated with replacement equipment should be indicated by placement of an R. | | | New Equipment Total | \$0.0 |
| Existing Equipment Usage: | | Number of Units | Inventory Agency | |
| Description | | | | |
| Research Skiff | | 1 | | |
| KBRR headquarters and research facilities | | 2 | | |
| KBRR Computers | | 3 | | |

FY03

Project Number: 02556
 Project Title: High Resolution Mapping of the Intertidal and Shallow Subtidal Shores in Kachemak Bay
 Agency: ADFG

FORM 3B
 Equipment
 DETAIL

Prepared: 8/20/02