Trustee Council Use Only
Project No: _____
Date Received: _____

GEM PROPOSAL SUMMARY PAGE

(To be filled in by proposer)

Project Title	Monitoring in the Nearshore: A Process for Making Reasoned Decisions (close-out of project 030687)
Project Period:	FY04: $10K FY03: $90K
Proposer(s):	James L. Bodkin and Thomas A. Dean
Study Location:	No field work. Study area is the Gulf of Alaska.

Abstract: Over the past several years, a conceptual framework for the GEM nearshore monitoring program has been developed through a series of workshops. However, details of the proposed monitoring program, e.g. what to sample, where to sample, when to sample and at how many sites, have yet to be determined. In FY 03 we were funded under Project 03687 to outline a process whereby specific alternatives to monitoring are developed and presented to the EVOS Trustee Council for consideration. As part of this process, two key elements are required before reasoned decisions can be made. These are: 1) a comprehensive historical perspective of locations and types of past studies conducted in the nearshore marine communities within Gulf of Alaska, and 2) estimates of costs for each element of a proposed monitoring program. We have developed a GIS database that details available information from past studies of selected nearshore habitats and species in the Gulf of Alaska and provide a visual means of selecting sites based (in part) on the locations for which historical data of interest are available. We also provide cost estimates for specific monitoring plan alternatives and outline several alternative plans that can be accomplished within reasonable budgetary constraints. The products that we will provide are: 1) A GIS database and maps showing the location and types of information available from the nearshore in the Gulf of Alaska; 2) A list of several specific monitoring alternatives that can be conducted within reasonable budgetary constraints; and 3) Cost estimates for proposed tasks to be conducted as part of the nearshore program. Because data compilation and management will not be completed until late in FY03 we are requesting support for close-out of this project in FY 04.

Funding:	EVOS Funding Requested:	FY 04	$ 10K	
		FY 05	$	
		FY 06	$	TOTAL: $10K
	Non-EVOS Funds to be Used:	FY 04	$ 9.5K	
		FY 05	$	
		FY 06	$	TOTAL: $9.5K

Date: Date proposal prepared June 5, 2003

GEM RESEARCH PLAN

Monitoring in the Nearshore: A process for making reasoned decisions
(close-out of Project 030687)
Principal Investigators: Jim Bodkin, Tom Dean

I. NEED FOR THE PROJECT

A. Statement of Problem

Over the past year, a series of workshops were convened to help develop a conceptual model for monitoring in the nearshore (Project 02395) aimed principally at detecting and understanding ecosystem change. As part of the development process, it was recognized that the changes are likely to occur and to be attributable to a number of different agents (e.g. global climate changes, shoreline development and associated inputs of pollutants). It was also recognized that changes are likely to occur over varying temporal and spatial scales. For example, global climate change may result in a gradual change in the nearshore community that occurs over decades and has impacts over the entire Gulf of Alaska (GOA), and beyond. On the other hand, impacts from shoreline development will likely be more episodic and more local. Thus, one challenge of designing a monitoring program is to detect changes occurring over widely varying scales of space and time. In response to this challenge, the conceptual design for monitoring in the nearshore (Schoch et al 2002) called for a multi-pronged approach consisting of the following:

1) Synoptic sampling of specified physical and biological parameters (e.g. weather, sea surface temperature) over the entire GOA
2) Intensive sampling of a variety of specified biological and physical parameters (e.g. abundance and growth of intertidal organisms, abundance of selected birds and marine mammals) within a few specified areas spread throughout the GOA using a nested sampling approach. The nested design calls for sampling at some number of locations within the GOA, and at a number of sites within each of those locations.
3) Sampling of a smaller suite of selected biological and physical parameters (e.g. the abundance, growth, and contaminant levels in mussels and clams) at a larger number of less intensively studied sites stretching across the GOA. These are referred to as extensive sites.
4) Conduct of shorter-term studies aimed at identifying important processes regulating or causing changes within a given system or subsystem.

Sampling at intensive sites was designed primarily to detect large-scale changes (e.g. those due to global climate change) while sampling at extensive sites was designed primarily to detect changes that might occur as a result of more localized events such as shoreline development or logging activities.

A long list of potential parameters to be measured was developed and priorities were given for each of these within the synoptic, intensive, and extensive components. This provided a reasonable framework for development of a nearshore GEM monitoring program, but specifics

as to the parameters to be measured, the number of sites to be sampled, and the location of sampling sites were not determined. Furthermore, no specific cost estimates were provided and no determination was made as to the appropriate allocation of effort (and costs) among the various components (synoptic, intensive, extensive and process studies).

In FY 03 we were funded under EVOS Project 030687 to compile in a geographically explicit format, a listing of available study of selected nearshore resources that might be included in the GEM program, and to provide alternative sampling programs for consideration of incorporation into the GEM Program. Close-out funds in FY04 are necessary to complete the GIS product, finalize potential sampling scenarios and provide a final report.

B. Relevance to GEM Program Goals and Scientific Priorities

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 actions. 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 ecosystems that support 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.

As part of the overall GEM program, a comprehensive examination of the nearshore zone is required. The nearshore is a critical component of the GOA system, was one of the components most severely injured by the *Exxon Valdez* oil spill, is utilized to a large extent (both directly and indirectly) by humans, and is likely to be adversely impacted by anthropogenic effects over the next century. Therefore, development of a cost-effective program that is able to detect and understand causes for change in the nearshore is a critical.

II. PROJECT DESIGN

A. Objectives

The objectives of the proposed study are:

1. Establish a historical database that identifies types and locations of data of interest in selecting monitoring sites for nearshore monitoring.

2. Provide a list of alternative nearshore sampling designs that can detect changes in the nearshore and fit within budgetary constraints. Each alternative will specifically identify the location and number of sampling sites, the metrics to be sampled at each, and the frequency of sampling.

3. Provide cost estimates for a series of alternative nearshore sampling designs to be used to detect and understand changes in the nearshore environment of the GOA.

B. Procedural and Scientific Methods

1. Establish a historical database that identifies types and locations of data of interest in selecting monitoring sites for nearshore monitoring.

We will use ArcInfo to develop a GIS database to organize available historical and current information, habitat characteristics, and human use for GOA areas of interest. The database will contain the following layers: 1) A base map of the GOA bounded by Sitka to the southeast and the western extent of Kodiak Island to the west. 2) Available habitat information (e.g. bathymetry), 3) The location of historical data for a suite of selected nearshore organisms (e.g. invertebrates, fishes, birds and mammals), 4) The presence of known or suspected "hotspots" that are of special biological significance, 5) The areas of special cultural or biological importance that are to be avoided, and 6) Human use patterns including locations of towns and villages, important recreational areas, and areas of subsistence harvest.

Much of the database development will entail gathering and collating existing databases and building GIS coverages, including past EVOS studies. For example, base maps for most of the region are currently available from USGS, habitat data are available from Environmental Sensitivity Index (ESI) databases (e.g. RPI, 1983) and on recent video surveys of Harper et al (1991 and unpublished), recreational use within Prince William Sound has been gathered by Murphy et al. (1999), and biological hotspots have been identified by the National Wildlife Federation (2002) and on ESI maps. Additional sources of information will include existing catalogs of data sets (Michaelson 1995, Michaelson 1996) and Environmental Impact Statements (USDA 2002). While we have a reasonable understanding of the data and coverages currently available, we clearly do not know all of them, and part of this task will be to seek out appropriate databases and incorporate them into a unified set of coverages. Community representatives will be asked to provide locations used for subsistence harvest and areas of special cultural significance that are to be avoided as sampling sites.

The historical biological information will necessarily be restricted to those metrics that are of interest to a nearshore monitoring program, and will not attempt to be inclusive of all marine habitats and species (e.g. historical catch data for commercial fishes). Sites where historical data have been gathered will be identified in a GIS layer and coded as to type (e.g. bird abundance, sea otter abundance, intertidal invertebrate abundance, PAH concentration in mussels). Each GIS layer will be accompanied by meta-data that briefly describes the type of data available, methods used in collection, the time period over which it was collected, and the reference where the data can be obtained.

An example of the kind of maps that will be produced is given for a portion of Glacier Bay for which we have compiled these data based on recent surveys (Figure 1).

2. Provide a list of alternative nearshore sampling designs that can detect changes in the nearshore and fit within budgetary constraints. Each alternative will specifically identify the location and number of sampling sites, the metrics to be sampled at each, and the frequency of sampling.

Based on the processes described above, we will compile a list of alternative sampling plans. An example of such plans, based on a preliminary evaluation of metrics, sampling locations and costs is given in Table 3.

3. Provide cost estimates for alternative nearshore sampling designs to be used to detect and understand changes in the nearshore environment of the GOA.

Cost estimates will be provided for each alternative sampling design presented. These will be established by starting with an estimated total budget per year, establishing a reasonable percentage of costs for each element (e.g. synoptic sampling, intensive sampling, extensive sampling, and process studies), and working backwards to determine the sampling design that could fulfill the requirements of detecting change yet fit within this cost structure. An estimated cost per site for conducting sampling of given metrics will be established based on our experience and on cost estimates obtained from other experts within the field.

The metrics to be examined will be selected from the list given in Table 2. Our process for selection of metrics to be examined in synoptic, intensive, and extensive sampling is as follows. First, metrics listed as having highest priority (based on past workshops) will be considered. However, we will make modifications to these as required in order to achieve program goals. For example, not all physical data identified has having highest priority are likely to be included because initial estimates of costs suggest that measuring all of these would leave little or no funding for biological measurements that are also considered as essential. Second, we will give priority to metrics necessary to detect change over those used to understand change. While we see understanding change as an important component of the GEM program, it is critical to first be able to detect change with reasonable certainty. Finally, we will focus on metrics that fit the temporal and spatial scale of the impacts we that we are attempting to detect within each component. For example, the goal of intensive sampling is to detect changes that might occur over large geographic areas and long time periods. As a result, we will rely on metrics that integrate environmental changes over large spatial and temporal scales.

C. Data Analysis and Statistical Methods

It is anticipated that the power associated with a selected sampling design will be evaluated after a first year of preliminary sampling and the designs will be modified accordingly. The initial sampling is not a part of this proposal. However, where estimates of sampling variances are available, power analyses will be included in each sampling design, and as part of the metric selection process.

D. Description of Study Area

The study will focus on a sampling design aimed at evaluating changes over the entire GOA, generally defined by the following bounding coordinates North 61.700 N X 147.500 W, South 56.500 N X 146.000 W, East 60.000 N X 144.000 W, and West 56.500 N X 147.500W. It is anticipated that sampling designs will be bounded to the Copper River Delta (Cape Suckling), and to the northwest by Kodiak, with sampling concentrated within the PWS and Kenai (Cook Inlet and Resurrection Bay) areas. It is anticipated that a portion of the sampling design will focus on sampling at extensive sites centered in communities of Kodiak, Homer, Seward, Valdez, and Cordova as well as native villages throughout the region (e.g. Tatitlek, Chenega, English Bay).

E. Coordination and Collaboration with Other Efforts

It is anticipated that the GIS database development portion of the project will be coordinated with other efforts being conducted as part of Alaska watershed and coastal current projects. This portion of the project will rely on past and current efforts funded by the EVOS Trustee Council and the USGS that have developed GIS databases. In addition, we will coordinate and collaborate with other federal, state, public and private institutions and communities in acquiring and sharing GIS layers required for this proposal.

III. SCHEDULE

A. Project Milestones

Objective 1. Establish a GIS database that identifies types and locations of data of interest in selecting monitoring sites for nearshore communities in the GOA.

To be met by September 2003

Objective 2. Provide a list of alternative nearshore sampling designs that can detect changes in the nearshore and fit within budgetary constraints. Each alternative will specifically identify the location and number of sampling sites, the metrics to be sampled at each, and the frequency of sampling.

To be met by December 2003

Objective 3. Provide cost estimates for alternative nearshore sampling designs to be used to detect and understand changes in the nearshore environment of the GOA.

To be met by December 2003

B. Measurable Project Tasks

FY 03, 1st quarter (October 1, 2002-December 31, 2002)
November 25: Project funding approved by Trustee Council

FY 03, 2nd quarter (January 1, 2003-March 31, 2003)
January 13-17: Annual EVOS Workshop (joint symposium with GLOBEC and NMFS)
Initiate collection and compilation of existing data and initiate development of GIS data coverages

FY 03, 3rd quarter (April 1, 2003-June 30, 2003)
March 30: Continue GIS database
April 30: Prepare sampling alternatives and cost estimates.

FY 03, 4th quarter (July 1, 2003-September 30, 2003)
September 1: Complete GIS data layers and sampling alternatives
Submit annual report

FY04, 1st quarter (October 1, 2003-December 31, 2003):
December 1, 2003 Submit Final report to the Trustee Council

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

Community representatives will be asked to provide input with respect to locations of cultural resources and subsistence harvest areas to be included in the GIS database. This information will be used in helping to select sites for sampling.

The final report will be presented to the Trustee Council and to its community representatives for review. It is anticipated that the final decision regarding selection of a nearshore monitoring plan will be done in consultation with community representatives.

B. Resource Management Applications

The immediate use of the GIS database of historical information proposed for this project will be to aid in the selection of long-term monitoring sites. However, it is also anticipated that this database will have benefit to resource agencies concerned with nearshore habitats. This database will be especially valuable in efficiently gathering information that may be used to detect changes caused by some future unanticipated event, such as an oil spill. The products of this proposal will make important regional data sets more accessible to scientists, managers and other resource dependent individuals, including subsistence users, fishers and teachers.

V. PUBLICATIONS AND REPORTS

No manuscripts will be submitted as a result of this project. A final report will be prepared and presented upon project completion.

VI. PROFESSIONAL CONFERENCES

We do not anticipate presenting results at a conference.

Resume

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Education

1985 - MS, California Polytechnic State University, San Luis Obispo, CA. (Wildlife Biology)
1976 - BS, Long Beach State University (Biology), Long Beach, CA
1972 - AS, Cypress College (Biology), Cypress, CA

Publications

Dean, T.A., **J.L. Bodkin**, A.K. Fukuyama, S.C. Jewett, D.H. Monson, C.E. O'Clair, and G.R. VanBlaricom. 2002. Food limitation and the recovery of sea otters in Prince William Sound. Marine Ecology Progress Series. 241:255-270

Bodkin, J.L., B.E. Ballachey, T.A. Dean, A.K. Fukuyama, S.C. Jewett, L.M. McDonald, D.H.Monson, C.E. O'Clair and G.R. VanBlaricom. 2002. Sea otter population status and the process of recovery from the Exxon Valdez oil spill. Marine Ecology Progress Series. 241:237-253.

Monson, D.H., D.F. Doak, B.E. Ballachey, A. Johnson, and **J.L. Bodkin**. 2000. Long-term impacts of the *Exxon Valdez* oil spill on sea otters, assessed through age-dependent mortality patterns. Proceedings National Academy of Sciences, USA.97(12):6562-6567.

Doroff, A.M. and **J.L. Bodkin**. 1994. Sea otter foraging behavior and hydrocarbon levels in prey. *in* T. Loughlin, editor. Marine mammals and the Exxon Valdez. Academic Press. San Diego, CA pages 193-208.

Bodkin, J. L. and M.S. Udevitz. 1999. An aerial survey method to estimate sea otter abundance. in: Garner, G.W., S.C. Amstrup, J.L. Laake, B.F.J. Manly, L.L. McDonald, and D.G. Robertson, (eds.) Marine mammal survey and assessment methods. Balkema Press, Netherlands pg. 13-26.

Other Publications

Bodkin, J.L., A.M. Burdin and D.A. Ryzanov. 2000. Age and sex specific mortality and population structure in sea otters. Marine Mammal Science 16(1):201-219.

Ballachey, B.E., **J.L. Bodkin** and A.R. DeGange. 1994. An overview of sea otter studies. *in* T. Loughlin editor. Marine mammals and the Exxon Valdez. Academic Press. San Diego, CA pages 47-59.

Bodkin, J.L., B.E. Ballachey, M.A. Cronin and K.T. Scribner. 1999. Population demographics and genetic diversity in remnant and re-established populations of sea otters. Conservation Biology 13(6):1278-1385.

Bodkin, J.L. 2001. Marine Mammals: Sea otters. Pages 2614-2621. in Steele, J. S.Thorpe and K. Turekian (eds.) Encyclopedia of Ocean Sciences. Academic Press, London UK. (invited ms).

Estes, J.A. and **J.L. Bodkin**. 2002. Marine Otters. In W.F. Perrin, B. Wursig,, J.G.M. Thewissen and C.R. Crumly (eds) Encyclopedia of Marine Mammals. Academic Press 843-858. (invited ms).

Collaborators

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Snyder, Paul, Purdue University, West Lafayette, IN 765-494-9676

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Resume

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Education

University of Delaware, Ph.D., Biology	1977
East Carolina University, M.A., Biology	1973
Gettysburg College, B.A., Biology	1970

Professional Experience

President Coastal Resources Associates, Inc.	1988 to Present
Associate Research Biologist University of California, Santa Barbara	1978 to 1987
Senior Staff Ecologist E.H. Richardson Associates	1976 to 1978

Publications

Dean T.A., L. Haldorson, D.R. Laur, S.C. Jewett, A. Blanchard. 2000. The distribution of nearshore fishes in kelp and eelgrass communities in Prince William Sound, Alaska: associations with vegetation and physical habitat characteristics. Environmental Biology of Fishes 57: 271-287

Osman, R., **T.A. Dean**. 1987. Intra- and interregional comparisons of numbers of species on marine hard substrate islands. J. Biogeography 14: 53-67

Dean, T.A. 1985. The temporal and spatial distribution of underwater quantum irradiation in a southern California kelp forest. Estuar. Coast. Shelf Sci. 21:835-601

Dean. T.A. 1981. Structural aspects of sessile invertebrates as organizing forces in an estuarine fouling community. J. Exp. Mar. Biol. Ecol. 53: 163-180

Dean, T.A., L.E. Hurd. 1980. Development in an estuarine fouling community: the influence of early colonists on later arrivals. Oecologia 46: 295-30.

Other Publications

Dean, T.A., J.L. Bodkin, A. Fukuyama, S.C. Jewett, D.H. Monson, C.E. O'Clair, G.R. VanBlaricom. 2002. Food limitation and the recovery of sea otters following the *Exxon Valdez* oil spill. Marine Ecology Progress Series (In press)

Bodkin, J.L., B. Ballachey, **T.A. Dean**, F.K. Fukuyama, S.C. Jewett, L.L. McDonald, D.H. Monson, C.E. O'Clair, and G.R. Van Blaricom. 2002. Sea otter population status and the process of recovery following the 1989 *Exxon Valdez* oil spill. Marine Ecology Progress Series (In press)

Golet, H.G., P.E. Seizer, A.D. McGuire, D.D. Roby, J.B. Fischer, K.J. Kuletz. D.B. Irons, **T. A. Dean**, S.C. Jewett, and S.H. Newman. 2002. Long-term direct and indirect effects of the the *Exxon Valdez* oil spill on pigeon guillemots in Prince William Sound, Alaska. Marine Ecology Progress Series (In press).

Esler, D., T.D. Bowman, K.A. Trust, B.E. Ballachey, **T.A. Dean**, S.C. Jewett, C.E. O'Clair. 2002. Harlequin duck population recovery following the *Exxon Valdez* oil spill: Progress, process, and constraints. (In press).

Jewett, S.C., **T.A. Dean**, B.R. Woodin, M.K. Hoberg, and J.L. Stegeman. 2002. Exposure to hydrocarbons ten years after the *Exxon Valdez* oil spill: evidence from cytochrome P4501A expression and biliary FACs in nearshore demersal fishes. Marine Environmental Research. 54:21-48.

Collaborators

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EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06		TOTAL PROPOSED
Personnel	$0.0	$0.0	$0.0		$0.0
Travel	$0.0	$0.0	$0.0		$0.0
Contractual	$9.2	$0.0	$0.0		$9.2
Commodities	$0.0	$0.0	$0.0		$0.0
Equipment	$0.0	$0.0	$0.0		$0.0
Subtotal	$9.2	$0.0	$0.0		$9.2
General Administration (9% of Subtotal)	$0.8	$0.0	$0.0		$0.8
Project Total	$10.0	$0.0	$0.0		$10.0

Cost-share Funds:
In this box, identify non-EVOS funds or in-kind contributions used as cost-share for the work in this proposal. List the amount of funds, the source of funds, and the purpose for which the funds will be used. Do not include funds that are not directly and specifically related to the work being proposed in this proposal.

FY04: USGS will contribute approximately 1 month of Jim Bodkin's salary = $9500

FY 04-06

Date Prepared:June 16, 2003

Project Number: 040687
Project Title: Monitoring in the Nearshore: A Process for Making Reasoned Decisions
Agency: DOI--USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 04 - FY 06

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 04

Project Number: 040687
Project Title: Monitoring in the Nearshore: A Process for Making Reasoned Decisions
Agency: DOI--USGS

FORM 3B
Personnel
& Travel
DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

Contractual Costs:	Contract Sum
Description	
Coastal Resources Associates, Dr. Tom Dean	
salary, 1 month X $8K per month	8.0
site licenses for both SAS and ARCVIEW software, 1/2 year	1.2
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$9.2

Commodities Costs:	Commodity Sum
Description	
Commodities Total	$0.0

FY 04

Project Number: 040687
Project Title: Monitoring in the Nearshore: A Process for Making Reasoned Decisions
Agency: DOI--USGS

FORM 3B
Contractual & Commodities DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

New Equipment Purchases:		Number	Unit	Equipment
Description		of Units	Price	Sum
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
			New Equipment Total	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 04

Project Number: 040687
Project Title: Monitoring in the Nearshore: A Process for Making Reasoned Decisions
Agency: DOI--USGS

FORM 3B
Equipment
DETAIL

BUDGET JUSTIFICATION

Monitoring in the Nearshore: A Process for Making Reasoned Decisions
(close-out of Project 030687)
PI's: Bodkin, Dean

FY04 total project cost: $19.5K, with $10K requested from EVOS and $9.5K provided by USGS

In FY 03 we were funded under EVOS Project 030687 to compile in a geographically explicit format, a listing of available study of selected nearshore resources that might be included in the GEM program, and to provide alternative sampling programs for consideration of incorporation into the GEM Program. Close-out funds in FY04 are being requested to complete the GIS product, finalize potential sampling scenarios and provide a final report.

Personnel: $8.0K requested from EVOS to support PI Tom Dean
USGS will contribute $9.5K salary costs for Jim Bodkin

Contractual: $1.2 for site license for SAS and ARCVIEW software