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GEM PROPOSAL SUMMARY PAGE
(To be filled in by proposer)

Project Title:	A Synthesis of Natural Variability in the Nearshore: Can We Detect Change?
Project Period:	FY 04-FY 05
Proposer(s):	Dr. Ginny L. Eckert, University of Alaska Southeast
Study Location:	Alaska (Synthesis)
Abstract:	One of the primary goals of the GEM program is to detect anthropogenic changes within the four focal habitats in the Gulf of Alaska, however natural variability in these systems can be so high that it prevents detection of human-induced effects. The goal of this proposal is to synthesize existing data to identify, within the nearshore habitat, environments and species that have less natural variability so that these variables can be included in the GEM monitoring plan. Data will be synthesized from the Gulf of Alaska and across a broad range of geographic areas to identify general characteristics that predict lower levels of natural variability in nearshore marine populations. The principal investigator is well suited to conduct this analysis because she was a coauthor of the current GEM nearshore monitoring plan, and she has conducted extensive analyses of natural population variability in nearshore organisms.
Funding:	EVOS Funding Requested: FY 04 \$ 36.3 K FY 05 \$ 17.5 K TOTAL: \$53.8 K Non-EVOS Funds to be Used: FY 04 \$ 3.5 K FY 05 \$ 4.1 K TOTAL: \$7.6 K
Date:	June 3, 2003

A SYNTHESIS OF NATURAL VARIABILITY IN THE NEARSHORE: CAN WE DETECT CHANGE?

GEM RESEARCH PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

"Perhaps the most insidious problem associated with detecting effects stems from the natural variability of biotic assemblages" (Paine et al. 1996).

One of the primary goals of the Gulf Ecosystem Monitoring (GEM) program is to detect anthropogenic changes within the four focal habitats in the Gulf of Alaska, however natural variability in these systems can be so high that it prevents detection of human-induced effects. Distinguishing human-induced effects from natural variability is a difficult and challenging task (Marsh 2001, Peterson et al. 2001, Paine et al. 1996, Wiens 1996, Wiens and Parker 1995, Thrush et al. 1994). The goal of this proposal is to synthesize existing data to identify, within the nearshore habitat, the environments and species that have less natural variability so that these variables can be included in the monitoring plan. It is not intended that these species and environments would be the only ones included in the final monitoring plan, because other characteristics may necessitate the inclusion of other environments or species. However, inclusion of environments and species that have less natural variability greatly increases the power to detect anthropogenic influences. This synthesis effort will build on the proposed monitoring structure and use existing data within the nearshore in the Gulf of Alaska, and, in addition, will synthesize data from across a broad range of geographic areas to identify general characteristics that predict lower levels of natural variability in nearshore marine populations. Such an analysis will be informative not only to GEM, but also to other monitoring programs and the ecological community in general. The principal investigator is well suited to conduct this analysis because she was a coauthor of the current GEM nearshore monitoring plan (Schoch et al. 2002), and she has conducted extensive analyses of natural population variability in nearshore organisms (Eckert 2003).

Designing a monitoring program requires, in essence, the ability to see into the future, because the data to be collected will be analyzed to examine the consequences of activities in the future. Some activities can be predicted, such as fishing, forestry, and other human uses of resources. However, the timing and location of some events cannot be predicted, such as the Exxon Valdez oil spill. In both cases, it is useful to have a baseline of information about the ecosystem and how it functioned before the event in question. In practice, baselines will concentrate on two categories of species: those that people care about and those that are reliable indicators of change (Paine et al. 1996). Selecting the former group of species is relatively easy, because people tend to care about a handful of charismatic and/or commercially important species. In contrast, selecting the latter group of species, those that are reliable indicators of change, can be difficult.

Indicators of change

The best indicators of change are ones that are sensitive, but not too sensitive, to change, and have low natural variability. Natural variability is often viewed as noise, with the non-natural inducer of change viewed as signal. What is desired is a high signal to noise ratio. However, it is not clear that this ideal exists. For example, are responses to natural and human-induced changes linked? In other words, are species with little natural variability likely to be insensitive to anthropogenic sources of change? Osenberg et al. (1994) conclude that individual attributes (such as growth) have greater power to detect change than population attributes (such as density) or physical-chemical attributes (such as hydrocarbon concentration). Therefore, one immediate lesson is that the GEM monitoring plan should include individual parameters, but that is not to say that population parameters should not be monitored. Population attributes are often used in monitoring programs because they reflect the ecological consequences of the disturbance and are features of fundamental concern to resource managers and regulatory agencies. The low power of population attributes, compared to individual attributes, is due to their high natural variability. Osenberg et al. (1994) note that while the average power for population parameters is low, some species will have greater power than others. The goal, in designing a monitoring program, is to identify these species and environments for which population parameters have greater power.

There is much dogma, but little direct evidence, in the scientific literature for which species are the best indicators of change in the nearshore. Paine et al. (1996) recommend focusing on species with local dispersal, however Eckert (2003) demonstrates that marine intertidal and shallow benthic subtidal species with no larval dispersal have greater population variability than species with larval dispersal. Eckert's (2003) study synthesizes 570 time series from 170 species and is unique in the large amount of data that is used to study the relationship between life history characteristics and temporal variability in marine species. More studies like this one would yield predictive information on the range of natural variation for different environments or species that could be used in designing monitoring programs. Paine et al. (1996) also recommend focusing on long-lived species, however there is little information to evaluate this recommendation. Perhaps long-lived species have less natural population variability, and perhaps they do not.

One of the retrospective outcomes of the research on the effects of the Exxon Valdez oil spill in Prince William Sound was that good baseline data and better estimates of spatial and temporal variability may have helped to better quantify effects of the spill on natural populations (Wiens and Parker 1995, Paine 1996). For many species it was unclear whether populations were smaller after the spill compared to before the spill, despite the clear evidence that a great amount of mortality had occurred (Wiens 1996). In the case of sea otters, a survey of otters after the spill showed higher densities than a survey taken in 1985 (Johnson and Garshelis 1995, Garshelis and Johnson 2001). In the case of some seabird species, populations appeared to be larger after the spill than before the spill, providing resounding evidence that spatial and temporal variability in pre- and post-spill surveys was large enough to swamp any effect, even one of such large magnitude as the Exxon Valdez oil spill (Wiens 1996). Knowledge of normal rates of annual change can be used to detect if population changes after an impact are greater or less than normal (Boersma et al. 1995). In a review of the future research needs within the field marine ecology, Estes and Peterson (2000) identified understanding spatial and temporal variability as is one of the most pressing topics.

Reducing sampling error

Population variability is the sum of variation due to sampling error within a site and the true temporal variation. Reducing sampling error by more intensive sampling can therefore decrease estimates of variability, however, only to a point. Osenberg et al. (1994) estimate that improving sampling intensity would reduce the observed variation by only ˜ 50%. Monitoring by GEM should include a statistically rigorous sampling scheme that minimizes sampling error (as designated in the GEM Science Plan). It is possible that sampling error is greater for certain species. For example, seabird surveys that sample resting birds on shore may have a great amount of variability due to sampling because the number of resting birds may not be consistent from time to time (Boersma et al. 1995). In contrast, it is possible that barnacles, because they are affixed to the rock, may be sampled with less error. This study will identify the species for which temporal variability is lower, and therefore have greater power to detect change.

Population variability in different environments

Sheltered and exposed rocky shores, wave-cut platforms, and beaches with varying mixtures of sand, gravel, cobble, and boulders are the dominant habitats in the Gulf of Alaska region (Page et al. 1995, Sundberg et al. 1996). Population variability likely differs among different substrates in the nearshore habitat due to the interaction between and relative importance of natural disturbance and ecological interactions such as competition and predation. Classic ecological studies in the nearshore are discussed in the GEM Program Document and will only be briefly reviewed here. In boulder habitats, the frequency of disturbance and the intensity of competition interact to result in intermediate levels of diversity (Connell 1978, Sousa 1979a, 1979b). However, competition is not a structuring force in soft sediment substrates (Peterson 1979). In addition, the effect of disturbance will vary in different substrates. I am not aware of any studies that compare temporal variability among populations on different substrates. Such a study would be very informative to designing a monitoring program. Similar comparisons of temporal variability could be made between sheltered and exposed shores, and vegetated and non-vegetated habitats to inform monitoring program planning. Environmental sensitivity is presumed to be lower in high-energy environments, where oil or other pollutants are more likely to be removed by wave action and where vertebrate consumers are less able to forage (Teal & Howarth 1984, NRC 1986). ‘Estuarine’ soft sediment marshes are known to be highly sensitive to human impact (Teal & Howarth 1984). However, sensitivity is little more than an informed guess (Peterson et al. 2001). Ideally, necessarily limited resources should not be squandered either by devoting extensive effort to sampling abundant habitats with low sensitivity or by oversampling rare but sensitive habitats in hopes of detecting small but biologically unimportant differences (Peterson et al. 2001).

In summary, there is little scientific literature that quantifies or compares natural variability in order to establish predictions as to which kinds of species or environments should demonstrate the lowest variability and yet serve as a signal of human-induced change. However, many time series of nearshore marine species are available to be analyzed to determine predictive characteristics that are associated with natural variability, such as the analysis done by Eckert (2003).

B. Relevance to GEM Program Goals and Scientific Priorities

This proposal directly addresses the first priority in the GEM Science Plan: detection of change. Implementation of GEM will be guided by the sequence of the goals of the program: to first, attain the ability to detect changes in the environment, then to understand the origin of those changes, to inform about changes and their origins, to use the information to solve problems created by changes, and lastly to predict changes. The ability to detect changes in the environment necessarily relies on the ability to separate natural variability from human-induced changes. This nearshore synthesis proposal builds on the Science Plan and the design work of Schoch et al. (2002) to compile and analyze natural variability in nearshore populations. This work concentrates on the nearshore habitat, and could serve as a model for similar analyses that could be conducted in the watershed and the Alaska Coastal Current habitats. The causes of natural variability in the nearshore are likely linked to processes occurring in these other habitats, however, as detection of change is the focus of this proposal, these causes will not be directly addressed here.

This proposal directly addresses three of the four questions designated for the nearshore habitat from the Science Plan:

Is long-term monitoring of attributes (plants, animals) of soft substrates, hard substrates, or some combination of the two likely to provide the best signal of decadal scale variability due to natural sources? Natural variability in populations from these different substrates will be directly compared in the proposed project to determine which has the lowest natural variability and therefore the most power to detect signals of human-induced change.

In consideration of existing programs and sampling strategies (NMW, PWSRCAC, OSRI, KBRR, USGS, PISCO), what are the appropriate localities and variables for detecting decadal scale changes in species diversity and productivity in the GEM region? The proposed project will use long-term data from existing programs and from the literature to determine which environments and species will provide the best indicators of decadal scale changes.

What are the best measures of human impacts over decadal scales, and what are these impacts, other than harvest, trampling, hydrocarbon pollution and organic enrichment? The best measures of human impacts over decadal scales are going to be measures that have low natural variability and therefore can detect change. This proposal, through a rigorous synthesis of data and analysis, determines which measures are most suitable for the GEM nearshore program.

II. PROJECT DESIGN

A. Objectives

1. Collect long-term time series data of Gulf of Alaska nearshore populations.

2. Collect long-term time series data of nearshore populations from the scientific literature and existing sampling programs in regions other than the Gulf of Alaska.

3. Collect life history and natural history information for the species for which time series information is available (see Objectives 1 & 2).

4. Quantify and compare natural variability in populations from different environments, including different substrates, exposure regimes, vegetated states, and tidal heights, using time series collected from the Gulf of Alaska and other geographic areas.

This objective tests the following null hypotheses.

4a. There is no difference in variability between populations living on more stable substrates (bedrock) and populations on more dynamic substrates (cobble or sand).

4b. There is no difference in variability between populations living on more exposed coasts and populations living on sheltered coasts.

4c. There is no difference in variability between populations living in vegetated environments and populations living in unvegetated environments.

4d. There is no difference in variability between populations at different tidal heights in the intertidal and subtidal.

5. Quantify and compare natural variability in populations with different life history characteristics, such as life span, trophic level, and development mode, using time series collected from the Gulf of Alaska and other geographic areas.

This objective tests the following null hypotheses.

5a. There is no difference in variability between populations from long-lived species and populations from shorter-lived species.

5b. There is no difference in variability between populations from species in higher trophic levels and populations from species in lower trophic levels.

5c. There is no difference in variability between populations from species with larval dispersal and populations from species without larval dispersal.

6. Identify individual species that have low natural variability and could serve as good indicators of change for GEM.

7. Disseminate results of project through presentation at a professional conference and preparation of manuscript to be submitted to a peer-reviewed journal.

Importance of the intended research

This research will identify characteristics of the habitat and of the life history that serve as good predictors of low population variability. These characteristics can then be used in selecting monitoring sites and variables for the nearshore GEM program.

B. Procedural and Scientific Methods

This project is a data synthesis project. It therefore has two major components: data collection and data analysis. The data collection methods in Objectives 1 through 3 will be described here, while the data analysis and methods for Objectives 4 through 6 will be described in the next section (Data Analysis and Statistical Methods.)

Objective 1 is to collect long-term time series data of the Gulf of Alaska nearshore populations. Species to be targeted include non-harvested marine mammals, birds, intertidal and benthic subtidal fishes, algae and invertebrates. For the purposes of this analysis, long-term time series are defined as time series that consist of at least 5 samples over greater than 5 years. According to the GEM Science Plan (2002), long-term nearshore monitoring programs currently exist in Cook Inlet (Kachemak Bay and Kasitsna Bay) and Prince William Sound (PWSRCAC multiple localities, Alyeska Valdez Arm, National Mussel Watch multiple localities). Time series from these programs that meet the above criteria will be collected. As many of the monitoring programs within the Gulf of Alaska are in their first few years (Kachemak Bay) or still in development (National Park Service), it is possible that many of the time series will not be long enough to use for long-term analysis to determine variability over decadal scales. If long-term data are not available for Gulf of Alaska populations, then the above datasets will be used to generate a species list for which time series will be specifically targeted to be collected from other geographic regions (see Objective 2).

I have not extensively searched for existing datasets from the Gulf of Alaska, because Bodkin and Dean in GEM Project # 030687, titled, “Monitoring in the Nearshore: A Process for Making Reasoned Decisions” are identifying past studies conducted in nearshore marine communities within the Gulf of Alaska. I will use their list as a starting point for data collection for this proposal.

There were several studies conducted after the Exxon Valdez oil spill that included control (unoiled) sites that may provide time series for the proposed study. The Coastal Habitat Injury Assessment project surveyed intertidal sites in three regions: Prince William Sound, the Kenai Peninsula, and Kodiak/Alaska Peninsula. Data analyzed from these studies are available in various reports and publications (e.g., Highsmith et al., 1994, 1996; Stekoll et al., 1996). In some regions, the National Park Service funded additional sampling. Data from this study will be collected from publications and from follow up data that is available from these other sources. The NOAA Hazmat study conducted by Houghton, Lees, Driscoll, and Lindstrom after the spill has been continued long-term. Data will be collected from publications resulting from this study (e.g. Houghton et al. 1996, Lindstrom et al. 1996, Driskell et al. 2001). A request will be made to this program to obtain complete time series data that may not be available in publications.

Historical monitoring data from before the spill from MMS, NOAA NMFS, and Alyeska will be used to the extent that it meets the above criteria. According to the GEM Science Plan, this work provided the first window into the quantitative benthic ecology of the region. Focus was most intense on lower Cook Inlet, the Aleutian Islands, the Alaska Peninsula, Kodiak Island, and northeast GOA, including Valdez Arm in PWS (Rosenberg 1972, Hood and Zimmerman 1986).

Objective 2 is to collect long-term time series data of nearshore populations from the scientific literature and existing sampling programs in regions other than the Gulf of Alaska. As for Objective 1, species to be targeted include non-harvested marine mammals, birds, intertidal and benthic subtidal fishes, algae and invertebrates. For the purposes of this analysis, long-term time series are defined as time series that consist of at least 5 samples over greater than 5 years. The PI currently has a very large data set including 570 time series of nearshore marine populations collected from the literature (Eckert 2003, Eckert 1999). A complete listing of this dataset is available as an Electronic Archive at the Ecological Society of America (*Ecological Archives* E084-009-A1; http://www.esapubs.org/archive/ecol/E084/009/default.htm). This data and the data collection structure used previously will greatly simplify the collection of new data. Data from the literature will be graphically digitized using image analysis software (Sigma Scan). Each time series will be contained in its own text data file and is referenced to a master file (like in a relational database). Data processing and integration will be done using SAS. A literature review will be conducted to incorporate additional time series to update and broaden this data set.

Time series data that meet the above criteria will also be collected from existing sampling programs in other geographic regions along the west coast of North America, including PISCO, Olympic National Park, Channel Islands National Park, and others. The PI already has contacts with many of these programs. Species lists from a number of these programs were used in an analysis of life history traits across different habitats in which the PI was co-author (Grantham et al. 2003).

Objective 3 is to collect life history and natural history information for the species for which time series information is available from Objectives 1 & 2. Once again, the PI has already compiled a significant amount of this data into a relational database that currently contains taxonomic information as well as information on geographic range, body size, distribution, habitat type, feeding mode, reproductive mode and season, development time, and several other life history characteristics for over 800 marine invertebrate species found on the west coast of North America (Eckert 1999). This structure will be used to easily include information on additional species. It will be necessary to return to the original papers from which data was collected for Eckert (2003) (Appendix 1) in order to obtain information on environmental variables, as this information was not needed for the original analyses. Literature searches will be conducted to extract the necessary natural history and life history information (see below in Data Analysis and Statistical Variables for list of variables to be included).

C. Data Analysis and Statistical Methods

There are three primary data analysis goals for this project using time series collected from the Gulf of Alaska and other geographic areas. 1) Quantify and compare natural variability in populations from different habitats, including different substrates, exposure regimes, vegetated states, and tidal heights (Objective 4). 2) Quantify and compare natural variability in populations with different life history characteristics, such as life span, trophic level, and development mode (Objective 5). These two goals will develop predictive criteria for lower levels of natural variability. 3) Identify individual species that have low natural variability and could serve as good indicators of change for GEM (Objective 6).

Calculation of Variability
Variability is a measure of dispersion about the mean. When making comparisons among different populations across space, time, and different sampling methods, proportional variability is a more appropriate measure of variability than absolute variability because it scales variability relative to the mean. Take a simplified example—two populations have the same standard deviation, 4.23, and two different means, 61.67 and 11.67. The standard deviation and variance

do not reflect the dispersion about the mean, whereas the coefficient of variation (CV) ([standard deviation/ mean]·100) does: for the large population it is 7.5 and for the small population it is 39. I will use CV as the measure of variability, and to confirm the independence of the CV from the mean in my data, I will statistically compare the relationship between mean and CV to determine that this relationship is nonsignificant. Another common proportional measure, the standard deviation of logarithm-transformed observations (SD log N), gives similar results to the CV, but cannot be used when there are zeros in the data (McArdle and Gaston 1993, 1995). For each time series, I will calculate proportional variability using the CV and then use this value as the response variable in a one-way analysis of variance (ANOVA) comparing fluctuations among character traits. The sample size in ANOVA will be the number of time series. Post-hoc Tukey tests will be used when there are significant differences and greater than two character traits. These methods are the same as used in the analysis of variability among populations with different developmental modes by Eckert (2003).

Characters to be Analyzed - Habitat
Information will be obtained from the published study or sampling program to determine the habitat in which each time series was collected. Substrate will be classified as bedrock, cobble, or soft-sediment. Exposure will be classified as exposed or sheltered. Habitat will be classified as vegetated (macroalgae, kelp, eelgrass) or unvegetated. Tidal height will be classified as high, mid or low intertidal or shallow subtidal (<20 m). When information on a character is not available for a time series, the time series will not be used in the statistical comparison for that character.

Characters to be Analyzed – Life History
Life history information will be obtained from the literature for each species for which a time series has been collected. Life span information will be collected as continuous rather than categorical data. Trophic level will be classified as basal, intermediate or top. Basal species include autotrophs. Intermediate species include detritivores, suspension feeders, and herbivores. Top species include carnivores and omnivores. Development mode will be classified for each species as no planktonic period, short planktonic period, or long planktonic period using the criteria outlined in Eckert (2003). When information on a character is not available for a time series, the time series will not be used in the statistical comparison for that character.

Analysis by Species
The CV of all time series for a particular species will be pooled, and variability will be ordered by species. The ten species with the lowest variability will be reported, as will the two species with the lowest variability for each organism type (marine mammals, birds, intertidal and benthic subtidal fishes, algae and invertebrates).

D. Description of Study Area

As this is a synthesis project, there is not one specific study area. Time series data will be collected for the Northern Gulf of Alaska and for sampling programs from other geographic areas (See Procedural and Scientific Methods above).

E. Coordination and Collaboration with Other Efforts

This proposal builds on the monitoring plan developed in GEM Project 02395, titled, "Planning for Long-Term Monitoring in the Nearshore: Designing Studies to Detect Change and Assess Cause" by C. Schoch, G. Eckert and T. Dean. This project gathered input from a panel of experts outside Alaska and from stakeholders within Alaska to develop a monitoring plan. This project produced a draft nearshore monitoring plan that provides a framework for future monitoring that focuses on tractable components of the nearshore, and is statistically sensitive to temporal and spatial change. However, there are many hurdles that were identified in this planning process, and one of the biggest is identifying variables and monitoring sites that are likely to be most powerful in detecting change. This proposal very nicely follows up on that important topic. The timing of this proposal is also well suited because it will be able to inform monitoring that is slated to begin in FY06.

This proposal will use information gathered in GEM Project 030687, titled, "Monitoring in the Nearshore: A Process for Making Reasoned Decisions" by J. Bodkin and T. Dean. Their one-year project that began in FY 03 will produce a list of past studies that can be used in this rigorous and quantitative analysis of natural variability.

III. SCHEDULE

A. Project Milestones

Objective 1. Collect long-term time series data of Gulf of Alaska nearshore populations.
To be met by August 2004

Objective 2. Collect long-term time series data of nearshore populations from the scientific literature and existing sampling programs in regions other than the Gulf of Alaska..
To be met by August 2004

Objective 3. Collect life history and natural history information for the species for which time series information is available (see Objectives 1 & 2).
To be met by August 2004

Objective 4. Quantify and compare natural variability in populations from different habitats, including different substrates, exposure regimes, vegetated states, and tidal heights, using time series collected from the Gulf of Alaska and other geographic areas.
To be met by January 2005

Objective 5. Quantify and compare natural variability in populations with different life history characteristics, such as life span, trophic level, and development mode, using time series collected from the Gulf of Alaska and other geographic areas.
To be met by January 2005

Objective 6. Identify individual species that have low natural variability and could serve as good indicators of change for GEM.
To be met by January 2005

Objective 7. Disseminate results of project through presentation at a professional conference and preparation of manuscript to be submitted to a peer-reviewed journal.
To be met by June 2005

B. Measurable Project Tasks

FY 04, 1st quarter (October 1, 2003-December 31, 2003)

October:	Project funding approved by Trustee Council

FY 04, 2nd quarter (January 1, 2004-March 31, 2004)

January 12-16 (tentative):	Annual GEM Workshop
Jan-Mar	Contact PIs to request time series data

FY 04, 3rd quarter (April 1, 2004-June 30, 2004)

Apr-Jun	Collect time series data requested in FY04 2nd quarter
Apr-Jun	Collect time series data from literature
Apr-Jun	Collect natural history and life history data from literature

FY 04, 4th quarter (July 1, 2004-September 30, 2004)

Jul-Sept	Finish collecting data outlined in FY04 3rd quarter
Jul-Sept	Begin data analyses
Sept 1	Submit annual report for year 1

FY 05, 1st quarter (October 1, 2004-December 31, 2004)

Oct-Dec:	Finish data analyses
Nov (dates not yet known)	Western Society of Naturalists Meeting

FY 05, 2nd quarter (January 1, 2005-March 31, 2005)

(dates not yet known)	Annual GEM Workshop

FY 05, 3rd quarter (April 1, 2005-June 30, 2005)

June 30	Submit final report (which will consist of draft manuscript for publication) to Trustee Council Office

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

This synthesis proposal involves collection and synthesis of scientific data from existing sampling programs and from the literature. Existing sampling programs that currently involve community members will be explicitly included. A collaboration will be established with GEM project 030647, titled, “Evaluate the relative roles of natural factors (predation, grazing & natural variability) and anthropogenic impacts (harvest) in altering intertidal community structure, using the black chiton, *Katharina tunicate,* as a model.” This collaboration will take advantage of the alliance between Tribal Natural Resource experts and non-Tribal ecologists to communicate with tribal members and collect Traditional Ecological Knowledge on long-term variability in nearshore populations.

B. Resource Management Applications

The data syntheses outlined in this proposal will have broad implications for nearshore monitoring beyond the scope of the GEM program. To reach the broadest audience, the results of the analyses proposed here will be prepared as a manuscript for publication in a peer-reviewed journal. Effort will be made to communicate with other individuals planning monitoring programs including the National Park Service, which is currently planning monitoring throughout parks in Alaska. Contact has been made with Alan Bennett, who is designing monitoring programs within National Parks in South-Central Alaska.

V. PUBLICATIONS AND REPORTS

It is anticipated that the results of this synthesis project will result in at least one manuscript to be submitted to a peer-reviewed journal. The manuscript will address natural variability in nearshore marine populations, and a tentative title is “Predictors of natural variability in nearshore marine populations.” Potential journals for submission include *Biological Conservation* or *Marine Ecology Progress Series*. Approximate date for submission is June 30, 2005. It will be requested that this manuscript satisfy a portion of the final reporting requirements.

VI. PROFESSIONAL CONFERENCES

Support for travel to the EVOS Annual Meeting is requested in years 1 and 2. In year 2 partial support for travel to the Western Society of Naturalists meeting in November, 2004 is requested. The remainder of travel support will be provided by UAS as cost-share. The exact date and location of this conference is not yet known. The PI will present the results of this synthesis effort at this professional meeting.

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Sousa, W. P. 1979a. Disturbance in marine intertidal boulder fields: the nonequilibrium maintenance of species diversity. Ecology 60:1225-1239.

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Stekoll, M. S., L. Deysher, R. C. Highsmith, S. M. Saupe, Z. Guo, W. P. Erickson, L. McDonald, and D. Strickland. 1996. Coastal habitat injury assessment: Intertidal communities and the Exxon Valdez oil spill. American Fisheries Society Symposium 18:177-192.

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Wiens, J. A. 1996. Oil, seabirds, and science. The effects of the Exxon Valdez oil spill. Bioscience 46:587-597.

Wiens, J. A., T. O. Crist, R. H. Day, S. M. Murphy, and G. D. Hayward. 1996. Effects of the Exxon Valdez oil spill on marine bird communities in Prince William Sound, Alaska. Ecological Applications 6:828-841.

Biographical Sketch

GINNY LYNNE ECKERT
University of Alaska, 11120 Glacier Highway, Juneau, AK 99801
(907) 465-6450 phone 465–6447 fax
ginny.eckert@uas.alaska.edu

Professional Preparation:	Dartmouth College, Hanover, NH	Biology	B.A.	1990
	University of Florida, Gainesville, FL	Zoology	M.S.	1994
	University of California, Santa Barbara, CA	Biology	Ph.D.	1999

Appointments:

Assistant Professor of Biology, University of Alaska Southeast, 2000-present

Assistant Professor of Biology (joint appointment), Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 2001-present

Research Assistant, Marine Sciences Institute, University of California, Santa Barbara, CA 1994-1999

NSF Graduate Research Training Fellowship, Marine Sciences Institute, University of California, Santa Barbara, CA 1997-1998

University of California Toxic Substances Research and Teaching Program Fellowship, Marine Sciences Institute, University of California, Santa Barbara, CA 1995-1998

Teaching Assistant, Biological Sciences, University of California, Santa Barbara, CA 1994-1995

Research Assistant, Zoology, University of Florida, Gainesville, FL 1992-1994

Teaching Assistant, Zoology, University of Florida, Gainesville, FL 1991-1994

Related Publications:

Eckert, G.L. 1999. Consequences of diverse reproductive strategies in marine invertebrates. PhD dissertation. Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara.

Micheli, F., K.L. Cottingham, J. Bascompte, O.N. Bjørnstad, G.L. Eckert, J.M. Fischer, T.H. Keitt, B.E. Kendall, J.L. Klug, and J.A. Rusak. 1999. The dual nature of community variability. Oikos 85: 161-169.

Eckert, G.L. 2003. Effects of the planktonic period on marine population fluctations. Ecology 84: 372-383.

Grantham, B., G.L. Eckert, and A.L. Shanks. 2003. Dispersal potential of marine invertebrates in diverse habitats. Ecological Applications 13: S108-S116.

Eckert, G.L. submitted June 2003. Spatial patchiness in a marine species with limited dispersal. Marine Ecology Progress Series.

Other Publications:

Eckert, G.L. 1995. A novel, larval feeding strategy in the tropical sand dollar, Encope michelini (Agassiz): Adaptation to larval food limitation and an evolutionary link between planktotrophy and lecithotrophy. Journal of Experimental Marine Biology and Ecology 187: 103-128.

Eckert, G.L. 1998. Larval development, growth, and morphology of the sea urchin Diadema antillarum. Bulletin of Marine Science 63: 443-451.

Eckert, G.L., J.M. Engle and D.J. Kushner. Sea star disease and population declines at the Channel Islands. 2000. Proceedings of the Fifth California Islands Symposium. Minerals Management Service 99-0038.

Collaborators in the Past 48 Months:

Dr. T. Dean	Coastal Resources Associates
J. Douglas	University of Alaska Southeast
Dr. L. Eisner	Oregon State University
Dr. J. Engle	Marine Science Institute, University of California, Santa Barbara
J. Fisher	Moss Landing Marine Laboratory
Dr. B. Grantham	Zoology, Oregon State University
Dr. N. Hillgruber	University of Alaska Fairbanks
Dr. G. Irvine	USGS – Alaska Science Center
D. Kushner	Channel Islands National Park, Ventura, CA
D. Pinkard	Rosential School of Marine and Atmospheric Sci., Univ. of Miami
S. Porter	University of California, Berkeley
Dr. D. Reed	Marine Science Institute, University of California, Santa Barbara
Dr. C. Schoch	Kachemak Bay National Estuarine Research Reserve
Dr. S. Schroeter	Marine Science Institute, University of California, Santa Barbara
Dr. A. Shanks	Oregon Institute of Marine Biology, University of Oregon
Dr. T. Shirley	University of Alaska Fairbanks
Dr. J. Taggart	USGS – Alaska Science Center
Dr. S. Tamone	University of Alaska Southeast

Graduate Advisors:
Dr. Steven D. Gaines, University of California, Santa Barbara
Dr. Larry McEdward, University of Florida, Gainesville (deceased)

Thesis Advisor for:
Kristin Cieciel, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks (MS)
Joel Webb, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks (MS)

CURRENT AND PENDING SUPPORT FORM

The following information must be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Ginny L. Eckert

Other agencies to which this proposal has been/will be submitted: None

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

MRI/RUI Acquisition of Planktonic Sampling Equipment for Southeast Alaska

Source of Support: National Science Foundation

Total Award Amount: $112,530 Total Award Period Covered: 8/1/03 – 7/31/04

Location of Project: Alaska

Months of Your Time Committed to the Project: 0 FY04 0 FY 05 0 FY 06 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Reproductive Biology of Snow Crab

Source of Support: Alaska Department of Fish and Game

Total Award Amount: $383,211 Total Award Period Covered: 8/1/01-1/31/04

Location of Project: Alaska

Months of Your Time Committed to the Project: 0.5 FY FY 05 FY 06 Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Assessing the Effectiveness of Marine Reserves for an Alaskan Crab Species

Source of Support: Alaska Sea Grant

Total Award Amount: $97,528 Total Award Period Covered: 2/1/04-1/31/06

Location of Project: Alaska

Months of Your Time Committed to the Project: 0.5 0.5 FY FY 06 Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Months of Your Time Committed to the Project: FY FY 05 FY 06 Sumr:

*If this project has previously been funded by another entity, please list and furnish information for immediately preceding funding period.

BUDGET JUSTIFICATION

FY05

Personnel

Funds are requested for 2 months of PI salary and 1 semester half-time salary plus full-time summer salary for an undergraduate research assistant. The University of Alaska will provide 0.5 months PI salary in cost-share to contribute to this project, for a total PI commitment to this project of 2.5 months. The PI will, with assistance from the student, collect data for this synthesis project and conduct data analysis during this time. The undergraduate student will do much of the collection of data from the literature, including data extraction and data entry where necessary, and will coordinate data retrieval from existing sampling programs.

Travel

Funds are requested in FY05 for PI travel to the EVOS Annual Meeting.

Commodities

Software requested for data acquisition and analysis include SPSS SigmaScan for image analysis of digitized graphical data and SAS for data analysis. To ensure adequate data storage, a read-write CD and media are requested.

FY06

Personnel

Funds are requested for 1.5 months of PI salary. The University of Alaska will provide 0.5 months PI salary in cost-share to contribute to this project, for a total PI commitment to this project of 2.0 months. The PI will conduct data analysis, prepare presentations for and attend the EVOS Annual Meeting and the Western Society of Naturalists meeting and prepare a manuscript during this time.

Travel

Funds are requested for PI travel to the EVOS Annual Meeting and partial funds for travel to the Western Society of Naturalists Annual Meeting in November (exact dates and place not yet determined). The University of Alaska Southeast will provide partial funding for this professional conference (approximately $600 to cover airfare.)

Commodities

Annual license renewal for data analysis software (SAS).

Indirect Costs for the University of Alaska calculated at 25% of direct costs.

QUALITY ASSURANCE/QUALITY CONTROL STATEMENT

No raw data or samples will be collected in this Synthesis project.

Acquired data will be collected and processed using methods from Eckert (2003).

Existing time series data will be compiled and analyzed with SAS (version 8).

GEM PROPOSAL SIGNATURE FORM

THIS FORM MUST BE SIGNED BY THE PROPOSED PRINCIPAL INVESTIGATOR AND SUBMITTED ALONG WITH THE PROPOSAL. If the proposal has more than one investigator, this form must be signed by at least one of the investigators, and that investigator will ensure that Trustee Council requirements are followed. Proposals will not be reviewed until this signed form is received by the Trustee Council Office.

By submission of this proposal, I agree to abide by the Trustee Council's data policy (*Trustee Council/GEM Data Policy**, adopted July 9, 2002) and reporting requirements *(Procedures for the Preparation and Distribution of Reports***, adopted July 9, 2002).

PROJECT TITLE: A Synthesis of Nearshore Habitat Variability: Can We Detect Change?

Printed Name of PI: _Ginny L. Eckert________________________

Signature of PI: ________________________ Date __6/12/03_

Printed Name of co-PI: ________________________

Signature of co-PI: ________________________ Date __________

Printed Name of co-PI: ________________________

Signature of co-PI: ________________________ Date __________

* Available at http://www.oilspill.state.ak.us/pdf/admin/datapolicy.pdf

** Available at http://www.oilspill.state.ak.us/pdf/admin/reportguidelines.pdf

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06		TOTAL PROPOSED
Personnel	$23.5	$10.5	$0.0		$34.0
Travel	$1.5	$2.3	$0.0		$3.8
Contractual	$0.0	$0.0	$0.0		$0.0
Commodities	$1.6	$0.1	$0.0		$1.7
Equipment	$0.0	$0.0	$0.0		$0.0
Subtotal	$26.6	$12.9	$0.0		$39.5
Indirect (rate will vary by proposer)	$6.7	$3.2	$0.0		$9.9
Project Total	$33.3	$16.1	$0.0		$49.4
Trustee Agency GA (9% of Project Total)	$3.0	$1.4	$0.0		$4.4
Total Cost	$36.3	$17.5	$0.0		$53.8

Cost-share Funds:
$7.6 K - University of Alaska Southeast: 0.5 months salary for G. Eckert in FY04 and FY05 and airfare for the national conference in FY05.

FY 04-06

Date Prepared:

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4A NON-TRUSTEE SUMMARY

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
G. Eckert	Asst. Professor of Biology		2.0	6.9		13.8
to be determined	Undergraduate Research Asst		4.3	0.8		3.4
to be determined	Undergraduate Research Asst - sumr		3.5	1.8		6.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	9.8	9.5	0.0	
					Personnel Total	$23.5

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
G. Eckert, EVOS Annual Meeting, Anchorage	0.3	1	6	0.2	1.5
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.5

FY 04

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contract
Description	Sum
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$0.0

Commodities Costs:	Commodity
Description	Sum
Software for Data Acquisition and Analyses (SigmaScan Pro 5.0 and SAS Annual License)	1.1
Data storage	0.5
Commodities Total	$1.6

FY 04

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Contractual &
Commodities
DETAIL

EXXON VALDEZ OILSPILL 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
				0.0
			New Equipment Total	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 04

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Equipment
DETAIL

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04 - FY 06

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
G. Eckert	Asst. Professor of Biology		1.5	7.0		10.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.5	7.0	0.0	
					Personnel Total	$10.5

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
G. Eckert, EVOS Annual Meeting, Anchorage	0.3	1	6	0.2	1.5
G. Eckert, Western Society of Naturalists, California	0.0	1	4	0.2	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.3

FY 05

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contract
Description	Sum
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$0.0

Commodities Costs:	Commodity
Description	Sum
Software for Data Analysis (SAS Annual License renewal)	0.1
Commodities Total	$0.1

FY 05

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Contractual &
Commodities
DETAIL

EXXON VALDEZ **OILSPILL 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
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 05

Project Number:
Project Title: A Synthesis of Nearshore Habitat Variability
Proposer: G. Eckert

FORM 4B
Equipment
DETAIL