EVOS PROPOSAL SUMMARY PAGE

Project No. *G-030666*
Date Received *9/4/02; TC approved 11/25/02*

Project Title:	Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life
Project Period:	FY03-FY04 October 1, 2002 through September 30, 2004
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EVOS Funding:	$ 434,927 ($266,300 in FY 03)
Matching Funds:	Collaborators include Sloan Foundation $310,000 and others. See Section III E: Coordination and Collaboration with Other Efforts.
Study Location:	Kodiak Island, Prince William Sound and Kachemak Bay
Trustee Agency:	ADF&G

Abstract:
This proposal seeks funding to initiate near-shore biodiversity studies along a pole-to-pole latitudinal gradient by applying protocols developed under the Census of Marine Life program. After initial sampling in south central Alaska, the gradient will develop further throughout Alaska, along the pacific coast of North and South America into the Antarctic. Under GEM funding during the years 2003 and 2004, this project will sample four study sites in each of three core areas in the Gulf of Alaska: Kodiak Island, Prince William Sound and Kachemak Bay. Study sites are macroalgal hard bottom or seagrass communities, and are characterized by a high level of pristiness. The project is heavily based on local community involvement for sampling. Expected outcomes are biodiversity baseline data for future long-term monitoring programs, initiation of long-term involvement of local communities in monitoring efforts in coastal areas, capacity building, and a broad outreach to the public.

I. INTRODUCTION

The ecological and economical consequences of marine biodiversity, and the potential loss of it, have recently aroused controversial debate and initiated an increasing number of studies trying to identify the importance of biodiversity for ecosystem functioning (Loreau et al. 2001, Pachepsky et al. 2001, Cardinale et al. 2002, Pfisterer & Schmid 2002). Biodiversity is one potential measure of ecosystem health, though criteria are not always clear; high biodiversity may not necessarily represent the natural state of an ecosystem. But biodiversity can definitely be a measure of biological interactions such as competition, disturbance, facilitation, predation, recruitment, and productivity of a system (Petraitis et al. 1989, Bourget et al. 1994, Elis et al. 1996, Worm et al. 1999, Mittelbach et al. 2001, Yamamura et al. 2001, Paine 2002). On a larger scale, biodiversity measurements can serve as an indicator of the balance between speciation and extinction (Mckinney 1998 a,b, Charles et al. 2001, Rosenzweig 2001).

Compared to a wealth of information available on terrestrial biodiversity, marine biodiversity estimates are probably still largely underestimated (Lambshead 1993, Williamson 1997). So far, tropical coral reefs have been considered the “hotspots” of marine biodiversity (Stone et al. 1996, Gray 1997a, Small et al. 1998, Knowlton 2001, Roberts et al. 2002), with a decrease in biodiversity towards higher latitudes (Gray 1997a,b), however, recent data from the maritime Antarctic suggest high species richness for high southern latitudes (Arntz et al. 1997,Gray 2001, Willis & Whittaker 2002). Though high species richness in the tropics is undebatable, an increasing number of studies in other marine systems are showing the overall importance of marine biodiversity.

Apart from our increasing appreciation of deep-sea species richness (Grassle & Maciolek 1992, Butler et al. 2001), biodiversity in coastal areas other than coral reefs starts to receive more and more attention (Gray et al. 1997). Coastal marine biodiversity can be very high (Ray 1996) and particularly the three-dimensional structure of macroalgal habitats and seagrass communities support and enhance species richness (van Oppen et al. 1996, Phillips 1998, Walker & Kendrick 1998, Wysor et al. 2000, 2001, Duarte 2000, Engelhardt & Ritchie 2001, Duffy et al. 2001, Sommerfield et al. 2002, Bulleri et al. 2002). Shallow water coastal areas, however, are also the areas most impacted by humans, and human impact such as fisheries, pollution, invasive species, recreational activities, and habitat fragmentation have severe effects on near-shore biodiversity (Beatley 1991, Gray 1997a, Walker & Kendrick 1998, Cury 1999, Bax et al. 2001, Tilman & Lehman 2001, Piazzi et al. 2001, Barnes 2002). On a larger scale, human-induced global climate change has a significant impact (Scheffer et al. 2001). Within the last decade the need for nearshore biodiversity studies on a large spatial, or even global, range has become increasingly obvious for the intent of conservation and establishment of Marine Protected Areas (Shaffer et al. 2002, ten Kate 2002, Eiswerth & Haney 2001, Cabeza & Moilanen 2001, Zacharias & Roff 2000, Vanderklift et al. 1998, Costello 1998,Waugh 1996, Norse 1994). We have now begun to better understand that biologically-diverse communities are more resilient to environmental and ecological stress and disturbances, e.g. from invasive species (Kennedy et al. 2002).

The sustainable use of coastal biodiversity has to be one of the major efforts in our conservation and management efforts (Gray 1997a, Price 2001). "The extent, cause and maintenance of biodiversity are among the most important biological issues of our time" (DIVERSITAS Systematics Agenda 2000). Limited resources and manpower often limit the amount of studies possible, but in near-shore investigations, especially intertidal work, the involvement of volunteers and local communities can make a significant contribution (Evans et al. 2001). Therefore, biodiversity is becoming one of the key criteria in the management of marine habitats and Marine Protected Areas (Ray 1985, Olsen 1999, Ward et al. 1999). Although many attempts have been made to measure and evaluate biodiversity, small- and large-scale comparisons are hampered by the fact that different methods have been usually applied (France & Rigg 1998). For a comparative biodiversity assessment on multiple scales within an area, between areas or among global gradients, a unified approach is needed (e.g. Rabb & Sullivan 1995, Valero et al. 1998, Mikkelsen & Cracraft 2001). The Census of Marine Life, and its associated projects is such a framework for global study of biodiversity.

ANaGISA is the Alaska portion of the larger NaGISA (National Geography In Shore Areas) project studying biodiversity in near-shore areas. The original NaGISA will complete a longitudinal gradient while ANaGISA will conduct a latitudinal pole-to-pole gradient, beginning in the Gulf of Alaska. ANaGISA is likely to play a central role in biodiversity studies for Alaska's extensive shoreline and variety and abundance of pristine environments. ANaGISA is therefore expected to be of great importance in both the context of NaGISA as well as for local interest because of the importance of near-shore ecosystems in local commercial and subsistence fisheries.

Both NaGISA and ANaGISA hold a unique position in the Census of Marine Life (CoML) as ambassador projects, linking CoML to local interests. They focus on the narrow inshore zone of the world's oceans, at depths of less than 20 meters, the area people know best and impact most. It is also one of the four habitat types selected within the GEM program as representative of the Gulf of Alaska area. Sampling in this zone can be done routinely and inexpensively, and is of great ecological and economical interest. Thus, these projects are ideally suited to generate public interest and involvement. Building on site selection and sampling protocols developed during the International Biodiversity Observation Year (IBOY, Appendix 1), these project's aims are to achieve wide coverage with standardized techniques that will provide a biodiversity baseline for future comparisons. The ultimate goal is a series of well-distributed standard transects from shore to 20 meters depth around the world, which can be repeated over a 50-year or even greater time frame.

The Sloan Foundation is funding the initial steps of the NaGISA project. With this, we are establishing NaGISA administrative centers in Japan and Alaska. The Japan center is working with several other groups to establish sampling sites along an equatorial longitudinal gradient from the east coast of Africa to the Palmyra Atoll. This sampling is beginning this summer (2002). The Alaska center (ANaGISA) is working towards beginning a pole-to-pole latitudinal transect starting in south-central Alaska. This center has been contacting local communities and researchers in the anticipated study sites at Kodiak, Prince William Sound and Kachemak Bay to coordinate research efforts and to locate feasible sampling sites along the coast. This proposal seeks funding to begin sampling sites within the Gulf of Alaska and to bring together a group of taxonomic specialists. Once the sampling in this area has been established and proven, we will seek out and encourage other areas in Alaska (such as Beaufort Sea's Boulder Patch, Aleutians, west coast of Alaska, southeast Alaska including Glacier Bay, etc.) to join our project. After the Alaska center is established, we will extend our work southward to the Antarctic. In the mean time, we are discussing the NaGISA protocols with other countries in the hopes that they will also adopt this biodiversity study. For example, we have been invited to speak at a joint CoML/POGO regional meeting in Concepción, Chile, 28-31 October 2002. Presently, we hope to interest South American researchers in our protocols.

In all core areas, sampling sites will be identified to provide the minimum essential biodiversity coverage, but satellite sites will also be developed as local interest dictates and it is hoped that the baseline and protocols will be adopted more widely for environmental monitoring.

To ensure comparability of our data with those of other NaGISA study sites, we intend to apply the sampling procedure developed for baseline biodiversity coverage (Appendix 1). All sampling sites are centered in large algal communities and sea-grass/soft bottom communities, which are more complex and less well characterized than coral communities, and which also represent important habitat types along the Alaskan seashore. We propose a two-year sampling effort to obtain a minimum temporal resolution for biodiversity estimates. For each study site, replicate samples will be collected at the high, mid and low intertidal areas and at 1m, 5m and 10m subtidal water depths, and, where possible, also at 15m and 20m depths. Sampling consists of a non-destructive photographic image record prior to destructive aerial sampling of all macrophytes and fauna. Initial taxonomic analysis will focus on visible organisms associated with large algae and sea-grass communities, but a full spectrum of samples will be collected and preserved for analysis as resources become available. As part of this proposal, we will sort and work up all macroorganisms collected. Voucher specimens for all these organisms will be collected and stored at the University of Alaska Museum. We have begun gathering a group of taxonomic specialists to assist in species identification. This group of taxonomic experts will in fact be a valuable capacity building tool and local participants will be encouraged to expand their interests through student and post-doctoral programs.

The complete analysis of even one transect sample series, which would include microscopic organisms, including bacteria in the bottom sediment, is a huge task, taking many years, but a task that could reveal thousands of new species. Detailed analysis of the hundreds of transects that may ultimately be taken will require a new approach. Thus, although the core NaGISA program is intentionally 'low-tech', the planning phase will include efforts to maximize the value of the samples collected through development of automated sorting and species recognition systems. Associations with groups interested in molecular diversity approaches are also part of the planning process. These new technologies will be essential for the success of extensive future long-term biodiversity monitoring programs.

The core of this project is an exercise in international cooperation, community involvement and capacity building, which are organizationally complex but clearly achievable at a significant level. The full extent of new knowledge of global marine biodiversity extracted from the sampling program will be determined by the success of the planning phase in applying the sampling protocols in the selected areas, organizing the interaction between taxonomists, other scientists and native people, and obtaining valuable biodiversity data to be compared in a latitudinal and global context.

II. NEED FOR THE PROJECT

A. Statement of Problem

The Census of Marine Life (CoML) is a major international research program assessing and explaining the diversity, distribution, and abundance of marine organisms throughout the world's oceans, expected to be completed by 2010. Technical and political barriers, as well as the vastness of the oceans, have kept these areas of the globe largely unexplored. New technologies, the end of the Cold War and increased concerns about the health of life in the oceans are among the factors that combined make the concept of a census feasible and necessary. During 1999 a group of scientists from many countries committed themselves to making it happen, and the CoML is now active around the world. The History of Marine Animal Populations (HMAP) projects and a series of Initial Field Projects are coming together in the Ocean Biogeographic Information System (OBIS), which is becoming a powerful and accessible tool for viewing, understanding and predicting the future of life in the oceans.

The land and sea meet along millions of kilometers around the world, where the combination of solar, tidal and wave energy have fuelled the evolution of some of earth's most complex ecosystems, from temperate rocky intertidal to tropical coral reefs. A project studying near-shore areas has special challenges because it focuses on the zone most heavily affected by humans. It is also the zone most studied by humans, but, because it is so diverse and so subject to influences from pollution to global warming to changing sea-levels, baseline studies are critically needed over most of the world's coasts. NaGISA is the Census of Marine Life project specifically designed to meet these challenges globally by standardizing a simple, economical, yet powerful, protocol for comprehensive coverage of shore zones out to 20m depth. ANaGISA is the Alaska center of NaGISA and is intended to meet the challenges of near-shore biodiversity studies in the coastal regions of the Gulf of Alaska. The intertidal/subtidal region of the Gulf of Alaska has also been identified by the GEM restoration program as one of the four key habitat types specifically important in the context of ecological health, economical interest and traditional knowledge.

There has been much work done in the Gulf of Alaska. We have listed some of the references in Section X by core area (Kodiak Island, Prince William Sound and Kachemak Bay). We have taken this vast amount of research into consideration when choosing the study sites. Optimally, our sites are accessible to native communities, have local infrastructure, have long-term data, and are relatively pristine.

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 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 ecosystem that support the resources, as well as the people, of the spill region. In addition, prudent use of the natural resource of the spill area without compromising their health and recovery requires increased knowledge of critical ecological information about the northern Gulf of Alaska. This information 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

The mission of the GEM program is to "sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska (GOA) and the human use of the marine resources in that ecosystem through greater understanding of how its productivity is influenced by natural changes and human activities". In pursuit of this mission, the GEM program will sponsor monitoring and research projects and will promote local stewardship by involving stakeholders and have them help carry out parts of the GEM program. The ANaGISA project will provide valuable baseline biodiversity data by utilizing stakeholders that will benefit both monitoring and research efforts in the Gulf of Alaska.

Program goals have been identified as necessary to accomplish the GEM mission. These goals include: 1) detecting annual and long-term changes in the marine ecosystem; 2) identifying causes of change in the marine ecosystem; 3) providing integrated and synthesized information; 4) developing tools, technologies and information to improve management and help resource managers; and 5) develop the capacity to predict the status and trends of natural resources for use by resource managers. In order to accomplish these goals we must have a basic understanding of biodiversity in the system, including spatial and temporal variation. ANaGISA is the first step towards reaching these goals.

The GEM Program Document also describes various implementation goals to achieve the program goals. These include: 1) integrate monitoring and research results to convey a "big picture" status for the Gulf of Alaska; 2) track work of other entities relevant to understanding biological production in the Gulf of Alaska; 3) leverage funds to augment ongoing monitoring work funded by other entities; 4) involve other agencies, organizations, and local communities and; 5) facilitate application of GEM research and monitoring results to benefit conservation and management of marine resources. As is obvious in this proposal, ANaGISA is going to reach its goals with a similar implementation plan. We are going to integrate and compare data collected from three core areas within the Gulf of Alaska, which will eventually be used in a more global context. This global context will be attained with other funds, agencies, and organizations. The key for ANaGISA to work effectively is community involvement.

In the GEM Phase II Invitation, proposals are requested to "conduct baseline research on diversity and distribution of marine organisms at one or more locations within the GEM area." Our biodiversity study will be conducted at three locations (with replicate study sites within each location) in the GEM area. This invitation also states that research sites should be selected based on a number of criteria including: availability of historical data, proximity to other research areas, relative level of pristineness, long-term stability, accessibility and representativeness. These are the criteria that were used in selecting the ANaGISA study sites. Lastly, the invitation asks for proposals that will use the coastal monitoring protocols being developed under the Census of Marine Life and the Diversitas Western Pacific and Asia (DIWPA) programs. ANaGISA is based on these protocols (Appendix 1).

Specifically, ANaGISA is intended to perform a pole-to-pole latitudinal gradient of biodiversity studies. Eventually, the project will have a large taxonomic coverage, extending spatially from the Arctic along the western coasts of North, Central and South America to the Antarctic. The initial census of ANaGISA will start with pristine sites in south-central Alaska (Gulf of Alaska) and will provide both baseline data, for long-term monitoring, and information, to sustain a healthy and biologically diverse marine ecosystem: both are central tasks of the GEM restoration program. On a larger scale, the biodiversity gradient will also provide the information needed to answer fundamental ecological questions about biodiversity and latitude. The ecological answers will undoubtedly be compounded with other variables such as temperature, light attenuation, nutrient availability, substrate, and exposure. Our protocols will be designed to work along other gradients allowing interactions among variables to be factored out. For example, a similar east-west transect along the northern margin of the Indian Ocean would provide a comparable matrix with a very different set of variables. Once the latitudinal transect along the Pacific coast of the Americas down to the Antarctic is complete it would provide a comparison of eastern and western boundary currents. Later transects along the American Atlantic coasts, when compared to Western Pacific, would contrast biodiversity in relative ancient and new ecosystems, as would the comparison of the European and African Coasts to the Eastern Pacific. The great strength of ANaGISA and NaGISA is that the CoML goals of global biodiversity coverage can be met and financed through locally vested interests in every country in the world, and yet creating a standardized data matrix suitable for testing a wide range of ecological theories and solving practical problems.

III. PROJECT DESIGN

A. Objectives

The objective of our proposal is to provide biodiversity data, according to a standardized sampling protocol, which will serve primarily as local baseline data for biodiversity comparisons and monitoring purposes and secondly as part of a large-scale longitudinal biodiversity gradient. In the Gulf of Alaska, we want to examine both spatial and temporal variation in biodiversity.

B. Procedural Methods

This proposal to GEM seeks support to develop the protocols necessary to begin sampling along the latitudinal gradient and to gather taxonomic experts for Alaska's marine flora and fauna. In year one, we will begin sampling for this gradient using core areas within the Gulf of Alaska (at Kodiak, Prince William Sound and Kachemak Bay). We will survey four study sites within each of the core areas, following the NaGISA protocols (Appendix 1). We plan to perform an initial sampling of all study sites in the summer of 2003, intending to repeat sampling in the following summer of 2004.

As detailed in Appendix 1, there are two levels of target sampling of increasing difficulty: (1) Non destructive sampling of five quadrates for macro-algal and/or seagrass/soft-bottom communities at the high, mid and low intertidal and at water depths of 1, 5, 10 m will be conducted using photography and observational techniques. Non-destructive measurements (observation) of large macrobenthos such as sea cucumbers and fishes will also be conducted. (2) Destructive sampling of five quadrates, for each sampling strata at each site, will be conducted for standard identification of macrophyte, small macrobenthos and meiobenthos. Voucher specimens will be made from these collections. The relative simplicity of the sampling program makes it ideally suited for intense involvement of local communities, especially in the intertidal work.

C. Statistical Methods

Biodiversity will be analyzed from non-destructive photographic images as well as destructive transect samples. Diversity is divided into two components: “species richness” and “evenness.” Species richness is defined as the number of species present; evenness is a measure of the distribution of population sizes of the respective species (Levinton 1982). To describe the structural characteristics of the communities, we will use the Shannon Weaver index (Shannon & Weaver 1949). It is the diversity index with the widest application and will allow comparison on many different scales. It is also based on data obtained from random samples drawn from a large community (Krebs 1985). The Shannon Weaver index is defined as

$$H' = -\sum_{i=1}^{s} p_i (\ln p_i)$$

with p_i as the relative abundance of each species i $(0 \leq p_i \leq 1)$
and s as the number of species
and $\ln = \log_e$

The value of H' is greater the more even the number of individuals per species are distributed. H' usually ranges between 0 and ln of the number of species present. Hence, the index equally accounts for species richness and evenness. The evenness is a measure of the distribution of the individuals in the species, independent of the number of species present. Evenness is a relative measure and is defined as (Pielou 1969):

$$E = \frac{H'}{H'_{\max}}$$

with H' as the measured diversity
and H'_{max} as the maximum diversity, calculated as $H'_{max} = \ln s$

Evenness is 0 if only one species is present in the sample, and the maximum value for E is 1 if several species are present with the same abundance.

The importance of rare species may be underestimated by using the Shannon Weaver index (Hurlbert 1971). To account for rare species, Hurlbert (1971) developed a diversity index *E(Sn)* that is based on the rarefaction method of Sanders (1968). Rarefaction methods, both sample-based and individual-based allow for meaningful standardization and comparison of datasets. We will use the Hurlbert index in samples where we encounter rare species.

$$E(S_n) = \sum_i \left(1 - \frac{\binom{N-N_i}{n}}{\binom{N}{n}} \right)$$

with *E(Sn)* as the expected number of species within a sub-sample with n randomly selected individuals. The sub-sample is taken from a sample with N individuals, S species and the respective abundance N_i of all species i.

We will also calculate dominance of species, which is defined as the relative proportion of a species of the total number of individuals per sample. Dominance is presented in logarithmic rank frequency distributions (Lambshead et al. 1983), and gives information on the proportion of the most dominant species in total abundance and on the number of species that represent 90% of total abundance.

Many attempts to describe complex communities by one single attribute, such as richness, diversity or evenness, can be criticized because valuable information is often lost. We are trying to circumvent some of these problems by using various measures including the Hurlbert index for rare species, but we will also construct rank-abundance diagrams for all core areas and study sites. A more complete picture of the distribution of species abundances in a community can be made using the full array of P_i values by plotting P_i against rank (Begon et al. 1990; where P_i = the proportion of total individuals in the ith species). Thus the P_i for the most abundant species is plotted first, then the next

D. Description of Study Areas

In Kodiak, we have met with researchers from the Gulf Apex Predator project (GAP), the Nearshore Habitat Use by Commercial Fish Around Kodiak Island project and the Mapping Marine Habitat-Kodiak Island project. GAP is primarily interested in ecosystem relationships that involve top predators (Steller sea lions, fish, whales, etc.). The Habitat Use project was recently funded by the Cooperative State Research, Education and Extension Service to survey essential fish habitats in bays around Kodiak. The Mapping

Marine Habitat project is an island-wide aerial mapping project funded by GEM. At this time, the Habitat Use project is just getting started though the mapping project has completed their aerial photography work, and habitat types have been noted by observers flying in the aircraft. Thus far, no ground-truthing has been attempted for either project. ANaGISA can accomplish this ground-truthing. We have discussed this with Bob Foy (PI of the habitat use and mapping projects) and feel this collaboration will be beneficial to all projects. Four of the areas that the habitat project, the mapping project, and GAP (GAP PIs are Kate Wynne, Bob Foy and Loren Buck) feel would be most beneficial to ground-truth include Sitkalidak Straight, Alitak Bay, Uyak Bay, and Kuzuyak Bay. All of these areas are of scientific interest because of the presence of various marine mammals including harbor seals, Steller sea lions, sea otters, and assorted whales and their prey. In addition to the connection to other ongoing research programs, these areas are of particular interest to ANaGISA and comply with the site criteria, proposed by GEM, since historical data are available (see reference list in Section X), since they have native communities (Old Harbor in Sitkalidak Straight, Akhiok in Alitak Bay, Larson Bay by Uyak Bay, Port Lions in Kuzuyak Bay), and since they are relatively pristine.

For all Kodiak sampling, we will ask the Youth Area Watch program to assist us to get help for the destructive intertidal sampling. We hope to involve kids from the various native villages that we will be working by so that we can interact with and teach them how to collect biological samples and to increase their interest and awareness in their natural resources. GAP has worked with this group in the past and has had much success. We anticipate this local involvement to be essential for our work.

In Prince William Sound, we have contacted local researchers (Loren Buck, David Irons, Raymond Highsmith, Jim Bodkin, Stephen Jewett, Howard Feder and Arny Blanchard) for input in study site selection. Areas that have repeatedly come up in our conversations with them include Anderson Bay, Knight Island (Herring Bay), Green Island, and Montague Island. All of these sites have some historic data on intertidal and sublittoral fauna and flora already available, among others from numerous detailed reports from the *Exxon Valdez* oil spill investigations (see Section X). Many sites also have current or future research planned at them.

For all Prince William Sound sampling, we will ask the local Youth Area Watch program to assist with the destructive intertidal sampling. We anticipate this local involvement to be essential for our work.

We have chosen Kachemak Bay as another of our core areas because of the amount of past and present research conducted there, the high quality of infrastructure, such as the Kasitsna Bay Marine Laboratory and the Kachemak Bay National Research Reserve, and the relative pristineness. Kachemak Bay is also a newly designated National Estuarine Research Reserve. In Kachemak Bay, we have been in contact with local researchers (Susan Saupe, Raymond Highsmith, Carl Schoch, Glenn Seaman, and Loren Buck) to get input into study site selection. So far we have chosen Jakolof Bay, Anisom Point, Outside Beach, and Seldovia Bay. The first three sites are rocky hard-bottom habitats while the latter is a seagrass/soft-bottom habitat. Final site selection will be done in cooperation with the Kachemak Bay Research Reserve (Carl Schoch) and their ongoing projects, some of which are complementary to our study by using the PISCO sampling design. We feel that this collaboration will be very fruitful. For most sites in Kachemak Bay, historical data and current project data are available (see Section X).

For all Kachemak Bay sampling, we contacted the Seldovia High School and the Seldovia Village Tribal Council to supply local assistance with the destructive intertidal sampling. Konar has participated in career days with these groups in the past and we feel that this field involvement will be beneficial to all groups.

At this point, our efforts will be concentrated on establishing biodiversity study sites according to the NaGISA protocol (see Appendix 1), which is intentionally “low-key” so it can be compared to sampling at many other sites along the planned latitudinal and longitudinal gradients. Once the sampling of these study areas has proven successful, we hope to expand these protocols to include other areas within the Gulf and also other Alaska communities (Prudhoe Bay, Barrow, Point Hope, Kotzebue, Nome, Bethel, Togiak, Dillingham, Port Moller, Akutan, Adak, Yakutat, Glacier Bay, Sitka, Juneau etc.). This will expand the anticipated latitudinal gradient throughout Alaska. Site selection in these new core areas will again be through interaction with monitoring and other research groups already active in those areas (e.g. Glacier Bay National Park Service, Aleutian Maritime National Wildlife Refuge, UAF Marine Advisory Programs, researchers at University of Alaska Southeast, local agencies and communities). The next step in expanding the latitudinal gradient further will be to get in contact with other monitoring and biodiversity groups along the Pacific coast of the U.S. (e.g. PISCO program). Our efforts to extend the gradient beyond the U.S. will be supported by our participation of the “Biodiversity in the Oceans around South America: The known and the unknown” workshop to be held in Concepción, Chile, from October 28-30, 2002, organized by Ron O’Dor (Senior Scientist, Census of Marine Life) and Victor A. Gallardo, University at Concepción.

For the core areas selected so far (Kodiak, Prince William Sound and Kachemak Bay) we feel that our study could provide the baseline data for long-term monitoring projects. Applying the NaGISA protocols now will allow us to evaluate the suitability of selected sites for long-term monitoring. Monitoring effort will have to be coordinated with other agencies and ongoing programs to expand the amount of replicate sampling as well as to expand from only pristine areas to a comparison with human impact sites.

We feel that the best and most efficient way to accomplish our goals, now and in the future, is through local community involvement. This does not only provide manpower for the sampling but also creates curiosity and caring for the local natural history and potential involvement in long-term ecological monitoring. The funds to support the extension of our sampling will be sought after we have completed our initial sampling of the Gulf of Alaska core areas. We will seek funding through agencies such as the Alaska Sea Grant, North Pacific Research Board, Coastal Marine Institute, Project AWARE Foundation, Cooperative Institute for Coastal and Estuarine Environmental Technology, and smaller, local groups.

The University of Alaska Fairbanks will create interest and expertise in cold-water flora and fauna, which has been much less studied than tropical areas, although recent work has shown that these areas have much undocumented biodiversity. The development of cold-water expertise in Alaska will provide a bridge for researchers in Canada and the Antarctic, as well as other regions in the Arctic.

E. Coordination and Collaboration with Other Efforts

THE NAGISA CONSORTIUM:

1. DIWPA (Diversitas Western Pacific and Asia)
   Existing collaborators as listed in Appendix 1

2. Africa
   Mike Roberts, Marine and Coastal Management, Cape Town, SA
   Tony Ribbink, SAIAMB, SA

3. Alaska (ANaGISA)
   Brenda Konar and Katrin Iken, University of Alaska Fairbanks

4. Canada
   Ron O'Dor, Dalhousie University, Halifax, Nova Scotia, Canada

5. Antarctica
   UK - Paul Rodhouse, Head of Biological Science, British Antarctic Survey
   Biodiversity specialist, Alex Rogers, works on Nemertine worms (ex SOC).
   Also: Eugene Murphy, Lloyd Peck

   US – NSF Antarctic lead - Polly Penhole. Also: Deneb Karentz

   Australia - Steve Nichol, Senior Biologist, Australian Antarctic Division.
   George Jackson, Institute of Antarctic and Southern Ocean Studies, University of Tasmania

   Germany - AnDeep is a major international program involving the Polarstern.
   Angelika Brandt, University of Hamburg, in charge of identifying new species.

6. Mexico
   Michel Boudrias, Director of U. San Diego International Program, boum@acusd.edu
   Has similar projects running in Mexico.

7. South America
   Victor Gallardo, U. of Concepcion, Chile

CORRESPONDING FUNDING COLLABORATORS:

1. Existing JSPS Funding

JSPS funding is primarily for scientific exchanges with neighboring Pacific countries. There is about $100,000 per annum available for coastal biodiversity from 2001 to 2011. Within this core area, these funds can be used to bring students or scientists to Japan for training and to send scientists out to teach and supervise fieldwork. Thus, this funding can support a high percentage of the travel for students coming to training courses and for caravans with taxonomic experts going to train for sampling or to analyze samples. However, there are constraints on these funds and expanding the zone of activity will require additional, more flexible funding.

2. GBIF Funding

Japan has a renewable commitment to the OECD Megascience Forum for $1,000,000 p.a. from 2001 to 2005. Some of this funding will be available for the OBIS database, but negotiations are still in progress to determine how this can be accessed for NaGISA.

3. GTI Funding

Funding from the Global Taxonomy Initiative is still under review, but applications include about $250,000 p.a. from 2002 to 2006 for studies of marine benthic and pelagic groups, including database development.

4. SLOAN Funding

Funding from the Sloan Foundation ($310,000 in 2002) has allowed us to set up the NaGISA administrative centers in Fairbanks and Japan. This funding is also going to allow Japan to begin the longitudinal sampling.

IV. SCHEDULE

A. Project Milestones

Objective 1. Provide baseline biodiversity data according to a standardized sampling protocol. To be met by June 2004.
Objective 2. Determine spatial and temporal variation associated with biodiversity in the Gulf of Alaska.
To be met by June 2004

B. Measurable Project Tasks

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

FY03, 2nd quarter (January 1, 2003-March 31, 2003)
January 13-17: Annual EVOS Workshop (joint symposium with GLOBEC and NMFS)

FY03, 3rd quarter (April 1, 2003-June 30, 2003)
May 30: Set up WEB page
June 30: Sample Kachemak Bay

FY03, 4th quarter (July 1, 2003-September 30, 2003)
August 30: Sample Kodiak Island
September 30: Sample Prince William Sound

FY04, 1st quarter (October 1, 2003-December 31)
December 30 Finish sorting and constructing vouchers

FY04, 2nd quarter (January 1, 2004-March 31, 2004)
Dates not known yet Annual EVOS Workshop
March 31: Finish identifying all organisms

FY04, 3rd quarter (April 1, 2004-June 30, 2004)
June 30: Sample Kachemak Bay

FY04, 4th quarter (July 1, 2004-September 30, 2004)
August 30: Sample Kodiak Island
September 30: Sample Prince William Sound

FY05, 1st quarter (October 1, 2004-December 31, 2004)
December 30: Finish sorting and vouchers

FY05, 2nd quarter (January 1, 2005-March 31, 2005)
Dates not known yet Annual EVOS Workshop
March 31: Finish identifying all organisms

FY05, 3rd quarter (April 1, 2005-June 30, 2005)
June 30: Submit final report (including draft manuscripts for publication) to EVOS

NaGISA spans the entire CoML decade: the first field sampling on the longitudinal transect was conducted in 2001 and scheduled re-sampling will, under the JSPS programs, occur for the next ten years. The longitudinal transect that is organized by the Japan center is being partially funded by the Sloan Foundation, but this transect is likely to be expanded by including existing sampling sites from within the DIWPA project.

ANaGISA is in the initial phase of organizing the latitudinal transect from the Arctic to Antarctic. In this initial phase, the ANaGISA proposal to GEM is only seeking support for two years to begin the northern extension of the latitudinal transect in the Gulf of Alaska. We seek funding for the first sampling in summer of 2003 and the re-sampling of our core sites in the summer of 2004. Although we only request funding until the end of 2004, analysis of the second sampling and the preparation of manuscripts may extend into early 2005. During this initial phase of establishing sampling sites within the Gulf of Alaska we will also begin organizing and locating funding for the extension of the transect to other Alaska sites. We will also start organizing the expansion of the transect southwards by contacting other scientific groups and organizations (see Section 3E) for initiating sampling along the western coast of the Americas and in the Antarctic with local or existing funding. This process of organization, fundraising and additional sampling will take time; the completion of the entire latitudinal transect is not anticipated to occur till 2008. As short-term milestones of the ANaGISA project, however, there will be many opportunities to publish results of individual transects, which will serve as a basis for essential environmental management programs (see Section VI).

We will provide a quarterly report to the Trustee Council Office where we will report on the project's progress and indicate possible problems and changes that might arise. Both PI's will participate in the annual EVOS workshop to be held in Anchorage, January 13-17, 2003, to present the proposed project. We also plan to participate in other professional conferences to present the ANaGISA project.

Although the goals of the CoML focus on the results of a single sampling series on a global scale, both NaGISA and ANaGISA have interest in and will be seeking funding for longer-term re-sampling programs and will use the organizational structures created within the projects to attempt to stabilize time series to monitor environmental change. The JSPS program will support re-sampling of selected sites five and ten years after initial sampling. It is hoped that similar long-term commitments, e.g. as monitoring sites, will be developed for ANaGISA and other sites based on local interest and societal requirements.

V. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

We feel that the best and most efficient way to accomplish the goals of this project now and in the future is through local community involvement. This not only provides manpower for the sampling but also creates curiosity and caring for the local natural history and potential involvement in long-term ecological monitoring. In all core areas, we have made contact with the local Youth Watch Programs. We plan on taking individuals from these programs into the field to assist in all intertidal sampling.

B. Resource Management Applications

The immediate goals of examining latitudinal gradients in the biodiversity of macrophyte communities can be met by the intensive, but traditional, approach outlined in this proposal. The information gleaned here will be useful to resource managers. In addition to this basic knowledge, many of the samples collected will provide the basis for a discovery program with the potential to characterize hundreds of thousands of new species of meiofauna along the gradients. This is a challenge that requires a breakthrough approach. Traditional taxonomic methodology has failed to deal with the sheer magnitude of biodiversity in groups such as the nematodes. A single sample may contain a million specimens of as many as ten thousand new species. It would take thousands of nematode taxonomists, who would have to be trained their entire lives, to examine, draw, describe and name all of the species recovered in the NaGISA project. By the time they had completed this work the specimens would have dissolved because traditional preservation techniques do not work on this scale.

The Japan NaGISA Administrative Center is currently developing a totally new approach to taxonomic description of organisms in this size range to be brought on stream for the final phase of detailed analysis of the NaGISA samples. Once these new protocols are perfected, we will adopt them to ANaGISA. The principal elements would be:

1) Automated sorting of samples using flow-cytometry techniques,
2) Suspension of the organisms in a gel,
3) Holographic imaging of the entire gel volume using simultaneous direct and interference holograms,
4) Automated computer scans of the holograms with trainable software to identify and count know species,
5) Capture of holographic images of unrecognized species for examination by experts using expert software to generate descriptions,
6) Holograms are preserved to become the permanent record of the type specimen (physical specimens can also be recovered from gel blocks for preservation or DNA analysis).

This process should be highly efficient and applicable to a wide variety of sample types and small taxa. The gel suspension approach allows near instantaneous examination in 3D, and the holograms that define new species will be instantly stored, added to the database, and become one of the images searched and counted. The technologies all exist and are in use for other purposes, but it will take a well focused program to plan the stages and bring the appropriate experts, technologies and manufacturers together to produce a working system. However, once developed, the system will be valuable in a wide range of habitats, since it will be applicable to routine monitoring and beneficial to resource managers: thus we believe that manufacturers will contribute to development.

VI. PUBLICATIONS AND REPORTS

An important early outcome of both the ANaGISA and NaGISA projects is capacity building. Development and standardization of the basic research kits will make it possible to sample areas where even such fundamental scientific equipment is rare, and so that long-term monitoring becomes feasible. The need for sites for sample storage will help local institutions such as museums and schools justify and acquire facilities as well. In many cases, the collections made for ANaGISA will include rare, or even type, specimens for new species, and input from the NaGISA consortium will facilitate local funding for sample management procedures, facilities and personnel. The training provided through ANaGISA will insure that local people with appropriate skills as well as international connections are available to accept these responsibilities. Especially in Alaska, where native and other coastal communities depend heavily on marine resources through subsistence fisheries, it is important to encourage the awareness of the value of marine life and the responsibility to take charge in monitoring and conservation. The intentional "low-tech" approach of the ANaGISA sampling program provides the possibility to both strongly involving local communities during the two-year approach of the anticipated GEM funding and also for planning long-term monitoring projects (which we expect to develop from this initial sampling). Capacity building will also be obtained through the interaction of taxonomic specialists and students involved in the project, as taxonomic knowledge is an important tool in biodiversity and monitoring studies.

Another important outcome of ANaGISA and NaGISA will be accession of standardized, high quality data from a wide range of study sites from many countries, managed in such a way that it becomes easily available for large-scale comparisons and for temporal comparisons as re-sampling occurs. The Sloan Foundation is supporting the formatting and entry of the initial NaGISA data into OBIS. In the longer term, support is being sought through the Japanese component of the Organization for Economic Co-operation and Development's Megascience Forum through the OBIS partnership with the Global Biodiversity Information Facility (GBIF) and through the Global Taxonomy Initiative (GTI).

ANaGISA will have its own site on the University of Alaska Fairbanks School of Fisheries and Ocean Sciences website that will be linked with NaGISA. On this website, we will highlight community involvement in each of our core areas. The output from NaGISA, and access to its data, will come from web publishing on a main NaGISA website. This site will be developed to function as a window to the public to make the project more popular and to invite more scientific participation. The site will also be developed to serve as a receiving facility for data assembled at remote sites and may eventually become the repository for the NaGISA database for OBIS. Full development of this site will be more expensive and take longer than typical sites because of the need to communicate with many language groups.

It is difficult to predict the full scope of the published output of both NaGISA and ANaGISA because no other project has ever dealt with biodiversity information with such fine resolution on such a wide scale. Many of the transects will create definitive catalogs of local biodiversity, which will be published locally, and which will likely contribute to regional field guides. Specialists on each taxon will publish taxonomic papers on their particular group of organisms - both primary descriptions of new species and synthetic reviews. The project design of three core areas (Kodiak, Prince William Sound and Kachemak Bay), with four study sites within each core area, will allow for biodiversity comparisons within and between areas. The two-year time span of this project will allow for temporal comparisons. This will provide an excellent estimate of the biodiversity range present in the Gulf of Alaska. This project milestone is consistent with GEM's program mission of providing baseline data, for a database which will be useful in monitoring and gap analysis of existing knowledge, and sustaining "a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska" for present and later generations. We expect publications in peer-reviewed journals, such as Marine Biology, Marine Ecology Progress Series, Trends in Ecology and Evolution, Ecological Applications, Biodiversity and Conservation, and Ecological Research since within-site and between-site biodiversity comparisons have case study characteristics that should be of interest for the local and international scientific community. Publications and reports are also likely to provide guidance to local agencies.

Later, there will be comprehensive comparisons of broad geographic series (latitude vs. longitude, eastern boundaries vs. western, etc.) with joint authorship for contributors. It seems likely that the scale of the project will attract interest from the popular media, such as National Geographic. We anticipate a unique collection of photos and videos as a byproduct of the sampling process. Coffee table books for sale in museums are a possibility, and perhaps in the end there will be a paper or CD encyclopedia on the biodiversity of the shores of the world.

VII. PROFESSIONAL CONFERENCES

Travel support for attendance of the annual EVOS meeting and other professional meetings is asked for where we will present the results of our study to the scientific community. Travel and conference support is requested for year 1 and 2 of the project.

In year 1 (2003), we would like to attend the Western Society of Naturalists and the American Academy of Underwater Sciences to share our protocols with other ecological researchers. The time and place of these conferences have not yet been set.

In year 2 (2004), we would like to attend the Benthic Ecology Meeting that will be held at Brown University, Providence, RI. This will be an ideal environment to present our results to other benthic ecologists and advertise the ANaGISA sampling protocol.

VIII. PERSONNEL

A. Principal Investigators (PIs)

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B. Other Key Personnel

A graduate student is requested for this project since ANaGISA is an ideal Ph.D framework for providing a concise sampling program, interaction with local scientists, agencies and local communities and the potential interaction on an international level. The committed involvement of a graduate student will further ensure continuity and capacity building.

We are also seeking funds for student sorters. Their primary responsibility will be to sort through the destructive samples and help construct the voucher collection. This work will provide valuable experience for undergraduate students.

C. Contracts

We need to contract taxonomic experts in macroalgae and invertebrates. Although both PI's are familiar with the local fauna and flora, taxonomic experts will be necessary for quality insurance of species identification as well as to participate in capacity building. We have acquired macroalgal specialist Gayle Hanson (Hatfield Marine Science Center, Oregon) who is a proven expert on the macroalgal flora in the Gulf of Alaska region. Nora Foster and Max Hoberg are invertebrate specialists with years of experience in identifying species from the Gulf of Alaska.

We will also be contracting vessels for transportation around Kodiak and Prince William Sound. We will use local contractors for this who are familiar with our core areas.

IX. PRINCIPAL INVESTIGATOR QUALIFICATIONS

Both PIs (Brenda Konar and Katrin Iken) hold positions as Assistant Professors in Marine Biology at the University of Alaska Fairbanks. Both have extensive experience in near-shore ecological work that is documented in a list of peer-reviewed publications (see CVs). Konar and Iken are both knowledgeable cold-water SCUBA divers with years of experience in designing valuable sampling programs, collecting and handling samples, and performing scientific work in a timely manner. The applied knowledge and experience both PIs possess about shallow-water and intertidal community levels, as well as organismal levels with macroalgae and invertebrates, provides the background necessary for the proposed project.

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APPENDIX 1: DIWPA/IBOY Protocols (in press)

Marine Coastal Habitats in the Western Pacific

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1. INTRODUCTION

As defined by the United Nations Environment Programme, the coastal region extends from upper tidal limits out across the continental shelf, slope, and rise (see Global Biodiversity Assessment, UNEP 1995). This definition includes rocky shores, sandy beaches, kelp forests, subtidal benthos, and the water column over the shelf, slope, and rise. Coastal systems are generally considered to encompass the Exclusive Economic Zones of nations, a strip approximately 200 nautical miles wide.

The importance of coastal ecosystems to humanity is vital as most of the world’s people live within 80 km of the coast. Coastal ecosystems provide food and other resources, transportation, waste disposal, recreation, and inspiration. Some kelp forests, intertidal shores, and estuaries are among the world's most productive ecosystems and coastal fisheries are the richest in the world, with more than 75% of the world's catch coming from coastal waters. Coastal ecosystems are also among those most heavily affected by humans, and threats to biodiversity are multiple and serious; they may also be synergistic. The effects of over-exploitation and pollution are increasingly obvious and serious (e.g. depletion or loss of food species, viral and bacterial diseases of marine organisms, contamination of food organisms, toxic-algal blooms), but the full consequences of alien species introductions, habitat modification or destruction, changes in UV-B radiation, and climate change have yet to be documented. Human pressure on the marine environment has never been so intense.

1.1 IMPORTANCE OF HABITATS

Article 7 of the Convention on Biological Diversity calls for the identification and monitoring of biodiversity, i.e. of ecosystems and habitats, species and communities, genomes and genes. In marine, as in terrestrial and freshwater ecosystems, it is well recognized that the biotic and physical attributes of habitats have a major influence on the diversity, distribution, and survival of organisms. Changes in the nature of marine habitats can cause rapid changes in biodiversity composition, including species of commercial interest. For example, seagrass beds in estuarine and open-coast environments influence local species diversity including fish species whose juveniles use such beds as nursery areas. In the tropics, scleractinian and soft corals structure habitats three-dimensionally, locally increasing biodiversity by providing spatial niches for a wide range of invertebrates, vertebrates, and algae, in turn influencing food-web structure and increasing the complexity of biological interactions. In shallow temperate waters, large seaweeds, bryozoans, hydroids, and tubeworms play a similar role, and in deeper water, as on seamounts, tree-like black corals, gorgonians, scleractinians, and stylasterid hydrocorals are important.

Alterations to natural habitats may be caused by natural processes or human activities. The latter may be direct (e.g. input of terrestrial sediments from forest clearance, pollutants, mariculture, benthic trawling, dumping of offal from fish-factory ships, introduction of alien species including disease organisms) or indirect (e.g. climate change). Changes in population abundance or density, or removal of species (especially keystone, trophically important, or habitat-structuring species), can initiate a cascade of effects that may fundamentally alter biodiversity. Destructive fishing techniques seriously affect marine communities structured by slow-growing coralline and tree-like organisms on rocky bottoms, but very few impact and monitoring studies have been carried out in such critically important subtidal habitats.

1.2 IMPORTANCE OF MONITORING

Inventory and monitoring of biodiversity are crucial for identifying or clarifying the pressures that impact on ecosystems, the rates at which those pressures are operating, present and likely states of those ecosystems, and the actions or responses needed to mitigate or stop negative pressures. The pressure-state-response model is among the more helpful models being used to guide the process of asking the right questions and formulating monitoring programs.

Monitoring generally requires repeated sampling over time. Effective monitoring requires that sampling is replicated to detect variations over short to long time periods, and at more than one location. This means that sampling design is a very important part of devising a monitoring strategy. Distribution and abundance studies generally sample across a timescale in order to detect patterns that could potentially change over short time-scales of days (state of tide, fluctuations in light, temperature, and atmospheric pressure), seasons, years, and decades. Sampling frequency must therefore coincide with whatever variable is being measured. For example, if one is sampling every month, additional sampling should be done within months to demonstrate that variation within a day, between days, and between weeks is less than the variation one is finding among months, seasons, and years; and ideally this procedure should be done at more than one location.

1.3 Baseline studies

Baseline studies refer to data that are collected to define the present state of a habitat, population, or biodiversity in general, in relation to physical parameters and anticipated impacts. Before conducting a baseline study it is important to ask some initial questions. What is being measured? What changes could be anticipated and why? What spatial and temporal scales are appropriate? One-off baseline studies are generally of limited value if they are not replicated in time and space. They have very little predictive power.

Baseline data usually include:

1. The presence and/or abundance of species or other units;
2. Other dependent data (e.g. size and distribution of rock pools, boulders, caves, canopy species, and other features of habitats affecting marine occurrences).
3. Appropriate influential abiotic variables (see below).
4. Human variables.

As the goals and scales of inventorying and monitoring programs may change with time the baseline data collected should be sufficiently robust to accommodate such changes. Provided the data represent a robust sample of the system under study, baseline data can calibrate methods of Rapid Biodiversity Assessment (see below).

2. Goals for Monitoring Coastal Ecosystems

For the purposes of IBOY, we suggest monitoring three codependent gradients in the coastal zone throughout the DIWPA region to a depth of 10 m (15 and 20 m are optional). These are latitudinal and related gradients or clines; gradients induced by human impacts; and temporal gradients (long-term monitoring).

2.1 Latitudinal and related gradients

Gradients of distribution of organisms have been identified in the sea. The details of some of these gradients are still being clarified, however, as they are not all necessarily straightforward. For example, in the northern hemisphere there is a said to be a latitudinal increase in the numbers of species from the Arctic to the tropics. This is not the case in the southern hemisphere, however, where some of the highest diversities for soft-sediment biota have been found at 38° S off the Victorian coast of Australia, and Antarctica has high diversities for many taxa. It is also still not clear how diversity changes in soft sediments from the continental shelf into the deep sea, as there are relatively few data for many groups of organisms and the deep sea is badly under-sampled. One of the best-known diversity patterns is that of regional-scale decreases in coral genera from the Malaysian archipelago eastwards across the Pacific Ocean and westwards across the Indian Ocean, with the lowest diversity in the Caribbean. Similar patterns have been found for mangroves and gastropod snails. On a smaller scale, some South Pacific islands have an E–W rainfall gradient that may be expected to have local effects in lagoonal and littoral environments.

Inventory and monitoring of biodiversity in the coastal environment (as defined above) are necessary to clarify the details of such gradients and how they may shift as a consequence of natural and anthropogenic perturbations.

2.2 Long-term monitoring

DIWPA monitoring sites have the potential to become Long-Term Ecological Research (LTER) sites.

3. SITE SELECTION

3.1 Regional level

Within the DIWPA region, from the Russian sub-Arctic through the tropics to New Zealand's sub-Antarctic islands, there is a huge range of coastal marine ecosystems and habitats. As a preliminary to selecting biodiversity monitoring sites in the DIWPA region, those countries that have not yet devised coastal classification schemes would benefit from doing so. Various schemes have been devised, including one for the marine realm globally. That is a hierarchical scheme that begins "coarse-grained" (zoogeographic realm): then proceeds through "medium-grained" (the finest level possible at a regional scale) to "fine-grained" (national and provincial scale), at which point it becomes a genetic classification, subdividing coastal environments, offshore environments, pelagic environments, coast-associated habitats, living reefs, and critical habitats into finer categories (see appendix). Use of a consistent classification scheme, like that above, throughout the DIWPA region would more easily allow selection and subsequent monitoring of comparable sites (e.g. shallow subtidal kelp beds in Japan with those in

New Zealand; hermatypic coral reefs in the northern Ryukyu Islands with those in the southern Great Barrier Reef).

In reality, coastal ecosystems represent the margins of larger ecosystems, varying considerably depending on atmospheric, oceanographic, geological, and historical factors. Accordingly, forty- nine (49) Large Marine Ecosystems have been delineated globally, representing regions of ocean space from deltas and estuaries to the seaward boundaries of continental shelves and coastal current systems. They are regions characterized by distinct bathymetry, hydrography, productivity, and tropically linked populations. Those in the DIWPA region comprise: West Bering Sea, Sea of Okhotsk, Oyashio Current, Sea of Japan, Kuroshio Current, Yellow Sea, East China Sea, South China Sea, Sulu-Celebes Seas, Indonesian Seas, Northern Australian Shelf, Great Barrier Reef, New Zealand Shelf, and Insular Pacific.

A similar concept is that of the Global 200, the world's most outstanding ecoregions (233 identified) organized biogeographically by habitat type within terrestrial, freshwater, and marine realms (Olson & Dinerstein 1998). Of these, 18 are located within the DIWPA region. Ideally, it would be desirable to locate biodiversity monitoring sites in each of the Large Marine Ecosystems / Global 200 Ecoregions in the overall DIWPA region. As Brunckhorst and Bridgewater (1994) have pointed out, bioregions should be the ultimate management units for sustainable societies, affecting consequent planning and management purposes, whereas the management paradigm should be ecologically-sustainable use.

More practically, in order to compare biodiversity on a global scale, in the IBOY study at least three study sites are required in each 20° bin along the proposed latitudinal transect between 50°N and 50°S.

3.2 Local selection criteria

A two-tiered approach to biodiversity monitoring is recommended, utilizing core and satellite sites. Intensive baseline studies and monitoring will be carried out at core sites using all standard methodologies; at satellite sites, only some methodologies need be employed or data collected. Core and satellite sites may be selected on the basis of the following criteria.

- ***A.*** Infrastructure. Long-term monitoring (over years to decades) is most easily accomplished in proximity to a research facility (e.g. a marine laboratory) where there is also likely to be accommodation and ongoing research programs. Automatic 24-h monitoring of physical data is possible when remote instrumentation is connected directly to a computer in a laboratory. [See section 5 on methodology.] A major benefit of locating monitoring sites near a research facility is that routine measurements of biodiversity and physical variables can often be carried out relatively cheaply using student labor or other on-site/near-site human resources. It also means that a commitment to long-term monitoring is more easily achievable. Marine station networks may facilitate planning and coordination of research effort.

B. Baseline information. For a variety of historical, geographic, resource, and other reasons, some areas of coastline are better known biologically and physically than others. The existence of historical data allows closer comparisons between former and current states, and may help in the process of site selection when potential monitoring sites are otherwise closely similar. In addition such information would be useful for future compilation of biological information.

C. Reasonably natural environment (pristiness according to MARS definition). A goal of the regional monitoring program is within-region comparisons of biodiversity and biotic change. For this reason, it is desirable that monitoring should be carried out in areas that are as natural as possible. It would be advantageous to locate monitoring programs within marine protected areas (MPAs), for example. There are a variety of marine reserves and usages throughout the DIWPA region, ranging from controlled exploitation of certain species (usually line-fishing of reef fish) to completely no-take. The latter type of MPA is not common but could be ideal for monitoring activities provided other criteria are satisfied.

D. Long-term stability of the site. It needs to be ascertained if a proposed monitoring site is likely to remain the same during the monitoring period. Thus it may be necessary to determine if coastal development or modification of an adjacent catchment is intended. The elimination of human-caused variables is important.

E. Accessibility. Sites that are more natural in biological character, i.e. containing ecosystems or habitats that are unmodified or scarcely modified by human activities, are frequently the most remote and difficult of access. Some coasts are also subject to greater wave exposure and are less able to be regularly sampled. Deeper-water habitats are expensive to sample and monitor, and successful occupation of the same station for extended periods or over the long term is dependent on sea-surface state.

F. Biological character. Pre-selection criteria can include known biodiversity values; is the candidate site biodiversity-rich, is it representative of a wider biotic ecosystem or realm, is there a significant number of rare species, etc.? It is also important that the target habitats, i.e. ‘homogenous’ macroalgae-hard and/or seagrass-soft substratum habitats (with a shoreline extent of 20-200m), should be available in the site.

3.3 Application of selection criteria

Potential biodiversity monitoring sites can be rated according to each criterion (excellent, reasonable, poor, no data) and ranked according to their scores.

3.4 Potential availability of no-fishing/no-take areas for stability of long-term monitoring

As mentioned under 3.3, above, monitoring could effectively be carried out in protected areas. Ideally, these areas should be completely no-take marine reserves, where no extraction of organisms takes place. Such reserves are unfortunately rare anywhere in the world, although should be established as a matter of principle. In most maritime countries there are presently many areas of seafloor that are declared no-fishing and/or no-entry areas for sectoral reasons — because of their restricted nature these areas constitute de facto reserves (e.g. military areas and cultural sites). All of these constitute areas where potential undisturbed monitoring could take place under appropriate circumstances.

3.5 Marine BioRap — Identifying biodiversity priority areas

Marine BioRap is a methodology and set of analytical tools developed in Australia for identifying and assessing, in less than 18 months, priority areas of marine biodiversity. It is a decision support tool that can help planning and decision-making by identifying priority areas from local to ocean-basin scales. BioRap also uses biodiversity itself (or surrogates of biodiversity) to identify priority areas, while taking into consideration other factors, and precedes using iterative approaches. BioRap is an approach that can be used in selecting from among candidate monitoring sites when there are number of similar sites to choose from.

4. Sampling Protocol

4.1 Sampling strategy

At each study site a stratified random sampling strategy will be employed, with strata representing vertical heights above and below low water datum. That is for each study habitat, five random replicate samples are to be taken at high, mid and low intertidal positions and 1, 5 and 10m subtidal water depths (15 and 20m depth strata are optional). The most expedient randomization procedure should be adopted. The sampling program at each study site should take place at least once a year, during the period of expected highest diversity, and commence by the end of 2002.

4.2 Sampling methodology

The sampling methodology hereafter described is a minimal requirement to be done at each site for IBOY activity. Ideally, there are a lot of factors to be measured or subjects to be studied. All these are described later as a recommendation.

At each random replicate sample location both non-destructive and destructive sampling will be undertaken according to the following protocol: -

In-situ observation (non-destructive)

A photographic image record (digital or film) should be made immediately prior to sampling. If conditions do not permit such a photographic record to be made (e.g. poor visibility) then a hand-drawn map should be constructed as an alternative. All macrophytes and conspicuous macrofauna (>2cm length) within a quadrat sample will be identified in-situ, and either counted or an estimate of % cover made using a standard technique. For macroalgae-hard substrate habitats a 1x1m quadrat will be utilized, whilst for seagrass-soft substrate habitats a 50x50cm quadrat will be sampled. Counts will be made of solitary fauna, erect colonial organisms and seagrass plants. Percent cover estimates (using a standard technique) will be made for canopy and under-story macroalgae, and encrusting colonial organisms.

Direct removal (destructive)

A photographic image record (digital or film) should be made immediately prior to sampling. All macrophytes and fauna within a quadrat or core sample will be carefully and completely removed. For macroalgae-hard substrate habitats a 25x25cm quadrat will be sampled, whilst for seagrass-soft substrate habitats a 15cm diameter cylindrical core (to 10cm substrate depth) will be utilized. Both quadrat and core shall have a 63 λm mesh bag attached, into which macrophytes and fauna should be collected without significant loss of material. Hand scrapers will be used in macroalgae-hard substrate habitats in order to facilitate removal of attached organisms.

In the first year of sampling, the 25x25cm quadrat utilized for directly sampling the macroalgae-hard substrate shall form a sub-sample (always the same position within the larger sample) of a 50x50cm quadrat, from which only macroalgae shall be completely removed. This latter sample is taken in order to ensure sufficient algal reference material to support the in-situ observation.

The surface and bottom seawater temperature should be measured at each sample location. In addition, the substratum should be visually classified according to the standard Wentworth convention for the description of sediments.

4.3 Initial processing of direct samples

Resulting samples should be sieved on nested meshes of 1mm and 63 microns. Macrophytes remaining on the 1mm sieve should be carefully washed (and if necessary scraped) over the mesh to remove associated macrofauna. Both the floral and faunal component of the 1mm sample are to be retained, but should be stored separately. The material retained on the 63 λm sieve will largely comprise of meiofauna. All three portions of the sample should be separately fixed and preserved using 5% neutralized* seawater formalin (2% formaldehyde).

*concentrated formalin (=35% formaldehyde) saturated with borax (sodium hexaborate)

4.4 Recommendations

The above protocol constitutes the minimum standardized sampling requirement for the proposed biodiversity determination, comparison and monitoring study. The following recommendations represent actions which are considered useful optional additions to the program: (1) Sampling to take place more than once a year, e.g. during potentially separate periods of highest diversity for macrophytes and associated fauna; (2) Sampling of additional habitats that occur at study site, e.g. mangrove, coral reef, unvegetated sediment; (3) Creation of a macrophyte and macrofauna reference collection for the study site; (4) Taking of additional samples for future molecular studies (fixed and preserved in 100% ethanol); (5) Compilation of a site species inventory from existing information and; (6) Construction of site history, e.g. adjacent terrestrial land 'use', potential anthropogenic impacts.

5. Subjects To be Studied and Monitored

A regional approach to monitoring coastal biodiversity invites the question: What aspects of biodiversity may be monitored that can be compared throughout the region? Four subjects are recommended here for study and monitoring at core sites:

(a) species inventory of selected taxonomic groups
(b) abiotic and biotic parameters
(c) habitat mapping
(d) all-biota taxonomic inventory.

The minimal requirements for sampling mentioned above will provide samples that fulfill most subjects mentioned below. However, it is not possible to carry out all subjects listed below, for each participating sampling site, due to lack of funds, facilities and human resources. Strategies to overcome these problems will be discussed later.

5.1 Species inventory of selected taxonomic groups

Major taxa to be studied may be selected by a variety of criteria including representation throughout the DIWPA region, ease of identification by non-experts, commonness, ecological role (keystone species, habitat-structuring, trophic importance), use as an environmental indicator, etc. Selected species from the following groups are recommended:

(a) macroalgae
(b) seagrasses
(c) mollusks
(d) decapod crustaceans
(e) echinoderms
(f) fish
(g) cnidarian corals.

Depending on locality and geographic area, optional taxa can include selected species of:

(a) sponges
(b) other macro-invertebrates (large bryozoans, hydroids, ascidians)

(c) marine reptiles
(d) sea birds
(e) marine mammals.

5.2 Abiotic and biotic parameters

Easily measurable physical and biological parameters influencing or associated with coastal biodiversity include the following:

(a) temperature
(b) salinity
(c) water chemistry (C, H, N, O, nutrients, etc.)
(d) pH
(e) suspended sediments
(f) currents
(g) light
(h) chlorophyll a.

Although the sampling protocol requested to measure only temperature, it is recommended that the parameters listed above will be measured at the sea surface down to 20 m depth. To ensure data quality and to facilitate regional comparisons, continuous observation by multiple-sensor data-loggers is most desirable. Standardized methodology may be possible by mass production of sensing apparatus.

5.3 Habitat and biodiversity mapping

As mentioned in the sampling section, it is necessary to find a homogeneous macroalgae-hard and/or seagrass soft substratum habitat in each site. Information obtained from habitat mapping will provide data necessary for selecting sampling place at each site.

Mapping can be a two-tiered exercise. At one level, entire coastlines can be mapped biologically, based on a variety of data sources, though it is not mandatory for each participating site. If such maps already exist, as they do for parts of some DIWPA countries, again they can facilitate the selection of biodiversity monitoring sites. At a finer level, detailed maps may exist for some marine protected areas, and should be carried out in areas selected for monitoring. If maps of coastlines do not already exist, then the production of habitat maps at monitoring sites can contribute to the downstream production of larger-scale coastal maps.

Coastal-zone maps may already exist for mangroves and coral reefs at a variety of scales. Maps can also depict the distribution of macroalgae, subtidal biogenic structures (e.g. bryozoan mounds, tubeworm reefs, sponge beds), shellfish beds, seagrasses, seabird and turtle nesting sites, and hauling grounds for pinnipeds. Use of GIS can overlay and correlate associated sediment, hydrographic, and other data obtained from on-site and remote (aerial and satellite photography, sonograph) measurements.

5.4 Species inventory and sampling

Coddington et al. (1991) have provided strategies for species inventories. These include —

- Use proven collecting methods for different taxonomic groups in order to standardize techniques with previous and future workers.
- Keep the number of collecting methods for each group to the minimum necessary, but maximize the independence among methods.
- Use general protocols that work in plot-based or plotless sampling.
- Keep the sampling unit general, simple, and comparable: time spent sampling is perhaps the best unit of measure. Sample unit should be small enough to permit among-sample comparisons.
- Large samples should be reassembled from smaller replicate samples.
- Data collected should permit variation to be estimated and analyzed, especially with respect to site, season, sampling method, etc.
- Samples of species and individuals per species should be sufficient to construct species abundance distributions that can be used to estimate species diversity.
- Since quantitative sampling tends to under-record rare taxa, sampling should aim to reliably reproduce the population characteristics as distinct from sampling-error effects.
- Voucher specimens of each species must be conserved to ensure taxonomic consistency and accuracy of identification.

More detailed information can be found in Global Biodiversity Assessment (Heywood 1995: p. 478).

The sampling protocol described in section 4 was designed to fulfill all these criteria.

5.5 All-biota taxonomic inventory

Where appropriate, some core monitoring sites throughout the region in similar habitats should be chosen for all-biota taxonomic inventory (ABTI). These could be considered as core sites for long-term monitoring beyond the immediate scope of the IBOY project.

Impediments to an ABTI include the availability of systematic expertise in the short and long term and funds for capacity building. It is recommended that, where possible, the same taxonomic experts be available for shared comparative inventory across the DIWPA region. The availability of expertise will determine whether an inventory of target taxa will be intensive or whether some form of rapid assessment will be used. The latter approach can be effective if it allows for repeatability in the discrimination of recognizable but unnamed taxa (so-called RTUs).

6. Strategies for Future Activities

6.1 Sampling kit

To ensure the highest degree of standardization practicably possible, it is desirable to seek central funding for the provision of sieves and digital camera equipment (part of minimal sampling kit).

6.2 Future activities

In the near future, it is proposed that a database containing contact addresses/emails of the study participants and the details of all selected study sites will be constructed. Study site details (e.g. precise latitude/longitude, habitat characteristics etc) have been solicited by questionnaire. Information pertaining to the study - its aim, sampling protocol, map of study sites, list of participants etc. - will be posted on a soon to be developed DIWPA web page (with support from CoML). It is essential that all study participants communicate their sampling schedule directly by means of the group email list and via the web page.
In order to analyze the initial results of the study (data for macrophytes and conspicuous macrofauna), a workshop will be organized for all participants at the end of 2002 or the beginning of 2003. Currently there is no precise agreement for the mechanism of identifying samples of fauna (macrofauna and meiofauna) not examined in-situ, and the compiling and analyzing of results. However, one possibility is to assemble a team of 'itinerant' post-doctoral researchers who can be collectively responsible for ensuring that the biodiversity assessment of each study site is completed.

It is envisaged that collaboration will be established and maintained with related projects within programs such as BIOMARE.

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The identification of problematic algae collected during ANaGISA studies

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Alaska Natural Geography in Shore Areas (ANaGISA)

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University of Alaska,
Fairbanks, Alaska

August 1, 2002

Executive Summary of the ANaGISA Project.

ANaGISA is the Alaska portion of the larger NaGISA (National Geography In Shore Areas) project studying biodiversity in near-shore areas. The original NaGISA will complete a longitudinal gradient while ANaGISA will conduct a latitudinal pole-to-pole gradient, beginning in the Gulf of Alaska. ANaGISA is likely to play a central role in biodiversity studies for Alaska's extensive shoreline and variety and abundance of pristine environments. ANaGISA is therefore expected to be of great importance in both the context of NaGISA as well as for local interest because of the importance of near-shore ecosystems in local commercial and subsistence fisheries.

Both NaGISA and ANaGISA hold a unique position in the Census of Marine Life (CoML) as ambassador projects, linking CoML to local interests. They focus on the narrow inshore zone of the world's oceans at depths of less than 20 meters, the area people know best and impact most. Sampling in this zone can be done routinely and inexpensively, and is of great ecological and economical interest. Thus, these projects are ideally suited to generate public interest and involvement. Building on site selection and sampling protocols developed during the International Biodiversity Observation Year (IBOY), these project's aims are to achieve wide coverage with standardized techniques that will provide a biodiversity baseline for future comparisons. The ultimate goal is a series of well-distributed standard transects from shore to 20 meters depth around the world, which can be repeated over a 50-year or even greater time frame.

The Sloan Foundation is funding the initial steps of the NaGISA project. With this, we are establishing NaGISA administrative centers in Japan and Alaska. The Japan center is working with several other groups to establish sampling sites along an equatorial longitudinal gradient from the east coast of Africa to the Palmyra Atoll. This sampling is beginning this summer (2002). The Alaska center (ANaGISA) is working towards beginning a pole-to-pole latitudinal transect starting in south-central Alaska. This center has been contacting communities and researchers to locate feasible sampling sites along the coast. This proposal seeks funding to bring together a group of taxonomic specialists and to begin sampling sites within the Gulf of Alaska. Once the sampling in this area has been established and proven, we will seek out and encourage other areas in Alaska (such as Beaufort Sea's Boulder Patch, Aleutians, west coast of Alaska, southeast Alaska including Glacier Bay, etc.) to join in with our project. After Alaska is established, we will extend our work south-ward to the Antarctic. This obviously is a long-term commitment that we are ready to make.

In all sampling areas, core sites will be identified to provide the minimum essential biodiversity coverage, but satellite sites will also be developed as local interest dictates and it is hoped that the baseline and protocols will be adopted more widely for environmental monitoring.

To ensure comparability of our data with those of other NaGISA study sites, we intend to apply the sampling procedure developed for baseline biodiversity coverage (Appendix 1). All sampling sites are centered in large algal communities and seagrass/soft bottom communities, which are more complex and less well characterized than coral communities, and which also represent important habitat types along the Alaskan seashore. For each study site, replicate samples will be collected at the high, mid and low intertidal and 1, 5 and 10m subtidal water depth, where possible also at 15 and 20m depth. Sampling consists of a non-destructive photographic image record prior to destructive aerial sampling of all macrophytes and fauna. Initial taxonomic analysis will focus on visible organisms associated with large algae and sea-grass communities, but a full spectrum of samples will be collected and preserved for analysis as resources become available. As part of this proposal, we will sort and work up all macroorganisms collected. Voucher specimens for all these organisms will be collected and stored at the University of Alaska Museum. We have begun gathering a group of taxonomic specialists to assist in species identification. This group of taxonomic experts will in fact be a valuable capacity building tool and local participants will be encouraged to expand their interests through student and post-doctoral programs.

The complete analysis of even one transect sample series to include microscopic organism including bacteria in the bottom sediment is a huge task that could reveal thousands of new species and take many years. Detailed analysis of the hundreds of transects that may ultimately be taken will require a new approach. Thus, although the core NaGISA program is intentionally ‘low-tech’, the planning phase will include efforts to maximize the value of the samples collected through development of automated sorting and species recognition systems. Associations with groups interested in molecular diversity approaches are also part of the planning process. These new technologies will be essential for the success of extensive future long-term biodiversity monitoring programs.

The core of this project is an exercise in international cooperation and capacity building, which is organizationally complex, but clearly achievable at a significant level. The full extent of new knowledge of global marine biodiversity extracted from the sampling program will be determined by the success of the planning phase in funding and developing automated image analysis, microscopic and molecular approaches to taxonomy.

THE 2003 FIELD SEASON:

During this first year of sampling, the NaGISA teams will set up transect lines at 9 field sites: 3 in Prince William Sound, 3 in the Cook Inlet/Kenai region, and 3 in the Kodiak Island/Alaska Peninsula. These transect areas will become the permanent sampling sites for the NaGISA long term studies. Quadrats will be set in the intertidal and subtidal parts of these transects and analyzed for both their invertebrate and algal composition. Both percent cover and destructive sampling for quantitative data will be incorporated into the study. However, the exact site locations and procedures for sampling will not be determined until this first year's field season.

The data will be processed entirely by the NaGISA teams except for taxa that are not easily recognized. These specimens will be sent to taxonomic experts for identification. Our experts include the following people:

Algae: Gayle I. Hansen, Hatfield Marine Science Ctr., Oregon State University, Newport
Invertebrates: (1) Nora Foster, University of Alaska Museum, Fairbanks
(2) Max Hoberg, IMS, University of Alaska, Fairbanks

The identification of problematic seaweeds collected during the ANaGISA 2003 studies

A Subcontract to:

Gayle I. Hansen
Oregon State University

The macrobenthic marine algae of seaweeds are an important component of the marine ecosystem in Alaska providing food, shelter, substratum, and oxygen for a wide variety of animals. Their occurrence is dependent on having the appropriate substratum, water temperature, salinity, nutrients, light, and daylength for survival and by the absence of overly voracious herbivores. Other factors that influence species distributions are wave exposure and currents, siltation and sand scour. Many marine algal species have a definite seasonality and disappear in the winter and their associated animals often disappear as well. When seaweeds completely die off due to factors like el Nino or over grazing, there is a profound impact on the dependent animal communities. Because of this fact, many of the larger marine algae are considered keystone species in rocky intertidal and nearshore marine communities. Therefore, for NaGISA programs, it is essential that these marine plants are carefully documented and monitored.

We estimate that in Alaska there are approximately 600 seaweed species. Even so, the only published comprehensive account of marine algae in this state (Lindstrom, 1976) lists only 376 species. However, in a recent study of the algae collected during EVOS impact studies, 324 species and species complexes of marine algae were found to occur in southcentral Alaska alone, and our predicted species for the rest of Alaska nearly double this number. Although many of these species are identifiable with keys written for the marine algae of British Columbia (Gabrielson, 1998), many others require the use of the original literature and of floristic accounts for marine algae in Japan, Korea, Russia, and northern Europe. It is these latter species as well as the more common but difficult to differentiate species that require identification by a professional taxonomist.

For this first field sampling year (2003), I will be responsible for the identification of all problematic specimens of marine algae sent to me by the ANaGISA teams. Entire specimens of these species, preferably fertile, will be pressed onto herbarium paper in duplicate by the field teams, labeled with the date, collection site, and tidal level and sent to GIH in Newport, Oregon. She will identify the specimens, write her identification on the sheets, and database the specimen information. She will then return an electronic copy of the identification and site data and one set of the specimens to UAF for curation and reference by the NaGISA teams. The other set of species will be curated and retained by GIH for the OSU herbarium.

During the second year of sampling and in a future subcontract, GIH hopes to work with the NaGISA team to do an all-seaweed species inventory of the NaGISA sites and prepare an annotated checklist of the algal species.

EQUIPMENT AVAILABLE FOR THE ALGAL TAXONOMIC IDENTIFICATIONS:

GIH has a Zeiss compound and dissecting microscope available for the project and an excellent library and herbarium emphasizing Alaskan marine algae.

BUDGET and BUDGET JUSTIFICATION:

Salary. The NaGISA teams will provide pressed specimens for identification that will require 1 month of GIH's time spread over 2 months.

Her salary is set by her university. - 1 month = .083 FTE	$4800
Fringe. 53%	$2544
Supplies: slides, coverslips, stains, razor blades, and some herbarium paper and plastic bags for processing the OSU pressed specimens.	$350
Mailing, internet, computer, phone and library costs:	$450
Subtotal	$8144
Overhead at 41.5%	$3380
Total subcontract cost	$***11,524***

CONTACT INFORMATION:

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home phone: 541-265-4061

NRF Taxonomic Services

Identification Services Subcontract for

Nora R. Foster
NRF Taxonomic Services
2998 Gold Hill Road
Fairbanks, Alaska 99097

(907) 474-9557
swamprat@mosquitonet.com

Amount: $ 10,000

Services: Expert identifications to lowest taxon for invertebrates sampled as part of *Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life* proposed by Brenda Konar and Katrin Iken

Product: Final report on species identifications, list of species occurrence by site, and discussion of taxonomically difficult or poorly known species. Voucher specimens: with name, id by and reference

Timeline: FY 03/04

FY03, 4th quarter (July 1, 2003-September 30, 2003)
October 1: Kodiak Island and Kachemak Bay vouchers received

FY04, 1st quarter (October 1, 2003-December 31, 2003)
November 1: Prince William Sound vouchers received
March 31: Finish identifying all organisms
December 31: Final report completed and vouchers returned

Payment schedule:

$5,000- payable on B, Konar's receipt of a progress report including draft species lists from Kachemak Bay and Kodiak Island.

$5,000- payable on B. Konar receipt of a final report including final species lists and voucher specimens.

Nora Foster

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROJECT BUDGET

Budget Category:	Proposed FY 04
Personnel	$92.2
Travel	$24.2
Contractual	$41.7
Commodities	$3.5
Equipment	$0.0
Subtotal	$161.6
Indirect	$38.3
Project Total	$199.9
Other Funds	

Comments: EVOS Workshop Attendance
Other Professional Meetings
25% MTDC

FY04

Prepared: July 02

Project Number:
Project Title: Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life
Name: UAF/Katrin Iken and Brenda Konar

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROJECT BUDGET

Personnel Costs:			Months	Monthly	
Name	Description		Budgeted	Costs	Overtin
Konar, B.			3.0	7.7	
Iken, K.			3.0	8.2	
Hoberg, M.			1.0	5.9	
Ph. D student			9.0	1.4	
student assistants (6 @ 4 hours)			24.0	0.7	
				0.0	
Ph. D student summer			3.0	2.8	
	Subtotal		43.0	26.7	C
					Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
R/T UAF-Kodiak (5 people X 2)	2.1	2		
R/T UAF-Seldovia (5 people)	2.4	1		
R/T UAF- Valdez (5 people X 2)	2.4	2		
Hotel	0.8	1		
Meetings	6.0	1		
Annual EVOS meeting				
(2 persons R/T Fairbanks-Anchorage)	0.2	2		
(2 persons Hotel costs)	0.5	1		
BEM meeting				
(3 persons R/T Fairbanks-Rhode Island)	1.0	3		
Registeration	0.5	1		
hotel costs	1.6	1		
				Travel To

FY04

Prepared: July 02

Project Number:
Project Title: Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life
Name: UAF/Katrin Iken and Brenda Konar

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROJECT BUDGET

Contractual Costs:	
Description	
Transportation to core sites in Kodiak (2x8 days)	
Boat charter in Prince William Sound (2x8 days)	
Lab fees Kachemak Bay (2 weeks/5 people)	
Bunks	
Lab	
Boat	
Pickup	
Food	
Shipping of gear	
Communications	
tuition, resident, Ph. D student	2 semesters
	Contractual To

Commodities Costs:
Description
misc. gear
collecting vials for invertebrates
pressing paper and press for algae
sampling bags
Commodities Tot

FY04

Prepared: July 02

Project Number:
Project Title: Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life
Name: UAF/Katrin Iken and Brenda Konar

New Equipment Purchases:	Number of Units	Unit Price
Description		
Indicate replacement equipment purchases with an R.	New Equipment Total	

Existing Equipment Usage:	Number of Units
Description	

FY04

Prepared: July 02

Project Number:
Project Title: Alaska Natural Geography In Shore Areas: An Initial Field Project for the Census of Marine Life
Name: UAF/Katrin Iken and Brenda Konar