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

GEM PROPOSAL SUMMARY PAGE

(To be filled in by proposer)

Project Title - Impacts of Seafood Waste Discharge in Orca Inlet, Prince William Sound

Project Period: FY 04-FY 06

Proposer(s): Richard E. Thorne and Mary Anne Bishop
Prince William Sound Science Center

Study Location: Orca Inlet, Prince William Sound

Abstract

This proposal brings together several entities with concerns over the impacts of seafood waste discharge into Cordova Harbor (Orca Inlet). The Prince William Sound Science Center (PWSSC) is acting as the facilitator of this effort because of its strategic location and long-term interest in the problem. Primary collaborators are DEC, ADF&G and Cordova seafood processors. Anticipated collaborators include the Native Village of EYAK and the City of Cordova. The proposed research will investigate possible impacts seafood waste discharge through a series of experiments that will evaluate the nearshore community response to alternate techniques of seafood waste discharge, including different grind sizes and whole carcasses, as well as a pile remediation study. These experiments will not only aid our understanding of the historic impacts, but will form the basis for a more healthy and productive approach to seafood waste recycling. A three-year project is proposed, with the first year devoted to baseline observations and experimental design.

Funding:			
	EVOS Funding Requested:	FY 04 $ 66,679	
		FY 05 $102,470	
		FY 06 $ 99,948	TOTAL:$269,097
	Non-EVOS Funds to be Used:	FY 04 $ 15,000	
		FY 05 $ 20,000	
		FY 06 $ 20,000	TOTAL:$55,000

Date: June 13, 2003

(NOT TO EXCEED ONE PAGE)

Impacts of Seafood Waste Discharge in Orca Inlet, Prince William Sound

Research Plan

I. NEED FOR THE PROJECT

A. Statement of Problem

The discharge of wastes from seafood processing is a substantial anthropogenic impact on nearshore waters of Alaska. Prior to the mid-1970s, Orca Inlet, located on the eastern side of Prince William Sound (PWS) teemed with marine life: crab, clam and groundfish. These once plentiful and valuable resources have been replaced with huge numbers of Glaucous-winged Gulls (*Larus glaucescens*) and Mew Gulls (*Larus canus*), green algae and *Capitella sp* polychaete worms. Seafood wastes were discharged into Orca Inlet both before and after these changes. However, the nature of the discharge process changed, and the change in the environment corresponded to a 1977 change in discharge practices.

The separation of anthropogenic effects from natural changes is often difficult. The change in Orca Inlet corresponds to the 1977 mandate by EPA to discharge seafood wastes in ground form with maximum 0.5" size. However, the change in Orca Inlet also corresponds to many widespread changes that many attribute to climate change (Agler et al. 1994; Piatt and Anderson 1996). Among the natural changes in Orca Inlet was a major increase in the population of sea otters.

This proposal brings together several entities with concerns over the impacts of seafood waste discharge into Cordova Harbor. The Prince William Sound Science Center is acting as the facilitator of this effort because of its strategic location and long-term interest in the problem, dating back to a proposal for Saltonstall-Kennedy funds in 1993. Two trustee agencies, the Alaska Department of Environmental Conservation (DEC) and

the Alaska Department of Fish and Game (ADF&G), are closely involved with the effort, along with the Cordova seafood processors. Additional involvement is anticipated from the Native Village of Eyak and the City of Cordova. The proposed research will investigate possible impacts seafood waste discharge through a series of experiments that will evaluate the nearshore community response to alternate techniques of seafood waste discharge. These experiments will not only aid our understanding of the historic impacts, but will form the basis for a more healthy and productive approach to seafood waste recycling.

B. Relevance to GEM Program Goals and Scientific Priorities

The overall GEM mission is to "sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska and the human use of marine resources in that ecosystem through greater understanding of how its productivity is influence by natural changes and human activities". The concerns addressed in this proposal are completely in line with this mission. In particular, we are concerned with the impact of seafood waste discharge on the health and diversity of the nearshore environment of Orca Inlet and how alternate methods of seafood waste recycling may enhance the health, diversity and productivity of that environment.

The GEM nearshore working concept is that "biological production and the structure of food webs in nearshore environments are controlled by local primary production, imports of nutrients and food from watersheds, the Alaska Coastal current and the offshore, as influence by predation, physical, and anthropogenic factors". In this study, we seek to document the impact of anthropogenic factors on the nearshore environment of Orca Inlet, and at the same time, seek alternate waste treatment strategies that will minimize impacts, or even enhance a healthy, diverse nearshore community.

The GEM nearshore program seeks to develop a geographically distributed network capable of measuring decadal scale changes in oceanographic variables, habitat type,

benthic community structure, human use, contaminant levels and abundance of selected marine plants, mammals, birds, shellfish and fishes. In this study, we will look at the baseline characteristics of an area minimally impacted by human use, monitor changes in such an area as it becomes impacted by human use (waste discharge), look at the characteristics of an area heavily impacted by human use, and possibly changes in that same area as the intensity of human use is changed or moderated.

The monitoring techniques for each of these situations will be closely coordinated with developing GEM nearshore protocols (e.g. Schoch et al. 2002).

II. PROJECT DESIGN

A. Objectives

We propose a three-year investigation of the impacts of the current seafood waste discharge process in Cordova and an evaluation of alternate waste discharge and recycling processes. The initial year will be devoted to planning the experiment and collecting background or baseline data, followed by two years of fieldwork and experimentation. Objectives to be accomplished in the initial year are the following:

1. Explore options for grind size
2. Explore options for experimental design
3. Seek further collaboration
4. Select sites for experiments
5. Evaluate techniques
6. Further document characteristics of the current discharge process
7. Collect baseline and background data
8. Finalize the experimental design

The second and third years will be devoted to the conduct of the experiment. While some details of the experiment will obviously depend on the results of the design phase, the experiment will incorporate the following objectives:

9. Evaluate responses to various grind sizes
10. Evaluate benefits of pile remediation
11. Evaluate impacts of reduced waste discharge on current site.

B. Procedural and Scientific Methods

The first 7 objectives involve planning and experimental design. They will be accomplished primarily through literature research and consultation. The process will be enhanced through a workshop in Cordova. Further details associated with the specific objectives are given below.

Objective 1- Explore options for grind size

Current EPA regulations limit grind size to 0.5", the existing process in Cordova. A very limited experiment proposed for 2003 in Ketchikan will compare 0.5" grind to a 1-2" grind and whole fish heads. The Ketchikan study will comprise three small piles, with just one placement of wastes during the processing season. We propose for the Cordova study to discharge a larger volume of waste over a select area. It will descend from the surface, rather than be placed in a finite location on the sea floor. Cordova processors have the capability to grind from 3/8" to 1.5", and the proposal would also study the results of using whole fish carcasses.

Objective 2- Explore options for experimental design

Consideration for the experimental design include the number of experiments (based on the options stated above), the number of replicates, the parameters to be measured, the periods (extent and season) of study, magnitudes of waste involved, size of waste piles, area of waste piles, and proportions of waste to be diverted to experiment.
Characteristics of the present waste discharge system have to be incorporated into the

experimental design. Typically pollock are processed from late January through March and salmon from mid-May to September. In addition, the nature of the response needs to be carefully considered. Several important responses are obvious, such as water quality, gas production, polychaete worms, species diversity. However, there are also several potentially critical responders, including crabs, seabirds, fishes and sea otters.

Objective 3- Seek further collaboration

At this point, we have established collaboration among PWSSC, DEC, ADF&G and the Cordova seafood processors. Historic collaboration on this issue exists with the Native Village of Eyak and City of Cordova, and initial contacts have been made for each of these entities. For this proposal, additional critical collaborations need to take place with GEM researchers in the nearshore environment to establish sampling protocols and for further advice on site selection.

Objective 4- Select sites for experiment

Williams et al. 1999 established a sampling plan for the existing discharge area. Sites need to be selected for experiments that are comparable to the existing site and amenable to the experiment.

Objective 5- Evaluate techniques

Many techniques are standard including diver observations, water quality sampling, benthic (grab) sampling. We will further explore feasibility of underwater cameras, sampling of crab populations, options to assess fish responses including cameras, acoustics and nets. Further, technique application has to be selected with regard to currently developing GEM nearshore protocols.

Objective 6- Further document characteristics of the present discharge system

Some historic literature exists on the present discharge system to a single location, or point and its impacts, including Caponigro (1979) and Williams et al. (1999). In addition there are several published reports from EPA, as well as reports provided by processors

as part of the permit process. Additional background material is available as per the reference section.

Objective 7- Collect baseline and background data

Initial observations will be made concurrent with the planning effort. These are needed to verify historic information and to guide the planning effort. We will base our data collection on the Williams et al. (1999) study, which covered the same 20 sites originally sampled by Caponigro (1979). Parameters that were measured included water sampling for dissolved oxygen, temperature, pH, salinity, conductivity and turbidity, benthic sampling using a 0.1 m^2 van Veen grab. Diver observations are conducted as part of the permit process and will be expanded for this study. We will also make observations with a Sediment Profile Imager, acoustics and nets and current measurements.

Objective 8- Finalize the experimental design

The expected and primary product of the first year will be the detailed experimental design that will be conducted over the subsequent two years.

Objective 9 (years 2,3)- Evaluate responses to various grind sizes

The exact suite of parameters to be monitored will depend upon the outcome of the planning stage. The primary parameter to observe is the response of biological organisms. The response of benthic organisms is relatively straightforward to monitor through standard techniques. More difficult, but ultimately more interesting, is the potential response by larger, mobile organisms, including crabs and fishes. It is the intention of the study to see whether commercially harvestable species are increased by the dispersal of fresh seafood wastes of different sizes. We will work with the Native Village of Eyak and other interested parties to design collaborative research that will address these concerns. We would anticipate a monitoring program for gulls that will be set in an experimental context that takes into account both seasonal impacts and substantial changes in the current discharge magnitude. Investigations of fish and crabs will probably use a combination of underwater camera observations, diving observations, acoustical techniques and possibly pot sampling.

Objective 10 (years 2,3)-Evaluate benefits of pile remediation

A pile remediation study will be conducted to see the rate of additional consumption and degradation of the pile by the introduction of oxygenated water. The experimental procedure is to drag an apparatus that resembles a spring tooth drag across selected seafood waste piles. The experimental design is to compare the characteristics of the experimental piles with control piles that are not dragged. Parameters to be evaluated include presence of internal crusts, gas release, pile area and volume.

Objective 11 (years 2,3)- Evaluate impacts of reduced waste discharge on current site

Both operational (seasonal) changes in discharge amounts and diversion to barging should produce substantial changes in discharge amounts over extended periods that can be monitored for rates of change. The same monitoring techniques will be used for this objective as for objective 9.

C. Data Analysis and Statistical Methods

In most cases, detailed procedures will arise from the planning stage. A wide range of expertise is available among the interested parties. In most cases, such as water quality and benthic samples, the techniques are standard. For statistical approaches we will explore a variety of univariate and multivariate methods. Funds are included in the budget for a statistical consultant.

D. Description of Study Area

Orca Inlet is located on the eastern side of PWS, with the city of Cordova on the eastern shore. Four canneries operate in Cordova and discharge waste under National Pollutant Discharge Elimination System (NPDES) permits. Twenty sites associated with the discharge have been historically sampled. Nine sites run parallel to the shore starting at the end of the breakwater and running just beyond the Cannery Row dock. Four sites run perpendicular to the shore starting at the Cannery Row dock. Three sites run

perpendicular to the shore starting at the North Pacific Processors facility, and three sites were control stations located 1.75 km from the area of the outfall.

E. Coordination and Collaboration with Other Efforts

The proposed study is a joint endeavor by several organizations and is the result of a long history of concern with this issue. In 1993-94, the Prince William Sound Science Center prepared and submitted a proposal for Saltonstall-Kennedy funds that was directed toward the seafood waste discharge problem. The proposal garnered substantial and widespread support among processors and the Cordova community. However, it was not able to gain permitting for a major provision of the proposal, an evaluation of whole carcass disposal. Subsequently, in 1999, PWSSC and the Native Village of Eyak cooperated on a small study, funded by U.S. EPA, to look at specific characteristics of the present waste discharge system (Williams et al. 1999). That study substantiated community concerns over the deleterious impacts of the present system including the presence of *Capitella sp* polychaete worms, a well-documented index of environmental stress.

More recently, DEC has initiated studies of seafood waste grind size and waste pile remediation in Ketchikan. The Ketchikan study independently incorporates some elements of the original PWSSC proposal for Cordova. This study will bring together the PWSSC and associated collaborators in the Cordova effort with the DEC investigators conducting the Ketchikan experiment. The Prince William Sound Science Center is acting as the lead entity and facilitator because of its location and experience with this issue. The Alaska Department of Environmental Conservation (DEC) is a major participant because of its expertise and interest in the waste disposal issue. The lead investigator for DEC is Kenwyn George. Cordova city processors (lead contact Ken Roemhildt of North Pacific Processors) will contribute substantially in the proposal. Similarly, Steve Moffit of ADF&G, Cordova, has expressed the interest of ADF&G in the effort. We have made initial contacts with the Native Village of Eyak (Kate Williams and Altana Olson) and know of their keen historical interest in this issue. The City of

Cordova, Mayor Tim Joyce, is also interested because of the importance of the issue to the City. The study will also interface closely with that of Mary Anne Bishop & Sean Powers, a GEM study on Trophic Dynamics in Soft-Sediment Communities. Nearby Hartney Bay is one of their study sites, and there are considerable data on the nearshore benthic community.

Additional critical collaborations will need to take place with other GEM researchers in the nearshore environment to establish sampling protocols and for further advice on site selection. For example, we would hope to consult with Brenda Konar, who is a current principle researcher on the GEM nearshore effort (030687) and also provided advice for the DEC effort in Ketchikan.

III. SCHEDULE

A. Project Milestones

Objective 1. Explore options for grind size

To be met by June 04

Objective 2. Explore options for experimental design

To be met by June 04

Objective 3. Seek further collaboration

To be met by March 04

Objective 4. Select sites for experiments

To be met by July 04

Objective 5. Evaluate techniques

To be met by July 04

Objective 6. Further document characteristics of the present discharge system

To be met by Sept 04

Objective 7. Collect baseline and background data

To be met by Sept 04

Objective 8. Finalize the experimental design

To be met by Sept 04

Objective 9. Evaluate responses to various grind sizes

To be met by Sept 06

Objective 10. Evaluate benefits of pile remediation

To be met by Sept 06

Objective 11. Evaluate impacts of reduced or zero waste discharge on current site.

To be met by Sept 06

B. Measurable Project Tasks

FY 04, 1st quarter (Oct 1-Dec 31, 2003)

Project approval, make contact with all potential participants, initiate baseline studies

FY 04, 2nd quarter (Jan 1-Mar 31, 2004)

Annual Gem Workshop, Workshop in Cordova, complete objective 3

FY04, 3rd quarter (Apr 1-June 30, 2004)

Complete objectives 1 and 2

FY 04, 4th quarter (Jul 1-Sep 30, 2004)

Complete objectives 4-8, complete annual report

FY05, 1st quarter (Oct 1-Dec 31, 2004)

Second year approval, initiate experiment

FY05, 2nd quarter (Jan 1-Mar 31, 2005)

Annual GEM Workshop

FY05, 3rd quarter (Apr 1-June 30, 2005)

Workshop to discuss status of experiment (Cordova)

FY05, 4th quarter (Jul 1-Sep 30, 2005)

Complete first year of experimental design, complete annual report

FY06, 1st quarter (Oct 1-Dec 31, 2005)

Third year approval

FY06, 2nd quarter (Jan 1-Mar 31, 2006)

Annual GEM workshop

FY06, 3rd quarter (Apr 1-June 30, 2006)

Complete data collection

FY06, 4th quarter (Jul 1-Sep 30, 2006)

Complete final report

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

This study has strong involvement with the community. The Cordova community, including seafood processors, has strongly supported the need for this research in the past, and has indicated strong support for this project. The Native Village of Eyak is very concerned with the impact of seafood waste discharge and has participated with PWSSC on previous research on waste discharge impacts in Cordova.

B. Resource Management Applications

One of the goals of GEM is to the development of tools, technologies and information that can help resource managers and regulators to improve management of marine resources and address problems that may arise from human activities. This proposal seeks to determine impacts of human activities and to evaluate alternative waste discharge strategies that can minimize or even enhance natural production. These studies will provide valuable information not only for Cordova and Prince William Sound, but also for processors and communities statewide, as well as regulatory agencies.

V. PUBLICATIONS AND REPORTS

We anticipate peer-reviewed journal products from this study, but specific funds for that purpose are not included in the proposal request.

VI. PROFESSIONAL CONFERENCES

Funds are requested only for annual participation in GEM workshops. Funds are also requested for two workshops in Cordova to specifically address this research.

REFERENCES

Agler, B.A., S.J. Kendall, D.B. Irons and S.P. Klowiewski 1994. Declines in marine bird populations in Prince William Sound, Alaska, coincident with a climatic regime shift. Waterbirds 22:980103.

Anderlini, V.C. and R.G. Wear. 1992. The effect of sewage and natural disturbances on benthic macrofaunal commuknities in Fitzroy Bay, Wellington, New Zealand. Marine Pollution Bull. 24:21-26.

Bakus, G.J. 1978. Benthic ecology in the Gulf of Alaska. Energy/Environment '78. Society of Petroleum Industry Biologists, Los Angeles, CA 169-192.

Caponigro, M.A. 1979. Benthic macrofauna, sediment and water quality near seafood cannery outfalls in Keni and Cordova, Alaska. Final Report to USEPA, SCS Engineers, Long Beach California.

Dean, T.A., S.C. Jewett, D.R. Laur and R.O. Smith. 1996. Injury to epibenthic invertebrates resulting from the *Exxon Va*ldez oil spill. American Fisheries Society Symposium 18:424-439.

Driskell, W.B., A.K. Fukuyama, J.P. Houghton, D.C. Lees, A.J. Mearns and G. Shigenaka. 1996. Recovery of Prince William Sound intertidal infauna from *Exxon Valdez* oiling and shoreline treatments, 1989 through 1992. American Fisheries Society Symposium 18:362-378.

Estes, J.A. and J. F. Palmisano. 1974. Sea otters: their role in structuring nearshore ocmmunities. Science 185:1058-1060.

Feder, H.M. and A. Blanchard. 1998. The deep benthos of Prince William Sound, Alaska, 16 months after the *Exxon Valdez* oil spill,. Marine Pollution Bull. 36:118-130.

Highsmith, R.C., M.S. Stekoll, W.E. Barber, L. Deysher, L. McDonald, D. Strickland and W.P. Erickson. 1994. Comprehensive assessment of coastal habitat, *Exxon Va*ldez oil spill state/federal natural resource damage assessment final report. Fairbanks, School of Fisheries and ocean Science, University of Alaska, Fairbanks Coastal Habitat Study Number 1A.

Jones, G.P. and U.L. Kaly. 1996. Criteria for selecting marine organisms in biomonitoring studies. Pp 29-48 *In* R.J. Schmitt and C.W. Osenberg (eds) Detecting Ecological Impacts: Concepts and Applications in Coastal Habitats, Academic Press.

Kvitek, R.G., J.S. Oliver, A.R. DeGrange and B.S. Anderson. 1992. Changes in Alaskan soft-bottom prey communities along a gradient in sea otter predation. Ecology 73:413-428.

Lambshead, P.J.D., H.M. Platt and K.M. Shaw. 1983. The detection of differences among assemblages of marine benthic species based on an assessment of dominance and diversity. J. Natural History 17:859-874.

Page, D.S., E.S. Gilfillan, P.D. Boehm and E.J. Horner. 1995. Shoreline ecology program for Prince William Sound Alaska, following the *Exxon Valdez* oil spill: Part 1- study design and methods. Pp 263-295 in Wells, P.G., J.N. Butler and J.S. Hughes (eds) *Exxon Valdez* oil spill: fate and effects in Alaskan waters. American Society for Testing and Materials, Philadelphia.

Paine, R.T. 1966. Food web complexity and species diversity. American Naturalist 100:65-75.

Paine, R.T., J.L. Ruesink, A. Sun, E.L. Soulanille, M.J. Wonham, C.D.G. Harley, D.R. Brumbaugh and D.L. Secord. 1996. Trouble on oiled waters: lessons from the *Exxon Valdez* oil spill. Annual Review of Ecology and Systematics 27:197-235.

Pearson, T.H. 1987. Benthic ecology in an accumulating sludge-disposal site. Pp. 195-200 In J. Capuzzo and D. Kester (eds) Biological Processes and Wastes in the Ocean. E.E. Krieger, Malabar, Florida.

Pearson, T.H. and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. Ann. Rev. 6:229-311.

Peterson, C.H. 1991. Intertidal zonation of marine invertebrates in sand and mud. American Scientist 79:236-249.

Peterson, C.H. 2001. The *Exxon Valdez* oil spill in Alaska: acute, indirect and chronic effects on the ecosystem. Advances in Marine Biology 39:1-103.

Piatt, J.F. and P.Anderson 1996. Response of common murres to the EXXON VALDEZ oil spill and long-term changes in the Gulf of Alaska marine ecosystem. Pp 720-737 in Proc. of the EXXON VALDEZ oil spill symposium, S.D. Rice, R.B. Spies, D.A. Wolfe and B.A. Wright (eds). American Fisheries Society Symposium 18, Anchorage AK.

Rafaelli D. and S. Hawkins. 1996. Intertidal ecology. Chapman and Hall, London

Rhoads, D.C. and D.K. Young. 1970. The influence of deposit-feeding organisms on sediment stability and community trophic structure. Journal of Marine Research 28: 150-178.

Ritz, D.A., M.E. Lewis and M. Shen. 1989. Response to organic enrichment of infaunal macrobenthic communities under salmonid seacages. Marine Biology 103:211-214.

Schoch, G.C., G.L. Eckert and T.A. Dean 2002. Long-term monitoring in the nearshore: designing studies to detect change and assess cause.

Sundberg, K., L. Deysher and L. McDonald. 1996. Intertidal and supratidal site selection using a geographic information system. American Fisheries Society Symposium 18: 167-176.

Warwick. R.M. 1988. The level of taxonomic discrimination required to detect pollution effects on marine benthic communities. Marine Pollution Bull. 19:259-268.

Williams, K., J. Williams and A. Blanchard. 1999. Pollution concerns of fish waste in Orca Inlet, Prince William Sound, Alaska. Final Report to USEPA, Native Village of Eyak, Cordova, AK.

Wootton, J.T. 1994. The nature and consequences of indirect effects on ecological communities. Annual Review of Ecology and Systematics 25:443-466.

RESUME

Richard E. Thorne, Ph.D.
P.O. Box 705, Cordova, Alaska 99574
(907) 424 -5800 (work), -5820 (fax)
thorne@pwssc.gen.ak.us

Employment History

Prince William Sound Science Center	Director of Research 2002 Senior Scientist 2000-present
BioSonics, Inc. 4027 Leary Way NW Seattle, WA 98107 (206) 782-2211	Vice President 1996-1999 Manager Technical Services 1991-1999 Senior Scientist 1988-1999
University of Washington School of Fisheries Fisheries Research Institute Seattle, WA	Affiliate Research Professor 1991-2001 Research Professor 1981-1990 (LOA 1988-1990) Research Associate Professor 1976-1981 Senior Research Associate 1970-1976
Commercial Fisher (salmon and albacore)	1957-1968

Academic Background

Ph.D., Fisheries-1970, University of Washington, School of Fisheries
MS Degree-1968, University of Washington, Department of Oceanography
B.S. Degree-1965, University of Washington, Department of Oceanography

Selected Publications

Thomas, G.L. and R.E. Thorne 2003. Acoustical-optical assessment of Pacific herring and their predator assemblage in Prince William Sound, Alaska. Aquatic Living Resources (in press).

Thorne, R.E. 2003. Factors Governing Pink Salmon Survival in Prince William Sound, Alaska. Proceedings 21st Pink and Chum Salmon Workshop, Victoria B.C., Can. Spec. Pub. (in press).

Thomas, G.L, J. Kirsch and R.E. Thorne 2002. Ex situ target strength measurements of Pacific herring and Pacific sand lance, North American Journal of Fisheries Management 22:1136-1145.

Thomas, G.L. and R.E. Thorne 2001. Night-time Predation by Steller Sea Lions. Nature **411**:1013.

Thorne, R.E. and G.L. Thomas 2001. Monitoring the juvenile pink salmon food supply and predators in Prince William Sound. Pages 42-44, *in* R. Beamish, Y. Ishida,

V. Karpenko, P. Livingston and K. Myers, Workshop on factors affecting production of juvenile salmon: comparative studies on juvenile salmon ecology between the East and west North Pacific Ocean, Technical Report 2, North Pacific Anadromous Fish Commission, Vancouver, B.C.

McClatchie, S., R. Thorne, P. Grimes and S. Hanchet 2000. Ground truth and target identification for fisheries acoustics. Fisheries Research 47:173-191.

Thorne, R.E. 1998. Review: experiences with shallow water acoustics. Fish. Res.35:137-141,
Elsevier Science, Amsterdam

Tarbox, K.E. and R.E. Thorne, 1996. Assessment of adult salmon in near-surface waters of Cook Inlet, Alaska. ICES Journal of Marine Science 53:397-401.

Thorne, R.E. 1983. Hydroacoustics. Chapt. 12 in L. Nielson and D. Johnson (eds)., Fisheries
Techniques. American Fisheries Society, Bethesda, MD

Mathisen, O.A., R.E. Thorne, R. Trumble and M.Blackburn 1978. Food consumption of pelagic fish in an upwelling area. Pp. 111-123 in R. Boje and M. Tomczak (eds) Upwelling Ecosystems. Springer-Verlag.

Recent Collaborations:

Foster, M.B.	Alaska Department of Fish and Game, Kodiak, Alaska
Kirsch, J.	Prince William Sound Science Center (currently independent)
McClatchie, S.	New Zealand Department of Fisheries
Thomas, G.L.	Prince William Sound Science Center (currently, University of Miami)

MARY ANNE BISHOP, Ph.D.

Prince William Sound Science Center
P.O. Box 705
Cordova, Alaska 99574

Phone: 907-424-5800 ext. 228
Fax: 907-424-5820
Email: mbishop@pwssc.gen.ak.us

Education

Ph.D. Wildlife Ecology, Department of Wildlife & Range Sciences, University of Florida, Gainesville, 1988.
M.S. Wildlife & Fisheries Sciences, Department of Wildlife and Fisheries Sciences, Texas A & M University, College Station, 1984.
B.B.A. School of Business, University of Wisconsin-Madison, 1974.

Professional Experience

6/99-present Research Ecologist, Prince William Sound Science Center, Cordova, Alaska.
11/88-present Research Associate & Principal Investigator for Tibet Black-necked Crane Study, Intl. Crane Foundation, Baraboo, Wisconsin (location: Tibet, PR China).
3/97-5/99& 4/90-4/94 Research Wildlife Biologist, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska
4/94-3/97 Research Wildlife Biologist, Dept. Fisheries and Center Streamside Studies, Univ. Washington assigned to Copper River Delta Institute, US Forest Service
5/92-4/93 Acting Manager, Copper River Delta Institute, Pacific Northwest Research Station, U.S. Forest Service, Cordova, Alaska.
7/89-4/90 Wildlife Biologist, Forestry and Range Sciences Laboratory, Pacific Northwest Research Station, U.S. Forest Service, LaGrande, Oregon.
9/88-6/89 Biological Technician, Malacology Lab, Florida Museum of Natural History, Gainesville, Florida.
8/83-8/88 Project Biologist, Department of Wildlife and Range Sciences, University of Florida, Gainesville.

Awards

U.S. Forest Service National *Taking Wing* Awards:
- 2001 Capacity Building Category
- 1999 Public Awareness & Community Involvement Category
- 1997 Research Investigations Category
- 1993 Research Investigations Category

Tibet Autonomous Region, PR China:
- 1994 *Development of Science and Technology in Tibet* Award (2nd Place)

Wildlife Conservation Society: 1993 Research Fellow

The Wildlife Society
- 1992 Monograph Publication Award for "A conservation strategy for the Northern Spotted Owl," Interagency Scientific Committee (Team Member).
- 1991 Group Achievement Award for Participation as Team Member in Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl

Team Memberships

United States Shorebird Conservation Plan, Research and Monitoring Working Group (since 1998)
Scientific Advisory Board, Western Hemisphere Shorebird Reserve Network (since 1998)
Crane Specialist Group, IUCN Species Survival Commission (since 1995)
Platte River Whooping Crane Maintenance Trust, Science Review Panel (since 1999)
Copper River Watershed Project, Board of Directors (since 1998)

Five Most Relevant Publications

Powers, S.P., **M.A. Bishop**, and J.H. Grabowski. in review. *Biotic and abiotic limitations of an invasive bivalve, Mya arenaria: growth and distribution on the Copper River Delta Alaska.* Canadian Journal Fisheries & Aquatic Sciences.

Powers, S.P., **M.A. Bishop**, J.H. Grabowski, and C.H. Peterson. 2002. *Intertidal benthic resources of the Copper River Delta, Alaska, USA.* Journal Sea Research. 47: 13-23.

Bishop, M.A. and S.P. Green. 2001. *Predation on Pacific herring (Clupea pallasi) spawn by birds in Prince William Sound, Alaska.* Fisheries Oceanography 10(1):149-158.

Bishop, M.A., P. Meyers, and P.F. McNeley. 2000. *A method to estimate shorebird numbers on the Copper River Delta, Alaska.* Journal Field Ornithology 71(4): 627-637.

Bishop, M.A. and N. Warnock. 1998. *Migration of Western Sandpipers: links between their Alaskan stopover areas and breeding grounds.* Wilson Bulletin 110(4): 457-462.

Other Publications

Bishop, M.A., N. Warnock, and J. Takekawa. In review. *Differential spring migration of male and female Western Sandpipers at interior and coastal stopover sites.* Ardea.

Bishop, M.A., and Fengshan Li. 2002. *Effects of farming practices in Tibet on wintering Black-necked Crane (Grus nigricollis) diet and food availability.* Biodiversity Science 10:393-398 (in Chinese).

Bishop, M.A. 2002. *Great possessions: Leopold's good oak.* Pages 72-87 *in* R.L. Knight and S. Reidel, eds. Aldo Leopold and the Ecological Conscience. Oxford University Press, New York.

Warnock, N. and **M.A. Bishop**. 1998. *Spring stopover ecology of migrant Western Sandpipers.* Condor 100(3): 456-467.

Publications in Preparation

Bishop, M.A. and S.P. Powers. in prep. *The relationship between migrant shorebirds and invertebrate densities on intertidal areas of the Copper River Delta.* Journal Field Ornithology.

Professional Collaboration (in addition to Powers & Peterson)

Clesceri, Erica J., University of North Carolina, Chapel Hill, NC
Grabowski, John, University of Maine.
Li, Fengshan. International Crane Foundation, Baraboo, Wisconsin.
Reeves, Gordon. Pacific Northwest Research Station, US Forest Service & Oregon State Univ.
Takekawa, John T., US Geological Survey- Biological Research Division, San Francisco CA
Tsamchu, Drolma. Tibet Plateau Institute of Biology, Lhasa, Tibet, PR China
Warnock, Nils. Pt. Reyes Bird Observatory, Pt. Reyes, CA
Yangzom, Drolma. Dept. of Forestry, Tibet Autonomous Region, Lhasa, Tibet, PR China

RESUME

Kenwyn P. George, P.E.
Environmental Engineer
Alaska Department of Environmental Conservation
Air & Water Quality Section
410, Willoughby Ave., Suite 303, Juneau, AK 99801
(907) 465-5313,FAX -5274

Employment History

State of Alaska	Environmental Engineer 1992 - 2002
Echo Bay Mines	Exploratory analysis technician 1990-92
URS Consultants	Civil Engineer 1984-1990
City of Toledo, Oregon	Site engineer 1982-1984

Academic Background

BS Civil Engineering, Brighton Polytechnic, England, 1971

Environmental projects

Waste Pile remediation. Project Manager on a pile reduction/scarifying project in Ketchikan, 2001, with continued studies projected for 2003.

Waste particle size study. Project manager on a study in Ketchikan in 2003 to review the effect and fate of three different seafood waste grind sizes.

Mixing zone size. Project manager for a 2003 study in Ketchikan to determine impacts on the water column from seafood processor discharges, and the determination of an appropriate mixing zone size.

Zone of Deposit impacts study. Project manager for a study in 2003 in Ketchikan using Sediment Profile Imaging to determine the extent and magnitude of impacts on the sea floor from large seafood deposits.

Seafood byproducts study. Participant in a survey and report of the economics of byproduct manufacture in Alaska, and of world markets.

Cruise ship waste water discharges. Member of a Science Advisory Panel providing scientific analysis of cruise ship black and gray water.

Mixing Zone determinations. State modeler for waste water discharge mixing zones to rivers or the ocean using EPA PLUMES and CORMIX models.

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

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06	TOTAL PROPOSED
Personnel	$13,350.0	$21,115.0	$21,749.0	$56,214.0
Travel	$6,120.0	$6,120.0	$3,000.0	$15,240.0
Contractual	$32,450.0	$51,950.0	$51,950.0	$136,350.0
Commodities	$1,000.0	$1,500.0	$2,000.0	$4,500.0
Equipment	$0.0	$0.0	$0.0	$0.0
Subtotal	$52,920.0	$80,685.0	$78,699.0	$212,304.0
Indirect (rate will vary by proposer)	$13,759.0	$21,785.0	$21,249.0	$56,793.0
Project Total	$66,679.0	$102,470.0	$99,948.0	$269,097.0
Trustee Agency GA (9% of Project Total)	$6,001.1	$9,222.3	$8,995.3	$24,218.7
Total Cost	$72,680.1	$111,692.3	$108,943.3	$293,315.7

Cost-share Funds**:** 0.5 mos salary of Richard Thorne and in kind services from Cordova Seafood Processors (diving and barging operations). Estimated value, FY 04 = $15,000, FY 05 and 06 = $20,000 per year.

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

FY 04-06

Date Prepared: 13-Jun-03

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer: Prince William Sound Science Center

FORM 4A NON-TRUSTEE SUMMARY

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

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
Mary Anne Bishop	Scientist		0.5	7300.0		3,650.0
Shelton Gay	Oceanographer		1.0	6200.0		6,200.0
Other (TBA)	Staff		1.0	3500.0		3,500.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	2.5	17000.0	0.0	
					Personnel Total	$13,350.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
GEM Workshop (three persons)	300.0	3	12	175.0	3,000.0
Cordova Workshop (three persons)	400.0	3	12	160.0	3,120.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6,120.0

FY 04

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer: Prince William Sound Science Center

FORM 4B
Personnel & Travel DETAIL

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

Contractual Costs:	Contract Sum
Description	
Alaska Department of Environmental Conservation	8,450.0
Boat Charters	6,000.0
Dive Contractor	6,000.0
Other (ADF&G, Native Villiage of Eyak, Statistical)	12,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$32,450.0

Commodities Costs:	Commodity Sum
Description	
Misc	1,000.0
Commodities Total	$1,000.0

FY 04

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Name: Prince William Sound Science Center

FORM 4B
Contractual & Commodities
DETAIL

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

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

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 04

Project Number:
Project Title:Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer:Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

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

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
Mary Anne Bishop	Scientist		1.0	7519.0		7,519.0
Shelton Gay	Oceanographer		1.0	6386.0		6,386.0
Other (TBA)	Staff		2.0	3605.0		7,210.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	4.0	17510.0	0.0	
					Personnel Total	$21,115.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
GEM Workshop (three persons)	300.0	3	12	175.0	3,000.0
Cordova Workshop (three persons)	400.0	3	12	160.0	3,120.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6,120.0

FY 05

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer: Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contract Sum
Description	
Alaska Department of Environmental Conservation	14,350.0
Boat Charters	12,600.0
Dive Contractor	12,000.0
Other (ADF&G, Native Village of Eyak, Statistical)	13,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$51,950.0

Commodities Costs:	Commodity Sum
Description	
Misc	1,500.0
Commodities Total	$1,500.0

FY 05

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer: Prince William Sound Science Center

FORM 4B
Contractual & Commodities
DETAIL

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

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

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 05

Project Number:
Project Title:Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer:Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

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

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
Mary Anne Bishop	Scientist		1.0	7745.0		7,745.0
Shelton Gay	Oceanographer		1.0	6578.0		6,578.0
Other (TBA)	Staff		2.0	3713.0		7,426.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	4.0	18036.0	0.0	
					Personnel Total	$21,749.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
GEM Workshop (three persons)	300.0	3	12	175.0	3,000.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3,000.0

FY 06

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer: Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contract Sum
Description	
Alaska Department of Environmental Conservation	14,350.0
Boat Charters	12,600.0
Dive Contractor	12,000.0
Other	13,000.0
Contractual Total	$51,950.0

Commodities Costs:	Commodity Sum
Description	
Misc	2,000.0
Commodities Total	$2,000.0

FY 06

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer:Prince William Sound Science Center

FORM 4B
Contractual & Commodities DETAIL

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

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

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 06

Project Number:
Project Title: Impacts of Seafood Waste Discharge in Orca Inlet, PWS
Proposer:Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

Budget Justification:

Salaries-Salary requests from the PWSSC are 2.5 mos in FY04 to cover participation in planning, workshops and baseline data acquisition. Salary requests in FY05 and FY06 are 4.0 mos/year to participate in field work. One-half month is donated by Co-P.I. Richard Thorne each year.

Consultants-Several other agencies and institutions will participate as collaborators. DEC has requested $8,450 in FY04 and $14,350 each year for FY05 and FY06 to cover planning and some baseline work in FY04 and participate in the experiment in FY05 and FY06. Funds of $12,000 in FY04 and $13,000 in FY05 and FY06 are requested to cover participation of ADF&G, the Native Village of Eyak and a statistical consultant in the planning effort of FY04 and the field work of FY05 and FY06. Additional subcontracts are requested for boat charters ($6,000 in FY04 and $12,600 each in FY05 and FY06) and dive operations ($6,000 in FY04 and $12,000 each in FY05 and FY06). An amount of $35,000 will be provided in in-kind services by the Cordova seafood processors, including dive operations and barging costs.

Travel-$3,000 per year is requested for participation of three persons in annual GEM workshops. $3,120 is requested to support workshops in Cordova each of the first two years. The funds will be used to bring in expertise from outside Cordova.

Supplies-Supply costs are budgeted as $1000 for FY04, $1500 for FY05 and $2000 in FY06. Supply costs in FY04 will support the planning, a workshop and baseline measurements. Supply costs in FY05 will support a workshop and field efforts. Supply costs in FU06 will support field efforts and reporting.

Indirect Costs-Indirect costs are applied as per federally established rates for the Prince William Sound Science Center.