SIGNATURE FORM

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

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

PROJECT TITLE: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the Exxon Valdez Oil Spill

Printed Name of PI: Lucinda Jacobs, Ph.D.

Signature of PI:  Date 09/14/05

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Signature of co-PI: _____ Date _____

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

PROPOSAL SUMMARY PAGE

Trustee Council Use Only
Project No: **060783**
Date Received: _____

PROPOSAL SUMMARY PAGE
(To be filled in by proposer)

Project Title:	Information Synthesis and Recovery Recommendations for Resources and Services Injured by the Exxon Valdez Oil Spill
Project Period:	October 1, 2005 through July 1, 2006 (FY06)
Proposer(s):	Lucinda Jacobs, Les Williams, Rob Pastorok, and Damian Preziosi
Study Location:	Prince William Sound

Abstract: The periodic reassessment of the resources and services injured by the *Exxon Valdez* oil spill (EVOS) is essential to understanding effects of the original spill and lingering oil, documenting recovery of resources, and identifying new areas where additional restoration action or research may be needed. The proposed work is designed to synthesize restoration work performed to date; develop a scientifically sound process for objectively assessing the status of resources and services classified as injured, recovering, or unknown; distinguish (where possible) the contribution of other stressors to the condition of the resource; identify appropriate restoration actions for resources that are not recovering; and definitively identify resources that are unlikely to be suffering any residual injury from the 1989 spill. This proposal addresses all resources and services currently classified as Not Recovered, Recovering, or Recovery Unknown.

Funding:

EVOS Funding Requested: FY 06 518,635.28

(must include 9%GA) GA 46,677.18

TOTAL $565,312.46

Non-EVOS Funds to be Used: FY 06 $ None

TOTAL: $565,312.46

Date: April 13, 2005; revised September 14, 2005

PROJECT PLAN

I. Need for Project

A. Statement of Problem

The periodic reassessment of the resources and services injured by the *Exxon Valdez* oil spill (EVOS) is essential to understanding effects of the original spill and lingering oil, documenting recovery of resources, and identifying new areas where additional restoration action or research may be needed. Communication to the Trustee Council and the public is a major part of this reassessment. Evaluation of the recovery status of injured resources has posed a challenge to scientists since 1994, when the Trustee Council first adopted an official list of injured species. As acknowledged in the original 1994 Restoration Plan and subsequent updates in 1999 and 2002 (Trustee Council 1999, 2002), objective evaluation of resource recovery is complicated by uncertainties in population estimates, lack of pre-spill data, interaction of spill and natural factors, and the potential emergence of new and previously unidentified effects.

The proposed work is designed to synthesize restoration work performed to date; develop a scientifically sound process for objectively assessing the status of resources classified as injured, recovering, or unknown; distinguish (where possible) the contribution of other stressors to the condition of the resource; identify appropriate restoration actions for resources that are not recovering; and definitively identify resources that are unlikely to be suffering any residual injury from the 1989 spill.

Unique challenges associated with this project include:

- Focused engagement of individuals and entities that possess pertinent expertise in specific resource species and EVOS research
- Efficient prioritization, review, management, and synthesis of the large body of information related to currently unrecovered resources and services in Prince William Sound (PWS) and other affected areas that has been generated over the past 16 years
- Effective integration of related work, minimizing redundancy with ongoing studies (Jacobs *et al.* 2005, and Spies 2005)
- Refinement of recovery objectives to ensure that the condition of the resources and services is objectively evaluated using practical assessment criteria
- Development and application of a decision framework to systematically and objectively evaluate the status of injured resources.

Our proposed approach to each of these challenges is presented under the objectives and the procedural and scientific methods descriptions provided in Section II, Project Design.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

The project will 1) fully evaluate the status of unrecovered[1] resources and services identified in the 1994 *Exxon Valdez* Restoration Plan, and 2) identify options for achieving recovery and/or potential additional restoration projects. In reviewing the iterative development and evolution of the restoration plan goals and scientific priorities described in the 1994 Restoration Plan and updates, several things are clear:

- Periodic updates to the Restoration Plan have not included a comprehensive assessment and ongoing synthesis of previous restoration activities.
- The restoration strategies implemented for the different injured resources are no longer explicitly identified in the restoration updates. This is of concern because the specific link between injury and restoration action has been diminished or lost.
- Resource-specific recovery objectives have evolved, but some remain broad and are difficult to assess. Therefore, it is important to refine recovery objectives to accommodate new scientific information and incorporate meaningful and practical recovery metrics.
- The absence of a systematic and objective method for evaluating the status of injured resources has made it difficult to come to closure on several resources and related services.

In addition, Trust-funded projects supporting evaluations of resource recovery have transitioned over the past several years towards efforts and projects that address the broader stewardship principals embodied in the Gulf Ecosystem Monitoring Study (GEMS) program.

The proposed project will address these issues by first reassessing recovery objectives to ensure that they are practical, that they clearly identify measurable variables for assessing recovery, and that they are consistent with the broader goal of achieving a self-sustaining and productive ecosystem. In consultation with a team of experts, a decision framework will be developed to objectively and systematically evaluate the recovery status of injured resources and services. Restoration studies and related information will then be reviewed and synthesized to ensure that all relevant information has been considered in the reassessment. Scientists with expertise in key resources and issues both within and outside Trustee agencies will be accessed to more efficiently prioritize, compile and synthesize information; to review and refine the recovery objectives and decision framework developed by the project team; and to participate in resource-specific evaluations.

An important part of the assessment will be to clearly establish the link between specific resources/services and the restoration strategy. This effort will include both the careful documentation of past restoration strategies for injured resources and a clear statement of the path forward for resources that may not have recovered. This work effort will be grounded in the 1994 Restoration Plan, which describes the goal of restoration as recovery of all resources and services injured by the Exxon Valdez oil spill, and states that all restoration actions must be directed toward this goal.

[1] Unrecovered includes recovering, not recovered, and recovery unknown categories.

This general framework laid out in the 1994 Plan will be incorporated into the evaluation and synthesis of the recovery status of resources as described below in Section II (Project Design).

II. Project Design

A. Objectives

The goals of the Synthesis Project are to 1) fully assess the status of unrecoverd resources and services identified in the 1994 *Exxon Valdez* Restoration Plan and 2) identify options for reaching recovery and/or potential additional restoration projects. These goals will be achieved through the systematic realization of the following objectives:

- Objective 1 (Task 1, below)—Identify scientists with appropriate experience and expertise who can facilitate a synthesis and evaluation of major issues associated with resource injury status, recovery objectives, and restoration strategies
- Objective 2 (Task 2)—Assess 2002 recovery objectives and develop refinements to improve their functionality in a practical decision framework
- Objective 3 (Task 3)—Develop a decision framework to objectively and systematically evaluate the recovery status of unrecoverd resource populations
- Objective 4 (Task 4)—Compile and synthesize research and information relevant to resource injury classification and recovery status that can be used effectively in the decision framework
- Objective 5 (Task 5)—Characterize the recovery condition of each evaluated resource and recommend restoration activities as needed.

B. Procedural and Scientific Methods

B.1—Task 1: Establish Technical Panel and Workgroup and Conduct Meetings

Technical workgroups are proposed as the forum for the focused engagement of individuals and entities that posses pertinent expertise in specific species and EVOS research. Two types of workgroups are proposed:

- Technical Review Panel
- Resource/Services Workgroup

It will be important to maintain the focus of the Technical Review Panel and Resource/Services Workgroup to meet the deadline for the April 1, 2006 draft report. The Integral team will draft decision frameworks, propose refinements to recovery objectives, and prepare the draft and final technical reports. The Technical Review Panel will provide key input on evaluation criteria and the decision process. The Resource/Services Workgroup will provide focused expertise on unrecovered resources and services, potential restoration options, the importance of oil and other stressors, and key issues and technical resources that are relevant to the evaluations.

The following sections provide additional information on participants in the technical review panel, participants in the resource/services workgroup, and projected meeting dates.

B.1.1 Technical Review Panel

It is proposed that the Technical Review Panel be comprised of the following individuals:

- Lucinda Jacobs (Integral), meeting facilitator
- Robert Spies, Les Williams, Robert Pastorok (Integral team technical experts)
- Jeff Short; National Oceanic and Atmospheric Administration (NOAA)
- Dan Rosenberg; Alaska Department of Fish and Game (ADFG)
- Jim Bodkin; U.S. Geologic Survey (USGS)
- Al Springer, University of Alaska.

This group will participate in the refinement of the technical approach proposed here, with focus on recovery objectives, the decision framework, and the final recommendations to the Steering Committee. All members of the technical review panel have agreed to serve on the Technical Review Panel. The budget for their participation is described in Section II.

B.1.2 Resource/Services Workgroup

The Resources/Services Workgroup is comprised of resource agency scientists and outside experts[2] who have conducted research on or who otherwise possess pertinent expertise in specific species and EVOS research. The following individuals have been asked to participate in the Resource/Services Workgroup:[3]

- Seabirds and Seaducks
    - Dan Rosenberg, ADF&G (also on Technical Review Panel)
    - Dan Esler, Simon Frasier University (SFU)
    - David Irons, US Fish and Wildlife
    - Al Springer, U AK (also on Technical Review Panel)
- Sea Mammals
    - Jim Bodkin, USGS (also on Technical Review Panel)
    - Brenda Ballachey, USGS
    - Jim Harvey, Moss Landing Marine Laboratory
    - Bob Small, ADF&G
    - Craig Matkin, North Gulf Oceanic Society
- Fish
    - Stanley Rice, NOAA
    - Kelly Hepler, ADF&G
    - Robert Pastorok, Integral
- Intertidal and Shallow Subtidal Communities
    - Robert Spies, Applied Marine Sciences (AMS)
    - Les Williams, Integral
- Biomarkers
    - Brenda Ballachey, USGS

[2] Experts would have expertise in Marine mammals; Fish; Birds; Ecosystems, Benthic resources; Services; and Fate and transport of *Exxon Valdez* oil (EVO).

[3] All have agreed to participate except Kelley Hepler and Jim Harvey, who have not yet responded.

    - Jim Bodkin, USGS
    - Dan Esler, SFU
- Ecosystems Connectivity
    - Al Springer, U AK
    - Jim Harvey, UCSC
    - Robert Pastorok, Integral
    - Robert Spies, AMS
- Lingering Oil
    - Jeff Short , NOAA
    - Stanley Rice, NOAA
    - Damian Preziosi, Integral
- Services—Commercial Fishing, passive use, recreation and tourism
    - Kelly Hepler, ADF&G
- Services—Subsistence Use
    - Jim Fall (ADF&G)

The workgroup will help to identify and prioritize relevant research, identify key issues to be addressed in the evaluation and synthesis, and review the work products related to information synthesis, resource recovery status, and restoration recommendations. It is anticipated that there will be a high degree of communication across resources when common issues (e.g., biomarker measurement and interpretation) or inter-related resources (e.g., herring and intertidal community) are being addressed.

B.1.3 Meetings

To facilitate the planning process, the following meeting dates have been identified and cleared with most participants:

November 1, 2005: Kickoff Meeting; Technical Review Panel (Anchorage)
December 8 and 9, 2005: Expert Workgroup Meetings (Anchorage)
January 26-28, 2006 (the week of the Alaska Marine Science Symposium): Technical Review Panel and Workgroup meetings
February 25, 2006: Technical Review Panel Meeting

B.2—Task 2: Conduct Critical Review of 2002 Recovery Objectives and Recommend Alternatives

Restoration plans of 1994, 1999, and 2002 are based on recovery objectives and recovery strategies set within an adaptive management approach. In Task 2, we will critically review the recovery objectives and restoration strategies for each of the unrecovered resources, incorporate supplemental environmental and biological information to facilitate assessment of injured populations, and recommend revised recovery objectives that can be used in a structured decision framework.

Task 2.1: Historical recovery objectives and restoration strategies

In the early post-spill era the Trustee Council (1994) established a restoration plan for 30 injured resources and services that were affected by the EVOS. The plan is based on a broad restoration goal that is applicable to all injured resources and states that recovery is to be sustained by healthy, productive ecosystems that maintain naturally occurring biodiversity. For each resource, the plan then identified:

- Injury and recovery – The nature of the injury to the resource and its current recovery status
- Recovery objectives – An explicit statement of desired endpoints that would be achieved via implementation of a restoration strategy
- Restoration strategy – A resource-specific plan of action to achieve recovery.

The restoration strategies developed under the 1994 restoration plan were tailored to each injured resource and its recovery status at that time (Table 1). For biological resources and sediments, the recovery objectives were typically expressed as either a return to pre-spill conditions or, in the absence of knowledge of pre-spill conditions, a return to levels in oiled areas that are comparable to those unoiled areas.

Table 1. Exxon Valdez Oil Spill Restoration Strategies 1994

	Restoration Actions				
	General Recovery				
Resource Category	Active Recovery	Natural Recovery	Habitat Protection & Acquisition	Monitoring	Research
Biological Resources					
Recovering		■		■	
Not Recovering	■		■	■	■
Unknown Recovery		■	■	■	
Other Resources					
Archeological	■		■		
Sediments	■	■		■	
Wilderness	‹— Dependant on recovery of other affected resources —›				
Human Use Services[a]	‹— Dependant on recovery of other affected resources —›				

[a]Commercial fisheries, passive uses, recreation, tourism, subsistence uses.
Source: Exxon Valdez Oil Spill Trustee Council (1994).

The 1994 recovery plan also provided for an adaptive management approach. Under this approach, information gathered during implementation of a restoration strategy is used to judge progress towards the recovery objective(s) and to facilitate modifications of the recovery strategy to better meet its recovery objectives. Consequently, recovery objectives were modified for some of the resources in subsequent iterations of the restoration plan in 1999 and again in 2002.

This adaptive management approach will be further extended and used in the work proposed for the 2006 Synthesis. For each resource, the historical sequence of recovery objectives and restoration strategies will be summarized, critically reviewed, and evaluated in the context of their ability to resolve and distinguish real changes in populations that can be attributed to the EVO during the initial spill or to lingering oil. We anticipate that this evaluation will identify additional environmental and biological dimensions for each injured resource (see Task 2.2 below) that can then be used in a practical way to refine recovery objectives and strategies (see Task 2.3) and facilitate their use in a structured decision framework (Task 3).

Task 2.2: Supplemental Recovery Metrics

The recovery objectives established in the Restoration Plans of 1994, 1999, and 2002 are most often expressed as assessment goals based on higher-level scientific principles of population and community ecology and environmental health. Restoration strategies are intended to generate the actual measurements that can be used to directly support progress towards these higher-level goals and facilitate judgments concerning recovery from injury caused by EVO. However, such judgments have proved difficult or inconclusive in many cases because the relationship between the injury of a resource and its recovery is often obscured or overwhelmed by inherent ecological variability. Consequently, we propose four recovery categories each with quantitative measures or metrics that can provide additional perspective in describing the status of resource injury and framing progress towards higher level recovery objectives or milestones. The supplemental recovery metric categories are:

- Population characteristics–The functional and structural characteristics of injured populations or communities comprise those characteristics that can be used to understand their growth, natural variability, and expected role in the PWS ecosystem. Important functional components include birth and survivorship rates, which determine growth rates of populations. For example, whales are long-lived and slowly reproducing species that will respond slowly to population disturbance over several decades. Structural population characteristics concern the extent and form of populations, whether they are continuous or divided, how they are connected through migrations, and their age structures.
- Physical and chemical factors–The physical nature and extent of EVO and lingering oil in relation to affected populations and important life history traits will be important in evaluating continuing injury and recovery. Evaluation of physical and chemical factors will focus on the exposure pathways and habitat conditions that are important to resource populations and communities and which can be practically used to determine whether they remain altered as a direct or indirect consequence of EVO or lingering oil.
- Temporal factors–Approximately 16 years have passed since the original spill. At the time of the 1994 Restoration Plan, it was expected that some resources would take several decades to recover. This expectation is within the time frame established for other major spills over the past 40 years. Consequently, the time frame for population growth or community succession following disturbance by EVO is important in scaling expectations for recovery.
- Spatial factors–The area over which lingering oil continues to affect injured resources will be expressed in relation to the distribution of resource populations in PWS and affected areas outside of the sound. For lingering oil, this will likely entail a determination its predicted extent in relation to the presence of important habitat and corresponding injured populations. For sediments, an assessment of both the physical habitat provided and the extent to which injured resource populations are dependent on this habitat will be required. Where possible, the potentially patchy distribution of both lingering oil and injured populations will be identified and expressed using probabilities to provide perspective on co-occurrence of widely dispersed but discrete patches of EVO and exposed populations.

In summary, a variety of metrics will be identified within four supplemental recovery categories and used to assess injury status and recovery. These metrics will principally focus on population or habitat viability and will provide a practical foundation for developing refined recovery

objectives and strategies (Task 2.3) and a structured decision framework to evaluate recovery status (Task 3).

Task 2.3: Refine recovery objectives and restoration strategy

The results of Task 2.1 and Task 2.2 will be used to restructure recovery objectives in a way that is practically related to resource-specific restoration strategies. The refined recovery objectives will be expressed in two parts:

- Higher-level recovery objectives that are resource-specific and compatible with the overall restoration goal stated for the program
- Practical recovery metrics associated with specific attributes of affected populations and expressed in the context of the information developed by the historical restoration strategy (see Task 4 – Review and Synthesis) and the supplemental recovery categories described above in Task 2.2.

These refined recovery objectives will be used in a structured decision framework to judge the current injury and recovery status of the resource and, if needed, will be used to guide recommendations for a revised restoration strategy pursuant to the adaptive management framework established for the program.

Task 2.4: The interplay between biological resources and services

Recovery objectives and restoration strategies for services categories have historically been dependent upon their respective biological resources. We do not expect these dependencies to change during the 2006 Synthesis. However, we do expect that judgments concerning the recovery status of services will be affected by any refinements to the recovery objectives and restoration strategies developed for their supporting resources. For example, in 2002 subsistence use was classified as a recovering service because the natural resources upon which it depends were not recovered. However, if the supplemental recovery categories proposed above indicate that a natural resource (e.g., harbor seals) has recovered, then it is likely that services provided by that resource would also be classified as recovered.

B.3-Task 3: Establish Framework for Evaluation of Resource Recovery Status

A key challenge and a chief objective of the proposed work is the critical evaluation of the recovery status of unrecovered resources. As described in detail under Task 2 above, the evaluation of current recovery status is complicated because the relationship between injury and recovery is often obscured or overwhelmed by inherent ecological variability. Drawing upon supplemental recovery categories identified in Task 2.2, we propose to establish a structured framework in Task 3 for assessing the recovery status of resource populations within the construct of recommended recovery objective alternatives.[4]

[4] The proposed framework described under Task 3 addresses biological resources and the population-level characteristics that may be integrated into the critical evaluation of recovery status. As indicated in Task 2, the evaluation of recovery for sediments and designated wilderness will be addressed based in part upon habitat considerations for resource populations. Services will be evaluated based upon the recovery status evaluations for biological resources.

The recovery status of a resource population is determined by the magnitude of the initial impact of the EVOS, the population's intrinsic recovery potential, time since the spill, the magnitude of any continuing effects, and effects of other natural and anthropogenic stresses. Because the status of a population at any given time depends on a variety of life history traits, a simple measure of population abundance at any one time may not be a reliable indicator of future population viability. Population viability is a key measure of recovery status because it indicates the ability of the population to persist within a range of acceptable abundance levels in the future. Therefore, the evaluation of recovery status should be based on those life history traits, spatial-temporal factors, physical-chemical characteristics, and other outside stresses which most heavily influence population viability.

Task 3.1: Select Recovery Metrics

The evaluation of the recovery status of resource populations will draw upon qualitative and quantitative information about intrinsic population variables (e.g., abundance and reproductive measures) as well as extrinsic factors (e.g., habitat, harvesting) that determine population viability and attendant recovery status (Figure 1). Collectively, these variables will be referred to as *recovery metrics*.

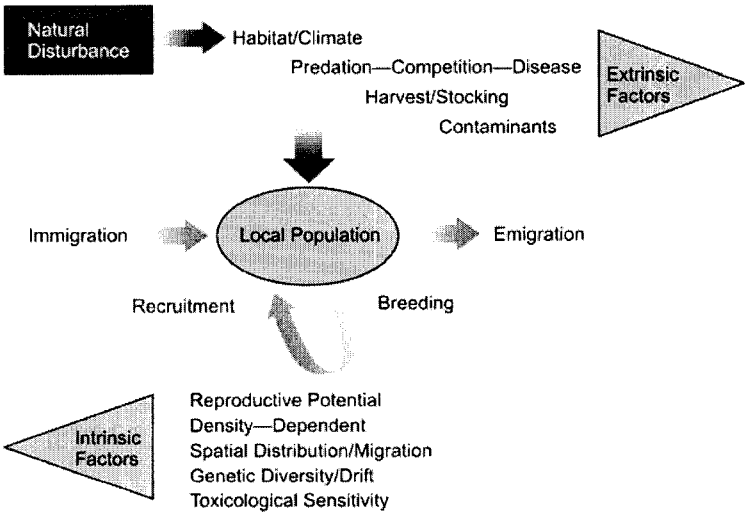

Figure 1. Factors Affecting Resource Populations

Task 3.2: Develop Decision Framework

A decision framework is required to ensure that a consistent and systematic evaluation process is applied to all resources. Under this subtask, such a decision framework will be developed to integrate both qualitative and quantitative information on multiple recovery metrics that pertain to population status. Figure 2 shows the process for evaluating recovery status of resources and an example of how the decision framework will be used.

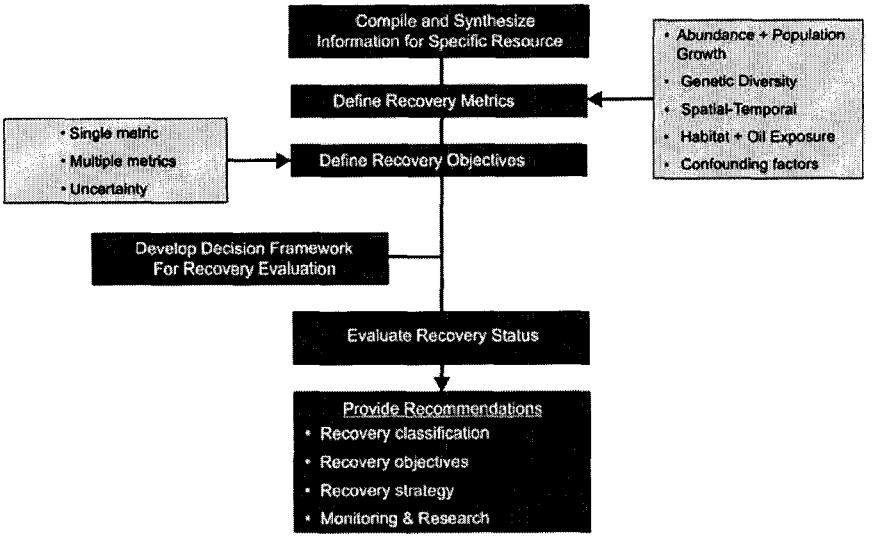

Figure 2. Process for Evaluating Resource Recovery Status

The decision framework will be resource-specific and will likely incorporate recovery metrics from the following categories:

- Abundance and Population Growth – The viability of a population, or conversely its risk of decline to undesirably low levels, depends on its abundance and productivity. Life history characteristics and food web interactions combine to determine the potential viability of a population in a given habitat.
- Genetic and Phenotypic Diversity – Small populations may be at risk for loss of genetic diversity (Nelson and Soule1987). High genetic diversity maximizes population persistence and productivity by allowing the population to use a wide range of habitats and environmental conditions (NRC 1996, and McElhany *et al.* 2000). Genetic diversity also protects populations against climatic disturbances.
- Spatial-Temporal Structure of Populations – The evaluation of population spatial structure will include consideration of the amount of habitat available, the spatial organization and connectivity of habitat patches, and the overlap of the original spill and lingering oil with the population distribution. Temporal issues mainly relate to the amount of time since the spill in relation to generation time of a population, as well as seasonal migration behavior relative to the potential for release of lingering oil.
- Habitat: Physical-Chemical Factors – Habitat quality and extent clearly affect the recovery status of populations. In addition to spatial-temporal issues considered earlier from the standpoint of basic population ecology, the potential effects of lingering oil must be considered.
- Confounding Environmental Factors – Non-EVO related stressors or natural disturbances may affect population recovery status.

Examples of the kinds of questions and issues addressed by these recovery metrics are provided in Table 2. The final decision framework will be developed in consultation with the Technical Review Panel as part of the project. The decision framework will then be tailored to each species to allow consideration of appropriate spatial-temporal scales and recovery evaluation designs according to available data (e.g., Parker and Wiens 2005).

Table 2. Examples of Questions and Issues That Will be Used to Structure a Decision Framework for Injured Resources

Recovery Metrics	Example Questions and Issues
Abundance and Productivity	Are populations significantly reduced in oiled areas relative to reference areas or relative to pre-spill levels? Are population parameters (e.g., growth, reproduction, mortality) similar to those expected in a natural population? Is inter-annual variability of each key population measure (e.g., average abundance; average fecundity) within the expected range of variation for natural populations? Is the population exhibiting a trend of increasing (or decreasing) abundance?
Spatial-Temporal Structures	Are metapopulation structure and habitat connectivity suitable for enhancing the stability of populations and fostering recovery of perturbed populations? Is there evidence of habitat fragmentation related to EVOS? Has sufficient time (and number of generations) elapsed since the EVOS to allow full recovery of the population?
Genetic and Phenotypic Diversity	What percentage of the population was killed in the original EVOS? Did the population reach a critical small size that would potentially lead to decreased genetic or phenotypic diversity? Is there evidence of decreased genetic heterogeneity since the EVOS?
Habitat: Physical Chemical Factors	What percentage of the population's habitat has lingering oil? Is lingering oil bioaccessible? Is the oil in a form that is bioavailable or capable of causing physical effects? Is there evidence of ongoing exposure (e.g., visual observations; bioaccumulation; biomarkers)?
Other stressors	Are natural or invasive predators threatening the viability of the population? Are climatic or other natural disturbances potentially inhibiting recovery of the resource species? Are other factors (e.g, harvesting or contaminants other than EVO) potentially inhibiting recovery of the resource species?

B.4—Task 4: Synthesis of Information

The synthesis of information relevant to the determination of the current status of unrecovered resources and services is the centerpiece of this project. Under this task, Integral's information synthesis will be defined as a systematic analysis consisting of 1) the identification and compilation of research and data pertinent to understanding unrecovered resources and services; and 2) the subsequent review and prioritization of this research and data pursuant to objectives described in Tasks 2 and 3 above. Each of these subtasks is described under Tasks 4.1 and 4.2.

Task 4.1: Identification and compilation of research and data

Extensive research has been performed or is ongoing involving the characterization of the health and degree of recovery of resources and services adversely affected by the EVOS. Most of this research has been conducted through the EVOS Trustee Council. This would include the extensive body of research listed in the Summary of Restoration Strategies and Projects – FFY 92-02, as well as other research, monitoring and restoration projects generated through the Trustee Council.[5] Additional information is available, including results of Exxon-sponsored research activities and the Natural Resource Damage Assessment reports generated following the

[5] This would additionally include the ongoing studies being performed by Integral Consulting (available at http://www.evostc.state.ak.us/pdf/04_DPD_Budgets/Jacobs_DPD_FINAL.pdf) and the project being completed by Dr. Robert Spies (available at http://www.evostc.state.ak.us/pdf/04_DPD_Budgets/Spies_DPD_FINAL.pdf).

EVOS.[6]

The proposed synthesis will largely draw upon this collective, existing body of research. The new search engine developed by Trustee Council staff is expected to facilitate this compilation effort (www.gem.state.ak.us/projects/searchstart.cfm). Additional information will be identified through engaging researchers with expertise in specific species and EVOS research. This will occur primarily through meetings of the Technical Review Panel and the Resource/Services Workgroup described above under Task 1. Additional dialogue with experts outside of these meetings is also envisioned to augment identification of research and data.

The collective information identified throughout this process will be compiled and organized in a format compatible with ProCite. Approximately 500 references relevant to unrecovered resources and services are currently contained within Integral's existing electronic EVOS library. The existing library will be augmented with additional references and data identified throughout this subtask.

Task 4.2: Review and prioritization of pertinent research and data

As indicated, an extensive body of research and data currently exists related to the EVOS. However, not all of this information is pertinent to understanding the current status of resources or services. For example, research available for recovered resources is obviously not pertinent. For unrecovered resources and services, a number of completed projects may be of limited utility for the current work. Examples would include projects associated with curation techniques for animal carcasses, development of trawl survey techniques, and miscellaneous tasks associated with project management. Nevertheless, a large amount of potentially pertinent information remains, necessitating a process for prioritization of this information.

The primary mechanism for prioritizing pertinent research and data is the engagement of those experts who have conducted research and generated data and reports for unrecovered resources and services. During Technical Review Panel and Resource/Services Workgroup meetings and through separate discussions, experts will be relied upon to help focus and direct the review of research and data most pertinent to understanding injury classification and current recovery status. This would include research and data associated with the following:

- Natural history and ecology of unrecovered resources, with particular emphasis on current population status or other endpoints associated with current recovery objectives
- Ongoing effects (both direct and indirect) associated with the original spill and lingering oil
- Other factors potentially influencing continuing injury and rates of recovery (e.g., cyclical changes in the marine environment, other threats and effects of anthropogenic factors)
- Identified or hypothesized relationships between current population status and the EVOS.

Additional consideration for prioritization will be given to the pertinence of research and data within the context of the supplemental recovery categories described under Task 2 and the decision framework described under Task 3.

[6] See for example http://www.evostc.state.ak.us/restoration/projects_NRDA.html.

The product of Task 4 will be a document that compiles and synthesizes the Trustee-funded research related to EVOS. This document will summarize key features of each study, with emphasis on those feature that directly relate to research objectives, restoration objectives, monitoring tools, and information that can be applied to future oil spills. This document will be included in the final report as an appendix. The prioritized list of research projects and technical papers identified during this task will be the foundation for the technical analysis and recommendations related to resource condition and restoration activities (Task 5).

B.5—Task 5: Characterize Resource Condition and Recommend Restoration Activities

Resources and services classified as recovering, not recovered, and unknown will be evaluated using the Task 3 decision framework and the supporting Task 4 synthesis of information. The use of the single decision framework will help to ensure that a consistent evaluation process is applied to all resources. The report format for each resource or service will be consistent with Table 2 of the 2006 invitation for proposals, which is reproduced below in abbreviated form as Table 3.

Table 3. Status Update of an Injured Species or Service

1. Introduction
2. Background
   - 2.1 Natural history and ecology
   - 2.2 Summary on initial impact (1989-1994)
   - 2.3 Summary of follow-up impact if spill (1995 – 2005)
3. History and current status of recovery classification
   - 3.1 Status in the 1994 Restoration Plan
   - 3.2 Summary of changes in status over time
   - 3.3 Current status (2002 Restoration Plan with 2003 additions)
4. Summary of monitoring, research, and restoration projects conducted to date
   - 1.1 Summary of EVOS funded projects
   - 1.2 Summary of non-EVOS funded projects
   - 1.3 Relationship of projects to recovery objectives an restoration strategy
5. Synthesis of EVOS effects
   - 5.1 Direct effects of initial spill
   - 5.2 Indirect and cascade effects of initial spill
   - 5.3 Ongoing effects of spill
6. Other factors influencing injury, recovery rate, and population
   - 6.1 Long-term population trends within and outside spill area
   - 6.2 Ecosystem change, regime shifts, and cyclical changes in the marine environment
   - 6.3 Other threats and anthropogenic factors
7. Summary of current population status and relationship to EVOS
   - 7.1 Relationship to past and current recovery objectives
   - 7.2 Supplemental endpoints for interpretation of population status (physical, temporal, spatial)
8. Recommendations for revised EVOS recovery objectives and restoration strategy
   - 8.1 Populations
   - 8.2 Physical factors
   - 8.3 Temporal factors
   - 8.4 Spatial Factors
9. Recommendation for future actions
   - 9.1 Research, monitoring, or restoration costs
   - 9.2 Direct and indirect costs
   - 9.3 Primary and secondary benefits of action

It is anticipated that a portion of the required work effort (i.e., portions of Sections 1 - 7 and Section 9, above) for those resources classified as recovering and not recovered will have been addressed by the ongoing work of Jacobs *et al.* (2005). Resources and services that have not been addressed by Jacobs *et al.* (2005) include wilderness areas, archeological resources, all resources currently classified as unknown (i.e., Dolly Varden, Cutthroat trout, Rockfish, Kittlitz's Murrelet, and subtidal communities) and all services classified as recovering (i.e., commercial fishing, passive use, recreation and tourism, and subsistence use).

Critical steps in the process proposed for characterizing resources and developing recommendations have been captured in Tasks 1, 2, and 3. The early identification of refinements to recovery objectives, the development and use of a consistent evaluation framework, and the timely inclusion of key decision-makers and experts

will collectively provide for consistency across resources (and resource-dependent services) and ensure a scientifically sound and objective approach.

C. Data Analysis and Statistical Methods

A significant portion of this work will entail the review and synthesis of a large body of research and data associated with various scientific reports and other literature. Of critical importance will be the implementation of an electronic library database to efficiently manage and facilitate the review of this information. As described under Task 4, a large number of pertinent references currently exist within Integral's electronic EVOS library. We envision that additional references will be identified under Tasks 1 and 4 to augment this existing library. The new search engine developed by Trustee Council staff is expected to facilitate this compilation effort (www.gem.state.ak.us/projects/searchstart.cfm).

Integral's electronic library is built upon commercially available, innovative and specialized bibliographic software known as Biblioscape.[7] Biblioscape offers a number of distinct advantages for the review and synthesis of information required under the proposed work. These include the storage of electronic references,[8] full text and keyword searching, secure web accessibility, the ability to generate formatted bibliographies within reports, and the ability to transfer a Biblioscape database to a ProCite database.[9]

Data analysis other than that associated with the management of the electronic library is anticipated to be limited. The proposed work represents a synthesis project, and as such, it is anticipated that limited new data will be generated that will require conventional quantitative analysis. In instances where such analyses are required, Integral will utilize a number of general analytical software products, such as Microsoft Excel. Specialized statistical software may also be utilized, including Systat v.10.0 and Statistica v.7.0. Throughout Tasks 1 and 4, Integral's statistical experts will also actively engage statisticians associated with research considered under this synthesis. This will facilitate the assessment of the statistical soundness underlying research data and its interpretation. For example, under Integral's current lingering oil evaluation, we engaged the statistical experts who developed the study design for the 2001 lingering oil survey performed by NOAA's Auke Bay Laboratory.

D. Description of Study Area

This project will focus upon pertinent research and data compiled throughout PWS on unrecovered resources and services. Pertinent information for other areas throughout the Gulf of Alaska impacted by the EVOS will additionally be considered.

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[7] See http://biblioscape.com/index.html.

[8] Electronic files can be entered and stored in Biblioscape in a number of formats, including but not limited to portable document format files (.pdf) Microsoft Word, PowerPoint, and Excel files (.doc, .ppt, .xls), standard text files (.txt), hyper-text markup language files (.html), and various picture formats (e.g., .gif. tif, .bmp, .jpg, .wmf).

[9] Reviewers are invited to go to the following ftp site to download a Word document that provides screen captures of various features of Integral's electronic EVOS library. ftp:// ftp.integral-corp.com User name: c113 Password: evos123

E. Coordination and Collaboration with Other Efforts

We envision a closely coordinated and highly collaborative effort with Trustee Scientists and other scientists as described in Section II.A.1, Task 1.

III. Schedule

A. Project Milestone

Based on the FY2006 Invitation for Proposals, the duration of the project will be nine months commencing with funding on October 1, 2006 with ending with submission of final reports due July 1, 2006. Project milestones for the objectives identified in Section II.A are:

Objective 1. Task 1 - Identify scientists with appropriate experience and expertise who can contribute to an evaluation and a synthesis of major issues associated with resource injury status, recovery objectives, and restoration strategies.
To be met prior to project initiation (by October 1, 2005).

Objective 2. Task 2 - Assess 2002 recovery objectives and develop refinements to improve their functionality in a practical decision framework.
To be met by January 1, 2006

Objective 3. Task 3 - Develop a decision framework to objectively and systematically evaluate the recovery status of injured resource populations.
To be met by January 1, 2006

Objective 4. Task 4 - Compile and synthesize research and information relevant to resource injury classification and recovery status that can be used effectively in the decision framework.
To be met by February 15, 2006

Objective 5. Task 5 - Characterize the recovery condition of resources classified as recovered, not recovered, and recovery unknown and recommend restoration activities as needed.
To be met by April 1, 2006

B. Measurable Project Tasks

Measurable tasks will consist of the meetings, presentations, and draft and final reports anticipated over the duration of the project as follows:

FY06, 1st quarter (October 1 – December 31, 2005)

November 1	Technical Review Panel Meeting to discuss refinements to approach (Anchorage)
December 1	Prepare draft technical memo describing approach
December 8 and 9	Expert Workshop to communicate approach, comment, and prioritize resource issues and studies for synthesis effort (Anchorage)

FY06, 2nd quarter (January 1 – March 31, 2006)

January	Quarter 1 progress report
January 22-25	Alaska Marine Science Symposium (Anchorage)
January 25 and 26	Technical Review Panel Meeting—Planning for workshops (Anchorage)
January 23-26	Expert Workshops–Discuss status of resource synthesis, recovery objectives, recovery status (Anchorage)
February 25	Technical Review Panel–Discuss outcome, initial conclusions, planning for public meeting (Anchorage)

FY06, 3rd quarter (April 1 – June 30, 2006)

April 1	Draft Report
April 15	Presentation to the Trustee Council
April 16	Presentation to the public
June	Quarter 2 progress report

FY06, 4rd quarter (July 1 – September 30, 2006)

July	Final report
July	Presentation to the Trustee Council

IV. Responsiveness to Key Trustee Council Strategies

A. Community Involvement and Traditional Ecological Knowledge (TEK)

Community involvement and incorporation of traditional ecological knowledge are most relevant to the development of restoration alternatives for resources and services that have not yet recovered. Public communication is also anticipated at project milestones, for example when the recovery objectives and decision framework have been developed or when the draft recommendations regarding injury classification and restoration alternatives are developed.

The specific methods for incorporating traditional ecological knowledge and involving the community will be determined during the initial meeting of the Technical Review Panel and from feedback from the Trustee Council.

B. Resource Management Applications

Distinguishing the impacts of the various factors that can influence resource populations is a major challenge to resource managers. The refinement of recovery objectives and the development of a decision framework to evaluate resource populations are anticipated to have much broader application than the resources injured by the Exxon Valdez oil spill. The evaluation of the recovery status of resource populations will draw upon qualitative and quantitative information about intrinsic population variables (e.g., abundance and reproductive measures) as well as extrinsic factors (e.g., habitat, harvesting) that determine population viability and attendant recovery status. The decision framework developed for this project is not resource-specific, and should be applicable to all resources and resource populations that are vulnerable to these multiple stressors from both human and natural conditions (see Table 2).

V. Publications and Reports

Draft and final reports for the Synthesis Project will be provided April 1, 2006 and July 1, 2006 respectively. Draft and final reports will be prepared according to Trustee Council guidance entitled *Procedures for the Preparation and Distribution of Reports*. A proposed outline of the report for the Synthesis Project is described above in Section II.B of this Project Plan. We anticipate that portions of the Synthesis Report will provide the foundation for several peer reviewed publications. However, the scope of those publications will be determined in consultation with the Technical Review Panel and the Resources/Services Workgroup as the Synthesis Project nears completion in July 2006. Consequently, we are not requesting funding for production of peer-reviewed publications in this funding cycle.

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NRC (National Research Council). 1996. Upstream: Salmon and society in the Pacific Northwest. National Academy Press, Washington, D.C.

Parker, K.R., and J.A. Wiens. 2005. In press. Assessing recovery following environmental accidents: Environmental variation, ecological assumptions, and strategies. *Ecological Applications.*

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RESUMES

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Lucinda A. Jacobs, Ph.D.
Principal

Professional Profile

Dr. Lucinda Jacobs is an environmental scientist who specializes in aquatic and sediment geochemistry, processes that mitigate exposure to toxic chemicals, and processes that control chemical transport and fate. During her 25 years of experience, she has designed, directed, and contributed to a variety of multidisciplinary environmental studies, including global studies of metal behavior in anoxic marine systems; remedial investigation/feasibility study (RI/FS) and ecological risk assessment projects in wetlands, river systems, urban lakes, and bays; and natural resource damage assessments (NRDAs). Dr. Jacobs has developed and directed investigations that integrated source control and chemical fate processes (*e.g.*, bioavailability, natural recovery) with effects-based testing to derive site-specific toxicity thresholds, cleanup levels, and benchmark values. She is familiar with a wide variety of field sampling and laboratory analytical methods, including toxicity testing and radionuclide dating techniques, and has designed or contributed to the design of a variety of field studies. She has directed the preparation of two data validation guidance manuals.

Dr. Jacobs has served as an expert witness and expert consultant on chemical fingerprinting, loading analyses, the timing of releases, natural resource injury, and the interpretation and conclusions of environmental investigations. This has included reconstructing historical scenarios for environmental releases and analyzing existing environmental distributions in the context of current and ongoing sources and transport/fate processes.

Professional and Academic Credentials

Ph.D., Chemical Oceanography, University of Washington, 1984
M.S., Chemical Oceanography, University of Washington, 1982
B.S. Chemistry, University of California, Los Angeles (honors), 1974

Society of Environmental Toxicology and Chemistry
American Geophysical Union

Relevant Experience

Exxon Valdez Oil Spill, Prince William Sound—Currently serving as project manager and project executive for the State of Alaska. Project involves evaluation of the current injury and restoration status of resources injured in the 1989 Exxon Valdez Oil spill. Technical activities include document review, information synthesis, communication and coordination with trustee agencies, and public communication.

Clark Fork River, Montana—Managed a natural resource injury assessment for ARCO in anticipation of litigation. Activities included study design, development of key technical arguments, design of data interpretation strategy and injury assessment methods, and preparation of an expert report.

Coeur D'Alene River, Idaho—Served as a consulting expert for ASARCO and HECLA in a natural resource damage litigation related to the mining activities in the Coeur d'Alene basin. Primary focus of assessment was water quality injuries.

General Support to National Oceanic and Atmospheric Administration (NOAA)—Served as project chemist for a NOAA project to investigate the threat posed to natural resources at a variety of uncontrolled hazardous waste sites. This investigation included the assessment of environmental transport and fate processes that influenced the relationship between contaminants and sensitive resources.

Ward Cove Sediment Remediation Project, Alaska—Project manager and technical coordinator of all technical activities related to sediment assessment and remedy design, including facilitating communication with regulators. Project addressed historical pulp mill releases, which consisted largely of wood debris, organic matter, and organic matter degradation products. The absence of unacceptable human and wildlife risks, the nature of chemicals of concern, and the type of sediment toxicity were the basis for developing an innovative remedy for the 80-acre problem area that consisted of thin capping/sediment amendment (27 acres) and natural recovery (53 acres).

Alaska Pulp Company Investigation, Sitka, Alaska—Served as an independent reviewer and technical resource for a fast-track RI/FS at a former pulp mill site. Participated in the development of technical strategies for interpreting sediment data, assessing exposure and risk, and developing appropriate remedial approaches.

Selected Publications

Klein, S.M., and L.A. Jacobs. 1995. Distribution of mercury in the sediments of Onondaga Lake, N.Y. *Water Air Soil Pollut.* 80:1035–1038.

Jacobs, L.A., S.M. Klein, and E.A. Henry. 1995. Mercury cycling in the water column of a seasonally anoxic urban lake (Onondaga Lake, NY). *Water Air Soil Pollut.* 80:553–562.

Jacobs, L.A., H.R. von Gunten, R. Keil, and M. Kuslys. 1988. Geochemical changes along a river-groundwater infiltration flow path; Glattfelden, Switzerland. *Geochim. Cosmochim. Acta* 52:2693–2706.

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Jacobs, L.A., and S. Emerson. 1982. Trace metal solubility in an anoxic fjord. *Earth Planet. Sci. Lett.* 60:237–252.

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Robert A. Pastorok, Ph.D.
Senior Science Advisor

Professional Profile

Dr. Robert Pastorok is an ecologist specializing in ecological risk assessment and restoration ecology. He has over 30 years of experience, with expertise in study design, ecological modeling, and analysis of the effects of toxic chemicals in aquatic and terrestrial ecosystems. Dr. Pastorok was co-investigator to assess the ecological effects of oil spills and cleanup techniques in coastal habitats, leading to the first field guidance manual for oil spill cleanup developed by the American Petroleum Institute. His experience includes impact assessments in Cook Inlet, Alaska and offshore waters, as well as investigation of oil spill effects on California sea otter and development of rehabilitation techniques. Dr. Pastorok managed an expert panel to develop guidance on restoration of aquatic habitats for the U.S. Army Corps of Engineers. He also led major multidisciplinary investigations in Puget Sound (WA), the Willamette River (OR), the Hudson River (NY), and the Clark Fork River (MT).

Professional and Academic Credentials

Ph.D., Zoology, University of Washington, 1978
B.S., Biology, University of Notre Dame (honors), 1971

Senior editor, *Human and Ecological Risk Assessment* (Senior 2000–2005; Associate 1997-2000)
Society of Environmental Toxicology and Chemistry
Ecological Society of America

Relevant Experience

Exxon Valdez Oil Spill, Prince William Sound—Evaluating population modeling for harlequin duck and sea otter to assess recovery status after the Exxon Valdez oil spill.

Restoration of River Habitats, Hudson River—Analyzed ecological structure and function relationships to guide the selection of indicators for monitoring the success of habitat restoration.

Ecological Modeling, Worldwide—Evaluated ecological models for population-, ecosystem-, and landscape-level endpoints for use in ecological risk assessment (book published by CRC Press).

Habitat Restoration after Oil Spills, USA—Evaluated relative benefits, ecological impacts, and costs of restoration after oil spills in marine and freshwater habitats.

Aquatic Habitat Restoration Guidance, USA—Led an expert panel to develop guidance for restoration of coastal and freshwater habitats.

Oil Spill and Cleanup Impacts, Worldwide—Evaluated potential ecological impacts and recovery in marine habitats affected by oil spills and cleanup operations.

Drilling Mud Impacts, Alaska—Evaluated potential effects of drilling mud discharges on plankton of the Beaufort, Chukchi, and Bering seas; Cook Inlet; and northeast Gulf of Alaska.

Comparative Risk Expert Panel, California—Member of Corps of Engineers panel of experts to review a comparative risk assessment of dredged material disposal options in Moss Landing Harbor and Monterey Bay, CA.

Bioaccumulation Monitoring Guidance, USA—Served as technical supervisor to develop national guidance manuals on estimating the bioaccumulation potential of toxic pollutants, selecting target species, and selecting sampling strategies for bioaccumulation monitoring.

Selected Publications

Pastorok, R.A., S.M. Bartell, S. Ferson, and L.R. Ginzburg. 2002. Ecological modeling in risk assessment: chemical effects on populations, ecosystems, and landscapes. CRC Press, Lewis Publishers, Boca Raton, FL. 302 pp.

Pastorok, R.A., C. Noftsker, *et al.* 2000. Natural remediation of polynuclear aromatic hydrocarbons and other petroleum hydrocarbons. *In:* M. Swindoll, R.G. Stahl, Jr., and S.J. Ells (eds.) Natural Remediation of Environmental Contaminants: Its Role in Ecological Risk Assessment and Management. SETAC Press, Pensacola, FL., pp. 159-198.

Pastorok, R.A., A. MacDonald, J.R. Sampson, P. Wilber, D.J. Yozzo, and J.P. Titre. 1997. An ecological decision framework for environmental restoration projects. *Ecolog. Engineer.* 9:89-107.

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Ginn, T.C., and R.A. Pastorok. 1992. Assessment and management of contaminated sediments in Puget Sound. pp. 371–401. *In:* Sediment Toxicity Assessment. Lewis Publishers, Ann Arbor, MI.

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Johnson, T.L., and R.A. Pastorok. 1982. Oil spill cleanup: Options for minimizing adverse ecological impacts. API Publication No. 4435. American Petroleum Institute, Washington, DC.

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Damian V. Preziosi
Managing Scientist

Professional Profile

Mr. Damian V. Preziosi is an environmental scientist with specialization in the evaluation of potential ecological and human health risks associated with exposures to physical, chemical, and biological hazards. Mr. Preziosi's areas of expertise include environmental fate, exposure, toxicology, aquatic ecology, statistics, and natural resource damage assessment. He has developed and applied innovative quantitative methods, including probabilistic and other varieties of uncertainty analysis, Geographic Information Systems (GIS) analysis, and a wide variety of environmental fate, transport and food chain models used in the assessment and management of both ecological and human health risks.

Professional and Academic Credentials

M.S., Biology, Department of Biology, Bucknell University, 1994
B.S., Biology and Geology, Juniata College, 1991

American Society of Testing and Materials (E-47)

Ecological Society of America

Society of Environmental Toxicology and Chemistry

Society of Toxicology, National Capital Area

Relevant Experience

Exxon Valdez Oil Spill, Prince William Sound—Currently serving as a technical lead and task manager for the State of Alaska. Project involves evaluation of the current injury and restoration status of resources injured in the 1989 Exxon Valdez Oil spill. Technical activities include document review, information synthesis, and communication and coordination with trustee agencies.

Greens Bayou and Houston Ship Channel, Texas—Conducted ecological evaluation and risk assessment of contaminated sediments in Greens Bayou and Houston Ship Channel located in coastal Texas. Work included the designing of a fish sampling study, the development of aquatic-based food web models, and conducting statistical and chemometric (e.g., chemical fingerprinting) analyses of PAHs and organochlorine residues in fish and sediment.

Development and Application of a Habitat Valuation Tool—Developed and applied a quantitative ecosystem model to evaluate competing risks from chemical residuals with those associated with remediation. The model, referred to as the Adaptive Ecosystem Rehabilitation Approach (AERA), assessed the value of an ecosystem's functions and components such that the cost (e.g., alteration of the natural setting during remediation) and benefit (e.g., removal of chemical risk) of a remedial alternative could be assessed.

Marine Groundfish Resource Survey—Under the National Marine Fisheries Service (NMFS), conducted biological surveys of benthic and pelagic fishes of the North Pacific Ocean and Bering Sea. Abundance, life history, and distribution of species were assessed.

McKay Bay Estuary, Florida—Conducted multiple pathway ecological risk assessment a former industrial site located along McKay Bay, Florida. Potential risks to benthic community were assessed utilizing multiple lines of evidence, including sediment bulk chemistry, community metrics, and simultaneous extracted metals and acid- volatile sulfide analyses (SEM/AVS). For migratory birds, both single-point and probabilistic techniques were used to assess exposure and risk.

Selected Publications and Presentations

Preziosi, D.V., and L.G. Williams. 2004. Quantile regression - another tool for examining the predictive ability of sediment quality guidelines. 2004 Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Portland, OR.

Preziosi, D.V., and P.C. Chrostowski. 2003. Foodchain model calibration and post-hoc validation – a risk assessment case study. 2003 Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Austin. TX.

Preziosi, D.V., and J.L. Durda. 2002. The concentration term in ecological risk assessment. Society of Environmental Toxicology and Chemistry (SETAC) Globe 3(6):20-21.

Preziosi, D.V., and P. Woodbury. 2000. Techniques and Tools for Addressing Scales in Ecological Risk Assessment. Interactive Poster Session co-Chairs. 21st Annual Meeting for the Society of Environmental Toxicology and Chemistry (SETAC). November 12-16, Nashville, TN.

Preziosi, D.V. 1999. Probabilistic Ecological Risk Assessment Platform Session. Session Chair. 20th Annual Meeting for the Society of Environmental Toxicology and Chemistry (SETAC). November 14-18, Philadelphia, PA.

Preziosi, D.V., and J.L. Durda. 1998. The adaptive ecosystem rehabilitation approach (AERA), a new habitat valuation approach for remedial alternative selection. Society of Environmental Toxicology and Chemistry (SETAC) News 18(1):24-25.

Buck, E.H., and D.V. Preziosi. 1995. Overcapitalization in the US Marine Commercial Fishing Industry. Congressional Research Service Report for Congress. Library of Congress, Washington, DC: #95-296ENR.

Durda, J.L., P.C. Chrostowski, and D.V. Preziosi. 2004. Chemometrics as a tool for sediment assessment and management: A case study of Greens Bayou, Houston, Texas. 2004 Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Portland, OR.

Durda, J.L., L.G. Williams, and D.V. Preziosi. 2004. Challenges to conventional wisdom regarding biomagnification in aquatic food webs. 2004 Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Portland, OR.

Durda, J.L., and D.V. Preziosi. 2000. Data quality evaluation of toxicological studies used to derive exotoxicological benchmarks. *Human and Ecological Risk Assessment*. Vol. 6, No. 5, pp 747-765.

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Les Williams, Ph.D.
Managing Scientist

Professional Profile

Dr. Les Williams is aquatic ecologist specializing in the characterization and quantification of ecological risk and natural resource injury in support of focused management strategies for contaminated aquatic and sediment ecosystems. His consulting practice includes quantitative techniques and modeling applications that can be used in site-specific evaluations of injury to natural resources, management of contaminated sediment and dredged materials, determination of chemical bioaccumulation and toxicity in aquatic organisms, development of site-specific sediment quality and water quality values, and human health and ecological risk assessments.

Professional and Academic Credentials

Ph.D., Marine Studies, University of Delaware, 1978
M.S., Marine Biology, University of the Pacific, 1971
B.A., Biology, Whitman College, 1968

Association of Environmental Health and Sciences
Estuarine Research Federation
Society for Environmental Toxicology and Chemistry
Society for Risk Analysis

Relevant Experience

Exxon Valdez Oil Spill, Prince William Sound Alaska—Currently leading a re-evaluation of natural resource injury and recovery status for unrecovered resources. Project activities include development of a conceptual exposure model and re-evaluation of the status of unrecovered resources (e.g., Pacific herring, sea otter, harlequin duck, intertidal communities) in the context of the original oil spill and possible continuing exposure to lingering oil in intertidal sediments.

Ecological Risk Assessment of Benthic Communities in a Texas Estuary— Conducted an evaluation of risks to the benthic community in an urbanized Texas bayou in the vicinity of a former pesticide manufacturing facility. The benthic community evaluation was based on three lines of evidence: sediment quality values vs. sediment chemistry concentrations; sediment toxicity tests; benthic community analyses. The risk assessment showed the presence of a stressed benthic community that was disturbed by natural estuarine gradients in salinity, temperature, and dissolved oxygen. There was no indication that chemical residues related to the pesticide manufacturing facility had impaired the benthic community in the bayou.

Marine Ecological Risk Assessment, Sitka Mill Site, AK—Managed an ecological risk assessment of chlorinated dibenzodioxins and dibenzofurans, resin acids, and trace metals to marine invertebrates, fish, birds, and mammals in the vicinity of the Sitka Mill. Sediment chemistry, sediment toxicity testing, and sediment profile imaging (SPI) were used to assess potential risks to benthic marine invertebrates. A state-of-the-science physiological-based biokinetic food chain model was used to evaluate exposure and risk to shorebirds, seabirds, sea otter, and harbor seal als in the vicinity of the site.

Ecological Risk Assessment, Adak Island, AK— Developed ecological risk-based screening concentrations to identify chemicals of potential concern in soils, to prioritize sites for further evaluation, and to set preliminary cleanup goals for soil remediation. Evaluated two stream drainages containing a total of seven hazardous waste sites for possible toxic effects in a subarctic tundra ecosystem. Using a general knowledge of Adak Island flora and fauna, a variety of food-chain models were used to estimate chemical exposure to representatives of freshwater and terrestrial communities. These receptors included fish, aquatic invertebrates, caribou, Norway rat, bald eagle, ptarmigan, and mallard. Chemicals of concern included several volatile organic compounds, PAHs, PCBs, and metals.

Expert Peer Review for Ecological Impacts of Wood Debris in the Marine Environment—On behalf of the Sealaska Corporation, consulted and provided expert commentary on Alaska Department of Fish and Game's proposed plan for assessing marine ecological impacts associated with wood debris in the vicinity of log transfer and storage facilities in Southeast Alaska. Recommended alternative approach to document key processes of ecosystem structure and function that would provide basis for management decisions concerning natural recovery vs. active site remediation. Authored review article on marine ecological impacts of wood waste.

Selected Publications

Williams, L. R.A. Schoof, J.W. Yager, and J.W. Goodrich-Mahoney. 2005. Arsenic bioaccumulation in freshwater fishes. In preparation. *Human and Ecological Risk Assessment.*

Williams, L., R. Schoof, A. Schuler, P. Zieber, J. Yager, and J. Goodrich-Mahoney. 2004. Arsenic Bioaccumulation – Implications of using a power function to estimate bioaccumulation factors. Abstract. Society of Environmental Toxicology and Chemistry, 25th Annual Meeting, Portland, OR.

Williams, L., J. Durda, D. Preziosi, and P. Sparks. 2004. Benthic ecological risk assessment – Balancing environmental and chemical stressors in an estuary. Abstract. Society of Environmental Toxicology and Chemistry, 25th Annual Meeting, Portland, OR.

Preziosi, D. and L. Williams. 2004. Quantile Regression Another Tool for Examining the Predictive Ability of Sediment Quality Guidelines. Abstract. Society of Environmental Toxicology and Chemistry, 25th Annual Meeting, Portland, OR.

Williams, L. and G. Braun. 2001. Costs and benefits of a toxicity testing program to facilitate contaminated sediment cleanup. Abstract. Society for Risk Analysis, 2001 Annual Meeting, Seattle, WA.

Braun, G., J.Q. Word, M. Pinza, and L. Williams. 1997. An assessment framework for interpreting toxicity data in the vicinity of a pulp mill. Poster Abstract. Society of Environmental Toxicology and Chemistry, 18th Annual Meeting, San Francisco, CA.

Suedel, B.C., E.A. McKenna, L.G. Williams, U. Vedagiri, P.A. Clifford, and D.F. Ludwig. 1995. Comparability of Human and Ecological Risk Assessments. *J. Hum. Ecol. Risk Assess.* 1:478-482.

Hummell, R. and L.G. Williams. 1994. Use of allometric relationships to standardize ecological risk models and predict risk-based screening concentrations for soil-borne contaminants. Poster Abstract, Society of Environmental Toxicology and Chemistry, 15th Annual Meeting, Denver, Colorado.

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Wildlife Biologist

Professional Profile

Ms. Lori Anderson has worked in the fields of natural resource management and environmental compliance for the past 15 years. A wildlife biologist by training, she specializes in vertebrate species and habitats of the Pacific Northwest. Her work, conducted in both the public and private sectors, includes environmental impact assessments, wildlife studies, watershed analysis, and forest resource management. She has helped design projects to avoid significant impacts to wildlife and habitats. Her experience extends to watershed and wetlands issues as well.

Professional and Academic Credentials

M.S., Environmental Science/Terrestrial Ecology, Western Washington University, 1992
B.A., Environmental Studies/Biology, Middlebury College, 1986

Board Member, Nooksack Salmon Enhancement Association, 1999-2002
The Wildlife Society

Relevant Experience

Exxon Valdez Oil Spill Resource Evaluation—Conducted review of injured resources, including sea otters, harlequin ducks, seabirds, harbor seals, and killer whales. Reviewed the recovery status of these species since the injury caused by the Exxon Valdez oil spill. Critically examined results published in restoration study reports. Evaluated present-day status of populations recovering from the oil spill. Evaluated evidence of continued effects to species from lingering oil. Presented findings in a series of technical memoranda.

Donahue Forks Environmental Assessment, Olympic National Forest, Washington—Led a 6-person interdisciplinary team in the assessment of alternatives to accelerate development of old-growth forest in second-growth forest stands. The project required creative and independent thinking, leading to the design of unique habitat enhancement and silvicultural treatment strategies. Ms. Anderson ensured that all aspects of the project were completed in a timely and professional manner. Ms. Anderson supervised the interdisciplinary team, led the public scoping effort, wrote and edited the environmental assessment, managed the budget, and made formal presentations to the client.

Tollgate Environmental Impact Statement, North Bend, Washington—Conducted an assessment of potential impacts to wildlife and habitats from a proposed development project. The proposal included a 200-acre housing development on farmland adjacent to the city of North Bend, WA. Issues to assess included potential impacts to threatened and endangered species such as the bald eagle and peregrine falcon, and habitat connectivity for riparian-dependent wildlife species. Ms. Anderson conducted the analysis in accordance with both State and National Environmental Policy Acts (SEPA and NEPA) and reviewed the project for compliance with the King County Sensitive Areas Code. Her findings led to mitigation measures to provide habitat along the riparian corridor.

Salmon-Neskowin Watershed Analysis, Siuslaw National Forest, Oregon—Led a team of professionals in analyzing ecological conditions within the Salmon and Neskowin watersheds on the Oregon Coast. She managed all aspects of the project for an independent consulting firm, coordinating the effort with Forest Service and Bureau of Land Management personnel. The project included an assessment of wildlife, vegetation, fisheries, human resources, and geology. Recommendations were made for restoring ecosystem functions. Ms. Anderson directed the production of a useful and readable watershed analysis document.

Baker Lake Elk Study, Mt. Baker-Snoqualmie National Forest, Washington—Acted as principal investigator on a 5-year Forest Service administrative study designed to identify seasonal movements and habitat preferences of the Nooksack elk. Ms. Anderson was responsible for study design and on-the-ground implementation, including supervision of field personnel and coordination with cooperating agencies. Her efforts resulted in implementation of key habitat enhancement and protection measures for the declining elk herd. Methodologies included radio-tagging of elk, habitat analysis through the use of GIS technology, and habitat modeling with the aid of specialized spatial database software.

Green/Duwamish Watershed Restoration, King County, Washington—Assessed the potential impacts of watershed restoration projects on wildlife and habitats in the Green River watershed, King County, WA. The restoration plans included projects to restore channel diversity, reduce sedimentation, increase fish passage, and restore riparian, wetland, and estuarine habitat. Ms. Anderson wrote a biological assessment and portions of the environmental impact statement.

Lower Snake River Dredged Material Management Plan, Walla Walla, Washington—Conducted a biological assessment for this project, which included reviewing potential impacts to bald eagles, bull trout, and sensitive plants. Issues centered on potential disturbance to fish and wildlife caused by the proposed river-dredging operation and subsequent in-water disposal of dredged material. Strategies to reduce impacts included the use of manual rather than hydraulic dredging techniques and use of dredged material to create near-shore salmon rearing habitat.

Wildlife Surveys, U.S. Forest Service, Region 6, Washington and Oregon—Managed and conducted numerous wildlife survey and monitoring efforts. Ms. Anderson managed crews of two to ten field biologists in surveying for spotted owls, marbled murrelets, bald eagles, mollusks, amphibians, and elk. Throughout her career she has conducted hundreds of hours of field work. During her tenure with the U.S. Forest Service she trained and supervised crews in monitoring and sampling techniques. Methodologies included use and knowledge of current wildlife inventory and monitoring protocols and radio-telemetry tagging and tracking techniques.

Ecological Risk Assessment, Seattle, Washington—Conducted background research for ecological risk assessments. Her work included development of informational papers describing the transfer of contaminants through terrestrial food chains. She assisted with food chain modeling of contaminated sites and collected information on bioaccumulation of PCBs, heavy metals, and organic compounds within relevant ecosystems.

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Vicki L. Fagerness
Senior Scientist

Professional Profile

Ms. Vicki Fagerness has over 14 years experience in the environmental field, with emphasis in the collection, analysis, and evaluation of sediment, water quality, and biological data from marine and estuarine environments. Ms. Fagerness is experienced in contaminated sediment management under CERCLA, Washington State Sediment Management Standards, and the Puget Sound Dredged Disposal Program, and has applied this knowledge to projects ranging from sediment characterization for dredging and disposal to sediment remediation at hazardous waste sites. She identified and evaluated potential chemical sources and pathways to the marine environment for Slip 4 in the Duwamish River and the Hylebos Waterway pre-remedial design program. Ms. Fagerness' work evaluating potential impacts of human activity on biological resources includes preparation of numerous environmental impact statements, biological evaluations/biological assessments, and permit applications for marine construction and dredging projects.

Professional and Academic Credentials

M.S., Biological Oceanography, Oregon State University, 1984
B.A., Biology, Colorado College, 1977

Hazardous Waste Operations and Emergency Response 40-hour Certification
Hazardous Waste Operations Supervisor 8-hour Certification
Society of Toxicology and Chemistry/Pacific Northwest Chapter

Relevant Experience

Exxon Valdez Oil Spill Impact Assessment, Alaska—Compiled existing data and information to assess potential impacts of lingering oil from the Exxon Valdez Oil Spill on natural resources (e.g., herring, clams, mussels) 15 years after the initial spill.

Slip 4, Duwamish Waterway, Seattle, Washington—Deputy project manager responsible for preparation of numerous reports related to early actions for the cleanup of contaminated sediments in Slip 4 of the Duwamish Waterway. Ms. Fagerness managed the preparation of the report summarizing existing conditions, including sediment quality, water quality, and human and biological resources. She identified and prioritized data gaps to be addressed during site characterization. Following sample collection and analysis to fill data gaps, she prepared the data report presenting results and a technical memorandum describing the proposed cleanup boundary. Currently assisting with preparation of the Engineering Evaluation/Cost Analysis report evaluating cleanup alternatives.

Portland Harbor Upland Site Evaluations, Portland, Oregon—Summarized available information on upland sites for evaluation of contaminant sources to Willamette River sediments and Portland Harbor Superfund Site. For each individual property and facility, information on ownership; current and historical operations; regulatory status; spills; discharges; and soil,

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groundwater, and discharge data were compiled and summarized to evaluate possible contaminant contributions to the river.

Biological Evaluation/Biological Assessment, Olympia, Washington—Prepared BE/BA in support of 404 permitting for a proposed bulkhead replacement and repair project. The BE/BA evaluated potential impacts to endangered and threatened species, including Chinook salmon and bull trout. Forage fish were of particular concern as the project was located in a designated surf smelt spawning area. Ms. Fagerness worked with the property owner to incorporate measures to improve forage fish habitat.

Portland Harbor CERCLA RI/FS, Portland, Oregon—Coordinated preparation of the Round 1 Field Sampling Plan for the Lower Willamette River Superfund Site RI. Data were required for site characterization and ecological and human health risk assessments. This extensive sampling program involved multiple consultants and required collection of several hundred sediment, invertebrate, and fish tissue samples for chemical analysis.

Chemical Source Control Evaluation, Tacoma, Washington—Coordinated task to evaluate the potential for recontamination prior to sediment remediation in Hylebos Waterway, under CERCLA. Ms. Fagerness compiled and evaluated groundwater, soil, and surface water data. She compared upland data to applicable criteria and standards. Other types of data analysis included evaluation of chemical spatial distributions, temporal changes in chemical concentrations, and chemical fingerprinting. Identified and prioritized potential chemical sources requiring investigation.

Hylebos Waterway Sediment Investigation, Tacoma, Washington—Prepared sampling and analysis plan and coordinated field sampling effort for Phase 3 of the Hylebos Waterway Pre-Remedial Design program. This effort included collection and analysis of subtidal and intertidal sediments at 30 stations for chemical analysis, biological toxicity testing, and benthic infauna abundance analysis.

Natural Resources Damage Assessment, Kitsap County, Washington—Managed project to evaluate PCB contamination in intertidal and marine sediments at a CERCLA site and to identify potential biological effects. Responsible for sampling plan design, field sampling, subconsultant oversight, data evaluation, and final report.

Priority Habitats and Species Survey, Ilwaco, Washington—Responsible for marine component of Priority Habitats and Species Survey prepared in support of permit requirements for waterfront expansion at a U.S. Coast Guard Station. Conducted reconnaissance-level survey of marine habitat and biological communities in intertidal and shallow subtidal areas to evaluate the possible presence of priority habitats, threatened or endangered species, or other protected or monitored species.

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Deborah A. Rudnick, Ph.D.
Ecologist

Professional Profile

Dr. Deborah Rudnick is an ecologist specializing in the design and execution of complex ecological investigations. In her 8 years of professional experience, Dr. Rudnick has conducted research in population and community ecology, trophic ecology, and processes of biological invasions in aquatic habitats. She has investigated behavioral interactions among aquatic invasive species, conducted stable isotope analyses and designed experimental mesocosms to investigate aquatic food webs, quantified geomorphological processes in Pacific Northwest rivers, and developed monitoring designs for wildlife habitat, water chemistry, and pharmaceutical products in the marine environment. Dr. Rudnick's professional experience includes conducting biological inventories, riparian and wetland restoration, macroinvertebrate sampling, and in-stream improvements for fish and wildlife habitat in a diversity of geographic regions. Dr. Rudnick has provided leadership on research and management teams addressing invasive species and ecosystem health.

Professional and Academic Credentials

Ph.D., Environmental Science, Policy and Management, University of California at Berkeley, 2003
B.A., Ecology and Evolutionary Biology, Brown University, 1994

American Institute of Biological Sciences
Ecological Society of America
North American Benthological Society
Sigma Xi Scientific Honors Society

Relevant Experience

10,000 Years Institute, Hoh River Water Monitoring Program, Washington—Implemented water quality monitoring program for the Hoh River Basin. Conducted fish, amphibian, and stream gradient surveys; measured discrete and long-term water quality parameters using a variety of instrumentation; conducted substrate classification surveys. Developed and reviewed Quality Assurance Program Plan for water quality monitoring program. Reported data to Hoh Indian Tribe and Olympic National Park scientists and managers.

Jefferson County Open Space, Colorado—Conducted timber management to improve foothills wildlife habitat. Conducted wetland mitigation to offset county development projects, including site selection, excavation and re-vegetation.

United States Department of Agriculture Public Lands and Environment Program, Vermont—Conducted timber management, prescribed burning, and salmonid stocking to restore wildlife habitat and supplement important fish populations on US Forest lands.

University of California at Berkeley, California—Designed and executed independent research on the population and community ecology of aquatic invasive species. Employed multiple

experimental techniques, including stable isotope analysis with laboratory calibration, experimental mesocosms, and behavioral observations. Quantified invasive species impacts to riparian geomorphology and commercial fisheries. Chaired a multi-agency, multi-institution statewide workgroup to coordinate research and provide management recommendations for the control of Chinese mitten crabs at state and national levels.

Ventana Wilderness Sanctuary, Big Sur, California—Conducted point-count and mist-netting censuses to examine riparian passerine diversity and habitat use. Conducted steelhead trout population monitoring. Oversaw and trained volunteers in avian research techniques.

Kent Island Research Station, New Brunswick, Canada—Conducted research on avian parental care and offspring success in the Savannah sparrow (*Passerculus sandwichensis*). Conducted mist-netting, banding, blood sample collection, and nest-finding and observation.

Selected Publications

Hui[a], Clifford A., Deborah Rudnick[b,1] and Erin Williams[c]. 2005. Mercury burdens in Chinese mitten crabs (Eriocheir sinensis) in three tributaries of southern San Francisco Bay, California, USA. *Environ. Pollut. 2005* 133(3):481-487.

Rudnick, D., C. Culver, K. Hieb, D. Tullis, T. Veldhuizen, and B. Tsukimura. 2005. A life history model for the San Francisco Bay population of the Chinese mitten crab, *Eriocheir sinensis. Biological Invasions* 7:333-350.

Rudnick, D., K. Hieb, K. Grimmer, and V.H. Resh. 2003. Patterns and processes of biological invasion: The Chinese mitten crab in San Francisco Bay. *J. Basic Applied Ecology* 4: 249-262.

Rudnick, D., and V.H. Resh. 2002. A survey to examine the effects of the Chinese mitten crab on commercial fisheries in Northern California. *Interagency Ecological Project Newsletter* 15(1): 19-21.

Rudnick, D., V.H. Resh, and K.H. Halat. 2000. Ecology, distribution and potential impacts of the Chinese mitten crab (*Eriocheir sinensis*) in San Francisco Bay. Center for Wildlands and Water Resources Report UCAL-WRC-W-881.

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Robert B. Spies, Ph.D.
Managing Scientist

Credentials and Professional Honors

Ph.D., University of Southern California, Los Angeles, California, 1971
M.S., University of Pacific, Dillon Beach, California, 1969
B.S., St. Mary's College, Moraga, California, 1965

Relevant Experience

Review of Proposals, Papers and Dissertations—Environmental Protection Agency, National Center for Environmental Research; National Oceanographic and Atmospheric Administration; National Science Foundation; National Research Council; Natural Environment Research Council (United Kingdom); European Congress of Limnology and Oceanography; International Joint Commission (Great Lakes); Massachusetts Sea Grant; Georgia Sea Grant; State of Alaska; Estuarine Research Federation; Department of Energy; National Undersea Research Center; University of California, Davis; University of California, Santa Barbara; University of Maryland; CRC Press; American Chemical Society, Petroleum Research Fund; Southern California Coastal Water Research Project; Hudson River Foundation; John Simon Guggenheim Foundation; Aquatic Toxicology; Canadian Journal of Fisheries and Aquatic Sciences; Environmental Toxicology and Chemistry; Journal of Experimental Marine Biology and Ecology; Marine Biology; Marine Ecology Progress Series; Marine Pollution Bulletin Science

Major Research Interests—The fate and effects of contaminants (especially petroleum) in the aquatic environment; alteration of hormone production and balance by receptor-mediated contaminant effects; the effects of oil spills on ecosystems; the detection and quantification of polynuclear aromatic hydrocarbons and chlorinated aromatic hydrocarbons in sediments and organisms; the degradation and utilization of petroleum hydrocarbons in sediments; the utilization of petroleum and sewage carbon in nearshore marine food webs; natural isotopes in food webs as tracers; biological processes in natural petroleum seeps; benthic-pelagic coupling; biogeochemistry of oil-contaminated sediments; chemical tracers of street runoff; detecting community change in deep-water, hard-bottom communities; effects of contaminated sediments on marine organisms; design of programs to detect long-term change in benthic communities; applications of accelerator mass spectrometry in marine ecology.

Positions Held—Instructor, University of California , Los Angeles, 1968; Senior Research Officer, Ministry for Conservation, Melbourne, Australia, 1970-1973: Marine Scientist, Lawrence Livermore National Laboratory, Livermore, California, 1973-1991; President, Applied Marine Sciences, 1990- :Chief Scientist, Exxon Valdez Oil Spill Trustee Council, 1990-2001; Board of Directors of the Romberg Tiburon Center for Environmental Studies, 1993-2002l; Board of Directors, Alaska SeaLife Center, 1994- : President, 2003-

Selected Publications

Spies, R.B., and P.H. Davis. 1979. The infaunal benthos of a natural oil seep in the Santa Barbara Channel. *Mar. Biol.* 50, 227-237.

Spies, R.B., J.S. Felton, and L.J. Dillard. 1982. Hepatic mixed-function oxidases in California flatfish are increased in contaminated environments and by oil and PCB ingestion. *Mar. Biol.* 70, 117-127.

Steurmer, D.H., R.B. Spies, P.H. Davis, D.J. Ng, C.J. Morris, and S. Neal. 1982. The hydrocarbon chemistry of the Isla Vista Marine Seep Environment. *Mar. Chem.* 11, 413-426.

Montagna, P.A., J.E. Bauer, M.C. Prieto, D.H. Hardin, and R.B. Spies. 1986. Benthic metabolism in a natural coastal petroleum seep. *Mar. Ecol. Prog. Ser.*, 34, 31-40.

Spies, R.B. 1987. The biological effects of petroleum hydrocarbons in the sea: Assessments from field and microcosms, pp. 411-467 in long-term environmental effects of offshore oil and gas development. D.F. Boesch and N.N. Rabalais, Eds. Elsevier-Applied Sciences, London.

Montagna, P.A., J.E. Bauer, J. Toal, D.H. Hardin and R.B. Spies. 1987. Temporal variability and the relationship between benthic meiofaunal and microbial populations in a natural coastal petroleum seep. *J. Mar. Res.* 45, 761-789.

Melzian, B.D., C. Zoffman, and R.B. Spies. 1987. Chlorinated hydrocarbons in lower continental shelf fish collected near the Farallon Islands, California. *Marine Pollution Bull.* 18, 388-393.

Spies, R.B., D. Hardin, and J. Toal. 1988. Organic enrichment or toxicity? A comparison of the effects of kelp and crude oil in sediments on the colonization and growth of fauna. *J. Exp. Mar. Biol. Ecol.* 124, 261-282.

Bauer, J.E., P.A. Montagna, R.B. Spies, D.H. Hardin, and M. Prieto. 1988. Microbial biogeochemistry and heterotrophy in sediments of a marine hydrocarbon seep. *Limnol. Oceanogr.* 33, 1493-1513.

Spies, R.B. 1993. So why can't science tell us more about the effects of the Exxon Valdez oil spill? pp. 1-5, In: Exxon Valdez oil spill symposium, EVOS Trustee Council, Anchorage Alaska.

Spies, R. 1995. Restoring Prince William Sound. *Science* 269, 1328-1329. (letter)

Spies, R.B., J.J. Stegeman, D.E. Hinton, B. Woodin, M. Okihiro, R. Smolowitz, and D. Shea. 1996. Biomarkers of hydrocarbon exposure and sublethal effects in embiotocid fishes from a natural petroleum seep in the Santa Barbara Channel. *Aquatic Toxicol.* 34: 195-219.

Spies, R.B., S.D. Rice, D.A. Wolfe, and B.A. Wright. 1996. The effects of the Exxon Valdez Oil spill on the Alaskan Coastal environment, pp. 1-16, in: S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (Eds.) Exxon Valdez Oil Spill Proceedings, Anchorage, Alaska, 2-5 February 1993. American Fisheries Society Symposium No. 18.

BUDGET

Budget Justification

Personnel

Personnel hours for this project were developed for each of the five tasks discussed in the Proposed Plan. Assumptions for the cost and level-of-effort for each task are discussed below. The total cost for this project is estimated to be $565,312.46. This total includes $382,624.28 for personnel [including Integral, NOAA, DOI (USF&W and USGS), and ADF&G]; $29,200 for travel (Integral and NOAA); $76,565.00 for contractual costs (experts who are subcontracted to Integral); $30,246.00 for commodities, and $46,677.18 for General Administration (GA).

Task 1: Refine Project Scope and Establish Review Panel and Technical Workgroup

The proposed approach will benefit from review comments, discussions with Trustee scientists, and refinements to the proposed approach. The costs for this task include 1) project coordination, 2) meetings, and 3) participation of identified experts in the project. Integral costs for this task (including experts as subcontractors) are estimated at $178,110. Agency costs reflect the participation of the following agency experts in two to four meetings:

- NOAA—Jeff Short (4 meetings) and Stanley Rice (2 meetings)
- ADF&G—Dan Rosenberg (4 meetings) and Bob Small, Kelly Hepler, and Jim Fall (2 meetings each)
- USGS—Jim Bodkin (4 meetings) and Brenda Ballachey (2 meetings)
- USF&W—David Irons and Kathy Kuletz (2 meetings each).

Costs for the Integral staff are estimated to be 562 hours for senior staff,[1] 24 hours for mid-level staff, and 84 hours for junior or support staff.

Task 2: Review Recovery Objectives and Recommend Alternatives

This task involves review of recovery objectives for all 18 resources and 5 services to be addressed by the project and recommendations for refinements. The costs for this task include: 1) review of objectives, 2) development of proposed refinements, and 3) finalization of changes to recovery objectives. Costs for this task are $20,000; 96 hours for senior staff and 24 hours for mid- and junior-level staff.

Task 3: Establish Framework for Resource Assessment

This task involves development of a decision framework to consistently and systematically evaluate the recovery status for the resources and services to be addressed by the project. The costs for this task include development of a draft framework and finalization of framework. Costs for this task are $30,000; 118 hours for senior staff, 44 hours for mid-level staff, and 40 hours for junior and support staff.

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[1] Hours for R. Spies of Applied Marine Sciences are included in the total hours for senior staff.

Task 4: Synthesize Information

Activities under this task include review and synthesis of information related to the 18 resources and 5 services currently classified as recovering, not recovered, and recovery unknown. It is assumed that 5 resources and 3 services that were not addressed by Jacobs *et al.* 2005 will require a greater level of effort than the other resources currently classified as recovering, not recovered, and unknown; however, the information synthesis performed by Jacobs *et al.* (2005) will need to be supplemented to ensure that all of Trust-funded work performed over the last 15 years is addressed in the synthesis. Costs for this task are estimated to be $70,000; 64 hours for senior staff, 344 hours for mid-level staff, and 248 hours for junior and support staff.

Task 5: Characterize Resources and Recommend Restoration Activities

This task includes preparation of draft and final reports. It is assumed that the reports developed by Jacobs *et al.* (2005) will be the starting point for resource classified as recovering and not recovered. Background information for the resource- and service-specific sections of the draft report (Sections 1 – 4 of the report; see Task 5 of the Project Plan) will be developed under Task 4. One meeting in Anchorage to communicate with to the public is also include in this task. Remaining sections of the draft and final report will be prepared under Task 5. Costs for this task are estimated to be $154,000; 292 hours for senior staff, 420 hours for mid-level staff, and 620 hours for junior and support staff.

Travel

It is assumed that 5 meetings will be held in Anchorage, Alaska throughout the course of this project. When possible, related project meetings (e.g., a Technical Review Panel meeting and a Resource/Service Workshop) will be scheduled closely in time to minimize travel costs. Similarly, meetings are scheduled in coordination with the annual EVOS workshop. A total of 4 trips to Anchorage are included in the budget for technical review panel and expert workshop meetings. L. Jacobs, L. Williams, R. Pastorok and R. Spies will participate in all 4 meetings. D. Preziosi will participate in one meeting. R. Spies, L. Jacobs, and L. Williams will participate in the public meeting.

Contractual

Five subcontractors are included in this cost estimate: Robert Spies (Applied Marine Sciences), Dan Esler (Simon Fraser University), Craig Matkin (North Gulf Oceanic Society), Al Springer (University of Alaska), and Jim Harvey (Moss Landing). Costs for Bob Spies are included in the justification for Integral (above). Al Springer will serve on the Technical Review Panel and will participate in 4 meetings (estimated to require approximately 132 hours). Dan Esler, Craig Matkin, and Jim Harvey[2] will participate in the expert workgroup (2 meetings; estimate to require 76 hours).

[2] Jim Harvey has not yet responded to our request for his participation.

Commodities and Equipment

There are no commodities and equipment associated with this project.

DATA MANAGEMENT AND QA/QC STATEMENT

As described under Section C of the Project Plan, the proposed work represents a synthesis project, and limited new data requiring conventional QA/QC is anticipated. If existing data require quantitative analyses, such analyses will be subjected to a formal QA/QC process as specified under Integral's quality assurance review policy. Integral's quality assurance process includes technical and editorial reviews of project deliverables as well as technical review of project data, calculations, and other critical supporting documentation. Depending on the nature and complexity of a task, one or more technical reviewers will be assigned to perform technical reviews.

A significant portion of this work will be dependent on the effective management of information using Integral's electronic EVOS library (see Section C above). Integral has developed an internal procedural guidance for the management of this and other internal electronic libraries. This internal guidance will be implemented in support of the proposed work.

It is also envisioned that the Technical Review Panel and Resource/Services Workgroup will serve to provide a more global QA/QC of existing data, particularly with respect to the collective interpretations and deductions formulated throughout the course of this work. The engagements of experts will additionally serve to direct and focus the use of the most appropriate data in order that the intended objectives of the proposed work are met. Collectively, the Technical Review Panel and Resource/Services Workgroup will serve to ensure further the integrity of the conclusions and recommendations reached during the synthesis.

The specific elements of Integral's data management and QA/QC procedures are as follows:

1. **Data management.** Section C, page 14, paragraph 1 describes the use of Integral's electronic EVOS library.

2. **Study design.** Item does not apply to proposed work.

3. **Data acceptability.** Section C, page 14, paragraph 2 describes the engagement of statisticians to ascertain acceptability of data based on statistical considerations; page 36, paragraph 3 of this statement describes the engagement of experts in the Technical Review Panel and Resource/Services Workgroup to direct and focus the use of the most appropriate data to meet the intended objectives of the proposed work.

4. **Characteristics of produced data.** Item does not apply to proposed work.

5. **Definitions of algorithms.** Item does not apply to proposed work.

6. **Sample handling and custody**. Item does not apply to proposed work.

7. **Analytical instrumentation calibration and performance evaluation.** Item does not apply to proposed work.

8. **Data reduction and reporting.** Section C, page 14, paragraph 2 describes the use of general analytical software products, such as Microsoft Excel, and specialized statistical softwares such as Systat v.10.0 and Statistica v.7.0.

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2005 - September 30, 2006

Budget Category:	Authorized FY 2005	Proposed FY 2006	PROPOSED FY 2006 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$ 26,814.00			$ 26,596.00	511,902.46
Personnel	$0.0	382,624.28						
Travel	$0.0	29,200.00						
Contractual	$0.0	76,565.00						
Commodities	$0.0	30,246.00						
Equipment	$0.0	-	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	518,635.28				Estimated FY 2007		
General Administration	$0.0	46,677.18						
Project Total	$0.0	565,312.46				$0.0		
Full-time Equivalents (FTE)	0	1.45						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	-				$0.0		

Comments:
Agency staff are included in this proposal as follows:

Alaska Department of Fish and Game: $21,600 Personnel; $2,600 Travel
U.s. Geological Survey: $12,480 Personnel; $2,000 Travel
U.S. Fish and Wildlife Service: $9,120 Personnel; $800 Travel
National Oceanic and Atmospheric Administration: $14,524 Personnel; $3,000 Travel
General Administration 9%: 5,951.16

Total Agency costs: $72,075.16

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: NOAA - ADFG - DOI (USFWS/USGS)

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2005 - September 30, 2006

Budget Category:	Authorized FY 2005	Proposed FY 2006						
Personnel		339,024.28						
Travel		23,800.00						
Contractual		76,565.00						
Commodities		30,246.00						
Equipment		-	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	469,635.28				Estimated FY 2007		
General Administration		42,267.18						
Project Total	$0.0	511,902.46						
Full-time Equivalents (FTE)		1.45						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
NOAA agnecy costs $17,524 (plus GA)
Integral Contract through NOAA $452,111.28 (GA to go to NOAA)

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: NOAA

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2006
L. Jacobs	Principal		1.663	30400.0		50,555.20
R. Pastorok	Senior Science Advisor		1.075	30400.0		32,680.00
L. Williams	Managing Scientist		2.213	27200.0		60,193.60
D. Preziosi	Managing Scientist		0.900	24000.0		21,600.00
V. Fagerness	Senior Scientist		1.475	16800.0		24,780.00
L. Anderson	Senior Scientist		0.500	16000.0		8,000.00
D. Rudnick	Scientist		2.750	15200.0		41,800.00
K Moshenberg	Scientist		1.500	12800.0		19,200.00
M. Behum	Scientist		1.500	12000.0		18,000.00
G. Cocks	Scientist		0.600	15200.0		9,120.00
M. Perri	Technical Writer		0.825	15200.0		12,540.00
Graphics/Tech. Writer	Tech. Support		0.775	11800.0		9,145.00
Word Process/Clerical	Tech Support		1.6237	10400.0		16,886.48
NOAA /NMSFS						
Jeff Short	Scientist					8,643.00
Jeep Rice	Scientist					5,881.00
	Subtotal		17.4	237400.0	0.0	
					Personnel Total	339,024.28

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2006
L. Jacobs	800.0	5	14	200.0	6,800.00
L. Williams	800.0	5	14	200.0	6,800.00
R. Pastorok	800.0	4	11	200.0	5,400.00
D. Preziosi	1200.0	1	3	200.0	1,800.00
					-
Jeff Short					2,000.00
Jeep Rice					1,000.00
					-
					-
					-
					-
					-
				Travel Total	23,800.00

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: NOAA

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Contractual Costs:	Proposed
Description	FY 2006
Robert Spies (Applied Marine Sciences)	33,800.00
Robert Spies Travel (Applied Marine Sciences)	7,500.00
Dan Esler (Simon Fraser University)	3,800.00
Dan Esler travel	3,000.00
Craig Matkin (North Gulf Oceanic Society)	2,185.00
Craig Matkin Travel	3,000.00
Al Springer (University of Alaska)	10,560.00
Al Springer travel	600.00
Jim Harvey (Moss Landing Marine Laboratory)	9,120.00
Jim Harvey travel	3,000.00
Contractual Total	76,565.00

Commodities Costs:	Proposed
Description	FY 2006
Large Document Production and Copying and Misc. Project Purchases	5,885.00
Integral Overhead (Direct Project Expenses)	16,704.00
Subcontractor Burden	7,657.00
Commodities Total	30,246.00

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: NOAA

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2006
No equipment will be purchased			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	-

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: NOAA

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2005 - September 30, 2006

Budget Category:	Authorized FY 2005	Proposed FY 2006						
Personnel		22,000.00						
Travel		2,600.00						
Contractual		-						
Commodities		-						
Equipment		-	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	24,600.00				Estimated		
General Administration		2,214.00				FY 2007		
Project Total	$0.0	26,814.00						
Full-time Equivalents (FTE)		-						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: ADFG

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2006
Dan Rosenberg	Scientist					7,920.00
Bob Small	Scientist					4,560.00
Kelly Hepler	Scientist					4,560.00
Jim Fall	Scientist					4,960.00
						-
						-
						-
						-
						-
						-
						-
	Subtotal		0.0	0.0	0.0	
					Personnel Total	22,000.00
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2006
						-
Dan Rosenberg	Scientist					800.00
Bob Small	Scientist					1,000.00
Kelly Hepler	Scientist					400.00
Jim Fall	Scientist					400.00
						-
						-
						-
						-
						-
						-
					Travel Total	2,600.00

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: ADFG

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Contractual Costs:	Proposed
Description	FY 2006
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	-

Commodities Costs:	Proposed
Description	FY 2006
Commodities Total	-

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: ADFG

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2006
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	-

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: ADFG

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2005 - September 30, 2006

Budget Category:	Authorized FY 2005	Proposed FY 2006						
Personnel		12,480.00						
Travel		2,000.00						
Contractual		-						
Commodities		-						
Equipment		-	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	14,480.00				Estimated FY 2007		
General Administration		1,303.20						
Project Total	$0.0	15,783.20						
Full-time Equivalents (FTE)		-						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI USGS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2006
Name	Position Description					
Jim Bodkin	USGS Scientist					7,920.00
Brenda Ballachey	USGS Scientist					4,560.00
						-
						-
						-
						-
						-
						-
						-
						-
						-
	Subtotal		0.0	0.0	0.0	
					Personnel Total	12,480.00

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2006
Description						
						-
Jim Bodkin	USGS Scientist					1,000.00
Brenda Ballachey	USGS Scientist					1,000.00
						-
						-
						-
						-
						-
						-
						-
						-
					Travel Total	2,000.00

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USGS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Contractual Costs:	Proposed
Description	FY 2006
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	-

Commodities Costs:	Proposed
Description	FY 2006
Commodities Total	-

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USGS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2006
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	-

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USGS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Budget Category:	Authorized FY 2005	Proposed FY 2006						
Personnel		9,120.00						
Travel		800.00						
Contractual		-						
Commodities		-						
Equipment		-	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	9,920.00				Estimated		
General Administration		892.80				FY 2007		
Project Total	$0.0	10,812.80						
Full-time Equivalents (FTE)		-						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USFWS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2006
						-
USFWS						-
David Irons	USFWS Scientist					4,560.00
Kathy Kuletz	USFWS Scientist					4,560.00
						-
						-
						-
						-
						-
						-
						-
	Subtotal		0.0	0.0	0.0	
					Personnel Total	9,120.00
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2006
						-
David Irons	USFWS Scientist					400.00
Kathy Kuletz	USFWS Scientist					400.00
						-
						-
						-
						-
						-
						-
						-
						-
					Travel Total	800.00

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USFWS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

Contractual Costs:	Proposed
Description	FY 2006
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	-

Commodities Costs:	Proposed
Description	FY 2006
Commodities Total	-

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USFWS

2006 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2005 - September 30, 2006

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2006
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
			-
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	-

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY06

Prepared:

Project Number: 060783
Project Title: Information Synthesis and Recovery Recommendations for Resources and Services Injured by the EVOS
PI: Lucinda Jacobs, Integral Consulting
Lead Agency: DOI - USFWS