PROPOSAL FORM

THIS FORM MUST BE SUBMITTED BY THE PROPOSED PRINCIPAL INVESTIGATOR (S) AND SUBMITTED ALONG WITH THE PROPOSAL.

By submission of this proposal, I agree to abide by the Trustee Council's data policy (*Trustee Council Data Policy**, adopted March 17, 2008) and reporting requirements *(Procedures for the Preparation and Distribution of Reports***, adopted June 27, 2007).

PROJECT TITLE: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species – submitted under BAA.

Name of PI:	Zachary Nixon	
Email:	znixon@researchplanning.com	Phone: 803-256-73622
Mailing Address	1121 Park St.	
City, State, Zip	Columbia SC 29201	
Name of PI:	Jacqueline Michel	
Email:	jmichel@researchplanning.com	Phone: 803-256-73622
Mailing Address	1121 Park St.	
City, State, Zip	Columbia SC 29201	
Name of PI:	Brenda E. Ballachey	
Email:	bballachey@usgs.gov	Phone: 403-288-9184
Mailing Address	U.S. Geological Survey, Alaska Science Center, 4210 University Drive	
City, State, Zip	Anchorage, Alaska 99508	
Name of PI:	James Bodkin	
Email:	jbodkin@usgs.gov	Phone: 907-748-4367
Mailing Address	Alaska Science Center, 616 Marrowstone Point Road	
City, State, Zip	Nordland, WA 98358	
Name of PI:	Dan Esler	
Email:	desler@sfu.ca	Phone: 604-940-4652
Mailing Address	Simon Fraser University, 5421 Robertson Road	
City, State, Zip	Delta, BC, V4K 3N2, Canada	

* www.evostc.state.ak.us/Policies/data.cfm

** www.evostc.state.ak.us/Policies/reporting.cfm

FY12 INVITATION
PROPOSAL SUMMARY PAGE

Project Title: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species – submitted under BAA

Project Period: October 1, 2011 – September 30, 2012

Primary Investigator(s): Zachary Nixon, Jacqueline Michel, Brenda Ballachey, James Bodkin, Dan Esler

Study Location: Prince William Sound

Abstract: Much recent work has been carried out in Prince William Sound (PWS) to characterize the distribution and ongoing impacts of lingering subsurface oil from the Exxon Valdez Oil Spill (EVOS). The ongoing work of Bodkin et al., Esler et al., and Monson et al., (1994, 1999, 2000, 2002, 2010, in review) have provided an unprecedented understanding of the ongoing recovery status of certain recovering species via detailed population dynamics and measures of individual health: biomarker expression, contaminant concentrations, and pathological effects. In parallel, Michel et al.,(2009) and Boufadel et al., (2010) have successfully characterized, synoptically, and in spatial detail, the distribution of and factors contributing to the ongoing presence of lingering oil reservoirs within PWS and the wider EVOS impact area. We propose to synthesize these two bodies of work by rigorously examining the strength of spatial correlations between measures of recent and ongoing impact to recovering species, at both the individual and population level, and where lingering subsurface oil is specifically estimated to persist. Presence or absence of such links will provide insight into the recent and potentially ongoing nature of the impact of this oil, and could guide proposed remediation efforts with specificity not previously possible.

Estimated Budget:
EVOS Funding Requested:

FY12 = $177.4

TOTAL = $177.4

Non-EVOS Funds to be used:

FY12 = $.00

TOTAL = $177.4

Date: 2/28/2011

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Both the distribution of remaining lingering subsurface EVOS oil as well as the recovery status, individual health impacts, and population status of recovering species in northern PWS have been investigated recently and are relatively well known (Bodkin et al.,1994, 1999, 2002, 2010, in review; Esler et al., 2000, 2002, 2010, in press; Michel et al., 2009).

There remains substantial uncertainty, however, in the linkages between where and how species are still recovering, and the distribution of remaining subsurface oil. Recent work has called into question the existence of plausible physical pathways for continuing exposure of some recovering species to lingering oil (Boehm et al., 2007, 2010; Harwell et al., 2010). Due to lack of area-wide estimates of the current distribution of lingering subsurface oil, most characterizations of recovering species attempt to compare populations in areas that were ever oiled during the spill to those that were never oiled. The work of Michel et al., (2009) make possible more precise comparisons where estimations of the *current* extent and relative amount of lingering oil, previously unavailable, are taken into account.

We propose to synthesize the results of the lingering oil modeling work by Michel et al., (2009) with data describing population abundance and intertidal habitat use for otters and harlequin ducks, as well as CYP1A and other bioindicators of exposure and health for sea otters, harlequin ducks, Barrow's goldeneyes, and other nearshore vertebrate species. We will use all available datasets to examine the presence of spatial correlations between where recovering species show evidence of potential lingering population or individual effects, and where lingering oil is estimated to occur, while controlling for habitat suitability. The presence or absence of such spatial correlations will support or refute the hypothesis that it is the continued and ongoing presence of lingering oil that is contributing to the incomplete recovery of impacted resources. If such spatial correlations are present, the results could guide proposed remediation efforts with more specificity, by prioritizing areas with potential lingering subsurface oiling for investigation and remediation based upon the habitat suitability or importance of those areas with regard to recovering species.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

This proposal directly addresses the question of whether lingering oil in Prince William Sound is now, or has been recently, impacting the population status or health of recovering species. We expect to confirm or refute the hypotheses that the distribution of lingering subsurface EVOS oil in the intertidal areas of PWS is related to the current or recent spatial footprint of population or health impacts observed for recovering species – specifically sea otters and harlequin ducks. If such spatial relationships exist, this work could guide potential remediation efforts with better specificity.

The proposal is submitted under the FY12 Lingering Oil Initiative. Under this Initiative, the Council is seeking additional information for use in reaching a decision point on further efforts for active remediation. This work directly addresses the question of whether such remediation

would be effective in contributing to resource recovery, and, if so, what areas would best be targeted for such remediation based upon potential for improving resource status.

II. PROJECT DESIGN

We present the project design organized into four distinct tasks, as described below.

Objective 1. Revise Existing Synoptic Subsurface Oil Presence Model

A. Objectives

The existing subsurface oil presence models are well parameterized and accurate within known bounds. They were designed to predict locations with remaining subsurface oil within the EVOS impact area by calculating a class-membership score for all locations along a generalized two-dimensional shoreline. For the proposed work, it is preferable to modify the model to predict probabilities of encountering oil at specific pits at various tidal elevations rather than at the entire intertidal zone at once. We will modify the existing model to generate these probabilities.

B. Procedural and Scientific Methods

Using the synthesized dataset compiled from the work by Michel et al., (2009) and Short et al., (2003, 2005) and collected using the methods described in Short et al., (2003), we will adapt the methodology used to model presence/absence of lingering subsurface oil along the shorelines of PWS and the GOA from Michel et al., (2009). This will involve no new data collection, but rather a modification to the methodology to output the per-pit encounter probability of lingering subsurface oil. This would include the following modifications:

- Use of pit-wise subsurface oil presence or absence at different tidal elevations and different burial depths as the response variable
- Incorporate newly-available ShoreZone dataset (CORI, 2008) as predictor variables
- Present results in the form of probabilities, rather than class membership scores

C. Data Analysis and Statistical Methods

The data required for this objective have already been compiled and assimilated into a single database by the investigators for previous work. The analysis methods would consist of modifications to the database and model construction code to use subsurface oil presence-absence at specific pits as the response variable. For modeling, we would leverage the same statistical/machine learning methods for model construction as previous work to model lingering oil distribution – specifically boosted tree-based classification models implemented via custom code in the R statistical computing language as per Elith et al., (2008).

Objective 2. Synthesize Existing Population and Biomarker Data for Recovering Species

A. Objectives

In Objective 2, we will combine in a similar format and database, and provide initial syntheses of the 1) abundance and distribution and 2) biomarker/health data (Cytochrome P450 and other biomarker data) for all recovering species for which sufficient data are available to provide a meaningful contribution to Objective 4. We will convert these datasets to compatible digital data formats, and assemble within a single geospatial database for analysis. Primarily, this will include sea otters, harlequin ducks, and Barrow's goldeneyes, but we will include available all species for which meaningful data are available.

B. Procedural and Scientific Methods

We will obtain, and process all data described above in single ESRI ArcGIS geodatabase to provide a unified platform for analyses described in the tasks below. This has been accomplished on a test basis already. See Figure 1, for example.

C. Data Analysis and Statistical Methods

All spatial data analyses will be conducted using ESRI ArcGIS v.9.3 or v10.0. No statistical methods are required for this task.

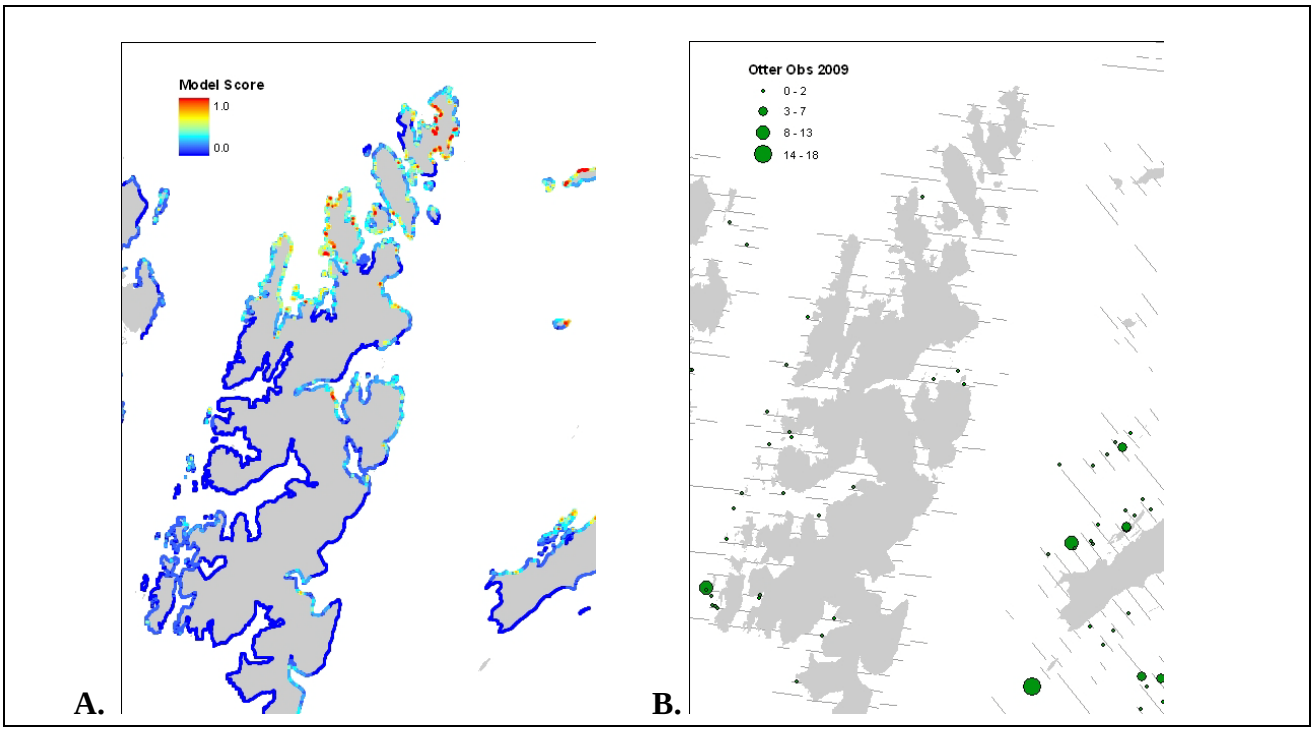


Figure 1. A.) Model output data from Michel et al., (2009) describing predicted lingering subsurface oil distributions, and B.) Unpublished data from Bodkin describing sea otter observations from 2009. These data have been compiled in a common geodatabase for use in geospatial analyses.

Objective 3. Develop or Adapt Intertidal Habitat Preference Models for Recovering Species

A. Objectives

Before we can estimate the degree to which recovering species are responding to the presence or absence of subsurface oil in potential habitat, we must understand how those species would be using habitat without the possible presence of that oil. We will use historical pre-spill population estimates or specific habitat preference modeling approaches to develop simple but quantitative estimates of intertidal and nearshore habitat suitability and use for recovering species at all locations within the study area.

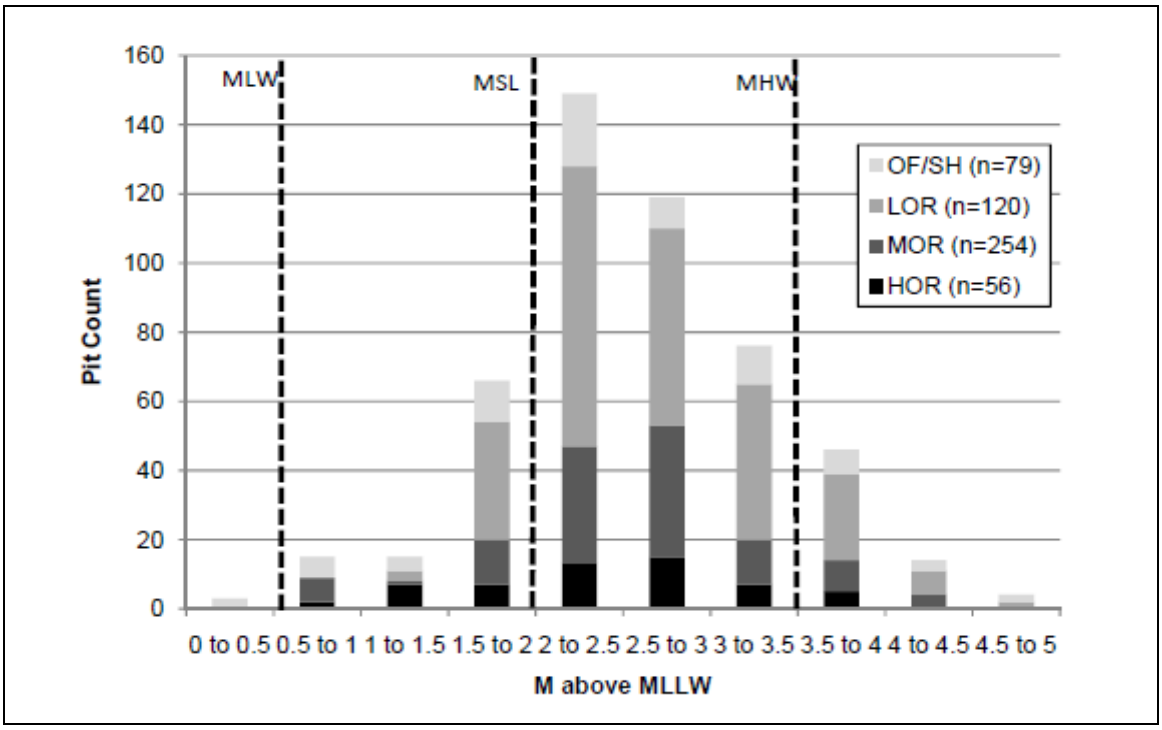
B. Procedural and Scientific Methods

Substantial work has been done to understand the feeding and habitat preferences of recovering species (Colletti, 2006; Esler, et al., 2000). We will develop a synoptic intertidal habitat preference model by integrating this and other previous work with the otter pit location studies carried out in 2008 (Bodkin et al., in review) and intertidal habitat use data from 2004 and 2005 (Bodkin, unpublished). In the 2008 study, the frequency and locations of use of soft-sediment intertidal areas by foraging sea otters was estimated via surveys in Prince William Sound. Specifically, we will use the dataset that describes intertidal habitats in spatial and morphological detail developed previously by Michel et al.,(2009) and adapted in Task 1, combined with the data from Bodkin et al., (in review) to develop a comprehensive understanding of intertidal habitat that is available for use by recovering species. This will allow a classification of all shorelines in the PWS area relative to their suitability for use as intertidal habitat by recovering species. We will also include estimates of use by tidal elevation, as per Figure 2.

C. Data Analysis and Statistical Methods

We will conduct spatial overlays of the data of Bodkin et al., (in review) that describe intertidal habitat use by foraging otters with the intertidal habitat descriptor data developed by Michel et al.,(2009) and modified as described in Task 1 above using Geographic Information Systems (GIS). We will then develop statistical or machine learning models of habitat suitability based on the relationships between these datasets. Guisan and Zimmerman (2000) provide a review of statistical and machine-learning techniques used in habitat modeling. We will conduct quantitative comparisons between multiple modeling techniques to select the model with the highest predictive power, and use this model to classify the shorelines of PWS.

All spatial data analyses will be conducted using ESRI ArcGIS v.9.3 or v10.0. All statistical analyses will be conducting using the R statistical computing language and existing or custom coded extensions.



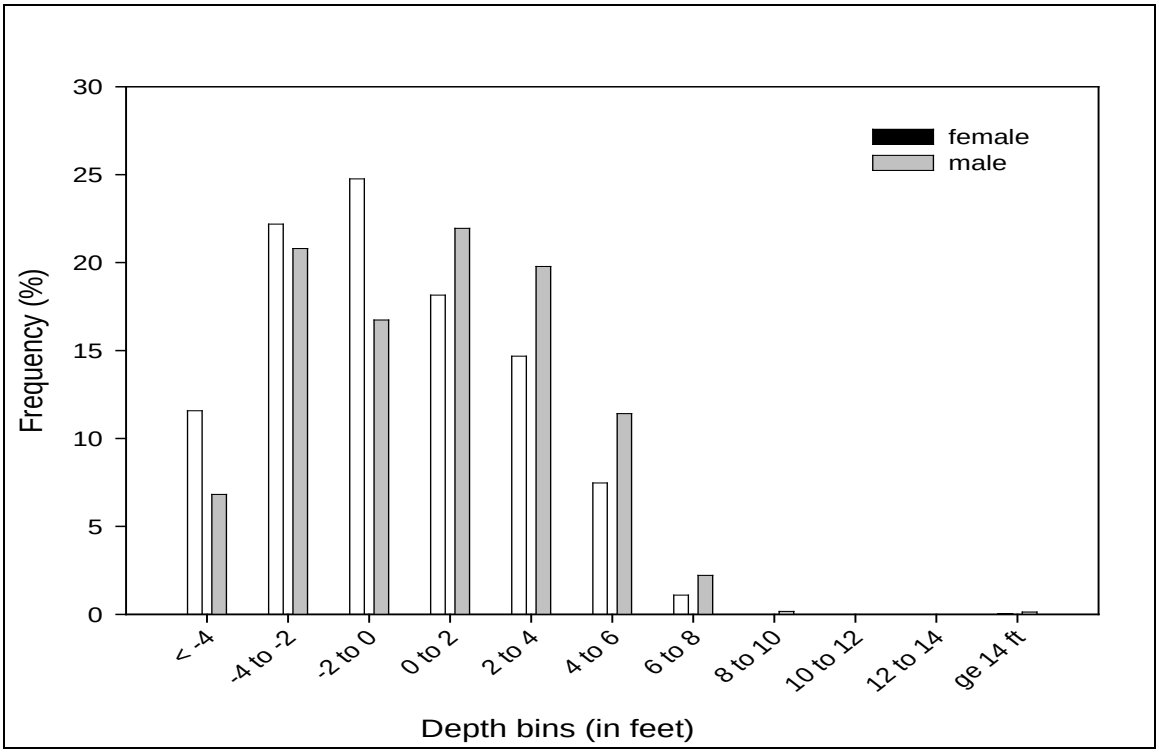


Figure 2. Field data synthesis of subsurface oil by intertidal preference from Michel et al., (2009) and unpublished data from Bodkin describing sea otter foraging in intertidal habitat by tidal elevation.

Objective 4. Evaluate Spatial Patterns in Population Trend, Habitat Use and Health & Exposure Metrics with Modeled Distribution of Remaining Lingering Subsurface Oil

A. Objectives

Examine the relationships between the spatial distribution of the results from the revised pit-wise subsurface oil probability model with the distribution of population and health and exposure metrics of recovering species, as moderated by the presence of suitable intertidal habitat, in PWS. Specifically, we will seek to answer the questions:

- Are recovering species not occupying or utilizing patches of suitable intertidal habitat in certain parts of PWS?
- If so, are the locations of habitat underutilization correlated with locations where lingering subsurface oil is estimated to be present?
- If recovering species are utilizing habitat patches where lingering subsurface oil is estimated to be present, are there statistically measurable spatial correlations with measures of individual exposure and health?

B. Procedural and Scientific Methods

We will use geospatial analysis techniques borrowed from landscape ecology, as informed by spatially explicit exposure modeling techniques (see Purucker et al., 2007, Stromberg et al., 1998) to compare the spatial distribution of recovering species population, and biomarkers or other measures of exposure or individual health, with the modeled and known distribution of lingering subsurface shoreline oiling. This opens up the potential to prioritize continued remediation efforts based on the degree to which areas with lingering oil are both being utilized by, and are likely impacting, recovering species.

C. Data Analysis and Statistical Methods

For analyses of population level effects, we will use landscape ecology techniques to test for correlations between modeled likelihood of lingering oil presence and species presence/absence or abundance while controlling for habitat suitability across the landscape of Prince William Sound. Potential techniques include the use of Mantel tests of distance matrices, non-parametric multiple analysis of variance (NPMANOVA), or analysis of similarity (ANOSIM) methods, as described in Anderson (2001), Clarke (1993) and Sokal and Rohlf (1995). These techniques will allow us to test for differences in recovering species abundance or between different sites with different local probabilities of harboring lingering oil while controlling for differences in local habitat suitability.

For analyses of individual biomarker data, we will conduct parametric or nonparametric modeling of individual health and exposure metrics at particular locations and indexes of local or regional estimated lingering subsurface oil amount and character. We will then conduct tests of significance of model parameters to determine the presence and strength of correlations between health and local lingering oil contamination. In addition to metrics of health or exposure for single recovering species, we will also conduct modeling using joint metrics of available biomarker data across all species.

All spatial data analyses will be conducted using ESRI ArcGIS v.9.3 or v10.0. All statistical analyses will be conducting using the R statistical computing language and existing or custom coded extensions.

D. Description of Study Area

The project will assimilate a variety of datasets describing lingering oil distribution and recovering species abundance, distribution and biomarker/health data. While we have not obtained access to all datasets, and thus do not know their exact spatial extents, these are generally synoptic across all of PWS or western PWS. In general, the footprint of data synthesis will extend from 62.46 degrees to 58.54 degrees north and from -149.33 to -144.89 degrees west.

E. Coordination and Collaboration with Other Efforts

The project directly extends and synthesizes a wide variety of previously funded work of the Trustee Council. Specifically, this work builds upon the lingering oil modeling effort of Michel et al., (2009) and a variety of Trustee Council funded work on the population and health status of recovering species (Bodkin et al., 2010).

In addition, principal investigators from the USGS and the Simon Fraser University (Brenda Ballachey, James, Bodkin, and Dan Esler) are actively working on previously funded ongoing long term monitoring work of the Trustee Council and will derive financial support for their components of this work from those projects. These investigators will generally provide existing digital datasets, methodological review and oversight, and report and publication authorship. These investigators will also be able to assist in the rapid and flexible integration of newly acquired data from long-term monitoring projects into this work.

III. REFERENCES

Anderson, M.J. 2001. A new method for non-parametric multivariate analysis of variance. Austral Ecology 26: 32-46.

Bodkin, J.L., B.E. Ballachey, T.A. Dean, A.K. Fukuyama, S.C. Jewett, L. McDonald, D.H. Monson, C.E. O'Clair, and G.R. VanBlaricom. 2002. Sea otter population status and the process of recovery from the 1989 'Exxon Valdez' oil spill. Marine Ecology Progress Series 241:237-253.

Bodkin, J.L., G.E. Esslinger, and B.E. Ballachey. In review. Trends in sea otter population abundance in western Prince William Sound: Progress toward recovery following the 1989 *Exxon Valdez* oil spill. Exxon Valdez Restoration Project //0808. Draft Final Report.

Bodkin, J.L., J.A. Reed, and B.E. Ballachey. In review. Sea otter use of intertidal habitats relative to the presence of lingering oil in western Prince William Sound. Exxon Valdez Restoration Project //0808. Draft Final Report.

Bodkin, J.L. and M.S. Udevitz. 1994. An intersection model for estimating sea otter mortality along the Kenai Peninsula. In T. R. Loughlin, editor. Marine mammals and the Exxon Valdez. Academic Press, San Diego, USA. Pp. 81-95

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

Boehm, P.D., D.S. Page, J.M. Neff, and C.B. Johnson. 2007. Potential for sea otter exposure to remnants of buried oil from the Exxon Valdez oil spill. Environmental Science and Technology, 41:6860-6867.

Boehm, P.D., D.S. Page, J.M. Neff, and J. S. Brown. 2010. Are sea otters being exposed to subsurface intertidal oil residues from the Exxon Valdez oil spill? Marine Pollution Bulletin

Boufadel M. C., A. Bobo, and Y. Xia. 2011. Feasibility of deep nutrients delivery into a Prince William Sound beach for the bioremediation of the Exxon Valdez oil spill. *Ground Water Monitoring and Remediation*, accepted, 2011.

Clarke, K. R. 1993. Non-parametric multivariate analysis of changes in community structure. Australian Journal of Ecology 18, 117-143

Coastal and Ocean Resources, Inc. (CORI). 2008. ShoreZone Database for Prince William Sound.

Coletti, H.A. 2006. Correlating sea otter density and behavior to habitat attributes in Prince William Sound, Alaska: A model for prediction. M.S. Thesis, University of New Hampshire.

Elith, J., J.R. Leathwick, and T. Hastie. 2008. A working guide to boosted regression trees. Journal of Animal Ecology 77: 802-813.

Esler, D. and S.A. Iverson. 2010. Female harlequin duck winter survival 11 to 14 years after the Exxon Valdez oil spill. Journal of Wildlife Management 74: in press.

Esler, D., B.E. Ballachey, K.A. Trust, S.A. Iverson, J.A. Reed, A.K. Miles, J.D. Henderson, B.W. Wilson, B.R. Woodin, J.J. Stegeman, M. McAdie, and D.M. Mulcahy. Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's Goldeneyes to residual *Exxon Valdez* oil. *In Press*: Mar. Poll. Bull.

Esler D, Bowman TD, Dean TA, O'Clair CE, Jewett SC, McDonald LL. 2000. Correlates of harlequin duck densities during winter in Prince William Sound, Alaska. Condor 102:920–926.

Esler, D., T.D. Bowman, K. Trust, B.E. Ballachey, T.A. Dean, S.C. Jewett, and C.E. O'Clair. 2002. Harlequin duck population recovery following the Exxon Valdez oil spill: progress, process, and constraints. Marine Ecology Progress Series 241:271-286.

Esler, D., J. A. Schmutz, R.L. Jarvis, and D.M. Mulcahy. 2000. Winter survival of adult female harlequin ducks in relation to history of contamination by the Exxon Valdez oil spill. Journal of Wildlife Management 64:839-847.

Esler, D., K.A. Trust, B.E. Ballachey, S.A. Iverson, T.L. Lewis, D.J. Rizzolo, D.M. Mulcahy, A.K. Miles, B.R. Woodin, J.J. Stegeman, J.D. Henderson, and B.W. Wilson. 2010. Cytochrome P4501A biomarker indication of oil exposure in harlequin ducks up to 20 years after the *Exxon Valdez* oil spill. Environ Toxicol Chem 29(5):1138-1145.

Guisan, A. and Zimmerman, N.E., 2000. Predictive habitat distribution models in ecology. Ecological Modelling, 135(2-3): pp. 147-18

Harwell, M.A., Gentile, J.H., Johnson, C.B., Garshelis, D.L., Parker, K.R., 2010. Quantitative ecological risk assessment of sea otters in Prince William Sound, Alaska: toxicological risks from Exxon Valdez subsurface oil residues. Hum. Ecol. Risk Assess. 16, 727–761.

Michel, J., Z. Nixon, M.O. Hayes, J. Short, G. Irvine, D. Betenbaugh, and C. Boring. 2009. Modeling the Distribution of Lingering Subsurface Oil from the Exxon Valdez Oil Spill. Final Report, EVOS Restoration Project 070801.

Monson, D.H., D.F. Doak, B.E. Ballachey, and J.L. Bodkin. Could residual oil from the *Exxon Valdez* spill create a long-term population "*sink"*for sea otters in Alaska? Submitted to: Ecological Applications, January 2011.

Purucker, S.T., C.J.E. Welch, R.N. Stewart., and P. Starzec. 2007. Use of habitat-contamination spatial correlation to determine when to perform and spatially explicit ecological risk assessment. Ecological Modelling, 204:180-192.

Short, J.W., M.R. Lindeberg, P.M. Harris, J.M. Maselko, J.J. Pella, and S.D. Rice. 2004. Estimate of oil persisting on the beaches of Prince William Sound 12 years after the Exxon Valdez oil spill. Environmental Science & Technology 38(1):19-25.

Short, J.W., J.M. Maselko, M.R. Lindeberg, P.M. Harris, and S.D. Rice. 2006. Vertical distribution and probability of encountering intertidal Exxon Valdez oil on shorelines of three embayments within Prince William Sound, Alaska. Environmental Science & Technology 40:3723-3729.

Sokal, R. R., & Rohlf, F. J. 1995. Biometry, 3rd edn. New York: Freeman.

Spromberg, J. A., B. M. John and W. G. Landis. 1998. Metapopulation dynamics: indirect effects and multiple discrete outcomes in ecological risk assessment. Environ. Toxicol. Chem. 17:1640-1649.

IV. SCHEDULE

A. Project Milestones

Objective 1. Revise existing synoptic subsurface oil presence model.
To be met by December 2011

Objective 2. Synthesize existing population and biomarker data for recovering species.
To be met by March 2012

Objective 3. Develop or adapt intertidal habitat preference models for recovering species.
To be met by June 2012

Objective 4. Evaluate spatial patterns in population trend, habitat use and health and exposure metrics with modeled distribution of remaining lingering subsurface oil.
To be met by September 2012

B. Measurable Project Tasks

We present proposal tasks by fiscal year quarter below.

FFY 12, 1st quarter (October 1, 2012-December 31, 2012)

October 1:	*Begin planning and acquiring population/biomarker data*
October 7:	*Acquire additional data required to revise model*
December 20:	*Complete revised model*

FFY 12, 2nd quarter (January 1, 2012-March 31, 2012)

January 7:	*Submit revised model output. This will consist of ESRI shapefile or geodatabase and FGDC-compliant metadata*
February 1:	*Begin assembling synthesis database*
March 1:	*Complete database, begin habitat preference modeling*

FFY 12, 3rd quarter (April 1, 2012-June 30, 2012)

June 1:	*Complete habitat preference modeling / Begin synthesis*

FFY 12, 4th quarter (July 1, 2012-September 30, 2012)

August 15:	*Complete synthesis*
September 30:	*Submit final report. This will consist of a draft manuscript for publication to the Trustee Council Office.*

V. INFORMATION REQUESTED ON THE ORGANIZATION

1. Information on Consortium or Organization

a. Years in existence – Research Planning, Inc. was founded in 1990.

b. Current and future sources of funding – NOAA, National Park Service, Department of Justice, SC Department of Health and Environmental Control, BOEM, State of Florida, USAID, Presidency of Meteorology and Environment, Saudi Arabia

c. Current staff size by area of expertise (e.g., science management, administration, IT, etc.) – Scientists: 15; GIS/IT: 10; Administration: 4

d. Audited financial statement covering past three years: Unaudited financial statements attached as Appendix A.

e. Information about facility, including location, ownership, authority to use, size, and resources available: 13,300 ft2 building under long-term lease in Columbia, SC.

f. The proposal and related activities are consistent with the founding, authorizing documentation of our organization.

g. Number of members of existing science or technical review panel = 0

h. Number of members of existing public advisory committee or mechanism for public involvement = 0

i. Name and resume of the Team Leader and any key staff. This should include a summary of the experience of the Team Leader in managing large and complex scientific programs: Zach Nixon and Jacqueline Michel, resumes attached.

j. We have excellent capabilities of existing IT infrastructure to make data and reports publically available.

2. Experience with EVOSTC Program

a. Amount of funding received from EVOSTC programs currently or in the past and listing of projects funded – Project 070801 - $1,296,000; Project 050788 - $45,000.

b. We have read and clearly understand the Council's founding documents and related policies and procedures. There are no conflicts between the Council's policies and procedures and RPI's.

3. Current Focus Areas and Funding Sources

a. Listing of current focus areas and amount of funds released for each area – Sensitivity Mapping, Spill Response, Training for ERD, NOAA = $3,675,000

Natural Resource Damage Assessment = $125,000
Coastal and Watershed Restoration = $1,250,000

b. Experience with Invitation area(s) addressed in the proposal. This should include the total amount of funding that has been released for the program area of interest.

RPI has been working on the Lingering Oil project for the EVOSTC since 2005, with EVOSTC funding of $1,340,000.

4. Collaboration/Coordination

a. RPI staff have been working with state, federal, and private entities to complete projects since 1978. We have been under contract to NOAA ERD since 1978 as part of the NOAA Scientific Support Team. We also have been under contract to NOAA ARD since 1991. We have been working with the State of Florida since the early 1990s.

b. RPI has some experience working with local and tribal communities in the spill area, in that we hired local tribal members to be on our field surveys.

c. Outreach plan that details the types of outreach envisioned and the audience for each type – N/A because this is a desktop study using existing data.

JACQUELINE MICHEL, PH.D.
President, Research Planning, Inc.
1121 Park Street, Columbia, SC
jmichel@researchplanning.com; 803-256-7322

EDUCATION

Ph.D., Department of Geology, University of South Carolina (USC), Columbia (1980).
M.S., Department of Geology, USC, Columbia (1976).
B.S., Department of Geology, USC, Columbia (1974)

CURRENT ACTIVITIES

Dr. Michel is an internationally recognized expert in oil and hazardous materials spill planning and response with a primary focus in the areas of oil fates and effects, non-floating oils, shoreline cleanup, alternative response technologies, and natural resource damage assessment. Much of her expertise is derived from her role, since 1978, as part of the Scientific Support Team to the U.S. Coast Guard provided by the National Oceanic and Atmospheric Administration (NOAA). Under this role, she is on 24-hour call and provides technical support for an average of 50 spill events per year. She leads shoreline assessment teams and assists in selecting cleanup methods to minimize the environmental impacts of the spill. She has evaluated and used a wide range of alternative response technologies, including surface washing agents, solidifiers, bioremediation agents, *in situ* burning (mostly on wetlands and inland habitats), and methods to track and recover non-floating oils. She has been the NOAA Shoreline Cleanup Assessment Technique (SCAT) Coordinator in Louisiana since April 2010.

Dr. Michel also has extensive expertise in natural resource damage assessment (NRDA). She is part of the NOAA Damage Assessment Center's Rapid Assessment Program, and since 1985, she has conducted NRDAs for numerous spills in the U.S. She assisted NOAA in preparing two guidance documents on how to conduct the preassessment and injury assessment phases of NRDAs under the Oil Pollution Act of 1990.

SELECTED PUBLICATIONS

Michel, J., Z. Nixon, M.O. Hayes, J. Short, G. Irvine, D. Betenbaugh, C. Boring, and D. Mann. 2010. Distribution of subsurface oil from the *Exxon Valdez* oil spill. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 070801), National Oceanic and Atmospheric Administration, Juneau, AK. 121 pp. + app.

Michel, J., Z. Nixon, and L. Cotsapas. 2006. Evaluation of oil remediation technologies for lingering oil from the *Exxon Valdez* oil spill in Prince William Sound, Alaska. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 050778), National Marine Fisheries Service, NOAA, Juneau, AK, 47 pp. + appendices.

Michel, J. and M.O, Hayes. 1999. Weathering patterns of oil residues eight years after the *Exxon Valdez* oil spill. Marine Pollution Bull. 38: 855-863.

Hayes, M.O. and J. Michel. 1999. Factors determining the long-term persistence of *Exxon Valdez* oil in gravel beaches. Marine Pollution Bull. 38:92-101.

ZACHARY J. NIXON
Geospatial Analyst
Research Planning, Inc.
1121 Park St.
Columbia SC 29205znixon@researchplanning.com

EDUCATION

Duke University, Durham North Carolina - Master of Environmental Management, 2006
University of South Carolina, Columbia, S.C - B.S., Marine Science, 1997

PROFESSIONAL EXPERIENCE

Mr. Nixon specializes in bringing statistical and analytical rigor to natural resource mapping and damage assessment via the use of Geographic Information Systems (GIS), geostatistics, spatial and multivariate ecology, and applied quantitative analysis. As part of RPI's team since 1996, Mr. Nixon has extensive experience in the development of unique and advanced analytic and statistical techniques and tools for damage assessments and geomorphic and ecological mapping. He has participated in multiple natural resource damage assessments for oil spills in from the Gulf Coast to Alaska. In addition to his work on lingering oil in Prince William Sound, he developed advanced spatially and temporally explicit population models for bird populations in Delaware Bay. Recently, Mr. Nixon led the technical team in developing ecological and habitat components of the United Arab Emirates Coastal Environmental Atlas database, developed analysis tools for projects in the Great Lakes, and been working actively in shoreline oiling data management and advanced analyses for the Mississippi Canyon 252/Deepwater Horizon Spill response.

SELECTED PUBLICATIONS

Michel, J, Z. Nixon, J. Dahlin, D. Betenbaugh, M. White, D. Burton, and S Turley. 2009. Recovery of Interior Brackish Marshes Seven Years After the Chalk Point Oil Spill. Marine Pollution Bulletin. Manuscript submitted for publication.

Michel, J., Z. Nixon, M.O. Hayes, J. Short, G. Irvine, D. Betenbaugh, and C. Boring. 2009. Modeling the Distribution of Lingering Subsurface Oil from the Exxon Valdez Oil Spill. Final Report, EVOS Restoration Project 070801.

Nixon, Z., 2008. Predictive Modeling of Storm-Generated Marine Debris. Poster session presented at: 2008 Mississippi – Alabama Bays and Bayous Symposium, Biloxi, MS.

Nixon, Z., 2008. Modeling Storm-Generated Marine Debris. Poster session presented at: 2008 NOAA Marine Debris Information Forum, Bethesda, MD..

Nixon, Z., Michel, J., Hoff, J. Forsell, D., Krest, S., Hossler, R., Clark, K., Nichols, T. and J. Dunn. 2008. Estimating Bird Injury From the M/T Athos Spill. Proc. In: 2008 International Oil Spill Conference, American Petroleum Institute.

Michel, J., Nixon, Z., and Cotsapas, L. 2005. Evaluation of Oil Remediation Technologies for Lingering Oil from the Exxon Valdez Oil Spill in Prince William Sound, Alaska. Exxon Valdez Oil Spill Restoration Project Report #050778

Henry, C., R. Pavia, S., Zengel, Z. Nixon, C. Locke, and K. Debusschere. 2003. Developing Contingency Planning Tools to Address Wetland Loss, Ageing Infrastructure, and Oil Spill

Risk in Louisiana. In: Proc. 2003 International Oil Spill Conference, American Petroleum Institute.

Michel, J., Z. Nixon, and H. Hinkeldey. 2003. Use of *in situ* burning as an oil spill response tool: Follow-up of four case studies. In: Proc. 2003 International Oil Spill Conference, American Petroleum Institute.

Zengel, S., Z. Nixon, C. Plank, J. Hanifen, D. Sa, and D. Braud, 2002. Environmental Sensitivity Mapping and GIS: the Louisiana G-WIS Database. In: Fourth Biennial Freshwater Spills Symposium. EPA, Cleveland OH.

Michel, J., Z. Nixon, and H. Hinkledey. 2002. Recovery of Four Oiled Wetlands Subjected to *In Situ* Burning. API Publ. No., American Petroleum Institute, Washington, D.C., 71 pp.

Zengel, S., Z. Nixon, and J. Hanifen. 2001. Louisiana Gulf-Wide Information System: coastal habitats, wildlife, and fisheries components. Invited Presentation, 17th Annual Louisiana Remote Sensing and GIS Conference, Baton Rouge, Louisiana.

Zengel, S. and Z. Nixon. 2001. Louisiana Gulf-Wide Information System: Environmental Sensitivity Index Components. CleanGulf '01, Proceedings, abstract.

BRENDA E. BALLACHEY
Research Physiologist
U.S. Geological Survey, Alaska Science Center
4210 University Drive
Anchorage, Alaska 99508
(403)288-9184bballachey@usgs.gov or bballachey@shaw.ca

EDUCATION

Oregon State University, Corvallis, Oregon - Ph.D., 1985
Colorado State University, Fort Collins, Colorado - M.S., 1980
Colorado State University, Fort Collins, Colorado - B.S. with distinction, 1974

PROFESSIONAL EXPERIENCE

Research Physiologist
Alaska Biological Science Center, U.S. Geological Survey, Anchorage, AK
(Formerly National Biological Service; Fish & Wildlife Service)
July 1990 to present: *Research focus on the identification and understanding of chronic or long-term population and ecosystem level effects of contaminants in the nearshore marine environment, addressing species and ecosystems of high interest to the U.S. Department of the Interior as part of a multi-disciplinary team.*

General Biologist
Alaska Fish and Wildlife Research Center, U.S. Fish and Wildlife Service, Anchorage, AK
November 1989 to July 1990: *Research on sea otters, with emphasis on studies of acute and chronic effects of the Exxon Valdez oil spill on the sea otters.*

Staff Officer
Board on Agriculture, National Research Council (NRC), Washington, DC, USA
March 1987 to November 1989: *Worked with Committee on Managing Global Genetic Resources to assess genetic diversity in agricultural species, including crops, livestock, forests and fisheries. March 1987 to June 1989, hired by the US Department of Agriculture, assigned to the NRC. July to November 1989, consultant to the NRC.*

SELECTED PUBLICATIONS

Ballachey, B.E., J. L. Bodkin, and A. R. DeGange. 1994. An Overview of Sea Otter Studies. Chapter 3 in Marine Mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Ballachey, B.E., J.L. Bodkin, S. Howlin, A.M. Doroff and A.H. Rebar. 2003. Survival of juvenile sea otters in Prince William Sound, Alaska, 1992-93. Cdn. Jnl. Zoology

Bodkin, J.L. and B.E. Ballachey. 1996. Monitoring the status of the wild sea otter population: field studies and techniques. Endangered Species Update 13(12):14-19.

Bodkin, J.L. and B.E. Ballachey. 2010. Modeling the effects of mortality on sea otter populations. Scientific Investigations Report 2010-5096. U.S. Geological Survey. 12 p.

Bodkin, J.L., B.E. Ballachey, T.A. Dean, S. Jewett, L. McDonald, D. Monson, C. O'Clair, and G. VanBlaricom. 2002. Recovery of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. Mar. Ecol. Prog. Ser. 241:237-253.

Esler, D., B.E. Ballachey, K.A. Trust, S.A. Iverson, J.A. Reed, A.K. Miles, J.D. Henderson, B.W. Wilson, B.R. Woodin, J.J. Stegeman, M. McAdie, and D.M. Mulcahy. 2011.

Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's Goldeneyes to residual *Exxon Valdez* oil. *In Press*: Mar. Poll. Bull.

Esler, D., T.D. Bowman, K.A. Trust, B.E.Ballachey, T.A. Dean, S.C. Jewett and C.E. O'Clair. 2002. Harlequin duck population recovery following the *Exxon Valdez* oil spill: progress, process and constraints. Mar. Ecol. Prog. Ser. 241:271-286.

Esler, D., K.A. Trust, B.E. Ballachey, S.A. Iverson, T.L. Lewis, D.J. Rizzolo, D.M. Mulcahy, A.K. Miles, B.R. Woodin, J.J. Stegeman, J.D. Henderson, and B.W. Wilson. 2010. Cytochrome P4501A biomarker indication of oil exposure in harlequin ducks up to 20 years after the *Exxon Valdez* oil spill. Environ Toxicol Chem 29(5):1138-1145.

Lannan, J.E., G.A.E. Gall, J.E. Thorpe, C.E. Nash, and B.E. Ballachey. 1989. Genetic resource management of fish. Genome 31(2):798-804.

Larson, S.D., D. Monson, B.E. Ballachey, R. Jameson, and S.K. Wasser. 2008. Stress-related hormones and genetic diversity in sea otters (*Enhydra lutris).* Mar Mamm Sci 25(2):351-372.

Lipscomb, T.P., R.K. Harris, R.B. Moeller, J.M. Pletcher, R.J. Haebler and B.E. Ballachey. 1993. Histopathologic lesions in sea otters exposed to crude oil. Vet. Path. 30:1-11.

Lipscomb, T.P., R.K. Harris, A.H. Rebar, B.E. Ballachey and R.J. Haebler. 1994. Pathology of Sea Otters. Chapter16 in Marine Mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Loughlin, T.R., B.E. Ballachey and B. Wright. 1996. Overview of studies to determine injury caused by the *Exxon Valdez* oil spill to marine mammals. *In* Rice, S.D., R.B. Spies, D.A. Wolfe and B.A. Wright, Eds. Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium Number 18:798-808.

Monson, D.H., D.F. Doak, B.E. Ballachey, and J.L. Bodkin. In review. Could residual oil from the *Exxon Valdez* spill create a long-term population "*sink"*for sea otters in Alaska? *Submitted to:* Ecolog Applic, January 2011.

Monson, D.H., D.F. Doak, B.E. Ballachey, A. Johnson and J.L. Bodkin. 2000. Long-term impacts of the *Exxon Valdez* oil spill on sea otters assessed through age-dependent mortality patterns. Proc. Natl. Acad. Sci., USA 97:6562-6567.

Monson, D.H., C. McCormick and B.E. Ballachey. 2001. Chemical anesthesia of northern sea otters: results of past field studies. J. Zoo Wild. Med. 32:181-189.

Mulcahy, D.M and B.E. Ballachey. 1994. Hydrocarbon residues in sea otters. Chapter 18 in Marine mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, and D.B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302:2082-2086.

Ricca, M.A., A.K. Miles, B.E. Ballachey, J.L. Bodkin, D.E. Esler, and K.A. Trust. 2010. PCB exposure in sea otters and harlequin ducks in relation to history of contamination by the *Exxon Valdez* oil spill. Mar Poll Bull 60(6):861-872.

Rebar, A.H., T.P. Lipscomb, R.K. Harris and B.E. Ballachey. 1995. Clinical and clinical laboratory correlates in sea otters dying acutely in rehabilitation centers. Vet. Clin. Path. 32:346-350.

JAMES L. BODKIN
Project Leader, Research Wildlife Biologist
U.S. Geological Survey, Alaska Science Center
616 Marrowatone Pt. Rd, Nordland, WA 98568
Phone: 907 748 4367
Fax: 360 390 5611
James_Bodkin@usgs.gov

EDUCATION

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

CURRENT ACTIVITIES

I lead the Alaska sea otter research project and the coastal ecosystems team of the Alaska Science Center, US Geological Survey. Research is organized into three programs: 1) Sea otter population assessment, 2) Processes structuring coastal ecosystems and, 3) Effects and status of recovery of the nearshore ecosystem from the 1989 Exxon Valdez oil spill in Prince William Sound. Each of these programs consists of several independent research projects. I supervise and manage all activities associated with this complex and diverse array of research projects internal to the Alaska Science Center and collaborate with at least 14 agencies, academic or private institutions on cooperative, multi-disciplinary projects. I lead a scientific team of six, and manage annual budgets of about $800,000 that include USGS and cyclic funds. I also lead the Coastal Marine Ecosystem Team, a multi-disciplinary research effort investigating coastal ecosystems in the North Pacific. Coastal Marine Ecosystem Team research programs, in addition to sea otters include; benthic habitat classification, biological and physical oceanography, seabirds and other marine mammals, marine invertebrates, and marine fishes.

SELECTED PUBLICATIONS

Bodkin, J.L., and B.E. Ballachey. 2010. Modeling the effects of mortality on sea otter populations. USGS Scientific Investigation Report 2010-5096. 12p.

Estes, J.A. M.T. Tinker, and J.L. Bodkin. 2009. Using ecological function to develop recovery criteria for depleted species: Sea otters and kelp forests in the Aleutian Archipelago. Conservation Biology 24(3):852-860.

Bodkin, J.L., D.H. Monson, and G.G. Esslinger. 2007. Population status and activity budgets derived from time-depth recorders in a diving mammal. J. Wildlife Management 71(6):2034-2044.

Estes, J.A., J.L. Bodkin, and M Ben-David. 2008. Marine Otters. In W.F. Perrin, B. Wursig,, J.G.M. Thewissen and C.R. Crumly (eds) Encyclopedia of Marine Mammals, 2nd Edition. Academic Press.

Iverson, S.J., A.M. Springer, and J.L. Bodkin 2007. Strategies for survival: Marine Mammals. Pages 114-131, *in* Robert Spies (ed.). Long term ecosystem change in the northern Gulf of Alaska. Elsevier, Amsterdam, the Netherlands.

Springer, A.S., S. J. Iverson and J.L. Bodkin. 2007. Marine Mammal Populations. Page 352-375, *in* Robert Spies (ed.). Long term ecosystem change in the northern Gulf of Alaska. Elsevier, Amsterdam, the Netherlands.

Laidre, K.L., J. A. Estes, M. T. Tinker, J. Bodkin, D. Monson, and K. Schneider. 2006. Patterns of growth and body condition in sea otters from the Aleutian archipelago before and after the recent population decline. J. Animal Ecology 75:978-989.

Tinker, T.M., D.F. Doak, J.A. Estes, B.H. Hatfield, M.M. Staedler, J.L. Bodkin. 2006. Incorporating diverse data and realistic complexity into demographic estimation procedures: a case study using the California sea otter, *Enhydra lutris nereis*. Ecological Applications 16(6):2293-2312.

Lowry, L.L. and J.L. Bodkin. 2005. Marine Mammals, in. Phillip R. Mundy (ed.). The Gulf of Alaska: Biology and Oceanography. Alaska Sea Grant College Program, University of Alaska Fairbanks. pp 99-116.

Bodkin, J.L., G.G. Esslinger and D.H. Monson. 2004. Foraging depths of sea otters and implications to coastal marine communities. Marine Mammal Science 20(2):305-321.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, D.B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302:2082-2086.

Ballachey, B.E., J.L. Bodkin, S. Howlin, A.M. Doroff, and A.H. Rebar. 2003. Correlates to survival of juvenile sea otters in Prince William Sound, Alaska. Canadian J. Zoology 81:1494-1510.

Bodkin, J.L. 2003. Sea Otter. Pages 735-743, in Feldham. G. A., B.C. Thompson, and J.A. Chapman (eds), Wild Mammals of North America, 2nd edition. Johns Hopkins University Press, Baltimore. 735-743

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

DAN ESLER
Centre for Wildlife Ecology
Simon Fraser University
5421 Robertson Road, RR 1
Delta, BC V4K 3N2 Canada
(604) 940-4652
desler@sfu.ca

EDUCATION:

2000 Ph.D. Wildlife Science. Oregon State University, Corvallis, Oregon, USA.
1988 M.Sc. Wildlife Ecology. Texas A&M University, College Station, Texas, USA.
1985 B.Sc. Biology/Outdoor Education. Northland College, Ashland, Wisconsin, USA.

PROFESSIONAL EXPERIENCE:

February 2001 - present	University Research Associate and Adjunct Professor, Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, British Columbia
March 1993 - February 2001	Research Wildlife Biologist, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska
March 1990-Feb 1993	Wildlife Research Biologist, Alaska Fish and Wildlife Research Center, U.S. Fish and Wildlife Service, Anchorage, Alaska

SELECT PUBLICATIONS:

Esler, D., B. E. Ballachey, K. A. Trust, S. A. Iverson, J. A. Reed, A. K. Miles, J. D. Henderson, B. W. Wilson, B. R. Woodin, J. R. Stegeman, M. McAdie, and D. M. Mulcahy. In press. Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's goldeneye to residual *Exxon Valdez* oil. Marine Pollution Bulletin: in press.

Mulcahy, D. M., and **D. Esler**. In press. Survival of captive and free-ranging harlequin ducks (*Histrionicus histrionicus*) following surgical liver biopsy. Journal of Wildlife Diseases: in press.

Esler, D., K. A. Trust, B. E. Ballachey, S. A. Iverson , T. L. Lewis, D. J. Rizzolo, D. M. Mulcahy, A. K. Miles, B. R. Woodin, J. J. Stegeman, J. D. Henderson, and B. W. Wilson. 2010. Cytochrome P4501A biomarker indication of oil exposure in harlequin ducks up to 20 years after the Exxon Valdez oil spill. Environmental Toxicology and Chemistry 29:1138-1145.

Ricca, M. A., A. K. Miles, B. E. Ballachey, J. L. Bodkin, **D. Esler**, and K. A. Trust. 2010. PCB exposure in sea otters and harlequin ducks in relation to history of contamination by the *Exxon Valdez* oil spill. Marine Pollution Bulletin 60:861-872.

Iverson, S. A., and **D. Esler**. 2010. Harlequin duck population dynamics following the 1989 Exxon Valdez oil spill: assessing injury and projecting a timeline to recovery. Ecological Applications 20:1993-2006.

Esler, D., and S. A. Iverson. 2010. Female harlequin duck winter survival 11 to 14 years after the *Exxon Valdez* oil spill. Journal of Wildlife Management 74:471-478.

Iverson, S. A., and **D. Esler**. 2006. Site fidelity and the demographic implications of winter movements by a migratory bird, the harlequin duck. Journal of Avian Biology 37:219-228.

Iverson, S. A., **D. Esler**, and D. J. Rizzolo. 2004. Winter philopatry of harlequin ducks in Prince William Sound, Alaska. Condor 106:711-715.

Peterson, C. H., S. D. Rice, J. W. Short, **D. Esler**, J. L. Bodkin, B. A. Ballachey, and D. B. Irons. 2003. Long-term ecosystem response to the *Exxon Valdez* oil spill. Science 302:2082-2086.

Esler, D., T. D. Bowman, K. Trust, B. E. Ballachey, T. A. Dean, S. C. Jewett, and C. E. O'Clair. 2002. Harlequin duck population recovery following the Exxon Valdez oil spill: progress, process, and constraints. Marine Ecology Progress Series 241:271-286.

Esler, D., T. D. Bowman, T. A. Dean, C. E. O'Clair, S. C. Jewett, and L. L. McDonald. 2000. Correlates of harlequin duck densities during winter in Prince William Sound, Alaska. Condor 102:920-926.

Esler, D., T. D. Bowman, C. E. O'Clair, T. A. Dean, and L. L. McDonald. 2000. Densities of Barrow's goldeneyes during winter in Prince William Sound, Alaska in relation to habitat, food, and history of oil contamination. Waterbirds 23:425-431.

Esler, D., D. M. Mulcahy, and R. L. Jarvis. 2000. Testing assumptions for unbiased estimation of survival of radio-marked harlequin ducks. Journal of Wildlife Management 64:591-598.

Esler, D., J. A. Schmutz, R. L. Jarvis, and D. M. Mulcahy. 2000. Winter survival of adult female harlequin ducks in relation to history of contamination by the Exxon Valdez oil spill. Journal of Wildlife Management 64:839-847.

Trust, K. A., **D. Esler,** B. R. Woodin, and J. J. Stegeman. 2000. Cytochrome P450 1A induction in sea ducks inhabiting nearshore areas of Prince William Sound, Alaska. Marine Pollution Bulletin 40:397-403.

Lanctot, R., B. Goatcher, K. Scribner, S. Talbot, B. Pierson, **D. Esler**, and D. Zwiefelhofer. 1999. Harlequin duck recovery from the Exxon Valdez oil spill: a population genetics perspective. Auk 116:781-791.

Mather, D. D., and **D. Esler**. 1999. Evaluation of bursal depth as an indicator of age class of harlequin ducks. Journal of Field Ornithology 70:200-205.

Mulcahy, D. M., and **D. Esler**. 1999. Surgical and immediate postrelease mortality of harlequin ducks implanted with abdominal radio transmitters with percutaneous antennae. Journal of Zoo and Wildlife Medicine 30:397-401.

Mulcahy, D. M., **D. Esler**, and M. K. Stoskopf. 1999. Loss from harlequin ducks of abdominally implanted radio transmitters equipped with percutaneous antennas. Journal of Field Ornithology 70:244-250.

BUDGET JUSTIFICATION

I. PERSONNEL: amount requested - $157,112

This work will involve extensive work by RPI employees. We have developed detailed costs by task. A summary of the level of effort for each RPI employee is shown below. Personnel cost is calculated using RPI's approved GSA/NOAA rates.

Jacqueline Michel, PI (Geochemist) = 6 days
Zach Nixon, PI (Geospatial Analyst) = 120 days
Lincoln Smith (GIS Analyst) = 120 days

II. TRAVEL: amount requested - $5,350

Airfare is included for one (1) trip by RPI staff from Columbia, SC to Anchorage, AK, and one (1) trip by RPI staff from Chicago, IL to Anchorage, AK, to present the results to the EVOS Trustee Council.

Per diem for 10 days is included in the budget to cover hotel and meal expenses for the out-of-town RPI team members to cover such costs during travel to Anchorage for presentation to the EVOS Trustee Council.

Ground transportation is included for transport of the RPI staff while in Anchorage, AK.

III. CONTRACTUAL: amount requested - $-0-

IV. COMMODITIES: amount requested - $-0-

V. EQUIPMENT: amount requested - $-0-

VI. INDIRECT COSTS: amount requested - $-0-

VII. OTHER CONTRACTUAL INFORMATION:

RPI has completed the certification in CCR online at https://orca.bpn.gov

Budget Category:	Proposed FY 12	TOTAL PROPOSED
Personnel	$157,112.4	$157,112.4
Travel	$5,350.0	$5,350.0
Contractual	$0.0	$0.0
Commodities	$300.0	$300.0
Equipment	$0.0	$0.0
Indirect *(will vary by proposer)*		
SUBTOTAL	$162,762.4	$162,762.4
General Administration (9% of subtotal)	$14,648.6	$14,648.6
PROJECT TOTAL	$177,411.0	$177,411.0
Other Resources (Cost Share Funds)	$0.0	$0.0

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

FY12

Project Title: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species
Lead PI: J. Michel & Z. Nixon

FORM 4A
NON-TRUSTEE
AGENCY SUMMARY

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
J. Michel	PI (Geochemist)		0.3	35152.0		9,842.6
Z. Nixon	PI (Geospatial Analyst)		5.5	15380.5		85,208.0
L. Smith	GIS Analyst		5.5	11202.5		62,061.9
						0.0
						0.0
						0.0
						0.0
	Subtotal		11.4	61735.0	0.0	
					Personnel Total	$157,112.4

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
Airfare Chicago - AK	800.0	1	5	285.0	2,225.0
Airfare Cola - AK	1200.0	1	5	285.0	2,625.0
Ground Transportation			5	100.0	500.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5,350.0

FY12

Project Title: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species
Lead PI: J. Michel & Z. Nixon

FORM 4B PERSONNEL & TRAVEL DETAIL

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

Commodities Costs:		Commodities
Description		Sum
Printing/Reproduction - Reports		100.0
Phone/Mail/Misc		200.0
	Commodities Total	$300.0

FY12	**Project Title: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species** **Lead PI: J. Michel & Z. Nixon**	**FORM 4B CONTRACTUAL & COMMODITIES DETAIL**

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

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY12	**Project Title: Spatial synthesis of lingering oil distribution modeling with population and biomarker data for recovering species** **Lead PI: J. Michel & Z. Nixon**	**FORM 4B** **EQUIPMENT DETAIL**

Appendix A

Unaudited Financial Statement Covering Past Three Years

Research Planning, Inc.
Balance Sheet
12/31/2009
Unaudited

Assets	2009	2008	2007
Cash	319,838	8,486	24,124
Accounts Receivable	423,776	753,151	436,316
Prepaid Expense	2,800	2,800	2,800
Deposits	9,050	9,050	9,050
Prepaid Taxes	0	0	1,000
Equipment (less Depreciation)	66,546	72,546	78,546
Due from RPI LA	0	0	0
Total Assets	822,010	846,033	551,836
Liabilities			
Accounts Payable	59,935	83,915	74,231
Salaries Payable	118,043	65,253	50,690
Line of Credit	0	128,000	0
Income Tax Liability	0	5,390	0
Lease	0	0	0
Prepaids	0	0	0
Other Payables	0	115,000	0
Total Liabilities	177,978	397,558	124,921
Stockholders Equity			
Common Stock	1,000	1,000	1,000
Current Year Earnings	195,557	21,560	97,948
Retained Earnings	447,475	425,915	327,967
Total Stockholders Equity	644,032	448,475	426,915
Total Liabilities & Stockholders Equity	822,010	846,033	551,836

Research Planning, Inc.
Income Statement
Twelve Months Ended December 31, 2009
Unaudited

	12/31/2009	12/31/2008	12/31/2007
Revenue	2,680,140	1,987,335	2,810,345
Interest Income	0	0	0
Total Revenue	2,680,140	1,987,335	2,810,345
Direct Expense			
Salary	804,472	583,828	605,192
Travel, Food, Lodging	182,422	152,337	221,016
Office & Equipment Rental	3,123	20,206	305,356
Field, Lab, & Other Supplies	24,740	11,828	34,866
Consulting & Contract Labor	79,724	72,822	442,356
Printing & Reproduction	15,657	43,974	25,426
Computer Services/Data	0	74	100
Other	15,956	12,937	6,989
Total Direct Expense	1,126,094	898,006	1,641,301
Gross Margin	1,554,046	1,089,329	1,169,044
General & Administrative Expense			
Salaries & Fringe	517,229	745,568	648,398
Fringe	242,267		
Supplies	63,216	12,044	34,898
Communications	37,290	35,511	33,423
Utilities	15,358	15,603	16,466
Repairs & Maintenance	30,689	24,968	36,652
Building & Equipment Rental	188,107	182,199	149,876
Depreciation	6,000	6,000	6,000
Interest/Fees	809	10,411	5,979
Legal & Accounting	834	810	780

Sepp Match	77,736	0	58,090
Other	74,188	29,265	30,850
Total G&A Expense	1,253,724	1,062,379	1,021,412
Pre-tax Income	300,323	26,950	147,632
Income Taxes	(104,766)	(5,390)	(49,684)
Net Income	195,557	21,560	97,948