

Trustee Council Use Only

Project No: _____

Date Received: _____

GEM PROPOSAL SUMMARY PAGE

(To be filled in by proposer)

Project Title: Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 2004

Project Period: October 1st to September 30th, 2004 (FY 04)

Proposer(s): David B. Irons, Migratory Bird Management, U. S. Fish and Wildlife Service

Study Location: Prince William Sound, Alaska

Abstract: We propose to conduct small boat surveys to monitor abundance of marine birds and sea otters (*Enhydra lutris*) in Prince William Sound, Alaska during March and July 2004. Seven previous surveys have monitored population trends for >65 bird and 8 marine mammal species in Prince William Sound after the *Exxon Valdez* oil spill. We will use data collected in 2004 to examine trends from summer 1989-2004 and from winter 1990-2004 by determining whether populations in the oiled zone changed at the same rate as those in the unoiled zone. We will also examine overall population trends for the Sound from 1989-2004. Due to the lack of data prior to the *Exxon Valdez* oil spill, continued monitoring of marine birds and sea otters is needed to determine whether populations injured by the spill are recovering. Data collected in 2000 indicated that bald eagles (*Haliaeetus leucocephalus*) are increasing in winter and summer throughout Prince William Sound, harlequin ducks (*Histrionicus histrionicus*) are increasing in the oiled area in winter, and black oystercatchers are increasing throughout Prince William Sound in summer. Numbers of all other injured species are either not changing or are declining in the oiled area. Common loons (*Gavia immer*), cormorants (*Phalacrocorax spp.*), and common murrelets (*Uria aalga*) are showing no trend in the oiled area; pigeon guillemots (*Cepphus columba*) and marbled murrelets (*Brachyramphus marmoratus*) are declining in the oiled areas of Prince William Sound and Kittlitz's Murrelet (*Brachyramphus brevirostris*) is declining throughout Prince William Sound. Results of these surveys up through 1998 have been published by Irons et al. (2000) and Lance et al. (2001). Analyses of these survey data are the only ongoing means to evaluate the recovery of most of these injured species. A Final Report will be written upon completion of the project that will address population status of species observed during the survey.

Funding: EVOS Funding Requested: FY 04 \$175,518
TOTAL:\$175,518

Non-EVOS Funds to be Used: FY 04 \$ 94,760
TOTAL: \$94,760

Date: June 5, 2003

GEM RESEARCH PLAN FOR PROJECT NUMBER 04159

Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 2004

I. NEED FOR THE PROJECT

A. Statement of Problem

The waters and shorelines of Prince William Sound support abundant marine bird and sea otter populations throughout the year (Isleib and Kessel 1973, Hogan and Murk 1982, Irons et al. 1988a). Potential injuries to marine birds from exposure to the *T/V Exxon Valdez* oil spill included, but were not limited to, death, changes in behavior, and decreased productivity. U. S. Fish and Wildlife Service, Migratory Bird Management conducted boat surveys in Prince William Sound prior to the *Exxon Valdez* oil spill in 1972-73 (Dwyer et al. 1976) and 1984-85 (Irons et al. 1988a,b). After the oil spill, Natural Resource Damage Assessment Bird Study Number 2 (Burn 1994, Klosiewski and Laing 1994) was initiated to document damage from the oil spill on the marine bird and sea otter populations of Prince William Sound. Data from these surveys indicated that populations of sea otters (Burn 1994) and several marine bird species (Klosiewski and Laing 1994) declined in the oil spill area. Thus, restoration projects 93045 (Agler et al. 1994a), 94159 (Agler et al. 1995a), 96159 (Agler and Kendall 1997), 98159 (Lance et al. 1999), and 00159 (Stephensen et al. 2001) were initiated to continue monitoring marine bird and sea otter population abundance to assess recovery of injured species. Restoration projects 93045, 94159, 96159, 98159, and 00159 continued the original *Exxon Valdez* oil spill damage assessment study (Bird Study Number 2, Burn 1994, Klosiewski and Laing 1994) from 1989-91.

Using small boat surveys, this project will collect additional information to monitor the distribution and abundance of marine birds and sea otters in Prince William Sound. These data will be combined with data collected in 1989-91 (Klosiewski and Laing 1994), 1993 (Agler et al. 1994a), 1994 (Agler et al. 1995a), 1996 (Agler and Kendall 1997), 1998 (Lance et al. 1999, Irons et al. 2000, Lance et al. 2001) and 2000 (Stephensen et al. 2001) to examine trends in marine bird and sea otter distribution and abundance. This project will benefit restoration of Prince William Sound by determining whether populations that declined due to the spill are recovering and by identifying what species are still of concern.

Almost 30,000 marine bird (Piatt et al. 1990) and 900 sea otter (DeGange and Lensink 1990) carcasses were recovered following the *Exxon Valdez* oil spill. Based on modeling studies using carcass search effort and population data, an estimated 250,000 marine birds were killed in Prince William Sound and the northern Gulf of Alaska (Piatt and Ford 1996). Garrott et al. (1993) estimated that 2,800 sea otters also were killed. These estimates are probably low, because they only include direct mortality occurring in the first five months after the spill.

The U. S. Fish and Wildlife Service conducted boat surveys of marine bird and sea otter populations in Prince William Sound in 1972-73 (Dwyer et al. 1976), 1984-85 (Irons et al. 1988b), and several years following the spill (1989, 1990, 1991, Klosiewski and Laing 1994; 1993, Agler et al. 1994a; 1994, Agler et al., 1995a; 1996, Agler and Kendall, 1997; 1998, Lance

et al., 1999; and 2000, Stephensen et al. 2001). Klosiewski and Laing (1994) documented overall declines in 15 species or species groups between 1972-73 (Dwyer et al. 1976) and the years after the spill. When comparing population estimates with 1984-85 data, Klosiewski and Laing (1994) documented decline of 6 species or species groups.

Burn (1994), using data from the boat surveys, documented declines in sea otter abundance in shoreline habitats of Prince William Sound following the spill. Burn (1994) detected a continuing pattern of significantly lower sea otter densities in oiled coastal areas, suggesting mortality in or displacement of sea otters from these areas.

Stephensen et al. (2001) examined whether marine bird and mammal species designated as injured by the *EVOS* trustee council had shown signs of recovery by 2000. Data collected from 1989 to 2000 indicated that bald eagles (*Haliaeetus leucocephalus*) are increasing in winter and summer throughout Prince William Sound, harlequin ducks (*Histrionicus histrionicus*) are increasing in the oiled area in winter, and black oystercatchers are increasing throughout Prince William Sound in summer. Numbers of all other injured species are either not changing or are declining in the oiled area. Common loons (*Gavia immer*), cormorants (*Phalacrocorax spp.*), and common murrelets (*Uria aalga*) are showing no trend in the oiled area; pigeon guillemots (*Cephus columba*) and marbled murrelets (*Brachyramphus marmoratus*) are declining in the oiled areas of Prince William Sound and Kittlitz's Murrelet (*Brachyramphus brevirostris*) is declining throughout Prince William Sound. Analyses of these survey data are the only ongoing means to evaluate the recovery of most of these injured species.

B. Relevance to GEM Program Goals and Scientific Priorities

Restoration of marine bird and sea otter populations requires population estimates to determine whether recovery is occurring or if species are still affected by the oil spill. This project will benefit marine birds and sea otters by revealing species that show continuing injury due to the *TV Exxon Valdez* oil spill. Agler et al. (1994a, 1995a), Agler and Kendall (1997), and Lance et al. (1999), and Stephensen et al. (2001) found additional populations that were not previously shown to be injured. Survey data from this project have also been used by investigators of other studies on pigeon guillemots (Greg Golet, pers. comm.), marbled murrelets (K. Kuletz, pers. comm.), Kittlitz's murrelets (B. Day, per comm.), harlequin ducks (D. Rosenberg and D. Esler, pers. comm.), sea ducks (K. Laing and D. Esler, pers. comm.), black oystercatchers (B. Andres, pers. comm.), birds and forage fish (W. Ostrand, pers. comm.), herring (E. Brown, pers. comm.), and sea otters (Burn 1994).

This project relates to the restoration objectives of several species. The *Exxon Valdez Oil Spill Restoration Plan* (Exxon Valdez Oil Spill Trustee Council 1994) lists each species' restoration objectives separately, and we have only included objectives relating to this project:

Cormorants - "will have recovered when their populations return to pre-spill levels in the oil-spill area. An increasing population trend in Prince William Sound will indicate that recovery is underway."

Harlequin duck - “will have recovered when breeding and post-breeding season densities and production of young have returned to estimated pre-spill levels, or when there are no differences in these parameters between oiled and unoiled areas.”

Bald eagle - “will have recovered when their population and productivity return to pre-spill levels.”

Black oystercatchers - “will have recovered when populations attain pre-spill levels”

Marbled murrelet - “will have recovered when population trends are increasing.”

Pigeon guillemot - “will have recovered when populations are stable or increasing.”

Sea otter - “will be considered recovered when population abundance and distribution are comparable to pre-spill abundance and distribution”

All of the above recovery objectives relate to determining the population abundance of injured species. This is critical to determining recovery for most species. Common loons and Kittlitz’s murrelets were also designated as injured species, but no recovery objective has been developed due to lack of information on their populations. We propose to sample the entirety of Prince William Sound during March and July 2004 to estimate population abundance and distribution of marine birds and sea otters. Data will be comparable with pre- and post-spill data collected by the U. S. Fish and Wildlife Service (Dwyer et al. 1976, Irons et al. 1988a,b, Agler et al. 1994a, Klosiewski and Laing 1994, Agler et al. 1995a, Agler and Kendall 1997, Lance et al. 1999, and Stephensen et al. 2001) and can be used to examine trends in abundance for these species. There are currently no other studies monitoring the populations of loons, cormorants, and black oystercatchers, harlequin ducks, murrelets, pigeon guillemot, marbled murrelets, or Kittlitz’s murrelets in Prince William Sound.

Additionally, Klosiewski and Laing (1994) found evidence of oil spill damage for scoters (*Melanitta* spp.), mew gull (*Larus canus*), arctic tern (*Sterna paradisaea*), and northwestern crow (*Corvus caurinus*). These species have never been added to the list of injured species and do not have restoration objectives. At the present time, this proposed study is the only study continuing to consider these species and track their populations.

By using data from previous surveys we have conducted power analyses to examine the power to detect trends in population abundance (Taylor and Gerrodette 1993). If all other parameters are equal, power is determined by the number of surveys conducted in a given period of time. As the number of surveys increases the ability to detect a trend increases. For example if a population had a coefficient of variation (C.V.) of 0.30 (this is higher than that of 73% of the injured species; Agler and Kendall 1999) the ability to detect an average annual 10 % change in population is 40% with 6 surveys (Fig. 1). By conducting surveys in 2004 the number of surveys increases to 7 and the power to detect same population change increases to ~71% (Fig. 1).

II. PROJECT DESIGN

A. Objectives

The purpose of this study is to obtain population estimates of marine birds and sea otters in Prince William Sound to monitor the recovery of species whose populations may have declined due to the *T/V Exxon Valdez* oil spill. The specific objectives of this project include:

1. To determine population abundance, with 95% confidence limits, of marine bird and sea otter populations in Prince William Sound during March and July 2004 in order to allow changes in population trends of injured species to be detected.

B. Procedural and Scientific Methods

Survey methodology and design will remain identical to that of post-spill surveys conducted by the U. S. Fish and Wildlife Service in 1989, 1990, 1991, (Klosiewski and Laing 1994), March and July 1993 (Agler et al. 1994a), March 1994 (Agler et al. 1995a), March and July 1996 (Agler and Kendall 1997), March and July 1998 (Lance et al. 1999), and March and July 2000 (Stephensen et al. 2001). We will conduct two surveys: one during March and another during July 2002. We will use three 7.7 m fiberglass boats traveling at speeds of 10-20 km/hr to survey transects over two 3-week periods. For each survey, two observers will survey a sampling window 100 m on either side, ahead of, and above the vessel (Klosiewski and Laing 1994). When surveying shoreline transects, observers will also record sightings on land within 100 m of shore. Observers will sample continuously and use binoculars to aid in species identification. Observers will practice estimating distances with a duck decoy, and radars on the survey vessels will be used to assist in determining our distance from land on shoreline transects. We will survey most transects when wave height is <30 cm, and we will not survey when wave height is >60 cm.

We will continue to use a stratified random sampling design containing three strata: shoreline, coastal-pelagic, and pelagic (Klosiewski and Laing 1994). The shoreline stratum will consist of waters within 200 m of land. Irons et al. (1988b) divided this stratum, by habitat, into 742 transects with a total area of 820.74 km². We will locate shoreline transects by geographic features, such as points of land, to facilitate orientation in the field and to separate the shoreline by habitat (Irons et al. 1988a,b). Shoreline transects will vary in size, ranging from small islands with <1 km of coastline to sections of the mainland with over 30 km of coastline. Mean transect length will be 5.55 km. During winter, we plan to survey 99 shoreline transects, but this number varies among years, due to weather conditions and ice blockage. During summer, we plan to survey 212 shoreline transects. All transects were randomly chosen, and the same transects are used each survey (Klosiewski and Laing 1994).

To sample the coastal-pelagic and pelagic strata of Prince William Sound, we will divide the study area into 5-minute latitude-longitude blocks. When a block includes >1.8 km of shoreline, we will classify it in the coastal-pelagic stratum, and we will classify blocks with ≤1.8 km of shoreline in the pelagic stratum (Klosiewski and Laing 1994). When coastal-pelagic or pelagic blocks intersect the 200 m shoreline stratum, they will be truncated to avoid overlap. We plan to survey 2 north-south transect lines, 200 m wide each, located 1 minute inside the east and west boundaries of each coastal-pelagic and pelagic block. We will use Global Positioning Systems and nautical compasses to navigate transect lines. In the coastal-pelagic stratum, we plan to

survey ≤ 29 blocks in the winter and ≤ 46 blocks in the summer. In the pelagic stratum, we plan to survey ≤ 25 blocks during both seasons.

To examine population trends over time and to determine if populations injured by the spill are recovering, we will poststratify Prince William Sound into two zones, oiled and unoiled, based upon the pattern of oiling by the *Exxon Valdez* oil spill (Klosiewski and Laing 1994).

C. Data Analysis and Statistical Methods

As in previous surveys (Klosiewski and Laing 1994, Agler et al. 1994a,b,c, 1995a,b, Agler and Kendall 1997, Lance et al. 1999, Stephensen et al. 2001), we will use a ratio estimator (Cochran 1977) to estimate population abundance. Shoreline transects will be treated as a simple random sample; whereas, the coastal-pelagic and pelagic transects will be analyzed as two-stage cluster samples of unequal size (Cochran 1977). To do this, we will estimate the density of birds counted on the combined transects for a block and multiply by the area of the sampled block to obtain a population estimate for each block. We then will add the estimates from all blocks surveyed and divide by the sum of the areas of all blocks surveyed. We will calculate the population estimate for a stratum by multiplying this estimate by the area of all blocks in the strata. Population estimates for each species and for all birds in Prince William Sound will be calculated by adding the estimates from the three strata, and we will calculate 95% confidence intervals for these estimates from the sum of the variances of each stratum (Klosiewski and Laing 1994).

Population estimates for each species will be combined with other post-oil spill population estimates to determine population trends. We plan to use a homogeneity of slopes test (Freud and Littell 1981) to compare population trends between the oiled and unoiled zones of Prince William Sound to examine whether species with population estimates of >500 individuals have changed over time. To do this, we must assume that marine bird and sea otter populations increase at the same rate in the oiled and unoiled zones of Prince William Sound. The \log_{10} of each population estimate will be calculated after adding 0.5 to the estimate to prevent effects from using $\log 0$. Significantly different slopes would indicate that population abundance of a species or species group changed at different rates. For species or species groups showing a significant difference in slopes or ratios, we will determine the rate of change in each zone by linear regression analyses.

To determine optimum survey frequency, we conducted a power analysis to estimate the probability of detecting trends in abundance using linear regression from a given number of samples (Taylor and Gerrodette 1993). We examined our power to detect trends when coefficient of variation (CV) of the population was 0.30 (greater than the mean CV from previous surveys for 73% of the injured species; Fig. 1) and when the CV = 0.13 (the mean summer CV for *Brachyramphus* murrelets, an injured species; Fig. 3). Models of seabird population growth predict most species increase no more than 12% per year (Nur and Ainley 1992), so we used 10% for our comparisons.

With CV=0.30 the probability of detecting an average annual change of 10% would be 55% with the 7 surveys completed to date (Fig 1). The probability would increase to $\sim 71\%$ in 2004 (8 surveys). If 10 surveys were completed the probability would be 92%. For murrelets the power

to detect a 10% change is now 95% (Fig. 3). This would increase to 100% with the completion of the 2004 surveys (Fig. 3).

D. Description of Study Area

Our study area includes all waters within Prince William Sound and all land within 100 m of shore (Fig. 2). We exclude Orca Inlet, near Cordova, Alaska and the southern sides of Montague, Hinchinbrook, and Hawkins Islands (Klosiewski and Laing 1994).

E. Coordination and Collaboration with Other Efforts

Principle investigators from other EVOS trustee council funded projects have used our survey data in the past. Data from these surveys would be helpful for the sea otter, harlequin duck, studies. All data will be entered into the North Pacific Pelagic Seabird Database and will be available on the web to other scientists, and lay people that would like to see it or use it.

III. SCHEDULE

A. Project Milestones

Objective 1. Collect and analyze data and write report on recovery of injured marine bird populations in Prince William Sound.

To be met by March 30, 2004.

B. Measurable Project Tasks

Specify, by each quarter of each fiscal year, when critical project tasks (for example, sample collection, data analysis, manuscript submittal, etc.) will be completed. This information will be the basis for the quarterly project progress reports which are submitted to the Trustee Council Office. Please format your schedule like the following example.

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

October: Project funding approved by Trustee Council

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

January 12-16 (tentative): Annual GEM Workshop

January, February Prepare for next survey.

March 1-30 Data Collection

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

April, May, June Prepare for next survey

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

July 1 -30: Data Collection

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

Analyze data

FY 05, 2nd quarter (January 1, 2005-March 31, 2005)
March 30 Submit Draft Final Report to Trustee Council Office

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

All community input is always welcome to our project, the proposal process is open and the PAG members and other members of local communities may comment on proposals. The findings of the study will be communicated to local communities through various means including the Annual GEM meeting, on the Web, distribution of reports and of course the reports will always be available in the local libraries.

B. Resource Management Applications

The US Fish and Wildlife Service is responsible for the management of all migratory birds, including marine birds. The Service spends 100's of thousands of dollars annually to manage seabirds and waterfowl and to determine population trends. However there are still many species in many areas for which the Service data are lacking. Simply put the Service cannot do it all. The population trends of the injured birds in Prince William Sound are of great importance to the Service, the local people and the scientific community at large. The length of time required for bird populations to recover from oil spills has never been well documented for many of the species injured in the EVOS. This information is important to the Service for managing birds after future oil spills and for general management of many of these species.

V. PUBLICATIONS AND REPORTS

Three papers have been published on the results of past surveys. Only a report will be written after this survey.

VI. PROFESSIONAL CONFERENCES

No funds are requested for attending meetings.

LITERATURE CITED

- Agler, B. A., P. E. Seiser, S. J. Kendall, and D. B. Irons. 1994a. Marine bird and sea otter populations of Prince William Sound, Alaska: population trends following the *T/V Exxon Valdez* oil spill. Restoration Project No. 93045. Final Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 51 pp. + appendices.
- Agler, B. A., S. J. Kendall, P. E. Seiser, and D. B. Irons. 1994b. Population estimates of marine bird and sea otter populations in Lower Cook Inlet, Alaska during June 1993. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 73 pp. + appendices.

- Agler, B. A., S. J. Kendall, P. E. Seiser, and D. B. Irons. 1994c. Field report: marine bird survey of Lower Cook Inlet, February-March 1994. Unpubl. Rep., U. S. Fish and Wildlife Service, Anchorage, Alas. 17 pp.
- Agler, B. A., S. J. Kendall, P. E. Seiser, and D. B. Irons. 1995a. Winter marine bird and sea otter abundance of Prince William Sound, Alaska: trends following the *T/V Exxon Valdez* oil spill from 1990-94. Final Rep., U. S. Fish and Wildlife Service, Anchorage, Alas. 68 pp. + appendices.
- Agler, B. A., S. J. Kendall, P. E. Seiser, and J. R. Lindell. 1995b. Estimates of marine bird and sea otter abundance in Southeast Alaska during summer 1994. Draft Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 87 pp. + appendices.
- Agler, B. A., and S. J. Kendall. 1997. Marine Bird and Mammal Population Abundance of Prince William Sound, Alaska: Trends following the *T/V Exxon Valdez* Oil Spill, 1989-96. Restoration Project No. 96159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.
- Burn, D. M. 1994. Boat-based population surveys of sea otters (*Enhydra lutris*) in Prince William Sound, in response to the *Exxon Valdez* oil spill. NRDA Marine Mammal Study Number 6. U. S. Fish and Wildl. Serv., Anchorage, Alas.
- Cochran, W. G. 1977. Sampling techniques. John Wiley and Sons, Inc., New York 428 pp.
- DeGange, A. R., and C. J. Lensink. 1990. Distribution, age, and sex composition of sea otter carcasses recovered during the response to the *T/V Exxon Valdez* oil spill. Pages 124-129 in K. Bayha and J. Kormendy, eds. Sea otter symposium: proceedings of a symposium to evaluate the response effort on behalf of sea otters after the *T/V Exxon Valdez* oil spill into Prince William Sound, Anchorage, Alaska, 17-19 April 1990. U. S. Fish and Wildl. Serv., Biol. Rep. 90(12). 485 pp.
- Dwyer, T. J., P. Isleib, D. A. Davenport, and J. L. Haddock. 1976. Marine Bird Populations in Prince William Sound Alaska. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 24 pp.
- Ecological Consulting, Inc. 1991. Assessment of direct mortality in Prince William Sound and the western Gulf of Alaska resulting from the *Exxon Valdez* oil spill. Unpubl. Rep., Ecological Consulting, Inc., Portland, Oreg. 153 pp.
- Exxon Valdez* Oil Spill Trustee Council. 1994. *Exxon Valdez* oil spill restoration plan. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alas. 56 pp. + appendices.
- Freud, R. J., and R. C. Littell. 1981. SAS for linear models: a guide to the ANOVA and GLM procedures. SAS Institute Inc., Cary, N. C. 231 pp.
- Garrott, R. A., L. L. Eberhardt, and D. M. Burn. 1993. Mortality of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. Mar. Mamm. Sci. 9(4):343-59.

- Hogan, M. E., and J. Murk. 1982. Seasonal distribution of marine birds in Prince William Sound, based on aerial surveys, 1971. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 22 pp. + appendices.
- Irons, D. B., S. J. Kendall, W. P. Erickson, L. L. McDonald, and B. K. Lance. 2000. Chronic effects of the *Exxon Valdez* oil spill on summer marine birds in Prince William Sound, Alaska. *Condor* 102:723-737.
- Irons, D. B., D. R. Nysewander, and J. L. Trapp. 1988a. Prince William Sound sea otter distribution in relation to population growth and habitat type. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 31 pp.
- Irons, D. B., D. R. Nysewander, and J. L. Trapp. 1988b. Prince William Sound waterbird distributions in relation to habitat type. Unpubl. Rep., U. S. Fish Wildl. Serv., Anchorage, Alas. 26 pp.
- Isleib, P. and B. Kessel. 1973. Birds of the North Gulf Coast - Prince William Sound Region, Alaska. *Biol. Pap. Univ. Alaska* 14. 149 pp.
- Klosiewski, S. P., and K. K. Laing. 1994. Marine bird populations of Prince William Sound, Alaska, before and after the *Exxon Valdez* oil spill. *Exxon Valdez Oil Spill State and*

- Federal Natural Resources Damage Assessment Final Reports, U. S. Fish and Wildl. Serv., Anchorage, Alas. 89 pp.
- Lance B. K., D. B. Irons, S. J. Kendall, L. L. McDonald. 2001. An evaluation on marine bird population trends following the Exxon Valdez oil spill, Prince William Sound, Alaska. Marine Pollution Bulletin.
- Lance, B. K., D. B. Irons, S. J. Kendall, and L. L. McDonald. 1999. Marine Bird Population Abundance of Prince William Sound, Alaska: Trends following the *Exxon Valdez* oil spill. Restoration Project No. 98159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.
- Nur, N. and D. G. Ainley. 1992. Comprehensive review and critical synthesis of the literature on recovery of marine bird populations from environmental perturbations. Final Rep., *Exxon Valdez* Restoration and Planning Work Group.
- Piatt, J. F., C. J. Lensink, W. Butler, M. Kendziorek, and D. R. Nysewander. 1990. Immediate impact of the 'Exxon Valdez' oil spill on marine birds. *Auk* 107:387-397.
- Piatt, J. F. and R. G. Ford. 1996. How many birds were killed by the *Exxon Valdez* oil spill? Pages 712-719 in S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright, eds. Proceedings of the *Exxon Valdez* oil spill symposium. American Fisheries Society Symposium 18. 931 pp.
- Sauer, J. R., and P. H. Geissler. 1990. Estimation of annual indices from roadside surveys. Pages 58-62 in J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish and Wildl. Serv., Biol. Rep. 90(1). 166 pp.
- Stephensen, S. W., D. B. Irons, S. J. Kendall, B. K. Lance, and L. L. McDonald. 2001. Marine Bird Population Abundance of Prince William Sound, Alaska: Trends following the *Exxon Valdez* oil spill. Restoration Project No. 00159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.
- Taylor, B. L., and T. Gerrodette. 1993. The use of statistical power in conservation biology: the vaquita and northern spotted owl. *Cons. Biol.* 7(3):489-500.

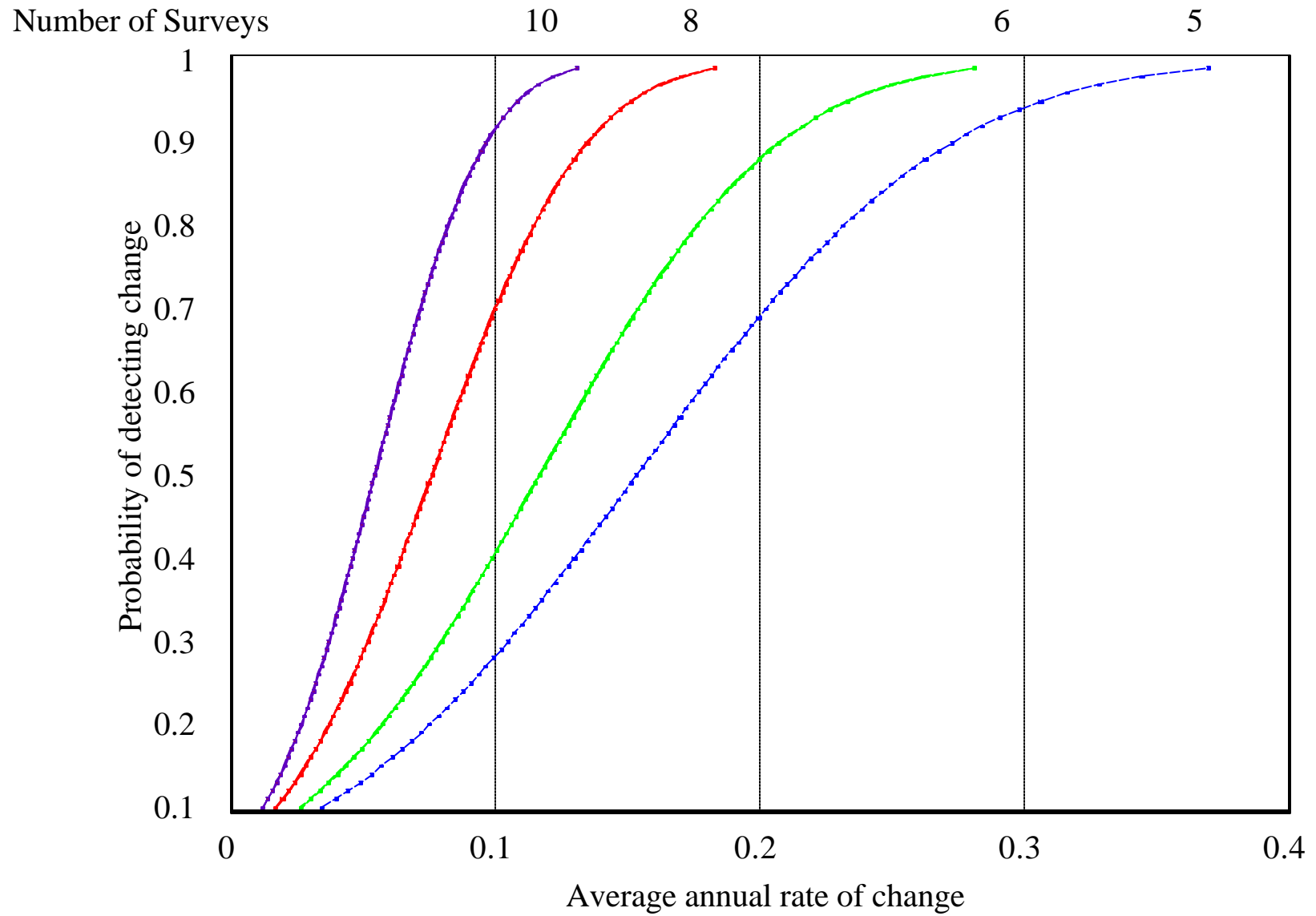


Figure 1. Estimated power based on numbers of surveys conducted to detect a trend in marine bird populations in Prince William Sound when the CV = 0.30.

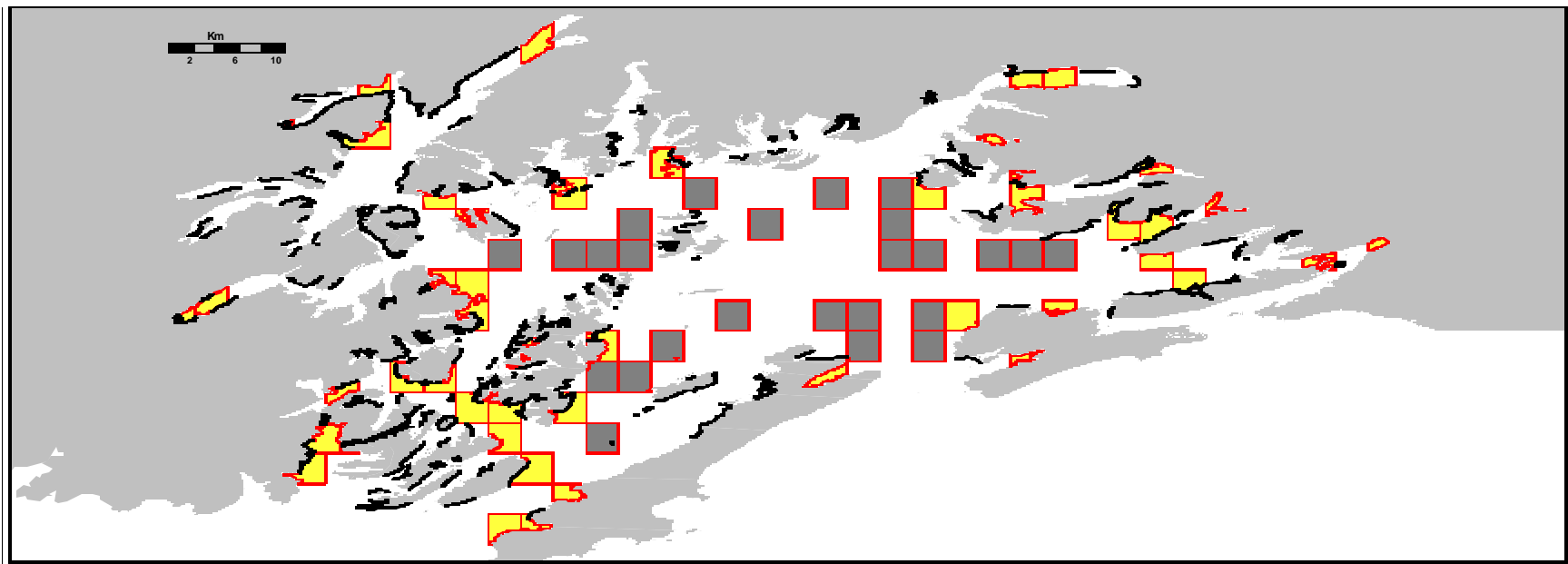


Figure 2. Transects and blocks surveyed during July small boat surveys of Prince William Sound. Transects were classified into 3 strata; the shoreline stratum, (<200 m from land), the coastal-pelagic stratum (lighter shaded blocks), and the pelagic stratum (darker shaded blocks).

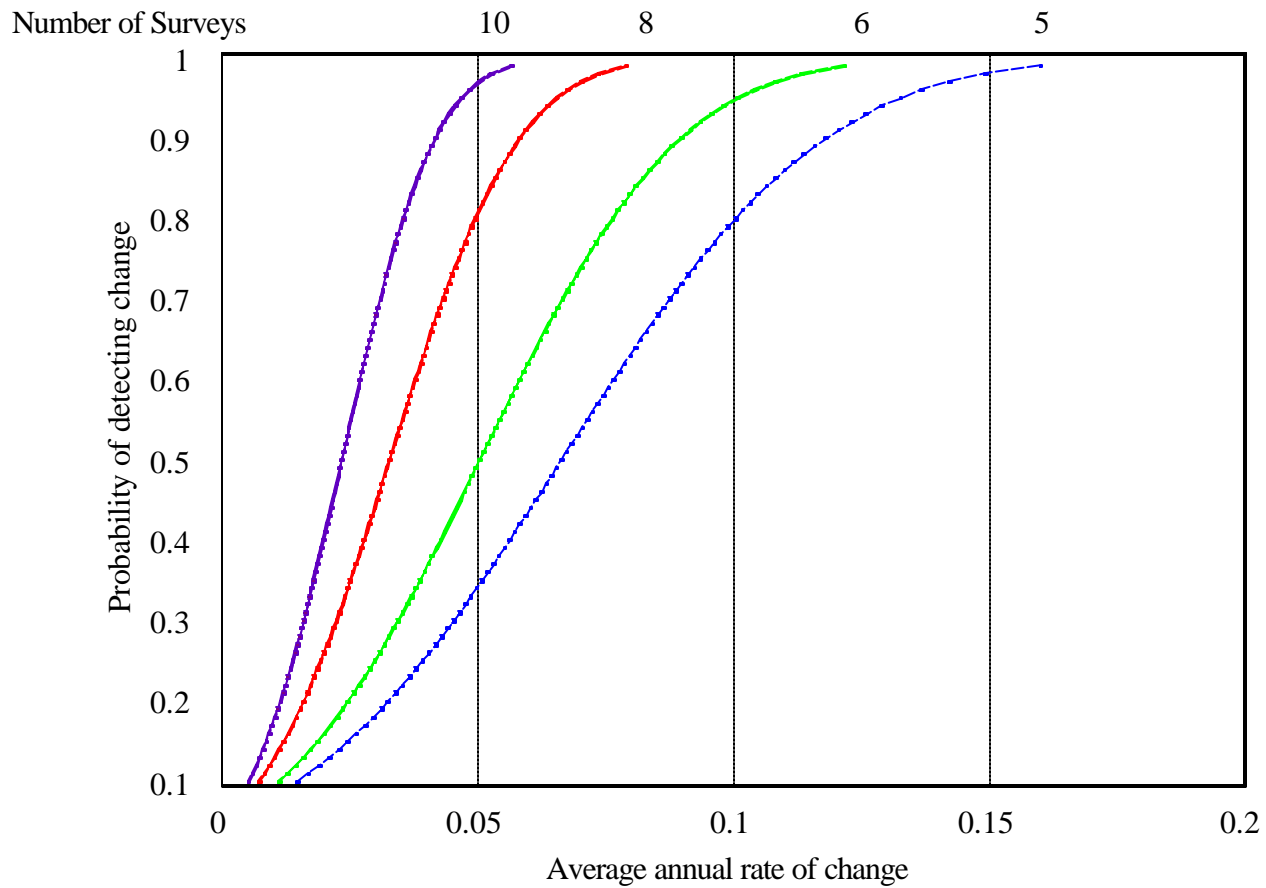


Figure 3. Estimated power based on numbers of surveys conducted to detect a trend in the July *Brachyramphus* murrelet population in Prince William Sound. The CV = 0.13.

RESUME OF PROPOSED PRINCIPAL INVESTIGATOR

Project title: Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 2004, #04159

David B. Irons
U.S. Fish and Wildlife Service
1011 East Tudor Road
Anchorage, Alaska 99503
david_iron@fws.gov
Phone 907/786-3376

Education

B. S. Environmental Resource Management 1976 Pennsylvania State University
M. S. Wildlife Ecology 1982 Oregon State University
Ph. D. Biology 1992 University of California, Irvine

Recent Professional Experience

1999-2003 Alaska Seabird Coordinator, Migratory Bird Management, U.S. Fish and
Wildlife Service
1993-1998 Marine Bird Monitoring Coordinator, Migratory Bird Management, U.S.
Fish and Wildlife Service
1984-1992 Biologist, Migratory Bird Management, U.S. Fish and Wildlife Service

Committees

Alaska Region Representative, North American Colonial Waterbird Conservation Plan
Chair, Alaska Seabird Working Group
Chair, Circumpolar Seabird Group
Seabird Coordinator, Circumpolar Arctic Flora and Fauna (CAFF), Circumpolar Biodiversity
Monitoring Network.
Chair-elect Pacific Seabird Group

Selected Publications

Lance B. K., D. B. Irons, S. J. Kendall, L. L. McDonald. 2001. An evaluation on marine bird
population trends following the Exxon Valdez oil spill, Prince William Sound, Alaska.
Marine Pollution Bulletin 42:298-309.

Irons, D. B., S. J. Kendall, W. P. Erickson, L. L. McDonald, and B. K. Lance. 2000. Chronic
effects of the *Exxon Valdez* oil spill on summer marine birds in Prince William Sound,
Alaska. *Condor* 102:723-737.

Golet, G. H., K. J. Kuletz, D. D. Roby, D. B. Irons. 2000. Adult prey choice affects chick

growth and reproductive success of Pigeon Guillemots. *The Auk* 117:82-91.

Hunt, G. L., F. Mehlum, R. W. Russell, D. B. Irons, M. B. Decker, and P. Becker. 1999. Physical processes, prey abundance, and the foraging ecology of seabirds. In: Adams, N. and Slowtow, R. (Eds.) 22 International Ornithological Congress, Durban, South Africa, University of Natal.

Agler, B.A., Kendall, S.J., Irons, D.B., and Klosiewski, S.P. 1999. Declines in Marine Bird Populations in Prince William Sound, Alaska Coincident with a Climatic regime Shift. *Waterbirds* 22:98-103.

Golet, G. H., and D. B. Irons. 1999. Raising young reduces body condition and fat stores in Black-legged Kittiwakes. *Oecologia* 120:530-538.

Irons, D. B. 1998. Foraging area fidelity of individual seabirds in relation to tidal cycles and flock feeding. *Ecology* 70:647-655.

Golet, G. H., D. B. Irons, and J. A. Estes. 1998. Survival costs of chick rearing in Black-legged Kittiwakes. *Journal of Animal Ecology* 67:827-841.

Irons, D. B. 1996. Size and productivity of Black-legged Kittiwake colonies in Prince William Sound before and after the *Exxon Valdez* oil spill. Pages 738-747, in S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright, editors. Exxon Valdez Oil Spill Symposium. Am. Fisheries Soc. No. 18.

Irons, D. B., R. G. Anthony, and J. A. Estes. 1986. Foraging strategies of glaucous-winged gulls in a rocky intertidal community. *Ecology* 67:1460-74.

Collaborators:

Ainley, David, H.T. Harvey and Associates	Kendall, Steve, USFWS
Anker-Nilssen, Tycho, NINA, Norway	Kuletz, Kathy, USFWS
Benson, Jeb UAF	Lance, Brian, NMFS
Brown, Evelyn, UAF	Maniscalco, John, Seward Sealife Center
Byrd, Vernon, USFWS	McDonald, Lyman, West Inc.
Decker, Mary Beth, Yale U	Ostrand, Bill, USFWS
Drew, Gary, USGS	Piatt, John, USGS
Dragoo, Don, USFWS	Roby, Dan, OSU
Erickson, Wally, West Inc.	Schmutz, Joel USGS
Estes, Jim, USGS	Stephensen, Shawn, USFWS
Ford, Glenn, R.G. Ford Consulting	Suryan, Rob, OSU
Golet, Greg, TNC	Turco, Kathy, self employed
Hunt, George, UCI	Visser, G.H, Centre for Isotope Res., The Netherlands
Jodice, Pat, Clemson U.	Wohl, Kent, USFWS
Kaufmann, Max UAF	

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

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06	TOTAL PROPOSED
Personnel	\$83,700.0	\$0.0	\$0.0	\$83,700.0
Travel	\$10,582.0	\$0.0	\$0.0	\$10,582.0
Contractual	\$40,500.0	\$0.0	\$0.0	\$40,500.0
Commodities	\$24,744.0	\$0.0	\$0.0	\$24,744.0
Equipment	\$1,500.0	\$0.0	\$0.0	\$1,500.0
Subtotal	\$161,026.0	\$0.0	\$0.0	\$161,026.0
General Administration (9% of Subtotal)	\$14,492.3	\$0.0	\$0.0	\$14,492.3
Project Total	\$175,518.3	\$0.0	\$0.0	\$175,518.3

Cost-share Funds:

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.

In-kind contributions:

David B. Irons salary (GS12 for 4 months) = \$21,460
 Shawn W. Stephensen salary (GS9 for 9 months) = 33,300
 Boat user fee (120 days @ 200/day) = \$24,000
 Equipment user fee (computers, survival suits, electronics, etc.) = \$12,000
 GSA vehicle user fee = \$4,000

Total = \$94,760

**FY 04-
06**

Project Number: 04159
 Project Title: Project Title: Surveys to Monitor Marine Bird Abundance
 in Prince William Sound during Winter and Summer 2004,
 Agency: U.S. Fish and Wildlife Service

**FORM 3A
TRUSTEE
AGENCY
SUMMARY**

Date Prepared:

5-Jun-03

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

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Name	Description					
Unknown	Co-project Leader	GS11-1	6.0	4500.0	2700.0	29,700.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
Unknown	Biological Technician	GS5-1	3.0	2500.0	1500.0	9,000.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			24.0	19500.0	11700.0	
Personnel Total						\$83,700.0
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Description						
Truck and boat tunnel fee (Portage - Whittier)	20.0	8				160.0
Per diem (camp rate), 9 people, 20 days winter; 9 people, 20 days summer				360	3.0	1,080.0
Per diem (travel rate), 9 people, 2 days winter; 9 people 2 days summer; 6 people, 3 days training				54	48.0	2,592.0
Lodging, 6 nights, 2 rooms @ \$90/night/room (Cordova)				6	180.0	1,080.0
Lodging, 9 people, 14 nights (Whittier plus boat training)				126	45.0	5,670.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$10,582.0

FY 04

Project Number: 04159
 Project Title: Project Title: Surveys to Monitor Marine Bird
 Abundance in Prince William Sound during Winter and Summer
 2004,
 Agency: U.S. Fish and Wildlife Service

FORM 3B
 Personnel
 & Travel
 DETAIL

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

Contractual Costs:		Contract
Description		Sum
Charter vessel (winter - 10 days @ \$2,000/day)		20,000.0
Charter vessel (summer - 7 days @ \$2,000/day)		14,000.0
Harbor Fees		500.0
Boat repairs and parts		6,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required.		Contractual Total
		\$40,500.0
Commodities Costs:		Commodity
Description		Sum
Boat fuel (70 gal/day/boat) 60 boat-days/winter; 60 boat-days @ \$2.00/gal		16,800.0
Outboard oil (2 gal/boat/survey) 3 boats, 2 surveys @ \$12.00/gal		144.0
Food (\$10.00/person/day) 9 people for 30 days/winter; 9 people 30 days/summer		5,400.0
Rain gear, rubber boots and gloves for 6 people @ \$200/person		1,200.0
Scientific supplies (batteries for radios & other equipment, waterproof notebooks & paper, thermometers, wind gauges)		1,200.0
		Commodities Total
		\$24,744.0

FY 04

Project Number: 04159
 Project Title: Project Title: Surveys to Monitor Marine Bird
 Abundance in Prince William Sound during Winter and Summer
 2004,
 Agency: U.S. Fish and Wildlife Service

FORM 3B
 Contractual
 &
 Commoditie

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

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

FY 05

Project Number:
Project Title:
Agency:

FORM 3B
Contractual
&
Commoditie

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

Contractual Costs:	Contract Sum
Description	
Contractual Total	\$0.0
Commodities Costs:	Commodity Sum
Description	
Commodities Total	\$0.0

FY 06

Project Number:
 Project Title:
 Agency:

FORM 3B
 Contractual
 &
 Commoditie

BUDGET JUSTIFICATION (FY 2004)

Project Title: Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 2004, # 04159

Budget category: Personnel	Amount Requested: \$83,700
Request Explanation: A co-project leader (GS11) is needed to assist the project leader and must possess supervisory skills to govern the activities of seven subordinate workers. A minimum of three persons per boat (3 boats) for a total of nine persons are needed to conduct the survey. We will need biological technicians for three months since total survey time is approximately 60 days and field gear preparation/maintenance will be an additional 30 days. The co-project leader will allocate 6 months to the project; which includes 60 days survey time, 30 days field gear preparation, and 90 days for data analysis and report writing.	

Budget category: Travel	Amount Requested: \$10,582
Request Explanation: Nine people will be traveling throughout Prince William Sound and will need approximately 20 nights of lodging. Per diem rates will be given to each person during the survey. A tunnel fee is assessed to every vehicle traveling through the tunnel near Portage and the truck/boat will make 8 round trips during the survey.	

Budget category: Contractual	Amount Requested: \$40,500
Request Explanation: Prince William Sound is large and requires extensive travel by boat. To make the survey cost effective a support vessel will be contracted to provide lodging and food for 17 survey days. The boats will operate for hundreds of hours and will need repairs and replacement parts. There is also fees associated with launching and parking the boat in the harbors.	

Budget category: Commodities	Amount Requested: \$24,744
Request Explanation: The only method of transportation in Prince William Sound is by boat. The three boats will use approximately 70 gallons of fuel per day per boat for 60 days to provide a survey platform and transportation during the survey. Fuel costs are estimated at \$2.00 per gallon. Nine persons will need food for 60 days and be supplied with water proof gear. Scientific equipment needed to gather environmental data will also be purchased.	

Budget category: Equipment	Amount Requested: \$1,500
Request Explanation: Most of the equipment needed to conduct the survey will be supplied by our organization, however, some equipment may fail and need to be replaced. We propose \$1,500 to cover those costs.	

Budget category: In-kind Contributions	Amount Contributed: \$94,760
Contribution Explanation: We will provide the salaries of the project leader (GS12) for 4 months and a GS9 for 9 months to assist with preparations, surveys, data analysis, and report writing. Three boats that are owned by FWS will be used. The standard user fee rate of \$200 per day per boat has been charged to other agencies that have rented the boats from us. We will use that amount to determine the in-kind contribution amount for the boats. Miscellaneous equipment and trucks needed to complete the survey is also supplied by FWS.	