PROPOSAL SIGNATURE FORM

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

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

PROJECT TITLE: Evaluating Harlequin Duck Population Recovery: CYP1A Monitoring and a Demographic Population Model

Printed Name of PI: Dan Esler ____________________

Signature of PI: ______________________________ Date 2 Aug 2006

Printed Name of co-PI: ______________________________

Signature of co-PI: ______________________________ Date __________

Printed Name of co-PI: ______________________________

Signature of co-PI: ______________________________ Date __________

* **www.evostc.state.ak.us/Policies/data.htm**
** **www.evostc.state.ak.us/Policies/Downloadables/reportguidelines.pdf**

Trustee Council Use Only Project No.______________ Date Received: _________

FY07 INVITATION
PROPOSAL SUMMARY PAGE

Project Title: Evaluating Harlequin Duck Population Recovery: CYP1A Monitoring and a Demographic Population Model

Project Period: FY07-08

Proposer(s): Dr. Dan Esler

Study Location: Prince William Sound, including oiled and unoiled study areas used during previous studies of harlequin duck population recovery.

Abstract: Harlequin ducks are one of the few species defined as “not recovered” from the 1989 *Exxon Valdez* oil spill. In this document, we propose 2 areas of inquiry to (1) evaluate the status of population recovery, specifically the degree of exposure to lingering oil, and (2) more fully understand the demographic processes underlying population recovery, through application of a quantitative population model.

Cytochrome P4501A (CYP1A) has proven to be an extremely useful tool for documenting the spatial and temporal degree of exposure to lingering oil, and there is a large body of historical CYP1A data (1998 to 2005) for harlequin ducks. The most recent data from March 2005 irrefutably demonstrated that harlequin ducks continued to be exposed to lingering oil. Because population recovery requires cessation of exposure to oil, we propose to resample harlequin ducks from throughout the oiled area of Prince William Sound, along with nearby unoiled areas, to determine whether they continue to be exposed to lingering oil.

A considerable volume of demographic data on harlequin ducks has been collected during research and monitoring efforts since the spill. We propose to assemble these data in a population model, which will be valuable for: (1) identifying the timing and magnitude of oil spill injury, (2) identifying the mechanisms by which injury occurred and population recovery was constrained, (3) evaluating the current status of recovery, including predictions for timing of full recovery, and (4) recommending future restoration activities.

Funding:
EVOS Funding Requested: FY07: $ 177.8 K
FY08: $ 23.9 K

TOTAL: $ 201.7 K

Date: 4 August 2006

Evaluating Harlequin Duck Population Recovery: CYP1A Monitoring and a Demographic Population Model

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Harlequin duck are one of the few species for which population recovery status was designated as "not recovered" by the Exxon Valdez Oil Spill Trustee Council (EVOSTC) in 2002. Therefore, it is particularly important that the EVOSTC have a thorough understanding of the sources, mechanisms, and timing of injury for this species, as well as constraints to population recovery, in order to conduct appropriate restoration.

The current understanding of harlequin duck population responses to the Exxon Valdez oil spill can be summarized briefly as follows. Acute mortality during the period immediately following the spill was roughly estimated to be 7% of the wintering harlequin ducks in Prince William Sound (Esler et al. 2002). Because much of the oil from the Exxon Valdez spill was deposited in nearshore intertidal and shallow subtidal habitats (Galt et al. 1991), where harlequin ducks occur, there was significant potential for exposure and injury beyond the acute phase. In fact, the Nearshore Vertebrate Predator study (NVP), conducted from 1995-1999, indicated that several vertebrate species including harlequin ducks in oiled areas of western Prince William Sound were exposed to lingering Exxon Valdez oil (EVO), based on elevated levels of cytochrome P4501A (CYP1A), an enzyme biomarker of aromatic hydrocarbon exposure (Ballachey et al. 2006, Trust et al. 2000). Evidence from NVP also indicated that chronic exposure to persistent subsurface oil in intertidal sedimentary habitats led to additional long-term impacts (Peterson et al. 2003, Esler et al. 2002). In the case of harlequin ducks, female winter survival probabilities were found to differ between oiled and unoiled areas within Prince William Sound 6-9 years after the spill (Esler et al. 2000a), and harlequin duck densities were shown to be lower in oiled than unoiled areas, even after accounting for habitat-related differences (Esler et al. 2000b). Additional EVOSTC-sponsored studies on harlequin ducks from 2000 to 2002 (EVOSTC project //423) demonstrated that survival differences and CPY1A values between oiled and unoiled areas generally appeared to be converging through 2002, suggesting diminishing exposure and subsequent demographic effects. However, the most recent CYP1A data, collected in March 2005, indicated greater induction, and hence oil exposure, in oiled areas compared to unoiled. Further, data on dispersal attributes of harlequin ducks (Iverson et al. 2004, Iverson and Esler 2006) indicated that full recovery might still be constrained by intrinsic demographic properties of the species, even after cessation of demographic effects related to exposure to oil.

The results to date strongly indicate that exposure to oil and population recovery have occurred over much longer time periods for harlequin ducks than anticipated at the time of the spill. Therefore, continued monitoring of important measures of recovery, such as degree of exposure to oil, and efforts to more fully understand the process of population recovery are clearly warranted. In this document, we propose to: (1) monitor CYP1A to determine whether exposure to lingering oil is still occurring in winter 2006-07 and (2) to develop a population model to quantitatively evaluate the process of population recovery.

CYP1A Monitoring -- Quantification of oil exposure is an important component of the findings described above, and continues to be an important gauge of the status of harlequin duck population recovery. The current recovery objectives for harlequin ducks explicitly recognize that biochemical markers of oil exposure must be equivalent between oiled and unoiled areas for recovery to be considered underway.

For harlequin ducks, along with other nearshore vertebrates, inferences about oil exposure have been drawn through quantification of CYP1A. CYP1A has proven to be a sensitive and specific biochemical measurement for assessing exposure to PAHs (Ballachey et al. 2006). Certain PAHs induce CYP1A responses; therefore, measuring resultant enzyme production or activity can indirectly indicate exposure to oil constituents. In the case of harlequin ducks, liver samples have been collected to assess CYP1A induction by measuring 7-ethoxyresorufin-O-deethylase (EROD) activity. EROD activity, which is the catalytic function of hydrocarbon-inducible CYP1A, is a widely used and recognized method for quantifying oil exposure.

Exposure of harlequin ducks to lingering oil has, as expected, generally diminished with time since the oil spill (Fig. 1). These data fit the pattern observed for other vertebrates, in which CYP1A declined over time as bioavailable lingering oil presumably diminished (Ballachey et al. 2006). However, results for harlequin ducks sampled in March 2005 indicated that oil exposure continues to be an issue; we found significantly higher CYP1A induction in birds captured on oiled areas than unoiled areas. This is a robust result, as not only did harlequin ducks show this pattern but Barrow's goldeneye (*Bucephala islandica*) captured in the same sites during the same period also showed significantly higher CYP1A on oiled areas (Ballachey et al. 2006). In addition, two labs independently showed the same pattern for harlequin ducks, and we confidently conclude that higher availability of a CYP1A-inducing compound existed in areas oiled during the EVOS in relation to unoiled areas in March 2005.

It is not clear why harlequin ducks in 2005 showed higher induction on oiled areas of Prince William Sound relative to unoiled areas, when data in 2002 did not show this pattern. 2005 samples were taken in March, whereas 2000-02 samples were taken in November, so there could be a seasonal pattern deriving from changes in rates of oil release from sediments, the duration of time that harlequin ducks were in Prince William Sound and thus available to be exposed, or changes in the condition or foraging behavior of the ducks. However, because oil exposure has been considered a primary constraint to recovery of harlequin duck populations (Esler et al. 2002) and definition of recovery status of harlequin ducks is based, in part, on the degree of exposure to lingering oil, we propose additional CYP1A monitoring during winter 2006-07.

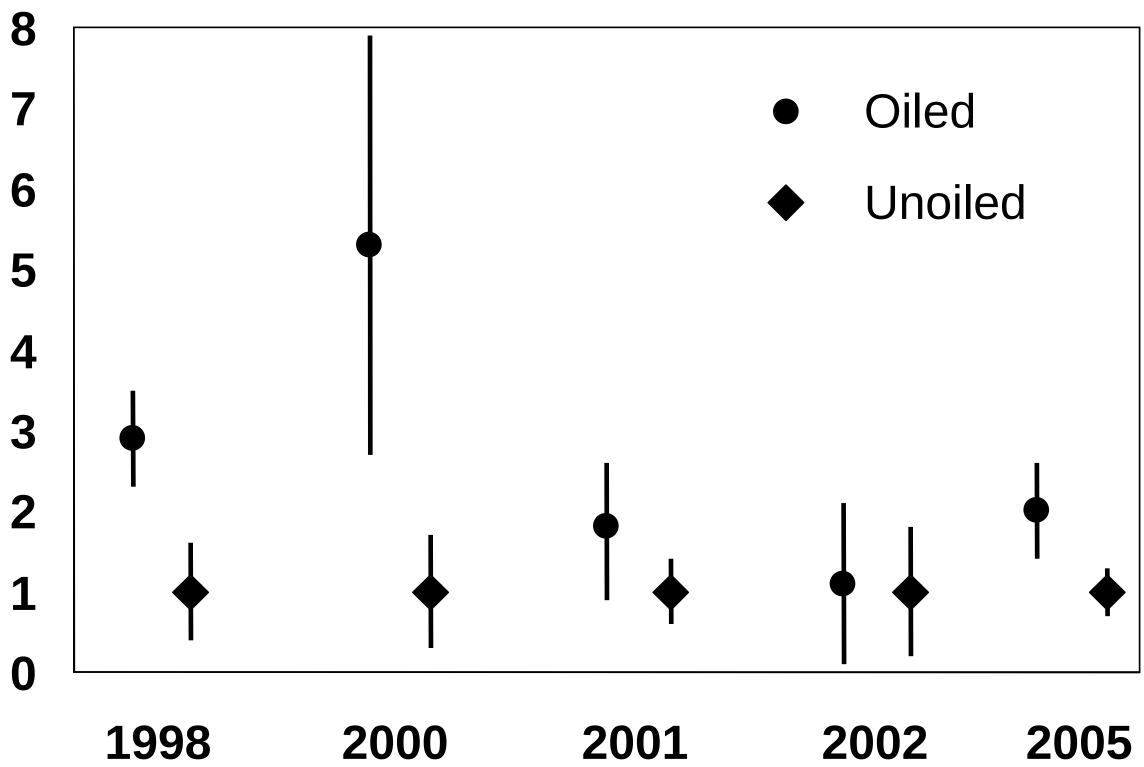

Figure 1. Variation in CYP1A Index (y-axis; the ratio of EROD in oiled areas to EROD in unoiled areas ± 95% CI) across years.

Population Modeling -- Harlequin ducks are one of the few species (along with sea otters *Enhydra lutris*) for which detailed demographic data exist that allow explicit, quantitative considerations of the processes involved in population recovery. As described above, data collected over the past decade include measures of female survival (Esler et al. 2000a, Bodkin et al. 2003), dispersal (Iverson et al. 2004, Iverson and Esler 2006), population trends (Rosenberg et al. 2005, McKnight et al. 2006), and exposure to oil (Trust et al. 2000, Ballachey et al. 2006, Esler 2006), as well as the relationships among these variables. However, these data have not been synthesized into a format that allows direct contrasts of acute versus chronic losses from the spill, nor that quantifies the mechanisms by which losses occurred and recovery proceeded. Such analyses are necessary to evaluate total injury and recovery from the spill and can only be accomplished through the use of a population model. The synthesis that we propose will provide a detailed description of the patterns and data above (along with incorporation of other data sources), as well as application of quantitative tools to allow fuller understanding of post-spill dynamics of injured harlequin duck populations.

The quantity and quality of the available data will allow us to use a quantitative approach that is explicitly structured to provide answers about the sources, timing, and mechanisms of injury, as well as the demographic responses and recovery. We are convinced that this kind of analysis provides the clearest, and most defensible, method for determining the status and process of population injury and recovery. Specifically, we intend to build a model that answers the key remaining questions surrounding harlequin duck population recovery, including: (1) what were the relative magnitudes of acute versus chronic mortality? (2) how do observed differences in female survival affect population trajectory? (3) what is the role of dispersal for providing a “rescue effect” for injured populations in oiled areas? (4) what is the geographic scale over which injury would be expressed (i.e., what is the connection between subpopulations and how far would birds from oiled areas normally move and contribute demographically)? (5) what is the magnitude of demographic effects due to loss of productivity by adults killed prematurely by acute and/or chronic oil? (6) given the degree of oil exposure to date, how long should we expect chronic effects such as reduced survival to continue? (7) once effects of lingering oil are gone, how long will it take for full recovery to estimated pre-spill levels? (8) what are the relative contributions of recruitment and immigration to population recovery? (9) what is the predicted demographic effect of various restoration strategies, including remediation to remove lingering oil? Taken together, the answers to these questions will provide valuable insights into the process of harlequin duck population recovery and will be critically important in the context of risk assessment related to other potential oil pollution scenarios, including catastrophic spills and chronic, low-level contamination. We fully expect that results from this effort will be of significant interest to the scientific community and, accordingly, will be published in a high-profile journal.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

This proposed work is directly responsive to the FY07 Invitation for Proposals, and thus the restoration goals and priorities. Lingering oil issues continue to be important for the EVOSTC, as recovery of the Prince William Sound ecosystem from the *Exxon Valdez* oil spill can not be considered complete until individuals are no longer exposed to spilled oil. Quantification of changes in oil exposure over time is central to that measure of recovery. Because oil exposure in harlequin ducks was indicated as recently as March 2005, it is important to resample to determine the timeline of exposure in this species.

In addition, the proposed population model (requested in the FY07 Invitation) will provide important insight into the recovery status of harlequin ducks, indicating the mechanisms and time lines of oil spill effects. This will be useful for directing current restoration activities, including oil remediation activities. We envision the end products of this work to be tools that the EVOSTC and other interested parties can use to quickly and concisely gauge the current recovery status of harlequin ducks and clearly understand the processes leading to their current status. In particular, we intend the population model to be structured so that it can be actively manipulated, to allow consideration of population level effects under different scenarios of varying degrees or mechanisms of injury and recovery. Finally, this work will provide a tool for scientists and managers to use to consider the importance of different mechanisms of contaminant effects, which in turn can influence their response to catastrophic and chronic environmental contamination.

II. PROJECT DESIGN

A. Objectives

CYP1A Monitoring -- (1) To measure cytochrome P4501A (CYP1A) induction in harlequin ducks in oiled and unoiled areas of Prince William Sound to determine the degree of exposure to residual oil from the *Exxon Valdez* oil spill (EVOS). (2) To evaluate seasonal variation in CYP1A induction.

Population Modeling -- (3) To create a population model for harlequin ducks that uses existing demographic data to evaluate (a) the relative magnitudes of acute and chronic oil spill effects, (b) the importance of various demographic constraints on population recovery (i.e., reduced survival, low dispersal, low productivity), (c) the current status of population recovery, and (d) a projected timeline for full recovery.

B. Procedural and Scientific Methods

CYP1A Monitoring -- Methods for field and laboratory studies to quantify CYP1A induction will follow those used in previous work, to allow direct comparisons for evaluating temporal trends. Harlequin ducks will be captured in November 2006 and March 2007 using a modified floating mist net (Kaiser et al. 1995). Upon capture, all birds will be transported by skiff to a larger vessel where U.S. Fish and Wildlife Service bands will be affixed, morphological measurements taken, and surgeries conducted to take a small (<1g) liver biopsy for CYP1A analysis. Sex determinations will be made based on plumage characteristics and cloacal examination and age class will determined by probing bursal depth (Mather and Esler 1999). We will measure CYP1A across all age and sex cohorts; in March 2005, CYP1A induction did not vary by cohort (Ballachey et al. 2006). Following surgery, birds will be held in portable kennels for at least 1 hour and then released at the site of their capture.

When liver biopsies are surgically removed, they will be immediately placed into a labeled cryovial and frozen in a liquid nitrogen shipper. All samples will be maintained in liquid nitrogen or a -80° C freezer until they are shipped to the lab in liquid nitrogen.

We will store liver samples collected in November 2006 until those from March 2007 are collected and then they all will be shipped to a laboratory that we have used for previous samples for preparation and analysis. Individual liver pieces will be homogenized in 7 ml final volume homogenizing buffer (0.05 M Tris, 0.15 M KCl, pH 7.4), and microsomes sedimented by differential centrifugation as described previously (Stegeman et al. 1979). Microsomes will be resuspended in approximately 2 ml per g tissue with resuspension buffer (0.05 M Tris, 0.1 mM EDTA, 1 mM DTT, 20% v/v glycerol, pH 7.4). Protein will be determined in a 96 well plate using the micro- procedure of Smith et al. (1985). 7-Ethoxyresorufin-O-deethylase (EROD), the catalytic function of hydrocarbon-inducible CYP1A, will be measured using a kinetic modification of the plate-based assay of Kennedy et al. (1993). EROD activity will be determined in duplicate in a 48 well plate at 20° C using a Cytofluor® fluorescent plate reader

(Millipore, Bedford, MA). Each well will contain 200 µl consisting of 1µl of microsomes (4-15 µg protein), 2 µM 7-ethoxy resorufin in 50 mM Tris buffer, 0.1 M NaCl, pH = 7.8. Catalytic activity will be initiated by the addition of NADPH in buffer to a final 1.67 mM concentration. Fluorescence will be determined at 1 min intervals over 6 min, and the linear slope (fluorescence per minute) will be divided by the slope of the resorufin product standard curve (fluorescence per pmol) determined under the same conditions to yield pmol per minute per mg protein catalytic rates.

Population Modeling -- The population model will be built from data collected during studies previously funded by the EVOSTC, including measures of female survival (Esler et al. 2000, Bodkin et al. 2003), dispersal (Iverson et al. 2004, Iverson and Esler 2006), population trends (Rosenberg et al. 2005, McKnight et al. 2006), recruitment (via age ratios; Rosenberg et al. 2005) and exposure to oil (Trust et al. 2000, Ballachey et al. 2006, Esler 2006). In the simplest sense, population dynamics are a function of the inputs from immigration and recruitment and outputs of mortality and emigration. In the case of harlequin ducks wintering in Prince William Sound, previous studies documented that age ratios, and hence recruitment, did not differ between oiled and unoiled areas (Rosenberg et al. 2005). Therefore, the population model will focus primarily on spatial and temporal variation in survival and immigration/emigration rates, although recruitment rates will be incorporated when estimating true rates of population change.

The population model will be constructed as simple matrix models, but will be structured to explicitly incorporate both space and time. Temporal changes will be calculated over 1-year time steps, incorporating starting population sizes, survival rates, and dispersal rates on an annual basis to derive population sizes at the end of each winter. This will occur using an array of scenarios of variation in survival and movements, as described below. Temporal consideration will begin at the time of the oil spill and will proceed through the present to forecast future population dynamics.

Spatial considerations will be critical in this exercise. Because direct effects of the oil spill are manifested in a discrete area and because the spatial inter-relationships among subpopulations (especially with respect to dispersal distances) will have an important influence on model results, we will construct the model to accommodate analyses that can be conducted at several geographic scales.

Survival and movement data vary temporally and spatially, and were not collected during each year since the spill. Therefore, we will apply various methods of extrapolation to fill in data gaps. For example, temporal variation in survival rates on oiled areas will be considered as increasing linearly since the spill, increasing as a sigmoidal curve, increasing with an exponential decay, or remaining static for some period since the spill before increasing linearly. All of these are plausible scenarios, and we will contrast the model outcomes based on different assumptions about the temporal variation in survival. Similarly, not all areas have data on dispersal, so we will apply an array of plausible dispersal scenarios based on the available data from other areas. By acknowledging and addressing these issues, we can use the model to bracket the range of results and apply probabilities to various outcomes.

We have used this sort of approach for other research questions (Iverson and Esler 2006) and have applied these methods, in a gross manner, to the harlequin duck data to be used for this project. We are convinced that this will provide intuitive, easily-interpretable results, as well as a structure that can be easily manipulated to answer different questions or to modify the input data. Conduct of this part of the proposal relies on the expertise and experience of Sam Iverson, who also collaborates with other population modelers and thus can solicit advice as needed.

C. Data Analysis and Statistical Methods

We will use a General Linear Model to evaluate variation in EROD activity in relation to area (oiled vs. unoiled), year (categorical variable with levels for 1998, 2000, 2001, 2002, 2005, and 2006/07), and the interaction of area by year. We also will construct the analysis to allow consideration of seasonal effects (November versus March), and effects of mass and age and sex cohort. We will use an information-theoretic approach to model selection (Burnham and Anderson 2002), finding the most parsimonious grouping of cells within the area by year matrix, after accounting for any effects of season, mass, age, or sex.

D. Description of Study Area

The samples used in CYP1A analyses will be collected from sites used during previous studies of harlequin duck demography and oil exposure. In brief, these include areas within Prince William Sound that were oiled during the Exxon Valdez spill (Green Island, Bay of Isles, Lower Passage, Herring Bay, Crafton Island, Main Bay, and Foul Bay) and nearby unoiled sites on northwestern Montague Island.

E. Coordination and Collaboration with Other Efforts

All the objectives in this proposal build on previously funded EVOSTC projects, some of which were conducted by the proposed investigators and others by teams led by other investigators. The CYP1A aspect of the study relies on expertise of other scientists, including Brenda Ballachey, Kim Trust, and Jim Bodkin, for perspective and interpretation. The nature of the population modeling work requires a great deal of collaboration and communication with other investigators. Specifically, we will solicit the input and expertise of the agencies and researchers responsible for the work we will be synthesizing into the quantitative model. These parties include, but are not limited to, the USFWS Region 7 (David Irons), the Alaska Dept. Fish & Game (Dan Rosenberg), and USGS Alaska Science Centre (Jim Bodkin and Brenda Ballachey). We have included travel funds in our proposed budget to facilitate exchange of ideas and information.

III. SCHEDULE

A. Project Milestones

Objectives 1 and 2.	Document degree of harlequin duck exposure to lingering *Exxon Valdez* oil, based on CYP1A induction. To be met by March 2008.
Objective 3.	Develop a population model describing harlequin duck population recovery from the *Exxon Valdez* oil spill, including a manuscript for submission to a scientific journal. To be met by March 2008.

B. Measurable Project Tasks

FY07, 1st quarter (October 1, 2006 – December 31, 2006)

October	Plan logistics for first round of CYP1A sampling
November	Conduct first round of CYP1A sampling
Nov-Dec	Compile data for population modeling

FY07, 2nd quarter (January 1, 2007 – March 31, 2007)

January	Arrange CYP1A lab analyses
February	Plan second round of CYP1A sampling
March	Conduct second round of CYP1A sampling
Jan-Mar	Compile and organize data for population modeling

FY07, 3rd quarter (April 1, 2007 – June 30, 2007)

April	Ship CYP1A samples to lab
June	Receive CYP1A data
Apr-Jun	Conduct population model analyses

FY07, 4th quarter (July 1, 2007 – September 31, 2007)

July-Sep	Data analysis and write-up

FY08, 1st quarter (October 1, 2007 – December 31, 2007)

Oct-Dec	Data analysis and write-up

FY08, 2nd quarter (January 1, 2008 – March 31, 2008)

Jan-Mar	Data analysis and write-up
March	Submit final report and manuscript

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

As in previous studies, we will be available to interact with local communities with an interest in the proposed work. A web site is being created that describes sea duck research conducted within the Centre for Wildlife Ecology, including *Exxon Valdez* studies. This will be updated regularly as information becomes available. As with previous field efforts, contractual arrangements will be sought with members of local communities for vessel charters to support capture efforts.

B. Resource Management Applications

The data generated under this proposal will provide clear answers to questions about effects of lingering Exxon Valdez oil on migratory bird populations, including the duration of exposure and subsequent chronic effects. These will have important implications for prescribing restoration strategies for harlequin ducks and other intertidal resources, including potential remediation efforts to remove lingering oil. These data will be useful not only for understanding effects of the Exxon Valdez spill, but also in the context of risk assessment for other catastrophic events. Finally, these data will contribute to the understanding of effects of other sources of chronic contamination on wildlife populations. These kinds of data from previously funded EVOSTC projects are already being used by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service.

V. PUBLICATIONS AND REPORTS

We will submit a final report to the EVOSTC that will include a summary of the CYP1A monitoring, in the context of all previous CYP1A work, and a full description of the population modeling exercise. Additionally, a peer-reviewed manuscript entitled "A quantitative synthesis of harlequin duck population recovery in Prince William Sound following the Exxon Valdez oil spill" will be prepared for the Journal of Applied Ecology. We are requesting funds in FY08 for personnel time for final analysis and write-up, as well as costs of publication.

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RESUME

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
website:http://www.sfu.ca/biology/wildberg/desler/index.html

Education:

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

Research Interests:

Avian ecology and conservation, sea duck biology, nearshore marine systems, population biology and demography, population structure and genetics, wildlife habitat associations, nutrition and energetics.

Recent 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

Select Publications:

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Esler, D. 2000. Applying metapopulation theory to conservation of migratory birds. Conservation Biology 14:366-372.

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.

Collaborators:

Collaborators on projects and publications within the last 4 years are too numerous to fit in the allotted space. Here I list some recent collaborators on projects from Alaska, including some of those related to Exxon Valdez oil spill projects:

Brenda Ballachey, USGS, Alaska Science Center
Jim Bodkin, USGS, Alaska Science Center
Tim Bowman, USFWS, Migratory Bird Management
Dirk Derksen, USGS, Alaska Science Center
Paul Flint, USGS, Alaska Science Center
Jack Hodges, USFWS, Migratory Bird Management
Tuula Hollmen, Alaska SeaLife Center and UAF
Dave Irons, USFWS, Migratory Bird Management
Sam Iverson, USGS, San Francisco Bay Field Station
Dan Mulcahy, USGS, Alaska Science Center
Dan Rizzolo, USGS, Alaska Science Center
Jason Schamber, USGS, Alaska Science Center
Joel Schmutz, USGS, Alaska Science Center
Kim Trust, USFWS, Ecological Services
David Ward, USGS, Alaska Science Center

BUDGET JUSTIFICATION

Costs of this research are contractual costs to the Centre for Wildlife Ecology, Simon Fraser University (SFU) and 9% GA for the hosting agency, USGS-DOI.

Within the contract to SFU, budget items are justified as follows:

Personnel: $58,400 FY07 and $17,800 FY08
Personnel costs reflect expected direct costs associated with time devoted to conducting the proposed work, for the Principal Investigator (Esler), a Modeling and Demography Specialist highly familiar with this project (Iverson), a Project Manager/Research Assistant (Bond), and technical assistance for field studies. Note that all personnel are in positions in which salary is covered by soft-money sources, such as research grants; none are in salaried/tenured positions and thus direct costs of participation in this research must be covered.

Travel: $9,900 FY07 and $1100 FY08
Travel costs include expected costs to conduct field work, to interact with owners of data relevant for the population modeling exercise, and to attend the required Annual Science Symposium.

Contracts: $69,000 FY07
Contract costs are expected costs for contracted boat charters, veterinary assistance, and laboratory analyses.

Commodities: $11,000 FY07 and $1000 FY08
Commodities costs are supplies that will be consumed in the field, including veterinary equipment (anesthetic, drapes, gloves, syringes, needles, etc) and field gear (nets, capture gear maintenance, vials, liquid nitrogen, etc).

Indirect: $14,800 FY07 and $2000 FY08
Contract costs include university overhead of 10%, a rate agreed to by SFU and USGS.

DATA MANAGEMENT

1. Study Design

Methods and analyses are described above.

2. Criteria/Acceptable Data Quality

The USGS Alaska Science Center's has in place a data management plan, developed from the EVOS NVP project. All data used in this project will be treated according to guidelines delineated in the USGS Alaska Science Center data management plan.

3. Metadata

(a) Metalite Metadata information:

Identification_Information:
Citation:
Citation_Information:
Originator:
Centre for Wildlife Ecology, Simon Fraser University - Dan Esler, PI
Publication_Date: 20060804
Title: Esler_FY07_Proposal
Geospatial_Data_Presentation_Form: model
Publication_Information:
Publication_Place: Burnaby, BC Canada
Publisher: Centre for Wildlife Ecology
Description:
Abstract:
Datasets related to cytochrome P4501A induction in harlequin ducks from Prince William Sound, captured during Nov 2006 and Feb 2007. Also, population model information evaluating demographic processes involved in population recovery.
Purpose:
To assess harlequin duck population recovery from the Exxon Valdez oil spill.
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20061001
Ending_Date: 20080901
Currentness_Reference:
Status:
Progress: Planned
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -147.2
East_Bounding_Coordinate: -147.9
North_Bounding_Coordinate: 60.75
South_Bounding_Coordinate: 60.15
Keywords:

Theme:
Theme_Keyword_Thesaurus:
Theme_Keyword: population recovery
Theme_Keyword: harlequin ducks
Theme_Keyword: oil spill
Place:
Place_Keyword_Thesaurus:
Place_Keyword: Prince William Sound
Place_Keyword: Alaska
Temporal:
Temporal_Keyword_Thesaurus:
Temporal_Keyword: 1995-2008
Access_Constraints: none
Use_Constraints: none

Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Point

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Dan Esler
Contact_Organization: Centre for Wildlife Ecology, Simon Fraser University
Contact_Address:
Address_Type: Mailing and Physical Address
Address: 5421 Robertson Road
City: Delta
State_or_Province: BC
Postal_Code: V4L 1S5
Country: Canada
Contact_Voice_Telephone: 604 940-4652
Contact_Facsimile_Telephone: 604 946-7022
Contact_Electronic_Mail_Address: desler@sfu.ca
Distribution_Liability:

Metadata_Reference_Information:
Metadata_Date: 20060804
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Dan Esler
Contact_Organization: Centre for Wildlife Ecology, Simon Fraser University
Contact_Address:
Address_Type: Mailing and Physical Address
Address: 5421 Robertson Road

City: Delta
State_or_Province: BC
Postal_Code: V4L 1S5
Country: Canada
Contact_Voice_Telephone: 604 940-4652
Contact_Facsimile_Telephone: 604 946-7022
Contact_Electronic_Mail_Address: desler@sfu.ca
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998

Generated by mp version 2.6.0 on Wed Aug 02 16:13:54 2006

(b) Dataset category: species specific measurements: fields: species code, individual ID and encounter histories, region and site specific vital rates, time, CYP1A, notes.

4. Algorithms

No algorithms will be utilized in this project.

5. Sample Collection, Handling, Custody, Storage

Sample collection, handling, custody, and storage will follow procedures outlined in the main proposal text.

6. Analytical Instrumentation

Calibration of analytical instruments will be the responsibility of contract labs.

7. Data Reduction and Reporting

Off the shelf statistical (e.g., SAS, Statistica, Program Mark) programming software (e.g., Visual Basic, Excel), and presentation softwoare (e.g., SigmaPlot) will be used for data compilation and analysis.

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

Budget Category:	Proposed FY 07	Proposed FY 08		TOTAL PROPOSED
Personnel	$0.0	$0.0		$0.0
Travel	$0.0	$0.0		$0.0
Contractual	$163.1	$21.9		$185.0
Commodities	$0.0	$0.0		$0.0
Equipment	$0.0	$0.0		$0.0
Subtotal	$163.1	$21.9		$185.0
General Administration (9% of subtotal)	$14.7	$2.0		$16.7
Project Total	$177.8	$23.9		$201.7
Other Resources: (Cost Shares)				

Comments:
Considerable gear and infrastructure costs are contributed by the Centre for Wildlife Ecology, Simon Fraser University; these are estimated to be $25,000.

FY 07-08

Date Prepared:August 3, 2006
format revisions: August 11, 2006

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

Contractual Costs:	Contractual
Description	Sum
4A Linkage	163.1
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$163.1

Commodities Costs:	Commodities
Description	Sum
Commodities Total	$0.0

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

Contractual Costs: Description	Contractual Sum
4A Linkage	21.9
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$21.9

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Agency: USGS-DOI

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

Budget Category:	Proposed FY 07	Proposed FY 08		TOTAL PROPOSED
Personnel	$58.4	$17.8		$76.2
Travel	$9.9	$1.1		$11.0
Contractual	$69.0	$0.0		$69.0
Commodities	$11.0	$1.0		$12.0
Equipment	$0.0	$0.0		$0.0
Subtotal	$148.3	$19.9		$168.2
Indirect (rate will vary by contractor)	$14.8	$2.0		$16.8
Project Total	$163.1	$21.9		$185.0

FY 07-08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology, Simon Fraser University

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

Personnel Costs:				Months	Monthly		Personnel
	Name	Description		Budgeted	Costs	Overtime	Sum
	CYP1A Monitoring--						0.0
	Esler	PI		2.0	7.2		14.4
	Bond	Research Assistant		4.0	4.8		19.2
	To be determined	Technical Assistants		2.0	3.0		6.0
							0.0
	Population Modeling--						0.0
	Esler	PI		1.0	7.2		7.2
	Iverson	Demography Specialist		2.0	5.8		11.6
							0.0
							0.0
							0.0
							0.0
		Subtotal		11.0	28.0	0.0	
						Personnel Total	$58.4

Travel Costs:		Ticket	Round	Total	Daily	Travel
	Description	Price	Trips	Days	Per Diem	Sum
	CYP1A Monitoring--					0.0
	Vancouver to Anchorage (PI and field crew in Nov and Mar)	0.9	8			7.2
						0.0
	Population Modeling--					0.0
	San Francisco to Vancouver (Iverson)	0.7	1			0.7
	San Francisco to Anchorage (Iverson)	0.9	1			0.9
						0.0
	Annual Science Symposium--					0.0
	Vancouver to Anchorage	0.9	1	2	0.1	1.1
						0.0
						0.0
						0.0
					Travel Total	$9.9

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University

Contractual Costs:	Contractual
Description	Sum
CYP1A Monitoring--	
Veterinarian (30 days @ $400/day)	12.0
Boat Charter (30 days @ $1500/day)	45.0
CYP1A Analysis (80 samples @ $150/ea)	12.0
Contractual Total	$69.0

Commodities Costs:	Commodities
Description	Sum
CYP1A Monitoring--	
Veterinarian Supplies (80 birds @ $100/ea)	8.0
Misc. Consumable Field Gear	3.0
Commodities Total	$11.0

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

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

Existing Equipment Usage: Description	Number of Units	
Extensive use of SFU-owned field gear and general infrastructure.		

FY 07

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
Esler	PI		1.0	7.2		7.2
Iverson	Demographic Specialist		1.0	5.8		5.8
Bond	Research Assistant		1.0	4.8		4.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	17.8	0.0	
					Personnel Total	$17.8

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
					0.0
Annual Science Symposium					0.0
Vancouver to Anchorage	0.9	1	2	0.1	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.1

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 07 - FY 09

Contractual Costs:	Contractual
Description	Sum
Contractual Total	$0.0

Commodities Costs:	Commodities
Description	Sum
Manuscript publication costs	1.0
Commodities Total	$1.0

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 07 - FY 09

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

Existing Equipment Usage: Description	Number of Units	

FY 08

Project Number: 070816
Project Title: Evaluating Harlequin Duck Pop. Recovery
Name of Contractor: Centre for Wildlife Ecology,
Simon Fraser University