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GEM PROPOSAL SUMMARY PAGE

(To be filled in by proposer)

Project Title:	Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery
Project Period:	FY 05
Proposer(s):	Dan Rosenberg, Alaska Dept. Fish and Game
Study Location:	Prince William Sound

Abstract: This project will address the effects of lingering oil in nearshore habitats of Prince William Sound on populations of harlequin ducks. We will also address GEM objectives for long-term monitoring of harlequin and other sea duck species. We will conduct winter boat surveys to test if harlequin ducks have recovered from the effects of the EVOS by comparing population structure and trends between oiled and unoiled treatments in four areas (2 oiled, 2 unoiled) of PWS. Similar structure and trends between oiled and unoiled areas will indicate populations have recovered or are in a position to recover. Work will be complimentary to studies addressing cytochrome P450 induction and over winter survival of female harlequin ducks to give a complete picture of the effects of lingering oil. We will also test for geographic differences in population structure and trend for oiled and unoiled treatments. This is a continuation of surveys begun in 1997. Up to 3 years of surveys are proposed with the results of each year determining the need for continuation.

Funding:	EVOS Funding Requested:	FY 05	$ 39.9	
		FY 06	$	
		FY 07	$	TOTAL: 39.9
	Non-EVOS Funds to be Used:	FY 05	$ 32.0	
		FY 06	$	
		FY 07	$	TOTAL: 32.0

Date: April 14, 2004

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Harlequin Duck Population Dynamics in Prince William Sound:
Measuring Recovery

GEM RESEARCH PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Harlequin duck (*Histrionicus histrionicus*) populations in Prince William Sound (PWS) are in the process of recovering from the effects of the *Exxon Valdez* Oil Spill (Rosenberg and Petrula 2004). However, oil remains in the intertidal (Short et al. 2004) and population trends in oiled areas while no longer declining are not increasing at an equal or greater rate than those in unoiled areas (Rosenberg and Petrula 2004). This suggests a lack of full recovery.

Harlequin ducks occur year-round in intertidal zones of PWS (Isleib and Kessel 1973). At least 1,298 harlequin ducks were estimated to have died as a direct result of oil exposure following the Exxon Valdez oil spill (J. Piatt pers. comm.). Oil spill studies of harlequin ducks in western Prince William Sound (PWS) from 1990-93 found consistently low numbers of birds during the breeding season, little breeding, low productivity, and an apparent decline in post-breeding molting birds (Patten et al. 1998a, Patten et al. 1998b). In 1995, six years after the Exxon Valdez oil spill there was no sign of recovery (Exxon Valdez Oil Spill Trustee Council 1996).

As of 1997, populations were declining in oiled areas while increasing in unoiled areas although population structure (age and sex ratios) was similar between treatments (Rosenberg and Petrula 1998). Similar population structures, a positive finding, indicated that the population was in a position to recover. However, ducks in oiled areas exhibited elevated levels of cytochrome P4501A induction, indicating continued oil exposure, and adult female winter survival was lower in oiled than unoiled areas (Trust et al. 2000, Esler et al. 2000). Lower survival rates may be related to continued oil exposure (Peterson 2001). Collectively, these studies suggest that oil exposure, female survival, and population dynamics are linked and provide strong evidence that harlequin ducks had not recovered from the effects of the *Exxon Valdez* oil spill.

Meanwhile, results of longer-term monitoring surveys (Lance et al. 2001) were equivocal with respect to the effects of oil contamination on the population level of harlequin ducks. Evidence of recovery was observed in the winter population but not in summer. Different sampling schemes made comparisons difficult with more specialized harlequin duck monitoring surveys.

More recent studies indicate improving conditions. Winter population monitoring indicated no trend in oiled areas with a slightly increasing trend in unoiled areas from 1997–2002 (Rosenberg and Petrula 2004) and measurements of cytochrome P4501A levels and female survival rates from 2000–2003 were similar between oiled and unoiled areas (D. Esler, pers. comm.). However, lingering oil still remains in the environment raising the possibility of continuing low-level chronic effects (Short et al. 2001, Short et al. 2004).

Sea duck populations, in general, are composed of relatively long-lived birds with delayed sexual maturity. Productivity may be limited to a few favorable years and population levels may change slowly. In addition, harlequin ducks are highly philopatric to breeding, molting, and wintering sites (Robertson and Goudie 1999, Robertson et al. 2000). This is an adaptive strategy in natural situations and predictable environments. It is not favorable in the face of dramatic environmental perturbations or changing land-use practices nor does it favor rapid recovery and colonization of new undisturbed sites. This strong philopatry may result in continued exposure to lingering oil. Population monitoring provides a direct approach to assess recovery.

Long-term population stability depends on high adult survival coupled with a few years of successful reproduction. Initial high losses of adults, especially females, may result in a long and slow recovery period, especially if initial causes of mortality are still influential.

B. Relevance to GEM Program Goals and Scientific Priorities

Harlequin ducks occur year-round in the nearshore environment, feed on benthic invertebrates, exhibit site-fidelity, are relatively long-lived, and are widely dispersed in the Gulf of Alaska. They are the only benthic feeding avian species present in abundance year-round in PWS. These characteristics make them unique among nearshore avian predators and ideal candidates for monitoring ecosystem change.

Harlequin ducks have not recovered from the effects of the *Exxon Valdez* oil spill. Lingering oil is still present in the nearshore environment (Carls et al. 2001, Short et al. 2001, Short et al. 2004) and has the potential to interfere with physiological processes (Holland -Bartels et al. 1999). Two main hypotheses have been presented to explain population declines: (1) ingested oil or contaminated prey is continuing to cause higher mortality rates and/or (2) initial mortality caused significant losses to the western PWS population, which may result in a protracted recovery period.

In addition to establishing population recovery from the EVOS, identifying and establishing mechanisms of population change depends on an historical knowledge of the status of the resource prior to environmental perturbations and an understanding of the inter-annual variability among years in periods of relatively little perturbations in the larger physical system. Thus, our ability to detect departures from natural variation is necessary if we are to accurately evaluate the effects of major environmental perturbations whether natural or human-caused. This requires numerous samples, distributed through space and time. We are focusing on relatively long-lived avian predators that tend to show less natural variability. With time-series data on harlequin duck abundance and distribution in concert with abiotic and biotic ecosystem changes we will improve our ability to interpret the affects of natural or man-induced processes and understand the mechanisms of population change.

This project occurs in nearshore habitats of the core sampling area of the GEM program and fulfills the objectives of the nearshore-monitoring program including the development of a long-term data set that can be used for predictive modelling of ecological change (Bodkin and Dean 2003). In addition to monitoring harlequin ducks, this survey also monitors loons, surf, white-winged, and black scoters, Barrow's and common goldeneyes, common and red-breated mergansers, and sea otters. An intensive nearshore winter bird survey that can detect spatial and temporal patterns of change is one of the key components of a long-term monitoring program (Bodkin and Dean 2003). For the past 5 years, ADF&G has been monitoring harlequin duck, other sea duck, loon, and sea otter wintering populations in Kachemak Bay, Alaska, another core area of the GEM program.

Once full recovery is established for harlequin duck populations in PWS we plan to adapt this survey to other areas in the Gulf included in the GEM program (Bodkin and Dean 2003). This will leverage GEM resources. This survey design and analysis is compatible with the goals and objectives of the GEM sampling design for nearshore monitoring and can be easily adapted to any of the proposed intensive sampling areas of the nearshore monitoring program (Bodkin and Dean 2003).

II. PROJECT DESIGN

A. Objectives

1. Compare population structure (number of breeding pairs, subadult males, adult males, and females) between treatments (oiled and unoiled survey areas).

2. Compare density estimates for oiled and unoiled treatments.

3. Compare annual changes in density and population structure for oiled and unoiled treatments.

4. Compare annual changes in density and population structure *within* oiled and unoiled treatments.

5. Compare results with prior EVOS Harlequin Duck Recovery Monitoring studies

6. Add to our knowledge of harlequin duck life history

7. Monitor population change in Barrow's and common goldeneyes, surf, white-winged, and black scoters, red-breasted and common mergansers, and loons.

8. Integrate data with other long-term monitoring surveys to detect long-term changes in marine ecosystems

This study will test the following hypotheses:

1. Objective 1.

   H_o: The ratio of males to females; total ducks to subadult males; and breeding pairs to total ducks is the same for oiled and unoiled populations during March.

   $H_{1:}$ The ratio of males to females; total ducks to subadult males; and breeding pairs to total ducks is different for oiled and unoiled populations during March.

2. Objective 2. No hypothesis is being tested.

3. Objective 3.
Ho: The rate and direction of population change between years is the same for oiled and unoiled survey sites.

H_1: The rate and direction of population change between years is different for oiled and unoiled survey sites.

4. Objective 4.
H_o: The rate and direction of population change between years is the same within oiled and unoiled survey sites.

H_1: The rate and direction of population change between years is different within oiled and unoiled survey sites.

5. Objective 5. No hypothesis is being tested.

6. Objective 6. No hypothesis is being tested.

7. Objective 7. No hypothesis is being tested at this time.

8. Objective 7. No hypothesis is being tested.
9.

This study is directly linked to the recovery objectives for harlequin ducks in the EVOS Restoration Plan (Exxon Valdez Oil Spill Trustee Council 2002) and the goals of the GEM, nearshore monitoring project (Bodkin and Dean 2003). This project will provide winter population trends, compare population structure, and provide an index of recruitment between oiled and unoiled areas, allowing us to assess recovery of harlequin duck populations from the EVOS. It will also provide insight into geographic differences within PWS. In the short-term it will help us understand the effects of lingering oil and in the long-term help identify mechanisms of population change in the nearshore environment.

Information from this project will aid in the development of a population model. This will allow researchers to predict rates of population change and predict trends. While some of this information has been collected for PWS populations (Rosenberg and Petrula 1998, Holland-Bartels et al.1999) and harlequin ducks in North America (Goudie et al. 1994, Robertson and Goudie 1999), many specifics are still lacking, including long-term data on productivity, recruitment, dispersal, and subadult survival.

Results of this work will have a direct bearing on assessing the status and outlook for this resource and help guide agency programs and policies related to public uses, including subsistence and recreational hunting, land-use practices, and wildlife viewing.

B. Procedural and Scientific Methods

We propose up to three additional years of winter boat surveys in order to compare population trends and structure with data from four winter surveys conducted from 1997–2002. We will survey oiled and unoiled areas identified in project \427 (Rosenberg and Petrula 1998) plus the additional oiled and unoiled areas added by project \407 (Rosenberg and Petrula in prep.). This will increase statistical power to detect recovery, improve our ability to assess changes in the marine ecosystem, and quantify geographic variation within PWS. Repeat surveys will be conducted at selected sites to improve estimates of variance.

Surveys will be conducted in late-winter. Surveys in oiled and unoiled areas will not be conducted simultaneously because this is a period of relative stability in both numbers and movements of harlequin ducks. This is a continuation of Project /407 conducted from 2000–2002 and continued in 2004.

All sea ducks, loons, and sea otters will be recorded on transects. For harlequin ducks, observations will be recorded by sex and males will be divided into two age groups using predetermined criteria (Rosenberg and Petrula 1998). Surveys will be conducted from open skiffs up to 20 feet long. Each skiff will have two observers. Surveys will be conducted from within 30 meters of shore along predetermined routes. Distance to shore will be peridically verified by use of electronic rangefinders. A pace and course will be chosen that will assure complete coverage of the survey area and maximize the opportunity to see ducks. All transects will be mapped and all observations will be recorded by date and location (GPS).

C. Data Analysis and Statistical Methods

Population composition and annual changes in density will be compared to test whether harlequin duck populations are exhibiting similar growth trends or the oiled (injured) population is exhibiting a different direction or rate of change. We will continue to test whether low reproductive success in oiled areas has resulted in changes in population age and sex structure. The proportion of first-year males to total males will be used as a measure of past reproductive success. Surveys will be used to detect changes in abundance and compare the direction and rate of change between years for the four survey areas and two treatments. Data from winter surveys in 1997, 2000–2002, and 2004 will be incorporated into the analysis and data from 1995-1997 surveys (spring, summer, fall) will be used when applicable.

Survey Coverage

Shoreline length (km) of transects will be calculated from the Alaska Department of Natural Resources PWS_ESI ARC/INFO GIS database. Shoreline length of small islands not included in the PWS_ESI ARC/INFO GIS database was calculated using the U.S. Forest Service CNFSHORE ARC/INFO GIS database.

Population Structure

We will use a generalized logit model (Agresti 1990) to test for annual differences among locations (WPWS, SWPWS, EPWS, MONT) and between treatments (oiled and unoiled) for the following ratios: (1) males to females; (2) sub-adult males to adult males; and 3) sub-adults (both sexes) to adult females. A test of the hypothesis of no interaction among main effects (year, location, treatment) is based on a likelihood ratio test (Stokes et al. 1995). Non-significant interaction terms are excluded from the model using a backward elimination process and at each step a reduced model is used to test for significant year, area, or treatment effect (Stokes et al. 1995). For example, if there is no evidence of a treatment by year interaction we fit a model without the interaction. This reduction continued in a stepwise fashion eliminating nonsignificant main effects and interaction terms from the model. The SAS model uses the Gen Mod Procedure (proc genmod) with a binomial distribution and link = logit.

The full model was (using the sex ratio as an example):

$$ln\left(\frac{m_{1jkl}}{m_{2jkl}}\right)=\alpha+\tau_j+\tau_k+\tau_{k(l)}+\tau_{jk}$$

Where *m* is the expected number of birds counted;

sex is indexed by number (1 = male, 2 = female);
j indexes year (1 = 1997, 2 = 2000, 3 = 2001, 4 = 2002);
k indexes treatment (1 = oiled, 2 = unoiled); and
l indexes area (EPWS, MONT, SWPWS, WPWS) within a treatment.

Harlequin ducks classified as unknown are not included in the ratio analysis. Counts will not be adjusted to compensate for variation in survey coverage among years because we used relative measures of abundance.

Trend Analysis

We will standardize all counts of birds to linear densities (birds/km of shoreline surveyed) to facilitate comparisons in trends in abundance among areas and between treatments. We will analyze our data in a hierarchical model at four spatial scales: (1) transect, (2) region, (3) area and (4) treatment. Using simple linear regression we estimate the rate of change in densities (mean slopes) for each transect. The estimated slopes are incorporated into our hierarchial model. Our four areas also referred to as 'study areas' are composed of two oiled treatments, WPWS and SWPWS, and two unoiled reference areas EPWS and MONT (Rosenberg and Petrula 2004).

Regions (regional spatial scale), subsets of areas, consist of groups of transects in close geographic proximity. We will average the slopes of each transect within a region based on the transect's weight (transect weight = mean number of ducks on a transect/regional total). This minimizes any variability incurred from short localized movements by birds between "neighboring" transects and gives more weight to transects supporting the most birds.

For each spatial scale we compare the average rate of change (ANOVA). For each transect we fit a simple linear regression model (y=density, x=year) to obtain an estimate of the rate of change in duck densities (bird/km) for total birds and for each age and sex class. We use a nested analysis of variance to test for differences in the rate of population change (population trends) between treatments and areas within treatments, and among regions within areas, and among transects:

Rate of change = overall mean + treatment + area (treatment) + region (treatment area) + transect (region area treatment)

Absolute Measures

When calculating annual variation in the number and composition of harlequin ducks, we will adjust our counts to include only those birds located in areas of comparable survey coverage, thereby adjusting for differences in survey effort. The number of harlequin ducks classified as unknown varied among our surveys. To avoid erroneous interpretation when comparing the absolute abundance of specific components of the population, we will partition unknown birds among the appropriate age and sex categories based on observed proportions.

Power Analysis

We will use power analysis to evaluate our statistical results. Power is our ability to detect a difference in mean slopes when there is a difference. The analysis evaluates the strength of our statistical test and measures our confidence in the results.

We calculate the power to detect differences in mean slopes between treatments at alpha (α) = 0.05, 0.10 and 0.20 (see Table 1). The power of a statistical test depends upon three interacting factors: 1) the risk of acceptable error (α) when rejecting the null hypothesis, 2) amount of change to be detected (difference in mean slopes between treatments) relative to the variance in the tested population, and 3) the sample size (Glantz 1981). Power increases with increasing α level and sample size and decreasing variance. Power decreases if we require stronger evidence that there be a treatment effect (lower α). A large effect (difference in slopes) is easier to detect than a small one.

D. Description of Study Area

The proposed project will be conducted in the oil spill area of western Prince William Sound and unoiled eastern PWS between Valdez and Cordova and northern Montague Island. March surveys will repeat areas surveyed in /427 Harlequin Duck Recovery Monitoring (Rosenberg and Petrula 1998) plus additional survey sites in PWS will be located on Montague Island, following the sampling scheme of project \025 Nearshore Vertebrate Predator Project (Holland-Bartels et al. 1999), and southwestern PWS.

Transects in the spill area will be located on Knight Island, Applegate Island, Culross Island, Foul Bay, Falls Bay, Crafton Island, Chenega Island, Green Island, Naked Island, and Bainbridge, Evans, Danger and Latouche islands. Surveys in non-oiled areas will include portions of

Hinchinbrook Island, Simpson Bay, Sheep Bay, Port Gravina, Landlocked Bay, Bligh and Busby islands, Galena Bay and Valdez Arm, and Montague Island.

These areas are all within the core area of the GEM program and include portions of all sampling blocks within PWS including most of the nearshore of the intensive sampling block identified by Bodkin and Dean (2003).

E. Coordination and Collaboration with Other Efforts

This project is complimentary to EVOS Project /423 Patterns and Processes of Population Change in Selected Nearshore Vertebrate Predators. Coordination is ongoing with the above project including sample collection, site coordination, and information sharing (Dan Esler, Dan Rizzolo, USGS and Tuula Hollmen, Alaska SeaLife Center). It is also complimentary to ADF&G's sea duck surveys in Kachemak Bay, Alaska (Petrula and Rosenberg In prep.) and ADF&G/Sea Duck Joint Venture/National Fish and Wildlife Foundation project on population delineation of harlequin ducks in PWS (Rosenberg and Petrula In prep. B).

ADF&G personnel will conduct all data collection and analysis. Winter surveys and contracts for vessel support for winter surveys will be coordinated with related EVOS projects. Private sector contracts for winter vessel support will be solicited.

This project will be integrated with ongoing studies or findings of past studies including project \427 Harlequin Duck Recovery Monitoring; and project \159 Prince William Sound Marine Bird and Mammal Surveys. Information exchange has been on-going with marine bird and mammal surveys (Dave Irons, USFWS).

Travel to villages will be coordinated with the Chugach School District (see Community Involvement).

III. SCHEDULE

A. Project Milestones

Objective 1. Compare population structure (number of breeding pairs, subadult males, adult males, and females) between treatments (oiled and unoiled survey areas).
To be met by March 2005 (field work).

Objective 2. Compare density estimates for oiled and unoiled treatments.
To be met by March 2005 (field work).

Objective 3. Compare annual changes in density and population structure for oiled and unoiled treatments.
To be met by October 2005 (report).

Objective 4. Compare annual changes in density and population structure *within* oiled and unoiled treatments.

To be met by October 2005 (report).

Objective 5. Compare results with prior EVOS Harlequin Duck Recovery Monitoring studies.
To be met by October 2005 (report).

Objective 6. Add to our knowledge of harlequin duck life history.
To be met by October 2005 (report).

Objective 7. Monitor population change in Barrow's and common goldeneyes, surf, white-winged, and black scoters, red-breasted and common mergansers, and loons.
To be met by March 2005 (field work).

Objective 8. Integrate data with other long-term monitoring surveys to detect long-term changes in marine ecosystems
To be met by October 2005 (report).

This is proposed as a possible multi-year monitoring program designed to assess the recovery of an injured species. Each project objective will be assessed annually for oiled and unoiled areas then compared with each other and with data collected in subsequent years.

B. Measurable Project Tasks

FY 05, 1st quarter (October 1, 2004-December 31, 2004)
October: Project funding approved by Trustee Council.
Interagency coordination. Plan logistics and personnel for winter surveys. Contract for vessel support.

FY 04, 2nd quarter (January 1, 2005-March 31, 2005)
January 12-16 (tentative): Annual GEM Workshop.
Hire seasonal technicians. Prepare field equipment. Finalize field logistics. Conduct winter surveys in PWS.

FY 04, 3rd quarter (April 1, 2005-June 30, 2005)
Create databases, GIS. Analyze field data and begin report preparation. Maintain equipment.

FY 04, 4th quarter (July 1, 2005-September 30, 2005)
Finish analyses and final report/manuscripts submitted to Trustee Council Office.

V. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

A Traditional Ecological Knowledge report was prepared as part of EVOS Restoration Project 427 Harlequin Duck Recovery Monitoring (Rosenberg and Petrula 1998). As we have done in the past we will continue to coordinate with the villages of Tatitlek (Gary Kompkoff) and Chenega Bay (Larry Evanoff, Pete Kompkoff and Kate McLaughlin),Cordova (Scott Hahn), and Valdez (Charlie Hughey)on our activities and possibilities for community involvement. No funds are being requested for local hire or equipment or vessel support. Limited funds for travel to Chenega is being requested.

B. Resource Management Applications

The Alaska Department of Fish and Game, has a statutory mandate to manage and protect wildlife and their habitats on state and private lands for the benefit of Alaskans. Migratory bird management requires good scientific information to detect population change, prevent habitat degradation, and manage public uses of migratory birds and their habitats. Numbers of several sea duck species are declining throughout much or all of their range including Alaskan breeding populations (Goudie et al 1994, Hodges 1996). Little is known about the status of wintering populations in the Gulf of Alaska. The ADF&G Statewide Waterfowl Program is responsible for adopting migratory bird hunting regulations (sport and subsistence) within the Pacific Flyway under the federal framework, and commenting on permits for mariculture and wetland, development within the nearshore environment, adjacent commercial and recreational activities, and oil spill contingency plans. This study will provide ADF&G with information to improve its management capabilities. Contact Tom Rothe or Dan Rosenberg, ADF&G.

V. PUBLICATIONS AND REPORTS

An annual report will be presented by September 30, 2005. Publications will be prepared for peer-review journals in lieu of final report when possible and will depend upon the duration of the project. Publications planned for FY05: Harlequin duck population dynamics following the *Exxon Valdez* Oil Spill. Waterbirds. Submit January 2005.

VI. PROFESSIONAL CONFERENCES

Tentative: Joint meeting of theAmerican Ornithological Socirety and Society of Canadian Ornithologists, 16-21 August, Quebec City, Canada. Presenter.

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Table 1. Power analysis of statistical test comparing (a) change in densities (difference in mean slopes) for entire oiled and reference areas for winter surveys conducted in Prince William Sound, Alaska from 1997–2002 and (b) change in densities (difference in mean slopes) for just WPWS (oiled) and EPWS (unoiled), our two original study areas, for winter surveys conducted in Prince William Sound, Alaska from 1997–2002. Observed differences in slopes are in **bold type** (from Rosenberg and Petrula 2004).

Table 5a.

Difference in Slopes	0	0.1	0.2	0.3	**0.304**	0.4	0.5	0.6	0.7	0.8	0.9	1
power (α= 0.05)	0.02	0.15	0.34	0.65	**0.66**	0.88	0.98	1.00	1.00	1.00	1.00	1.00
power (α= 0.10)	0.05	0.19	0.46	0.76	**0.77**	0.93	0.99	1.00	1.00	1.00	1.00	1.00
power (α= 0.20)	0.10	0.31	0.61	0.86	**0.87**	0.97	1.00	1.00	1.00	1.00	1.00	1.00

Table 5b.

Difference in Slopes	0	0.1	0.2	0.3	0.4	0.5	0.6	**0.649**	0.7	0.8	0.9	1
power (α= 0.05)	0.02	0.07	0.17	0.33	0.54	0.73	0.87	**0.92**	0.95	0.99	1.00	1.00
power (α= 0.10)	0.05	0.12	0.26	0.46	0.67	0.83	0.93	**0.96**	0.98	0.99	1.00	1.00
power (α= 0.20)	0.10	0.22	0.40	0.61	0.79	0.91	0.97	**0.98**	0.99	1.00	1.00	1.00

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Professional History

Wildlife Biologist. Alaska Department of Fish and Game, Anchorage, AK. 1985–Present.
Habitat Biologist. Alaska Department of Fish and Game, Anchorage, AK. 1983–1985.
Wildlife Biologist. U.S. Fish and Wildlife Service, Anchorage, AK. 1980–1983.
Adjunct Faculty. Anchorage Community College, Anchorage, AK. October 1984 - May 1987.

EDUCATION
Humboldt State University, Arcata, CA. March 1979.
Bachelor of Science degree - Wildlife Management.
Boston University, Boston MA. 1969 - 1972. Liberal Arts.

AWARDS
ADF&G Employee of the Year, 1991.
Alaska Outdoor Council, Waterfowl Conservationist of the Year, 1993

SELECTED PUBLICATIONS

Huntington, H.P., R.S. Suydam, and D.H. Rosenberg. In Press. Traditional ecological knowledge, satellites, and migratory species: complementary approaches to ecological understanding and conservation. Polar Record.

Huntington, H.P, P.K. Brown-Schwalenberg, K.J. Frost, M.E. Fernadez-Gimenez, D.W. Norton and D.H. Rosenberg. 2002. Observations on the workshop as a means of improving communication between holders of traditional and scientific knowledge. Environ. Mgmt. 30:6, 778-792.

Rosenberg, D. H., and M. J. Petrula. 1999. Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Proj. 98273). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage. 34pp.

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Rosenberg, D.H. and M.J. Petrula. 1998. Status of Harlequin Duck Populations in Prince William Sound, Alaska, after the *Exxon Valdez* Oil Spill, 1995-1997. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 97427), Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

Rosenberg, D. H., and M. J. Petrula. 2001. Harlequin duck population dynamics, Exxon Valdez Oil Spill Restoration Project Annual Report (Restoration Project 00407), Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska. 33pp

COLLABORATORS

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Tuula Hollmen, DVM – Alaska SeaLife Center, Seward, AK
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Mark Lindberg – Associate Professor, University of Alaska Fairbanks, Department of Biology and Wildlife, Fairbanks.
Edward Mallek – U.S. Fish and Wildlife Service, Office of Migratory Birds, Fairbanks, Alaska.
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Russ Oates – U.S. Fish and Wildlife Service, Office of Migratory Birds, Anchorage, Alaska.
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Academic Credentials:

M.S. Wildlife Biology	University of Alaska Fairbanks	1994
B. S. Animal Science	Tennessee Technological University	1978

Professional Credentials:

Wildlife Biologist II Alaska Department of Fish and Game 1996 – present

Publications:

Petrula, M. J. and D. H. Rosenberg. *in prep.* Small boat and aerial survey of waterfowl in Kachemak Bay, Alaska 1999-2003.

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Thomas Fondell – United States Geological Survey, Biological Resources Division, Alaska Science Center, Biological Science Office, Anchorage, Alaska.

Jerry Hupp – United States Geological Survey, Biological Resources Division, Alaska Science Center, Biological Science Office, Anchorage, Alaska.

Ken Jones – University of Illinois at Chicago, Department of Biological Sciences, Chicago, Illinois.

William Larned - United States Fish and Wildlife Service, Office of Migratory Birds, Soldotna, Alaska.

Mark Lindberg – Associate Professor, University of Alaska Fairbanks, Department of Biology and Wildlife, Fairbanks, Alaska.

Edward Mallek – United States Fish and Wildlife Service, Office of Migratory Birds, Fairbanks, Alaska.

John Pearce - United States Geological Survey, Biological Resources Division, Alaska Science Center, Biological Science Office, Anchorage, Alaska.

Rick Sinnott – Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

Sandy Talbot - United States Geological Survey, Biological Resources Division, Molecular Ecology Laboratory, Alaska Science Center, Biological Science Office, Anchorage, Alaska.

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

Budget Category:	Proposed FY 05	Proposed FY 06	Proposed FY 07		TOTAL PROPOSED
Personnel	$8.6				$8.6
Travel	$1.9				$1.9
Contractual	$24.3				$24.3
Commodities	$1.8				$1.8
Equipment	$0.0				$0.0
Subtotal	$36.6				$36.6
General Administration (9% of Subtotal)	$3.3				$3.3
Project Total	$39.9				$39.9

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.

Personnel: ADF&G will share salary cost. Salary for Principal Investigator (3.0 months) and Senior Biologist (2.5 months) will be provided by ADF&G from the agency's budget. Total = $32.0

FY 05-07

Date Prepared: 14-Apr-04

Project Number: 050759
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game
Lead Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Name	Description					
2 F&G Tech.	F&W Tech. III, Field Tech	11F	2.0	3.8	1.0	8.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	3.8	1.0	
					Personnel Total	$8.6

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Description					
Whittier Toll - 2 vehicles and trailers					0.1
Community Involvement - travel to Chenega	300.0	1	2	80.0	0.6
Conference Travel (tentative)	700.0	1	5	90.0	1.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.9

FY 05

Project Number: 050759
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game
Lead Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05 - FY 07

Contractual Costs:	
Description	Contract Sum
Boat and outboard motor repair and maintenance	2.0
Photo processing, presentation productions	0.1
Air charter for field support 4 hrs @ $270/hr	1.0
Launch fee, Trailer and boat moorage Whittier	0.2
Vessel support for March surveys 15 days @1300/day	19.5
Truck Leasing Costs	0.5
Manuscript Publication (see proposal)	1.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$24.3

Commodities Costs:	
Description	Commodity Sum
Boat fuel 350 gallons @ $2.00/gal	0.7
Boat supplies- replacement parts, props, fuel lines, fuel filters, water filters, battery, absorbent rags, oil, emergency provisions	0.8
Field survey supplies- rite-in-rain notebooks/paper, nautical charts, batteries,	0.3
Commodities Total	$1.8

FY 05

Project Number: 050759
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game
Lead Agency: ADFG

FORM 3B
Contractual &
Commodities
DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

New Equipment Purchases:	Number of Units	Unit Price	Equipment Sum
Description			
NONE			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:	Number of Units	Inventory Agency
Description		
17 ft. Boston Whaler	1	ADFG
10x40 binoculars	4	ADFG
Spotting Scopes	2	ADFG
Survival Suits	2	ADFG
Outboard Motors/various hp	6	ADFG
Garmin GPS	3	ADFG
Marine VHF radios	4	ADFG

FY 05

Project Number: 050759
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game
Lead Agency: ADFG

FORM 3B
Equipment
DETAIL

Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery

Budget Justification FY05

FY05: Total Request $39.9K including GA

Personnel Costs: Amount Requested $ 8.6

The ADF&G Statewide Waterfowl Program has a full time staff of 3, which includes the Statewide Coordinator. We have no additional staff, clerical or otherwise. To survey the proposed study area requires a window of 15 days using 2 skiffs with a crew of 2 each. The Coordinator is not available for surveys. Thus, we need to be prepared to hire or fund 2 part-time employees. At minimum, one of these employees is necessary for mobilization and demobilization. While conducting surveys at sea, state labor contracts require supplemental sea duty pay.

The state is providing 5.5 months of personnel costs for the two full-time biologists in the Statewide Waterfowl Program to cover project planning, additional mobilization and demobilization costs, survey time, and report preparation and writing, and attendance at conferences and meetings.

Travel Costs: Amount Requested $1.9

The majority of this is for travel to a conference. However this is tentative and if funding is a problem this can be eliminated. The remainder is primarily for Community Involvement. I have been requested to make a presentation to the Chenega School. This must be done during the school year, which requires air travel to Chenega and the cost of lodging in Chenega. Although the Whittier tunnel is a state facility, the state agencies are charged a toll for trucks and boat trailers.

Contractual Costs: Amount Requested $24.3

The majority of this is for vessel support during the survey. Short daylight and winter weather preclude the efficient and safe use of a field camp. Therefore it is necessary to charter a larger vessel to provide housing and tow skiffs when necessary in inclement weather to make travel safer and more efficient. Costs are based on past bids that vary from year to year. Weather delays also are factored in to the estimates.

We have never had to postpone or delay surveys due to mechanical problems. Boat and motor maintenance is necessary for safe and efficient operation. Honda recommends a complete tune-up every 200 hours (about the amount we put on each motor during a survey). The minimum cost is $200 per motor – we have three motors. That leaves just $1400 for any other repairs and maintenance. Shop labor is $89/hour.

One of our boats is provided in-kind by ADF&G.

Air Charter costs are based on floatplane access from either Anchorage or Cordova depending upon the location and situation. This includes changes in field crew if needed, emergency evacuation, emergency delivery of boat parts or survey equipment.

We do not have a dedicated truck (or vehicle for the waterfowl program) and need to arrange to use shared vehicles. We require 2 vehicles to tow the boats and transport gear to and from Whittier and move boats to service etc. This pays for 1 month of leasing costs for one shared vehicle or the two we require. The other is provided in-kind by ADF&G.

Commodities Costs: Amount Requested $1.8

The biggest costs are for boat fuel, purchased in Whittier and boat parts. Boat fuel is based on the amount used in past surveys for 2 skiffs operating for almost 200 hours each in a 15-day period. Fuel costs are estimated a year in advance. Many parts need to be replaced annually and/or require spare parts in case of failure during the field season. It would be costly and inefficient to return to town in the middle of a survey to buy parts so we need to be prepared. Safety is also a factor. Harlequin duck surveys are conducted in rocky nearshore areas and prop damage is not uncommon. Boat propellers alone cost about $100 each and we require a minimum of 5 extra propellers.

Equipment Costs: Amount Requested $0.0

No new equipment is being purchased.

Why costs not being fully covered by ADF&G.

The Alaska Department of Fish and Game, has a statutory mandate to manage and protect wildlife and their habitats on state and private lands for the benefit of Alaskans. The ADF&G Statewide Waterfowl Program has very limited funds to fulfill the obligations of this mandate and funds will be further reduced in 2005. Limited staffing and funding precludes ADF&G from undertaking these surveys as part of normal operations and in the past ADF&G has not conducted marine bird surveys in PWS as part of its normal waterfowl management functions nor responded to oil spills.

ADF&G is offering to partner to study the effects of lingering oil from the EVOS by providing staff salaries, and ADF&G in-kind contributions of a boat, vehicle, and office equipment and supplies.