

## 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 June 27, 2007).

**PROJECT TITLE:** Amendment to Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery from the Exxon Valdez Oil Spill

Printed Name of PI: Dan Rosenberg

Signature of PI: \_\_\_\_\_ Date 2/22/08

Printed Name of co-PI: NA

Signature of co-PI: \_\_\_\_\_ Date \_\_\_\_\_

Printed Name of co-PI: NA

Signature of co-PI: \_\_\_\_\_ Date \_\_\_\_\_

\* Available at [www.evostc.state.ak.us/Policies/data.htm](http://www.evostc.state.ak.us/Policies/data.htm)

\*\* Available at [www.evostc.state.ak.us/Policies/guidelines.htm](http://www.evostc.state.ak.us/Policies/guidelines.htm)

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Project No: \_\_\_\_\_

Date Received: \_\_\_\_\_

**PROPOSAL SUMMARY PAGE**  
**(To be filled in by proposer)**

Title: Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery from the *Exxon Valdez* Oil Spill. Amendment to add Pilot Study to assess transect variability.

Project Period: April 1, 2008 – September 30, 2008

Proposer(s): Dan Rosenberg, Alaska Dept. Fish and Game  
E-mail: dan.rosenberg@alaska.gov

Study Location: Prince William Sound

Abstract: Since demographic studies were initiated, Cytochrome P450 1A induction studies have documented exposure to EVO at smaller spatial scales than population monitoring studies can measure. This biomarker of oil exposure has been correlated with lower female survival and is consistent with a lower proportion of females in oiled areas. However, broad scale demographic studies indicate population stability in oiled areas and not the decline expected if oil exposure reduces survival rates. This proposal attempts to improve the ability of demographic studies to assess data at smaller spatial scales commensurate with extant oil exposure, lingering oil, and oiling intensity. We will conduct Phase 1 of a Pilot Study to assess the range of variability on our transect counts by conducting replicate surveys of a random subsample of transects based on transect length and oiling history. The Pilot Study (Phase 2) will be continued in FY09.

Funding:	<u>FY 08</u>
EVOS Funding Requested:	\$36.3
(must include 9% GA)	\$4.3
TOTAL:	\$40.6
Non-EVOS Funds to be Used:	\$6.4
<b>TOTAL:</b>	<b>\$47.0</b>

Date: February, 22, 2008

(NOT TO EXCEED ONE PAGE)

# Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery from the *Exxon Valdez* Oil Spill

## *Exxon Valdez* Oil Spill Trustee Council FY 2008 Amendment Injured Resources and Services

### **I. NEED FOR THE PROJECT**

#### **A. Statement of Problem**

Harlequin duck (*Histrionicus histrionicus*) populations in Prince William Sound (PWS) have not fully recovered from the effects of 1989 *Exxon Valdez* Oil Spill (EVOS Trustee Council 2002, Integral Consulting Inc. 2006). The outlook for full recovery for harlequin ducks is improving (Rosenberg et al. 2006, Integral Consulting Inc. 2006). However, bioavailable oil remains in the intertidal (Short et al. 2004, Short et al. 2005) and ducks residing in intertidal habitats are still being exposed to this lingering oil (Ballachey et al. 2006). The lack of a population increase (Rosenberg et al. 2005, McKnight et al. 2006) and the lower proportions of females in oiled areas (Rosenberg et al. 2005) coupled with chronic exposure (Ballachey et al. 2006) and lower female survival through 1998 (Esler et al. 2000a) suggest that oil exposure and population dynamics are linked and may be inhibiting full recovery.

The current status of harlequin duck populations in oiled areas of PWS is a result of the initial impacts from the spill, continued exposure to lingering oil, and other environmental stressors. Harlequin ducks occur year-round in intertidal zones of PWS (Isleib and Kessel 1973). At least 1,298 harlequin ducks (approximately 7% of the wintering population in PWS but a much higher percentage of ducks within oiled areas) were estimated to have died as a direct result of oil exposure following the *Exxon Valdez* oil spill (J. Piatt pers. comm.). Much of the *Exxon Valdez* oil was deposited in nearshore habitats where harlequin ducks reside (Galt et al 1991). The persistence of this oil (Short et al. 2004) created the potential for long-term chronic effects from continued exposure which was additive to the initial acute mortality that occurred immediately after the spill (Trust et al. 2000, Peterson 2001, Esler et al. 2002, Rosenberg et al. 2005, Ballachey et al. 2006).

Population recovery for harlequin ducks has taken much longer than anticipated at the time of the spill. Harlequin ducks are relatively long-lived birds with delayed sexual maturity and low rates of annual recruitment and dispersal. Long-term population stability depends on high adult survival coupled with a few years of successful reproduction. 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 and does not favor rapid recovery or colonization of new sites. Initial high losses of adults, especially females, coupled with many years of chronic oil exposure may result in a long recovery period. Once oil exposure abates full recovery may still take many years.

Population monitoring provides the most direct approach to assess recovery because it measures changes in abundance and composition. Harlequin duck population surveys in PWS following the spill were designed to measure recovery based on the EVOS Trustee Council Recovery Objectives for harlequin ducks. Although recovery objectives have been modified over the years, the most recent iteration states that “Harlequin ducks will have recovered when breeding- and nonbreeding season demographics return to pre-spill levels and when biochemical indicators of hydrocarbon exposure in harlequins in oiled areas of Prince William Sound are similar to those in harlequins in unoiled areas (EVOS Trustee Council 2006).

Unfortunately, pre-spill data on harlequin duck population trends and demographics in PWS are limited, making it difficult to compare post-spill trends with pre-spill data. Thus, most of the demographic information available for evaluating the status of injury comes from post-spill comparisons of oiled and unoiled areas of PWS (Rosenberg and Petrula 1998, Lance et al. 2001, Rosenberg et al. 2005, McKnight et al. 2006).

These demographic studies have been designed to compare population level effects at spill-wide and smaller but still broad regional spatial scales (Rosenberg et al. 2005) but were not intended to assess demographic changes based on oiling history at much smaller spatial scales (i.e. individual shoreline segments or bays). Since demographic studies were initiated, Cytochrome P450 1A induction studies have documented exposure to EVO at these much smaller spatial scales (Esler et al. 2000, Ballachey et al. 2006). This biomarker of oil exposure has been correlated with lower female survival (Esler et al. 2000a) and is consistent with demographic studies that have identified a lower proportion of females in oiled areas (Rosenberg et al. 2005). However, broad scale demographic studies (Rosenberg et al. 2005, McKnight et al. 2006) indicate population stability in oiled areas and not the decline in abundance expected if continued oil exposure reduces survival rates significantly or conversely the increase in abundance expected if exposure rates are declining.

This has generated interest in improving the ability of demographic studies to assess data at the smaller spatial scales commensurate with extant oil exposure and oil history. Differing population trends and composition for areas with continued exposure may be masked when analyzing data at much broader spatial scales within the spill area. Confounding this is the length of time since the spill, making it increasingly difficult to separate continued oil effects from natural or anthropogenic factors that may affect population structure or growth rates.

ADF&G demographic studies (Rosenberg and Petrula 1998, Rosenberg et al. 2005) were designed so they could be analyzed in a hierarchical fashion at different spatial scales or by degree of oiling but are limited by the variability in counts for individual transects. This is due to the mobility of harlequin ducks and their patchy distribution within PWS. Thus, before we can compare population level effects at much smaller geographic scales we need to assess whether we can improve our power to detect differences in trends at these smaller scales by reducing sampling variability for individual transects.

We propose to initiate a pilot study in FY08 as part of our harlequin duck monitoring surveys to assess the range of variability on our transect counts. We propose to continue the Pilot Study in FY09 and if successful in reducing the spatial scales for data analysis we will develop and

implement new survey protocol in FY09 that can incorporate our historical winter data (1997–2008) while improving our ability to detect changes in abundance and composition at smaller spatial scales.

## **B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities**

The demographic parameters we are measuring are consistent with EVOS Trustee Council recovery objectives. This study directly assesses the recovery status of harlequin ducks in PWS and is directly linked to the recovery goals, objectives and restoration strategy for harlequin ducks in the EVOS Restoration Plan including estimates of population sizes and trajectories in the spill area and comparisons of population estimates in oiled and unoiled areas of PWS (*Exxon Valdez Oil Spill Trustee Council 2002*). Additionally, continued demographic monitoring of harlequin ducks was recommended by Integral Consulting Inc. (2006).

Two main hypotheses have been presented to explain lack of full recovery: (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. This project will help assess the recovery rate and identify constraints to recovery of harlequin ducks by providing winter population trends, comparing population structure, and providing an index of recruitment between oiled and unoiled areas. It will also provide insight into geographic differences within PWS. In the short-term it will help us understand the effects of exposure to lingering oil and in the long-term help identify mechanisms of population change in the nearshore environment.

Information from this project will be incorporated into a population model that will improve our ability to predict rates of population change and estimate the time period necessary for full recovery (EVOS Project 070816, Evaluating Harlequin Duck Population Recovery: CYP1A Monitoring and a Demographic Population Model). There are no precedents for recovery from oil spills for harlequin ducks. Harlequin duck populations have relatively low intrinsic growth rates (Goudie et al. 1994) so full recovery from initial and chronic mortality may be delayed until long after all spill effects have abated (Esler et al. 2002). While some of the demographic information for a model has been collected for PWS populations (Rosenberg and Petruła 1998, Rosenberg et al. 2005, Holland-Bartels et al. 1999) and harlequin ducks in North America (Goudie et al. 1994, Robertson and Goudie 1999), long-term data on natural variation, productivity, recruitment, dispersal, and immature survival are still lacking.

Long-term data sets are needed for predictive modeling of ecological change. 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.

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.

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.

## **II. PROJECT DESIGN**

This study will attempt to improve our assessment of the recovery status of harlequin ducks in oiled areas of PWS by comparing changes in abundance (densities) and structure (sex and age ratios) between oiled and unoiled areas (treatments) since 1997 at smaller spatial scales than previously analyzed. We will first conduct a pilot study to assess the variability on our transect counts. If variability allows we will develop and implement a new survey protocol that will incorporate our historical winter data (1997–2008) but improve our ability to detect changes in abundance and composition at smaller spatial scales commensurate with areas of extant oil exposure in harlequin ducks (Cytochrome P450 1A induction) and oiling history.

Planning is complicated by the desire to expedite the project. Prior EVOS Restoration Office commitments will not allow us to conduct the Pilot Study this March. This necessitates beginning the Pilot Study in FY08 (April) before birds start to disperse and continuing it next winter (need more replicates to measure variability under various conditions). We will then analyze the data and develop new survey protocols in time to conduct the Population Monitoring survey in March 2009 using the new protocols.

### **Pilot Study**

The pilot data will give us estimates of within-year transect variability. Depending on the magnitude of transect variability we will create smaller “sub-regions” (i.e. consolidating several transects) which will be associated with oiling intensities (high, medium, low). The number of transects composing a sub-region will depend on variability.

### **A. Objectives**

1. Develop a sampling protocol to improve estimates of within year transect variability for oiled and unoiled treatments;
2. Determine the spatial scales suitable for trend and composition estimates relevant to oil history; and

3. Develop a new survey protocol to estimate changes in number of harlequin ducks and sex and age composition at smaller spatial scales.

No hypothesis is being tested.

## **B. Procedural and Scientific Methods**

The Pilot Study will be initiated in April 2008 and continued in winter 2009. Once completed, we will quickly have to analyze data and design new protocols prior to March 2009. Surveys cannot be conducted from mid-April to mid-November due to seasonal movements of birds.

Within oiled and unoiled treatments we will randomly select from a stratified list of previously surveyed transects to get initial estimates of measurement variability. Transects will be stratified based on length, treatment (oiled, unoiled) and within the oiled treatment by oiling history (high, medium, low). The selected transects will be surveyed repeatedly (we estimate five replicates each depending upon variability) at varying conditions (weather, tides, time of day). General survey methods will follow procedures in Rosenberg et al. (2005).

If possible we will incorporate transects from the USFWS Marine Bird Surveys (McKnight et al. 2006) into our analysis to increase the number of transects in the oiled area. We will also attempt to incorporate estimates of measurement variability from sampling conducted by the Nearshore Vertebrate Predator Project (Esler et al. 2000b). Our initial scaling efforts will focus on those areas where oil exposure (Cytochrome P450 1A induction) in harlequin ducks was identified (Trust et al. 2000, Ballachey et al 2006).

We will add an extra variance component to the current Proc GLIMMIX code to estimate the transect measurement variability (see Statistical Methods below).

## **C. Data Analysis and Statistical Methods**

The pilot study will provide estimates of within-year transect variability. The amount of variability reduction at the transect level will determine the increase of power to detect trends at smaller spatial scales. In addition, we can assess if there is more variability than would be expected under the Poisson model assumption and adjust the model accordingly. Transect level variability estimates are also necessary for any new sampling protocol optimization should we wish to start making inferences at smaller spatial scales. These will be incorporated into our Population Monitoring survey (Rosenberg et al. 2005).

## **D. Description of Study Area**

The proposed project will be conducted in the oil spill area of western and southwestern Prince William Sound and unoiled eastern PWS between Valdez and Cordova, western Montague Island and northern PWS from Valdez Arm to Passage Canal.

March surveys will repeat transects surveyed in /407 Harlequin Duck Recovery Monitoring (Rosenberg et al. 2006). 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 unoiled 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.

## **E. Coordination and Collaboration with Other Efforts**

We propose to coordinate and collaborate in either the planning and/or results of this project with several ongoing and proposed *Exxon Valdez* Oil spill Trustee council projects including the following: 1) Quantifying Temporal Variation in Harlequin Duck Exposure to Exxon Valdez Oil, Dan Esler, Project 0777; 2) Oil Exposure in Nearshore Vertebrate Predators, Brenda Ballachey, project 0774; 3) Lingering Oil and Predators: Pathways of Exposure and Population Status, Stanley Rice, project /0620; 4) Surveys to Monitor Marine Bird Abundance in PWS, project 0751, David Irons; 5) Evaluating Harlequin Duck Population Recovery, project 0816, Dan Esler; and a new proposed project 6) Evaluating Injury to Harlequin Ducks (*Histrionicus histrionicus*) Caused by Sublethal Hydrocarbon Exposure in Prince William Sound Using Species-specific Cell Lines, Tuula Hollmen and Katherine Springman.

This work was also heavily utilized by Integral Consulting, Inc., for Assessment of Lingering Oil and Resource Injuries from the *Exxon Valdez* Oil Spill, project 0776 and Information Synthesis and Recovery Recommendations for Resources and Services Injured by EVOS, project 0783 and information will be incorporated in any future synthesis efforts.

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.

This project will be integrated with ongoing studies and findings of past studies including project 407 Harlequin Duck Population Dynamics: Measuring Recovery from the Exxon Valdez Oil Spill. Information exchange has been ongoing with several marine bird and mammal studies.

## **III. SCHEDULE**

### **A. Project Milestones**

**Objective 1.** Conduct Pilot Study (Phase 1) to measure transect variability. To be met by May 2008.

**Objective 2.** Determine the spatial scales suitable for trend and composition estimates relevant to oil history. To be met by March 2009.

**Objective 3.** Develop new sampling protocol based on results of Pilot Study. To be met by March 2009.

This is proposed as a multi-year monitoring program designed to assess the recovery of an injured species. The Pilot Study will be continued in FY09.

## **B. Measurable Project Tasks**

FY 08, 3rd quarter (April 1, 2008-June 30, 2008)

- Project funding approved by Trustee Council.
- Interagency coordination.
- Contract for vessel support.
- Plan logistics and begin surveys for Pilot Study.
- Equipment maintenance.
- Data entry.

FY 08, 4th quarter (July 1, 2008-September 30, 2008)

- Data Analysis of Phase 1 of Pilot Study.

## **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). Results of this project have been presented in Tatitlek and Chenega Bay. As we have done in the past we will coordinate when appropriate with the villages of Tatitlek, Chenega Bay, Cordova, Valdez, and Whittier on our activities and possibilities for community involvement. No funds are being requested for local hire or community involvement. We will solicit bids for contract work from local communities.

### **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). 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**

A final report will be presented by April 2011. Publications will be prepared for peer-review journals in lieu of final report when possible and will depend upon the duration of the project.

## VI. LITERATURE CITED

- Agresti, A. 1990. *Categorical Data Analysis*. John Wiley & Sons. NY 557 pp.
- Ballachey, B.E., J.L. Bodkin, and D. Irons. 2006. Oil exposure biomarkers and population trends of Prince William Sound marine vertebrates (Restoration Project //0774). Draft Final Rept. U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska.
- Bodkin, J.L., B.E. Ballachey, D. Esler, and T. Dean. 2003. Patterns and processes of population change in selected nearshore vertebrate predators, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 030423), US Geological Survey, Alaska Science Center, Anchorage, Alaska.
- Dwyer, T.J., M.E. Isleib, and J. L. Haddock. 1976. Marine bird populations in Prince William Sound, Alaska. Unpubl. Rep. U.S. Fish and Wildl. Serv., Anchorage. 21pp.
- Esler, D., J.A. Schmutz, R.L. Jarvis, and D.M. Mulcahy. 2000a. Winter survival of adult female harlequin ducks in relation to history of contamination by the *Exxon Valdez* oil spill. *J. Wildl. Manage.* 64(3):839-847.
- Esler D, T.D. Bowman, T.A. Dean, C.E. O'Clair, S.C. Jewett, and L.L. McDonald. 2000b. Correlates of harlequin duck densities during winter in Prince William Sound, Alaska. *Condor* 102:920–926.
- Esler, D., T. D. Bowman, K. A. Trust, B. E. Ballachey, T. A. Dean, S. C. Jewett, and C. E. O'Clair. 2002. Harlequin duck population recovery following the '*Exxon Valdez*' oil spill: progress, process and constraints. *Mar. Ecol. Prog. Ser.* 241:271-286.
- Exxon Valdez* Oil Spill Trustee Council. 2002. *Exxon Valdez* Oil Spill Restoration Plan. Update on Injured Resources & Services. August 2002. Anchorage. 29pp.
- Galt, J. A., W. J. Lehr, and D. L. Payton. 1991. Fate and transport of the Exxon Valdez oil spill. *Environmental Science and Technology* 25: 202–209.
- Goudie, R. I., S. Breault, B. Conant, A. V. Kondratyev, M. R. Petersen, and K. Vermeer. 1994. The status of sea ducks in the North Pacific rim: toward their conservation and management. *Trans. 59th N. Amer. Wildl. Natur. Resour. Conf.:*27-49.
- Hodges, J.I., King J.G., Conant, B., Hanson, H.A. 1996. Aerial surveys of waterbirds in Alaska 1957-94: Population trends and observer variability. Information and Technology Report 4. USDI, Nat'l Biological Service U.S. Fish and Wildlife Service.
- Holland-Bartels, L. 1999. Mechanisms of impact and potential recovery of nearshore vertebrate predators. *Exxon Valdez* Oil Spill Restoration Project Draft Final Report (Restoration Project 98025), Alaska Biological Science Center, Anchorage, Alaska.

- Integral Consulting Inc. 2006. Information synthesis and recovery recommendations for resources and services injured by the Exxon Valdez oil spill, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 060783), Integral Consulting Inc., Mercer Island, Washington.
- Isleib, M.E. and B. Kessel. 1973. Birds of the North Gulf Coast and Prince William Sound, Alaska. Biol. Pap. Univ. Alaska No. 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. EVOS Bird Study No. 2. U.S. Fish and Wildl. Serv., Anchorage. 85pp.
- McKnight, A., K.M. Sullivan, D.B. Irons, S.W. Stephensen, and S. Howlin. 2006. Marine bird and sea otter population abundance of Prince William Sound, Alaska: trends following the T/V Exxon Valdez oil spill, 1989-2005. Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Projects 040159/ 050751), U. S. Fish and Wildlife Service, Anchorage, Alaska.
- Peterson, C.H. 2001. The *Exxon Valdez* oil spill in Alaska: Acute, indirect and chronic effects on the ecosystem. *Advances in Marine Biology*, 39: 1-103.
- Robertson, G.J., and R.I. Goudie. 1999. Harlequin Duck (*Histrionicus histrionicus*). In *The Birds of North America*, No. 466. A. Poole and F. Gill, Eds. The Birds of North America, Inc., Philadelphia, PA.
- Robertson, G.J., F. Cooke, R.I. Goudie, and Sean Boyd. 2000. Spacing patterns, mating systems, and winter philopatry in harlequin ducks. *The Auk* 117(2):299-307.
- 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., M. J. Petrula, D. D. Hill, and A. M. Christ. 2005. Harlequin duck population dynamics: measuring recovery from the *Exxon Valdez* oil spill. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 407). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.
- Short, J.W, M.R. Lindeberg, P.M. Harris, J.M. Maselko, J.J. Pella, and S.D. Rice. 2004. Estimate of oil persisting on the beaches of Prince William Sound 12 years after the Exxon Valdez oil spill. *Environmental Science and Technology*, vol 38, no. 1, pp 19-25.
- Short, J.W., M. Lindeberg, S.D. Rice, C. Sloan, P. Hodson, C. Khan, and K. Springman. 2005. Lingering EVOS remains the dominant source of CYP1A inducers in PWS. Abstract. Society for Environmental Toxicology and Chemistry. 26th Annual Meeting. Baltimore, MD.

Trust, K.A., Esler, D., Woodin, B.R. and Stegeman, J.J. 2000. Cytochrome P450 1A induction in sea ducks inhabiting nearshore areas of Prince William Sound, Alaska. *Marine Pollution Bulletin* 40(5):397-403.

# **Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery from the *Exxon Valdez* Oil Spill**

**Rosenberg FY08**

**Amended to add Pilot Study to measure transect variability**

## **Data Management and Quality Assurance/Quality Control Statement**

1. **Study Design etc.** See Project Plan (attached) and the following reference:

Rosenberg, D. H., M. J. Petrula, D. D. Hill, and A. M. Christ. 2005. Harlequin duck population dynamics: measuring recovery from the *Exxon Valdez* oil spill. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 407). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

See Metadata form (attached).

2. **Data Quality.**

a). All observers will be experienced, highly trained in small craft operation, bird identification, and harlequin duck sex and aging; b). All observers will be trained in standardized data recording protocols and techniques; c). All data will be recorded on pre-formatted standardized field forms and maps produced on “rite-in-rain” paper, data sheets will be retained by the Principal Investigator (PI) d). Whenever possible observations will be verified by two observers; e). Surveys will not be conducted when wave height or visibility compromise accuracy, survey speed will be adjusted according to conditions; f). Locations will be recorded by GPS and stored in memory, recorded on field forms, and marked on paper maps g). Crews and skiffs will be interchanged daily; h). Transects will be marked on maps and endpoints recorded by GPS. All crew will be familiarized with endpoints prior to starting transects. Radio contact will be maintained between crews if questions arise. i). Replicate sampling will occur.

3. **Data Characteristics**

- a) FGDC Metadata record file attached.
- b) Taxonomic Sampling (counts) – list of fields: Observer, Boat, Date, Transect start and finish time and GPS location, Time of observation, Wind Speed/Direction, Visibility, Wave Height, Transect number, Flock No., No. Males, No. Females, No. Pairs, No. Sub-adult males, No. Unknown sex and age, Total Harlequins, Latitude of observation in Decimal Degrees, Longitude in Decimal Degrees, Water depth (m), No. Sea otters, No. Loons, No. other waterfowl by species

4. **Algorithm** – No conversion algorithms will be used (except GPS locations).

5. **Collections** - No samples will be collected as a routine part of this study.

## 6. Instrument Calibration - NA

Data management and Quality Assurance/Quality Control Statement (continued).

## 7. Data Reduction and Reporting

a). See Proposal: Project Design, C. Data analysis and Statistical Methods and the following reference:

Rosenberg, D. H., M. J. Petrula, D. D. Hill, and A. M. Christ. 2005. Harlequin duck population dynamics: measuring recovery from the *Exxon Valdez* oil spill. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 407). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

b). To avoid errors in data entry, crew and PI will review data sheets daily and will immediately clarify any illegible or questionable data before it is entered into the computer. The raw data will be entered into an IBM-PC compatible computer in a standard EXCEL spreadsheet format. Rows, columns, and summations of categories will be crosschecked. Computer data will be printed and crosschecked with field data forms to screen for errors.

SAS Institute software will be used for statistical calculations.

## DANIEL H. ROSENBERG

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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

- Rosenberg, D. H., M. J. Petrula, D. D. Hill, and A. M. Christ. 2005. Harlequin duck population dynamics: measuring recovery from the *Exxon Valdez* oil spill. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 407). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.
- Huntington, H.P., R.S. Suydam, and D.H. Rosenberg. 2004. Traditional knowledge and satellite tracking as complementary approaches to ecological understanding. *Envir. Conservation* 31(3):177–180.
- Huntington, H.P., P.K. Brown-Schwalenberg, K.J. Frost, M.E. Fernandez-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. 2000. Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Proj. 99273). Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage. 33pp.

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.

### COLLABORATORS

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**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2008 - September 30, 2009

<b>Budget Category:</b>	Authorized FY 2007	Proposed FY 2008							
Personnel	\$41.1	\$23.2							
Travel	\$0.4	\$0.4							
Contractual	\$35.3	\$11.2							
Commodities	\$2.7	\$1.5							
Equipment	\$0.0	\$0.0							
Subtotal	\$79.5	\$36.3	LONG RANGE FUNDING REQUIREMENTS						
General Administration	\$8.6	\$4.3	Estimated FY 2009						
Project Total	\$88.1	\$40.6	\$176.7						
Full-time Equivalentents (FTE)	0.4	0.2							
Dollar amounts are shown in thousands of dollars.									
Other Resources			\$24.1						
Comments: For Pilot Study, Phase 1 in April 2008.									

**FY08**

Prepared: 22 Feb 2008

Project Number: 759  
 Project Title: Amend\_Harlequin Duck Population Dynamics  
 in PWS  
 Agency: Alaska Department of Fish and Game

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2008 - September 30, 2009

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	
Name	Position Description					
D. Rosenberg	WBIII, Principal Investigator	18L	0.5	9.1	2.4	
Mike Petrula	WBII, survey and data analysis	16 J	0.5	7.5	1.8	
Doug Hill	WB1	14F	0.5	6.1	1.4	
Fish and Game Tech III	Wildlife Tech III	11G	0.3	5.7	1.0	
Aaron Christ	Biometrician	20D	0.4	8.5	0.0	
Subtotal			2.2	36.9	6.6	
<b>Personnel Total</b>						
<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem	
Description						
Whittier parking, 2 vehicles-7 days			1			
Whittier Toll - 2 vehicles and trailers						
<b>Travel Total</b>						

**FY08**

Project Number: 759  
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**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2008 - September 30, 2009

<b>Contractual Costs:</b>		
Description		
Boat and outboard motor repair and maintenance Air charter for field support 4 hrs @ \$400/hr Launch fee, Trailer and boat moorage Whittier Vessel support for March surveys 7 days @1500/day		
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
<b>Commodities Costs:</b>		
Description		
Boat fuel 250 gallons @ \$3.50/gal Boat supplies- replacement parts, props, fuel lines, fuel filters, water filters, battery, absorbent rags, oil, emergency provisions Field survey supplies- rite-in-rain notebooks/paper, nautical charts, batteries,		
		<b>Commodities Total</b>

**FY08**

Project Number: 759  
 Project Title: Amend\_Harlequin Duck Population Dynamics  
 in PWS  
 Agency: Alaska Department of Fish and Game

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2008 - September 30, 2009

<b>New Equipment Purchases:</b>		Number of Units	Unit Price	
Description				
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		
<b>Existing Equipment Usage:</b>		Number of Units		
Description				
19 ft.rigid hull inflatable		1		
17 ft. Boston Whaler		1		
10x40 binoculars		4		
Image Stabilized binoculars		2		
Spotting Scopes		2		
Survival Suits		4		
Outboard Motors/various hp		5		
GPS		2		
Marine VHF radios		4		
Trucks		2		
Personal locator beacons		2		
Exposure Suits		4		

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 2008 - September 30, 2009

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2008 - September 30, 2009

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 2008 - September 30, 2009

**2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 2008 - September 30, 2009

## Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery

### **Budget Justification FY08 Amendment**

FY08: Total Request \$36.3 (not incl. Gen. Admin).

### **Personnel Costs: Amount Requested \$ 23.2**

To survey the proposed study over the 7-day time period requires 2 skiffs with a crew of 2 each. In addition to 2 full-time ADF&G employees in the Waterfowl program, we need to be to hire 1 part-time employee and 1 contract employee. These employees are necessary for mobilization and demobilization and various field preparatory tasks and post-survey data entry and equipment maintenance. While conducting surveys at sea, state labor contracts require supplemental sea duty pay.

The state is providing up to 1.0 month of personnel cost for the PI and program biologist to cover project planning, data entry and analysis.

### **Travel Costs: Amount Requested \$0.4**

We need to get personnel, boats, and equipment to Whittier. Although the Whittier tunnel is a state facility, the state agencies are charged a toll for trucks and boat trailers. We are charged to launch boats and park vehicles and boat trailers in Whittier.

### **Contractual Costs: Amount Requested \$11.2**

The majority of this is for vessel support during the surveys. 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 or air charter support are not factored in to the budget and may necessitate additional funds if we face weather delays or an emergency. Fuel costs and inflation have increased charter costs and due to the uncertainty of charter boat availability costs may vary greatly for similar vessels at certain times of year.

Boat and motor maintenance is necessary for safe and efficient operation and the extra week of surveys may necessitate some additional costs. We have three motors. Shop labor is at minimum \$90/hour. One of our boats and 2 motors are provided in-kind by ADF&G.

### **Commodities Costs: Amount Requested \$1.5**

The biggest costs are for boat fuel, purchased in Whittier and boat parts. Boat fuel is extrapolated based on the amount used during past surveys and current fuel costs. 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.

**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 not be increased in 2007. 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 in-kind contributions of boats, vehicles, and office equipment and supplies, and field sampling equipment. In addition ADF&G is covering some salary costs.

