From: Stanley Rice
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Sept 4, 2008

To: Michael Baffrey
Exxon Valdez Oil Spill Trustee Council
441 W. 5th Ave., Suite 500
Anchorage, AK 99501-2340

Re: Project 080804/ Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in PWS

Dear Michael:

Enclosed is our revised Detailed Project Description (DPD) including an updated budget sheets and a summary of our progress. This is a collaborative proposal among researchers at the Auke Bay Laboratories (ABL), University of Alaska Fairbanks (UAF), and the Sitka Sound Science Center (SSSC). We are seeking $366.5K, a 9% increase over FY08, to continue this project for a third year.

Our progress to date has been good: Our initial results in the pilot year (winter 2006/2007) confirmed a lingering of whales well into January and February in Prince William Sound, Sitka Sound, and Lynn Canal, and that these winter aggregations were associated with herring schools. Year 2, our first year with better geographic coverage in PWS confirmed that whale aggregations were not centered in Sawmill Bay alone, but that there were several focal areas, all associated with herring schools. The year 2 study estimates that 18 - 23% of the September biomass of herring was consumed by the overwintering whales. Another winter of field work in PWS will permit us to confirm if these numbers of over wintering whales are typical, continue to be associated with herring schools, and will give us a second quantitative year on the estimate of herring consumed. Two years of quantitative data will provide a better estimate of whale timing, distribution, and impact on herring in PWS.

This project has worked in close collaboration with EVOSTC funded project 080806 (Are Herring Energetics in PWS a Limiting Factor?), project 080814 (Seabird Predation on Juvenile Herring in PWS), and with project 070819 (Herring Disease Program). Together, these projects will provide a comprehensive interpretation of the interaction among herring energetics, disease, and predation.

Lastly, our strategy of studying PWS, along with Sitka Sound and Lynn Canal will continue. These two other locations, with different energetic dynamics and whale predation pressures will permit a much stronger interpretation of the data we gather.

These two other areas are in our backyards (Straley in Sitka, Moran in Lynn Canal), not as costly to study; the dominant number of charter days continues to be in PWS. We will continue the intense data collection centered in Chenega Bay (contract to McLaughlins), as this tracks the timing of over-wintering whales well for very little costs, but we will rely on multiple charters for making accurate counts of whales in PWS during the winter.

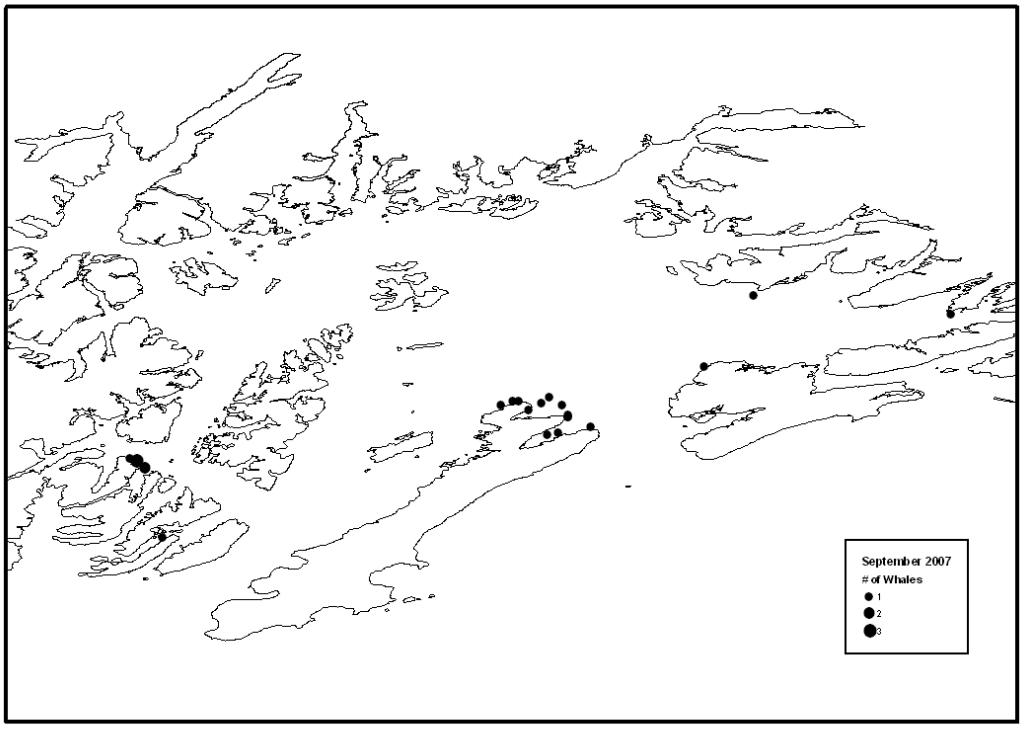
Thank you for your consideration and support on this project.

Sincerely,

Jeep Rice
Program Manager
Habitat and Marine Chemistry

Progress Report
Project 080804/ Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in PWS

Summary: Excellent survey conditions during the fall/winter of 2007/2008 allowed us to thoroughly survey Prince William Sound by boat for humpback whales. In addition to the known feeding aggregation of humpback whales in Sawmill Bay, we found whales feeding on herring in Elrington Passage, Prince of Wales Passage, and Port Gravina (Figure 1.). We did not locate whales at these sites during the fall/winter of 2006/2007 through aerial surveys, however most of our effort focused on Sawmill Bay in year 1 of this study. Counts of 25(Sept), 81(Nov) and 59(Jan) whales, combined with photographic mark-recapture models resulted in a peak estimate of 165 whales occurring in late December (Figure 2.). Based on a resting metabolic rate, the energetic requirements for these whales feeding exclusively on herring would account for 18-23% of the pre-winter herring biomass being consumed in PWS.



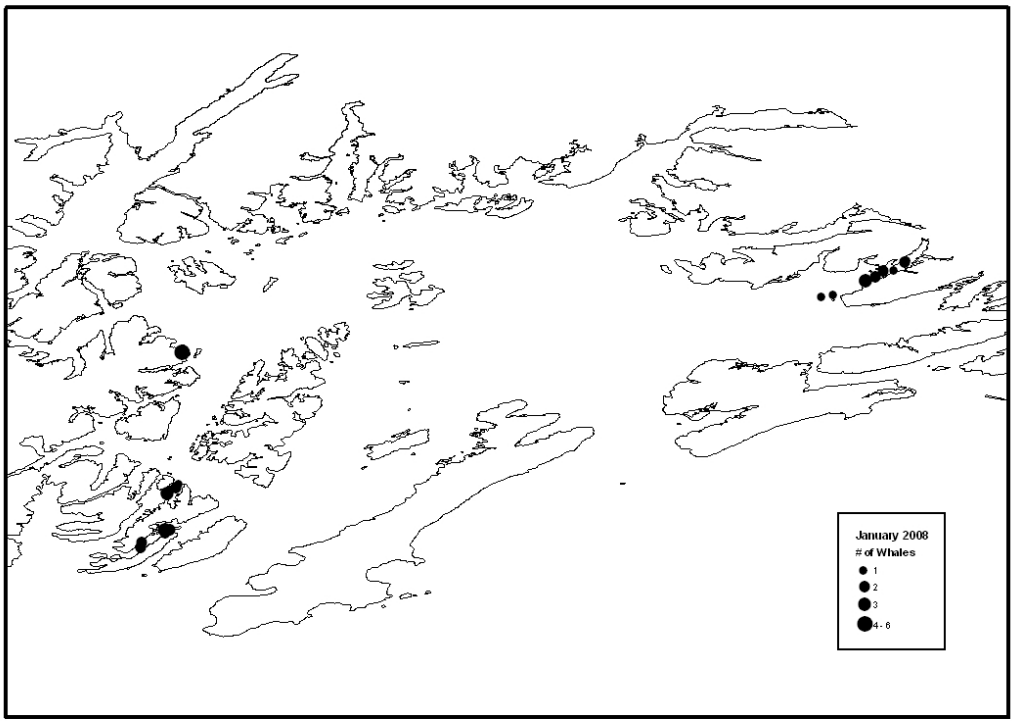


Figure 1. Distribution of humpback whales in Prince William Sound during September 2007, November 2007, and January 2008 boat-bases surveys.

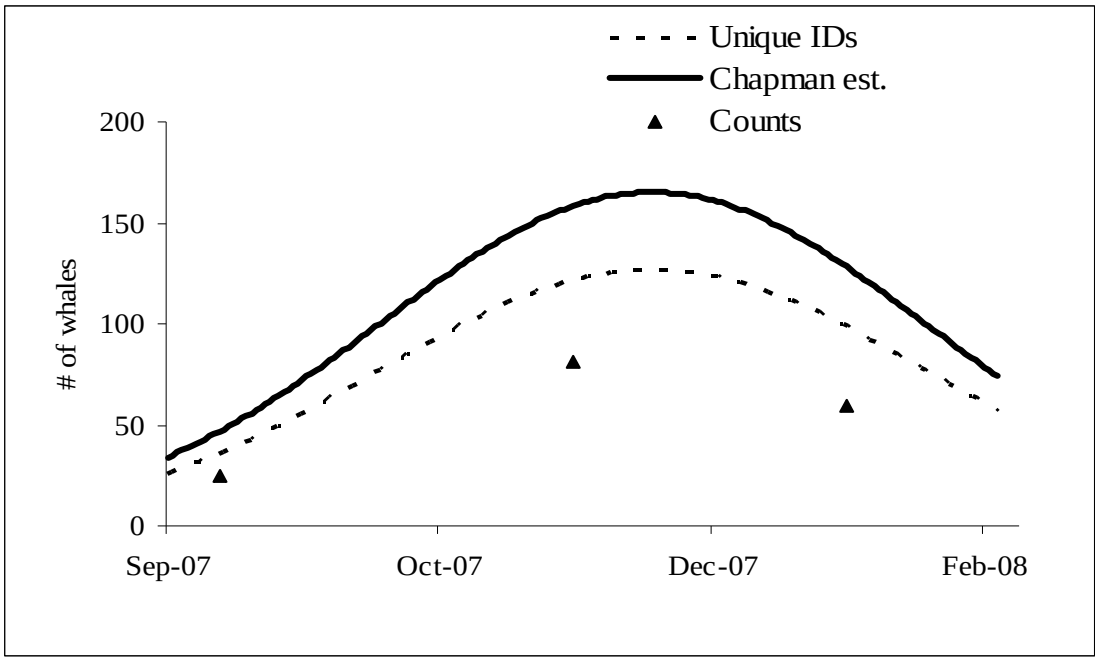


Figure 2. Estimates of humpback whale abundance in Prince William Sound from September of 2007 through February 2008. Estimates were based on counts during boat-based surveys (triangles), unique individuals from fluke photographs (dashed line), and the Chapman form of Petersen estimator (solid line).

Initial results: Trends in seasonal humpback whale abundance and the behavior of over-wintering herring differed among PWS, Lynn Canal, and Sitka Sound. In PWS we observed an increase in whale numbers during winter months (Figure 2.). When whales were feeding on herring, schools were dispersed and found throughout the water column. In Lynn Canal, whale abundance trends were similar to what we observed in year one of this study, numbers peaked in early fall and declined through the winter (2-5 whales where present in January 2008) (Figure 3 and 4.). Lynn Canal herring differed in their behavior from PWS herring by schooling in a stable cohesive layer by mid-December 70-100m below the surface. Although whale abundance trends in Sitka Sound appeared similar to Lynn Canal, declining in the winter months (Figure 5.), over-wintering herring aggregations did not appear in Sitka Sound until late February during the winter of 2008. Typically herring return to Sitka Sound during December/January, the cause of the late herring return to over-wintering grounds is unknown at this time. We believe that whales were targeting euphausids and small schools of fish at the surface (possible herring) during the fall of 2007 in Sitka Sound.

In the fall/winter of 2008/09 we will increase our effort in PWS to 25 days at sea. This will allow us to refine the timing of whale movements in to the Sound and determine if the high numbers of whales we observed during the winter of 2007/08 were typical for PWS. Work will continue in Sitka Sound and Lynn Canal to provide a comparison for whale predation rates on herring in PWS.

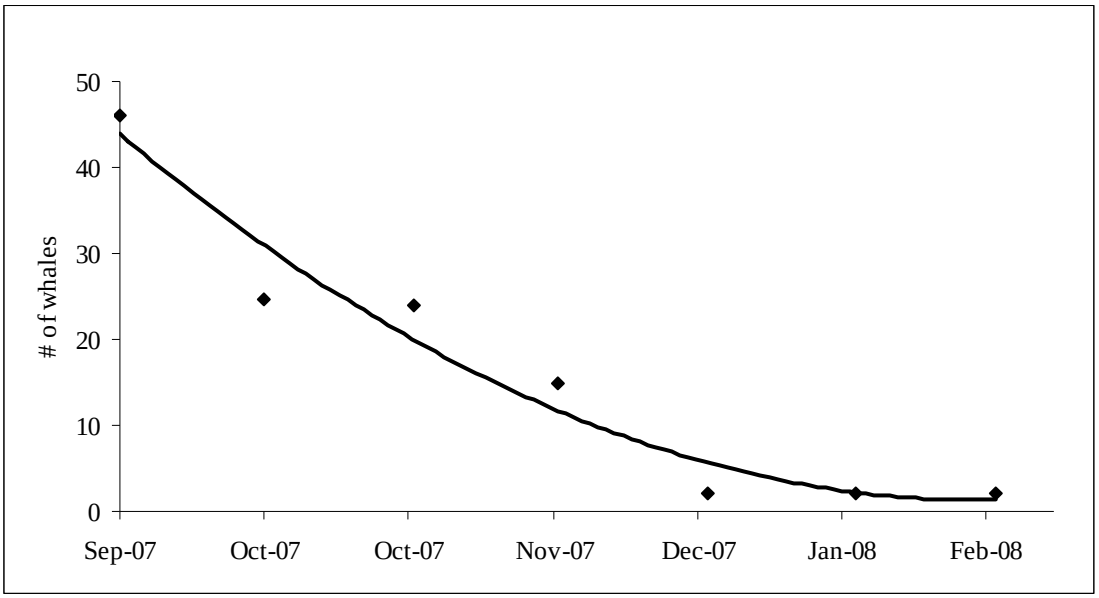


Figure 3. Estimates of humpback whale abundance in Lynn Canal from September of 2006 through February 2007, using the Chapman form of the Petersen estimator.

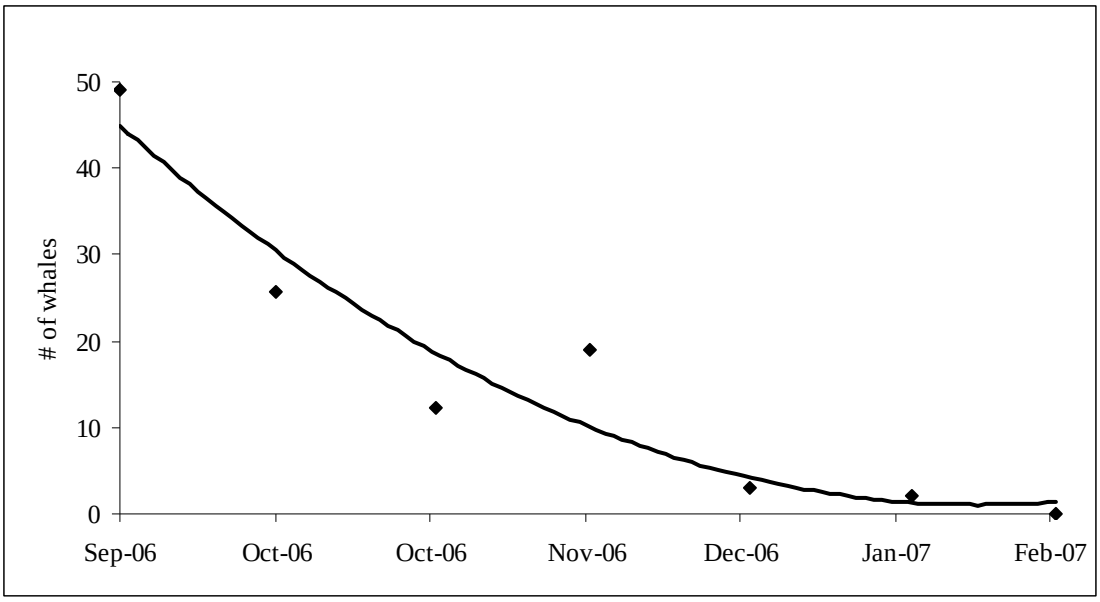


Figure 4. Estimates of humpback whale abundance in Lynn Canal from September of 2007 through February 2008, using the Chapman form of the Petersen estimator.

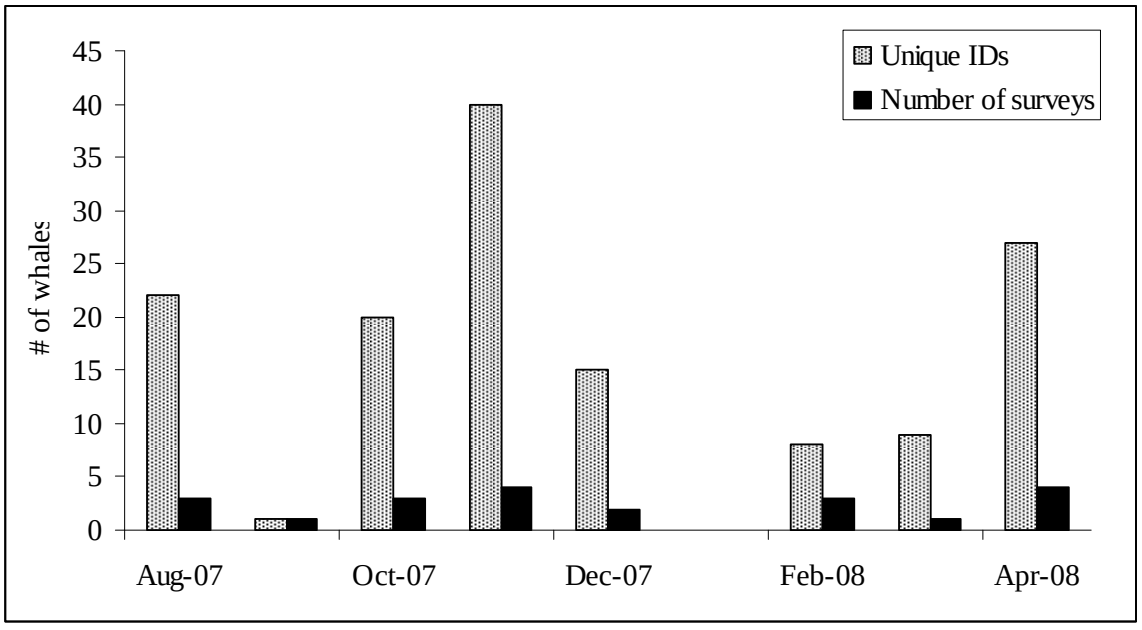


Figure 5. Estimates of humpback whale abundance in Sitka Sound from August 2007 through April 2008. Effort is displayed in number of survey days/month.

Modeling: We have pursued two research fronts for modeling work related to this project. The first is to refine the age-structured model for the herring population in Prince

William Sound. The second is to model the seasonal abundance of humpback whales during the winter using field data from 2007-2008.

EVOSTC and other agencies have funded Quinn and Marty for almost a decade to develop and refine the age-structured assessment model for Pacific herring in Prince William Sound that includes disease information (Quinn et al. 2001, Marty et al. 2003). ADF&G currently uses this model to evaluate the impact of disease on population abundance, recruitment, and survival, to assess the population status of herring, and to make harvest recommendations (S. Moffitt, ADF&G, pers. comm.). Consequently, the commercial herring fishery in PWS has not been opened since 1998 due to low abundance estimated from the model. Thus this is a management model as well as a research model that is integral to understanding the PWS herring population.

Specifically this modeling work will be used: (1) to determine if predation by humpback whales on adult PWS herring is significantly contributing to its failure to recover, (2) to compare the magnitude of this effect to other known factors such as disease and low recruitment, (3) to investigate whether low recruitment is a function of predation.

Our recent work has included the completion of two manuscripts for publication (Hulson et al. 2008, Marty et al. 2008) and one chapter of an M.S. Thesis (Hulson 2007). One major enhancement to the PWS herring model has been the incorporation of hydroacoustic information (Hulson 2007, Hulson et al. 2008). We revealed data conflicts between various sources of information in the years following the oil spill. Therefore there is ambiguity as to which factors caused the population to crash in 1993. We proposed that the large population of herring in 1989 – 1992 was not able to find sufficient food, resulting in poor condition in 1992. That led to a VHSV epidemic, which caused 2/3 of the adult population to die in 1993 (Hulson et al. 2008). PWSSC scientists reviewed our work and presented an alternate hypothesis related to sea lion predation (Thorne and Thomas 2008).

Disease has continued to have a major impact on adult PWS herring: VHSV has more effect on younger ages, while the fungus *Ichthyophonus hoferi* has more effect on older ages (Marty et al. 2008). There appear to have been three disease events since 1992. VHSV events were prominent in 1992-1993 and 1997-1998. It appears that *I. hoferi* contributed to higher adult mortality since 2001 (Marty et al. 2008). Thus, it appears that disease continues to play a major role in Pacific herring recovery.

Modeling the seasonal abundance of whales involved two components: estimation of total whale abundance and approximating the seasonal distribution. Estimation of total whale abundance was accomplished by using the Petersen mark-recapture method, using visual identification of whale flukes as the natural mark. This resulted in an estimate of about 160 whales, similar to the number of unique whales identified (127). The seasonal distribution was approximated by a quadratic function fitted to counts of whales during the three fall-winter surveys.

Bioenergetic models indicate that whales are an important herring predator in PWS. Our current bioenergetic model relates daily changes in whale numbers to the number of herring required to meet the total metabolic requirement for those whales (Klieber 1961). In PWS, whales required between 10,000 and 14,000 MJoules to meet metabolic demand between September 1, 2007 and February 28, 2008. The average mass specific energy content of a herring declined from approximately 8.9 kJ/g wet mass to 5.1 kJ/g wet mass during the same period. Thus, whales required 1600 to 2100 metric tons of herring over the winter of 2007/2008. This represents approximately 18-23% of the pre-winter biomass of herring. It is important to note that this estimate only reflects the energy required by whales to meet basic metabolic function. Energy costs associated with searching and handling prey will increase this estimate.

Details of how you have integrated with other projects:

Data sharing and vessel time

The Auke Bay Laboratories are working with the University of Alaska Southeast (Jan Straley), University of Alaska Fairbanks (Terry Quinn), both are co PIs on this project. We have shared vessel time, sample collection, chemical analysis, and labor with EVOSTC project 080806 (Are Herring Energetics in PWS a Limiting Factor?).Our cruises in Prince William Sound have served as platforms for seabird observations by the Prince William Sound Science Center (Mary Anne Bishop and Neil Dawson, EVOSTC project 080814). Kate and Andy McLaughlin of Chenega Bay are providing us with whale observations from Sawmill Bay. The Department of Fish and Game (Steve Moffit and Lauri Jemison) are providing us with whale and herring observations from their PWS cruises. Craig Matkin is provided with killer whale observational data and photographs from PWS. Mandy Lindeberg (ABL, EVOSTC project 070805) provided whale location.

In Lynn Canal we are sharing whale data with the NMFS Alaska Regional Office (Aleria Jensen), Alaska Stranding Network, and Whale Trust (Flip Nicklin). Fluke and dorsal photos from humpback whales will be made available to the National Marine Mammal Laboratory. USFWS Migratory Bird Management (Rob Mac Donald) provided humpback whale data. We assisted the University of Hawaii (Alison Stimpert) with tagging humpback whales foraging on herring.

Community involvement

Author Charles Wohlforth and Amy Bracken of KCHU public radio participated have on PWS cruises.

Interviews regarding this project have been made with Amanda Fehd and Kate Golden of the Juneau Empire, Pete Carran KINY, KTOO in Juneau and Amy Bracken of KCHU Valdez

The Lynn Canal portion of the humpback whale catalog has been made available to the public at http://www.afsc.noaa.gov/ABL/Humpback/JuneauCatalog.htm.

Presentations to the public include**:**

Moran, J.R., S.D. Rice and S.F. Teerlink. Humpback whale predation on Pacific herring southern Lynn Canal and northern Stephens Passage: Testing a top-down hypothesis. Abstract presented at the Alaska Marine Science Symposium. January 20-23, 2008, Anchorage, Alaska.

McLaughlin, K.A., A.T. McLaughlin, J.R. Moran, and S.D. Rice. Humpback whale (*Megaptera novaegliae)* predation on winter aggregations of Pacific herring (*Clupea pallasii*) in Sawmill Bay, Alaska: Is it a problem for the herring? Abstract presented at the Alaska Marine Science Symposium. January 20-23, 2008, Anchorage, Alaska.

Moran, J., S. Rice, J.Straley, T. Quinn, R. Heintz, and S. Teerlink. Humpback whale predation on Pacific herring in Prince William Sound, southern Lynn Canal, and Sitka, Alaska. Naturalist Training, 29 April 2008, Alaska Fisheries Science Center, Ted Stevens Marine Research Institute. Juneau, Alaska

References

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Hulson, P. J.F., Miller, S.E., Quinn, T.J., II, Marty, G.D., Moffitt, S.D., and Funk, F. 2008. Data conflicts in fishery models: incorporating hydroacoustic data into the Prince William Sound Pacific herring assessment model. ICES J. Marine Science 65: 25-43.

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Marty, G.D., Quinn, T.J., II, Carpenter, G., Meyers, T.R., and Willits, N.H. 2003. Role of disease in abundance of a Pacific herring population. Can. J. Fish. Aquat. Sci. 60: 1258-1265.

Marty, G.D., Hulson, P.-J. F., Miller, S.E., Quinn, T.J., II, Moffit, S.D., Merizon, R.A., and Meyers, T.R. 2008. Failure of population recovery in relation to disease in Pacific herring. Will be submitted to Science, September 2008.

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Seber, G.A.F. 1982. Estimation of Animal Abundance and Related Parameters, 2nd edition. Wiley, New York.

Thorne, R.E., and Thomas, G.L. 2008. Herring and the "Exxon Valdez" oil spill: an investigation into historical data conflicts. ICES Journal of Marine Science, 65: 44–50.

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 March 17, 2008) and reporting requirements *(Procedures for the Preparation and Distribution of Reports***, adopted June 27, 2007).

PROJECT TITLE: SIGNFICANCE OF WHALE PREDATION ON NATURAL MORTALITY RATE OF PACIFIC HERRING IN PRINCE WILLIAM SOUND

Printed Name of PI: Stanley Rice

Signature of PI: _____ Date _____

Printed Name of co-PI: Ron Heintz

Signature of co-PI: _____ Date _____

Printed Name of co-PI: John Moran

Signature of co-PI: _____ Date _____

* Available at www.evostc.state.ak.us/Policies/data.htm
** Available at www.evostc.state.ak.us/Policies/guidelines.htm

Trustee Council Use Only
Project No: ____
Date Received: ____

PROPOSAL SUMMARY PAGE
(To be filled in by proposer)

Project Title: SIGNFICANCE OF WHALE PREDATION ON NATURAL MORTALITY RATE OF PACIFIC HERRING IN PRINCE WILLIAM SOUND

Project Period: November 2006 to September 2009

Proposer(s): **:** Stanley Rice, Ron Heintz, and John Moran of TSMI/Auke Bay Labs, 17109 Point Lena Road, Juneau, AK 99801: jeep.rice@noaa.gov, (907) 789-6020; ron.heintz@noaa.gov, (907) 789-6058, john.moran@noaa.gov .
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Janice M. Straley University of Alaska Southeast – Sitka, PO Box 273, Sitka, Alaska 99835, (907)747-7779, Jan.Straley@uas.alaska.edu.
Collaborator: Kate McLaughlin McLaughlin Environmental Services,PO Box 8043 Chenega Bay, Alaska 99574907/573-5092

Study Location: Prince William Sound, Sitka Sound, and southern Lynn Canal.

Abstract: Pacific herring (*Clupea pallasi*) in Prince William Sound (PWS) have been classified as "not-recovered" by the Exxon Valdez Oil Spill Trustee Council. Predation by marine mammals has been cited as a factor in the failure of this population to rebound. We will assess the significance of humpback whale predation on herring in PWS, particularly in winter. Specifically we will estimate the number of whales foraging in winter, determine when and if there is a prey switch to herring, and how long whales focus on herring as prey.
These data will be combined in a bioenergetic model to determine numbers of herring consumed (and energy content consumed). Lastly, the estimated numbers of herring consumed would be included in an age-structured model so that the significance of whale predation on herring recovery can be evaluated.

Funding: EVOS Funding Requested: FY 09 $ 366.5
(must include 9%GA)

Non-EVOS Funds to be Used: FY 09 $ 185.0

TOTAL: 551.5

Project Description

Project 080804
Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in PWS

PREFACE

This is a revised project description for the third year of a three year collaborative proposal among researchers at the Auke Bay Lab (ABL), University of Alaska Fairbanks (UAF), and Sitka Sound Science Center (SSSC). The UAF component of research is exclusively a modeling component and does not involve the handling of fish or whales.

RESEARCH PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Pacific herring (*Clupea pallasi*) in Prince William Sound (PWS) have been classified as "not-recovered" by the Exxon Valdez Oil Spill Trustee Council. Predation by marine mammals has been cited as a factor in the failure of this population to rebound. This proposal attempts to assess the significance of humpback whale predation on herring mortality rates, particularly in the winter.

In FY 2005, a group of scientific investigators (including Rice and Quinn of this proposal) collaborated to integrate information about the herring population in Prince William Sound and identify factors contributing to its lack of recovery (EVOS TC funded project 050794). One essential component of the synthesis was the continued development of an age-structured assessment model. The group concluded that lingering oil exposure does not play a role in limiting recovery, but disease probably does. In addition, they noted that there were insufficient data to assess the role of predators in limiting recovery, but admitted they could be a significant factor. Therefore, future management and enhancement strategies need evaluations on the significance of predation.

Humpback whales in Alaska are seasonal migrants, spending summers feeding on schooling fish and large zooplankton. Most of these humpback whales winter in the lower latitudes near the Hawaiian Islands where birth and mating takes place (Herman and Antinoja 1977). However, individual humpbacks have been observed in the waters of PWS and northern Southeast Alaska during the winter months (McLaughlin in PWS, Rice, Quinn, Straley in Southeast). Observations during winter months in PWS and southeastern Alaska are frequent and associated with known herring schools; however, many of these winter observations are anecdotal and not accompanied with photographic identification. Over-wintering whales have been studied in the winter in Sitka Sound and Seymour Canal. Results of those studies suggest the timing of the winter migration is

staggered with some whales leaving earlier for the breeding grounds and some leaving later (Straley 1990, Straley 1994). It is likely that migration patterns in PWS and Lynn Canal would be similar. The migration to Hawaii takes about a month hence whales could be present on the feeding grounds into early February and still make it to Hawaii for the peak of the breeding season in March (Straley 1990, Straley1994, Gabriele et al. 1996). Whales foraging on aggregated herring in winter are consuming an energy rich prey (Vollenweider 2005). Therefore the whales leaving later in winter could be provisioning themselves for their migration and maximizing their reproductive fitness.

Intensive foraging on aggregated winter herring may represent a significant source of mortality to herring, particularly if herring stocks are depressed, and humpback whales numbers increase. We propose to evaluate this potential by estimating the number of whales foraging in winter, determine when and if there is a prey switch to herring, and how long they focus on herring as prey. These data will be combined in a bioenergetic model to determine numbers of herring consumed (and energy content consumed). Lastly the estimated numbers of herring consumed would be included in an age-structured model so that the significance of this focused foraging event on herring recovery can be evaluated.

Project strategy:
We will assess whale numbers and forage on a restricted scale in year one, and expand the scale of our analysis in year two. The time period of importance begins at the end of summer (August) when whale predation is likely on mixed invertebrates, and probably switches to herring dominance in the early fall, extending into winter through February. The funding cycle with approval after 1 Nov 2006 precludes a large scale study of winter predation on herring in year 1, but does allow intense smaller scale efforts in two locations: Sawmill Bay in PWS, and Lynn Canal in southeast Alaska. Both whale numbers and forage abundance will be assessed at both locations. In year two, Sitka Sound will be added as a reference site, and a larger scale effort will be made in PWS. A year-round study of Lynn Canal predation will continue. Both Lynn Canal and Sitka Sound are logistically easy to study and offer critical comparisons that will contextualize the PWS observations. Herring populations in Sitka Sound and PWS were similar in biomass and synchronous in their recruitment patterns prior to the Exxon Valdez oil spill. The Sitka Sound stock remains robust and supports an important fishery. The Lynn Canal stock is more representative of the PWS stock in its current form. Both PWS and Lynn Canal herring populations are small in size, neither supports a commercial fishery and recovery for both may be limited by humpback whale predation. In year three we will increase our effort in PWS to refine whale abundance estimates and residency. Data collected in year two identified new winter feeding areas and a higher number of whales than expected in PWS. Field work will continue in Lynn Canal and Sitka Sound.

In year one **(Field work completed)**: We will assess whale numbers in two restricted locations, Sawmill Bay in PWS and Lynn Canal in northern southeast Alaska. Herring and whales aggregate in both of these locations over winter. Both study sites will be studied intensely, with observations conducted twice monthly. In both locations, we will take advantage of local researchers to maximize observations and minimize costs. Whale numbers will be confirmed with photo ID; and changes in abundance noted. Herring biomass will be estimated with hydroacoustics coupled with and trawl collections to verify acoustic targets and determine age

structure and energy content of herring aggregates. Similar surveys conducted for euphausids will allow us to detect when and if whales use alternate prey. Some aerial assessments will be used to determine whale locations and verify that the foraging behavior we examined was representative of the behavior of whales over a broader spatial scale. The whale/prey information will be used to estimate herring consumption rates, and these data will be used in an age-structured model to determine if whales are significant predators. The model integrates population-level information from a variety of sources, so that the relative importance of factors such as predation, disease, fishing, and environment can be gauged (Marty et al. 2003). Our ability to sample Lynn Canal year- round for both whales and forage will permit a more accurate assessment of whale migration events as well as prey switching.

In year two **(Field work completed)**: The intense observations at Sawmill Bay and Lynn Canal will continue, and similar observations will be added from Sitka Sound. The phasing of whale numbers from summer populations will start earlier than in year one, will be more complete, and the switching to different prey should be better documented. Further, based on the broad scale location of other focal feeding areas in year one, more study in PWS will be focused in year two toward other feeding areas. A better estimate of whale numbers, timing, and focal feeding areas in PWS will be facilitated by the survey efforts in year one.

In year three: Unexpectedly high numbers of humpback whales and new feeding areas were located during winter surveys in year two in PWS. This lead to two new questions: Were the high counts in PWS an anomaly? And when does the increase in whale abundance occur? We will continue with the sampling scheme from year two, increasing effort in PWS to better describe seasonal trends in humpback whale abundance.

B. Relevance to Program Goals and Scientific Priorities

The Exxon Valdez Oil Spill Trustee Council classifies Pacific herring as “not recovered” in Prince William Sound. This project specifically addresses two concerns identified by the EVOSTC: “predation on juvenile herring in Prince William Sound” and “modeling marine mammal predation on herring”. Previous work in PWS (Norcross and Brown 2001) has shown that winter is a particularly sensitive period for herring because prey resources are scarce. Herring store energy prior to winter to forestall starvation and form tight aggregates, presumably to avoid predation. We hypothesize that these aggregations of energy rich prey form an appealing prey field to humpback whales.

II. PROJECT DESIGN

A. Objectives

1. Enumerate humpback whales
   Year one **(Completed) -** Determine whale numbers and distribution in Sawmill Bay and southern Lynn Canal.
   a. Find locations where whales are foraging and identify their prey
   b. Use photo-identification methods to estimate whale abundance in these locations using twice-monthly, surveys starting in fall 2006.

c. Locate other feeding focal areas in PWS through cooperative boat surveys and aerial observations

Year two **(Completed)** - Continue surveys, enumerate whales in Sitka Sound and PWS

a. Continue the intense observations at Sawmill Bay/Chenega Bay and Lynn Canal
b. Add similar set of observations in Sitka Sound
c. Expand the survey area to include other foraging locations to provide an estimate of the number of whales in PWS

Year Three - Continue surveys, enumerate whales in Sitka Sound and PWS

a. Continue the intense observations at Sawmill Bay/Chenega, Lynn Canal and Sitka Sound
b. Increase the survey effort to include other foraging locations to provide an estimate of the number of whales in PWS

2. Estimate biomass and energy content of prey for humpback whale

Year one **(Completed)** – Estimate biomass of herring and euphausids in Sawmill/Chenega Bay and Lynn Canal

a. Estimate biomass before, during, and end of winter to determine if direct impacts of whale foraging can be detected in Lynn Canal
b. Identify forage species consumed by whales to determine when and if prey switching occurs in Lynn Canal and Sawmill Bay/Chenega Bay
c. Determine size composition, and energy content of prey, using trawl surveys in Sawmill Bay and Lynn Canal

Year two **(Completed)**

a. Continue the forage assessments in Sawmill Bay and Lynn Canal
b. Add similar assessments in Sitka Sound
c. Add similar assessments at other foraging sites in PWS

Year three

Continue the forage assessments in PWS, Lynn Canal, and Sitka Sound

3. Estimate the percentage of a humpback whale's energy requirements fulfilled by herring using bioenergetic models. **(Completed for year 2 will reassess in year 3)**

a. Energy content will be determined for each forage type, including different age classes of herring
b. Using prey switching information, estimate the energy consumed by whales

4. Using herring age structure models, along with whale numbers and foraging information, assess the significance of winter humpback whale predation on each population, for both years. **(Completed for year 2 will reassess in year 3)**

a. Develop time series of whale abundance for PWS and Sitka from published reports, photo ID information, and mark-recapture methods (as described in Straley et al. 2002)
b. For Lynn Canal, compare whale sightings with the Sitka and PWS catalog to determine if unique whales utilize Lynn Canal. Estimate abundance in 2007 using photo ID and mark-recapture methods
c. From objective 3, estimate the winter consumption by humpback whales by herring age-class and year in PWS and Sitka

d. Modify the age-structured models for PWS and Sitka to subtract winter whale consumption. Compare with results from the models without predation time series
e. In Lynn Canal, determine what proportion of the herring population is consumed by humpback whales in the winter

B. Procedural and Scientific Methods

Objective 1. Estimate humpback whale abundance and distribution

We will survey locations where whales are known to forage in winter to establish whale foraging behavior. Surveys will be conducted bi-weekly in small boats; hence we refer to these as the small-boat-surveys. The objective of these surveys will be to determine what whales are eating, when they switch prey, how many whales are in the area and how long they remain there. Prey found in locations where whales are foraging will be collected by an Isaac-Kidd midwater trawl in order to identify species, determine size distributions and estimate energy content. Whales will be photographed in order to determine the number foraging .Comparison of photographs taken on different surveys be used to estimate the amount of time whales spend in a location. The small-boat-surveys will be conducted in Sawmill in PWS, Lynn Canal and Sitka Sound. Lynn Canal and the PWS locations will be sampled in both years, Sitka Sound will only be sampled in year 2. Each of these locations is conveniently located so that survey costs are minimized and local knowledge indicates that whales forage in these locations over winter. .

In year 2 and 3 the small-boat-surveys will be expanded to permit estimates of the number of whales foraging in all of PWS. The locations of these surveys and exact methodology will be determined following year 1. Opportunistic surveys conducted from herring stock assessment cruises and our own quarterly trawl surveys (described below under Objective 2) during year 1 will be used to identify other locations in PWS where whales forage. A set of these will be monitored during monthly surveys conducted in year 2 and 3 to determine the number of whales foraging and identify their prey. The same methods as those used in our small-boat-surveys will be used to evaluate whale foraging behavior. Estimates of the number of whales observed in these locations based photographic evidence will be compared to numbers reported by opportunistic observers to understand the error associated with opportunistic observations. By pursuing a larger number of locations we can establish a lower limit to the number of whales in PWS. In addition, we can use numbers provided by the opportunistic surveys to estimate a higher number of whales in the Sound. This latter estimate will be guided by our observations of the bias inherent in the opportunistic sightings.

The opportunistic surveys used to estimate the number of whales foraging in PWS are surveys conducted by the Prince William Sound Science Center (PWSSC) and the Alaska Department of Fish and Game. Both of these agencies conduct surveys designed to estimate herring biomass. Therefore these surveys should encounter the majority of the whales in PWS by virtue of the fact that the surveys are targeting herring. To verify that these surveys are covering locations where most whales are foraging, we will have local pilots from Cordova Air record the locations and numbers of whales they observe during regular operations. In Sitka Sound and Lynn Canal we

will rely on whale watching tours, local airlines and the Alaska Ferry System to provide information on the whereabouts of whales in our study area.

Time series of humpback whale abundance will be constructed using mark-recapture methods. The first photograph of a particular whale is treated as the "mark", and subsequent photographs of the same whale are "recaptures". Both closed and open population models will be examined, along the lines of Straley et al. (2002). By comparing these estimates to those from aerial surveys, it will be ascertained whether aerial surveys miss an appreciable portion of whales and hence would lead to an underestimate of herring consumption by whales.

Permitting: All humpback photographic data collected in Alaska is authorized under scientific research permit number 473-1700-00 issued to Janice M. Straley from National Marine Fisheries Service, Office of Protected Resources, WA, DC and with the approval of the Institutional Animal Care and Use Committee (IACUC), University of Alaska Fairbanks. The Alaska Fisheries Science Center (Auke Bay Lab) also has a permit for photographic data collection.

Objective 2. Estimate prey composition

Quarterly trawl surveys will be conducted to verify the diet information collected during the small-boat-surveys. These surveys are intended to insure that prey samples are collected in sufficient numbers to determine the energy content and size distribution (length and weight) of prey consumed by whales during winter. If we rely entirely on the small-boat-surveys for sample collection we risk not obtaining samples during winter, the most critical period in our study. Therefore we will conduct trawl surveys in PWS, Lynn Canal and in Sitka Sound at the beginning, middle and end of winter. Surveys will only be conducted in Sitka Sound in year 2 and 3. An additional survey will be conducted in late summer in each location. The PWS trawl surveys will also include whale observations at locations identified by the opportunistic and chartered aerial surveys, particularly in year 2 and 3. In Lynn Canal, hydroacoustic data will be collected because no stock assessments are made for the Lynn Canal herring. Hydroacoustic assessments will follow the method of Sigler and Csepp (2006) and focus on locations where herring are known to aggregate. This latter data set will allow us to determine if whales can locally deplete herring.

Objective 3 Estimate contribution of herring to humpback energy requirements.

Estimates of the relative number and size of forage consumed by whales will be determined from bioenergetic modeling. The daily energy requirement of active whales is estimated as $192M^{0.75}$ (Witteveen et al. 2006) where M is the mass of a whale. Daily consumption rate of prey will be determined as the number of prey that must be consumed to meet daily energy requirement based on the energetic value of the forage we observe whales consuming. Estimates of the energy in forage will be determined monthly for each of the prey items recovered during the bi-weekly surveys. If the bi-weekly surveys cannot provide samples, then we will us samples from the quarterly trawl surveys and interpolate energy content based on our knowledge of the seasonal changes in energy content of forage (Vollenweider 2005). These per capita estimates will be

multiplied by the number of whales found to forage in PWS in a given month to estimate the total number of prey items removed by whales. Size distributions of herring consumed will be assumed to be consistent with the size distribution observed in samples collected from locations where whales were foraging.

The energetic content of whale prey will be determined from their proximate composition. Energy content will be calculated using calorific equivalents for lipid and protein 36.43 kJ g^{-1} and 20.10 kJ g^{-1}, l respectively) (Brett 1995). Proximate analysis will be performed following methods outlined in Vollenweider (2005). Briefly, lipids will be extracted from whole fish homogenates using chloroform and methanol and an Dionex Accelerated Solvent Extractor. Lipid content will be determined gravimetrically from the purified extract. Protein content will be determined the total nitrogen content as measured on a Leco FP528 Nitrogen analyzer. Protein is estimated as 6.25 multiplied by the nitrogen content. Estimates of energy in all prey items will be made each month.

Objective 4 Estimate significance of predation

Comparison of the number of herring removed by whales from the different stocks will be compared to estimates of stock size to evaluate the respective impacts of whale predation on each stock. The total number of herring removed will be estimated as the product of the number of whales in each location and the per capita consumption rate, summed over each of the months in which we observe whales foraging on herring aggregates. This number will be expressed as a proportion of the total herring population to determine the impact whales have on herring. For the Lynn Canal stock we will be able to adjust the herring stock size estimate downward to reflect potential losses from Steller sea lions that winter in the area (Womble and Sigler 2006).

Table 1. Proposed sampling schedule for year 3.

	Oct – Dec 08	Jan – Mar 09	Apr – Jul 09	Aug – Oct 09
PWS				
Large boat surveys	10 days	10 days	Analysis	Write-up
Sawmill Bay Shore-based	Daily counts	Daily counts		
Sawmill Bay Small boat	6 days	6 days		
Air survey	2 days	2 days		
Sitka Sound				
Small-boat-surveys	6 days	6 days	Analysis	Write-up
Trawl/seine survey	2 days	2 days		
Air survey	2 days	2 days		
Lynn Canal				
Small-boat surveys	6 days	6 days	Analysis	Write-up
Trawl surveys	2 days	2 days		
Four Seasons Marine			Daily counts	Daily counts

C. Data Analysis, Statistical Methods, and Modeling

Data analysis is limited to estimating whale abundance and modeling their bioenergetic requirements. Whale abundance will be determined from photographic data as described in Straley et al (2002). We anticipate that whales will not forage exclusively on a single prey item. The relative abundance of different prey types in their diet will be assumed to be equivalent to the relative abundance of species collected in our mid-water trawls. Trawls will be fished at the same depths whales are observed diving. The energetic content of a unit mass of prey in a particular patch will subsequently be estimated as the mean energy content of the prey in the patch, weighted by their relative abundance. Dividing this mass specific energy content into the energy requirement of a whale (described above) will provide an estimate of the total mass of the patch a whale requires. The contribution of herring to this total mass will be determined from their relative abundance in the sample and the average mass of an individual.

Modeling: Quinn et al. (2001) and Marty et al. (2003) developed an age-structured assessment model for Prince William Sound that included disease information. Thus the model can be used to evaluate the impact of disease on population abundance, recruitment, and survival. ADF&G uses this model in its annual assessments of herring (S. Moffitt, ADF&G, pers. comm.).

The model contains information about the fisheries on PWS herring, which include purse-seine, gillnet, and pound fisheries in the spring (mainly for roe), and a food and bait fishery in the summer and fall. The model provides an estimation framework to integrate the various sources of information about Pacific herring in Prince William Sound from 1980 – 2006, including age compositions from the purse-seine fishery and spawning surveys, egg production estimates, mile-days of milt from aerial surveys, and hydroacoustic biomass estimates (Quinn et al. 2001, Marty et al. 2003, Hulson et al. 2006, Marty et al. 2006). These observations are compared to comparable model quantities in a least squares setting to obtain parameter estimates of recruitment, natural mortality, abundance, and biomass.

We propose to use this model as the basis of comparing the relative magnitudes of the various factors affecting PWS herring dynamics. Recruitment estimates at age 3 will be related to auxiliary variables related to disease, the environment, spawning stock, and predation. It is a simple matter to use the model as a simulation framework, in which alternative harvest and recruitment scenarios are developed. An example of a question to be addressed would be: If whales did not eat herring, would the population have rebounded more so than what really occurred?

Specifically the model will be used: (1) to determine if predation on adult PWS herring is significantly contributing to its failure to recover, (2) to compare the magnitude of this effect to other known factors such as disease and low recruitment, (3) to investigate whether low recruitment is a function of predation.

Proposed modeling work for year 3

The first modeling project is estimation of whale abundance from the new field data. It is important to have a second year of mark-recapture, because results from the first year were highly uncertain (CV = 24%). With 127 whales identified last year, this provides an excellent marking total from which to get additional recaptures. Secondly, it was not possible to characterize the variability in seasonal distribution, because there were only 3 data points for the counts. With additional count data, it should be possible to characterize variability and also to stabilize the center of the quadratic seasonal curve.

The second project, modeling of the herring population, is necessary to separate the effects of predation by humpback whales from disease and other factors. To get a historical view of the impact of whale predation, the age-structured assessment model can be extended to include whale predation. This requires the development of a whale time series back to 1980, which has not been done. Noted whale researcher Olga Von Ziegezar has collected data from Prince William Sound whales for over 25 years and is willing to collaborate with us and provide us with data. We will develop two series. The first is based on whale counts per unit effort. The second utilizes the Jolly-Seber method to obtain estimates of abundance and mortality using mark-recapture theory (Seber 1982).

We would then calibrate the relative abundance series to absolute estimates obtained from the ABL fall-winter mark-recapture studies of 2007 and 2008. This would require making the assumption that if whale abundance in the summer increases, then so would whale abundance in

the fall-winter.

Information on whale abundance will then be fed into an age-structured model for Pacific herring in order to compare the relative magnitudes of disease, whales, and and other factors on the mortality of herring. This will help EVOS TC better understand what factors are preventing the recovery of herring.

D. Description of Study Area

Prince William Sound: Results form year one and two from this study have identified humback whale feeding aggregations whales in Sawmill Bay, Elrington Passage, Prince of Wales Passage, and Port Gravina. Focusing on the waters of Sawmill Bay, where local researchers can be land based with small boats will continue to provide fine-scale temporal data, however to assess the impact of whales on herring, year three, will use larger vessels to survey all of PWS.

Sitka Sound: A large robust herring fishery has existed in Sitka Sound for several decades, similar to PWS prior to the oil spill. Recruitment in years prior to the spill of Sitka and PWS herring is correlated (Williams and Quinn 2000), likely due to the influence of broad-based environmental and oceanographic forces. Jan Straley has studied humpback whales year-round since the early 1980s. It is not known whether Sitka Sound whales switch prey sources during the year. Because the Sitka stock is not depleted, comparison of predation effects between Sitka and PWS should be revealing.

Lynn Canal: Our study area will include the waters of southern Lynn Canal, near the Auke Bay Lab. This area has a year-round presence of humpback whale (pers. com. T. Quinn, R. Heintz, and S. Rice) and known concentrations of over wintering herring (Sigler and Csepp 2006). This stock has not been commercially fished since the 1980s, is struggling, and is similar in status to the present PWS stock. Both are suspected of being limited by whale predation. Proximity to the Auke Bay Lab provides for the safe and immediate operation of small vessels, permitting us to survey during the brief periods of good weather occurring in the fall and winter months. Periodically, aerial surveys of PWS and Lynn Canal will extend beyond the study area to locate other areas of winter humpback whale activity.

E. Coordination and Collaboration with Other Efforts

This project will combine the skills and location advantage of researchers from Auke Bay Lab (Rice, Heintz, and Moran), Sitka Sound Science Center (Straley), Univ. of Alaska Fairbanks (Quinn), and local researchers at Sawmill Bay (McLaughlin). Further, we will coordinate with others, including ADFG in Sitka and Cordova (Moffitt), as well as Dick Thorne of the Prince William Sound Science Center. In addition, we will collect sighting information from tour boat operators and pilots. We expect to collaborate with two other EVOSTC proposals evaluating and contrasting herring populations from different regions of Alaska; (1) Are herring (*Clupea pallasi*) energetics in PWS a limiting factor in successful recruitment of juveniles and

reproduction investment of adults? (Vollenweider and Heintz of ABL), and (2) EVOSTC project 080814, Seabird Predation on Juvenile Herring in PWS.

We will build on earlier herring and forage fish studies performed by the Auke Bay Laboratory. We will combine acoustic survey techniques (Sigler and Csepp 2006), used to estimate age structure, biomass with estimates of the energy content of whale prey. We will share our information with Brenda Norcross and her colleagues (UAF), who we understand are submitting four proposals. Their work with juvenile herring may be directly applicable to our modeling, in that recruitment estimates may be a function of predation on juvenile herring.

For this project, Dr. Stanley Rice will provide overall project management and coordination. Co-PI Jan Straley (UAS) will conduct the whale observations for Sitka, and provide IDs for all humpback whale photographs for all three locations, and train researchers at the other locations for photo work. Ron Heintz of ABL will lead the bioenergetics collections and measurements. John Moran of ABL will lead the field efforts in Lynn Canal, and prey assessments/collections. Kate McLaughlin will conduct the on-sight observations and photo work at Sawmill Bay, as well as some collections of herring from skiff operations. John Moran will be the field party chief on quarterly prey assessments conducted by ABL. Dr. Quinn of UAF will lead the modeling efforts.

We will share our information with Brenda Norcross and her colleagues (UAF), who we understand are submitting four proposals. Their work with juvenile herring may be directly applicable to our modeling, in that recruitment estimates may be a function of predation on juvenile herring.

III. SCHEDULE

A. Project Milestones

April 2009 : Field work and data collection completed.
September 2009: Submit manuscripts for publication

B. Measurable Project Tasks

FY 08, 4th quarter
July-September: Evaluation of year one and two data. Conclude a third winter of field work is needed

FY 09, 1st quarter
October-December: Continue surveys and sample analysis.

FY 09, 2nd quarter
January- March: AMSS meeting ,complete year three field work.

FY 09, 3rd quarter
April-June: Conduct mark-recapture and sample analysis. Compare whale population estimates with whale consumption estimates. Begin report and manuscript preparation.

FY 09, 4th quarter
July-September: Complete reports and manuscript. Submit publications.

IV. RESPONSIVENESS TO KEY TRUSTEE STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

This project relies heavily on local knowledge and community involvement. We are relying on local knowledge to identify survey locations. In addition, we will rely on local businesses to provide information on whale locations. We are also relying on residents of Chenega to conduct small-boat-surveys in PWS.

B. Resource Management Applications

This project offers fishery managers with a direct estimate of the mortality due to whale predation. Humpback whale abundance is increasing in the Gulf of Alaska; consequently these data will also be of direct value to managers seeking to develop ecosystem based approaches to fishery management. The project will also increased knowledge of humpback whale movements and winter feeding ecology

V. PUBLICATIONS AND REPORTS

We envision four primary peer review publications resulting from this study:

1. Winter abundance, distribution, and movement patterns of humpback whales in PWS and Southeast Alaska.
2. Seasonal changes in the diets of humpback whales foraging in southeast Alaska and PWS.
3. Prey consumption rates of humpback whales from PWS and Southeast Alaska.
4. Non-recovery of Prince William Sound herring: disease, predation, and recruitment failure",
5. Final Report: The effect of winter whale predation on herring stocks in PWS, Sitka Sound, and Lynn Canal

We anticipate that each of the collaborators will participate in the production of four peer review manuscripts. However we have tentatively identified lead authorship of the first with Straley, the second two with ABL and the fourth with Quinn.

VI. PROFESSIONAL CONFERENCES

Result from this project will be presented at the Alaska Marine Science Symposium and at other professional meetings.

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Significance of whale predation on natural mortality rate of pacific herring in Prince

William Sound - Year 3 Budget Justification: NOAA & ADF&G = $366.5K

This is a three year collaborative proposal among researchers at the Auke Bay Lab, University of Alaska Fairbanks, and University of Alaska Southeast. We will cooperate with researchers from the Alaska Department of Fish and Game, Prince William Sound Science Center and community members from the Village of Chenega. The modeling of portion of this project will be lead by T. Quinn II at UAF. J. Straley at the Sitka Sound Science Center will lead the humpback whale portion of this project. ABL personnel will be responsible for herring biomass/energetic estimates.

Auke Bay Lab Budget Budget Justification - $194K

Personnel Salaries ($22,800) - One and a half months salary and overtime for J. Moran and two month salary and overtime for J. Vollenwieder.

Travel ($10,200) - Two round trips to the EVOS annual meeting. Four round trips Juneau to Cordova for field work Three round trips Juneau to Sitka for hydro acoustic surveys.

Contractual/Sample Analysis ($132,000) - Includes 20 large vessel days in PWS, 8 large vessel days in Lynn Canal and Sitka Sound, and air charters, soft labor to collect and process samples, but NOT Straley or Quinn.

Contractual Details: (See UAF & SSSC Details for ADF&G RSA for Contracted Services)

- Acoustic interpretation and quality assurance- Richard Thorne of the PWSSC will assist ABL personnel in the interpretation of acoustic data. Dr. Thorne has extensive experience conducting acoustic herring surveys in PWS.
- Chenega/Sawmill Bay humpback whale photo-ID/ herring sampling: Kate McLaughlin, of Chenega, will be contracted for monthly surveys in PWS. She has already collected three years of humpback whale data in our Chenega/Sawmill study area. Her local knowledge and proximity to for to foraging will provide detailed data at a relatively low cost.

Commodities ($13,000) - To prepare PWS sample for shipping, fuel for Lynn Canal small boat surveys and miscellaneous supplies.

Equipment ($0) - No new equipment will be purchased with EVOSTC funds.

Indirect Costs (ADF&G - $16,000) - General Administration

University of Alaska Fairbanks Budget Justification - $46.9K

Personnel Salaries ($29,400) - Funds are requested for PI Quinn. His responsibilities include modeling of whale and herring populations and supervision of a graduate student.

Funds are requested to support a graduate student stipend during the academic year and 2 months in the summer.

Senior personnel salaries are incremented by 4.5% and other personnel are incremented by 3% to allow for increases beginning in year 2. Students work full time in summer and part time during the academic year and are not incremented for increases.

Travel ($1,000) - *Domestic*: Funds are requested to cover airfare, lodging and meals at the Marine Science Symposium in Anchorage. 10% has been added to airfare, car rental and taxi travel beginning in year 2 to accommodate anticipated price increases. Per Diem (food, lodging and mileage) have not been increased.

Commodities ($2,000) - Funds are requested to cover project supplies.

Indirect Costs (UAF- $8,000) Facilities and Administrative (F&A) Costs for research is calculated at 25% of the Modified Total Direct Costs (MTDC) per EVOS instructions. MTDC includes Total Direct Costs minus tuition, stipends, scholarships, subaward amounts over $25,000, and equipment. A copy of the agreement is available at: http://www.alaska.edu/controller/cost-analysis/negotiated_agreements.html.
Student Services ($2,700) - Funds are requested to cover graduate student tuition for 1 year. Tuition is incremented by 10% per year to allow for increases beginning in year 2.
Indirect Costs (ADF&G - $3,900) - General Administration

Sitka Sound Science Center Budget Justification - $ 125.4K

Personnel Salaries ($81,900**) -** Funds are requested for six months of salary for PI Jan Straley (this will include field research, travel (meetings, presentations and training), administration, analysis, and report/paper writing) and six months of salary for Ms. Cedarleaf and three for Ms. Riley. Ms. Straley will coordinate the third year of data collection of humpback whale photo identification data in Lynn Canal and Prince William Sound, (including Chenega/Sawmill Bay) and the second full year of field work for Sitka Sound. Ms. Straley will conduct humpback photo identification surveys twice monthly and assist project staff with hydroacoustic prey assessment surveys in Sitka Sound during the fall and winter. Ms. Straley will conduct the photo identification work in the areas of Prince William Sound outside of Chenega/Sawmill Bay in conjunction with the monthly hydroacoustic surveys. She will continue to work with the data analyst, T. Quinn, in preparing the data for quantitative analysis. She will be responsible for grant administration, oversight of the humpback whale data and final report preparation that will describe numbers, movements, distribution, and residency times of individual humpback whales in the study areas. J. Cedarleaf, research assistant, will conduct the photographic matching to various catalogs (collections of fluke photographs) in the North Pacific, manage the database (data entry and organization) and oversee photographic quality. H. Riley will assist in field research in southeastern Alaska and Prince William Sound.

Benefits ($0) - Benefits are included in the contract hourly rate.

Equipment - No equipment is requested in this proposal.

Travel ($6,200) – *Domestic*: Travel funds are requested for Ms. Straley to work with project staff in Juneau for training in data collection methods and to conduct field research in Prince William Sound, which will be boat based. Three trips each are expected for Juneau and Cordova. Three trips are expected for a research assistant H. Riley. Per Diem is calculated for each town. *Foreign:* No foreign travel is requested in this proposal.

Other/Consultants/Services ($5,600) - Funds are requested for a charter air taxi in which to conduct aerial surveys. This is calculated at 3 trips, 3 hours per trip, $440 per hour. Sitka Sound boat surveys are calculated at 16 survey days at $100/day.

Supplies ($2,200) - Funds are requested for supplies which include: fuel (16 trips, 25 gallons per trip, $4.50 per gallon); photopaper (2 reams, $50 per ream); and DVDs for archiving digital photo data (100 DVDs, $3 per DVD

Facilities and Administration (F&A) Costs ($19,160) - Facilities and Administrative (F&A) Costs are calculated at 20% of the Modified Total Direct Costs (MTDC).

Indirect Costs (ADF&G - $10,359) - General Administration

CURRICULUM VITAE

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EDUCATION

Ph.D., Toxicology and Comparative Physiology, 1971, Kent State University
M.S., Biology, 1968, California State University Chico
B.A., Biology, 1966, California State University Chico

EXPERIENCE

1987-	Program Manager, Habitat and Oil Spill Programs NOAA, AFSC, Auke Bay Laboratory
1971-1986	Physiologist NOAA, AFSC, Auke Bay Laboratory

Over 127 peer reviewed publications; over 100 in toxicology.

Herring Articles

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Rice, S.D., M.M. Babcock, C.C. Brodersen, J.A. Gharrett, and S. Korn. 1987. Uptake and depuration of aromatic hydrocarbons by reproductively ripe pacific herring and the subsequent effect of residues on egg hatching and survival. *In* Pollution and Physiology of Estuarine Organisms (Edited by W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J. Vernberg), pp. 139-154. Belle W. Baruch Libr. Mar. Sci. 17, University of South Carolina Press, Columbia.

Collaborators: Malin Babcock, Mark Carls, Pat Harris, Ron Heintz, Larry Holland, Marie Larsen, Margo Lindeberg, Jacek Maselko, Jerome Pella and Jeffrey Short: NOAA
Mace Barron (EPA), Brenda Ballachey, James Bodkin, Gail Irvine (USGS), J. Cusick (NPS), David Irons (USFWS)

Daniel Esler (Simon Fraser), Gary Marty, Diane Naydan (UC Davis), Charles Peterson (UNC Chapel Hill), Robert Thomas (CSU Chico), William Driskell, Michael Lilly, and James Payne (private contractors)

CURRICULUM VITAE

Terrance J. Quinn II
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E-mail: Terry.Quinn@uaf.edu
Birthdate: October 27, 1952

EDUCATION

Ph.D., Biomathematics, 1980, University of Washington, Seattle WA
M.S., Fisheries, 1977, University of Washington, Seattle WA
B.A., Mathematics, 1973, University of Colorado, Boulder CO

EXPERIENCE

1998-	Professor of Fish Population Dynamics, Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks
1985-1997	Associate Professor of Fish Population Dynamics, Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks
1978-1985	Biometrician, International Pacific Halibut Commission

Books

Funk, F., T.J. Quinn II, J. Heifetz, J.N. Ianelli, J.E. Powers, J.F. Schweigert, P.J. Sullivan, and C.-I. Zhang (editors). 1998. Fishery Stock Assessment Models. Proc. Symp. Fishery Stock Assess. Models 21st Cent. Alaska Sea Grant College Program, Fairbanks AK, AK-SG-98-01. 1054 p.

National Research Council. 1998a. Improving Fish Stock Assessments. National Academy Press, Washington DC. 177 p. (co-chair and co-author)

National Research Council. 1998b. Review of Northeast Fishery Stock Assessments. National Academy Press, Washington DC. 128 p. (chair and co-author)

Quinn, T.J., II, and R.B. Deriso. 1999. Quantitative Fish Dynamics. Oxford University Press, New York. 542 pp.

Herring Articles

Marty, G.D., Quinn, T.J., II, Carpenter, G., Meyers, T.R., and Willits, N.H. 2003. Role of disease in abundance of a Pacific herring population. Can. J. Fish. Aquat. Sci. 60: 1258-1265.

Quinn, T.J., II, Marty, G.D., Wilcock, J., and Willette, M. 2001. Disease and population assessment of Pacific herring in Prince William Sound, Alaska. University of Alaska Sea Grant, AK-SG-01-04, Fairbanks. pp. 363-379.

Rooper, C.N., Haldorson, L.J., and Quinn, T.J., II. 1998. An egg-loss correction for estimating spawning biomass of Pacific herring in Prince William Sound, Alaska. Alaska Fishery Research Bulletin 5: 137-142.

Rooper, C.N., Haldorson, L.J., and Quinn, T.J., II. 1999. Habitat factors controlling Pacific herring (*Clupea pallasi*) egg loss in Prince William Sound, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 56: 1113-1142.

Williams, E.H., and Quinn, T.J., II. 1997. Age-structured analysis of Pacific herring from Norton Sound, Alaska. Alaska Fish. Res. Bull. 4: 87-109.

Williams, E.H., and Quinn, T.J., II. 1998. A parametric bootstrap of catch-age compositions using the Dirichlet distribution. Proc. Fishery Stock Assess. Models 21st Century, AK Sea Grant College Program, Fairbanks, AK: 371-384.

Williams, E.H., and Quinn, T.J., II. 2000a. Pacific herring, *Clupea pallasi*, recruitment in the Bering Sea and North-east Pacific Ocean: I. Relationships among different populations. Fisheries Oceanography 9: 285-299.

Williams, E.H., and Quinn, T.J., II. 2000b. Pacific herring, *Clupea pallasi*, recruitment in the Bering Sea and Northeast Pacific Ocean: I. Relationships to environmental variables and implications for forecasting. Fisheries Oceanography 9: 300-315.

Collaborators : Ram Myers, Paul Fanning, Robert Mohn, Paul Radomski, Jim Bence, Richard Deriso, Hal Geiger, Clive Turnbull, Vidar Wespestad, Gordon Kruse, John Calambokidis, Chris Gabriele, Jan Straley, Sally Mizroch, Joe Niebauer, Steve Hare, Paul Spencer, Jeremy Collie, Jim Ianelli, Martin Dorn, Anne Hollowed, Richard Marasco, Reg Watson, Fritz Funk, Lewis Haldorson, William Smoker, Gary Marty, John Wilcock, Lev Zhivotovsky, Tony Gharrett, Doug McBride, Peggy Merritt, Richard Gates, Jeff Fujioka, Ben van Alen, Pat Livingston, Graeme Parks, Milo Adkison, Robert Small, Carl Safina, Andy Rosenberg, Steve Moffitt

Students
Bonita Nelson, Jack Turnock, Scott Johnson, Bob Lafferty, Scott MacPherson, Nicole Szarzi, Robert Marshall, Lowell Fair, Daniel Bosch, Edgar Jones, Jon Heifetz, Peter Hagen, Randy Ericksen, Lewis Coggins, Erik Williams, Caihong Fu, Matthew Foster, Dana Hanselman, James Savereide, Brian Battaile, Colin Schmitz, Ben Williams, Briana Witteveen, Sara Miller, Kray Van Kirk, Haixue Shen, Peter Hulson, Joe Liddle. (Not chaired but significant involvement: Jie Zheng, Mike Sigler,Peggy Merritt, Ed Farley, Chris Rooper, Michio Fukushima, William Templin)

JANICE M. STRALEY
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EDUCATION:

1994 Master of Science, Biological Oceanography, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK (Dr. F. Fay, Advisor)
1975 Bachelor of Science, College of Fisheries, University of Washington, Seattle, WA
1974/76 Friday Harbor Marine Lab, U. W.: Invertebrate biology, embryology and botany field courses

PROFESSIONAL BACKGROUND:

1999-present **ASSISTANT PROFESSOR OF BIOLOGY** University of Alaska Southeast-Sitka
1994-1999 **ASSISTANT PROFESSOR** University of Alaska Southeast-Sitka and University of Alaska Fairbanks, College of Rural Alaska, Rural Alaska Science and Math Network.
1979-1999 **INDEPENDENT MARINE BIOLOGIST**
1988-1992 **MARINE BIOLOGIST** Glacier Bay National Park, Alaska
1987-1988 **INSTRUCTOR** University of Alaska Southeast-Sitka
1980-1984 **FISHERIES BIOLOGIST** NSRAA Sitka, AK
1979 **WILDLIFE BIOLOGIST** U.S. Forest Service, Sitka, AK
1977-78 **BIOLOGICAL TECHNICIAN** U.S. Fish and Wildlife Service, Sitka, AK
1974-1977 **WILDERNESS RANGER**, U.S. Forest Service, Winthrop, WA

OTHER SKILLS:

Biopsy (crossbow and rifle) for genetic sampling of marine mammals
Digital and film photography used for photo identification of marine mammals
Trained by NMFS for conducting necropsies and disentanglements in fishing gear
Extensive boat (to 50') driving and maintenance skills (primarily outboard)
Through knowledge of the waters of southeastern Alaska from Dixon Entrance to Yakutat Bay
Statistical analysis using various software and Microsoft Excel programs
Database programs (Access)
Sitka WhaleFest board president and co-speaker selection committee chair (along with Dr. Mike Castellini, UAF) to select scientists to speak at the annual symposium on marine research in the North Pacific

SELECTED PUBLICATIONS AND REPORTS:

Straley, J.M and A.W. Trites. 2005. Investigations of Transient Killer Whale Predation in Southeastern Alaska. Final report to the North Pacific Marine Science Foundation and Alaska Fisheries Development Foundation . NA04NMF4390067. 4 pp.

Straley, J., A. Thode, V. O'Connell, L. Behnken, S. Mesnick and J. Liddle. 2005. Sperm Whale and Longline Fisheries Interactions in the Gulf of Alaska. Final Report to the North Pacific Research Board, Anchorage, AK. 15 pp.

Sigler, M.F., C. R. Lunsford, **J. M. Straley** and J. Liddle. In Review. Sperm whale depredation of sablefish longline gear in the northeast Pacific Ocean.

Gabriele, C.M., **J.M. Straley** and J. L. Neilson. In Review. Age at first calving of female humpback whales in southeastern Alaska. Canadian Journal of Zoology

Mizroch, S.A., L.M. Herman, **J.M. Straley**, D. Glockner-Ferrari, C. Jurasz, J.D. Darling, S. Cerchio, C.M. Gabriele, D.R. Salden and O. von Ziegesar. 2004. Estimating the adult survival rate of Central North Pacific humpback whales. Journal of Mammology.

Straley, J.M., T.J. Quinn and C.M. Gabriele. 2002. Estimate of the abundance of humpback whales in southeastern Alaska 1994-2000. Final contract report G00000756, National Marine Mammal Laboratory, 7600 Sandpoint Way N.E. Seattle, WA 98115. 22pp.

Straley, J. M., S. A. Mizroch, C. M. Gabriele, O. v. Ziegesar, L. M. Herman, A. S. Craig, D. Glockner-Ferrari, C. S. Baker, J. Darling, D. McSweeney, C. Jurasz, S. Cerchio, D. Salden, J. K. Jacobsen and G. Ellis. 2001. Birth intervals and calving rates of central North Pacific humpback whales. In: ed. 14th Biennial Conference on the Biology of Marine Mammals, Vancouver, British Columbia. pp. 207.

Gabriele, C.M, **J. M. Straley**, S.A. Mizroch, C.S. Baker, A.S. Craig, L.M. Herman, D.Glockner-Ferraari, S.Cerchio, P. von Ziegesar, J. Darling, D. McSweeney, T.J. Quinn II and J. J. Jacobsen. 2000. Estimating the mortality rate of humpback whale calves in the central North Pacific Ocean. Can. J. Zool. 79:589-600

Gabriele, C.M., **J.M. Straley**, L.M. Herman and R.J. Coleman. 1996. Fastest documented migration of a North Pacific humpback whale. Marine Mammal Science 12:457-464.

Straley, J. M. and C. M. Gabriele. 1997. Humpback whales of southeastern Alaska: a catalog of photographs. National Park Service, Gustavus, Alaska 99826. 107 pp.

Straley, J.M. 1994. Seasonal characteristics of humpback whales (*Megaptera novaeangliae*) in southeastern Alaska. Master's thesis, University of Alaska Fairbanks, Fairbanks, AK. 121pp.

Straley, J.M., C.M. Gabriele, C.S. Baker. 1994. Annual reproduction by individually identified humpback whales (*Megaptera novaeangliae*) in Alaskan waters. Marine Mammal Science 10(1):87-92.

Straley, J.M. 1991. Population characteristics of humpback whales (*Megaptera novaeangliae*) in Glacier Bay and adjacent waters 1990. National Park Service, Glacier Bay National Park, Gustavus, AK. 21pp.

Straley, J.M. 1990. Fall and winter occurrence of humpback whales *(Megaptera novaeangliae)* in southeastern Alaska. Reports of the International Whaling Commission (Special Issue 12):319-24.

Straley, J.M. 1990. Assessment of possible humpback whale *(Megaptera novaeangliae)* displacement from Prince William Sound to southeastern Alaska, fall 1989 and winter 1990. Report to NMFS, National Marine Mammal Laboratory, Seattle, WA.

INVITATIONAL WORKSHOPS, APPOINTMENTS, COMMITTES, GRANTS:

2006 Steering committee to develop a research strategy for a study of North Pacific killer whales with a focus on predation upon marine mammal populations

2005 Steering committee to organize a workshop: Fisheries Depredation by Killer and Sperm Whales: Behavioural Insights, Behavioural Solutions. Vancouver Aquarium, October 2006

2005 Invitational workshop to develop a research plan for assessing populations of sperm whales

2004 Invitational workshop to assess fishing gear modifications to reduce large whale entanglement

2003-07 North Pacific Research Board grant to study sperm whale fisheries interactions in Gulf of Alaska

2004-05 Regional coordinator and received grant for North Pacific humpback whale study (SPLASH)

2002 Steering committee to develop a basin wide study of North Pacific humpback whales (SPLASH)

2002 Invitation to technical workshop on Cetacean Interactions with Commercial Longline Fisheries in the South Pacific Region: Approaches to Mitigation, Apia, Samoa, 11-15 November 02

2002 NMFS NMML grant to estimate the abundance of humpback whales in southeastern Alaska

2001 NOAA, NPUMMRC & CIFAR grants to study predation of Steller sea lions by killer whales in southeastern Alaska

1997 President Sitka WhaleFest, a non profit dedicated to celebrating marine wildlife in the North Pacific through community and educational events

1996 Appointment by NMFS to the Alaska Regional Scientific Review group for marine mammals

1988 Alaska Marine Mammal Health and Stranding Network member includes large whale disentanglement

RECENT COLLABORATORS:

John Calambokidis, Cascadia Research, Olympia, WA
Christine Gabriele, Glacier Bay National Park and Preserve, Gustavus, AK
Craig Matkin, North Gulf Oceanic Society
Sarah Mesnick, Southwest Fisheries Science Center, La Jolla, CA
Janet Neilson, Glacier Bay National Park and Preserve, Gustavus, AK
Tory O'Connell, Commercial Fisheries, Alaska Department of Fish and Game, Sitka, Alaska
Terry Quinn, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, AK
Aaron Thode, Scripps Institution of Oceanography, La Jolla, CA

Ron A. Heintz
Fishery Research Biologist
National Marine Fisheries Service
Auke Bay Laboratory
11305 Glacier Hwy.
Juneau, AK 99801 USA

Voice: (907) 789-6058
Fax : (907)789-6094
EMAIL: Ron.Heintz@NOAA.GOV

EDUCATION:

B.S. Ecology Ethology and Evolution, June 1979, University of Illinois, Urbana Illinois
M.S. Fisheries Biology, May 1987, University of Alaska, Juneau Alaska
PhD Candidate: University of Alaska, Fairbanks Alaska

PROFESSIONAL MEMBERSHIPS:

American Fisheries Society
American Institute of Biological Scientists
American Chemical Society

EMPLOYMENT AND STUDY FOCUS:

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Auke Bay Laboratory since 1985.

Prior to 2000

Examined the effects of crude oil exposure during embryogenesis on the life history of fish.

Since 2000

Leads AFSC Nutritional Ecology Laboratory program investigating the nutritional status and trophic relationships of marine forage species.

SELECTED BIOENERGETIC/LIPID BIOCHEMISTRY PUBLICATIONS:

Vollenweider, Johanna J. **R. Heintz** and B. Kelly. In Review. Seasonal variation in the proximate composition and whole-body energy content of forage fish. Marine Ecology Progress Series.

Heintz R. and J Volllenweider. In Review. Seasonal and ontogenetic changes in the energy allocation strategies of walleye pollock. Can. J. Fish. Aquat. Sci.

Hudson, JP, **R. Heintz,** J Vollenweider. Overwinter energy dynamics of capelin and eulachon in southeastern Alaska. Fishery Bulletin.

Vollenweider, Johanna J., Jamie Womble, **Ron Heintz**. Forage fish species contribution to total energy content of Steller sea lion diet in southeastern Alaska. Proc. 22nd Wakefield Fisheries Symposium: Sea Lions of the World

Otis, T., **R.A. Heintz** and K.P. Severin. In Review. Discriminating among Alaska's herring stocks using heart fatty acid profiles and otolith microchemistry. Oil Spill Restoration Project Final Report (Restoration Project 02538), Alaska Department of Fish and Game, Homer, Alaska.

Heintz, R.A., B.D. Nelson, J. Hudson, M. Larsen, and L. Holland. 2004. Marine subsidies in freshwater: Effects of salmon carcasses on lipid class and fatty acid composition of juvenile coho salmon. Trans. Am. Fish. Soc. 133:559-567.

Gende, S.M., T.P. Quinn, M.F. Willson, **R. Heintz**, T. M. Scott. 2004. Magnitude and fate of salmon-derived nutrients and energy in a coastal stream ecosystem. J. Fresh. Ecol. 19:149-160.

John R. Moran

Auke Bay Laboratory (As of 21 Aug 2006)
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EDUCATION

University of Alaska Fairbanks, M.S. in Fisheries, August 2003.
University of New Hampshire, B.A. in Zoology, minor in Marine Biology, May 1989.

PROFESSIONAL EXPERIENCE

Research Associate, *University of Alaska Southeast, Juneau, AK.* September 2003-present
Research Assistant, *University of Alaska Fairbanks, Juneau, AK*. January 2002-May 2003
Weir Crew Leader, *SWCA, Salt Lake City, UT.* September 2001-November 2001
Graduate Intern, *Alaska Department of Fish and Game, Juneau, AK.* April 2000-April 2001
Teaching Assistant, *University of Alaska Fairbanks, Juneau, AK.* September 1999-December 2000
Biological Technician (Fisheries), *U.S. Fish and Wildlife Service, Togiak NWR, Dillingham, AK***.** April 1998-August 1999
Biological Science Technician (Wildlife), *U.S. Fish and Wildlife Service, Togiak NWR, Dillingham, AK*
Fisheries Technician/Tagger/Diver, *Prince William Sound Aquaculture, Cordova, AK.* February 1992-April 1993

PAPERS (primary author)

Moran, J.R., B.P. Kelly, O.Badajos, and M. Kunnasranta. The influence of environmental variables on counts of visible ringed seals. In prep.

Moran, J.R., M.D. Adkison, and B.P. Kelly. Counting seals: Estimating the unseen fraction using a photographic capture-recapture and covariate model. In prep. for the Canadian Journal of Zoology.

Moran, J.R. 2003. Counting seals: Estimating the unseen fraction using a covariate and capture-recapture model. M.S. Thesis, University of Alaska Fairbanks.

Moran, J.R., and C. A. Wilson. 1996. Abundance and distribution of marine mammals in northern Bristol Bay and southern Kuskokwim Bay - a status report of the marine mammal monitoring effort at Togiak NWR. Annual report 1995. USFWS report, 19 pp. Dillingham, AK.

Moran, J.R. 1994. Landbird monitoring at Cape Peirce, Alaska, 1994. USFWS report, 4 pp. Dillingham, AK.

Moran, J.R.1994. Waterfowl and shorebird observations at Chagvan Bay and Cape Peirce, Alaska, 1994. USFWS report, 8 pp. Dillingham, AK

Moran, J.R. 1994. Small mammal studies and observations at Cape Peirce, Alaska, 1993. USFWS report, 5 pp. Dillingham, AK.

PAPERS (co-author)

Kelly, B.P., S. Nghiem, M. Kunnasranta, O.Badajos, J. Moran, and D. Douglas. The Ringed Seal's Sense of Snow. In prep.

Swanson, B.J., B.P. Kelly, C. Maddox, and J.R. Moran. Shed seal skin as a source of DNA molecular. In press. for Molecular Ecology Notes.

Wilson C.A., J.R. Moran, and R. Mac Donald. Pacific walruses (*Odobenus rosmarus divergens*) falling from cliffs in southwestern Alaska. In review for Marine Mammal Science.

Kelly, B., O. Badajos, M. Kunnasranta and J. Moran. 2005. Timing and re-interpretation of ringed seal surveys. Final report to Coastal Marine Institute, University of Alaska Fairbanks.

Lisac, M.J. and J.R. Moran 1999. Migratory and seasonal distribution of Dolly Varden *Salvelinus malma* in the Togiak River watershed, Togiak National Wildlife Refuge. Progress report 1999. USFWS report, 28 pp. Dillingham, AK.

Wilson C.A. and J.R. Moran. 1997. Abundance and distribution of marine mammals in northern Bristol Bay and southern Kuskokwim Bay-a status report of the marine mammal monitoring effort at Togiak NWR. Annual report 1997. USFWS report, 33 pp. Dillingham, AK.

Haggblom, L., and J. Moran 1995. The status of kittiwakes, murres, and cormorants at Cape Peirce, Bristol Bay, Alaska, Summer 1994. USFWS report, 14 pp. Dillingham, AK.

Haggblom, L., and J. Moran. 1994. The status of kittiwakes, murres, and cormorants at Cape Peirce, Bristol Bay, Alaska, Summer 1993. USFWS report, 20 pp. Dillingham, AK.

RECENT COLLABORATORS:

Brendan Kelly, University of Alaska Southeast, Juneau, AK
Mervi Kunnasranta, University of Joensuu, Joensuu, Finland
Peter Boveng, Polar Ecosystem Program, NMML, NMFS, Seattle, WA
Lois Harwood, Department of Fisheries and Oceans Canada, Yellowknife, NT, Canada
Tom Smith, EMC EcoMarine Corporation,Quebec, Canada
Rex Snyder, Nanuuq Commission, Anchorage, AK

DATA MANAGEMENT AND QUALITY ASSURANCE/ QUALITY CONTROL STATEMENT

This project involves collecting and processing data, conducting surveys, taking measurements, and modeling. Data management and quality control will be the responsibility of Dr. Stanley Rice of the Auke Bay Lab, using established scientific protocols. If this proposal is funded, then we will work with EVOSTC to set up a data management plan, so that essential data on humpback whales and herring will be archived. Computer models will be provided in electronic form along with detailed explanations of how they work. We will use MetaLite, freeware created by USGS for collecting and validating Federal Geographic Data Committee (FGDC)-compliant metadata, as requested.

1. Study design and statistical analyses are given elsewhere in this proposal.
2. Standard scientific protocols will be used for field studies and hypothesis testing.
3. Data characteristics
    a. Metadata will be provided if the proposal is funded.
    b. Quantitiative datasets will be obtained for humpback whales, herring, and related factors in three locations: Prince William Sound, Sitka Sound, and Lynn Canal.
4. Our cited literature describes the methods to be used for converting signals to observations.
5. Handling and custody of samples will follow standard ABL and University protocols.
6. Calibration and evaluation of analytical instruments are routinely performed at ABL and the University of Alaska.
7. Standard software will be used (Microsoft Office, R, Mark).

SIGNIFICANCE OF WHALE PREDATION ON MORTALITY RATE OF PACIFIC HERRING IN PRINCE WILLIAM SOUND
Metadata:

- Identification_Information
- Spatial_Data_Organization_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:
Citation:
Citation_Information:
Originator: S.D. Rice, J Moran, R. Heintz, T Quinn and J Straley
Publication_Date: 20091001
Title:
SIGNIFICANCE OF WHALE PREDATION ON MORTALITY RATE OF PACIFIC HERRING IN PRINCE WILLIAM SOUND
Geospatial_Data_Presentation_Form: atlas
Publication_Information:
Publication_Place: Juneau AK
Publisher: NOAA
Description:
Abstract:
Pacific herring (Clupea pallasi) in Prince William Sound (PWS) have been classified as "not-recovered" by the Exxon Valdez Oil Spill Trustee Council. Predation by marine mammals has been cited as a factor in the failure of this population to rebound. We will assess the significance of humpback whale predation on herring in PWS, particularly in winter. Specifically we will estimate the number of whales foraging in winter, determine when and if there is a prey switch to herring, and how long whales focus on herring as prey. Year one, is stand alone, small in scale with an intense monitoring strategy; year 2 would expand the scale up in area significantly. These data will be combined in a bioenergetic model to determine numbers of herring consumed (and energy content consumed). Lastly, the estimated numbers of herring consumed would be included in an age-structured model so that the significance of whale predation on herring recovery can be evaluated.
Purpose:
The purpose of this data set is to document whale predation on Pacific herring in PWS and determine if that predation contributes signficantly to herring mortality rates.
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Ending_Date: 20091001
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Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Jeep Rce
Contact_Organization: NOAA Auke Bay Lab
Contact_Address:
Address_Type: Mailing and Physical Address
Address: 11305 Glacier Hwy
City: Juneau
State_or_Province: AK
Postal_Code: 99801
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Contact_Facsimile_Telephone: 907-789-6094
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City: Juneau
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failure of this population to rebound.  We will assess the significance of
humpback whale predation on herring in PWS, particularly in winter.
Specifically we will estimate the number of whales foraging in winter,
determine when and if there is a prey switch to herring, and how long whales
focus on herring as prey.   Year one, is stand alone, small in scale with an
intense monitoring strategy; year 2 would expand the scale up in area
significantly.
These data will be combined in a bioenergetic model to determine numbers of
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significance of whale predation on herring recovery can be evaluated.
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Identification_Information:
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    Citation_Information:
      Originator: S.D. Rice, J Moran, R. Heintz, T Quinn and J Straley
      Publication_Date: 20091001
      Title: SIGNIFICANCE OF WHALE PREDATION ON MORTALITY RATE OF PACIFIC HERRING IN PRINCE WILLIAM SOUND
      Geospatial_Data_Presentation_Form: atlas
      Publication_Information:
        Publication_Place: Juneau AK
        Publisher: NOAA
  Description:
    Abstract:
      Pacific herring (Clupea pallasi) in Prince William Sound (PWS) have been classified as "not-recovered" by the Exxon Valdez Oil Spill Trustee Council. Predation by marine mammals has been cited as a factor in the failure of this population to rebound. We will assess the significance of humpback whale predation on herring in PWS, particularly in winter. Specifically we will estimate the number of whales foraging in winter, determine when and if there is a prey switch to

herring, and how long whales focus on herring as prey. Year one, is stand alone, small in scale with an intense monitoring strategy; year 2 would expand the scale up in area significantly.

These data will be combined in a bioenergetic model to determine numbers of herring consumed (and energy content consumed). Lastly, the estimated numbers of herring consumed would be included in an age-structured model so that the significance of whale predation on herring recovery can be evaluated.

Purpose: The purpose of this data set is to document whale predation on Pacific herring in PWS and determine if that predation contributes signficantly to herring mortality rates.

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20061001
Ending_Date: 20091001
Currentness_Reference: publication date
Status:
Progress: Complete
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: 148.5
East_Bounding_Coordinate: 144.5
North_Bounding_Coordinate: 61
South_Bounding_Coordinate: 60
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Theme:
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Theme_Keyword: ecological dynamics
Theme_Keyword: dinámica ecológica
Theme_Keyword: fish
Theme_Keyword: peces
Place:
Place_Keyword_Thesaurus: Prince William Sound
Place_Keyword: Prince William Sound
Temporal:
Temporal_Keyword_Thesaurus: Seasonal
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Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Jeep Rce
Contact_Organization: NOAA Auke Bay Lab

Contact_Address:
Address_Type: Mailing and Physical Address
Address: 11305 Glacier Hwy
City: Juneau
State_or_Province: AK
Postal_Code: 99801
Contact_Voice_Telephone: 907-789-6020
Contact_Facsimile_Telephone: 907-789-6094
Contact_Electronic_Mail_Address: jeep.rice@noaa.gov
Distribution_Liability: none
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City: Juneau
State_or_Province: AK
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Contact_Electronic_Mail_Address: jeep.rice@noaa.gov
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998

SITKA SOUND SCIENCE CENTER, INC.
834 LINCOLN ST. #20
P.O. BOX 1373
SITKA, ALASKA 99835-1373

SITKA SOUND SCIENCE CENTER IS DEDICATED TO INCREASING UNDERSTANDING AND AWARENESS OF TERRESTRIAL AND AQUATIC ECOSYSTEMS OF THE GULF OF ALASKA THROUGH EDUCATION AND RESEARCH.

To:	Jeep Rice NOAA Auke Bay Lab, Ted Steven Marine Research Institute 17109 Pt Lena Loop Rd Juneau AK 99801 Phone: 907.789.6020 Fax: 907.789.6094 Jeep.Rice@noaa.gov
From:	Sitka Sound Science Center PO Box 1373 Sitka, AK 99835 907-738-2677
Title:	Significance of whale predation on natural mortality rate of pacific herring in Prince William Sound-Year 3
Principal Investigator:	Jan Straley
Duration:	12 months
Proposed Start Date:	1 January 2009 (or earlier)
UAS Amount Requested:	$123,600

Jan Straley Date
Principal Investigator

John Stein Date
Sitka Sound Science Center Executive Director

Keith Cox Date
President Board of Directors
Sitka Sound Science Center

2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2007 - September 30, 2008

Budget Category:	Authorized FY 2008	Proposed FY 2009						
Personnel	$70.2	$81.9						
Travel	$4.7	$6.2						
Contractual	$1.5	$5.6						
Commodities	$5.9	$2.2						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$82.3	$95.9						
Indirect	$20.6	$19.2						
Project Total	$102.9	$115.1						
Full-time Equivalents (FTE)	0.8	1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
excluded 9% ADF&G over head (this is added on the ABL Sheet)

FY09

Prepared:

Project Number: 080804
Project Title: Role of Whale Predation on Dynamics of Herring in Prince William Sound
Agency: Sitka Sound Science Center (Straley)

FORM 4A
Non-Trustee
SUMMARY

2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2007 - September 30, 2008

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2009
	J. Straley	Project director		6.0	6.9		41.4
	J Cedarleaf	Research assistant		6.0	4.5		27.0
		Research assistant		3.0	4.5		13.5
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		15.0	15.9	0.0	
						Personnel Total	$81.9

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2009
	Juneau-Sitka RT-training photoid/analysis	0.4	3	4	0.2	2.0
	PWS field work Sit-Cordova RT	0.5	6	6	0.2	4.2
						0.0
						0.0
						0.0
						0.0
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						0.0
						0.0
						0.0
						0.0
					Travel Total	$6.2

FY09

Prepared:

Project Number: 080804
Project Title: Role of Whale Predation on Dynamics of Herring in Prince William Sound
Agency: Sitka Sound Science Center (Straley)

FORM 4B
Personnel
& Travel
DETAIL

2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2007 - September 30, 2008

Contractual Costs:	Proposed
Description	FY 2009
Air taxi for aerial surveys to locate whales and herring	4.0
Whale survey small boat charter days	1.6
Contractual Total	$5.6

Commodities Costs:	Proposed
Description	FY 2009
Fuel for Sitka Sound whale surveys	1.8
Photo printing paper 100 sheets per ream	0.1
DVDs for archiving photo digital data	0.3
Commodities Total	$2.2

FY09

Prepared:

PProject Number: 080804
Project Title: Role of Whale Predation on Dynamics of Herring in Prince William Sound
Agency: Sitka Sound Science Center (Straley)

FORM 4B
Contractual & Commodities DETAIL

2008 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2007 - September 30, 2008

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2009
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.			0.0
		New Equipment Total	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY09

Prepared:

Project Number: 080804
Project Title: Role of Whale Predation on Dynamics of Herring in Prince William Sound
Agency: Sitka Sound Science Center (Straley)

FORM 4B
Equipment
DETAIL