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 – Close out

Printed Name of PI: Stanley Rice

Signature of PI: Stanley D Rice Date 17 Apr 09

Printed Name of co-PI: Ron Heintz

Signature of co-PI: Ron Heintz Date 17 Apr 09

Printed Name of co-PI: John Moran

Signature of co-PI: John R Moran Date 17 Apr 2009

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

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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
Close Out Funding

Project Period: November 2006 to April 2010

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 .
Terrance J. Quinn II Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks 11120 Glacier Hwy, Juneau, Alaska 99801, (907) 796-2051, Terry.Quinn@uaf.edu
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. Year one was funded, small in scale with an intense monitoring strategy; year 2 would expand the scale up in area significantly. During year 3 will verify the impact on herring of the high numbers of humpback whales we observed in PWS during year 2.
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. Year 4 (2010) will close out the project with the completion of analysis, reports, and manuscripts.

Funding: EVOS Funding Requested: FY 10 $ 69.1K
(must include 9%GA)
TOTAL: 69.1K

Non-EVOS Funds to be Used: FY 10 $ 0

TOTAL: $69.1K

Date: April 20, 2009

(NOT TO EXCEED ONE PAGE)

Project Description

Project 090804
Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in PWS - Close out

PREFACE

This proposal is collaboration 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 **(Field work completed)**: 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? 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.

Year 4: We will close out the project with the completion of analysis, reports and manuscripts.

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/Chenga 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 **(Completed)** - 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 **(Field work Completed; lab and acoustic measurements in progress)**

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

YEAR 4 close out objectives

3. Estimate the percentage of a humpback whale's energy requirements fulfilled by herring using bioenergetic models
   a. Energy content will be determined for each forage type, including different age classes of herring. Complete year three samples in first quart of 2010.
   b. Using prey switching information, estimate the energy consumed by whales for each area.
   c. Compare across years and locations.
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.
   a. Develop time series of whale abundance for PWS, Lynn Canal, and Sitka from available data.

c. From objective 3, estimate the winter consumption by humpback whales by herring age-class, and model the impact on herring populations in all three locations.
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.
d. In Lynn Canal, determine what proportion of the herring population is consumed by humpback whales in the winterCompare across locations and years to determine the significance of whale predation to each population.
e. Finish specific manuscripts and synthesis report giving the significance of whale predation to each herring population.

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/Chenega Bay 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 and 4.

	Oct – Dec 08	Jan – Mar 09	Apr – Jul 09	Aug – April 10
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

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) a project on Salmon shark predation submitted by Bruce Wright of APIAI and Ron Heintz, NOAA, AFSC

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.
April 2010: 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:	AMSS meeting. Continue surveys and sample analysis.
FY 09, 2nd quarter	
January- March:	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 10

September-April:	Complete data analyses of acoustic data, whale numbers. Complete analyses of energetic data (calories per fish with numbers of fish available), and calculate energy demands by whales. Complete Model Whale numbers, and calculate consumption through the winters for each location.. Compare results across the three winters of results. Synthesize reports and manuscripts. 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, plus the final report:

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 by Moran, the third by Heintz, 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.

BUDGET JUSTIFICATION

Significance of whale predation on natural mortality rate of pacific herring in Prince William Sound – Close Out Budget = $69.1K

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 - $40.5K

Personnel Salaries ($3,400) – Funds are requested for1/2 month of salary for J. Moran.

Travel ($1,800) – Travel to AMSS 2010.

Contractual/Sample Analysis ($30,000).

Contractual Details:

- Acoustic interpretation and quality assurance- Kevin Boswell of the Louisiana State University will assist ABL personnel in the interpretation of acoustic data ($15,000).
- Complete biological and chemical analysis ($15,000).

Commodities ($2,000) - Publication fees.

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

Indirect Costs ($3,300) - General Administration 9% of $36.9K.

Sitka Sound Science Center Budget Justification - $ 28.6K

Personnel Salaries ($20,400**) -** Funds are requested for 1 months of salary for PI Jan Straley (report/paper writing) and 3 months of salary for Ms. Cedarleaf (quality assurance of data, metadata, 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).

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

Equipment ($0) - No equipment is requested in this proposal.

Travel ($1,800) – Travel to AMSS 2010.

Supplies ($0) – No supplies will be needed for the SSSC.

Facilities and Administration ($4,100) - Facilities and Administrative (F&A) Costs are calculated at 20% of the Modified Total Direct Costs (MTDC).

Indirect Costs ($2,400) - General Administration 9% of $28.6K.

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Foy, R.J., and Paul, A.J. 1999. Winter feeding and changes in somatic energy content of age-0 Pacific herring in Prince William Sound, Alaska. Transactions of the American Fisheries Society 128: 1193-1200.

Gabriele, C.M., Straley, J.M., Herman, L.M., and Coleman, R.J. 1996. Fasted documented migration of a North Pacific humpback whale. Marine Mammal Science 12(3):457-464.

Garvey, J.E., Ostrand, K.G, and Wahl, D.H. 2004. Energetics, predation, and ration affect size-dependent growth and mortality of fish during winter. Ecology 85: 2860-2871.

Haldorson, L.J., and Collie, J.C. 1990. Distribution of Pacific herring larvae in Sitka Sound, Alaska. Sea Grant College Program, University of Alaska, Fairbanks, Anchorage, Alaska.

Heintz, R.A., and Vollenweider, J.J. *In review*. Seasonal and ontogenetic changes in the energy allocation strategies of walleye pollock. Canadian Journal of Fisheries and Aquatic Sciences.

Herman, L.M., and Antinoja, R.C. 1977. Humpback whales in the Hawaiian breeding waters: population and pod characteristics. Scientific Reports to the Whales Research Institute 29: 59-85.

Hulson, P.-J.F., Miller, S.E., Quinn, T.J., II, Marty, G.D., Moffit, S.D., and Funk, F. 2006. Incorporating hydroacoustic data into the Prince William Sound Pacific herring assessment model. Final Report to EVOS TC, 2006.

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Marty, G.D., Miller, S.E., Hulson, P.-J.F., Quinn T.J., II, Moffit, S.D., Merizon, R.A., and Meyers, T.R. 2006. Role of *Ichthyophonus hoferi*, viral hemorrhagic septicemia virus, and cutaneous ulcers in preventing recovery of a Pacific herring (*Clupea pallasi*) population. Final Report to EVOS TC, 2006.

Mobley Jr., J., Spitz, S., Grotefendt, R., Forestell, P., Frankel, A., and Bauer, G. 2001. Abundance of humpback whales in Hawaiian waters: Results of 1993-2000 aerial surveys. Report for Hawaiian Islands Humpback Whale National Marine Sanctuary. 16pp.

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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. In Herring: Expectations for a new millennium. Edited by F. Funk, J. Blackburn, D. Hay, A.J. Paul, R. Stephensen, R. Toreson and D. Witherell. University of Alaska Sea Grant, AK-SG-01-04, Fairbanks. pp. 363-379.

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

Womble, J. N., and M. F. Sigler. 2006. Seasonal availability of abundant, energy-rich prey influences the abundance and diet of a marine predator, the Steller sea lion *Eumetopias jubatus*. Mar. Ecol. Prog. Ser. 325:281-293.

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

Peterson, C. H., S. D. Rice, J. W. Short, D. Esler, J. L. Bodkin, B. E.Ballachey, and D. B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302: 2082-2086.

Barron, M.G., M.G. Carls, J.W. Short, and S.D. Rice. 2003. Photoenhanced toxicity of aqueous phase and chemically dispersed weathered Alaska North Slope crude oil to Pacific herring eggs and larvae. Environ. Toxicol. Chem. 22(3): 650-660.

Carls, M.G., S.D. Rice, and J.E. Hose. 1999. Sensitivity of fish embryos to weathered crude oil: Part I. Low level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific herring (Clupea pallasi). Environmental Toxicol. Chem. 18:481-493.

Carls, M. G., G. D. Marty, T. R. Meyers, R. E. Thomas, and S. D. Rice. 1998. Expression of viral hemorrhagic septicemia virus in prespawning Pacific herring (*Clupea pallasi*) exposed to weathered crude oil. Can. J. Fish. Aquat. Sci. 55: 2300B2309.

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Rice, S.D., M.M. Babcock, C.C. Brodersen, M.G. Carls, J.A. Gharrett, S. Korn, A. Moles, and J. Short. 1987. Lethal and sublethal effects of the water-soluble fraction of Cook Inlet crude oil on Pacific herring *Clupea harengus pallasi* reproduction. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-111, 63 p.

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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)

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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)

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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.

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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)

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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

SELECTED PUBLICATIONS AND REPORTS:

Straley, J.M., Quinn, T.J., II, and Gabriele, C.M. 2009. Assessment of mark-recapture models to estimate the abundance of a humpback whale feeding aggregation in Southeast Alaska. Journal of Biogeography 36: 427-438.

Sigler, M.F., C. R. Lunsford, J. M. Straley and J. Liddle. 2008. Sperm whale depredation of sablefish longline gear in the northeast Pacific Ocean. Marine Mammal Science 24:16-27.

Mathias, D., A. Thode, J. Straley, and K. Folkert. In Press. Relationship between sperm whale *(Physeter macrocephalus*) click structure and size derived from videocamera images of a depredating whale (sperm whale prey acquisition). J. Acoust. Soc. Am.

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.

Neilson, J.A., Straley, J.M., Gabriele, C.M., Robbins, J. & Hills, S. 2007 Humpback whale (*Megaptera novaeangliae*) entanglement in fishing gear in northern Southeast Alaska. Journal of Biogeography, doi: 10.111/j.1365-2699.2007.01820.x

Thode, A, J. Straley, C. Tiemann, K. Folkert, V. O'Connell. 2007. Observations of potential acoustic cues that attract sperm whales (*Physeter macrocephalus*) to longline fishing activities in the Gulf of Alaska. J. Acoust. Soc. Am. 122(2): 1265-1277.

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.

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., 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

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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.

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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:

2009 Invitational workshop Ice Retreat and Potential Shipping and Fishing Effects on Western Arctic Marine Wildlife

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

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

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

Research Support

Ongoing Research Support

2007-P Exxon Valdez Oil Spill Trustees Council, Significance of Whale Predation on Herring, $123,600

2008-P USDA CSREES Strengthening Alaska and Hawai'i student and faculty partnerships through experiential learning, $99,511

2008-P Subaward from UCSD, International Association of Oil and Gas Producers, Testing of potential alerting signals on sperm and humpback whales, $109,329

<u>Completed research support</u>

2001 NOAA, North Pacific Universities Marine Mammal Research Consortium and Cooperative Institute for Arctic Research, Predation of Steller Sea Lions by Killer Whales in Southeastern Alaska, $131,000

2003-06 North Pacific Research Board, Sperm Whale Fisheries Interactions in the Gulf of Alaska, $284,000.

2004-06 Cascadia Research, Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) Southeastern Alaska, $80,000.

2005 Marine Mammal Commission, Understanding Killer Whale Diet Preference, $41,273.

2006-07 USDA CSREES ANNH, Animal Migration and Demographics, $125,000.

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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.

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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
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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 Fisheries Biologist, *National Oceanic and Atmospheric Administration, National Marine Fisheries Service, , Juneau AK. August 2006- present*
Research Associate, *University of Alaska Southeast, Juneau, AK.* September 2003- August 2006
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.

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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. 2006. Shed seal skin as a source of DNA molecular. Molecular Ecology Notes (2006) 6,1006-1009

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.

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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:

Kevin Boswell, Louisiana State University, Baton Rouge, LA
Mary Anne Bishop, Prince William Sound Science Center, Cordova, AK
Lois Harwood, Department of Fisheries and Oceans Canada, Yellowknife, NT, Canada
Ron Heintz, Auke Bay Laboratories, Juneau, AK
Brendan Kelly, University of Alaska Southeast, Juneau, AK
Mervi Kunnasranta, University of Joensuu, Joensuu, Finland
Craig Matkin North Gulf Oceanic Society, Homer, AK
Katherine McLaughlin, Chenega, AK
Stanley Rice, Auke Bay Laboratories, Juneau, AK
Janice Straley, University of Alaska Southeast, Sitka AK.
Tom Smith, EMC EcoMarine Corporation,Quebec, Canada
Johanna Vollenweider, Auke Bay Laboratories, Juneau, AK
Olga von Ziegesar Eye of the Whale Research, Homer, 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

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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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Time_Period_Information:
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Ending_Date: 20091001
Currentness_Reference: publication date
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Theme_Keyword: ecological dynamics
Theme_Keyword: dinámica ecológica
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Theme_Keyword: peces
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Contact_Organization: NOAA Auke Bay Lab
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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
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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
herring consumed (and energy content consumed). Lastly, the estimated numbers
of herring consumed would be included in an age-structured model so that the
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Range_of_Dates/Times:
Beginning_Date: 20061001
Ending_Date: 20091001
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West_Bounding_Coordinate: 148.5
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Theme:
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Contact_Person: Jeep Rce
Contact_Organization: NOAA Auke Bay Lab

Contact_Address:
Address_Type: Mailing and Physical Address
Address: 11305 Glacier Hwy
City: Juneau
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***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Budget Category:	Proposed FY 10	Proposed FY 11	Proposed FY 12	Proposed FY 13	TOTAL PROPOSED
Personnel	$3.4	$0.0	$0.0	$0.0	$3.4
Travel	$1.8	$0.0	$0.0	$0.0	$1.8
Contractual	$30.0	$0.0	$0.0	$0.0	$30.0
Commodities	$2.0	$0.0	$0.0	$0.0	$2.0
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0
SUBTOTAL	$37.2	$0.0	$0.0	$0.0	$37.2
General Administration (9% of subtotal)	$3.3	$0.0	$0.0	$0.0	$3.3
PROJECT TOTAL	$40.5	$0.0	$0.0	$0.0	$40.5
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0

COMMENTS:

FY10 - 13

Project Title: Whale predation on Pacific Herring
Lead PI: Rice
Agency: NOAA - Auke Bay Lab

FORM 3A
TRUSTEE AGENCY
SUMMARY

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Name	Project Title					
Moran	Co-PI		0.5	6.7		3.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	6.7	0.0	
					Personnel Total	$3.4

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Travel to AMSS	0.6	1	4	0.3	1.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.8

FY10

Project Title: Whale predation on Pacific Herring
Lead PI: Rice

FORM 3B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Chemistry lab analysis contract labor- ABL	15.0
Acoustic analysis	15.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$30.0

Commodities Costs: Description	Commodities Sum
Publishing cost	2.0
Commodities Total	$2.0

FY10

Project Title: Whale predation on Pacific Herring
Lead PI: Rice

FORM 3B
CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Budget Category:	Proposed FY 10	Proposed FY 11	Proposed FY 12	Proposed FY 13	TOTAL PROPOSED
Personnel	$20.4	$0.0	$0.0	$0.0	$20.4
Travel	$1.8	$0.0	$0.0	$0.0	$1.8
Contractual	$0.0	$0.0	$0.0	$0.0	$0.0
Commodities	$0.0	$0.0	$0.0	$0.0	$0.0
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect *(will vary by proposer)*	$ 4.1				$4.1
SUBTOTAL	$26.3	$0.0	$0.0	$0.0	$26.3
General Administration (9% of subtotal)	$2.4	$0.0	$0.0	$0.0	$2.4
PROJECT TOTAL	$28.6	$0.0	$0.0	$0.0	$28.6
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0

COMMENTS:

FY10 - 13

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4A
NON-TRUSTEE
AGENCY SUMMARY

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
J. Straley	Project director		1.0	6.9		6.9
J Cedarleaf	Research assistant		3.0	4.5		13.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		4.0	11.4	0.0	
					Personnel Total	$20.4

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
Travel to AMSS	0.6	1	4	0.3	1.8
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					0.0
					0.0
					0.0
					0.0
					0.0
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					0.0
					0.0
					0.0
				Travel Total	$1.8

FY10

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
PERSONNEL &
TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY10

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY10

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
EQUIPMENT
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

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

FY11

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
PERSONNEL &
TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY11

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY11

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
EQUIPMENT
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

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

FY12

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY12

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY12

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
EQUIPMENT
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

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

FY13

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
PERSONNEL &
TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Commodities Costs: Description	Commodities Sum
Commodities Total	$0.0

FY13

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY13

Project Title:Whale predation on Pacific Herring
Lead PI: Straley

FORM 4B
EQUIPMENT
DETAIL