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

Project Title:

Temporal stability of fatty acids used to discriminate Pacific herring in Alaska.

Project Period:

October 2005 to September 2007 (FY05-FY07)

Proposer(s):

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Study Location:

Gulf of Alaska (Sitka, Prince William Sound, Kodiak, Cook Inlet) and Bering Sea (Dutch Harbor, Togiak, Kuskokwim Bay)

Abstract:

This project follows up on a promising pilot study that demonstrated the ability to discriminate Alaska herring stocks at relatively fine spatial scales (> 100 km) based on the fatty acid composition of their heart tissue. The investigators propose to assess the temporal stability and biological variability of stock discrimination criteria derived from fatty acid analysis of herring cardiac tissues. Samples will be collected during the spring and fall/winter of 2005 and 2006 from putative herring stocks from Sitka, PWS, Kamishak, Kodiak, Dutch Harbor, Togiak, and Kuskokwim Bay. Results should allow managers to better define ecologically significant stock boundaries, which would likely affect how commercially exploited herring populations are assessed and managed. Results will be published in a peer-reviewed report and may lead to revision of fishery management plans for affected areas.

Keywords: Pacific herring, stock identification, fatty acid analysis, Gulf of Alaska

Funding:				
	EVOS Funding Requested:	FY05	$ 67.7	
	(Must include 9% GA)	FY06	$ 89.4	
		FY07	$ 25.1	
				TOTAL: $182,184
	NON-EVOS Funds to be used:	FY05	$ 99,954	
		FY06	$ 99,954	
		FY07	$ 0	
				TOTAL: $199,908

Date: 14 April 2004

GEM RESEARCH PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Despite decades of study and over a hundred years of commercial exploitation targeting Pacific herring (*Clupea pallasi*), considerable uncertainty continues to exist regarding: 1) the scale at which population structure exists within large geographic areas and, 2) the degree to which herring return to natal areas to spawn. These fundamental life history traits are directly relevant to how exploited herring stocks should be assessed and managed (Hourston 1982; Wheeler and Winters 1984; Hay and McCarter 1997; McQuinn 1997). State fishery managers require a tool that can identify ecologically significant population structuring among adjacent spawning aggregations that are exploited during spring sac-roe herring fisheries. They also require a mixed stock analysis tool that allows them to investigate whether winter herring fisheries (e.g., food/bait fisheries) target only the local spawning stock or a mixture of nearby stocks that aggregate during winter. The ability to manage stocks discretely is a principal component of sustainable fisheries management- one that requires the ability to accurately apportion the catch from mixed stock fisheries.

Researchers have attempted to use many different techniques to distinguish among herring stocks, including: scale pattern analysis (Rowell 1981), tagging studies (Hourston 1982), morphometrics and meristics (Schweigert 1990), microsatellite DNA (O'Connell et al. 1998), and otolith microchemistry (Otis and Heintz 2003). However, most techniques have proven to be unreliable at fine spatial scales. For example, O'Connell et al. (1998) found that herring from Prince William Sound (PWS) and the Bering Sea were genetically divergent, but they were unable to find similar divergence among stocks sampled within the north Gulf of Alaska. The difficulty encountered with genetic markers is likely due to the relatively high stray rates exhibited by herring (e.g., Tester 1949; Cushing and Burd 1957; Hourston 1982; Wheeler and Winters 1984). Very little gene flow between populations is necessary to compromise the ability of allozyme markers to discriminate among putative stocks (Smith and Jamieson 1986; Bembo et al. 1996; Waples 1998). In particular, Waples (1998) observed that "because the amount of migration necessary to obscure most genetic evidence of stock structure (only a handful of individuals per generation) is generally inconsequential as a force for rebuilding depleted populations on a time scale of interest to humans, there is no guarantee that genetic methods alone will provide sufficient precision for key management decisions involving marine species". Thus, herring managers have continued to seek a tool that allows them to identify population structure within and among their respective management areas.

In the absence of more definitive tools, many fishery managers have traditionally used spawning timing and location as proxies to roughly define herring stock structure. The logical assumption is, the greater the temporal and spatial separation between spawning aggregates, the greater the likelihood that they are discrete stocks. However, problems can arise when mixing of putative stocks occurs across jurisdictional boundaries. Anecdotal observers have reported examples in which the abundance of one presumptive spawning stock "crashes" while an adjacent area's presumptive stock simultaneously increases by a commensurate amount. Such observations of

"spawner relocation" highlight the behavioral complexity of herring (Overholtz 2002; Hay and McKinnell 2002; Huse et al. 2002) and raises questions regarding stock discreteness and population "sub-units" (Stephenson 1999).

Recently, a new method of stock identification was applied successfully to discriminate known herring stocks and reveal differences among putative stocks at relatively fine spatial scales ($\geq$ 100 km). The method discriminates stocks using differences in the fatty acid composition of cardiac tissue (Otis and Heintz 2003). This method has been tested for other fish species (e.g. Grahl-Nielsen and Mjaavatten 1992, Castell et al. 1995, Pickova et al. 1997, Joensen et. al. 2000) but requires further testing before it can be applied to herring. To date, these tests indicate that the fatty acid composition of cardiac tissues are the least influenced by environmental factors (Viga and Grahl-Nielsen 1990), is sensitive at discriminating stocks over small geographic scales (Grahl-Nielsen and Mjaavatten 1992) and has a genetic basis (Joensen et al. 2000).

Whether or not detection of discernable differences in arbitrarily selected variables constitutes ecologically significant, distinct populations is open to debate (Waples 1998). That debate has particular relevance to this proposal since many studies have shown that the fatty acid compositions of some tissues and lipid classes are highly sensitive to changes in diet and the environment (e.g., Hazel 1984, Henderson and Tocher 1987, Cordier 2002). Therefore, demonstrating that the variation in heart tissue fatty acid composition observed between stocks exceeds that imposed by the environment on a given stock will be a key element in the development of this method (Begg et al. 1999). We are proposing to target heart tissues because heart phospholipids are less subject to environmental influences than other tissues or lipid classes (Grahl-Nielsen and Ulvund 1990, Czesny et al. 2000, McKenzie 2001). Several studies have shown that dietary impacts on fatty acid composition are minimized in heart lipids. Viga and Grahl-Nielsen (1990) cultured groups of Atlantic salmon from the same stock for eight months on prescribed diets and found the fatty acid composition of salmon hearts was independent of diet. Grisdale-Helland et al. (2002) found significant differences in the heart phospholipids of Atlantic salmon fed different diets for approximately three months. However, they identified much greater differences in the composition of heart triacylglycerols. Similarly, studies reviewed by McKenzie (2001) reveal the tendency for heart fatty acid composition to respond to diet but at much lower magnitude than muscle or liver. These data indicate that examination of heart fatty acids should minimize the apparent variation imposed on populations due to diet, ration, and temperature (Grisdale-Helland et al. 2001; Kiessling et al. 2001; Jobling et al. 2002).

Three recent laboratory studies reported evidence of genetic control over some fatty acid concentrations, thus supporting the premise that they can be effective stock identifiers. Joensen et al. (2000) found significant differences in the fatty acid profiles of heart tissue extracted from representatives of two cod stocks that had been reared for 44 months under identical diets and environments. Peng et al. (2003) compared the fatty acid compositions of anadromous and landlocked Atlantic salmon (*Salmo salar*) fry, fed identical diets throughout a 44-day feeding trial, and reported significant differences in their phospholipids. In a companion study, Rollin et al. (2003) concluded that differences in the fatty acid composition of different strains of Atlantic salmon resulted from variation in the rates of desaturation and elongation of linolenic and linoleic acids. This suggests that differences in the activities of enzymes that regulate

phospholipid composition might explain the stock differences identified here and in other species examined in field studies (Grahl-Nielsen and Ulvund 1990, Grahl-Nielsen and Mjaavatten 1992).

The concept of genetic control over the composition of heart fatty acids is bolstered by studies demonstrating relationships between cardiac function and fatty acid composition. Bell et al. (1993) reported heart lesions in Atlantic salmon fed diets with high levels of n-6 fatty acids after the fish had been stressed. Agnisola et al. (1996) reported reduced heart rate and cardiac power output in the hearts of sturgeon fed diets high in n-3 fatty acids relative to those fed diets high in n-6 fatty acids. These data demonstrate an influence of heart fatty acid composition on individual fitness, thereby providing a basis for differences among reproductively isolated aggregates. Alternatively, interactions between phospholipid composition, eicosanoid production and cardiac function have rarely been described for fish (Stenslokken et al. 2002) despite their frequently described impacts on mammalian health (Das 2001). These data may account for the conclusion that C22:6n3 in fish heart phospholipids is not strongly influenced by diet (Thomassen and Røsjø 1989, Caballero et al. 2002, Grisdale-Helland 2002), and in fact may be under strong genetic control (Peng et al. 2003).

B. Relevance to GEM Program Goals and Scientific Priorities

The proposed project is intended to address several GEM Program goals outlined under the *Management Applications* section of the 2004 RFP. Specifically, we'll utilize existing ADF&G biological sampling programs and platforms (vessels) to collect the samples we need, and the new stock identification technique we're evaluating has tremendous potential to augment existing ADF&G stock assessment and management strategies. If we achieve the results we expect, ADF&G will gain a valuable tool to help them define ecologically significant stock boundaries for exploited herring spawning aggregations (spring sac roe fisheries) and determine the stock contribution for herring harvested in mixed-stock food/bait fisheries. Ultimately, the ability to identify the stock of origin for herring collected away from their natal spawning areas would provide a basis for better understanding the important role herring play in the marine ecosystem (e.g., GEM Ecosystem Model) by enabling studies directed at: larval dispersal patterns, home ranges of individual populations, locations of stock specific over-wintering areas, and perhaps the degree to which Pacific herring home back to their natal spawning areas. Recipients of the potential benefits resulting from this project include ADF&G (improved stock assessment and fishery management plans), subsistence and commercial herring fisherman (improved management of sac roe and food/bait fisheries), and herring researchers statewide (ability to define stock of origin for herring sampled away from natal spawning areas).

II. PROJECT DESIGN

A. Objectives

The goal of this research is to evaluate the temporal stability and biological variability of the fatty acid compositions that have already been used to discriminate Alaska herring stocks (Otis and Heintz 2003). Accurate knowledge of stock structure is relevant to the manner in which state officials assess and manage this commercially and ecologically important resource. The ability to identify the stock of origin for herring collected away from their natal spawning areas

would also have tremendous utility to managers of fisheries that may be harvesting mixed stocks (e.g. herring food/bait fisheries). For these purposes, we propose the following objectives:

Objective 1) Assess the temporal stability and biological variability of stock discrimination criteria derived from fatty acid analysis of cardiac tissues.

This objective addresses three hypotheses:

1). At spawning, the variation in fatty acid composition within a spawning stock is equal to the variation observed between that stock and other spawning stocks.

2) At spawning, the variation in fatty acid composition of a spawning aggregation is equal to that of a similar aggregate spawning in the same general area, but later during the spawning period.

3) The variation in fatty acid composition of a spawning stock in a given year is equal to the variation between that stock and a stock using the same spawning area in a different year.

The first of these hypotheses is an attempt to re-create the results described in Otis and Heintz (2003), without controlling for age, sex, and gonad maturity, as was done in their pilot study. Evaluation of this hypothesis will establish the extent to which heart fatty acid composition naturally varies across all contributing members (i.e., sexes, cohorts) of a putative spawning stock. The second examines temporal variation within a putative stock over the course of a protracted spawning period, within a given spawning year. The third hypothesis, undertaken in year two of the proposed study, examines the temporal variation in heart fatty acid composition across successive years. In addition, since we are proposing to resample the stocks examined in Otis and Heintz (2003), hypothesis 3 can be examined over a 6-year period (i.e. 2001 – 2006).

Objective 2) Assess whether the stock(s) of origin for herring harvested in winter food/fisheries can be determined by comparing their heart fatty acid composition to those of local area spawning aggregations.

This objective addresses one additional hypothesis:

4) The variation in fatty acid composition within herring schools aggregating during winter is equal to the variation observed between herring schools using the same general area for spring spawning.

This final hypothesis evaluates whether or not fatty acid compositions from spawning herring can be used to determine the stock(s) of origin for herring harvested during winter food/bait fisheries.

B. Procedural and Scientific Methods

To facilitate the most robust evaluation of hypothesis 3, we intend to resample the putative spawning stocks examined in Otis and Heintz's (2003) pilot study: Togiak, Kodiak, Kamishak,

Prince William Sound, and Sitka. At least two spawning samples will be collected in each of these principal areas, targeting the early and late season spawning waves, in order to best evaluate hypothesis 2. A third temporal sample will be collected during the fall/winter food/bait fisheries scheduled to occur in Kodiak and Dutch Harbor to evaluate hypothesis 4. The Dutch Harbor food/bait fishery is suspected to include herring from the Nelson Island, Togiak, and possibly Goodnews Bay stocks. All of the spring spawning collections outlined in Table 1 will be repeated in FY06 to facilitate evaluation of hypothesis 3. The winter food/bait fishery samples will only be collected in FY05, resulting in a total sample of approximately 840 herring hearts for the entire study.

Table 1. Proposed sampling locations, dates, and sample sizes for herring to be collected for heart tissue fatty acid analysis.

Region	**Sample location(s)**	**Sample date(s)**	**Sample Type**	**Sample size (2005)**	**Sample size (2006)**
Sitka	Sitka Sound	Mar 25-Apr 5	Spring (spawning)	30	30
	Hoonah	Apr 10-20	Spring (spawning)	30	30
Prince William Sound	Montague Island	Apr 15-20	Spring (spawning)	30	30
	NE (Gravina Bay)	Apr 5-10	Spring (spawning)	30	30
	N (Fairmont Bay)	Apr 15-20	Spring (spawning)	30	30
Westward (Kodiak)	Paramanof Bay	Apr 15	Spring (spawning)	30	30
	Uganik Bay	Apr 15-30	Spring (spawning)	30	30
	Uganik Bay	Nov-Jan	Winter (food/bait fishery)	30	0
	Dutch Harbor	July 15	Summer (food/bait fishery)	30	0
Kamishak Bay	Chenik Head	April 25-May 5	Spring (spawning)	30	30
	Iniskin Bay	May 15-25	Spring (spawning)	30	30
Togiak	Nunavachak	May 1-10	Spring (spawning)	30	30
	Hagemeister Is.	May 10-15	Spring (spawning)	30	30
Bering Sea	Nelson Island	May 15-30	Spring (spawning)	30	30
	Goodnews Bay	May 25-Jun 5	Spring (spawning)	30	30
			Total samples	450	390

At collection, the lengths and sexes of the sampled fish will be recorded and scale samples will be removed for aging. In contrast to Otis and Heintz (2003), the proposed study will target all age classes, maturity stages and sexes. Herring hearts will be removed and placed immediately in liquid nitrogen for shipment to Juneau (NMFS-Auke Bay Lab), where they will be stored at –80º C until analyzed.

Fatty acid analysis will be performed on the lipids of whole hearts, extracted using the Folch method. Before extraction, 50 µL of extraction surrogate (C23:0) and BHT will be added to the homogenized cardiac tissue. The homogenates will be extracted with on a Dionex 200 Accelerated Solvent Extractor (ASE), followed by rotary evaporation and volumetric dilution to a final volume of 1 ml. A 30 mg sample of the purified lipid will be suspended in toluene, mixed with 50 µL of transesterification surrogate (C21:0) and transesterified in methanol and sulfuric acid for two hours at 80°C. The resulting solution of fatty acid methyl esters will be extracted into hexane and dried by passing through a column packed with Na_2SO_4. The eluant will be spiked with 50 µL of internal standard (C19:0).

Fatty acids will be identified by injecting 1.0 µL of each transesterified sample into a Varian CP3800 gas chromatograph equipped with a Saturn model 2200 mass-detector. Fatty acids will be separated with a 30 m Omegawax 250 fused silica column operating under a ramped temperature program. Mass detection will be in single ion mode and 39 fatty acid peaks will be identified. These will be quantified relative to five- point calibration curves for each of the fatty acids and normalized to the recovery of the internal standard. Calibration curves will be developed for each batch of 15-20 tissue samples. Analytical accuracy for each batch of samples will be determined by examining the fatty acid composition of an in-house standard reference material (SRM). The composition of the SRM was initially calibrated against the National Institute for Standards and Technology SRM-1946, whose fatty acid composition has been certified. Precision of the estimated fatty acid concentrations will be evaluated by examining the variation observed in a duplicated sample. Sample purity will be examined by processing blank samples.

C. Data Analysis and Statistical Methods

Differences in the fatty acid composition of hearts collected from spawning aggregates at a given site will be determined by multivariate analysis of variance (MANOVA). Evaluation of our first two hypotheses will employ a one-way nested MANOVA with stock as the main factor and sampling period nested within stock. Response variables will be the percentages of analytes transformed following the method of Aitchison (1992). Wilk's lambda with α set to 0.05 will be used to test the hypothesis that sampling period has no effect on fatty acid composition and that stock has no effect on fatty acid composition. If the first hypothesis is accepted and the second rejected, the same approach will be repeated for samples collected in the second year.

Assuming no effect of spawn timing is found, then comparisons across years will be made to test the third hypothesis. Data described by Otis and Heintz (2003) will be used for one of the years. Data from the different sampling times will be pooled into a common stock in a given year, and a two-way MANOVA with years and stocks as the main factors will be evaluated by calculating

Wilk's lambda with α set to 0.05. If significant differences are found between spawning events within regions, sample events will not be pooled and the above analysis will be conducted for each unique spawning stock identified during evaluation of hypothesis 2.

Differences detected among groups under each hypothesis will be further examined by descriptive discriminant analysis (DA) to identify which groups differ. DA resolves differences among groups by identifying a series of canonical functions, each of which is a linear combination of the response variables. These functions progressively reduce the error in the data set. The number of functions that account for the error represents the dimensionality of the data set, which is determined by iteratively fitting a function and testing the hypothesis that the residual error is equal to zero (Huberty 1994). Bi-plots for each function will be constructed to examine how the functions separate the data. We will also examine the pooled within group canonical structure to identify which fatty acids exert the most influence on the separating functions. The results of the MANOVAs will be further examined by predictive discriminant analysis to examine the robustness of the conclusions. The analysis will employ the leave-one-out method to determine how frequently the discriminant functions accurately identify "unknown" samples. Results of these tests will be expressed as the probability of correctly identifying members of a test group to the appropriate stock or aggregate. The MANOVAs and discriminant analyses will be performed in SAS release number 6.12 using the non-parametric DISCRIM procedure. Prior to analysis, the homogeneity of the covariance matrices will be examined. If they are found to be not homogenous then correlation matrices will be used.

D. Description of Study Area

Our proposed study area includes sampling locations extending from Sitka Sound (~57º N Latitude, 136º W Longitude), north to Prince William Sound (~61º N Latitude) and west to Dutch Harbor (~54º N Latitude, 167º W Longitude; Figure 1). Except for Dutch Harbor, Togiak and Kuskokwim Bay (Goodnews Bay, Nelson Island), which are in the Bering Sea, all sampling locations are within the Gulf of Alaska (GOA), with most of the proposed samples coming from locations in the Northern Gulf of Alaska (NGA). Pacific herring can be found spawning at many locations along Alaska's ubiquitous coastline with commercially viable populations of interest to this study being located in Sitka Sound, Prince William Sound, Kamishak Bay (Lower Cook Inlet), Kodiak/Afognak Island (Paramanof Bay), Togiak Bay, and Kuskokwim Bay.

E. Coordination and Collaboration with Other Efforts

This collaborative project (ADF&G-Commercial Fisheries, NMFS-Auke Bay Lab) builds on the EVOS funded pilot study (Project 02538) conducted by Principal Investigators Otis and Heintz, which demonstrated the potential for using fatty acid analysis of herring hearts to discriminate among spawning aggregates sampled from Sitka, Cook Inlet, Kodiak, Togiak, and two locations in Prince William Sound. This follow-up study will rely on close coordination with existing ADF&G herring stock assessment projects in order to save on vessel charter costs to obtain samples. The following ADF&G collaborators will facilitate sample collections from their respective areas: Marc Pritchett (Sitka), Steve Moffitt (PWS), Mark Witteveen (Kodiak/Dutch Harbor), Ted Otis (Kamishak), Lowell Fair (Togiak), and Craig Whitmore (Bering Sea). Finally, this project proposes to develop stock discrimination tools that may help resolve questions

concerning the scale at which discrete herring stocks exist in PWS and the greater Gulf of Alaska. Information gained by this project could help put the results of other EVOS projects into context and illuminate new directions for long term monitoring under GEM.

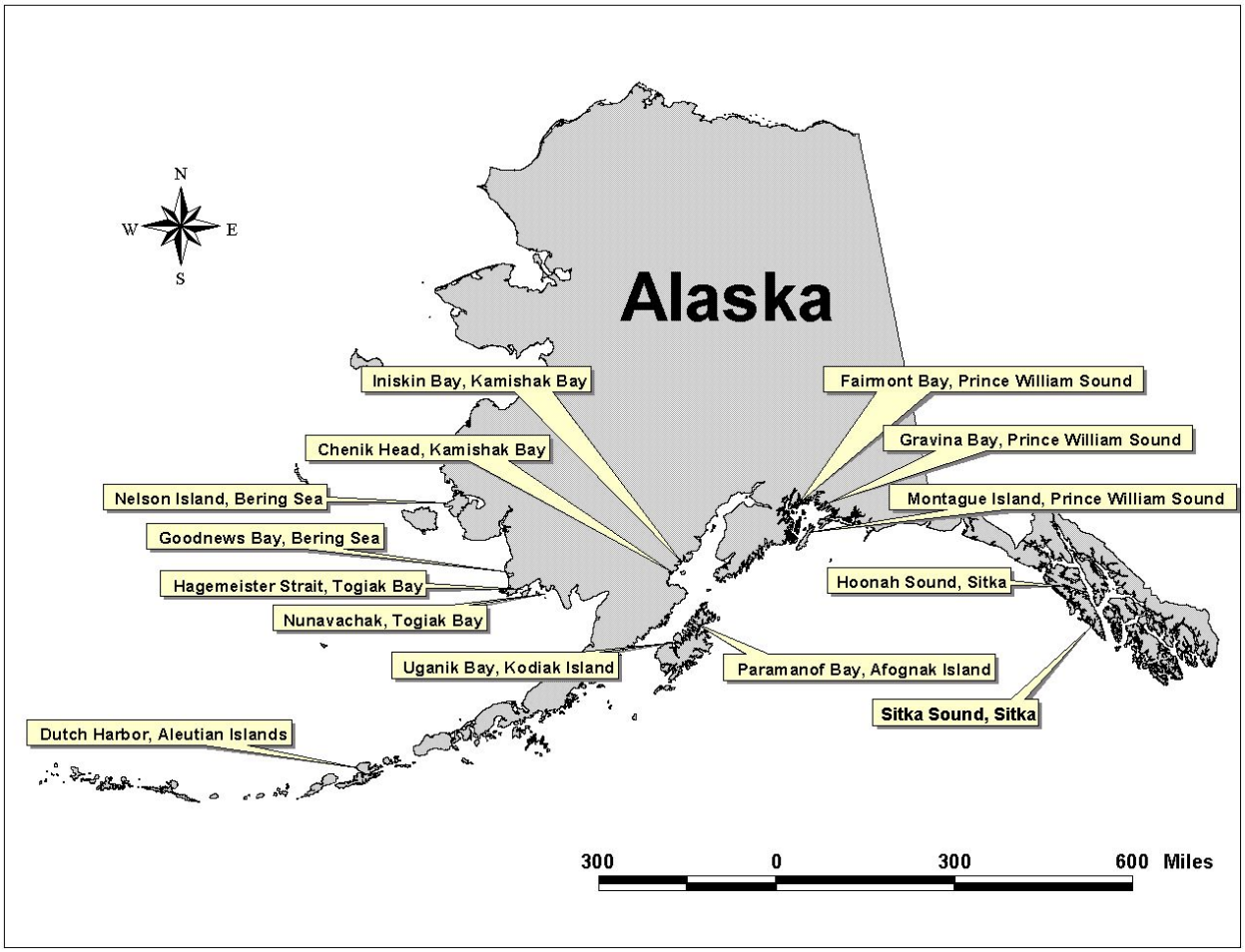

Figure 1. Map of Alaska illustrating the 14 locations from which Pacific herring will be sampled to evaluate the temporal stability of heart tissue fatty acid markers used to discriminate stock structure.

III. SCHEDULE

A. Project Milestones

Objective 1. Assess the temporal stability and biological variability of stock discrimination criteria derived from fatty acid analysis of cardiac tissues.
Preliminary assessment based on Year 1 data to be met by September 1, 2006
Final assessment based on two years data to be met by September 30, 2007

Objective 2. Assess whether the stock(s) of origin for herring harvested in winter food/fisheries can be determined by comparing their heart fatty acid composition to those of local area spawning aggregations.
To be met by September 1, 2006

B. Measurable Project Tasks

FY 05, 1st quarter (October 1, 2004-December 31, 2004)
October: Project funding approved by Trustee Council

FY 05, 2nd quarter (January 1, 2005-March 31, 2005)
January 12-16 (tentative): Annual GEM Workshop
March: Collect Sitka spawning samples

FY 05, 3rd quarter (April 1, 2005-June 30, 2005)
April - June: Collect PWS, Kodiak, Kamishak, Togiak, and Bering Sea spawning samples

FY 05, 4th quarter (July 1, 2005-September 30, 2005)
July: Collect Dutch Harbor food/bait samples
August-September: Begin chemical analysis of hearts
September 1: Submit Annual Report

FY 06, 1st quarter (October 1, 2005-December 31, 2005)
November-December: Collect samples from Kodiak food/bait fishery
Continue chemical analysis of hearts

FY 06, 2nd quarter (January 1, 2006-March 31, 2006)
(dates not yet known) Annual GEM Workshop
January-March: Complete chemical analysis/begin statistical analysis of year 1 data
March: Collect Sitka spawning samples (year 2)

FY 06, 3rd quarter (April 1, 2006-June 30, 2006)
April-June: Collect PWS, Kodiak, Kamishak, Togiak, and Bering Sea spawning samples (year 2)

FY 06, 4th quarter (July 1, 2006-September 30, 2006)
August-September: Begin chemical analysis of year 2 heart samples
September 1: Submit Annual Report

FY 07, 1st quarter (October 1, 2006-December 31, 2006)
October-December: Complete chemical analysis/begin statistical analysis of year 2 data

FY 07, 2nd quarter (January 1, 2007-March 31, 2007)
(dates not yet known) Annual GEM Workshop

January-March: Complete statistical analysis

FY 07, 3rd quarter (April 1, 2007-June 30, 2007)
April-June: Begin writing final report/manuscript for publication

FY 07, 4th quarter (July 1, 2007-September 30, 2007)
September 30: Submit final report/manuscript for publication.

IV. RESPONSIVENESS TO KEY TRUSTEE STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

Because this is a lab study evaluating a developing technology, there is not much room for incorporating TEK at this stage. However, we do envision opportunities to engage interested subsistence/commercial fisherman and coastal community members through various outreach endeavors. Along with presenting project results at at least one professional meeting in 2006/2007, we've identified two potential outlets that will reach a more general audience. The newly completed Alaska Islands and Oceans Visitor Center (AIOVC) in Homer should make an excellent outlet to reach up to 10,000+ visitors per year, including K-12 children attending AIOVC environmental education programs. We have contacted Carmen Field, the Kachemak Bay Research Reserve's (KBRR) Environmental Education Coordinator at AIOVC and begun developing potential outreach projects to be implemented in cooperation with the KBRR at the AIOVC in Homer. Because our project spans so much of coastal Alaska, we've also contacted Alan Parks, with the Alaska Marine Conservation Council (AMCC), to develop an appropriate strategy to outreach our project to the many fishing/coastal communities represented by AMCC's active membership (e.g., Sitka, Homer, Kodiak, Dutch Harbor). These partnerships will be further developed if our proposal is funded, however, we anticipate that our outreach efforts will take the form of visitor center displays, newsletter articles, project web site creation/maintenance, and using local AMCC representatives to outreach our project to their coastal communities.

B. Resource Management Applications

This project has tremendous resource management potential. A tool that is able to discriminate herring stocks over fine spatial scales would have great value to fishery managers. In the near term, this method could be used to resolve a number of pressing commercial fishery management questions regarding stock structure in the Bering Sea (e.g., What is the stock composition of herring harvested in Dutch Harbor's food/bait fishery) and Gulf of Alaska (e.g., Do spatially/temporally isolated spawning aggregations in Kamishak Bay [or Prince William Sound, Kodiak, or Sitka] represent discrete stocks?). Ultimately, the ability to identify the stock of origin for herring collected away from their natal spawning areas would provide a basis for better understanding the important role herring play in the marine ecosystem by enabling studies directed at: larval dispersal patterns, home ranges of individual populations, locations of stock specific over-wintering areas, and perhaps the degree to which Pacific herring home back to their natal spawning areas. This proposal has broad support from ADF&G Management/Research

staff, as demonstrated by their commitments to help collect samples from their respective areas (e.g., Sitka [Marc Pritchett], PWS [Steve Moffitt], Lower Cook Inlet [Lee Hammarstrom], Kodiak [Mark Witteveen, Kevin Brennan], Togiak [Lowell Fair], and Kuskokwim Bay [Craig Whitmore]).

V. PUBLICATIONS AND REPORTS

This project will provide a peer-reviewed final report on the identification of Alaska herring stocks based on free fatty acid composition of heart tissue, as well as an evaluation of the temporal stability of the fatty acid compositions used to discriminate among herring stocks. Annual Progress reports will be submitted by September 1 in Fiscal Years 2005 and 2006. We also intend to seek publication of an article tentatively entitled "Evaluation of the temporal stability of heart fatty acid compositions used to discriminate among Pacific herring stocks in Alaska" in the refereed journal *Transactions of the American Fisheries Society* (to be submitted in September 2007).

VI. PROFESSIONAL CONFERENCES

Along with presenting project updates (posters) at the annual GEM workshop, we intend to give an oral presentation at the Alaska Chapter Meeting of the American Fisheries Society in November 2006 (location to be determined). Travel funds have been requested to meet each of these obligations.

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RESUME

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Education:
Master of Science, Fisheries Science, University of Arizona, 1994.
Bachelor's of Science, Environmental Science, University of New Hampshire, 1988.

Professional Experience: *April 1996-present*: Area Finfish Research Biologist for Lower Cook Inlet, Alaska Department of Fish and Game- Comm. Fish., Homer, AK. Supervised by Jim Edmundson. Responsible for assessment and forecasting of Kamishak Bay herring stock; directs salmon and herring catch/escapement-sampling programs; forecasts Lower Cook Inlet salmon returns; develops new approaches to monitoring salmon escapement (e.g., remote video and time-lapse recording). Writes grants to secure outside funding for research projects, acts as principal investigator. *April 1994-March 1996*: Fishery Bio-technician, Kenai Fishery Resources Office, U.S. Fish and Wildlife Service, Kenai, AK. Supervised by Gary Sonnevil. Project leader for Andreafsky River (Yukon) adult salmon enumeration project: constructed and deployed resistance board/floating weir to count adult salmon; project leader for Kenai River rainbow trout radio-telemetry project: surgically implanted radio transmitters and tracked fish using mobile receivers and remote data loggers. *June 1991-March 1994:* Graduate Research Asst., Univ. of Arizona, Dept. of Renewable Natural Resources, Tucson, AZ. Supervised by Dr. O. Eugene Maughan. Designed and implemented field studies to assess the composition, abundance, and distribution of fishes in streams tributary to the Colorado River in Grand Canyon. Designed and implemented field study to inventory aquatic habitat available to stream fishes in Grand Canyon. *August 1987-June 1991 (intermittent*): Fishery Bio-technician, Kenai Fishery Resources Office, U.S. Fish and Wildlife Service, Kenai, AK. Supervised by Gary Sonnevil. Project Leader or team member on various field projects including: assessing adult salmon returns using weirs (Uganik R, Kodiak); developing new approaches to aging Dolly Varden and lake trout otoliths; enumerating emergent salmon fry (Tustumena Lake); investigating steelhead distribution and angler effort (Cold Bay); investigating run-timing and migration rates of chinook salmon (Kuskokwim River); and inventorying salmon spawning habitat (Ayakulik R., Kodiak).

Publications and Reports:

Otis, E.O., and R. Heintz. 2003. Evaluation of two methods to discriminate Pacific herring (*Clupea pallasi*) stocks along the northern Gulf of Alaska. Exxon Valdez Oil Spill Restoration Project *Draft* Final Report (Restoration Project 02538), Alaska Department of Fish and Game, Division of Commercial Fisheries, Homer, Alaska. 37 pp.

Otis Resume Cont'd

Publications and Reports (cont'd):

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Recent Project Collaborators (≤ 4 years)

William Bechtol, ADF&G-Commercial Fisheries, Homer
Wes Bucher, ADF&G-Commercial Fisheries, Homer (Retired)
Mark Dickson, ADF&G-Commercial Fisheries, Homer
Lee Hammarstrom, ADF&G-Commercial Fisheries, Homer
Ron Heintz, NMFS-Auke Bay Lab
Joe Meehan, ADF&G-Wildlife Conservation, Anchorage
Steve Moffitt, ADF&G-Commercial Fisheries, Cordova
Ken Severin, University of Alaska-Fairbanks
Margaret Spahn, ADF&G-Commercial Fisheries, Homer
Mark Witteveen, ADF&G-Commercial Fisheries, Kodiak

RESUME

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Fishery Research Biologist
National Marine Fisheries Service
Auke Bay Laboratory
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Juneau, AK 99801 USA

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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

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

Lead laboratory program investigating the nutritional status and trophic relationships of marine forage species.

Principle Findings:

Embryonic exposure to crude oil results in life long effects in pink salmon .

The components of oil that persist longest in the environment are those that are also the most toxic.

Fatty acids are better at discriminating herring stocks than elemental analysis of otoliths.

The benefits provided to juvenile salmon by decaying salmon carcasses include substantial increases in reserve energy.

Relevant Publications:

Barron, M. G., R. Heintz, M. M. Kran. 2003. Sci. Tot. Env. 311:111-133.

Heintz, R. A., J. W. Short, S. D. Rice. 1999. Env. Tox. and Chem. 18:3.

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Heintz, R.A., B. D. Nelson, M. Larsen, L. Holland, M. Wipfli, and J. Hudson. In Press. Trans. Am. Fish. Soc. Accepted Oct. 12, 2003.

Heintz Resume Cont'd

Relevant Publications (cont'd):

Marty, G. D., J. W. Short, D. M. Dambach, N. H. Willits, R. A. Heintz, S. D. Rice, J. J. Stegeman, and D. E. Hinton. 1997. Can. J. Zoology. 75:989_1007.

Murphy, M. L., R. A. Heintz, J. W. Short, M. L. Larsen, and S. D. Rice. 1999. Trans. Am Fish Soc. 128:909-918.

Otis, E.O., and R. Heintz. 2003. Exxon Valdez Oil Spill Restoration Project . Draft Final Report (Restoration Project 02538), Alaska Department of Fish and Game, Division of Commercial Fisheries, Homer, Alaska. 48 pp.

Short J. W and R. A. Heintz. 1997. Environmental Science Technology. 31:2375-2384.

Recent Project Collaborators (≤ 4 years)

Dr. Mace Barron	US EPA GED
Mark Carls	NOAA Fisheries AFSC
Dr. Scott Gende	National Park Service
Dr. Margaret Krahn	NOAA Fisheries NWFSC
Dr. Gary Marty	University of California Davis
Julie Meka	US Geological Survey ASC
Dr. Frank Morado	NOAA Fisheries AFSC
James Murphy	NOAA Fisheries AFSC
Ted Otis	ADFG
Dr. Ken Severin	University of Alaska Fairbanks
Jeff Short	NOAA Fisheries AFSC
Dr. Mike Sigler	NOAA Fisheries AFSC
Dr. Mike Stekoll	University of Alaska Southeast
Frank Thrower	NOAA Fisheries AFSC
Dr. Mark Wipfli	University of Alaska Fairbanks
Jamie Womble	University of Alaska Fairbanks

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

	PROPOSED TRUSTEE AGENCY TOTALS (FY 05-07))					
	ADEC	ADF&G	ADNR	USFS	DOI	NOAA
		$68.2				$113.9

Budget Category:	Proposed FY 05	Proposed FY 06	Proposed FY 07	TOTAL PROPOSED
Personnel	$36.8	$54.5	$17.7	$109.0
Travel	$1.6	$1.6	$2.3	$5.5
Contractual	$14.5	$17.5	$2.5	$34.5
Commodities	$9.1	$8.4	$0.5	$18.0
Equipment	$0.0	$0.0	$0.0	$0.0
Subtotal	$62.0	$82.0	$23.0	$167.0
General Administration (9% of subtotal)	$5.6	$7.4	$2.1	$15.0
Project Total	$67.6	$89.4	$25.1	$182.0

Cost-share Funds: $199,908

$58,500: ADF&G Vessel Charter costs (to collect/transport samples)
$7,800: ADF&G Air Charter costs (to transport samples)

$51,250: NMFS-ABL Accelerated Solvent Extractor
$72,458: NMFS-ABL Varian Gas Chromatograph/MC
$7,500: NMFS-ABL Instrument Service Contracts
$2,400 :NMFS-ABL 3 Liquid Nitrogen containers

FY 05-07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Lead Agency: ADF&G

FORM 2A
MULTI-TRUSTEE AGENCY SUMMARY

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

Budget Category:	Proposed FY 05	Proposed FY 06	Proposed FY 07	TOTAL PROPOSED
Personnel	$13.3	$14.1	$10.4	$37.8
Travel	$0.7	$0.7	$1.4	$2.8
Contractual	$6.5	$5.5	$2.5	$14.5
Commodities	$3.5	$3.5	$0.5	$7.5
Equipment	$0.0	$0.0	$0.0	$0.0
Subtotal	$24.0	$23.8	$14.8	$62.6
General Administration (9% of subtotal)	$2.2	$2.1	$1.3	$5.6
Project Total	$26.2	$25.9	$16.1	$68.2

Cost-share Funds:

$58,500: ADF&G Vessel Charter costs (to collect/transport samples)
$7,800: ADF&G Air Charter costs (to transport samples)

FY 05

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Date Prepared: 4/13/2004

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

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
T. Otis	Fishery Biologist III	18F	1.5	6301.3		9,452.0
J. Cope	Fisheries Tech III	11D	1.0	3883.5		3,883.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	10184.8	0.0	
					Personnel Total	$13,335.5

Travel Costs:		Ticket	Round	Total	Daily	Travel
Description		Price	Trips	Days	Per Diem	Sum
						0.0
T. Otis	RT travel to Anch to attend GEM Meeting	240.0	1	3	150.0	690.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$690.0

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contractual Sum
Description	
Shipping costs (sample kits, LN containers, samples, etc.)	3,000.0
Web Site Design/Construction (for project outreach)	1,500.0
Public Outreach (thru Kachemak Bay Research Reserve and Alaska Marine Conservation Council)	2,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$6,500.0

Commodities Costs:	Commodities Sum
Description	
Sampling supplies (liguid nitrogen, vials, containers, etc)	3,000.0
Misc office supplies	500.0
Commodities Total	$3,500.0

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
None			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
Desktop computer	1	ADF&G
Laptop computer	1	ADF&G
Research Vessels/skiffs (sampling platforms)	7	ADF&G

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Equipment
DETAIL

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

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
T. Otis	Fishery Biologist III	18G	1.5	6661.5		9,992.3
J. Cope	Fisheries Tech III	11E	1.0	4154.4		4,154.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	10815.9	0.0	
					Personnel Total	$14,146.7

Travel Costs:		Ticket	Round	Total	Daily	Travel
Description		Price	Trips	Days	Per Diem	Sum
						0.0
						0.0
T. Otis	RT travel to Anch to attend GEM Meeting	240.0	1	3	150.0	690.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$690.0

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contractual Sum
Description	
Shipping costs (sample kits, LN containers, samples, etc.)	3,000.0
Web Site Maintenance (for project outreach)	500.0
Public Outreach (thru Kachemak Bay Research Reserve and Alaska Marine Conservation Council)	2,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$5,500.0

Commodities Costs:	Commodities Sum
Description	
Sampling supplies (liguid nitrogen, vials, containers, etc)	3,000.0
Misc office supplies	500.0
Commodities Total	$3,500.0

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Desktop computer	1	ADF&G
Laptop computer	1	ADF&G
Research Vessels/skiffs (sampling platforms)	7	ADF&G

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Equipment
DETAIL

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

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
T. Otis	Fishery Biologist III	18J	1.5	6907.9		10,361.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.5	6907.9	0.0	
					Personnel Total	$10,361.9

Travel Costs:		Ticket	Round	Total	Daily	Travel
Description		Price	Trips	Days	Per Diem	Sum
						0.0
						0.0
T. Otis	RT travel to Anch to attend GEM Meeting	240.0	1	3	150.0	690.0
T. Otis	RT travel to Anch to attend AFS Meeting	240.0	1	3	150.0	690.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1,380.0

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contractual Sum
Description	
Web Site Maintenance	500.0
Public Outreach (thru Kachemak Bay Research Reserve and Alaska Marine Conservation Council)	2,000.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$2,500.0

Commodities Costs:	Commodities Sum
Description	
Misc office supplies	500.0
Commodities Total	$500.0

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Contractual & Commodity DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
None			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
Desktop computer	1	ADF&G
Laptop computer	1	ADF&G

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency A: ADF&G

FORM 3B
Equipment
DETAIL

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

Budget Category:	Proposed FY 05	Proposed FY 06	Proposed FY 07	TOTAL PROPOSED
Personnel	$23.5	$40.4	$7.3	$71.2
Travel	$1.0	$1.0	$1.0	$3.0
Contractual	$8.0	$12.0	$0.0	$20.0
Commodities	$5.6	$4.9	$0.0	$10.5
Equipment	$0.0	$0.0	$0.0	$0.0
Subtotal	$38.1	$58.3	$8.3	$104.7
General Administration (9% of subtotal)	$3.4	$5.2	$0.7	$9.4
Project Total	$41.5	$63.5	$9.0	$114.1
Other Funds				

Cost-share Funds:

$51,250: NMFS-ABL Accelerated Solvent Extractor
$72,458: NMFS-ABL Varian Gas Chromatograph/MC
$2,400 :NMFS-ABL 3 Liquid Nitrogen containers

FY 05-07

Date Prepared: 4/13/2004

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
						0.0
L. Schaufler	Chemist		3.0	6610.3		19,830.9
R. Heintz	Fishery Biologist		0.5	7322.0		3,661.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.5	13932.3	0.0	
					Personnel Total	$23,491.9

Travel Costs:		Ticket	Round	Total	Daily	Travel
Description		Price	Trips	Days	Per Diem	Sum
						0.0
						0.0
R. Heintz	(to GEM Meeting)	500.0	1	3	150.0	950.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$950.0

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:		Contractual Sum
Description		
Fatty acid analysis sample preparation		8,000.0
Sample homogenization	50 hrs x $20/hr	
Lipid Extraction	200 hrs x $20/hr	
Esterification	150 hrs x $20/hr	
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**		$8,000.0
Commodities Costs:		Commodities Sum
Description		
Misc. Lab Supplies		5,625.0
Sample homogenization	$2.25 x 450 samples = $1012.5	
Lipid Extraction	$8.00 x 450 samples = $3600	
GC/MS	$2.25 x 450 samples = $1012.50	
Commodities Total		$5,625.0

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Accelerated Solvent Extractor	1	NMFS-ABL
Variran GC/MS	1	NMFS-ABL
Liquid Nitrogen Containers	3	NMFS-ABL
Desktop computer	1	NMFS-ABL
Laptop computer	1	NMFS-ABL

FY 05

Date Prepared: 4/13/2004

Project Number: 050769
Project Title:Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Equipment
DETAIL

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

Personnel Costs: Name	Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
						0.0
						0.0
L. Schaufler	Chemist		5.0	6610.3		33,051.5
R. Heintz	Fishery Biologist		1.0	7322.0		7,322.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		6.0	13932.3	0.0	
					Personnel Total	$40,373.5

Travel Costs: Description		Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
						0.0
						0.0
R. Heintz	RT travel to Anc for GEM meeting	500.0	1	3	150.0	950.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$950.0

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:		Contractual Sum
Description		
Fatty Acid Analysis sample preparation		12,000.0
Sample homogenization	75 hrs x $20/hr	
Lipid Extraction	340 hrs x $20/hr	
Esterification	185 hrs x $20/hr	
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**		$12,000.0
Commodities Costs:		Commodities Sum
Description		
Misc. Lab Supplies		4,875.0
Sample homogenization	$2.25 x 390 samples = $877.5	
Lipid Extraction	$8.00 x 390 samples = $3120	
GC/MS	$2.2.5 x 390 samples = $877.5	
Commodities Total		$4,875.0

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Accelerated Solvent Extractor	1	NMFS-ABL
Variran GC/MS	1	NMFS-ABL
Liquid Nitrogen Containers	3	NMFS-ABL
Desktop computer	1	NMFS-ABL
Laptop computer	1	NMFS-ABL

FY 06

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Equipment
DETAIL

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

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Description	Step	Budgeted	Costs	Overtime	Sum
						0.0
						0.0
R. Heintz	Fishery Biologist		1.0	7322.0		7,322.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	7322.0	0.0	
					Personnel Total	$7,322.0

Travel Costs:		Ticket	Round	Total	Daily	Travel
Description		Price	Trips	Days	Per Diem	Sum
						0.0
						0.0
R. Heintz	RT to Anc for GEM meeting	500.0	1	3	150.0	950.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$950.0

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Contractual Sum
Description	
None	
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$0.0
Commodities Costs:	Commodities Sum
Description	
None	
Commodities Total	$0.0

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases:	Number of Units	Unit Price	Equipment Sum
Description			
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage:	Number of Units	Inventory Agency
Description		
Desktop computer	1	NMFS-ABL
Laptop computer	1	NMFS-ABL

FY 07

Date Prepared: 4/13/2004

Project Number: 050769
Project Title: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska
Agency B: NMFS-ABL

FORM 3B
Equipment
DETAIL

Budget Justification

Otis/Heintz: Temporal stability of fatty acids used to discriminate Pacific herring in Alaska

Note: Non-agency funding is required for this project because ADF&G does not have the lab facilities/expertise to conduct this type of chemical analysis, nor does ADF&G have in-house funding to develop new technologies at the present time.

Fiscal Year 2005

Personnel: $36.8 K
Otis will organize logistics for sample collections, attend meetings, write annual report.
Cope will assist in collecting field samples and inputting/summarizing field data
Heintz will manage sample inventory, attend meetings and conduct statistical analysis.
Schaufler will conduct the fatty acid analysis.

Travel: $1.6 K
Otis and Heintz will attend the Annual GEM meeting.

Contractual: $14.5 K
$3,000: for freight hauling charges to ship heavy liquid nitrogen containers (hazmat) to and from remote sampling locations.
$3,500: Contracting for Public Outreach of project results (e.g., Alaska Marine Conservation Council, Web site design/construction, etc.)
$8,000: ABL will contract out sample preparation (sample homogenization, lipid extraction, and esterification).
In-Kind Match: ADF&G providing ocean going research vessels and skiffs to provide sampling platforms ($58,500), and air charters to transport samples ($7,800).

Commodities: $7.3 K
$3,500: Expendible sampling equipment (e.g., liguid nitrogen, shipping containers, cryovials, etc.) and office supplies (e.g., waterproof paper, labels, photocopying, etc.)
$3,750: Items expended during chemical processing (e.g., gases, solvents, reagents).

*Equipment: $*0
No new equipment needed; desktop/laptop computers provided by NMFS-ABL and ADF&G.
In-Kind Match: NMFS-ABL providing Accelerated Solvent Extractor ($51.3 K), Varian GC/MS ($72.5 K), LN containers ($2,400 K).

Fiscal Year 2006

Personnel: $54.5 K
Otis will organize logistics for sample collections, attend meetings, co-author annual report.
Heintz will attend meetings, conduct statistical analysis, and co-author annual report.
Schaufler will conduct the fatty acid analysis.
Cope will assist in collecting field samples and inputting/summarizing field data.

Fiscal Year 2006 cont'd

Travel: $1.6 K
Otis and Heintz will attend the Annual GEM meeting.

Contractual: $17.5 K
$3,000: for freight hauling charges to ship heavy liquid nitrogen containers (hazmat) to and from remote sampling locations.
$2,500: Contracting for Public Outreach of project results (e.g., Alaska Marine Conservation Council, Web site maintenance, etc.)
$12,000: ABL will contract sample preparation (sample homogenization, lipid extraction, and esterification).
In-Kind Match: ADF&G providing ocean going research vessels and skiffs to provide sampling platforms ($58,500), and air charters to transport samples ($7,800).

Commodities: $8.4K
$3,500: Expendible sampling equipment (e.g., liguid nitrogen, shipping containers, cryovials, etc.) and office supplies (e.g., waterproof paper, labels, photocopying, etc.)
$4,875: Items expended during chemical processing (e.g., gases, solvents, reagents).

*Equipment: $*0
No new equipment needed; desktop/laptop computers provided by NMFS-ABL and ADF&G.
In-Kind Match: NMFS-ABL providing Accelerated Solvent Extractor ($51.3 K), Varian GC/MS ($72.5 K), LN containers ($2,400 K).

Fiscal Year 2007

Personnel: $17.7 K
Otis will attend meetings, co-author final report and manuscript for publication.
Heintz will attend meetings, conduct statistical analysis, co-author final report and manuscript for publication.

Travel: $ 2.3 K
Otis and Heintz will attend the Annual GEM meeting; Otis or Heintz will present project results at the Alaska Chapter Meeting of the American Fisheries Society.

Contractual: $2.5 K
$2,500: Contracting for Public Outreach of project results (e.g., Alaska Marine Conservation Council, Web site maintenance, etc.)

Commodities: $0.5 K
Misc. office supplies

Equipment: $0.0
No new equipment needed; desktop/laptop computers provided by NMFS-ABL and ADF&G.