Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Project Number:	030462
Restoration Category:	Oil Spill: Recovery monitoring
Proposer:	University of California, Davis
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	no
Duration:	5th year, 5-year project (additional analysis proposed)
Cost FY03:	$87,000
Cost FY04:	None
Geographic Area:	(closeout, analysis only; no field work)
Injured Resource/Service:	Pacific herring, commercial fishing, subsistence

ABSTRACT

In spring 2001, prevalence of *Ichthyophonus hoferi* (38%) in the Pacific herring population of Prince William Sound was more than 50% greater than in any year studied (1989-2000). *I. hoferi* causes severe, disseminated, chronic disease in Pacific herring that is best diagnosed using histopathology. Before 2001, *I. hoferi* was not associated with unexpected declines in population biomass, but during the last century increases in *I. hoferi* prevalence in Atlantic herring have been associated with several disease outbreaks. To understand the significance of the 2001 *I. hoferi* outbreak, we need to analyze samples already collected in fall 2001 and spring 2002 as part of project 02462. Project 03462 will fund complete histopathologic analysis of these samples.

INTRODUCTION

The population of Pacific herring (*Clupea pallasi*) in Prince William Sound (PWS), Alaska has not recovered since the estimated spawning biomass decreased precipitously from over 100,000 tons in 1992 to less than 20,000 tons in 1994 (Figure 1). Study of the population since 1994 (94320-S, 95320-S, 96162, 97162, and 98162) revealed that viral hemorrhagic septicemia virus (VHSV), associated ulcers, and *Ichthyophonus hoferi* (previously called a fungus; now called a choanoflagellate) cause the major diseases in Pacific herring, and that VHSV and associated ulcers probably contributed most to population decline in 1993 (Meyers et al. 1994; Marty et al. 1998; Quinn et al. 2001). PWS Pacific herring fisheries were severely curtailed in 1993, and were never opened in 1994 or 1995. The population began to recover in 1996, and a small bait fishery was opened in November of 1996. All fisheries were opened in 1997, but an unexpected increase in prevalence of VHSV in spring samples in 1997 and 1998 was associated with increased ulcer prevalence in 1998 (Figure 2).

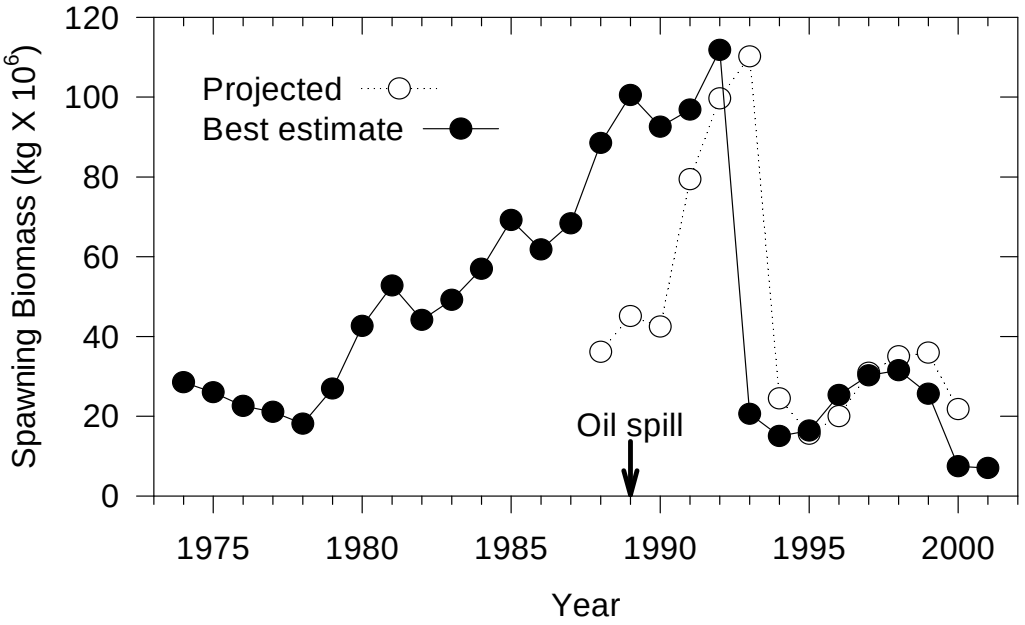

Figure 1. Spring prespawning biomass estimates of mature Pacific herring in Prince William Sound, Alaska. Unexploited spawning biomass is estimated using an age-structured assessment model (ADFG, unpublished data). Projections were not made before the 2001 or 2002 seasons, and the best estimate for 2000 and 2001 is based entirely on acoustic data.

High ulcer and virus prevalence in 1998 provided strong evidence that the population was at high risk of disease-related decline. Therefore, this project (\\462) was funded for 3 years to continue research on the effect of disease on Pacific herring population recovery. At the same time, the U.S. National Science Foundation (Biological Oceanography) funded a 3-year project to augment continued disease research in PWS. Trustee Council Project \\462 funded sampling and virus analysis, while NSF funded complete blood analysis, histopathology, and population modeling. Population recovery had still not occurred by the 3rd year of study, so the Trustee Council extended their part of the study to a fourth year (02462).

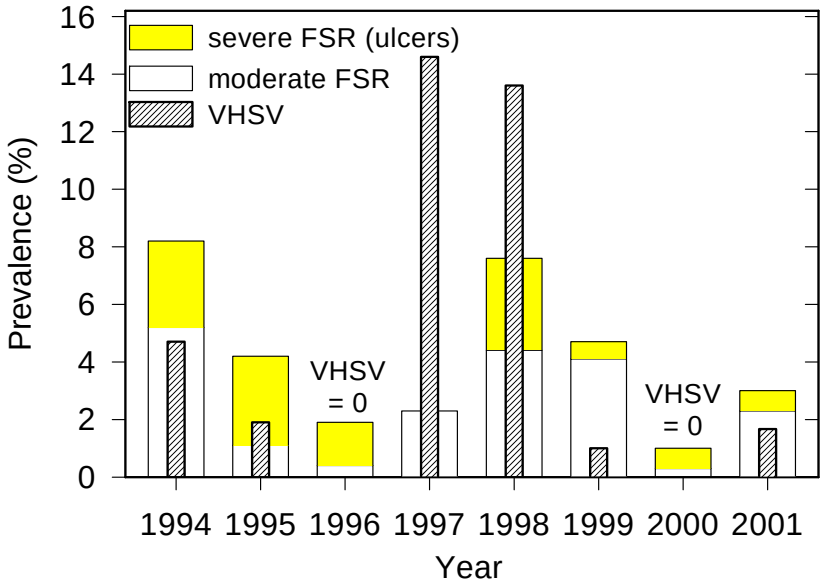

Figure 2. Spring prevalence of focal skin reddening (FSR) and viral hemorrhagic septicemia virus (VHSV) in adult Pacific herring sampled from Prince William Sound, Alaska.

During the first 7 years of this study (1994-2000), population decline was significantly associated with prevalence of viral hemorrhagic septicemia, but not with *I. hoferi* (Quinn et al. 2001). Indeed, *I. hoferi* was highly correlated with fish age, but not with unexpected population decline. Based on the age of fish in the sample in spring 2001, we predicted that prevalence of *I. hoferi* in spring 2001 would have been about the same as in 1996: 20% (Figure 3). However, in 2001 the prevalence of *I. hoferi* (38%) was more than 50% greater than in any previous year (Figure 4).

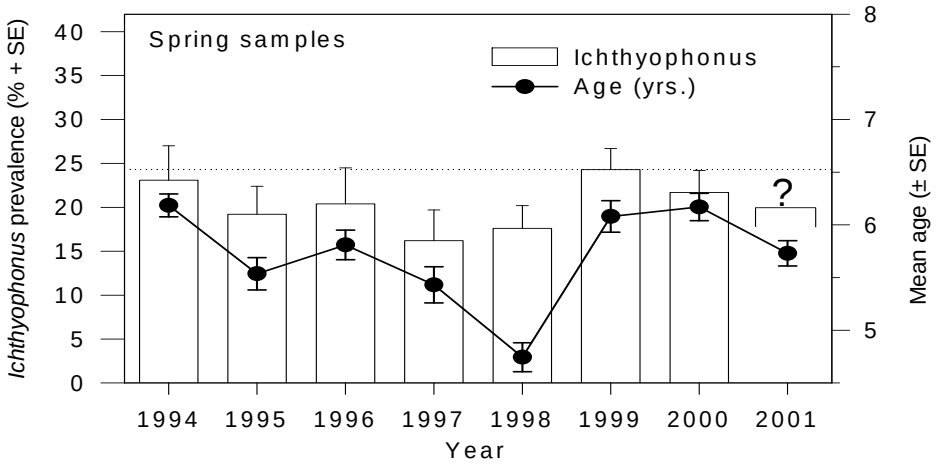

Figure 3. Mean age and prevalence of *Ichthyophonus hoferi* in Pacific herring sampled from Prince William Sound, Alaska (n = 233-300 per year). Reference line is at the maximum prevalence before 2001. "?" denotes predicted *I. hoferi* prevalence in 2001 based on fish age.

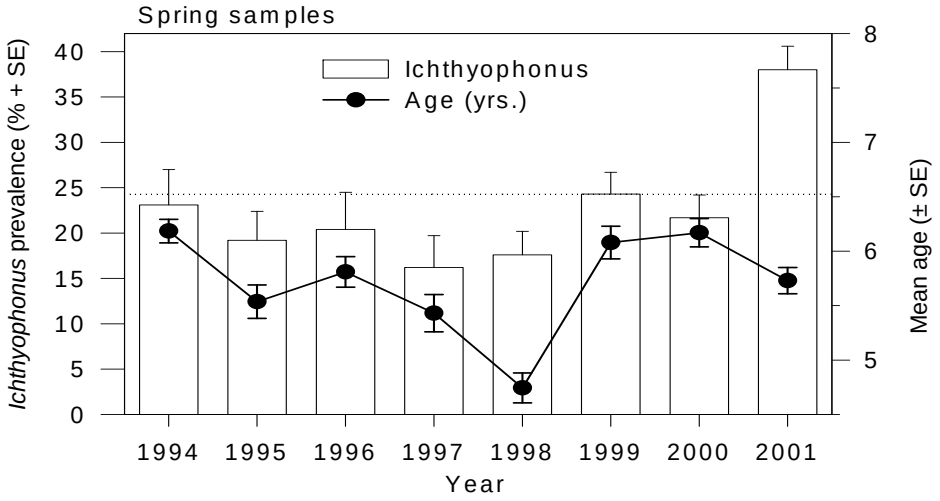

Figure 4. Mean age and prevalence of *Ichthyophonus hoferi* in Pacific herring sampled from Prince William Sound, Alaska (n = 233-300 per year). Reference line is at the maximum prevalence before 2001.

To understand the significance of the unprecedented increase in the prevalence of *I. hoferi* in 2001, this proposal (03462) asks the Trustee Council to fund complete histopathologic analysis of tissues already collected as part of project 02462. The Trustee Council has already funded collection of tissues for histopathology from fall 2000 (n = 100 fish) and spring 2001 (n = 300 fish), and histopathology is the best way to diagnose significant infections with *I. hoferi*. No additional sampling is proposed. Histopathologic analysis proposed for 03462 was included in the 8-15-02 proposal to NSF to continue their part of the research for 5 more years; however, analysis of 2001 *I. hoferi* prevalence was not yet complete when the NSF proposal was submitted, and NSF did not fund the renewal proposal.

Pacific herring are extremely important in the PWS ecosystem, and this project provides an understanding of disease and population change that is important for understanding marine fisheries worldwide. This project has benefited from project \\468 "Fundamental Estimations of Acoustic Target Strength" because acoustic estimates of population size are an important component of estimating population biomass. Better estimates of population biomass allow us to more accurately assess the relation of disease and population change.

NEED FOR THE PROJECT

A. Statement of Problem

Pacific herring are an injured biological resource in PWS classified as "recovering." However, estimates of population biomass in 2001 were the lowest on record. The population was low enough in 2001 that ADFG closed all herring fisheries in 2002 without using their age structured assessment model to calculate prespawning biomass. From ADFG's announcement Monday, April 1, 2001, "Based on last spring's estimated spawning biomass and assuming average recruitment each year, the PWS herring spawning biomass could be expected to remain below threshold for several more years" (http://www.cf.adfg.state.ak.us/region2/finfish/

herring/pws/pwsupd02.htm). Lack of recovery of the resource has resulted in lost services, particularly for commercial fisheries. Also, Pacific herring are a major part of the diet for harbor seals, an endangered species classified as "not recovering." And finally, Pacific herring and herring spawn-on-kelp are harvested annually for subsistence purposes and form an important part of the local native culture of Chenega and Tatitlek. Delay in recovery of the herring population results in lost resources for subsistence use. The final year of analysis is needed to determine the effect of the unprecedented increase in *I. hoferi* during 2001.

B. Rationale/Link to Restoration

This project should be done because it will provide information on what is limiting population recovery and it will monitor if fish are healthy and recovery has begun. Also, knowledge of what is limiting recovery of the Pacific herring population of PWS is important for the emotional "restoration" of people directly affected by the spill. Finally, ADFG now uses disease information as part of it mathematical model to estimate population biomass. If disease prevalence again increases, ADFG can use this information to delay opening of commercial fisheries until the population has truly recovered.

C. Location

Study will be done in at the University of California, Davis, on tissues previously collected in PWS, Alaska. Information will benefit fisheries managers as they consider alternatives for managing Pacific herring fisheries. As the resource is enhanced, users throughout PWS could potentially benefit. We previously identified ulcer prevalence as a key indicator of population health, but managers of other Pacific herring fisheries will also need to know of the potential for *I. hoferi* to adversely affect the health of their populations.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Dr. Marty has a solid record of local contact and dissemination of information, and continued collaboration with local users is proposed for FFY03. For example, contact with fishers, local residents, processors, and ADFG managers occurs through personal contact while in Anchorage and Cordova, and via regular e-mail updates. To aid in dissemination of information, Dr. Marty is available by phone for interviews (e.g., Anchorage Daily News 11-16-01) and he responds quickly to requests from the Restoration Office for general information and articles for newsletters.

PROJECT DESIGN

A. Objectives

The restoration objective states, "Pacific herring will have recovered when the next highly successful year class is recruited into the fishery and when other indicators of population health are sustained within normal bounds in PWS." The population cannot be classified as healthy until individuals within that population are healthy. Analysis of samples already collected in the only purpose for this proposal. Objectives include:

1. Determine the prevalence of major diseases in Pacific herring (particularly *I. hoferi*).

2. Determine the interaction of gender, age, and season on disease prevalence.

3. Determine if disease prevalence correlates with population trends.

B. Methods

Detailed methods for this project were included with the proposal for 02462. Because this proposal is limited to histopathologic analysis of tissues collected as part of 02462, only the histopathology component of the project design is repeated here. Pacific herring were or will be randomly sampled from PWS in November 2001 (at the end of the feeding season, n = 100) and in April 2002 (near the time of spawning, n = 300). Each fish will be examined for microscopic abnormalities (e.g., *I. hoferi*).

This proposal has two specific hypotheses to test:

1. Prevalence of microscopic lesions such as *I. hoferi* is different from previous years.
2. Microscopic lesions, including those resulting from *I. hoferi*, are related season, age, or gender.

To test the hypothesis that reproductive stage affects the development of disease, sampling was conducted during the spawning season (spring) and during the period of gonadal development and peak condition (fall). To provide a minimum number of fish from which at least the dominant year class can be analyzed in detail, we propose analyzing all 300 fish that were sampled in April. The age distribution in the spring is most consistent with data used in the historical age-structured assessment model. With a sample size of 300, diseases with a prevalence as low as 1% can be detected with 95% confidence, and a 6% difference in sample prevalence (e.g., 10 vs. 16%) can be detected with a statistical power of 0.80 (Becker and Grieb 1987). To test hypotheses of age differences, the dominant year class—often >40% of the sampled population—will be compared with combined groups of smaller year classes. To detect seasonal differences, and minimize costs, 100 fish will be analyzed from the fall. A sample size of 100 is sufficient to have 95% confidence that disease with a prevalence of 3% will be detected in at least one fish sampled (Becker and Grieb 1987).

For Histopathology, several tissues were fixed in 10% neutral buffered formalin: gill, spleen, liver, gonad, heart, stomach, intestinal tract, exocrine pancreas, trunk kidney, skeletal muscle, skin, brain, and other gross lesions. Tissues will be processed into paraffin, sectioned at 5 µm, and stained routinely with hematoxylin and eosin. Sections will be coded for blind study, combining fall and spring samples into one group. For histopathologic analysis, each lesion is semiquantitatively ranked on a four-point scale (0,1,2, or 3). To maximize comparability of results through the years, type specimens described for the 1994 data (Marty et al. 1998) provide the basis for diagnoses and scoring. For consistency, Dr. Marty will continue to perform all histopathologic analyses. A touch preparation of kidney from each fish is made on a glass slide, stained with a Wright's stain, and examined for the myxosporean *Ortholinea orientalis*. Changes in *I. hoferi* prevalence will be followed through each major year class. *I. hoferi* prevalence is

low when Pacific herring first recruit to the spawning population, but then increases.

Parasite prevalence - This study is designed to diagnose any type of disease that is causing morbidity in herring. Results will be compared with other years of study. Spring samples from PWS have several parasites that occurred at greater than 10% prevalence in at least some years; in order of decreasing prevalence, parasites in PWS spring samples included:
1) Anisakidae in the peritoneal cavity, 100% (all years);
2) intestinal coccidian *Goussia sp.* ?, 76-98%;
3) testicular coccidian *Eimeria sardinae*, 59-91%;
4) hepatic coccidian *Goussia clupearum*, 69-85%;
5) gall bladder myxosporean *Ceratomyxa auerbachi*, 16-50%;
6) renal intraductal myxosporean, *Ortholinea orientalis*, 16-32%;
7) renal intraductal myxosporean, species unclassified, 9-16%;
8) branchial *Epitheliocystis*, 11-36%;
9) gastric intraluminal trematodes, e.g., Hemiuridae, 5-16%;
10), intestinal trematodes, e.g., *Lecithaster gibbosus*, 3-34%
11) branchial monogenetic trematodes *Gyrodactylus spp.*, 1.5-13%;
12) branchial ciliated protozoans, mostly *Trichodina spp.*, 0-12%;
13) intestinal cestodes and acanthocephalans occurred at <10% in all years.

The ADFG fisheries laboratory in Cordova, Alaska, will handle logistics for shipping tissues to the University of California, Davis using funds already approved as part of 02462.

Statistical analysis in this study will focus on determining changes in disease prevalence over time. The association of selected categorical variables (e.g., *I. hoferi* status versus external lesion scores) will be evaluated using chi-square methods for categorical data analysis; comparisons will be considered valid only if individual expected cell frequencies are >1 and no more than 20% of the cells have expected cell frequency <5. Odds ratios will be calculated only for standard (2x2) two-way contingency tables. Significance of changes in disease prevalence will be tested using chi-square or Fisher's Exact test. Multiple regression analyses will be used to determine the significance of *I. hoferi* based on fish age, gender, year, and season of capture. For all analyses, comparisons will be considered significant when $P<0.05$ and highly significant when $P<0.01$.

An alternative for saving money on this project is to analyze only some of the 10 organs normally analyzed. This is not recommended because *I. hoferi* is a disseminated disease that affects many organs, and most of the organs also contain at least one parasite that has been quantified during the other 8 years of the study. Multiple regression analysis—the most important component of statistical analysis—cannot use any fish in which even a single variable contains missing data; therefore, multiple regression cannot be used on 2002 samples unless the histopathologic analysis is consistent with all previous years. To save money, blood analysis that was part of the unfounded NSF proposal is not being included in this proposal. Blood smears and plasma chemistries were useful for identifying significant pathogens, but they did not provide as much useful information as did histopathology for determining the population-level significance of disease.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The project is being run through ADFG because Dr. Marty has worked closely with ADFG on several Trustee Council-funded projects during the past decade. ADFG has unique local knowledge on Pacific herring in PWS, and ADFG personnel have the expertise to ship hazardous materials (e.g., formalin-fixed tissues) from Cordova to Davis. Close collaboration with ADFG allows for seamless transfer of disease information to fishery managers, and rapid transfer of disease information to commercial and subsistence fishers. No other agencies are requesting funds for this section of the project, and no other agencies or universities will be contracted for this work.

SCHEDULE

A. Measurable Project Tasks for FY03

DATES (results due on final date)	ACTIVITY
September 2002:	Ship tissue samples from Cordova, Alaska to Davis, CA; Person in charge: Steve Moffitt, ADFG, Cordova, AK.
Oct. 1 - Dec. 31, 2002:	Prepare microscopic sections of tissues for histopathology;
Dec. 1, 2002 – May 31, 2003:	Histopathologic analysis;
January 2003 (4 days):	Attend annual restoration workshop
June 1- Aug. 1, 2003:	Statistical analysis
Aug. 1, 2003 –April 15, 2004:	Final report writing
open:	Opportunities for public comment

B. Project Milestones and Endpoints

Review of Objectives:
1. Determine the prevalence of major diseases in Pacific herring.
2. Determine the interaction of gender, age, and season on disease prevalence.
2. Determine the effect of disease on population trends.

Objectives will be met when the multi-year study is completed and the final synthesis report is submitted April 15, 2004.

D. Completion Date

Basic project objectives will be met when histopathologic analysis of samples collected during the fourth year disease study is complete. Note, however, that each additional year of disease study in PWS provides more information on the recovery of the Pacific herring population. High prevalence of virus and ulcers among recruiting populations of both the 1994 and 1995 year-

classes in 1998 severely limited the capacity of these year classes to contribute to population recovery. Recruitment of the 1996, 1997, and 1998 year classes was minimal. Preliminary evidence indicates that recruitment of the 1999 year-class is fairly good. However, even if the 1999 year class is very large, population recovery cannot be fully documented until that year class is 5 years old: in 2004 (two years after sampling for the current project ends). Therefore, termination of study in 2002 is not likely to be sufficient to document population recovery. Following the population through a full cycle—probably 7 to 10 additional years—would be needed to understand how disease and population size are linked. The 9 years of disease information that we already have constitutes the most comprehensive study ever conducted on disease in a wild fish population. However, 9 years of study will provide information on only about ½ of a population cycle. Extending this project another 7-10 years through the Gulf Ecosystem Monitoring program (Phase II), with potential for cost sharing with the National Science Foundation, will greatly enhance our understanding of how and when the Pacific herring population recovers. Such an extension is not being proposed now, but a long-term extension will probably be proposed as part of phase II of the Gulf Ecosystem Monitoring program, with the focus being "Pacific herring population health as a marker of ecosystem health in Prince William Sound, Alaska."

PUBLICATIONS AND REPORTS

If we seem to have a complete picture of the *I. hoferi* outbreak after study of samples collected in spring 2002, one publications is anticipated in FY03. The publication will combine earlier work (\\162) with this project:

Marty, G. D., T.J. Quinn II, S.D. Moffitt, and N.H. Willits. Effect of *Ichthyophonus hoferi* on population biomass of Pacific herring in Prince William Sound, Alaska. Diseases of Aquatic Organisms.

If the prevalence of *I. hoferi* has not yet decreased, and additional study is funded, publication will be delayed until we have a more complete understanding of the *I. hoferi* outbreak, probably 1-3 years later (e.g., FY06). Diseases of Aquatic Organisms does not have a page charge, and costs for supplies associated with this publications is included in the supply part of the budget.

PROFESSIONAL CONFERENCES – No funds are requested. Funds to attend a professional conference each year are provided by UC Davis.

NORMAL AGENCY MANAGEMENT - Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project \\462 was closely coordinated with ADFG population modeling efforts as part of normal management, and with a 3-year project funded in late 1998 by the National Science Foundation's Division of Biological Oceanography. The three-year $286.4K NSF project had no funds for sample collection, and it depended entirely on Trustee Council funds for sample collection. The

NSF project included collaboration with the University of Alaska, Fairbanks (Dr. Terrance J. Quinn). Using Dr. Quinn's expertise, the NSF project included a modeling component to mathematically determine the relation of disease and changes in population biomass (Quinn et al. 2001). Trustee Council-funded studies of herring disease since 1994 were highlighted in the NSF proposal as a significant source of matching funds (about $2.2 million over the life of the project). NSF normally does not fund unsolicited proposals for more than $150K per year. Because the Trustee Council funded the first three years of this project (99462 - 01462), NSF saved about $230K on its project. At the same time, the Trustee Council benefited from $286.4K worth of analysis funded entirely by NSF. In August 2001, Dr. Marty submitted a competitive renewal proposal to NSF to continue funding disease analysis and modeling for another 5 years (2002-2006). Although the proposal was not funded, the NSF program director noted that the funding success for similar unsolicited proposals was only about 15%. Dr. Marty's initial proposal to NSF in 1997 was not funded until after the proposal was revised and resubmitted in 1998. Resubmission of a revised renewal proposal in August 2003 is likely if this proposal (03462) is funded.

This project is designed to provide the same types of data that were generated during detailed disease study since 1994 (94320S, 95320S, 96162, 97162, 98162, 99462, 00462, 01462, and 02462). Each year of research produces some new findings, but with each year the significance of the project becomes greater than its individual parts. The addition of one more year of histopathology data to our knowledge about the most important diseases will only add to the significance of this work.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS – This proposal requests funds for histopathologic analysis of tissues that were collected as part of project 02462 in fall 2001 and spring 2002. Funds for this analysis were included in a proposal to NSF, but the NSF proposal was not funded. However, information from histopathologic analysis of these tissues is critical for understanding 1) the effects of the *I. hoferi* outbreak of 2001, and 2) why population recovery continues to be delayed.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Gary D. Marty, DVM, Ph.D., and Diplomate, American College of Veterinary Pathologists, will be responsible for histopathologic analysis and final report writing. Dr. Marty has been doing equivalent work on this project since 1994.

OTHER KEY PERSONNEL

none

LITERATURE CITED and RELEVANT PUBLICATIONS:

Becker, S., and T. Grieb. 1987. Guidance for Conducting Fish Liver Histopathology Studies During 301(h) Monitoring. U.S. EPA 430/09-87-004, Washington, D.C.

Carls, M.G., **G.D. Marty, T.R. Meyers**, R.E. Thomas, and S.D. Rice. 1998. Expression of viral hemorrhagic septicemia virus in pre-spawning Pacific herring (*Clupea pallasi*) exposed to weathered crude oil. Can. J. Fish. Aquat. Sci. 55:2300-2309.

Davis, C.R., **G.D. Marty**, M.A. Adkison, E.F. Freiberg, and R.P. Hedrick. 1999. Association of plasma IgM with body size, histopathologic changes, and plasma chemistries in adult Pacific herring Clupea pallasi. Dis. Aquat. Org. 38:125-133.

Holst, J. C. 1996. Estimating the prevalence of *Ichthyophonus hoferi* (Plehn and Mulsow) in a herring stock (*Clupea harengus* L.): observed effects of sampling gear, target school density and migration. Fisheries Research 28:85-97.

Kocan, R.M., P. Hershberger, T. Mehl, N. Elder, M. Bradley, D. Wildermuth, and K. Stick. 1999. Pathogenicity of *Ichthyophonus hoferi* for laboratory-reared Pacific herring *Clupea pallasi* and its early appearance in wild Puget Sound herring. Dis. Aquat. Org. 35:23-29.

Marty, G.D., E.F. Freiberg, **T.R. Meyers**, J. Wilcock, T.B. Farver, and D.E. Hinton. 1998. Viral hemorrhagic septicemia virus, *Ichthyophonus hoferi*, and other causes of morbidity in Pacific herring *Clupea pallasi* spawning in Prince William Sound, Alaska, USA. Dis. Aquat. Org. 32:15-40.

Meyers, T.R., S. Short, K. Lipson, W.N. Batts, J.R. Winton, J. Wilcock, and E. Brown. 1994. Association of viral hemorrhagic septicemia virus with epizootic hemorrhages of the skin in Pacific herring *Clupea harengus pallasi* from Prince William Sound and Kodiak Island, Alaska, USA. Dis. Aquat. Org. 19:27-37.

Meyers, T.R., J. Sullivan, E. Emmenegger, J. Follet, S. Short, W.N. Batts, and J.R. Winton; 1992. Identification of viral hemorrhagic septicemia virus isolated from Pacific cod *Gadus macrocephalus* in Prince William Sound, USA. Dis. Aquat. Org. 12:167-175.

Meyers, T.R., and J.R. Winton. 1995. Viral hemorrhagic septicemia virus in North America. Ann. Rev. Fish Dis. 5:3-24.

Quinn, T.J. II, **G.D. Marty**, J. Wilcock, and M. Willette. 2001. Disease and population assessment of Pacific herring in Prince William Sound, Alaska. Pages 363-379 in F. Funk, J. Blackburn, D. Hay, A. J. Paul, R. Stephensen, R. Toreson, and D. Witherell,

editors Herring: Expectations for a new millennium. University of Alaska Sea Grant, AK-SG-01-04, Fairbanks.

Rahimian, H., and J. Thulin. 1996. Epizootiology of *Ichthyophonus hoferi* in herring populations off the Swedish west coast. Dis. Aquat. Org. 27:187-195.

Sindermann, C.J. 1958. An epizootic in Gulf of St. Lawrence fishes. Trans. N. Amer. Wildl. Conf. 23:349-360.

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2002	Proposed FFY 2003	LONG RANGE FUNDING REQUIREMENTS					
Personnel	12.9	$0.0						
Travel	0	$0.0						
Contractual	50.1	$79.8						
Commodities	9	$0.0						
Equipment	0	$0.0						
Subtotal	72	$79.8						
General Administration	5.4	$7.2						
Project Total	77.4	$87.0						
Full-time Equivalents (FTE)	0.4	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

This project proposal includes three components:

1. University of California, Davis: Fish organ histopathology (9-10 organs from each of 400 fish)
   a. Funds for writing the final report in FY03 were included in the FY01 budget.

2. University of Alaska Fairbanks: model the effect of disease on age structure and population biomass estimates

3. Alaska Department of Fish and Game: administrative support .

2003

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Agency: AK Dept. of Fish & Game

FORM 3A
AGENCY
PROJECT
DETAIL

Prepared:
GDMarty 12-10-02

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 2003
PM	Name	Position Description					
							0.0
							0.0
		Subtotal		0.0	0	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$0.0
Travel Costs:			Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 2003
PM							
	Description						
Those costs associated with program management should be indicated by placement of an *.						**Travel Total**	$0.0

2003

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FFY 2003
RSA for University of Alaska Fairbanks (see below)	7.9
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$7.9

Commodities Costs:	Proposed
Description	FFY 2003
Commodities Total	$0.0

2003

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual & Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases:		Number of Units	Unit Price	Proposed FFY 2003
Description				
Those purchases assoc. with replacement equipment should be indicated an "R."			**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	Inventory Agency
Description		

2003

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2002	Proposed FY 2003	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$12.3	$53.8						
Travel	$5.4	$1.0						
Contractual	$2.5	$0.0						
Commodities	$2.3	$5.5						
Equipment	$0.0	$0.0						
Subtotal	$22.5	$60.3						
Indirect	$4.3	$11.6						
Project Total	$26.8	$71.9						
Full-time Equivalents (FTE)	0.2	0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Indirect Costs include the standard overhead rates and applications for the Center for Health and the Environmental (CHE) at the University of California, Davis (19.3%).

Proposal includes funds (here, direct costs) for histopathologic analysis (3.0 month time for G. Marty), community involvement and manuscript preparation (1.0 mo time for G. Marty), and the annual workshop (travel and per diem). The proposal does **not** include funds for NEPA compliance (no field work is involved) or professional conferences (Dr. Marty can get funds from UC Davis to attend a professional conference).

Funds for technician time are for trimming and procesing ~4000 organs into paraffin (C. Teh, 2 months time) and preparing stained 5-µm sections from the resultant 2400 blocks (T. Harrington, 3 months time).

Costs for producing a final report have already been secured through previous year's funding.

FY03

Prepared:
GDMarty 12-10-02

Project Number: 03462
Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound
Name: University of California, Davis
Agency: ADFG

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2003
	Marty, G.	Assistant Researcher V	3.9	7.5	0.0	29.3
	Teh, C.	Laboratory Assistant III	2.0	4.0	0.0	8.0
	Harrington, T.	Staff Research Associate III	2.9	5.7	0.0	16.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	8.8	17.2	0.0	
					Personnel Total	$53.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2003
	airfare to Anchorage for annual restoration workshop	0.6	1	4	0.1	1.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.0

FY03

Prepared:
GDMarty 12-10-02

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of California, Davis
Agency: ADFG

FORM 4B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed FY 2003
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2003
Description	
Materials and supplies (for tissue processing, sectioning, staining, and hazardous waste disposal; 2400 blocks @ $2/block)	4.8
ITEH supplies (cover costs for project administration not included with the low CHE overhead rate)	0.7
Commodities Total	$5.5

FY03

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of California, Davis
Agency: ADFG

FORM 4B
Contractual & Commodities DETAIL

Prepared:
GDMarty 12-10-02

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2003
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
Those purchases associated with replacement equipment should be indicated an "R."		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units
Description	
IEC clinical centrifuge equipped with rotors for on-site plasma separation and packed cell vol. determination	1
Revco -80° freezer for archiving plasma	1
YSI Model 55 hand-held dissolved oxygen meter for checking fish holding conditions before necropsy	1
For report writing and correspondence:	
Pentium III 866 DELL-PC desktop computer with 256 Mb RAM, Ethernet card, and internal 56,600 baud modem	1
HP4L LaserJet printer	1

FY03

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of California, Davis
Agency: ADFG

FORM 4B
Equipment
DETAIL

Prepared:
GDMarty 12-10-02

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2002	Proposed FY 2003						
Personnel		$5.8						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.5						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$6.3						
Indirect		$1.6						
Project Total		$7.9						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Indirect Costs include the standard overhead rates and applications for the University of Alaska (0.25)

FY03

Prepared:
GDMarty 12-10-02

Project Number: 03462
Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound
Name: University of Alaska Fairbanks
Agency: ADFG

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2003
	Dr. Terry Quinn		0.5	11.5	0.0	5.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	0.5	11.5	0.0	
					Personnel Total	$5.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2003
						0.0
						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

FY03

Prepared:
GDMarty 12-10-02

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of Alaska Fairbanks
Agency: ADFG

FORM 4B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2003
Contractual Total	$0.0

Commodities Costs:	Proposed
Description	FY 2003
Materials and supplies (for paper, computer disks, long distance phone calls to Dr. Marty)	0.5
Commodities Total	$0.5

FY03

Prepared:
GDMarty 12-10-02

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of Alaska Fairbanks
Agency: ADFG

FORM 4B
Contractual & Commodities DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2003
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
Those purchases associated with replacement equipment should be indicated an "R."		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY03

Project Number: 03462
Project Title: **Effect of Disease on Pacific Herring Population Recovery in Prince William Sound**
Name: University of Alaska Fairbanks
Agency: ADFG

FORM 4B
Equipment
DETAIL

Prepared:
GDMarty 12-10-02