

**ASSESSMENT OF SPOT SHRIMP ABUNDANCE IN PRINCE WILLIAM SOUND
A DECADE AFTER THE EXXON VALDEZ OIL SPILL**

Project Number: 02401

Restoration Category: General Restoration

Proposer: Mandy Lindeberg and Charles O'Clair
NMFS, Auke Bay Laboratory
ABL Program Manager: Dr. Stan Rice

Lead Trustee Agency: NOAA

Cooperating Agencies: Valdez Native Tribe/Charlie Hughey
Prince William Sound Economic Development Council

Alaska Sea Life Center: no

Duration: 4th year, 4 year project

Cost FY 02: \$ 27.2

Geographic Area: Prince William Sound

Injured Resource/Service: Spot Shrimp/Subsistence

ABSTRACT

This proposal is for year four of a four year project. The project will estimate the abundance of spot shrimp and determine the structure of the spot shrimp population in Prince William Sound (PWS). The project will augment current Alaska Department of Fish and Game (ADF&G) surveys to determine whether the spot shrimp population is recovering from depletion. Our results and those of ADF&G in 1999 and 2000 indicate a cessation in the apparent decline of spot shrimp abundance in western PWS that had taken place between 1992 to 1998. Our data and that of ADF&G indicated a slight increase in the number and weight of spot shrimp per pot in 1999 compared to 1998. The increase was markedly greater in 2000. In year four we will close out, produce manuscripts, and provide input into the development of a shrimp management plan with ADF&G.

A. INTRODUCTION

The commercial spot shrimp fishery in Prince William Sound (PWS) was closed in 1992 after a rapid decline in the commercial catch following the peak harvest of over 110 tonnes in 1986 (Trowbridge 1994, Orensanz et al. 1998). The commercial fishery remains closed and further restrictions are being implemented for the sport and subsistence fishery. Annual surveys of the abundance of spot shrimp in PWS begun in 1989 by the Alaska Department of Fish and Game (ADF&G) continue to the present. The surveys sample spot shrimp at six to eight sites in the seven major statistical reporting areas that divide the Traditional Harvest Area in western PWS (Trowbridge 1992, 1994). From 1989 to 1998 the survey catch per unit effort (CPUE) declined from 0.6 kg/pot to 0.1 kg/pot (Trowbridge 1994; ADF&G, unpublished data). Catches of the present study and those of ADF&G in 1999 averaged CPUE's of 0.3 kg/pot and 0.2 kg/pot, respectively. In 2000 the mean CPUE of our catches was 0.44 kg/pot; that of ADF&G was 0.21 kg/pot. The mean number of shrimp/pot caught by the present study increased 1.9 x between 1999 and 2000. The mean number of shrimp/pot caught by ADF&G increased 1.5 x during the same period. These results indicate that the decline in spot shrimp CPUE between 1989 and 1998 did not continue into 1999 and 2000, and that there is some evidence of the beginning of recovery in the spot shrimp population in western PWS.

This proposal covers the final year of a four year study designed to augment the ADF&G annual survey data for 1999 and 2000 by adding population information from other areas in PWS. We seek to enhance our understanding of spot shrimp population dynamics by providing information on juvenile distribution, abundance, and size structure, and will ultimately aid ADF&G in developing a management plan for spot shrimp when the population recovers. In FY'99 NMFS personnel took input from the Valdez Native Tribe and former PWS commercial shrimpers to identify potential sampling sites. A preliminary, exploratory cruise was conducted in August 1999 to evaluate potential sites. The first sampling cruise of the study took place in October 1999 a week or two after the annual ADF&G cruise. The second full sampling cruise of the study took place in October 2000 and overlapped the ADF&G cruise for 2000.

NEED FOR PROJECT

A. Statement of Problem

Evidence for depletion of the spot shrimp resource in PWS after 1989 is convincing (Trowbridge 1994). The role that the *Exxon Valdez* oil spill (EVOS) may have played in the reduction of spot shrimp abundance in western Prince William Sound is unclear. Trowbridge (1992) found reduced CPUE in weight and number of spot shrimp in oiled vs unoiled areas in 1989 and 1990 in PWS. The differences in CPUE (number and weight of shrimp) did not persist into 1991. Mean size of shrimp was reduced in the oiled area in all three years. However, Trowbridge (1992) could not find conclusive evidence "that spot shrimp within PWS were themselves affected by the EVOS" owing, in large part, to limitations in time and funding for spot shrimp

damage assessment. Spot shrimp were not considered a high priority species by the EVOS damage assessment process. Lack of pre-spill abundance information coupled with confounding reductions in spot shrimp abundance prior to the spill rendered the species less favorable for a definitive damage assessment study. Trowbridge (1992) ultimately concluded that the observed abundance and structure of the spot shrimp stock in PWS in the first few years after the *Exxon Valdez* oil spill could mostly be explained by fishing pressure. Nevertheless, he hypothesized that highly sensitive shrimp larvae which were probably in the water column and near the surface during the oil spill were adversely affected by oil toxicity. No damage assessment study focused on larvae was initiated after the spill. The impact on the shrimp population after 1989 of exposure to oil of the 1989 year class in the larval stage is unknown.

Of additional concern is the increased pressure on the spot shrimp resource by sport and subsistence shrimpers as a result of greater access to western PWS following the completed access road connecting Portage and Whittier. Increased cruise ship traffic in and independent tourist visitations to western PWS in recent years may be having adverse impacts on spot shrimp habitat within PWS.

B. Rational/Link to Restoration

This project falls under the category of monitoring. We seek to assess the extent to which spot shrimp abundance has recovered since the population decline which began just prior to 1989. Although the major cause of the decline was probably overfishing rather than the EVOS, there is great interest by subsistence users of shrimp as well as sport shrimpers and individuals who fished for spot shrimp commercially in PWS prior to 1992 in the present status of the spot shrimp population in PWS. The ADF&G currently surveys spot shrimp abundance at selected locations in PWS annually. The goal of this study is first to broaden the geographical coverage and increase the amount of replication within existing major statistical reporting areas of the assessment of spot shrimp abundance in PWS. Second by focusing on the reproductive potential of females and recruitment potential as indicated by the abundance of young males and juveniles in the population we seek to determine whether the population is recovering. The results of this work should greatly enhance the information base underpinning ADF&G management decisions.

C. Location

This study focuses on 12 sites in the Traditional Harvest Area for spot shrimp in western Prince William Sound. The project includes six sites currently surveyed by ADF&G as well as six additional sites in statistical reporting areas currently surveyed. Elements of the communities of Whittier, Valdez and Cordova that are now or have in the past been associated with the sport, subsistence or commercial harvest of spot shrimp may be affected by the results of the project.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Charles Hughey of Valdez Native Tribe acts as community facilitator for the project. Shrimpers

in the Valdez Native Tribe provided information on potential sampling sites. Fishers in Valdez with shrimping experience participate in the project, providing vessels and crew.

PROJECT DESIGN

Two important considerations entered into the project design. First, the project overlaps existing survey sites of ADF&G as well as samples new sites, and, to the extent possible, the project duplicates the methods that ADF&G uses in their surveys. This accomplishes two ends: 1) It allows us to compare with greater confidence our data with that previously collected by ADF&G on spot shrimp abundance in western PWS in order to determine, more convincingly, whether spot shrimp population recovery is taking place in PWS, and 2) It will be more likely to provide data of the greatest value to ADF&G for future management of the spot shrimp resource in PWS.

The second consideration is that to maximize community involvement and to make the best use of traditional ecological knowledge, shrimpers associated with the Valdez Native Tribe are encouraged participate in the project and have timely access to project results. The shrimpers had input into the selection of the additional sampling sites. Because the shrimp pots and other fishing equipment used by the present study differ in configuration from that used by ADF&G, the extent to which the project can overlap the ADF&G sites and sampling dates may permit the calculation of correction factors for comparison of the project's data with that of ADF&G.

A. Objectives

1. Estimate abundance (CPUE) of spot shrimp by weight and number of individuals (years two and three).
2. Determine the sex and size composition of spot shrimp at the study sites (years two and three).
3. Estimate spot shrimp fecundity and relative number of egg-bearing females at the study sites (years two and three).
4. Estimate juvenile abundance and compare between sites (year three).
5. Compare abundance, sex and size composition, fecundity and proportion of ovigerous females between sites and years (year three).
6. Compare abundance data and data on population structure obtained under the present project with historical data collected by ADF&G to determine if the population is recovering and to assess the potential for full recovery of the spot shrimp population in PWS (year four).
7. Work with ADF&G, using data collected from this study, to develop a spot shrimp

management plan for PWS.

B. *Methods*

The methods used in the present study are modified after Trowbridge (1992, 1994). Shrimp pots were fished at six sites in northern and western PWS previously surveyed by ADF&G (Figure 1). The sampling sites were located in Unakwik Inlet, at Golden in Port Wells, in lower Culcross Passage, in Herring Bay, at northeast Chenega Island and at northern Green Island. Six additional sites located in Wells Bay, Eaglek Bay, McClure Bay, near East Finger Inlet in Port Nellie Juan, northwest Perry Island and near Jackpot Island. In 2000 a site at North Squire Island was substituted for the one in Eaglek Bay.

At least two strings of shrimp pots were set at each site. Each string consisted of 11 pots spaced 18.9 m (62 ft) apart along a groundline and buoyed at both ends. Standard, round, nesting pots were used. The diameter of the base and of the top of each pot was 107 cm (42 in) and 91 cm (36 in), respectively. The frame of the pot was mild steel with a black plastic coating and covered with a tar-coated mesh having stretched openings of 2.9 cm (1 1/8 in). There were two opposing tunnels in the side of each pot which had a 7.6 cm (3 in) opening. These pots differed in configuration from those of ADF&G which are rectangular pots measuring 41 cm x 41 cm x 91 cm (16 in x 16 in x 36 in). In 1999 we interspersed pots similar in configuration to, but somewhat smaller than (33 cm x 33 cm x 81 cm) those of ADF&G to test the relative efficiency of the two pot designs. The pots were fished in the depth range 27-183 m (15-100 fm) for a minimum of 18 h at each site. In year three additional pot sets were made in the depth range 0-27 m (0-15 fm) to assess the abundance of juvenile spot shrimp. The pots were similar in design to the larger nesting pots described above but were 71 cm (28 in) in diameter and covered with mesh with 8 mm openings. Each tunnel entrance had an opening of 5 cm (2 in).

Upon retrieval of the pot strings all pandalid shrimp in each pot were speciated. Spot shrimp were counted and the catch weighed to the nearest two grams on an electronic balance. Other species of pandalid shrimp (eg. *P. eous* and *P. hypsinotus*) were counted. All non-shrimp bycatch were speciated and counted. The carapace length of all spot shrimp was measured to the nearest mm. Carapace length was measured with calipers except when catches were large in which case the shrimp were photographed with a digital camera and carapace length determined with image analysis. A subsample of each catch was collected for staging and sexing in 1999. In 2000 all spot shrimp were collected for staging and sexing. Additional observations of ovigerous spot shrimp included egg condition (eyed vs uneyed) and egg color. The egg clutches of a total of about 10 ovigerous females were sampled at each site for estimates of fecundity and the number of dead eggs in the clutch. For nonovigerous females, the presence or absence of breeding dress [characterized by "...the presence of long, simple, and plumose setae on the protopodites of pleopods" (Butler 1980)] was recorded. Breeding dress indicates a mature female. The sampling cruises were conducted in October (the time of year when ADF&G normally conducts the annual survey) for the purposes of comparing the catch data collected by this project with that collected by ADF&G.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This project is a partnership between the National Marine Fisheries Service, the Valdez Native Tribe with Charlie Hughey as facilitator and Prince William Sound Economic Development Council.

SCHEDULE

A. Measurable Project Tasks for FY02 (October 1, 2001 - September 30, 2002)

- | | |
|------------------------|--|
| October 1 - March 31 | Complete processing of egg samples and analysis of data on spot shrimp adult and juvenile abundance, sex and size composition, and relative number of egg-bearing females and fecundity of spot shrimp at the study sites in year three. |
| April 1 - September 30 | Produce a final report. Analyse spot shrimp fecundity and juvenile abundance at the study sites in year three. |

B. Project Milestones and Endpoints

- | | |
|------------------|--|
| June 15, 2001 | Complete estimates of spot shrimp fecundity and juvenile abundance at the study sites in year two. |
| October 31, 2001 | Complete comparison of spot shrimp abundance, sex and size composition, fecundity and proportion of ovigerous females between sites and years. |
| January 15, 2002 | Complete comparison of the abundance data and the data on population structure obtained under the project with historical data collected by ADF&G. |
| April 15, 2002 | Submit final report and recommendations to ADF&G for development of a PWS shrimp management plan. |

C. Completion Date

September 30, 2002

PUBLICATIONS AND REPORTS

A final report will be submitted on 15 April in FY02. It is anticipated that at least two publications will derive from this project.

PROFESSIONAL CONFERENCES

Travel funds are requested for attendance of one individual at the annual Exxon Valdez Restoration Workshop in January 2002.

NORMAL AGENCY MANAGEMENT

The National Marine Fisheries Service (NMFS) does not manage shrimp resources in Alaska and has never been required by statute or regulation to survey spot shrimp populations in PWS. No project similar to the one proposed here has been conducted by NMFS in the past without funds from the Trustee Council. Spot shrimp are managed by ADF&G which conducts annual surveys in PWS to assess the status of the resource.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The Valdez Native Tribe Facilitator Charles Hughey and Prince William Sound Economic Development Council will work with NMFS scientists to successfully complete this spot shrimp project. The ADF&G will be asked to review the final report to improve the quality of it and to increase the relevance of the report to management goals.

The Prince William Sound Economic Development Council has coordinated other projects for EVOS in the past. The projects include the Chenega Bay Beach Clean-up and the five Oil Waste Management buildings in Valdez, Whittier, Cordova, Chenega Bay and Tatitlek.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

In fall 1999 and 2000 circular pots were substituted for the rectangular pots that ADF&G uses. The pots are identical to the pots that ADF&G uses in their surveys in southeastern Alaska. In 1999 the circular pots were cross-calibrated with rectangular pots similar to those used by ADF&G in Prince William Sound.

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Charles G. Hughey is a commercial fisherman, EVOS community facilitator for Valdez, and serves on the Alaska Fish and Game Advisory Committee.

Sue Cogswell is executive director of Prince William Sound Economic Development Council and has experience in project management.

Charles E. O'Clair will be responsible for sampling, data analysis and interpretation and report writing.

Mandy Lindeberg. will be responsible for arranging logistics (vessels, equipment, contracts, etc.), will participate in sampling, data processing, and will assist in report writing.

LITERATURE CITED

- Orensanz, J. M., J. Armstrong, D. Armstrong and R. Hilborn. 1998. Crustacean resources are vulnerable to serial depletion - the multifaceted decline of crab and shrimp fisheries in the Greater Gulf of Alaska. *Reviews in Fish Biology and Fisheries* 8: 117-176.
- Trowbridge, C. 1992. Injury to Prince William Sound spot shrimp. Final report for Exxon Valdez Oil Spill State/Federal Natural Resource Damage Assessment Subtidal Study Number 5. 141 p.
- Trowbridge, C. 1994. Spot shrimp *Pandalus platyceros* surveys in the Prince William Sound management area, 1989 -1993. Regional Information Report No. 2A94-31. Alaska Department of Fish and Game. Anchorage, Alaska. 30 p.

Prepared 4/05/01

Project 02401

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002					
Personnel	\$35.6	\$15.0					
Travel	\$3.5	\$0.8					
Contractual	\$39.1	\$6.0					
Commodities	\$1.7	\$1.0					
Equipment	\$0.0	\$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	\$79.9	\$22.8	Estimated				
General Administration	\$8.1	\$2.7	FY 2003				
Project Total	\$88.0	\$25.5	\$0.0				
Full-time Equivalent (FTE)	0.5	0.2					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
Comments: This is a closeout project. NOAA contribution: Dr. Stan Rice, Habitat Program Manager .25 mo @3.2K							

FY02

Prepared: 4/12/01

Project Number: 02401
Project Title: **Assesment of Spot Shrimp Abundance in PWS**
Agency: NOAA

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	
Name	Position Description					
Mandy Lindeberg	Fisheries Research Biologist	GS / 11/1	2.5	6.0		
Subtotal			2.5	6.0	0.0	
Personnel Total						
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	
Description						
RT Juneau - Anchorage EVOS Trustee workshop		0.4	1	2	0.2	
Travel Total						

FY02

Prepared:4/12/01

Project Number: 02401
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 Agency: NOAA

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:		
Description		
Temporary Labor Report Preparation		
When a non-trustee organization is used, the form 4A is required.		Contractual Total
Commodities Costs:		
Description		
Publication/Presentation costs		
		Commodities Total

FY02

Prepared:4/12/01

Project Number: 02401
 Project Title: **Assesment of Spot Shrimp Abundance in PWS**
 Agency: NOAA

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases:		Number of Units	Unit Price	
Description				
Those purchases associated with replacement equipment should be indicated by placement of an R.			New Equipment Total	
Existing Equipment Usage:		Number of Units		
Description				
computer (2)				

FY02

Prepared:4/12/01

Project Number: 02401
 Project Title: **Assesment of Spot Shrimp Abundance in PWS**
 Agency: NOAA