Project Title: Were pink salmon embryo studies in PWS biased?

Project Number:	00492
Restoration Category:	Research
Proposer:	John Thedinga, Mark Carls, Ron Heintz, NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stanley Rice NOAA Program Manager: Bruce Wright
NMFS Auke Bay Laboratory	
Lead Trustee Agency:	NOAA
Alaska SeaLife Center:	No
Cooperating Agencies:	
Duration:	2 years
Cost FY01:	$62,100
Cost FY02:	$48,900
Geographic Area:	Field studies: Little Port Walter on Baranof Island, Auke Creek Hatchery (Southeast Alaska) Laboratory studies: Retrospective analysis-PWS samples
Injured Resource/Service:	Pink salmon

ABSTRACT

Effects of the ***Exxon Valdez*** oil spill on wild pink salmon embryo survival in Prince William Sound are disputed among government- and industry-sponsored researchers. Exxon contends the government's conclusions that reduced embryo viability in oiled streams was caused by persistent oil contamination were biased because sampling times were earlier in oiled streams than in reference streams. We propose a combination of retrospective and experimental studies to determine if estimates of pink salmon embryo survival were accurate or biased by conducting a historical review of past sampling procedures and experimentally determining the ability to discriminate eggs killed by sampling (shock mortality) and previously dead eggs.

INTRODUCTION

The Trustee Council view of damage to pink salmon in Prince William Sound (PWS) is different than that of Exxon (Rice et al. 1999; Brannon and Maki 1996; Brannon et al. 1999). One controversial issue has been embryo mortality in oiled vs. non-oiled streams. Bue (1998) found that oiled streams had significantly higher pink salmon embryo mortality than non-oiled streams and Heintz et al. (1999) confirmed that incubation in oiled substrate can cause damage to embryos. Brannon (1996), however claimed that increased mortality in oiled streams was an artifact of sample design due to shocking and bias from sampling timing. Collins et al. (2000) showed that hydraulic sampling of embryos can cause mortality that can bias mortality estimates upward if not accounted for.

After 11 years, the questions remain- -was there bias in the sampling because of run timing differences between oiled and non-oiled streams? Were egg counters able to separate new mortalities caused by shocking during the sampling, and did they account for the sampling mortalities? Is it possible to account for the mortalities? These questions are basic to the assessment of damage to pink salmon from the spill, and to restoration strategies that should result. This multi-year project examines this continuing controversy with a combination of retrospective and experimental studies.

In the first year, experimental studies will focus on the ability to separate live eggs and dead eggs from newly shocked eggs. This will be done first in a controlled laboratory situation (hatchery) with a series on known life stages. A field test will also be conducted to test the relationship between run timing and susceptibility of eggs to pumping damage. For the field test, we will need a uniform stream that can be re-sampled periodically during the run; the spawning channel at Lovers Cove Creek near Little Port Walter (LPW) will be used for the field study. A proportion of the eggs in these experiments will be repeatedly viewed by several observers to test discrimination of recent and past mortality as a function of time.

In the second year, several different retrospective efforts will be conducted in this study. The analyses of the run timing issue by both ADFG (Craig et al. 1999) and Brannon et al. (1999) will be examined statistically in detail. Key to the issue is whether shock induced mortalities were caused, how they were counted, and if they were accounted for. The quality of the mortality data will be evaluated by interviewing supervising and technician personnel to determine what the sampling protocols were, if they were used, and if they were adequate. Sampling error by mis-identification of live/dead eggs can also be independently assessed by re-examination of the preserved live and dead eggs collected in 1990 and 1991. Auke Bay laboratory has received the preserved egg samples from all four zones sampled from 15 control and 10 oiled streams in 1990 and 1991 (several thousand eggs). The potential for error can be assessed by measuring the degree of necrosis in the preserved specimens, and also by identification of the life stage at the time of collection.

Ultimately, a model will be developed to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in spawn timing, processing time, and recognition of shock mortality. Data from both the retrospective and field studies and

from ADFG's egg pumping studies will be synthesized to determine if results were biased.

Spawning for pink salmon begins in August and September; Auke Bay Laboratory will provide in kind funds to facilitate initiation of this project in late FY 2000 so that it can be fully functional for FY 2001.

NEED FOR PROJECT

A. Statement of problem

There is an ongoing dispute between government and industry researchers concerning the impact of the Exxon Valdez oil spill on pink salmon in PWS. Government researchers concluded that pink salmon embryo survival was lower in oiled streams than in non-oiled streams from 1989-1993. Industry researchers allege that government sampling in oiled streams was earlier than in reference streams relative to run timing, thus biasing estimates of egg survival, because early egg stages are more susceptible to mechanical damage caused by hydraulic pump sampling than later stages. Industry researchers further contend that government observers failed to discriminate between previously dead eggs and those killed by sampling, thereby compounding the problem. The controversy continues after 11 years; this study attempts to clarify the controversy if possible and will use several lines of investigation. The controversy continues to cloud estimates of damage, restoration strategies, the impact of long term damage, and the definition of full recovery for this species.

B. Rationale/Link to Restoration

Pink salmon are listed as a recovering species, but before they can be added to the list of recovered species we need to know if persistent oil caused increased mortality of pink salmon embryos in PWS streams. Controversy over how sampling techniques and run timing affected the results of past embryo mortality studies needs to be resolved in order to determine the extent of possible damage from EVOS. Recent studies have shown that oil still exists near natal habitats and that pink salmon embryos are significantly more sensitive to oil exposure than previously believed (Heintz, et al. 1999a, b). If embryos are continuing to be exposed to oil in streams then the extent of damage needs to be understood. Understanding the damage that oil can cause to pink salmon embryos is also important in realizing potential risks associated with future oil spills.

C. Location

The field portion of the project will take place at Lovers Cove Creek near the Little Port Walter field station (LPW) in Southeast Alaska and at Auke Creek Hatchery in Juneau. Lovers Cove Creek provides a uniform spawning channel and an intertidal spawning population of pink salmon that allows repeated sampling. This location is appropriate because the streams physical characteristics are conducive to this type of project and it close to LPW which provides the necessary logistical and infrastructure support. The retrospective portion of this project will use pink salmon eggs pumped from PWS streams from 1990-1991. ADFG personnel that

participated in the egg pumping studies in PWS will be interviewed.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Scientists involved in this study will regularly present progress reports and results in scientific and public forums, including the annual workshop. They will be available to talk with interested public and will provide information for Trustee Council newsletters and annual reports as appropriate.

PROJECT DESIGN

A. Objectives

The primary objective is to determine if time-series estimates of pink salmon embryo survival in streams oiled by the Exxon Valdez oil spill were accurate or biased. Several steps are required to achieve this objective:

Experimental study (Year 1)

1. Develop models to relate previous field work to known life stages, run timing, and observer accuracy.
    a. At a hatchery, experimentally determine the period of time observers are able to discriminate between eggs of known age killed by shocking and previously dead eggs. This test will be repeated at different egg developmental stages by up to 10 observers.
    b. In the field, collect a time series of egg shock data by pumping samples from a pink salmon stream over time to determine sensitivity of eggs to stress. Relate mortality to run timing.

Retrospective study (Year 2)

1. Determine if there was potential for bias:
   Did sampling times differ in oiled and non-oiled streams relative to mean spawning time?
    a. Evaluate ADFG's (Bue 1998; Craig et al. 1999) results of PWS pink salmon embryo mortality data and Brannon et al.s (1999) interpretation of ADFG's results.

2. Determine if observers accounted for mortality induced by sampling procedures.
    a. Document standard operating procedures. Specifically, determine if instructions were given to egg counters to discriminate eggs killed by pumping from previously dead eggs.
    b. Document what data were actually collected by field crews. Determine if

observers followed protocol.

3. Determine if standard operating procedures were adequate.
   a. Determine if egg observers kept up with egg pumpers or fell behind: determine the average and range of times between egg collection and egg observation.
   b. Determine if there were differences between oiled and reference streams in lag times between egg pumpers and observers. Were the number of eggs to count different between oiled and un-oiled streams?

4. Determine the developmental stage of preserved eggs that were sampled by ADFG in 1990-1991 from oiled and non-oiled streams.
   a. Determine if there is evidence of errors in the identification of live and dead eggs.
   b. Visually examine live and dead eggs to determine if there is a difference in the life stage at mortality between oiled and non-oiled streams.

Synthesis (Year 2)

1. Develop a model to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in processing time, recognition of shock mortality, and spawn timing.

2. Discuss and compare results and conclusions to those reached by Brannon and Maki (1996).

B. Methods

Experimental study (year 1)

Hatchery: To determine the period of time observers are able to discriminate between shock mortality and previously dead eggs, eggs will be incubated in the Auke Creek hatchery and assessed for shock mortality at three times after fertilization. Eggs from two adult pink salmon from Auke Creek from three portions of the run will be fertilized and incubated. Eggs from each group will be assessed 1, 10, 20, 30, 40, and 50 days after fertilization. For assessment, 50 eggs from each sampling period will be shocked at three shock intensities; eggs will be shocked by dropping them into water from a distance of 1/4, 1, and 2 meters. Eggs will be assessed 5, 15, 30, 60, and 90 minutes after shocking independently by up to 10 observers. A subset of eggs will be preserved in 5% acetic formalin immediately after pumping for verification of live and dead eggs.

Field: Eggs will be pumped at Lovers Cove Creek where repeated sampling over a spawning run is feasible. Lovers Cove Creek was modified into an experimental spawning channel in the 1970's (Martin 1973), and today it is an intertidal stream channel with uniform width and spawning gravel and consistent stream flow. The 50 m channel will be partitioned into 25 transects 2 m apart. Care will be taken to avoid walking in other areas of the stream outside the

sampled transects to avoid damaging embryos. Eggs will be pumped using standard egg pumping procedures in randomly selected transects to identify live and dead eggs and those killed by pumping. Pumping will begin the end of September and end the first week of November. Approximate sampling dates are Sept. 30, Oct. 5, 10, 20, and Nov. 2. To ensure adequate sample size, five transects will be sampled each day, and five plots will be sampled at each transect for a total of 25 samples each sample date.

Eggs collected from each plot will be placed in separate plastic trays and assessed 10 minutes after pumping. Eggs will be classified into four groups: translucent, translucent eyed, dense opaque, and partially opaque. Translucent eggs will be considered live. Translucent eyed eggs that show eye pigmentation through the chorion will be considered live. Opaque eggs are those that contain coagulated yolk and appear white and will be considered to have died prior to sampling. Eggs that are partially opaque or are in the process of turning opaque will be considered fatalities or shock mortalities because the viteline membrane has ruptured and the yolk has begun coagulating. Samples of eggs that were assessed as shock mortalities will be preserved in 5% acetic formalin for later microscopic examination of embryo development.

To test the effect of time after collection on identifying shock mortality, eggs will be classified at several times following collection. At one of the transect each sample date, live and dead eggs will be assessed independently by two samplers after collecting the eggs. Handling of eggs will be minimized to reduce the chance of further inducing egg shock mortality. Eggs will be assessed 10, 30, and 60 minutes after pumping.

Run timing at Lovers Cove Creek will be monitored prior to and during egg pumping to determine run timing. Beginning in mid-August, the spawning channel at Lovers Cove Creek will viewed every other day to determine the onset and number of spawners. Egg pumping will begin when most fish have spawned.

Retrospective study (year 2)

ADFG personnel (supervisors, technicians) that supervised hydraulic egg sampling in PWS following EVOS will be interviewed to determine what egg sampling protocols existed and what protocol were given to field samplers. Personnel that sampled eggs will be interviewed to determine what data they actually collected and what sampling protocols were followed. We will determine if the number of eggs counted differed between oiled and nonoiled streams which could affect the time between egg collection and egg observation. A statistician will analyze pink salmon embryo and sampling timing data reported by Bue (1998) and Craig et al (1999) and challenged by Brannon et al. (1999). The findings in each report will be evaluated and if additional data exists it will be made available by ADFG and incorporated into the analysis. Results will be synthesized and a conclusion to whether the results are biased or not will be made.

The developmental stage of the eggs at the time of death will be assessed by visual estimating egg condition of preserved eggs sampled from PWS streams in 1990-1991. Visual estimates will confirm the amount of necrosis in both live and dead eggs. Live eggs that were killed by sampling will appear partially necrotic. All dead eggs with visible chorion will be of an earlier

stage of development than eggs in the live samples. The collection of eggs is from each of the four zones sampled from 15 control and 10 oiled streams in 1990 and 1991(Tables 1, 2).

Synthesis (year 2)

We will develop a model to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in processing time, recognition of shock mortality, and spawn timing. We will use data from both the retrospective and the field studies for the model.

In order to determine what level of misinterpretation of egg condition (live or dead) would bias the results of the embryo mortality study we model the PWS embryo data from 1989 - 1993. Based on Bue's (1996) data, we modeled the number of eggs counted in the oiled and control streams in PWS to account for the misidentification of eggs shocked and killed by the egg pumping procedure. We used a GLM two factor model based on the height above intertidal where the eggs were collected and compared the oiled vs. non-oiled streams. The difference in egg mortality between the oiled and non-oiled streams became non significant ($P = 0.05$) when 9.5% of eggs in all of the oiled streams were incorrectly counted as dead, but were actually killed by egg pumping and should have been counted as live. Whereas in the non-oiled streams, 11.3% of dead eggs would have to be incorrectly counted as live before mortality between oiled and non-oiled streams was no longer significantly different.

C. Cooperating agencies, contracts and other agency assistance

ADFG will provide historic egg sampling data, eggs, and run timing information. Contracts will be awarded to analyze preserved eggs from PWS and to evaluate Bue's (1998) pink salmon embryo mortality results and Brannon et al.'s (1999) rebuttal of the results. NMFS will pump eggs in the field, test egg shock mortality recognition in the hatchery, and conduct the retrospective analysis. In order to sample eggs from this years pink salmon run, this project will need to be started in FY 2000. NMFS will facilitate the start of the experimental portion of this project by making preparations this summer for sampling in September 2000.

SCHEDULE

A. Measurable tasks for FY00 (October 1, 1999 - September 30, 2000)

September:	Field: Begin pumping eggs at Lovers Cove Creek Hatchery: Begin incubating eggs at Auke Creek Hatchery

A. Measurable tasks for FY01 (October 1, 2000 - September 30, 2001)

Oct. - Nov.:	Field: Pump and assess eggs at Lovers Cove Creek Hatchery: Assess shocked eggs at Auke Creek Hatchery
Winter:	Begin analysis of egg pumping and egg shocking data from FY 01 field

season

Spring: Complete data analysis

Summer: Complete two manuscripts

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

Fall: Conduct retrospective study
Analyze preserved eggs

Winter: Analyze preserved eggs and retrospective data

Spring : Begin synthesis

Summer: Complete synthesis

B. Project Milestones and Endpoints

Fall 2000: Initiate and complete field and laboratory studies

Winter 2001: Analyze egg pumping and egg shocking data

Spring 2001: Complete data analysis

Summer 2001: Complete two manuscripts

Fall 2002: Initiate retrospective study

Spring 2002: Initiate synthesis manuscript

Summer 2002: Complete synthesis manuscript

C. Completion Date

Two manuscripts on egg shocking will be submitted Sept 30, 2001.

Synthesis manuscript will be submitted Sept 30, 2002.

PUBLICATIONS AND REPORTS

Final report

peer-reviewed manuscripts: Thedinga, J. T. et al. Detection of pink salmon eggs killed by hydraulic sampling. Journal unknown.

Carls, M. G. et al. Ability of observers to discriminate shock mortality in pink salmon eggs as a function of time after shock. Journal unknown.

Thedinga, J. T. et al. Pink salmon embryo studies in Prince William Sound: Did oil affect mortality or were sampling techniques biased?

PROFESSIONAL CONFERENCES

Travel to 2001 oil spill symposium is included.

NORMAL AGENCY MANAGEMENT

This project seeks to address the hypothesis that the effects of oil in streams on pink salmon embryo mortality was confounded by time of sampling through a cooperative relation ship between NMFS and the Trustees. NMFS would not be conducting this project if the oil spill had not occurred. NMFS proposes to make a significant contribution to the operation of this project, making it a cooperative venture with the Trustee Council.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The design of this project has been coordinated with work performed in the past by ADFG. NMFS will coordinate with the Trustees by providing labor requirements and laboratory overhead.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

GS-12 Fisheries Research Biologist - John F. Thedinga. BS Fisheries and Wildlife Management,

University of North Dakota (1975); MS Fisheries Science, University of Alaska (1986). He has been employed by the National Marine Fisheries Service, Auke Bay Laboratory since 1978 specializing in research on the effects of logging on salmon and freshwater habitat. He has been principle investigator and co-investigator on several projects. Recently he was co-investigator of Trustee project 98076 and principal investigator of Trustee project 00163A. He has published over 20 scientific papers.

CO INVESTIGATORS

GS-12 Fisheries Research Biologist - Mark G. Carls Received BA (1975) in Biology from Gustavus Adolphus College, St. Peter, MN, and MS (1978) in Biological Oceanography from Dalhousie University, Halifax, Nova Scotia. Mark has been employed at the Auke Bay Fisheries Laboratory since 1979. His principal involvement has been in research of petroleum hydrocarbon toxicology to marine fish and invertebrates, including egg, larval, and adult life stages. Mark has published 17 papers, and has 5 Exxon Valdez damage assessment papers in preparation or pending publication. Since 1989, he has been involved as a principal investigator and co-investigator on several studies resulting from the Exxon Valdez oil spill involving Pacific herring, pink, and chum salmon, and mussels.

GS-12 Fisheries Research Biologist - Ron A. Heintz Education: BS Ecology, University of Illinois (1979); MS Fisheries Science, University of Alaska (1986). Ron has been involved in examining the effects of Exxon Valdez oil on pink salmon since 1992. He has published 4 peer-reviewed papers and has another in press on this topic. To date his work has identified the sensitivity of pink salmon embryos to low concentrations of oil, demonstrated the existence of delayed effect on marine survival and the persistence of oil in stream deltas in Prince William Sound. He is currently working on two other EVOS projects related to this same topic.

OTHER KEY PERSONNEL

GS-12 Fisheries Research Biologist - Adam Moles will assist with the analysis of the preserved egg samples.

GS-9 Fisheries Research Biologist - Jacek M. Maselko will assist in setting up the experiments, collecting data, and analyzing data.

LITERATURE CITED

Brannon, E. L. and A. W. Maki. 1996. The Exxon Valdez oil spill: Analysis of impacts on the Prince William Sound pink salmon. Reviews in Fisheries Science 4(4): 289-337.

Brannon , E. L., L. Moulton, K. Parker, M. Cronin, and K. Collins. 1999. Resolution of oil spill

affects on incubation pink salmon Prince William Sound. Center for salmonid and freshwater species at risk, University of Idaho, Moscow, ID. Research Bulletin 99-1.

Bue, B. G., Sharr, S. D. Moffitt, and A. Craig. 1996. Injury to salmon eggs and preemergent fry due to the T/V Exxon Valdez oil spill. In S D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright (eds.). Exxon Valdez Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Bue, B. G., S. Sharr, and J. E. Seeb. 1998. Evidence of damage to pink salmon populations inhabiting Prince William Sound, Alaska, two generations after the Exxon Valdez oil spill. Trans. Am. Fish. Soc. 127:35-43.

Craig, A. K., M. Willette, D. G. Evans, and B. G. Bue. 1999. Injury to pink salmon embryos in Prince William Sound -field monitoring. Exxon Valdez Oil Spill Restoration Project Final Report. Restoration Project 8191A-1.

Collins, K. M. and E. L. Brannon. 2000 Hydraulic sampling protocol to estimate natural embryo mortality. Transactions of the American Fisheries Society. In press.

Heintz, R. A., S. D. Rice, A. C. Wertheimer, R. Bradshaw, F. P. Thrower, J. E. Joyce, and J. W. Short. 1999a. Delayed effects on growth and marine survival of pink salmon after exposure to crude oil during embryonic development. P. 5.1-5.19 in A. C. Wertheimer, A. C., R. A. Heintz, J. F. Thedinga, J. M. Maselko, A. G. Celewycz, R. Bradshaw, and S. D. Rice. Effects of oiled incubation substrate on straying and survival of wild pink salmon. Exxon Valdez Trustee Council Restoration Project 98076 Final Report.

Heintz, R. A., J. W. Short, and S. D. Rice. 1999b. Sensitivity of fish embryos to weathered crude oil: part II. Increased mortality of pink salmon (Oncorhynchus gorbuscha) embryos incubating downstream from weathered Exxon Valdez crude oil. Environ. Toxicol. Chem. 18(3):494-503.

Martin, R. M. 1973. Hydraulic modification of intragravel streambed flow as a means of improving egg-to-fry survival. Masters thesis, California State University, Humboldt.

Rice, S. D., R. E. Thomas, R. A. Heintz, A. Moles, M. Carls, M. Murphy, J. W. Short, A. Wertheimer. 1999. Synthesis of long term impacts to Pink Salmon following the Exxon Valdez oil spill: persistence, toxicity, sensitivity, and controversy. Final Report: project 99329, Exxon Valdez Trustee Council.

Table 1. Location, date, and number of jars of preserved live and dead eggs sampled in 1990 in oiled and non-oiled (control) streams in Prince William Sound by ADFG.

		Number of jars of eggs at each intertidal zone and upstream							
Creek	Date	6- 8' Live	8-10' Live	10-12' Live	Upstream Live	6-8' Dead	8-10' Dead	10-12' Dead	Upstream Dead
					Non-oiled				
Koppen Creek	24-Sep	2	0	2	2	1	0	1	1
McClure Creek	25-Sep	2	1	2	2	1	1	1	1
Mink Creek	25-Sep	2	1	2	2	1	1	1	1
West Finger Creek	26-Sep	2	2	2	2	1	1	1	1
Totemoff Creek	28-Sep	2	2	2	2	1	1	1	1
Port Audrey	29-Sep	2	2	2	2	1	1	1	1
Cathead Bay	1-Oct	2	2	2	2	1	1	1	1
Brizgaloff Creek	2-Oct	2	2	2	2	1	1	1	1
Erb Creek	2-Oct	2	2	2	2	1	1	1	1
Bernard Creek	8-Oct	1	2	2	2	1	1	1	1
Cabin Creek	9-Oct	2	1	2	2	1	1	1	1
Wilby Creek	9-Oct	2	1	2	2	1	1	1	0
Kelez Creek	10-Oct	2	2	2	2	1	1	1	1
O'Brien Creek	11-Oct	2	2	2	2	1	1	1	1
Falls Creek	12-Oct	2	1	2	2	1	1	1	1
Bainbridge Creek	14-Oct	0	2	2	2	1	1	1	1
Claw Creek	14-Oct	2	2	2	0	1	1	1	0
Hogg Creek	15-Oct	2	1	2	2	1	0	1	1
Cook Creek	18-Oct	2	2	2	2	0	1	1	1
Halverson Creek	18-Oct	2	1	2	2	1	1	1	1
					Oiled				
Junction	28-Sep	2	1	2	2	1	1	1	1
Herring Bay	30-Sep	2	1	2	2	1	1	1	1
Loomis Creek	30-Sep	2	1	2	2	1	1	1	1
Point Countess	3-Oct	2	1	2	2	1	1	1	1
Bjorne Creek	4-Oct	2	2	2	2	1	1	1	1
Hayden Creek	12-Oct	2	1	2	2	1	1	1	1
Hogan Bay	13-Oct	1	0	2	2	1	0	1	1
Shelter Bay	13-Oct	2	1	2	2	1	1	1	1
Snug Harbor	16-Oct	2	1	2	2	1	1	1	1
Sleepy Bay	30-Oct	2	1	2	2	1	1	1	1
Chenega	1-Oct	2	1	2	2	1	1	1	1
Canoe Pass	1-Oct	2	2	2	2	1	1	1	1

Table 1. Location, date, and number of jars of preserved live and dead eggs sampled in 1991 in oiled and non-oiled (control) streams in Prince William Sound by ADFG.

		Number of jars of eggs at each intertidal zone and upstream							
Creek	Date	6-8' Live	8-10' Live	10-12' Live	Upstream Live	6-8' Dead	8-10' Dead	10-12' Dead	Upstream Dead
					Non-oiled				
Moffitoffskiloff	1-Oct	1	1	1	1	1	1	1	1
Bernard Creek	23-Sep	0	1	1	1	0	1	1	1
Koppen Creek	23-Sep	0	1	1	1	0	1	1	1
Cabin Creek	24-Sep	1	1	1	1	0	1	1	1
Cook Creek	24-Sep	0	1	1	1	0	1	1	1
Kelez Creek	25-Sep	1	1	1	1	3	1	1	1
Wilby Creek	25-Sep	1	1	1	1	0	1	1	1
Falls Creek	28-Sep	1	1	1	1	1	1	1	1
Hogg Creek	28-Sep	1	1	1	1	1	1	1	1
O'Brien Creek	28-Sep	1	1	1	1	1	1	1	1
Halverson Creek	29-Sep	1	1	1	1	1	1	1	1
Claw Creek	31-Sept	1	1	1	1	1	1	1	0
Port Audrey	2-Oct	1	1	1	1	1	1	1	1
McClure Creek	8-Oct	1	1	1	1	0	1	1	1
West Finger Creek	8-Oct	1	1	1	1	0	1	1	1
Mink Creek	9-Oct	1	1	1	1	1	1	1	1
Erb Creek	10-Oct	1	1	1	1	1	1	1	1
Totemoff Creek	10-Oct	1	1	1	1	1	1	1	1
Bainbridge Creek	11-Oct	1	1	1	1	1	1	1	1
Brizgaloff Creek	11-Oct	1	1	1	1	1	1	1	1
Cathead Bay	10/1,10/2	1	1	1	1	1	1	1	1
					Oiled				
Sleepy Bay	25-Sep	1	1	1	1	1	1	1	1
Snug Harbor	26-Sep	1	2	2	2	1	2	2	2
Bjorne Creek	27-Sep	1	1	1	1	1	1	1	1
Hogan Bay	27-Sep	1	0	0	0	1	0	0	0
Shelter Bay	27-Sep	0	1	1	1	0	1	1	1
Point Countess	9/29-9/30	1	1	1	1	1	1	1	1
Junction	1-Oct	0	1	1	1	0	1	1	1
Herring Bay	7-Oct	1	1	1	1	1	1	1	1
Loomis Creek	9-Oct	1	1	1	1	1	1	1	1
Hayden Creek	12-Oct	1	2	1	1	1	1	0	1

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$22,460.0						
Travel		$8,094.0						
Contractual		$16,800.0						
Commodities		$9,000.0						
Equipment		$2,000.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$58,354.0				Estimated		
General Administration		$3,717.5				FY 2002		
Project Total	$0.0	$62,071.5				49K		
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

This project addresses the controversy between government and industry -sponsored researchers over the effect of oil on pink salmon embryo mortality in Prince William Sound streams.

NOAA Contribution FY00: Principal Investigator - John Thedinga 2 mo. @ $16K
Co-PI - Mark Carls1 mo. @ $8.2K
Jacek Maselko 2 mo. @ $10.5K

NOAA Contribution: Habitat Investigation Program Manager, S. Rice,1 mo @ $12.1K
Principal Investigator - John Thedinga 4 mo. @ $32K
Co-PI - Mark Carls 3 mo. @ $24.6K
Co-PI - Ron Heintz 1 mo. @ $7.7K,
Little Port Walter Research Facility, Auke Creek Hatchery

FY01

Prepared: 7/5/00

Project Number: 01492
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	
Name	Position Description					
John Thedinga	PI	GS12/4	1.5	8000.0		
Jacek Maselko	Fishery Research Biologist	GS9/3	2.0	5230.0		
	Subtotal		3.5	13230.0	0.0	
					Personnel Total	

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	
Description					
Juneau to Anchorage (Restoration Workshop/Thedinga)	444.0	1	3	150.0	
Juneau - LPW roundtrip	1800.0	4		0.0	
				Travel Total	

FY01

Prepared: 7/5/00

Project Number: 01492
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

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

Contractual Costs:	
Description	
NOAA Contract labor (Experimental hatchery and field studies) 1 x $4.2k/month - @ 1 months(Hatchery shocking experiment) 2 x $4.2k/month - ea 1.5 months (Field shocking experiment)	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	
Commodities Costs:	
Description	
Egg shocking supplies for hatchery study Gas, oil for outboards and LPW maintenace Egg pumping equipment Tent, tarps, pink salmon observation platform	
Commodities Total	

FY01

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

New Equipment Purchases:	Number of Units	Unit Price	
Description			
Hydraulic egg pump	1	2000.0	
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	

Existing Equipment Usage:	Number of Units	
Description		
Auke Creek hatchery equipment (heath trays, water heaters, hatchery facility)		
Boats and outboard motors	2	
Little Port Walter Research Station		

FY01

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