

Exxon Valdez Oil Spill
Restoration Project Annual Report

PWSAC - PWS System Investigation -
Experimental Fry Release

Restoration Project 96320K
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

Howard Ferren
Jeff Milton

Prince William Sound Aquaculture Corporation
P.O. Box 1110
Cordova, Alaska 99574

for:

Alaska Department of Fish and Game
Habitat and Restoration Division
333 Raspberry Road
Anchorage, Alaska 99518-1599

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Study History: In support of the needs of Sound Ecosystem Assessment (SEA) researchers, Prince William Sound Aquaculture Corporation (PWSAC) continued the late release of large pink salmon fry from Wally Noerenberg (WNH) and Armin F. Koernig (AFK) hatcheries. This procedure allows SEA researchers to target and quantify pink salmon fry migration and interaction with predators. The 1996 release project was the third in a series of four years of planned releases: 94320K, 95320K, 96320K and proposed 97320K.

SEA is an ongoing *Exxon Valdez* oil spill (EVOS) Trustee Council program which focuses on the processes and mechanisms that regulate losses of fry and juveniles to predators after emergence from nearshore natal habitats. Hatchery produced pink salmon fry and returning adults may provide a test of the influence of ocean-entry timing and of fry size at ocean entry on losses to predators.

Abstract: Prince William Sound Aquaculture Corporation released 11.39 million hatchery pink salmon fry in 1996 from the Wally Noerenberg Hatchery (WNH) which had been reared to an average 1.13 grams. The fry were coded wire tagged in known tagged to untagged ratios prior to release thereby making assessments of early marine growth, life stage mortality and migration patterns possible by other SEA researchers. Additionally, 12.46 million fry were released from the Armin F. Keornig Hatchery. These were smaller, released earlier and were not targeted for direct observation and sampling like those fry released from WNH. However, they too were coded wire tagged prior to release at known tagged to untagged ratios for later identification as adults and evaluation for marine survival.

Key Words: *Exxon Valdez*, hatchery, marine survival, *Oncorhynchus gorbuscha*, pink salmon, Prince William Sound, Prince William Sound Aquaculture Corporation, Sound Ecosystem Assessment (SEA).

Project Data: (will be addressed in the final report)

Citation:

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EXECUTIVE SUMMARY

The Experimental Release Project is an integral component of the Prince William Sound (PWS) Ecosystem Assessment (SEA) studies. Identifiable pink salmon *Oncorhynchus gorbuscha* are an excellent tool to test a central SEA recruitment hypothesis concerning time at ocean entry and fry size at ocean entry. Consequently, SEA researchers requested very large and late fry, relative to typical size and timing upon ocean entry, from the PWS Aquaculture Corporation (PWSAC). Additionally, by utilizing two release sites for the subject salmon fry, an increase in the spatial difference at ocean entry point allows researchers insight into subtle locational differences within the Sound.

Approximately 11.39 million pink salmon fry nurtured at Wally Noerenberg Hatchery were released on June 1-2, 1996 at an average size of approximately 1.2 grams each. 19,686 large, pink salmon fry were marked and tagged, making assessments by other SEA researchers of early marine growth, life stage mortality and migration patterns possible at a highly reasonable cost. Only fry released from WNH were targeted for recapture. Due to unusually warm surface waters a minor outbreak of *Vibrio* sp. bacteria occurred at Armin F. Koernig Hatchery and resulted in 2% fry mortality. To reduce potential for bacterial spread and increased mortality in the net pens, fry were released early (May 24), prior to fry reaching the target weight. Approximately 12.46 million fry were released at an average weight of 0.70 grams each.

The justification for the late-large rearing and release strategy is evidence from Alaska and elsewhere which suggests that fry size is an important determinant of salmon fry survival during early marine residence (Kaeriyama, 1989; Parker, 1971). Faster growing juveniles are thought to enjoy better marine survivals than slower growing fish.

INTRODUCTION

The knowledge garnered by SEA researchers in evaluating the changes occurring in the PWS ecosystem subsequent to *Exxon Valdez* oil spill, is vital to evaluating and defining the best approaches to efficiently, and effectively restore the many damaged marine resources and associated services. The key to understanding the complex species interactions that occur during critical early marine life stages requires an immense amount of effort and team work by many institutions, agencies, groups, and private individuals. The ecosystem level information that is now being developed will aid the *Exxon Valdez* Oil Spill Trustee Council and others in their restorative tasks assisting injured pink salmon and herring populations in PWS, as well as forming predictive models which will benefit resource managers and harvesters on into the future.

Identifiable as to salt water entry point, time, and size, salmon fry are required by SEA researchers. Consequently, PWSAC has made available its facilities, personnel and expertise. Releases of restoration and enhancement facility-nurtured pink salmon fry is, as indicated by the full SEA proposal, providing "...a powerful test of the influence of ocean-entry timing and fry size at ocean entry on losses to predators".

OBJECTIVES

The goal of this project is, through collaboration with the SEA program, to assist "to develop an ecosystem level understanding of the natural and man-caused factors influencing the production of pink salmon in PWS".

Specific objectives are:

- A. Rear approximately 12 million early emerging fry each at the Wally Noerenberg Hatchery (WNH) on Esther Island and Armin F. Koernig Hatchery (AFK) on Evans Island to 1.5 grams live weight for release in mid-June.
- B. Release fry from WNH coincident with SEA sampling program to allow direct observation of fry migration and predator interaction.
- C. Determine the marine survivals of fry in experimental releases from coded wire-tagged individuals recovered in corporate escapement and common property fishery the following year.
- D. Compare the marine survivals of late-released, larger fry with other releases at these same facilities.

METHODS

Project 96320K took place in PWS at the AFK facility located on Evans Island and the WHN facility sited on Esther Island. Site work commenced in February 1996.

Project pink salmon fry were designated from early outmigrants and weighed on average 0.25 grams wet weight, each. Volitional outmigration from PWSAC NOPAD incubators insured osmocompetence and optimum developmental fitness. After passing a bank of electronic counters (+/- 1% accuracy), fry were conveyed via flexible hose to 12m x 12m x 3m (432m³) saltwater rearing pens. Approximately three million fry were held in each of four pens at WNH, and four million fry in each of three pens at AFK Hatchery (Table).

Prior to release, 1/2mm Coded Wire Tags (CWT) were applied to approximately 1 out of every 600 fry. Each pen of fry contained a unique code (Table 1). The CWT fry are integral to identification thus allowing tracking migration patterns of pink salmon fry, and estimation of growth and mortality patterns.

All fry were fed a standard commercial diet of soft, semi-moist fish food for between 68-84 days at WNH and 53-66 days at AFK Hatchery prior to release. Releases occurred on June 1-2 at WNH Hatchery and May 24 at AFK Hatchery. One small release group was held at AFK Hatchery until June 12. Weights varied (Table) and were the maximum technically feasible given the release dates.

Close coordination and communication occurred between SEA researchers and the hatchery personnel during the field season to assure SEA's sampling efforts were closely timed to releases of facility pink salmon fry. Releases were done in concert with shipboard sampling carried out by SEA research teams. Fry release data from the hatcheries was communicated to biologists stationed on board trawl and purse seine vessels. Thus, near shore and open water sampling was targeted on released fry as deemed necessary by collaborating researchers' experimental designs and judgment.

RESULTS

Within the constraints of the state of the science and art of fish cultural technology, PWS pink salmon's genetically determined scope for growth, budgetary reality, and collaborating researchers' experimental designs/timing requirements, the results were as close to planned objectives as are currently feasible. Please see the Table for the exact dates, weights, numbers, number mark/tagged, codes, and untagged: tagged ratios.

DISCUSSION

PWSAC normally releases pink salmon fry in or near the peak of zooplankton biomass abundance after assisting with feeding and predator protection, thus closely emulating what PWS pink salmon fry do when unassisted. Consequently the test releases are not within the normal scope of PWSAC operational strategies. The project delineated herein, however, is intended to provide a tool for SEA researchers assisting increases in understanding of factors affecting survival of juvenile pink salmon fry in PWS.

CONCLUSIONS

Year to year variation in physical and biological oceanographic conditions in PWS are historically evidenced. That the saltwater entry of late, large-sized, marked and tagged pink salmon fry is of value to fellow SEA projects is evidenced by SEA researcher's requests that project 95320K be continued. Given the differences between inter-year PWS ecosystem comparisons, SEA projects require multi-years' data before reliable conclusions can be drawn concerning the many biotic and abiotic factors influencing PWS pink salmon survivals.

Hatchery produced pink salmon fry are a viable tool to test hypotheses regarding the causes of mortality in juvenile pink salmon in PWS.

The feasibility of releasing a 1.0-1.5 gram pink salmon fry using current technology has been ascertained by earlier work (94320K, 95320K) and 1996 work reported on in this annual report. The objectives appear to be attainable, particularly at the Esther Island facility, allowing that required additional resources are secured and employed.

Project 96320K should be continued as a necessary and important support function to other SEA projects as multiple years of data are needed before reliable conclusions can be drawn concerning factors affecting mortality in PWS pink salmon stocks. With the understanding of the theoretical underpinnings on the dynamics of pink salmon stocks and their interrelationships with abiotic and biotic factors, comes the promise of garnering the ability of enduring ecosystem management, thus assuring biodiversity, as well as economic security on into the future.

LITERATURE CITED

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TABLE

Prince William Sound Aquaculture Corporation
BROOD YEAR 1995 PINK SALMON - Late/Large Rearing Strategy

Wally Noerenberg Hatchery

Pen Number	Release Date	Weights (gm)	Released Untagged	Released Tagged	Total Release	Tag Code	Tag Ratio 1:
2	6/2/96	1.29	2,846,911	4,958	2,851,869	13-01-03-12-02	574
4	6/2/96	1.36	2,991,257	5,052	2,996,309	13-01-03-12-03	592
6	6/2/96	1.06	2,845,340	4,731	2,850,071	13-01-03-12-04	601
8	6/1/96	0.81	2,684,345	4,945	2,689,290	13-01-03-12-05	543
Totals			11,367,853	19,686	11,387,539		

Armin F. Koernig Hatchery

Pen Number	Release Date	Weights (gm)	Released Untagged	Released Tagged	Total Release	Tag Code	Tag Ratio 1:
2	5/24/96	0.79	4,214,839	4,810	2,756,287	13-01-03-14-12	573
2a	6/12/96	1.57		2,546	1,465,908	13-01-03-14-12	576
4	5/24/96	0.71	4,081,789	6,898	4,088,687	13-01-03-14-10	592
6	5/24/96	0.61	4,143,380	6,990	4,150,370	13-01-03-14-11	593
Totals			12,440,008	21,244	12,461,252		586

Grand Totals 23,807,861 40,930 23,848,791

* Note: AFK released earlier than planned due to a Vibrio outbreak.