Exxon Valdez Oil Spill
Restoration Project Annual Report

Port Graham Pink Salmon Project

Restoration Project 97225
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.

Ephim Anahonak, Jr.
Paul McCollum
David Daisy

Port Graham Village Council
P.O. Box 5510
Port Graham, Alaska 99603

for:

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

April 1998

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Study History: The project effort was initiated under Restoration Project 96225. This is the second year of a scheduled five year project.

Abstract: This project will help supply pink salmon (*Oncorhynchus gorbuscha*) for subsistence use in the Port Graham area during the broodstock development phase of the Port Graham hatchery. Because local runs of coho and sockeye salmon, the more traditional salmon subsistence resource, are at low levels pink salmon are being heavily relied on for subsistence. This project will help ensure that pink salmon remain available for subsistence use until the more traditional species are rejuvenated.

Key Words: Broodstock development, coded wire tagging, *Exxon Valdez* oil spill, marine survival, otolith marking, *Oncorhynchus gorbuscha*, pink salmon, Port Graham, subsistence.

Project Data: (will be addressed in final report)

Citation:

Anahonak, E., P. McCollum, and D. Daisy. 1998. Port Graham pink salmon project, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 97225), Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage, Alaska.

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Executive Summary

The goal of this project is to increase subsistence gathering opportunities for the Port Graham and Nanwalek villages by increasing the fry to adult survival of Port Graham hatchery pink salmon during the hatchery's broodstock development phase. Local runs of coho and sockeye salmon, the more traditional subsistence salmon species, are at low levels. This is putting more subsistence pressure on pink salmon at a time when the hatchery is building broodstock and needs to utilize as many of the returning adults as possible for hatchery spawning. Two strategies are being applied to help mitigate this problem. One is an attempt to increase marine survival of hatchery fish, i.e., the number of hatchery released fry that return as adults, and the other is maximizing the use of the adult return through increased monitoring.

The principal strategy being applied to increase marine survival is to increase the size of the fry prior to release into the wild. Pink salmon fry emerge from the incubators weighing 0.24 grams on average. Experiments on pink salmon fry around the state have shown that rearing the fry to at least double their emergent weight before releasing them can significantly enhance marine survival.

In 1993 and 1994 the hatchery experimented with growing a batch of pink salmon fry to eight grams before releasing them into the wild. Eight grams was chosen because that is the size that juvenile pinks are believed to leave the near shore area, where predation on them is high, for the high seas where the predation is somewhat less. It was thought that by enhancing survival through the near shore period the survival to the adult stage should be greatly increased. That turned out to be the case. Marine survival of fish reared to the eight gram size before release exceeded 10% compared to the approximately 1% survival to adult that the hatchery was getting from fry that were reared only a short time prior to release. Because of this success it was decided to make producing 8 gram pink fingerling for release the main vehicle for enhancing survival.

An outbreak of a bacterial disease called warm water vibriosis in the group of fish being reared to the 8 gram size curtailed that effort and caused the project to forgo this procedure in the future. Instead, it was decided to produce pink salmon fingerling in the 1.5 gram range for release in early June before water temperatures reach the point where warm water vibriosis is likely to occur.

The hatchery program released around 6.2 million pink salmon in 1996 in two different groups. The first group contained about 1.5 million fingerling. It was released into the major zooplankton bloom at the end of May and with an average weight of 0.5 grams. The second group contained about 4.7 million fingerling. It was released on June 10 and had an average weight of 1 gram. None of these fish were tagged because the tagging equipment was not working properly.

In 1997 about 1 million fry emerged from the incubators. They were split into two groups of about 500,000 each. One group was reared in pens until May 24 when they were released into the major mature zooplankton bloom in Port Graham. The second lot was reared to an average

weight of 1.4 grams and released on June 9. Approximately 10,000 of these fish released on June 9 were marked with an adipose fin clip and a coded wire tag.

Fingerling released in 1996 returned as adults in July and August of 1997. About 205,000, or 3.3%, of the 6.2 million fingerling released in 1996 survived to return as adults in 1997. This was the highest overall marine survival rate for pink salmon as well as the largest adult return to the hatchery to date. Although none of the fish in the 1997 adult return were marked it seemed reasonable that the release of larger sized fingerling increased the marine survival rate.

Future plans for this project call for emphasizing the release of larger sized fingerling. The threat of warm water vibriosis restricts the amount of time that fish can be held before release. It appears that a 1.5 gram fingerling is the practical limit at Port Graham using ambient temperature water. Another approach to producing large size fingerling will be tested in FY 98. This test will use heated water to produce a fingerling of a minimum 1 gram size for release at the peak of the mature zooplankton bloom which occurs in Port Graham around the end of May. Releasing 1+ gram fingerling into the peak of the zooplankton bloom should greatly enhance their marine survival rate. The hatchery has on hand the heating and heat transfer equipment that could provide limited amounts of both heated fresh and salt water for incubation and rearing.

The availability of heated water will also allow the hatchery to switch over to an otolith marking program in FY 98.

The second strategy of maximizing use of the adult return through increased monitoring went quite well in FY 97. The additional stream surveys, both aerial and ground, as well as closer monitoring of pink salmon entering the Port Graham subdistrict that was underwritten by this project provided the local Alaska Department of Fish & Game (ADF&G) fisheries manager with additional information with which he was able to allow more subsistence and broodstock harvesting opportunities without jeopardizing the wild escapement.

Introduction

The goal of this project is to increase subsistence-gathering opportunities for the Port Graham and Nanwalek villages by increasing the fry to adult survival of Port Graham hatchery pink salmon during the hatchery's broodstock development phase. Local runs of coho and sockeye salmon, the more traditional subsistence salmon species, are at low levels. This is putting more subsistence pressure on pink salmon at a time when the hatchery is building broodstock and needs to utilize as many of the returning adults as possible for hatchery spawning. One way to help mitigate this problem is to apply strategies that will increase the number of hatchery released fry that return as adults. Another way to lessen this problem is to provide the local ADF&G fisheries manager with additional information which he can use to fine tune management and hopefully allow more harvest or broodstock collection opportunities without compromising the wild escapement goals.

Normally, pink salmon fry emerging from the incubators are placed in saltwater rearing pens put on feed and released during the first mature zooplankton bloom. The bloom normally occurs within two to three weeks after the fry emerge from the incubators. The fry normally experience a 20% to 40% weight gain while waiting in the rearing pens for the bloom. However the marine survival of pink salmon reared and released in this manner has been poor.

In 1993 and again in 1994 the hatchery experimented with growing a small group of pink salmon fry to eight grams before releasing them into the wild. Eight grams was chosen because that is the size that juvenile pinks are believed to leave the near shore area, where predation on them is high, for the high seas where the predation is somewhat less. It was thought that by enhancing the survival through the near shore period the survival to the adult stage should be increased. And that turned out to be the case.

Adult survival of lots reared to the eight gram size before release exceeded 10% compared to the approximately 1% survival to adult that the hatchery was getting from fry that were reared only a short time before release. Although rearing fry to the eight gram size is expensive compared to short term rearing, the additional adults produced from this procedure would allow the hatchery to maintain its broodstock development schedule and allow for a large subsistence harvest.

At the 1996 Hatchery Manager's Workshop several papers were presented by other pink salmon hatcheries in the state that were doing their own experiments with longer term rearing of pink fry to enhance survival to adults. Generally, it was found that rearing pinks to at least 0.5 grams was more important in enhancing survival than releasing into zooplankton blooms. The various tests that were conducted grew fry up to 1.5 grams before release with survivals increasing with the fish size upon release. Adult survivals averaged around 5% for the 0.5 gram fish to over 7% for fish grown to 1.5 grams before release.

Originally the objective for this project was to rear as many fry as possible to the eight gram size before. However, in light of the information presented at the Hatchery Manager's Workshop the objectives were changed to set up a staggered release program that would produce fish of three different sizes (0.5 grams, 1 gram and 8 grams) at release. This approach would allow more fish to be included in the project for the same cost.

Problems arose with producing 8 gram fish in 1996. An outbreak of warm water vibriosis, a bacterial disease that can infect salmon when water temperatures are above around 10° C, occurred in the group of fish being reared to 8 grams. This infection caused these fish to be released much earlier than anticipated and called into question the efficacy of continuing this program in the future. This program required that the fish remain in the rearing pens for the entire summer and water temperatures often exceed 10° C during this time. Because of this it was decided that the risk of a warm water vibriosis infection was too great and was discontinued.

To explore how the management of the Port Graham subdistrict fisheries could be improved to allow more fish to be harvested either for subsistence or hatchery broodstock a meeting was held with the local ADF&G fisheries manager. The department expends a relatively small portion of its resources in the subdistrict because of the low number of fish and minor fisheries that occur

there. By doubling the number of stream surveys and adding an additional aerial survey of the subdistrict each week the manager felt he would have adequate information to maximize the harvest and still protect wild escapement. It was agreed that if funds could be found to pay for the additional surveys the manager would conduct them.

Objectives

Use the Port Graham hatchery to provide pink salmon for local subsistence use while maintaining the hatchery's pink salmon broodstock development schedule.

Methods

Two strategies were employed to meet the objective. The first was to supplement the ADF&G monitoring of the Port Graham pink salmon return and the second was to enhance the marine survival of the hatchery produced pink salmon through an extended rearing program.

The Port Graham River pink salmon run is the source of the hatchery broodstock. A program was established to work closely with ADF&G in monitoring the pink salmon return to Port Graham each year in order to get as precise an estimate as possible on the wild and hatchery return. This project provided funds that increased the normal management stream and bay surveys of Port Graham that ADF&G conducts. It included conducting additional stream and bay surveys as well as closely monitoring the subsistence fishery harvest. It also established a regular line of communications between Port Graham and ADF&G in order to coordinate the monitoring effort.

The other strategy of this project involved rearing pink salmon fry for extended periods to increase their size at release. One million pink salmon emerged from the incubators in mid April. These fish were split into two groups of more or less equal size. One group was reared in net pens until the height of the mature zooplankton bloom on May 24 when they were released. The other group was reared in net pens until the water temperature neared 10° C. They were released on June 9 with an average weight of 1.4 grams. About 10,000 of these fish were marked with an adipose fin clip and a coded wire tag.

Results

Of the 6.2 million fingerling released in 1996 around 205,000, or 3.3%, survived to return as adults in 1997. This was the highest overall marine survival rate for pink salmon as well as the largest adult return to the hatchery to date. Although none of the fish in the 1997 adult return were marked it seems reasonable to assume that the release of larger sized fingerling was a major factor in the increased the marine survival rate. The 1997 adult return was more than sufficient to meet subsistence needs and provide enough broodstock for a record egg take of 15 million eggs.

The exceptionally warm, sunny weather experienced during the broodstock collection and egg take took its toll on the penned broodstock. High water temperatures and the resultant low oxygen levels caused about 35% mortality in the broodstock. This resulted in an egg take that was about 10 million less than it otherwise would have been.

Discussion

The strategy of maximizing use of the adult return through increased monitoring went quite well in FY 97. The additional stream surveys, both aerial and ground, as well as closer monitoring of pink salmon entering the Port Graham subdistrict that was underwritten by this project provided the local Alaska Department of Fish & Game (ADF&G) fisheries manager with additional information with which he was able to allow more subsistence and broodstock harvesting opportunities without jeopardizing the wild escapement. It was also very instrumental in establishing a working relationship between the local ADF&G management staff and the village. This may indeed be the longest lasting benefit of the project.

Another method for increasing marine survival will be tested in FY 98. This is to use heated water to cause a batch of pink fry to emerge about 2 weeks earlier than normal. These fry would then be placed in a raceway with seawater heated to about 5° C. They would be reared in the raceway until the ambient seawater temperature reaches 5° C at which time they would be transferred to saltwater rearing pens and held until the peak of the mature zooplankton bloom. It is estimated that by causing the fish to emerge earlier and rearing them on heated saltwater they would reach the 1 gram size by the end of May which is when the peak of the zooplankton bloom occurs. Releasing 1 gram fry into the peak of the zooplankton bloom should greatly enhance the percentage that survive to adults.

From FY 98 on otolith marking will be used to differentiate groups of fish. The advantage of otolith marking is that all fish in a group are marked rather than a representative sample as in cwt marking. Otolith marking has less impact on the fish, is easier to apply and is cheaper than cwt. The main disadvantage is that the fish are marked as eggs and must kept segregated during incubation and rearing to ensure a particular mark receives the treatment intended for it.

Conclusions

The results of the FY 97 activities will not be available until after the 1998 pink salmon return. Because of the probability of long term reared fish contracting vibriosis, the production of 8 gram smolt has been curtailed for the remainder of the project. In its place a study will be conducted in FY 98 to test feasibility of using heated water, both fresh and salt, to produce a group of pink salmon fingerling with a minimum average weight of one gram ready for release during the mature zooplankton bloom in late May. The availability of heated water will also permit the project to use otolith marks to differentiate groups of fish as opposed to the current cwt/ad clip marking. Cooperative management efforts with ADF&G were very successful in FY 97 and will be continued.