Exxon Valdez Oil Spill
Restoration Project Annual Report

Port Graham Pink Salmon Project

Restoration Project 96225
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.

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Study History: The project effort was initiated under Restoration Project 96225, the subject of this annual report. This is the first 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 heavily relied on for subsistence. This project will help ensure that pink salmon remain available for subsistence use until the more tradition species are rejuvenated.

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

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

Citation:

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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, 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 marine survival can be significantly enhanced by rearing the fry to at least double their emergent weight before releasing them.

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 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 prior to release.

The initial FY 96 objective for the marine survival enhancement strategy was to produce a single lot of 250,000 eight gram fish. However, after consultation with fish culture experts and hatchery operators in the state, it was decided to expand the objective to include production of two additional lots of pink salmon fry, each with a different average weight at release.

The first lot contained about 1.5 million fry with an average weight of 0.5 grams. It was released into a major zooplankton bloom on May 23, 1996. The second lot contained around 4.7 million fish. It achieved an average weight of 1 gram and was released on June 10. The third lot containing around 250,000 fish was intended to be reared until it achieved an average weight eight grams which was estimated to be sometime in late August. Unfortunately in mid June this lot contracted a bacterial disease called warm water vibriosis. The ADF&G Fish Pathology Section recommended that these fish be released immediately. Consequently this lot was released on June 20, 1996 with an average weight of 1.3 grams.

Each lot was scheduled to have 10,000 fish marked with a coded wire tag and adipose fin clip (cwt/ad clip). The recovered tags from fish returning to Port Graham would be used to determine the survival rate of each lot. The tagging machine experienced a major breakdown shortly after

tagging began. Since a replacement machine could not be located in time the first two lots were released without any fish being marked. The vibriosis epizootic prevented the third lot from being tagged.

Even though no fish were tagged it will be possible to get a general indication of marine survival by comparing the 1997 return with return from previous years. Virtually all pink salmon return to spawn two years after their parents. This makes comparing marine survival rates among different brood years relatively easy.

Because of the disease problem future attempts to produce eight gram pink salmon smolt will be abandoned. Other methods are being investigated. One idea being considered 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 on 5° C seawater until the ambient seawater temperature reaches 5° C at which time they would be transferred to saltwater rearing pens and held until they reach a 1 gram average weight. 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 their marine survival rate. The hatchery already has on hand the heating and heat transfer equipment that could provide a limited amount of heated seawater for rearing.

The availability of heated water will also permit a study comparing cwt/ad clip marking with otolith marking. If otolith marking proves to be feasible and practical it will likely be adopted for use in FY 98.

The second strategy of maximizing use of the adult return through increased monitoring went quite well in FY 96. 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.

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, 1gram and 8 grams) at release. This approach would allow more fish to be included in the project for the same cost.

A meeting was held with the local ADF&G fisheries manager on 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. 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. 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.

In 1993 and again in 1994 the hatchery experimented with growing a small lot (20,000) 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.

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.

The original methodology that was planned to implement this strategy in FY 96 was to again rear a lot of pink salmon fry to an average weight of eight grams before release, but increase to lot size to 250,000. However, 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 what was found was 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.

In view of this information it was decided to produce a lot of pink salmon with an average weight of one gram in addition to the 8 gram lot. Eight times as many fish could be reared to the 1 gram size compared to the 8 gram size for the same relative cost. The shorter rearing time involved with rearing fish to 1 gram would mean less risk of fish loss from storms or disease. If the marine survival rate of the 1 gram fish was even half the survival rate of the 8 gram fish it would be far more cost effective to produce the 1 gram fish. A third lot of pink salmon would be released into the mature zooplankton bloom to replicate the standard hatchery procedure.

Ten thousand fish from each of the three lots (the zooplankton bloom release, the 1 gram lot and the 8 gram lot) would be differentially marked with a coded wire tag (cwt) and an adipose fin clip (ad clip). This would allow the project to determine and compare the marine survival of each lot.

Results

Of the 6.9 million eyed eggs seeded into the incubators last fall 6.5 million or 93% survived through emergence and were placed in saltwater rearing pens in April, somewhat earlier than normal. Average weight was 0.24 grams. The fry grew well and mortalities were negligible. On May 23, 1996, 1.5 million fry were released at an average weight of 0.5 grams, unusually large for this release. By June 10, the remaining fry had reached an average size of 1 gram. Around 4.7 million of these fry were released on June 10 and 11 leaving about 250,000 fry in the pens. These fry were scheduled to be grown to the eight gram size before release.

On June 17 the remaining fry began experiencing increased mortality. A sample was sent to the ADF&G fish pathology lab in Anchorage for analysis. Tests indicated that these fish were contracting a disease known as warm water vibriosis. This is a disease caused by the bacteria *Vibrio anuiillarum*. It effects salmon held in seawater, usually in temperatures over 50° F, which the case at Port Graham. It is very infectious and difficult to treat. Because of this, ADF&G recommended that all remaining fish in the saltwater pens be released. Consequently, all the fish (approximately 248,000) were released on June 20. The average weight was 1.2 grams.

Unfortunately no tagging was done this year. The tagging machine experienced a major breakdown shortly after tagging began. Since a replacement machine could not be located in time, the first two lots were released without any fish being marked. The vibriosis epizootic prevented the third lot from being tagged.

Discussion

The strategy of maximizing use of the adult return through increased monitoring went quite well in FY 96. 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.

Because of the disease problem future attempts to produce eight gram pink salmon smolt will be abandoned. Other methods are being investigated. One idea being considered 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 on 5° C seawater 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.

The method of marking the different lots of fish will remain cwt/ad clip for FY 97. However, now that the hatchery has the capability to produce heated water the potential for otolith marking needs to be investigated. The advantage of otolith marking is that all fish in a lot 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. If otolith marking appears to be feasible and practical, the procedure will likely be adopted in FY 98.

The overall pink salmon return in 1996 was relatively small. This exacerbated the competition between the subsistence fishery and collecting broodstock for the hatchery. The hatchery was able to take only 1.5 million eggs this year. Without the additional management effort by ADF&G that was underwritten by this project it is likely that the hatchery would have ended up with far fewer eggs.

Conclusions

The results of the FY 96 activities will not be available until after the 1997 pink salmon return. Because of the probability of long term reared fish contracting vibriosis, the production of 8 gram smolt will be curtailed for the remainder of the project. In its place a study will be conducted in FY 97 on the 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 a feasibility study on using otolith marking as opposed to the current cwt/ad clip marking. Cooperative management efforts with ADF&G were very successful in FY 96 and will be continued.