SUMMARY OF PACIFIC SALMON CODED WIRE TAG AND THERMAL MARK APPLICATION AND RECOVERY, PRINCE WILLIAM SOUND, 1999.

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PREFACE

This report was prepared as part of cooperative agreements between the Alaska Department of Fish and Game, the Prince William Sound Aquaculture Association, and the Valdez Fisheries Development Association for State Fiscal Year 1999.

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INTRODUCTION

Primary reporting duties for the Prince William Sound/Copper River Sockeye Salmon Coded-Wire Tag Project and the Pink Salmon Otolith Project have been associated with generation of technical reports for the *Exxon Valdez* Oil Spill Trustee Council. While these reports provide much technical information, they did not evaluate day-to-day project operations and may not have provided all information desired by cooperating private non-profit aquaculture associations, i.e. the Prince William Sound Aquaculture Corporation (PWSAC) and Valdez Fishery Development Association (VFDA). In order to better address the information needs of the aquaculture associations, the Alaska Department of Fish and Game (ADF&G) agreed to submit a separate annual report that provided estimates of hatchery contributions and survival rates by fishing period and week for sockeye and pink salmon.

Funding for sockeye salmon coded-wire tag (CWT) recovery efforts was first obtained as part of a cooperative agreement with PWSAC in 1996. Sockeye salmon tagging and recoveries are summarized in this report. Sockeye salmon are produced at both the Main Bay and Gulkana hatcheries operated by PWSAC. Most production from the Main Bay hatchery is harvested in the Eshamy District of Prince William Sound (PWS), but some has also been harvested from remote releases of sockeye salmon near Coghill River and into Coghill Lake. Gulkana hatchery adult returns result from fry stockings into lakes on the Copper River system. These adults contribute to the marine commercial gill net fishery, the inriver personal use dip net fishery, and the subsistence fishery.

CWT information from sockeye salmon returning to the Copper River system is used to estimate the timing of returns and contributions to the common property commercial fishery and, more recently, the personal use dip-net fishery. Some cost recovery operations occurred on the Crosswind Lake component of Gulkana Hatchery production after these salmon separated themselves from other Copper River stocks.

Chum and coho salmon are only briefly covered in this report. Neither chum nor coho salmon were scanned for CWT's in the common property and cost recovery fisheries. Chum and coho salmon hatchery returns were estimated using historic catch information and these estimates should be considered to be much more uncertain than those based tag recoveries.

Management of chum and coho salmon harvests is not dependent on CWT information. Concern about wild stock interceptions during the Wally H. Noerenberg (WHN) hatchery chum salmon fishery is limited to incidental harvest of Coghill Lake sockeye salmon. Wild stock harvests are not thought to be significant in the hatchery coho salmon fisheries; nearly the entire coho salmon catch from Coghill District and the Port of Valdez is considered to be of hatchery origin.

Management of pink salmon harvests in PWS has become more complex as hatchery production has increased. Harvesting surplus hatchery production without over-harvesting wild stocks is a responsibility of the area management biologist. The otolith program was developed to allow inseason management decisions to be made rapidly and with confidence. Data from otolith recoveries in test and commercial common property fisheries are needed to identify hatchery and wild components in mixed stock fisheries, enabling managers to more accurately target effort on hatchery stocks and reduce exploitation rates on wild stocks when necessary.

The CWT and otolith programs both consist of two components, tag or mark application and tag or mark recovery. Pink salmon have a two-year life cycle, and otolith thermal mark application occurs in the first fall when fish are still in the embryonic stage. Marks applied in brood year 1997 were recovered in 1999. Sockeye salmon have a more variable life cycle. Tags applied in 1999 at the Main Bay and Gulkana facilities will be recovered over several years. While tag recoveries from the summer of 1999 provide estimates of hatchery contributions to catches in that year, these recoveries only provide partial survival information for each brood year, because returns occur over several years. .

METHODS

Applying Tags

The hatcheries in PWS that presently apply CWT's are Main Bay and Gulkana, which produce sockeye salmon. Tagging procedures are similar at both hatcheries and are described in detail in the 1994 Coded Wire Tag Project Report to the *Exxon Valdez* Oil Spill Trustee Council (Restoration Project 94320B, Sharr et al 1995). Fish to be tagged are randomly selected from their release group, marked, and released with their cohorts. At Main Bay hatchery about one sockeye salmon in every 40 is tagged. At Gulkana hatchery sockeye salmon tagging ratios have ranged from one in 7 to one in over 70. Efforts were initiated in 1996 to maintain a tagging ratio of one in 15 at Gulkana hatchery.

Applying Thermal Marks

Thermal marks are applied to the otolith bones during incubation by rapidly changing the water temperature by approximately four degrees Celsius, and maintaining that temperature for at least

24 hours. For PWS pink salmon, water entering incubators is heated by oil fired boilers to achieve the proper temperature change. For early run chum salmon produced at WHN hatchery, thermal marks are applied by manipulating different water supply sources to create the necessary temperature change. Base identifying marks for each hatchery are applied to embryos after development to the "eyed" stage and prior to hatch. Accessory marks to identify different treatment or release groups are generally applied after the embryo has hatched, but prior to swim-up and migration.

Recovering Tags

Tags are recovered inseason from sockeye salmon harvested during common property and cost recovery fisheries. As salmon are pumped from fishing vessels onto tenders, or from tenders onto conveyer belts in processing plants, technicians count every salmon examined and remove the head from every salmon with a missing adipose fin. A goal of sampling 5% of the total sockeye salmon catch was established to ensure that a sufficient number of tags are collected to produce accurate and precise estimates of hatchery contributions. Due to concerns raised by a consultant for PWSAC, the number of samplers and processors sampled for the Copper River gillnet fishery was increased, so that 3 to 5 processors were sampled, instead of one or 2. About 12% of the total catch was sampled. Since returns to Main Bay hatchery were low, and funding was not available to hire a technician to sample landings at Whittier, less than 2% of the Eshamy district common property harvest was sampled.

Tags are also recovered daily from hatchery brood stocks immediately prior to or during egg take procedures at each facility. All sockeye salmon collected by the hatchery for egg production, and egg sales, as well as those collected which are surplus to these needs, are examined for tags. All these fish are counted, and the head is removed from any fish with a missing adipose fin.

All collected heads are sent to the CWT and Otolith Processing laboratory in Juneau, Alaska where tags are removed, read, and the information entered into a database.

Recovering Otoliths

At the conclusion of a common property or cost recovery fishery, otoliths are recovered by systematically sampling tender loads delivered to processors. Systematic samples are collected

by removing otolith pairs from one salmon passing along the processor belt every few minutes. The entire tender is sampled in this manner so that samples are taken throughout the load. If possible, all tenders from several different processors containing salmon from one fishing district and one fishing period are sampled. A weighted sample of 96 otoliths, taken from all otoliths collected after an opening, is formed using a proportional allocation scheme in which each sampled tender contributes otoliths to the total sample in proportion to its load. Another weighted sample of 96 otoliths is taken in a similar manner and stored for possible postseason analysis. The total catch for each period and district used in calculation of weights is obtained from the ADF&G fish ticket system. The recovered sample of 96 otoliths is sent to the Cordova Fish and Game otolith laboratory for mounting and microscopic examination. After the origin of an otolith is determined, the information is transferred to an Access™ computer database prior to calculating the hatchery contribution to the harvest taken during that fishery opening.

Otoliths are recovered in a similar manner from hatchery brood stocks and are processed in the same manner described above. A total daily count of the pink salmon spawned at each hatchery is used in place of the daily catch, and a total sample of 400 otoliths is taken from each brood stock.

All otoliths that are mounted, read and used for contribution calculations are sent to the CWT and Otolith Processing laboratory in Juneau for a quality control second reading. Any reading errors found in the quality control process are corrected in the database and contribution estimates are recalculated.

Estimating Hatchery Contributions with CWT's

Sockeye salmon common property and cost recovery fishery samples are stratified by harvest, district, period, and processor.

The contribution of release group t , C_{St}, to the sampled common property and cost recovery harvests, escapements and brood stocks, is estimated as:

$$\hat{C}_{St} = \sum_{i=1}^{L} x_{it} \left(\frac{N_i \hat{a}}{s_i p_t} \right),$$

where

x_{it} = number of group t tags recovered in the ith stratum,
N_i = total number of fish in the ith stratum,
s_i = number of fish sampled from the ith stratum,

p_t	=	proportion of group t tagged,
a	=	adjustment factor associated with the MB or Gulkana facilities (1999); and,
L	=	number of recovery strata associated with common property, cost recovery, brood stock, and special harvests in which tag code t was found.

The adjustment factor, for a given year, is estimated as the ratio of sampled sockeye salmon in the brood stock to the expanded number of fish based on tags found in the sample and is expressed as:

$$\hat{a} = \frac{s}{\sum_{i}^{T} \frac{x_i}{p_i}},$$

where,

T	=	number of tag code groups released from the hatchery in previous years.
p_i	=	tagging rate at release for the ith tag code (defined as number of tagged fish released with the ith code divided by the total number of fish in release group i),
x_i	=	number of tags of the ith code found in s and,
s	=	number of brood stock fish examined in the hatchery brood stock.

Adjustment factors were calculated for each hatchery in 1999. The purpose of an adjustment factor is to correct for any violation of the assumptions that 1) mortality of tagged and untagged sockeye salmon within a release group is the same and 2) marked sockeye salmon do not lose tags.

An adjustment factor of 1.2 was used for Main Bay hatchery sockeye salmon returns. This factor was calculated from historical brood stock data for this facility. Calculations were made assuming the adjustment factor was the same for fish of different ages, and for fish tagged in different years. A method to account for shed tags and differential mortality is still under review.

Adjustment factors were calculated separately for each returning age class from Gulkana hatchery. Calculations were based on 1999 CWT and age composition samples, and the percent of the catch attributed to each age class. Adjustment factors used for Crosswind Lake were 2.75 for returns from brood year 1994, and 2.19 for returns from brood year 1995. These factors are similar to those used in previous years: 2.84 for 1998, 2.65 for 1997, and 2.62 for 1996. Adjustment factors used for Summit Lake were 8.36 for returns from brood year 1994 and 1.68

for returns from brood year 1995. The adjustment factor for brood year 1994 was much higher than in previous years: 1.00 for 1996, 3.52 for 1997, and 2.52 for 1998.

Gulkana hatchery personnel reported that 81.4% of fin-clipped fish recovered at Crosswind Lake and 88.5% recovered at Summit Lake contained tags in 1999. However, we found that some tags were not being detected. When we rescanned a group of 116 heads from fin-clipped fish recovered at Crosswind Lake which were reported to not contain tags, we found that 15 (12.9%) did contain tags. Assuming a consistent false negative rate, the number of heads recovered with tags should have been 83.8% for Crosswind Lake rather than 81.4%. Missing 12.9% of the tags in the escapement would only have a minor effect on our population estimate, if all tagged fish were sent to the tag lab for dissection and decoding. But, at Crosswind Lake only about 1 out of every 5 heads with detected tags (429 out of 2201) was sent to the lab, and heads which did not register a tag were discarded by hatchery personnel. Missing tags in the escapement result in adjustment factors which are too large, and overestimate the actual Crosswind Lake return. We corrected for missed tags by estimating the number of heads with tags which were discarded. If the proportion of missed tags (12.9% of the heads initially discarded) remained constant over the season, then 65 discarded heads contained a tag. Thus, the expected number of heads with tags was 2266 rather than 2201.

The contribution of release group t to unsampled strata, C_{Ut}, is estimated from contribution rates associated with strata which were sampled from the same district-week openings as the unsampled strata and is expressed as:

$$\hat{C}_{Ut} = \sum_{i=1}^{U} \left[N_i * \left(\frac{\sum_{j=1}^{S} \hat{C}_{Stj}}{\sum_{j=1}^{S} N_j} \right) \right],$$

where

U	=	number of unsampled strata,
N_i	=	number of fish caught in ith unsampled stratum
S	=	number of strata sampled in the period in which the unsampled stratum resides,
C_{Stj}	=	contribution of release coded with tag t to the sampled stratum j, and
N_j	=	number of fish in jth sampled stratum.

An estimate of the contribution by tag code t to all strata, sampled and unsampled, is given by

$$\hat{C}_t = \hat{C}_{St} + \hat{C}_{Ut}$$

A variance approximation for $\hat{C}_t$, derived by Clark and Bernard (1987) and simplified by Geiger (1990) was used:

$$\hat{V}(\hat{C}_t) = \sum_{i=1}^{L} x_{it} \left[\frac{N_i \hat{a}}{s_i p_t} \right] \left[\frac{N_i \hat{a}}{s_i p_t} - 1 \right].$$

Summation of variance components over all tag codes provided an estimate of the variance of the total hatchery contribution. Variance components associated with unsampled strata are assumed to be negligible.

Estimation of wild stock production from Coghill and Eshamy lakes was made by summing all sockeye salmon harvests and removing all hatchery production estimated from CWT recoveries. All sockeye salmon caught in the Coghill District in excess of hatchery production were assumed to be Coghill wild stock. Since the common property fishery in the Eshamy district occurred after the Coghill wild stock run was complete, we assumed no Coghill wild stock were caught in that fishery. None of the smolt released in 1996 contained CWT's, so no tags could be recovered from returning adults. All the sockeye salmon harvested in the Southwest District were assumed to be Eshamy wild stock. Wild stock sockeye salmon harvested in other districts were not included in either Coghill or Eshamy lake production estimates.

Estimating Hatchery Contributions with Otoliths

Otolith-derived estimates of the contribution of hatchery h, C_{Sh}, to the sampled common property and cost recovery harvests, escapements and brood stocks, are calculated as:

$$\hat{C}_{Sh} = \sum_{i=1}^{Q} \frac{o_{hi}}{n_i} N_i$$

where,

o_{hi}	=	Number of otoliths from hatchery h in sample n_i
n_i	=	Number of otoliths sampled from stratum i (usually 96)
N_i	=	Number of fish caught in stratum i
Q	=	number of recovery strata associated with common property, cost recovery, brood

stock, and special harvests in which otoliths from hatchery h were found.

An estimate of the contribution by hatchery h to unsampled strata (very few), $\hat{C}_{Uh}$, was made in a manner similar to that for the CWT program.

An estimate of the contribution by hatchery h to all strata, sampled and unsampled, is given by

$$\hat{C}_h = \hat{C}_{Sh} + \hat{C}_{Uh}$$

A variance estimate for $\hat{C}_h$ is given by:

$$\hat{V}(\hat{C}_h) = \sum_{i=1}^{Q} \frac{N_i^2 o_{hi}}{n_i^2}\left(1 - \frac{o_{hi}}{n_i}\right)$$

For any sampled stratum, the estimate of the proportion of the catch comprised of hatchery fish is made such that there is a 95% chance that it is within 10% of the true proportion. When combined over strata, the precision of the estimated hatchery contribution improves.

Estimating Survival Rates with CWT's

The survival rate of CWT release group t (S_t), is estimated as:

$$\hat{S}_t = \frac{\hat{C}_{St} + \hat{C}u_t}{R_t},$$

where

R_t = total number of fish in release group coded with tag t released from hatchery.

Assuming the total release of salmon associated with a tag code is known with negligible error, and the cumulative variance contributions associated with the unsampled strata are small, a suitable variance estimate for S_t is given by:

$$\hat{V}(\hat{S}_t) = \frac{\sum_{i=1}^{L} x_{it} \left[\frac{N_i \hat{a}}{s_i p_t}\right]\left[\frac{N_i \hat{a}}{s_i p_t} - 1\right]}{R_t^2}.$$

Estimating Survival Rates with Otoliths

An estimate of the survival rate for hatchery h, S_h, is made from otolith recoveries as:

$$\hat{S}_h = \frac{\hat{C}_{Sh} + \hat{C}_{Uh}}{R_h}$$

where,

R_h = Number of pink salmon released from hatchery h.

An approximate variance of $\hat{S}_h$ is given by:

$$\hat{V}(\hat{S}_h) = \frac{\sum_{i=1}^{Q} \frac{N_i^2 o_{hi}}{n_i^2}\left(1 - \frac{o_{hi}}{n_i}\right)}{R_h^2}$$

There were very few unsampled strata and the variance associated with $\hat{C}_{Uh}$ is assumed to be negligible.

Estimating Hatchery Contributions Using Other Methods

Estimates of contributions of chum salmon produced by the WHN hatchery to common property and cost recovery fisheries were made by subtracting a pre-hatchery average catch from the years 1971 through 1983 (121,621) from the total catch in the Coghill District. Hatchery chum salmon

contributions to catches in the Eshamy District were estimated differently. There are no historic records of chum salmon catches prior to July 31 for this district. Before Main Bay hatchery production started, Eshamy District opened for harvesting Eshamy Lake sockeye salmon during late July and August. Chum salmon captured during this fishery were considered to be late run wild stocks. After hatchery production of early run chum salmon began, fishing occurred in June and early July. Chum salmon catch contribution estimates are available from CWT recoveries in Eshamy District prior to July 31 only for 1994. The early run catch estimate for that year is 7,730 wild chum salmon. We assumed a similar number of early run wild chum salmon were harvested in 1999, and subtracted this number from the Eshamy District chum salmon harvest prior to July 31 to estimate the hatchery contribution.

During 1999 Eshamy District common property fisheries, only the first four statistical weeks were sampled due to low sockeye salmon returns and a lack of sampling personnel. In order to estimate hatchery contributions for the remaining five statistical weeks, the percentage of Eshamy sockeye salmon in the catch was regressed on statistical week. We assumed none of the sockeye caught from weeks 33 to 37 were wild.

Stratification of Hatchery Contribution Estimates

Sockeye Salmon

Main Bay hatchery contributions of sockeye salmon to common property fisheries were estimated by statistical week during 1999. Gulkana hatchery contributions of sockeye salmon to common property fisheries were estimated by period for 1999, while contributions to the personal use fishery were estimated by calendar week. Hatchery contributions of sockeye salmon to brood stock for each hatchery were estimated by statistical week for 1999.

Pink Salmon

Hatchery contributions of pink salmon to common property fisheries were estimated for each fishing period during 1999. Contribution information for cost recovery fisheries was reported in 3 or 4 day increments. Adjacent 3 and 4 day strata encompassed a statistical week. Pink salmon brood stock hatchery contributions were usually estimated by statistical week.

Chum Salmon

Hatchery contributions of chum salmon to common property fisheries, cost recovery harvests, and brood stock were estimated after the 1999 fishing season for total salmon captured rather than by period or statistical week.

Coho Salmon

Hatchery contributions of coho salmon to common property fisheries, cost recovery harvests, and brood stock were estimated after the 1999 fishing season for total salmon captured rather than by period or statistical week.

RESULTS AND DISCUSSION

Much of the CWT information supplied in the following section was derived from summary reports submitted for each facility in 1999 (Table 1). Thermal mark information was also obtained from summary reports submitted for each facility.

We realize that 1999 Summit Lake adjustment factors for sockeye salmon are inaccurate, but there is not enough information to determine the specific causes and correct the error. Fortunately, the Summit Lake contribution to the Copper River fishery is small, so an error in the adjustment factor for this system has a very minor effect on the overall hatchery contribution estimates for Copper River fisheries.

Greater care must be taken to determine the presence or absence of tags when sampling sockeye salmon during Crosswind Lake escapement surveys. Missing tags increase the value of the adjustment factor which in turn results in an overestimate of the actual hatchery contribution. In 1999, the hatchery contribution estimate for Crosswind Lake decreased by about 25,000 fish when an estimate of mistakenly discarded heads containing tags was included in calculations.

Applying CWT's in 1999

Main Bay Hatchery

Main Bay hatchery staff tagged sockeye salmon smolt produced from 1997 brood year Eyak and Eshamy stocks and the 1998 brood year Coghill stock. The Coghill stock was released into Solf Lake. All stocks released were tagged at a 40:1 ratio (Table 1).

Gulkana Hatchery

Gulkana hatchery produces sockeye salmon fry for release into lakes which have more rearing than spawning capacity. Smolt migrating the following year are then captured, counted, and tagged. The 1999 smolt migration from Summit Lake started June 04 and ended July 19. Average smolt size was 7.0 grams. A total of 104,323 smolt migrated from the lake, of which 6,830 were marked with CWTs for a tagging ratio of 1:15.27. The smolt migration from Crosswind Lake's started June 06 and ended July 08. A total of 1,235,157 smolt migrated from Crosswind Lake, of which 82,590 were marked with CWTs for a tagging ratio of 1:14.96. The tagging ratio for all tag codes combined approached 1:15 (Table 1).

Prior to 1994, smolts migrating from Crosswind and Summit lakes were not counted, and contribution estimates were based on assumptions regarding fry to smolt survival. Beginning in 1996, smolts were counted, and a 1:15 untagged to tagged ratio was established as the standard for both lakes. All year classes returning in 1999 were from release groups having a 1:15 tag ratio. This allowed us to make inseason hatchery contribution estimates using only detected-tag information. Although, tag ratios for individual tag codes returning in 1999 ranged from nearly 1:1 to 1: 53, the overall tag ratio approached 1:15. Variable tagging ratios among tag-code groups probably did not affect our estimates, because run timing does not differ substantially among tag-code groups. Fishery managers considered inseason hatchery contribution estimates when setting fishing times and areas for both commercial gill net and dip net fisheries.

Applying Thermal Marks in 1999

A. F. Koernig Hatchery

Otoliths of pink salmon were thermal marked with a four ring band as the base mark. Pink salmon in several incubator modules were treated after hatching so that an accessory mark was produced in addition to the base mark. A total of 133.16 million thermally marked pink salmon fry were released at the hatchery site. Of these, 42.51 million fry had a three ring accessory mark and 37.37 million fry had a four ring accessory mark on their otoliths.

W. H. Noerenberg Hatchery

All pink and chum salmon fry released at WHN hatchery and at the Port Chalmers remote chum salmon release site received thermal marks. The 123.86 million pink salmon released at the WHN hatchery during the plankton bloom in Prince William Sound received a base mark prior to hatching of one band with eight rings. Of these, 32.6 million pink salmon fry had a three ring accessory mark, and 12.92 million had a four ring accessory mark on their otoliths. Accessory marks were applied to otoliths after fry hatched so that they could be distinguished as an early release rearing group.

A total of 75.02 million chum salmon fry were released at the WHN hatchery site. These fry were divided into two groups for release: the first was released in mid-May and the second was released in late May. The 37.94 million fry released as the first group received a base mark of one band with three rings followed by an accessory mark of band with two rings. The 37.08 million chum salmon fry released as the second group received the same base mark and an accessory mark of one band with four rings. All marks were applied before eggs hatched.

A total of 24.27 million chum salmon produced at the WHN hatchery were released at a remote site near Port Chalmers. All fry received a base mark of one band with six rings. While all fry were released on May 23, about half of them, 12.92 million, had an accessory mark of 2 rings to identify them as late release fry.

Cannery Creek Hatchery

All 131.20 million pink salmon fry released at the Cannery Creek hatchery site received a thermal base mark of one band with 3 rings followed by a second band of three rings. All marks were applied before eggs hatched.

Solomon Gulch Hatchery

All 213.91 million pink salmon fry released at the Solomon Gulch hatchery site received a thermal base mark of one band with six rings. One group of 113.49 million fry was released on April 29, and a second group of 100.42 million fry was released on May 20. No accessory marks were applied to these groups.

CWT-Derived Hatchery Contributions to the 1999 Harvest

Common Property Harvest Estimates Derived Using Coded Wire Tags

Sockeye Salmon The 1999 sockeye salmon common property catch in PWS is estimated to have been 2.04 million fish. The Copper River harvest was 1.68 million sockeye salmon of which 0.63 million were of hatchery origin (Table 2). The Crosswind Lake component was 598.3 thousand sockeye salmon, the Summit Lake component was 32.0 thousand, and the Main Bay component was 2.7 thousand released at Main Bay and 1.1 thousand released at Marsha Lake. The actual production of Gulkana hatchery is greater than this, because sockeye salmon released into Paxson Lake were not tagged.

The Coghill District common property fishery was not sampled in 1999. Although a portion of the sockeye salmon pre-smolt released into Coghill Lake during 1995 should have returned as age-.3 fish during 1999, all returning adults were assumed to be wild fish. The common property catch of sockeye salmon in Coghill district was 109.26 thousand fish.

The Eshamy district common property harvest included 160.4 thousand sockeye salmon and occurred during statistical weeks 29 through 37 (Table 3). The dominant year class of hatchery

sockeye salmon was from brood year 1995 Eshamy stock. The actual hatchery contribution to the fishery could not be calculated, because Coghill stock sockeye salmon from brood year 1994 were released untagged in January 1996 after a water pipeline break. Of the total catch, 124.6 thousand were estimated to be Eshamy stock and 31.1 thousand were estimated to be Coghill stock. Regression analyses using available CWT data indicated that all of the catch landed after statistical week 33 were probably of Eshamy origin. Although one tag was recovered from a Gulkana hatchery sockeye salmon during week 30, this fish may have actually been harvested in the Copper River District and subsequently mixed with fish from the Eshamy District either aboard a tender or at a processing plant .

Cost Recovery Harvest Estimates Derived Using Coded Wire Tags

Sockeye Salmon In 1999, PWSAC conducted a cost recovery fishery on sockeye salmon bound for Crosswind Lake. A total of 89.4 thousand sockeye were captured at a weir in the river draining Crosswind Lake and 36.8 thousand were sold (Table 4). All sockeye salmon returning to Crosswind Lake were assumed to originate from Gulkana hatchery, and CWT samples taken at the weir were used to generate adjustment factors. No cost recovery fishery was conducted at Main Bay hatchery during 1999.

Other Harvest Estimates Derived Using Coded Wire Tags

Sockeye Salmon Lack of an adequate sampling program in the Personal Use and lack of any sampling program for subsistence fisheries caused hatchery contributions to be underestimated. The Personal Use fishery harvest from the Copper River was 132.7 thousand sockeye salmon, which included an estimated 32.3 thousand sockeye salmon produced by Gulkana hatchery(Table 5). An estimated 73.5 thousand sockeye were taken during the subsistence fishery in the Copper River, but none of this catch was scanned for CWT's and hatchery contributions were not estimated.

A total of about 130.7 thousand sockeye salmon returned to Gulkana hatchery, Crosswind Lake and Summit Lake (Table 4). Of the 33.5 thousand fish which returned to Gulkana hatchery, 16.8 thousand were used for brood stock. All sockeye salmon returning to the Gulkana hatchery sites were assumed to be hatchery produced. About 89.4 thousand sockeye salmon returned to Crosswind Lake, of which 36.8 thousand were sold. Only 7.9 thousand sockeye salmon returned to Summit Lake and were counted at the weir. The minimum estimated number of Crosswind and Summit lake fish that passed the Miles Lake sonar is 133.0 thousand fish. This number is considered to be an underestimate since it did not include estimates of Crosswind and Summit

lake sockeye salmon caught in the subsistence fishery, which was not sampled, or an estimate of the Paxson Lake hatchery sockeye salmon contribution, because these fish were not tagged.

All sockeye salmon passing Coghill River weir were assumed to be wild fish. Only two samples were taken at the weir, and neither contained tagged fish. Due to an unexpectedly strong escapement into Coghill Lake, 9.4 thousand sockeye salmon were harvested by the department to avoid production problems that could arise from over escapement. The total escapement into Coghill Lake was 59.3 thousand sockeye salmon.

Eshamy weir was operated this year using funds obtained from Department sales of sockeye salmon at Coghill Lake. No remote released fish were expected to return during 1999, and no CWT samples were taken at the weir. A total of 27.1 thousand sockeye salmon were counted through the weir.

The common property fishery in the Eshamy District was postponed until sufficient Coghill stock brood had returned to the Main Bay hatchery. Since many of these fish were survivors of a release of untagged fry in January 1996 , only 48% of the brood stock could be classified (Table 6). The rest were assigned to the "untagged" category. A total of 7.7 thousand sockeye salmon were counted through the gate in the brood pond. The brood stock numbers were slightly higher, but could not be reconciled with the original sample, due to a time lag and unscanned fish jumping into the brood pond.

Otolith-Derived Hatchery Contributions to the 1999 Harvest

Common Property Harvest Estimates Derived Using Thermal Marks

Pink Salmon The 1999 pink salmon return to PWS and the Copper and Bering rivers was 51.7 million. This was the largest recorded pink salmon return to these areas. The pink salmon migration began 7 to 10 days later than normal. The total harvest in PWS was 45 million pink salmon. The common property pink salmon harvest was 31.62 million, and 13.37 million were taken during cost recovery fisheries which includes roe-stripped fish (Table 7). Four million three hundred thousand pink salmon were taken for brood stock. This number included an estimate of the number of fish that returned to the hatcheries but were not utilized during the eggtake, as well as fish which were processed for roe. In addition, 2.4 million pink salmon naturally escaped into index streams.

The Solomon Gulch hatchery produced the largest hatchery return this season with 14.79 million fish. The WHN hatchery was the second highest producing hatchery with a return of 9.47 million fish. The AFK hatchery had the next highest return with 9.45 million fish followed by

Cannery Creek hatchery with 8.72 million. In general, the nearest hatchery producing pink salmon contributed the largest number of pink salmon to the harvest in each district. Some pink salmon were left unharvested at the end of the season due to lack of markets. About 1,000,000 pink salmon were not harvested at the AFK and Cannery Creek hatcheries. At WHN and Solomon Gulch hatcheries about 500,000 and 300,000 fish were not harvested, respectively. Pink salmon hatchery contributions by district to the common property fishery are presented in Table 8. Specific contribution estimates for each district and period are presented in Tables 9 through 16.

Cost Recovery Harvest Estimates Derived Using Thermal Marks

Pink Salmon Hatchery pink salmon contributions to the cost recovery harvests were the highest for the Solomon Gulch hatchery at 4.35 million. The remaining hatchery contributions to the cost recovery harvests were WHN, 3.86 million; AFK, 2.99 million; Cannery Creek, 2.01 million; and wild fish, 0.1 million (Table 17). Hatchery pink salmon contributions by hatchery and date caught are presented in Tables 18 to 21.

Brood Stock Estimates Derived Using Thermal Marks

Pink Salmon Hatchery brood stocks were composed almost entirely of fish released from the hatchery of origin. (Table 22). Small numbers of wild pink salmon were present in the Cannery Creek and AFK hatchery brood stocks. WHN fish were also present in the brood stock of these 2 hatcheries. Detailed information on specific brood stocks is presented in Tables 23 through 26. Pink salmon that were not harvested are included in the brood stock tables.

Hatchery Contribution Estimates for Species Not Marked

Common Property Harvest Estimates for Species Not Marked

Chum salmon The chum salmon return to Eshamy and Coghill Districts totaled 2.32 million adults. The WHN hatchery produced about 2.19 million chum salmon adults (total catch - (historical average wild catch prior to 7/31 in Coghill District + 1994 wild catch in Eshamy District) + brood and excess brood). The common property chum salmon catch was comprised

of 1.31 million chum salmon in the Coghill District and 24.2 thousand in Eshamy District. The hatchery chum salmon portion of the common property catch was 1.19 million in Coghill District, and 16.5 thousand in Eshamy District.

The Port Chalmers common property catch was 638.7 thousand chum salmon. These fish were produced at WHN hatchery and released at Port Chalmers. No cost recovery occurred at this location and none of the fish were used as brood stock.

The total chum salmon return to the Valdez area, subdistricts 50, 60 and 61, was 43.9 thousand adults. The common property catch in these subdistricts was 42.5 thousand adults. The total cost recovery catch of chum salmon at Solomon Gulch hatchery was 0.3 thousand fish. The total number of chum salmon that were excess brood and salvaged for roe was 1.1 thousand adults. The Solomon Gulch hatchery produced about 1.4 thousand chum salmon (total CPF catch - (historical wild chum salmon CPF catch in the Valdez statistical area) + brood and excess brood).

Coho salmon The total coho salmon return to the Valdez area was about 133.7 thousand adults. This estimate includes an estimated 50 thousand sport harvest. Official estimates from sport fish statewide harvest surveys will not be available until next year. After the removal of the historical wild catch in the area, the total hatchery return was about 133.2 thousand fish. This return equates to a 7.5% survival from release.

The total coho salmon return to the Coghill District was about 1.2 thousand adults. Sport harvests are estimated at about 50 fish. After removal of the historical wild catch, the hatchery return was about 0.3 thousand. This return equates to a 0.1% survival from release. An additional 1.6 thousand coho were estimated to have returned to remote release locations for harvest by sport fishing anglers.

Cost Recovery Harvest Estimates for Species Not Marked

Chum Salmon In the Coghill District, 775.6 thousand chum salmon were harvested for hatchery cost recovery. The total brood stock available was 207.1 thousand which includes holding mortality and fish remaining after the egg take was complete.

Survival Rates

The survival rates by hatchery for pink salmon ranged from 6.34% to 9.13% (Table 27). The survival rate associated with the WHN hatchery was the highest overall. Two different pink salmon release groups were reared at the WHN hatchery. Those reared and released late in the spring had a survival rate of 8.47%, while those released into the plankton bloom survived at 9.41%. The overall survival rate for AFK hatchery fish was second highest at 8.91%. At AFK hatchery, fry released late and large survived at 11.1%, while fry released into the plankton bloom survived at 7.53%.

Sockeye salmon returns from brood year 1994 are complete, so smolt to adult survivals can be estimated (Table 28). The brood year 1995 returns are only partially complete, because the three ocean fish will return in the summer of 2000. The brood year 1995 survivals are listed to provide a look at the pattern of among release groups.

CONCLUSIONS

1) Hatchery production of pink salmon in PWS was very good at PWSAC and VFDA hatcheries in 1999. Survivals were less variable among hatcheries in 1999 than in 1998.

2) No adults returning from Main Bay hatchery presmolt releases into Coghill Lake were detected in catches.

3) At AFK hatchery, large pink salmon fry released later in the season had survival rates about 47% greater than those of fry released earlier into the plankton bloom. At WHN hatchery, fry released later at a large size had a survival rate 10% lower than those released into the plankton bloom.

4) The chum salmon return to WHN hatchery was very good in 1999.

5) The coho salmon return to WHN hatchery was very poor. The less than 0.1% survival from smolt to adult was the poorest survival to date for coho salmon released from that facility.

LITERATURE CITED

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Sharr, S., R.R. Riffe, S. Gehlbach, D.E. Evans, and B.G. Bue. 1995. Coded Wire Tag Recoveries from Pink Salmon in Prince William Sound Salmon Fisheries, 1994. EVOS TC Restoration Study 94320B, Alaska Department of Fish and Game, Cordova.

Table 1. Hatchery Releases for Valdez Fisheries Development Association and Prince William Sound Aquaculture Corporation during 1999.

Species	Hatchery	Location of Release	Type of Mark	Tag Code or Thermal Mark	Release Dates	Release Weight (gms)	Number Released	Number Tagged	Tag Ratio
Sockeye	Main Bay	Main Bay	CWT	310148	5/20	9.1	1,815,494	50,047	36.28
		Main Bay	CWT	310149	5/15 - 5/20	4.6 - 8.3	2,350,292	59,758	39.33
		Main Bay	CWT	310150	5/14 - 5/15	9.8	2,803,660	71,300	39.32
		Total					6,969,446	181,105	38.48
		Solf Lake	CWT	1301040115	6/18	0.4	103,142	2,597	39.72
	Gulkana	Crosswind Lake	CWT	310151	6/06 - 6/23	9.0	608,363	34,661	17.55
		Crosswind Lake	CWT	310152	6/23 - 6/28	11.3	456,782	34,967	13.06
		Crosswind Lake	CWT	310153	6/28 - 7/08	12.8	170,012	12,962	13.12
		Total					1,235,157	82,590	14.96
		Summit Lake	CWT	310157	6/04 - 7/19	7.0	104,323	6,830	15.27
Coho	Solomon Gulch	Port Valdez		No Tag	6/11	15.9	1,843,718	0	N/A
		Boulder Bay		No Tag	6/15	15.9	19,810	0	N/A
	W.H. Noerenberg	Lake Bay		No Tag	6/07	17.3	431,840	0	N/A
		Cordova		No Tag	6/06	20.0	99,943	0	N/A
		Whittier		No Tag	6/09	15.6	81,685	0	N/A
		Chenega		No Tag	6/10	13.2	56,467	0	N/A
Chum	W.H. Noerenberg	Lake Bay	otolith	(1:1.3,2.2)	5/14	1.7	37,938,786	37,938,786	1.00
		Lake Bay	otolith	(1:1.3,2.4)	5/26	2.1	37,081,099	37,081,099	1.00
		Total					75,019,885	75,019,885	
		Port Chalmers	otolith	(1:1.6 & 1:1.6,2.2)	5/23	1.7	24,273,399	24,273,399	1.00
Pink	Armin F. Koernig	Sawmill Bay	otolith	(1:1.4 & 1:1.4 +2.3)	4/30	0.3	71,533,521	71,533,521	1.00
		Sawmill Bay	otolith	(1:1.4 & 1:1.4+2.4)	5/14	0.4	61,623,474	61,623,474	1.00
		Total					133,156,995	133,156,995	
	Cannery Creek	Unakwik Inlet	otolith	(1:1.3, 2.3)	4/30 - 5/24	0.3	131,195,588	131,195,588	1.00
	Solomon Gulch	Port Valdez	otolith	(1:1.6)	4/29	0.4	113,490,717	113,490,717	1.00
		Port Valdez	otolith	(1:1.6)	5/20	0.6	100,415,925	100,415,925	1.00
		Total					213,906,642	213,906,642	
	W.H. Noerenberg	Lake Bay	otolith	(1:1.8+2.3 & 1:1.8+2.4	4/29	0.5	58,382,494	58,382,494	1.00
		Lake Bay	otolith	(1:1.8)	5/20	0.7	65,487,184	65,487,184	1.00
		Total					123,869,678	123,869,678	

Table 2. Estimated hatchery contributions of sockeye salmon to the Copper River gillnet fishery during 1999. 1/

Date	Period	Main Bay		Other		Crosswind Lake		Summit Lake		Total Hatchery		Wild + Paxson Lk.		Total	Total	Number
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Catch	Sampled	Tags
05/14	1											24,439	100.0	24,439	5,716	0
05/17	2											37,804	100.0	37,804	5,436	0
05/21	3							3,293	3.0	3,293	3.0	105,911	97.0	109,204	8,503	2
05/24	4							511	0.4	511	0.4	126,450	99.6	126,961	17,025	1
5/27 - 5/28	5							485	0.5	485	0.5	102,213	99.5	102,698	12,651	1
5/31 - 6/01	6							859	0.8	859	0.8	105,231	99.2	106,090	14,396	2
6/04 - 6/05	7							111	0.1	111	0.1	83,739	99.9	83,850	11,272	1
06/14	8					5,566	9.3	1,723	2.9	7,289	12.1	52,831	87.9	60,120	8,759	24
06/18	9					7,674	12.1			7,674	12.1	55,525	87.9	63,199	13,483	47
6/24 - 6/25	10	497	0.8			25,454	42.0	197	0.3	26,148	43.1	34,503	56.9	60,651	5,959	48
6/28 - 6/29	11					32,029	39.6	3,353	4.1	35,382	43.7	45,532	56.3	80,914	11,515	106
7/01 - 7/02	12					71,783	47.8	6,624	4.4	78,407	52.2	71,737	47.8	150,144	11,938	146
7/05 - 7/06	13			1068	0.9	66,711	57.8	3,133	2.7	70,912	61.5	44,465	38.5	115,377	12,684	216
7/08 - 7/09	14					72,804	69.4	2,267	2.2	75,071	71.5	29,869	28.5	104,940	13,406	214
7/12 - 7/13	15	1686	1.4			80,860	67.1	1,278	1.1	83,824	69.5	36,755	30.5	120,579	11,413	160
7/15 - 7/16	16					60,944	75.6	2,228	2.8	63,172	78.4	17,392	21.6	80,564	8,336	159
7/19 - 7/21	17					72,751	82.0	597	0.7	73,348	82.7	15,365	17.3	88,713	8,681	166
7/22 - 7/24	18					57,791	78.7	431	0.6	58,222	79.3	15,190	20.7	73,412	4,573	91
7/26 - 7/28	19					26,472	60.7	915	2.1	27,387	62.8	16,241	37.2	43,628	5,912	79
7/29 - 7/31	20					13,806	50.5	3,418	12.5	17,224	63.0	10,113	37.0	27,337	4,910	62
8/02 - 8/03	21	604	5.6			2,429	22.5	541	5.0	3,574	33.2	7,200	66.8	10,774	2,194	18
8/05 - 8/06	22					814	14.3			814	14.3	4,880	85.7	5,694	1,412	9
8/09 - 8/10	23 2/					339	14.3			339	14.3	2,031	85.7	2,370		
8/16 - 8/17	24 3/											2,083	100.0	2,083		
8/23 - 8/24	25 3/											832	100.0	832		
8/30 - 8/31	26 3/											180	100.0	180		
9/16 - 9/17	27 3/											2	100.0	2		
Subtotals		2,787	0.2	1,068	0.1	598,227	35.6	31,964	1.9	634,046	37.7	1,048,513	62.3	1,682,559	200,174	1,552

1/ Periods during which samples were taken delineated in bold script.

2/ Proportions from period 22 were used to estimate hatchery contribution estimate.

3/ No samples were taken. All fish were assumed to be wild.

Table 13. Estimated hatchery contributions of pink salmon to the Southwestern District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/20	1											0
7/22	2											0
7/25	3											0
7/27	**4**	17,873	27.5	3,763	5.8	8,466	13.0	5,644	8.7	29,161	44.9	64,907
7/29	**5**	21,294	13.5	4,914	3.1	18,018	11.5	21,294	13.5	91,725	58.3	157,245
8/2	**6**	11,764	3.2	50,978	13.7	54,899	14.7	47,057	12.6	207,833	55.8	372,531
8/4	**7**	5,382	1.0	53,815	10.4	107,631	20.8	182,972	35.4	166,827	32.3	516,627
8/8	**8**	8,721	1.1	104,656	12.6	122,098	14.7	366,294	44.2	226,754	27.4	828,523
8/10	**9**			78,641	13.5	114,937	19.8	223,825	38.5	163,331	28.1	580,734
8/12	**10**			192,780	17.7	204,120	18.7	521,640	47.9	170,101	15.6	1,088,641
8/14	**11**	9,000	1.1	126,002	14.7	108,001	12.6	423,005	49.5	189,003	22.1	855,011
8/16	**12**			97,198	11.6	114,871	13.7	547,844	65.3	79,526	9.5	839,439
8/18	**13**			131,443	17.9	77,319	10.5	402,062	54.7	123,711	16.8	734,535
8/20	**14**			128,636	16.8	64,318	8.4	450,227	58.9	120,596	15.8	763,777
8/22	**15**			38,967	7.3	58,450	10.9	375,057	70.0	63,322	11.8	535,796
8/24	**16**			14,782	3.2	44,345	9.5	285,781	61.1	123,181	26.3	468,089
8/25-8/27	**17**			68,398	19.8	41,799	12.1	136,796	39.6	98,798	28.6	345,791
8/28-8/31	22 2/			83,640	19.8	51,114	12.1	167,280	39.6	120,814	28.6	422,848
9/1-9/3	22 2/			21,126	19.8	12,911	12.1	42,252	39.6	30,516	28.6	106,805
9/4-9/7	22 2/			13,329	19.8	8,145	12.1	26,658	39.6	19,253	28.6	67,385
9/8-9/10	22 2/											0
9/11-9/14	22 3/							18,330	100.0			18,330
9/15-9/17	23 3/							199,695	100.0			199,695
9/18-9/21	24 3/							333,778	100.0			333,778
9/22-9/24	25 3/							178,630	100.0			178,630
9/25-9/28	26 3/							32,881	100.0			32,881
TOTAL		74,034	0.8	1,213,068	12.8	1,211,442	12.7	4,989,002	52.4	2,024,452	21.3	9,511,998

1/ Periods when samples were taken delineated in bold script.

2/ Proportions from Period 17 were used to apportion the catch.

3/ Excess brood caught for roe was assumed to originate from A.F. Koernig hatchery.

Table 3. Estimated hatchery contributions of sockeye salmon to the Eshamy district common property fishery during 1999. 1/

Week Ending Date	Stat Week	Fish Released in Main Bay								Other		Wild		Total Catch	Total Sampled	Number Tags
		Coghill Stock		Eshamy Stock		Main Bay Stock		Eyak Stock								
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent			
7/17	**29**	4,165	53.7	1,680	21.6			208	2.7			1,710	22.0	7,763	876	15
7/24	**30**	7,807	46.6	7,845	46.8					1,099	6.6			16,751	379	9
7/31	**31**	3,041	12.6	19,408	80.3							1,708	7.1	24,157	1,120	22
8/07	**32**	14,951	36.3	26,263	63.7									41,214	797	22
8/14	33 2/	1,090	6.8	14,982	93.2									16,072		
8/21	34 3/			22,481	100.0									22,481		
8/28	35 3/			18,979	100.0									18,979		
9/04	36 3/			9,997	100.0									9,997		
9/11	37 3/			2,996	100.0									2,996		
Subtotals		31,054	19.4	124,631	77.7	0	0.0	208	0.1	1,099	0.7	3,418	2.1	160,410	3,172	68

1/ Periods during which samples were taken delineated in bold script.

2/ A linear regression, developed from proportions of the sampled statistical weeks, was used to apportion the catch.

Table 4. Gulkana hatchery sockeye salmon counted in brood stock and in escapement surveys during 1999.

Brood and Escapement Surveys		Gulkana Hatchery 1/	Crosswind Lake	Summit Lake	Total
Stat Week	Date	Number	Number	Number	Number
33	8/08 - 8/14		7,063		7,063
34	8/15 - 8/21		18,822		18,822
35	8/22 - 8/28		3,353	254	3,607
36	8/29 - 9/04	634	4,660	401	5,695
37	9/05 - 9/11	3,269	21,511	917	25,697
38	9/12 - 9/18	8,071	16,346	2,352	26,769
39	9/19 - 9/25	7,978	12,398	2,134	22,510
40	9/26 - 10/02	5,488	4,471	1,224	11,183
41	10/03-10/09	2,730	753	490	3,973
42	10/10-10/16	5,318		98	5,416
Subtotals		33,488	89,377	7,870	130,735

1/ Number includes fish returning to Gulkana hatchery and nearby springs. Total number of fish used in egg take equals 16,777.

Table 5. Estimated hatchery contributions of sockeye salmon to the Chitina personal use fishery during 1999. 1/

Dates	Week	Crosswind Lake		Summit Lake		Hatchery		Wild & Paxson Lake		Total Catch	Total Sampled	No. of Tags
		Number	Percent	Number	Percent	Number	Percent	Number	Percent			
5/31-6/6	1											
6/7-6/13	**2**							1,105	100.0	1,105	48	0
6/14-6/20	**3**							3,733	100.0	3,733	497	0
6/21-6/27	**4**							24,199	100.0	24,199	1,384	0
6/28-7/4	**5**	128	0.8			128	0.8	16,364	99.2	16,492	1,436	1
7/5-7/11	**6**							15,162	100.0	15,162	738	0
7/12-7/18	**7**	404	2.5			404	2.5	15,865	97.5	16,269	593	2
7/19-7/25	**8**	9,847	63.0			9,847	63.0	5,784	37.0	15,631	1,375	17
7/26-8/1	**9**	9,391	61.9	244	1.6	9,635	63.5	5,528	36.5	15,163	1,315	23
8/2-8/8	**10**	5,062	61.8			5,062	61.8	3,134	38.2	8,196	453	5
8/9-8/15	**11**	1,541	28.3			1,541	28.3	3,913	71.7	5,454	105	2
8/16-8/22	**12**	3,982	55.7			3,982	55.7	3,168	44.3	7,150	298	5
8/23-8/29	13 /2	1,647	55.7			1,647	55.7	1,311	44.3	2,958	13	0
8/30-9/5	14							656	100.0	656		
9/6-9/12	15							362	100.0	362		
9/13-9/19	16							93	100.0	93		
9/20-9/26	17							28	100.0	28		
9/27-9/30	18							2	100.0	2		
Totals		32,002	24.1	244	0.2	32,246	24.3	100,407	75.7	132,653	8,255	55

1/ Weeks during which samples were taken delineated by bold script.

2/ Proportions from period 12 used to apportion catch.

Table 6. Estimated hatchery contributions of sockeye salmon to the Main Bay brood stock during 1999. 1/

		Releases into Main Bay								Untagged		Total	Total	Number
		Coghill Stock		Eshamy Stock		Main Bay Stock		Eyak Stock						
Week End	Stat Week	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Catch	Sampled	Tags
7/17	29	1,880	59.08					70	2.2	1,232	38.7	3,182	3,182	43
7/24	30	1,410	34.21	94	2.3					2,570	62.4	4,121	4,121	34
7/31	31	141	34.47							268	65.5	409	409	3
Subtotals		3,431	44.49	94	1.2	0	0.0	70	0.9	4,070	52.8	7,712	7,712	80

1/ Due to timing of samples, and number of fish jumping into brood pond, total does not match number of fish processed for brood.

Table 7. Estimated pink salmon contributions by hatchery to Prince William Sound fisheries and brood stocks for 1999.

Harvest Type	Solomon Gulch	Cannery Creek	W.H. Noerenberg	A.F. Koernig	Wild	Hatchery	Total
Common Property	9,486,878	5,414,942	4,828,682	5,108,346	6,793,207	24,838,848	31,632,055
Cost Recovery	4,354,601	2,014,448	3,861,891	2,994,037	146,624	13,224,977	13,371,601
Brood Stock 1/	954,305	1,293,460	776,277	1,352,746	2,505	4,379,293	4,379,293
Totals	14,795,784	8,722,850	9,466,850	9,455,129	6,942,336	42,443,118	49,382,949

1/ Brood Stock includes fish dying after cessation of egg take and fish processed for roe. See brood stock tables on specific districts for more information.

Table 8. Estimated hatchery contribution to Prince William Sound pink salmon common property fisheries in 1999.

District	Solomon Gulch	Cannery Creek	W.H. Noerenberg	A.F. Koernig	Wild	Hatchery	Total
Copper River					10,409		10,409
Eastern	9,329,528	43,345	11,843	22,650	2,903,995	9,407,366	12,311,361
Northern	80,550	3,811,042	554,374	46,916	488,203	4,492,882	4,981,085
Coghill	2,766	340,420	2,971,266	29,566	198,112	3,344,018	3,542,130
Eshamy			73,019	16,122	81,384	89,141	170,525
Southwestern	74,034	1,213,068	1,211,442	4,989,002	2,024,452	7,487,546	9,511,998
Montague		5,543	6,738		177,360	12,281	189,641
Southeastern		1,524		4,090	909,293	5,614	914,907
TOTAL	9,486,878	5,414,942	4,828,682	5,108,346	6,793,208	24,838,848	31,632,056

Table 9. Estimated hatchery contributions of pink salmon to the Eastern District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/6	**1**	717,177	96.9							23,135	3.1	740,312
7/10	**2**	929,622	100.0							0		929,622
7/12	**3**	1,294,009	97.9							27,828	2.1	1,321,837
7/14	**4**	1,152,519	91.7							104,774	8.3	1,257,293
7/16	**5**	1,471,627	98.9							15,656	1.1	1,487,283
7/18	**6**	1,326,196	99.0							13,960	1.0	1,340,156
7/20	**7**	771,895	90.3							82,703	9.7	854,598
7/22	**8**	541,961	84.4							100,363	15.6	642,324
7/25	**9**	382,405	68.8	5,975	1.1			11,950	2.2	155,352	28.0	555,682
7/27	**10**	201,132	43.7	5,293	1.1					254,061	55.2	460,486
7/29-7/30	**11**	241,553	48.4							257,306	51.6	498,859
7/31-8/1	**12**	153,129	29.5	5,469	1.1					360,948	69.5	519,546
8/2	**13**	66,114	14.7	9,445	2.1	4,722	1.1	4,722	1.1	363,625	81.1	448,628
8/4	**14**	10,682	3.2	10,682	3.2	7,121	2.1			309,775	91.6	338,260
8/6	**15**	18,776	5.4	3,755	1.1					322,956	93.5	345,487
8/8-8/9	**16**	6,505	2.2					3,252	1.1	289,452	96.7	299,209
8/10	**17**	2,496	2.0	2,496	2.0			2,496	2.0	119,796	94.1	127,284
8/12	18 2/	230	2.0	230	2.0			230	2.0	11,042	94.1	11,732
8/14	19 3/									20,410	100.0	20,410
8/16	**20**									10,936	100.0	10,936
8/18	21 3/									23,233	100.0	23,233
8/20	22 3/									9,291	100.0	9,291
8/22	23 3/,4/									5,731	100.0	5,731
8/24	24											0
8/25-8/27	25 3/									16,263	100.0	16,263
8/28-8/31	26 3/,5/	41,500	100.0									41,500
9/1-9/3	27 3/									5,351	100.0	5,351
9/4-9/7	28											0
9/8-9/10	29 3/									47	100.0	47
TOTAL		9,329,528	75.8	43,345	0.4	11,843	0.1	22,650	0.2	2,903,994	23.6	12,311,360

1/ Periods during which samples were taken delineated in bold script.
2/ Proportions from period 17 were used to apportion the catch.
3/ Proportions from period 20 were used to apportion the catch.
4/ Fish confiscated by Fish and Wildlife Protection.
5/ Includes excess hatchery brood caught for roe.

Table 10. Estimated hatchery contributions of pink salmon to the Northern District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/25	**1**	15,053	62.9	1,368	5.7					7,527	31.4	23,948
7/27	2 2/	15,127	62.9	1,375	5.7					7,564	31.4	24,066
7/29	3 3/	539	8.0	3,504	52.0	270	4.0			2,426	36.0	6,739
7/31	**4**	5,382	8.0	34,985	52.0	2,691	4.0			24,220	36.0	67,278
8/2	**5**	9,213	12.5	38,898	52.8	2,047	2.8			23,543	31.9	73,701
8/4	**6**	18,478	15.7	63,961	54.2	4,264	3.6			31,269	26.5	117,972
8/6	**7**	16,758	7.7	137,416	63.1	26,813	12.3			36,867	16.9	217,854
8/8	**8**			210,559	60.0	84,962	24.2	7,388	2.1	48,022	13.7	350,931
8/10	**9**			278,174	41.5	226,236	33.8	25,849	3.9	139,630	20.8	669,889
8/12	**10**			609,190	83.0	70,291	9.6			54,671	7.4	734,152
8/14	**11**			459,785	86.0	28,737	5.4	5,747	1.1	40,231	7.5	534,500
8/16	**12**			453,656	88.3	21,863	4.3			38,260	7.4	513,779
8/18	**13**			374,379	82.7	61,428	13.6	7,932	1.8	8,706	1.9	452,445
8/20	**14**			328,978	90.5	22,952	6.3			11,476	3.2	363,406
8/22	**15**			78,248	90.5	1,820	2.1			6,369	7.4	86,437
8/24	**16**			70,920	90.5					7,422	9.5	78,342
8/25-8/27	17											0
8/28-8/31	18 3/			13,581	100.0							13,581
9/1-9/3	19 3/			17,020	100.0							17,020
9/4-9/7	20 3/			43,316	100.0							43,316
9/8-9/10	21 3/			279,075	100.0							279,075
9/11-9/14	22 3/			312,654	100.0							312,654
TOTAL		80,550	1.6	3,811,042	76.5	554,374	11.1	46,916	0.9	488,203	9.8	4,981,085

1/ Periods when samples were taken delineated in bold script.
2/ Proportions from period 1 were used to apportion catch
3/ Proportions from period 3 were used to apportion catch
4/ Excess hatchery brood caught for roe was assumed to originate from Cannery Creek hatchery.

Table 11. Estimated hatchery contributions of pink salmon to the Coghill District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
6/14-6/15	1											0
6/18	2											0
6/24-6/25	3 2/									7	100.0	7
6/28	4											0
6/30-7/01	5											0
7/2	6 2/									8	100.0	8
7/4-7/6	7 2/									85	100.0	85
7/6-7/9	8 2/									303	100.0	303
7/9-7/13	9 3/	209	6.2	105	3.1	628	18.8			2,406	71.9	3,348
7/13-7/16	10 3/	528	6.3	264	3.1	1,583	18.7			6,070	71.9	8,445
7/16-7/20	11 3/	1,253	6.3	627	3.1	3,757	18.7			14,402	71.9	20,039
7/20-7/21	12 3/	100	6.3	50	3.1	300	18.8			1,149	71.9	1,599
7/22	**13**	676	6.3	338	3.1	2,027	18.8			7,769	71.9	10,810
7/25	**14**					1,077	33.3			2,155	66.7	3,232
7/27	15 4/					2,796	33.3			5,596	66.7	8,392
7/29-7/30	16 4/					6,265	33.3			12,536	66.7	18,801
7/31	17 4/					5,047	33.3			10,100	66.7	15,147
8/2	18 5/			7,783	26.3	21,793	73.7					29,576
8/4-8/5	19 5/			36,677	26.3	102,694	73.7					139,371
8/6-8/7	**20**			62,917	20.2	196,959	63.2			51,975	16.7	311,851
8/8-8/9	**21**			71,340	42.7	67,263	40.2			28,536	17.1	167,139
8/10	**22**			3,171	31.2	6,343	62.5			634	6.2	10,148
8/12	23											0
8/14	**24**			65,834	17.3	294,521	77.3	3,465	0.9	17,325	4.5	381,145
8/16	**25**			39,103	7.4	474,826	90.4			11,173	2.1	525,102
8/18	**26**			8,551	2.7	293,580	93.6	5,701	1.8	5,700	1.8	313,532
8/20	**27**			18,729	9.4	175,589	88.2			4,682	2.4	199,000
8/22	**28**			9,253	5.6	151,139	90.7			6,169	3.7	166,561
8/24	**29**			10,578	5.2	188,284	92.7			4,231	2.1	203,093
8/25-8/27	**30**			5,100	2.1	211,654	87.4	20,400	8.4	5,101	2.1	242,255
8/28-8/31	**31**					289,688	100.0					289,688
9/1-9/3	**32**					157,728	100.0					157,728
9/4-9/7	33 6/					294,674	100.0					294,674
9/8-9/10	34											0
9/11-9/14	35					21,051	100.0					21,051
	TOTAL	2,766	0.1	340,420	9.6	2,971,266	83.9	29,566	0.8	198,112	5.6	3,542,130

1/ Periods when samples were taken delineated in bold script.
2/ Fish were assumed to be wild.
3/ Proportions from Period 13 were used to apportion the catch.
4/ Proportions from Period 14 were used to apportion the catch.
5/ Proportions from Period 20 were used to apportion the catch.
6/ Proportions from Period 32 were used to apportion the catch.

Table 12. Estimated hatchery contributions of pink salmon to the Eshamy District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/15-7/16	1 2/					767	21.4	256	7.2	2,557	71.4	3,580
7/19-7/20	2 2/					1,871	21.4	624	7.1	6,236	71.4	8,731
7/22-7/23	3 2/					1,030	21.4	343	7.1	3,435	71.4	4,808
7/26-7/27	4 2/					1,541	21.4	514	7.1	5,137	71.4	7,192
7/29-730	5 2/					1,516	21.4	505	7.1	5,054	71.4	7,075
8/2-8/3	6 2/					3,041	21.4	1,014	7.1	10,138	71.4	14,193
8/5-8/6	**7**					4,436	21.4	1,479	7.1	14,787	71.4	20,702
8/9-8/10	8 2/					540	21.4	180	7.1	1,798	71.4	2,518
8/12-8/13	9 2/					2,182	21.4	728	7.1	7,274	71.4	10,184
8/16-8/17	10 3/					5,788	54.5	965	9.1	3,858	36.4	10,611
8/19-8/20	**11**					6,801	54.5	1,134	9.1	4,534	36.4	12,469
8/23-8/24	12 3/					9,613	54.5	1,603	9.1	6,409	36.4	17,625
8/26-8/27	**13**					14,557	66.7	2,911	13.3	4,367	20.0	21,835
8/30-8/31	14 4/					9,968	66.7	1,993	13.3	2,990	20.0	14,951
9/2-9/3	15 4/					5,775	66.7	1,155	13.3	1,732	20.0	8,662
9/6-9/7	16 4/					3,593	66.7	718	13.3	1,078	20.0	5,389
TOTAL		0	0.0	0	0.0	73,019	42.8	16,122	9.5	81,384	47.7	170,525

1/ Periods when samples were taken delineated in bold script.

2/ Results from period 7 were used to apportion the catch

3/ Results from period 11 were used to apportion the catch.

4/ Results from period 13 were used to apportion the catch.

Table 14. Estimated hatchery contributions of pink salmon to the Montague District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
6/02-6/03	1											0
6/05-6/08	2											0
6/09-6/11	3											0
6/12-6/15	4											0
6/16-6/18	5											0
6/19-6/22	6 2/									20	100.0	20
6/23-6/25	7 2/									64	100.0	64
6/26-6/29	**8**									1,245	100.0	1,245
6/30-7/2	9 2/									763	100.0	763
7/3-7/6	10 2/									248	100.0	248
7/7-7/9	11 2/									4,875	100.0	4,875
7/10-7/13	12 2/									175	100.0	175
7/14-7/16	13 2/									48	100.0	48
7/20	14 2/									245	100.0	245
7/22	15 2/											0
7/31	**16**					1,195	5.6			20,306	94.4	21,501
8/4	**17**			5,543	4.7	5,543	4.7			107,156	90.6	118,242
8/6	**18**									42,215	100.0	42,215
TOTAL		0	0.0	5,543	2.9	6,738	3.6	0	0.0	177,360	93.5	189,641

1/ Periods when samples were taken delineated in bold script.

2/ Fish were assumed to be wild.

Table 15. Estimated hatchery contributions of pink salmon to the Southeastern District common property fishery during 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/16	1											0
7/18	2											0
7/20	3											0
7/22	4 2/									799	100.0	799
7/25	**5**									105,244	100.0	105,244
7/27	**6**							1,169	2.7	42,664	97.3	43,833
7/29	**7**									22,953	100.0	22,953
7/31	8 3/									43,466	100.0	43,466
8/2	9 4/			200	1.1			200	1.1	18,202	97.8	18,602
8/4	**10**			1,324	1.1			1,324	1.1	120,529	97.9	123,177
8/6	**11**									274,956	100.0	274,956
8/8-8/9	**12**									207,996	100.0	207,996
8/10	**13**							1,397	2.0	67,041	98.0	68,438
8/12	14											0
8/14	15											0
8/16	16 5/									5,443	100.0	5,443
8/18	17											0
TOTAL		0	0.0	1,524	0.2	0	0.0	4,090	0.4	909,293	99.4	914,907

1/ Periods when samples were taken delineated in bold script.
2/ Results from Period 5 were used to apportion catch.
3/ Results from Period 7 were used to apportion catch.
4/ Results from Period 10 were used to apportion catch.
5/ Fish were assumed to be wild.

Table 16. Estimated hatchery contributions of pink salmon to the Copper River gillnet fishery in 1999. 1/

Date	Period	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
5/14	1											0
5/17	2											0
5/21	3											0
5/24	4											0
5/27-5/28	5											0
5/31-6/1	6									1	100	1
6/4	7											0
6/14	8											0
6/18	9									4	100	4
6/24-6/25	10									16	100	16
6/28-6/29	11									82	100	82
7/1-7/2	12									159	100	159
7/5-7/6	13									88	100	88
7/8-7/9	14									181	100	181
7/12-7/13	15									282	100	282
7/15-7/16	16									1,601	100	1,601
7/19-7/21	17									1,000	100	1,000
7/22-7/24	18									1,740	100	1,740
7/26-728	19									999	100	999
7/29-7/31	20									1,245	100	1,245
8/2-8/3	21									766	100	766
8/5-8/6	22									1,375	100	1,375
8/9-8/10	23									576	100	576
8/16-8/17	24									223	100	223
8/23-8/24	25									60	100	60
8/30-8/31	26									11	100	11
9/16-9/17	27											0
Totals		0	0	0	0	0	0	0	0	10,409	100	10,409

1/ No samples were taken. All fish are assumed to be wild.

Table 17. Estimated hatchery contributions of pink salmon to Prince William Sound cost recovery fisheries in 1999.

District	Solomon Gulch	Cannery Creek	W.H. Noerenberg	A.F. Koernig	Wild	Hatchery	Total
Eastern	4,354,601				25,058	4,354,601	4,379,659
Northern		2,014,448	3,923		56,990	2,018,371	2,075,361
Coghill			3,852,411		8,020	3,852,411	3,860,431
Southwestern			5,557	2,994,037	56,556	2,999,594	3,056,150
TOTAL	4,354,601	2,014,448	3,861,891	2,994,037	146,624	13,224,977	13,371,601

Table 18. Estimated hatchery contributions of pink salmon to the Solomon Gulch cost recovery fishery during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
6/28-6/30	294,610	98.9							3,202	1.1	297,812
7/1-7/3	547,195	100.0									547,195
7/4-7/7	1,049,260	100.0									1,049,260
7/8-7/10	447,461	100.0									447,461
7/11-7/13	534,438	98.9							5,747	1.1	540,185
7/14-7/17	446,394	100.0									446,394
7/18-7/21	560,577	99.0							5,901	1.0	566,478
7/22-7/24	474,666	97.9							10,208	2.1	484,874
Totals	4,354,601	99.4	0	0.0	0	0.0	0	0.0	25,058	0.6	4,379,659

Table 19. Estimated hatchery contributions of pink salmon to the Cannery Creek cost recovery fishery during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
8/4-8/7			54,931	97.2					1,569	2.8	56,500
8/8-8/14			353,095	93.7	3,923	1.0			19,617	5.2	376,635
8/15-8/21			629,710	96.7					21,226	3.3	650,936
8/22-8/24			976,712	98.5					14,578	1.5	991,290
Totals	0	0.0	2,014,448	97.1	3,923	0.2	0	0.00	56,990	2.7	2,075,361

Table 20. Estimated hatchery contributions of pink salmon to the W.H. Noerenberg cost recovery fishery during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/31-8/7					464,409	100.0					464,409
8/8-8/11					842,574	100.0					842,574
8/12-8/14					478,186	100.0					478,186
8/15-8/17					801,791	100.0					801,791
8/18-8/21					761,941	99.0			8,020	1.0	769,961
8/22-8/27					503,510	100.0					503,510
Totals	0	0.0	0	0.0	3,852,411	99.8	0	0.00	8,020	0.2	3,860,431

Table 21. Estimated hatchery contributions of pink salmon to the A.F. Koernig cost recovery fishery during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
8/1-8/7					5,557	1.5	361,174	98.5			366,731
8/8-8/14							887,893	98.9	9,446	1.1	897,339
8/15-8/21							909,082	96.9	29,325	3.1	938,407
8/22-8/24							599,527	97.9	12,756	2.1	612,283
8/24-8/30 1/							236,361	97.9	5,029	2.1	241,390
Totals	0	0.0	0	0.0	5,557	0.2	2,994,037	98.0	56,556	1.9	3,056,150

1/ Results from 8/22 - 8/24 used to apportion catch. Fish donated to charity.

Table 22. Estimated hatchery contributions of pink salmon to Prince William Sound hatchery brood stocks in 1999.

District	Solomon Gulch	Cannery Creek	W.H. Noerenberg	A.F. Koernig	Wild	Hatchery	Total
Solomon Gulch Brood Stock	954,305					954,305	954,305
Cannery Creek Brood Stock		1,293,460	492		492	1,293,952	1,294,444
W. Noerenberg Brood Stock			774,664			774,664	774,664
A.F. Koernig Brood Stock			1,121	1,352,746	2,013	1,353,867	1,355,880
TOTAL	954,305	1,293,460	776,277	1,352,746	2,505	4,376,788	4,379,293

Table 23. Estimated hatchery contributions of pink salmon to the Solomon Gulch hatchery brood stock during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
7/26-7/30	78,055	100.0									78,055
8/2-8/6	113,322	100.0									113,322
8/9-8/13	141,628	100.0									141,628
8/16-8/19	83,857	100.0									83,857
8/20-9/23 1/	537,443	100.0									537,443
TOTAL	954,305	100.0	0	0.0	0	0.0	0	0.0	0	0.0	954,305

1/ Fish were assumed to originate from Solomon Gulch hatchery. Includes 155,192 processed for roe (8/20 to 9/23), 300,000 extra fish (as of 9/20), as well as 72,908 in Solomon Gulch Creek .

Table 24. Estimated hatchery contributions of pink salmon to the Cannery Creek hatchery brood stock during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
8/31-9/4			46,270	97.9	492	1.0			492	1.0	47,254
9/5-9/11			99,652	100.0							99,652
9/12-9/18			140,195	100.0							140,195
9/20 1/			1,007,343	100.0							1,007,343
TOTAL	0	0.0	1,293,460	99.9	492	0.0	0	0.0	492	0.0	1,294,444

1/ Fish were assumed to originate from Cannery Creek hatchery. These fish either died after cessation of egg take or were processed for roe.

Table 25. Estimated hatchery contributions of pink salmon to the W.H. Noerenberg hatchery brood stock during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
8/26-9/04					91,403	100.0					91,403
9/05-9/11					84,134	100.0					84,134
9/12-9/16					99,127	100.0					99,127
9/17 1/					500,000	100.0					500,000
TOTAL	0	0.0	0	0.0	774,664	100.0	0	0.0	0	0.0	774,664

1/ Fish were assumed to originate from W.H. Noerenberg hatchery. These fish died after cessation of egg take.

Table 26. Estimated hatchery contributions of pink salmon to the A.F. Koernig hatchery brood stock during 1999.

Date	Solomon Gulch		Cannery Creek		W.H. Noerenberg		A.F. Koernig		Wild		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
8/28-9/04							93,624	97.9	2,013	2.1	95,637
9/05-9/11					1,121	1.1	105,348	98.9			106,469
9/12-9/18							127,813	100.0			127,813
9/19-9/22							25,961	100.0			25,961
9/23/1999 1/							1,000,000	100.0			1,000,000
TOTAL	0	0.0	0	0.0	1,121	0.1	1,352,746	99.8	2,013	0.1	1,355,880

1/ Fish were assumed to originate from A.F. Koernig hatchery. These fish died after cessation of egg take.

Table 27. **Survival estimates by hatchery of pink salmon released into Prince William Sound in 1998 and returning in 1999.**

	Solomon Gulch	Cannery Creek	W.H. Noerenberg	A.F. Koernig
1998 Fry Releases	195,162,163	137,571,564	103,675,208	105,974,235
Est.Total Return	14,795,784	8,722,850	9,466,850	9,445,129
Estimated Survival	7.58%	6.34%	9.13%	8.91%

Table 28. Survival estimates of sockeye salmon returning to Prince William Sound and Copper River hatcheries during 1999.

Brood Year	Release Site	Tag Code	Number # Released	Estimated Contribution	Estimated Variance	Percent Survival	Standard Error	Cumulative Percent Survival	Weight
1994	Summit Lake	312462	165,310	10,639	11,214,101	6.44	0.02	6.90	5.48
		312529	173,708	15,109	14,105,846	8.70	0.02	9.33	5.72
		312530	34,685	6,031	3,230,388	17.39	0.05	17.39	6.50
	Crosswind Lake	312457	265,389	44,188	65,303,961	16.65	0.03	28.55	7.68
		312518	34,442	7,431	631,319	21.58	0.02	27.42	8.66
		312522	23,585	6,369	644,253	27.00	0.03	30.43	8.06
		312524	628,525	162,899	548,446,372	25.92	0.04	35.60	7.70
		312525	580,651	141,019	334,155,543	24.29	0.03	29.11	7.93
		312526	52,954	9,619	2,826,375	18.16	0.03	24.10	7.44
		312527	47,987	12,187	3,168,772	25.40	0.04	33.48	8.03
		312528	15,153	2,013	138,719	13.28	0.02	18.73	8.03
		312609	9,398	2,642	679,485	28.11	0.09	29.09	9.14
	Marsha Lake	312517	215944	1,068	1,141,442	0.49	0.00	0.49	1.82
1995	Summit Lake	312523	279,718	6,360	3,061,619	2.27	0.01	2.27	5.66
		312531	138,675	1,380	189,072	0.99	0.00	1.00	5.67
		312610	100,216	62	3,876	0.06	0.00	0.06	5.56
		312611	20,756	53	89,551,725	0.26	0.46	0.26	5.56
		312612	17,658	26	126,238	0.15	0.02	0.15	5.56
		312643	55,080	48	122,252	0.09	0.01	0.09	5.56
	Crosswind Lake	312519	231,566	25,883	10,360,969	11.18	0.01	11.18	7.01
		312520	306,510	51,521	27,794,894	16.81	0.02	16.81	9.37
		312521	1,380,777	180,891	345,432,414	13.10	0.01	13.10	7.22
		312642	386,742	62,193	71,404	16.08	0.00	16.08	8.64
		312644	9,939	1,390	22,577	13.98	0.02	13.98	8.64
		312645	6,053	843	109,693	13.93	0.05	13.93	8.64
		312646	8,308	644	73,181	7.75	0.03	7.75	10.38
		312647	3,642	462	48,489	12.70	0.06	12.70	10.38
		312648	9,848	418	53,690	4.24	0.02	4.24	10.38
		312649	6,676	560	38,795	8.38	0.03	8.38	10.38
		1301030513	7,354	815	14,031	11.08	0.02	11.08	8.64
		1301031313	9,885	1,040	708	10.52	0.00	10.52	8.64
		1301031314	9,466	891	676	9.41	0.00	9.41	8.64
		1301031512	3,717	298	773	8.03	0.01	8.03	8.64
	Main Bay	312638	239,023	40,967	78,469,648	17.14	0.04	17.14	14.19
		312639	131,503	325	45,979	0.25	0.00	0.25	14.37
		312640	435,703	31,783	69,244,417	7.29	0.02	7.29	7.92
		312641	409,487	34,795	65,018,868	8.50	0.02	8.50	6.78