SOUTHEAST ALASKA ANADROMOUS SALMON RESEARCH

Pink and Chum Salmon Stock Evaluation Program
Southeast Alaska Coho Salmon Research
Troll Fishery Management Methods Research
Salmon Catch Sampling Project

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July 1, 2003 – March 31, 2004

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SUBMITTED BY:
Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 240020
Douglas, Alaska 99824-0020
Harold J. Geiger, Principal Investigator

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SALMON CATCH SAMPLING PROJECT

July 1, 2004 – March 31, 2004

Summary of Progress

A. Tasks Scheduled

This project allows biologists to sample commercial troll, gillnet, and purse seine salmon fisheries at major processors throughout Southeast Alaska and Yakutat for scales, otoliths, coded wire tags, parasites, and associated measurements and biological data. Trained samplers were deployed with appropriate gear and sampling forms to all major processors in Southeast Alaska and Yakutat. Samples and data were transmitted in a timely manner to the appropriate destination.

The Southeast Alaska summer chinook troll fishery traditionally begins July 1 and lasts from one to two weeks, depending on the abundance of chinook salmon and the catch-ceiling, both of which are defined by an agreement under the Pacific Salmon Treaty. Sampling and data transmission from the troll fishery is the number one priority of port sampling crews in early July. Typically, supervisory personnel assist with sampling. Overtime for regular samplers is usually needed to ensure that samples sizes are adequate, and that the data are transmitted in a timely manner. At the time of landing, trollers are interviewed to obtain catch-per-unit-of-effort information. This information is combined with overflight observations of the fishery, so that managers can estimate the number of vessels fishing and the locations of fishing concentrations. With this information, managers predict the final end-of-the-year catch, and manage the fishery so that the catch stays within the ceiling set by treaty agreement. Samplers attempt to examine a minimum of 20% of the landed catch for coded wire tags. This coded wire tag information produces estimates of the hatchery fraction of the catch, by specific release group, from among releases all along the west coast of the Pacific. The estimates of Alaskan hatchery harvest are used to generate an Alaskan hatchery "add-on," and modify the quota accordingly. To effectively influence the management of a fishery that usually lasts less than two weeks, the sampling data, catch-per-effort observations, and tags, must be processed immediately; a significant amount of time is spent organizing and shipping data and samples. After the ceiling is reached, the troll fishery switches to targeting coho, chum, and pink salmon and sampling continues on these species. By regulation, a second chinook troll fishery opening occurs later in the summer and this opening is also sampled intensively. Usually the abundance is less, and hence the number of fish landed and sampled is lower in the second summer fishery.

The gillnet and purse seine fisheries begin in late June and early July respectively, with catches peaking in late July and August along with the abundance of pink, chum, sockeye, and coho salmon. Landings from these fisheries are sampled for coded wire tags, scales, parasites, and associated biological data used to evaluate run strength, spawner-per-recruit estimates, migratory timing, and hatchery contributions. While not as

critical as the troll chinook data, the samples and data from the net fisheries must be forwarded in a timely manner so that it is available to answer any questions regarding these fisheries. Inseason evaluation of samples and data is usually important to find errors or shortcoming in sampling procedures or training.

The location where fish are landed and processed changes frequently due to a combination of factors, including local abundance and the price being offered by various processors. Catches may be segregated by species on the fishing grounds and shipped to different processors. Large catches may plug local processors and result in the excess catch being shipped hundreds of miles for processing. Supervisors must constantly evaluate fisheries and landings, to assure that sampling is effective and goals are being met. Management priorities often change depending on what is caught and where. Sampling goals and priorities are sometimes modified inseason to meet these changing needs.

Beginning in late summer and lasting into the fall, all the scales that were collected are processed and evaluated to determine the age of the fish the scale came from; sampling forms are edited and the data are entered into the regional database; and routine and custom age-sex-size summaries are produced in support of various stock analysis and abundance programs. During this period, the sampling program is evaluated and supervisors develop plans for addressing any continuing problems. Supervisors use this time to judge the success in meeting sampling goals, and, if needed, changes are initiated. Supplies are ordered and distributed. Processors are contacted to learn of any changes in the coming year and, if necessary, sampling plans are revised.

B. Tasks Accomplished

All the tasks detailed above were accomplished in a timely manner and all sampling goals were met. Approximately 95,000 scales from sampled fish (approximately 80,000 from sockeye salmon) have been forwarded to the Age Laboratory for processing, and the aging is in progress. During the performance period, sampling staff examined approximately 350,000 commercially harvested chinook salmon for adipose fin clips, which indicates the possible presence of a coded wire tag. Staff examined an additional 557,000 coho salmon for adipose fin clips. Approximately 25,000 coded wire tags were eventually detected. The coded wire tag information has been processed and is available to salmon researchers and the general public at http://tagotoweb.adfg.state.ak.us/.

C. Special Problems

Large pink salmon catches in Southeast Alaska resulted in local processors being overwhelmed, resulting in our samplers having some difficulty getting access to loads of fish that could be attributed to a specific area. Even so, samplers were able to mostly deal with the situation by communication with processors.

TROLL FISHERY MANAGEMENT METHODS

July 1, 2003 – March 31, 2004

Summary of Progress

A. Tasks Scheduled

Most importantly, this project provided personnel to plan and manage the 2003 summer troll fisheries and the 2004 winter troll fisheries. Additionally, this project supported personnel to enter and edit fish tickets from late summer and winter troll fisheries, edit fishery performance data for the 2003 season, archive data to go into a detailed management report, and summarizing information related to the stock assessment and management of the Southeast Alaska troll fisheries.

B. Accomplished Tasks

All scheduled tasks were accomplished. All fish tickets from the 2003 summer troll fishery and all tickets received for the 2003/2004 winter troll fishery have been edited and entered. Fishery performance data for 2003 was edited and entered into the Regional Integrated Fisheries Database.

C. Special Problems

None.

SOUTHEAST ALASKA COHO SALMON RESEARCH

July 1, 2003 – March 31, 2004

Summary of Progress

A. Tasks Scheduled

Primary tasks scheduled for this period included: (1) capturing and tagging coho presmolts at Ford Arm Lake, and (2) enumerating and sampling adult coho salmon at Ford Arm Lake and Berners River.

B. Tasks Accomplished

A total of 6,483 juvenile coho salmon were captured and coded wire tagged at Ford Arm Lake during July 7-18. The Ford Arm Lake weir was operated during August 10 - October 17. Returning adult fish were enumerated and sampled for coded wire tags, age-sex-length data, and fishery marks. The adult escapement (excluding jacks, or precocious males) was estimated at 6,800 fish, which was the third largest escapement in 21 years of estimation, and far above the goal of 1,300 - 2,900. A mark-recapture study produced an estimate of 1,400 adult spawners uncounted in September. During this time, the weir had to be opened to allow fish to pass into the lake because of a low-oxygen emergency. The total reconstructed run of 13,200 adults was far above the historical average of 8,077 adults. The estimated exploitation rate of 49% was below the long-term average of 60%, with commercial trollers accounting for 32%, seiners for 4%, and the marine sport fishery for 13%. The estimated sport harvest of 1,770 Ford Arm Lake coho salmon was a record, and contributed 2.4% of the total Sitka marine sport fishery harvest.

In 2003, an estimated 29,000 adult coho salmon returned to the Berners River, which was below the historical average of 31,441 fish. The escapement of 10,100 spawners exceeded the escapement goal range of 4,000-9,200 spawners. Exploitation rates on the Berners River stock were low in both the troll and gillnet fisheries (24% and 39%, respectively) for a total exploitation rate of 65%, including small seine and sport catches.

Project staff finalized smolt migration estimates through 2002 and marine survival estimates through 2002.

Coded wire tag release data from Spring 2003 was summarized and reported to the Pacific Marine Fisheries Commission.

Project staff produced run reconstruction estimates for the four primary long-term indicator stocks in 2003.

C. Special Problems

No special problems were experienced during this period.

PINK AND CHUM SALMON STOCK EVALUATION PROGRAM

July 1, 2003 – March 31, 2004

Summary of Progress

A. Tasks Scheduled

Work scheduled this reporting period included: (1) updating the traditional pink salmon escapement index, (2) forecasting the 2004 harvest of pink salmon in Southeast Alaska, and (3) conducting an observer calibration study for of aerial surveyors at Traitors Creek.

B. Tasks Accomplished

An escapement index was calculated for each management stock group in Southeast Alaska. In 2003, the entire index series was updated, and these statistics are now available for 45 stock groups from 1960 to 2003.

A preseason run prediction was completed and released to the public in December, and appeared in the official Alaska Department of Fish and Game forecast documents. During the performance period, staff conducted a review of past forecast performance and concluded that the forecast could be improved by simply updating the statistical methods. Several candidate methods were examined, and the exponential smoothing technique was chosen for its simplicity, ease of application, and performance. The 2004 pink salmon forecast for Southeast Alaska is for a harvest in the *Strong* to *Excellent* categories, with a potential total Southeast Alaska harvest of approximately 50 million fish (expressed as a range of 24 to 76 million fish; see Attachment A).

Eleven management staff (representing all area offices) were scheduled to fly aerial surveys of Traitors Creek during the peak of the pink salmon run, in the last week of August of 2003. Weather caused a delay of this calibration study, but it was eventually conducted in early September – delayed by about a week.

Project staff continued to monitor recording thermographs that were placed in southern Southeast Alaska at the White River, Harris River, Staney Creek, and Marten River. At each site, thermographs were placed at both the gravel surface and at approximately 0.3m gravel depth to further evaluate the relationship of air temperature data currently used with actual impacts to the incubation area for pink salmon eggs.

C. Special Problems

No special problems were experienced during this period.

ATTACHMENT A (TO REPORT ON PINK AND CHUM SALMON RESEARCH)

Harvest Predictions for Southeast Alaska
Pink Salmon in 2004

The following categories of pink salmon harvest in Southeast Alaska were obtained by calculating the 20th, 40th, 60th, and 80th percentiles of historical harvest during the 40-year period 1962 to 2001:

Table 1. Southeast Alaska pink salmon escapement indices by stock group and management area, 2003.

Category	Range (millions)	Percentile
Disaster	Less than 10	Less than 20th
Weak	10 to 17	21st to 40th
Average	17 to 30	41st to 60th
Strong	30 to 53	61st to 80th
Excellent	Greater than 53	Greater than 80th

The pink salmon return in 2004 is predicted to be *Strong* to *Excellent*, with a potential total Southeast Alaska harvest of **50 million fish, with a range of 24 to 76 million fish.**

Forecast Methods:

The forecast methods that were used for the last six years tended to under-forecast the actual harvest and the prediction ranges have been too narrow. The actual harvest was outside these prediction ranges about half the time (Table 1). For that reason, we have introduced new statistical methods this year that predict future harvests based on prior years' harvests. This forecast does not rely on estimates of total escapement or total run size, as did prior forecasts, because accurate measures of these variables are not currently available. We expect this new method to do a better job of forecasting trends in the harvest until ongoing efforts to improve escapement and total run size information are completed. Because it is strictly based on historical harvests, this new method of forecasting does not directly forecast the amount of fish that might be available for harvest. We note that harvests in recent years (especially in the strong and excellent categories) have been affected by processing capacity.

The forecast of the potential pink salmon harvest in Southeast Alaska in 2004 was based on a time-series technique called *exponential smoothing.* This technique is similar to a running average; recent harvest observations were given more weight in the analysis, while all observations in the past were increasingly down-weighted. All harvests over the past 40 years

(Figure 1) were used in the analysis. If x_t, x_{t-1}, ... denotes the observed harvests in year t, t-1, and so on, then the forecast in year t+1 is given by,

$$\hat{x}_{t+1} = cx_t + (1-c)\hat{x}_t . \qquad (1)$$

Notice that the forecast for year t, that is $\hat{x}_t$, is also a weighted average of the observed catch in year t-1, and the forecast in year t-2. This is a kind of recursive equation that contains all of the data in the series. In this case, we choose a value of c to be approximately 0.27, based on minimizing the sum of past squared errors.

Notice that there are four production periods in Figure 1: the low-production period of the 1960s, the very-low-production period of the early 1970s, the period of increase from the mid-1970s to the early-1990s, and the latter period of high production. The forecast range was based on an estimated 80% confidence interval, calculated by estimating the forecast error in the exponential smoothing technique over the last 11 years – during the period of high production.

Table 2. Preseason forecast of pink salmon harvests versus actual harvests for Southeast Alaska, 1994-2003 (millions of fish).

	Preseason		Postseason	
Year	Category	Harvest	Harvest	Category
1994	*Strong*	47	58	*Excellent*
1995	*Average*	21	48	*Strong*
1996	*Excellent*	62	65	*Excellent*
1997	*Strong*	37	29	*Average*
1998	*Strong*	31-51	42	*Strong*
1999	*Strong*	31-51	75	*Excellent*
2000	*Strong*	31-51	20	*Average*
2001	*Strong*	31-50	67	*Excellent*
2002	*Strong*	30-52	45	*Strong*
2003	*Strong*	30-52	52	*Strong*
2004	*Strong*	50		

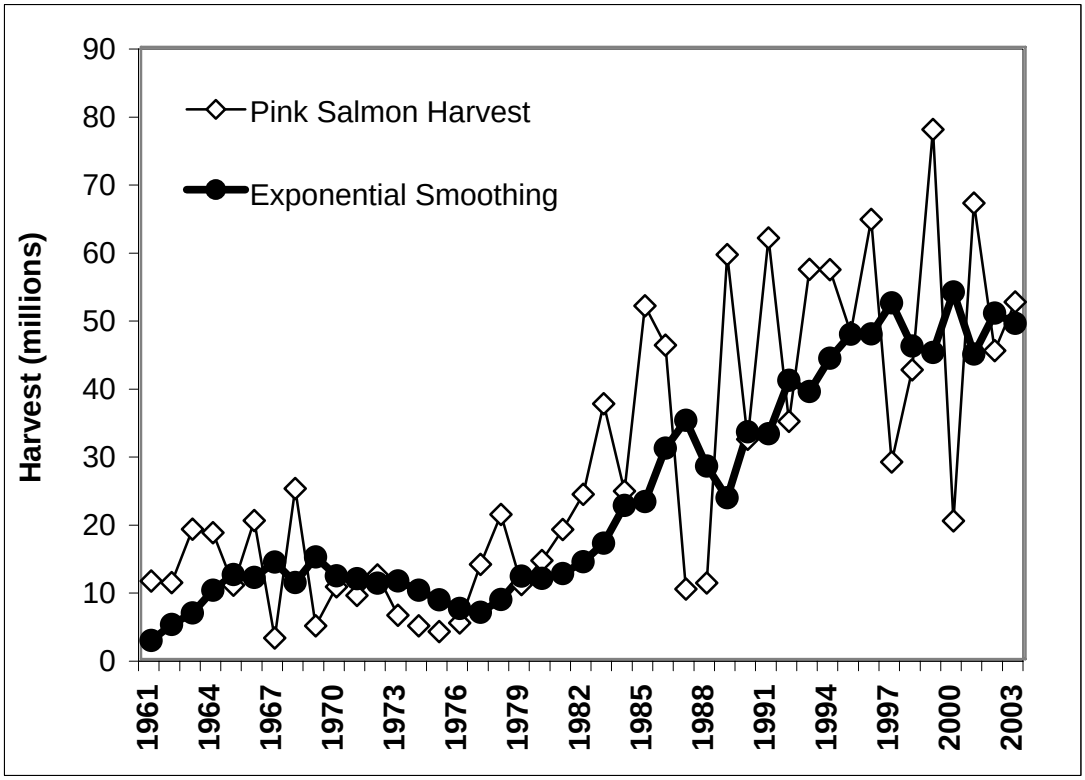

Figure 1. Comparison of annual harvest of pink salmon in Southeast Alaska, and smoothed values of the harvest used in the 2004 forecast model.

Forecast Discussion:

Many different statistical approaches all lead to the same general conclusion: pink salmon runs in Southeast Alaska have tended towards very high levels in recent years, and recent harvests have also tended to fluctuate around high levels. Moreover, the fluctuations in harvest have been caused by random, unknown factors in the marine environment, and by changes in the fishing industry. We have tried to present a forecast of next year's harvest using the simplest method we could find that makes the best possible use of our forecast indicators. We believe a simple, easily explained procedure that tracks the overall trend in harvest, will produce a better forecast than complicated analyses based on questionable assumptions or based on spurious correlations. This new forecast, had it been used during the prior six years, would have provided slightly higher forecast point estimates and wider forecast ranges than the old methods.

Although it is very hard to predict pink salmon returns from the ocean, the forecast of pink salmon harvest is further complicated by recent large-scale changes in the fishing and fish processing industries. Researchers cannot predict future management actions, fishing conditions, harvest and processing capacity, distribution of the fleet, or product demand that drives the harvest each year. These factors have affected recent harvest levels, and in both 2002 and 2003, our escapement measures indicated that there could have been considerable additional harvest had there been demand for the product. We note that there has been substantial error in past

forecasts, with a tendency to under-forecast the harvest. Although we do not have a statistically reliable estimate of total return, the trend in catch has probably under-represented the trend in total run size. One indication of this is, the upper end of the escapement goal range has been exceeded in at least one of the three subregions in Southeast Alaska each year since 1994. Moreover, the upper end of the escapement goal range has been exceeded in all three subregions the last three years – further suggesting that pink salmon returns to Southeast Alaska have continued to increase over time, even though the trend in harvest level stabilized in the mid-1990s. The department will continue to manage fisheries inseason based on the strength of salmon runs. Aerial escapement surveys and fishery performance data will continue, as always, to be essential in making inseason management decisions.

Other Considerations:

1. Brood year escapement indices in 2002 were the 6th highest on record for the region (17.4 million): the 8th highest in Southern (SSE); the 6th highest in Northern Inside (NSEI); and the 6th highest in Northern Outside (NSEO) for years 1960-2003. Escapements appear to have been ample to provide a *Strong* to *Excellent* total return in 2004.
2. Winter incubation temperatures throughout Southeast Alaska from November 2002 through February 2003 were above the 40-year average and should not be a significant cause of mortality for the 2004 return (Figures 3 and 4).
3. No early marine fry surveys were conducted in Southeast Alaska in 2003 to index fry abundance; however, anecdotal observations in Southeast indicated fry abundance was very high in some areas.

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