OBSERVATIONS ON CHINOOK SALMON HOOK AND RELEASE IN THE 1987 SOUTHEAST ALASKA TROLL FISHERY

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ABSTRACT

An onboard observer program was conducted to monitor incidental hook and release of chinook salmon during chinook non-retention periods of the 1987 Southeast Alaska summer troll fishery. Chinook non-retention regulations were implemented after chinook catch ceilings established by the Pacific Salmon Commission were reached and the troll fishery remained open for other species. Thirty-two volunteer troll vessels participated with observers logging approximately 132.6 gear days (13.7 fishing hours per gear day). Observers recorded numbers, size and condition of chinook hooked and released, catch of other species, type of fishing gear, and fishing time and area. Average chinook hooked and released per unit fishing effort obtained from observer vessels was combined with estimates of total fleet fishing effort to estimate total numbers of chinook hooked and released. Average hook and release mortality rates obtained from an independent study were used to calculate total hook and release mortalities.

Chinook non-retention occurred for 60 days during the 1987 summer troll season. An estimated 193.7 thousand legal size chinook (28" or larger) and 176.2 thousand sublegal size chinook (less than 28") were hooked and released during this period. Using the Wertheimer (1988) hook and release mortality rate estimates of 22.1% and 26.0% for legal and sublegal size chinook respectively yielded estimated mortalities of 42.8 thousand legal size chinook and 45.8 thousand sublegal size chinook during 1987 chinook non-retention periods. Minimum and maximum estimates were also calculated using 90% confidence interval estimates for numbers of chinook hooked and released, and minimum and maximum mortality rate estimates.

A number of measures were taken to reduce and minimize chinook hook and release mortalities during the 1987 troll season. Several outer coastal areas of high chinook abundance were closed during a portion of the chinook season to slow chinook catch rates and shorten the non-retention period; similar areas were also closed to all trolling during non-retention periods to reduce chinook encounters. A public information program was continued in 1987 to advise fishermen of ways to reduce chinook encounters and to minimize hook and release injuries. In response to continued increases in chinook abundance and corresponding increases in chinook non-retention observed in 1987, the Alaska Board of Fisheries has implemented regulations delaying opening of the summer troll season until July 1 beginning in 1988.

INTRODUCTION

An onboard observer program was conducted by the Alaska Department of Fish and Game (ADF&G) to monitor incidental hook and release of chinook salmon during chinook non-retention periods of the 1987 Southeast Alaska summer troll fishery. Chinook non-retention regulations were implemented during the 1987 season to ensure that the troll chinook catch, combined with chinook salmon catches in other Southeast Alaska fisheries, did not exceed the all-gear base catch ceiling of 263,000 chinook salmon. This ceiling was established under provisions of the U.S./Canada Pacific Salmon Treaty. An allowance is also provided for harvest of Alaska hatchery chinook salmon in addition to the base catch ceiling. Chinook salmon catch ceilings and other chinook conservation measures have been implemented under the Treaty since 1985 as part of a 15-year coastwide rebuilding program for depressed natural chinook stocks.

Provisions of the Pacific Salmon Treaty require that incidental mortalities of chinook salmon be monitored in all fisheries on a coastwide basis, and that potential impacts of such mortalities n the natural stock rebuilding program be assessed. The Chinook Technical Committee of the Pacific Salmon Commission (the Treaty implementing body) is currently conducting this assessment. Treaty provisions also require that measures be taken to minimize the effects of such incidental mortalities on the rebuilding program.

Several measures were taken in 1987 to minimize incidental hook and release mortalities of chinook salmon by the Southeast Alaska troll fishery. First, area closures were implemented July 4-12 in five outer coastal areas of frequent high chinook abundance to slow the chinook catch rate and extend the troll chinook season, thereby reducing the chinook non-retention period. Second, similar areas were closed to all trolling during the chinook non-retention period beginning July 13 to reduce the incidence of chinook hook and release. (Descriptions of these 1987 area closures are included as Appendix A.) Third, a public information program was conducted by ADF&G, in cooperation with the Alaska Trollers Association (ATA), to assist trollers in reducing chinook hook and release and associated mortalities. Trollers were advised to avoid areas of high chinook abundance encountered while fishing for coho and other non-chinook species. They were also advised to utilize fishing techniques, such as light leaders and small hooks, which would reduce incidental chinook hook and release. Finally, information was provided on release techniques which would help minimize injuries and mortalities of incidentally hooked chinook salmon. (A copy of an ATA informational leaflet distributed to trollers is included as Appendix B.)

Following the 1987 summer troll chinook season, which extended from June 20 through July 12, chinook non-retention regulations were implemented during the remainder of the

summer troll season from July 13 through August 2, and from August 13 through September 20 (Table 1). (A ten-day all species closure was implemented August 3-12 for coho management purposes.) After the chinook closure, the troll fishery targeted primarily on coho salmon harvesting approximately 895 thousand coho, or 86 percent of the total season catch of 1.04 million coho salmon. During the same period, approximately 366,000 pink salmon (75% of the season total), 9,200 chum salmon (72%) and 7,600 sockeye salmon (78%) were also harvested, mostly incidental to coho salmon. While fishing for other species, trollers were required to immediately release any incidentally hooked chinook salmon.

Funding for the 1987 onboard observer program to monitor incidental hook and release of chinook salmon in the troll fishery was provided by Pacific Salmon Treaty implementation funds. These funds are administered by the National Marine Fisheries Service of the National Oceans and Atmospheric Administration.

METHODS

Methods employed to monitor hook and release of chinook salmon during chinook non-retention periods of the 1987 Southeast Alaska troll fishery were similar to those used in 1985 and 1986 as described in Davis et al. (1986) and (1987). ADF&G observers on board volunteer commercial troll vessels recorded hook and release of chinook salmon while vessels were engaged in fishing operations for other species of salmon. Observer effort was distributed throughout time and area to the extent possible given the availability of observers and volunteer vessels. Fishermen participating in the program received renumeration to compensate for additional expenses incurred as a result of accommodating onboard observers.

Trollers participating in the observer program received no special instructions regarding fishing areas or techniques, but were encouraged to conduct normal commercial fishing operations for coho and other non-chinook species. Salmon, excluding chinook salmon, legally retained by the fishermen were sold in the usual commercial markets with proceeds accruing to the fishermen. Incidentally hooked chinook salmon were released by fishermen using a standard technique of bringing the fish to the stern of the boat and disengaging the hook with a gaff, or release stick, without removing the fish from the water.

Observers recorded information on numbers, approximate size, and apparent condition of chinook salmon incidentally hooked and released by volunteer vessels while targeting on other species. Information on area and fishing time was also recorded. Fishing time was

used to compute chinook hook and release rates per unit of fishing effort. Other information recorded included catches of coho and other non-chinook species, type of fishing gear, and depth of gear. A copy of the daily data collection form is included as Figure 1.

Observers were instructed to record the approximate size of chinook salmon incidentally hooked and released by two size categories: 28 inches or greater in overall length (legal size during troll chinook fisheries); or less than 28 inches (sublegal size). To prevent excessive handling of fish required for direct measurement, fishermen were asked assist the observers in judging the size of incidentally hooked chinook salmon as to legal or sublegal size while releasing the fish.

The apparent condition of chinook salmon hooked and released was recorded by observers according to one of three categories.

(1) Minor Injury - the fish was hooked near the outer portion of the mouth, little or no bleeding was observed, and the fish swam away quickly after being released;

(2) Serious Injury - the fish was hooked in or near the gills or eyes, severe bleeding was observed, and the fish swam away slowly or appeared stunned after release;

(3) Dead - the fish appeared to be dead, no swimming activity was observed, and the fish floated or sank upon release.

Average numbers of chinook hooked and released per unit fishing effort by observer troll vessels was expanded by the estimated total troll fleet fishing effort to estimate total numbers of chinook salmon hooked and released by all troll vessels during chinook non-retention periods. Estimates were initially calculated by time/area strata to account for spatial and temporal differences in chinook encounter rates; time/area estimates were then aggregated to yield total estimates.

Within time/area strata, estimates of numbers of chinook hooked and released per gear day by individual observer vessels were used to calculate sample variances. Strata sample variances were then used to calculate sample variances, standard errors and confidence intervals for estimates of total chinook hooked and released (Appendix D).

To estimate total mortalities of chinook salmon hooked and released during 1987 chinook non-retention periods, total numbers of chinook hooked and released estimated from onboard observer data were multiplied by hook and release mortality rates obtained from an independent study conducted by Wertheimer et al. (1988). (Although the observer program provides estimates of immediate mortality rates, i.e. the proportion of hooked and

released chinook which are dead when released, it does not provide a direct estimate of delayed mortality rates, i.e. the proportion of live chinook released which subsequently die.)

RESULTS

Observers spent approximately 132.6 gear days (13.7 fishing hours per gear day) on board volunteer commercial troll vessels to monitor incidental hook and release of chinook salmon during chinook non-retention periods of the 1987 Southeast Alaska summer troll season (Table 2). Thirty-two different commercial troll vessels participated in the program. A total of 1,594 chinook salmon of all sizes were hooked and released by observer vessels during observer coverage periods (Table 3).

For purposes of this analysis, observer data on incidental hook and release of chinook salmon was combined within each of six different areas, three outside and three inside areas (Figure 2). Data was also combined within two different time periods, July 13 through August 2 and August 13 through September 20. (The troll fishery was closed to all fishing Aug. 3-12). No observations were available for the northern outside area, therefore average chinook hook and release rates from the adjacent central outside area were used to derive estimates of chinook hooked and released in the northern outside area.

Distribution of observer effort among area strata in 1987 was similar to the distribution of fleet effort as shown in the table below:

Comparison of Area Distribution of Onboard Observer Effort and Troll Fleet Effort During the 1987 Season

	Observer Gear Days		Estimated [1] Fleet Gear Days	
	Number	Percent	Number	Percent
North/Central Outside	62.46	47%	16,491	53%
South Outside	33.82	26%	5,778	18%
North Inside	14.86	11%	4,998	16%
Central Inside	12.45	9%	2,499	8%
South Inside	9.01	7%	1,641	5%
Totals	132.60	100%	31,407	100%

[1] Fleet gear days estimated from aerial overflights and open fishing days (Appendix 3).

The majority of the observer effort (73%), as well as the fleet effort (71%), occurred in the outside areas. Approximately 27 percent of the observer effort and 29 percent of the fleet effort occurred in inside areas.

Average catch and release rates for chinook salmon of all sizes by observer vessels during July 13 through August 2 ranged from 9.2 chinook per gear day in the southern inside area to 16.4 in the central outside area (Table 2). During the second observation period, August 13 through September 20, catch and release rates ranged from 4.5 chinook of all sizes per gear day in the southern outside area to 37.9 in the southern inside area. For both periods combined, the average catch and release rate, weighted by fleet effort, was 11.8 chinook of all sizes per gear day (Table 3). Comparisons of 1987 chinook catch and release rates during chinook non-retention periods with observations in 1985 and 1986 as reported by Davis et al. (1985) and (1986) are shown below.

Comparison of Chinook Hook and Release Rates During Chinook Non-Retention Periods of the Southeast Alaska Troll Fishery

Year	Average Numbers of Chinook Salmon Hooked and Released Per Gear Day		
	Legal Size (≥ 28 in.)	Sublegal Size (< 28 in.)	Total
1985	4.7	4.1	8.8
1986	3.5	4.7	8.2
1987	6.2	5.6	11.8

The average catch and release rate of 11.8 chinook of all sizes per gear day in 1987 represented an increase of 34 and 37 percent above the 1985 (8.8) and 1986 (8.2) rates respectively. For legal size chinook, the average rate of 6.2 fish per gear day in 1987 was an increase of 32 percent over the 1985 rate of 4.7 fish per gear day, and 77 percent over the 1986 rate of 3.5 legal chinook per gear day. The 1987 rate of 5.6 sublegal chinook per gear day represented an increase of 37 and 19 percent above 1985 and 1986 respectively.

The percentage of legal size versus sublegal size chinook hooked and released by observer boats in 1987 varied considerably by time and area. Percentages of legal size chinook ranged from 78.8 percent in the central outside area during the second period to 6.5 percent in the southern inside area during the first period. However, the overall percentage of legal size chinook hooked and released, weighted by fleet effort for each time/area strata, was 52.5 percent. This is equivalent to a sublegal to legal chinook ratio of 0.9:1 or approximately 1:1. As shown below, the relative proportion of legal and sublegal size chinook hooked and released in 1987 were similar to 1985, but proportionately more sublegal chinook were hooked and released in 1986 (Davis et al. 1986 and 1987).

Comparison of Percentages of Legal and Sublegal Chinook Hooked and Released During Chinook Non-Retention Periods of the Southeast Alaska Troll Fishery, 1985-87

Year	Percentages of Chinook Salmon Hooked and Released: Legal Size (≥ 28 in.)	Sublegal Size (< 28 in.)	Ratio of Sublegal to Legal
1985	53.8%	46.2%	0.9:1
1986	42.7%	57.3%	1.3:1
1987	52.5%	47.5%	0.9:1

Estimated Total Numbers of Chinook Hooked and Released

Total numbers of chinook salmon hooked and released during chinook non-retention periods of the 1987 Southeast Alaska summer troll season were derived from average chinook catch and release rates obtained from the onboard observer program, expanded by estimates of total fleet fishing effort in each of the time/area strata (Table 4). Estimates of fleet fishing effort were obtained from vessel counts made during aerial overflights expanded for total fishing days (for non-chinook species) during chinook non-retention periods (Appendix C).

An estimated 193.5 thousand legal size chinook salmon were hooked and released during 60 days of troll chinook non-retention in 1987 (Table 4). Lower and upper 90 percent confidence intervals were estimated to be 151.1 and 236.4 thousand respectively. [See Appendix 4 for a description of procedures used to derive variance estimates.] Approximately 176.2 thousand sublegal chinook were estimated to have been hooked and released during the non-retention periods. Ninety percent confidence intervals for sublegal chinook were 154.8 and 197.6 thousand.

Observed Condition of Chinook Hooked and Released

Observers recorded apparent condition of chinook salmon hooked and released according to three categories: minor injury, serious injury, or dead. Visual characteristics associated with each injury category were described in the Methods section. Within each size category, legal and sublegal, observer data on condition of released chinook was combined for all time/area strata. Hook and release injury rates are assumed to be independent of time or area.

For legal size chinook 28 inches and larger, 763 of which were observed during 1987, injury category percentages were as follows: minor - 89.3%; serious - 9.0%; dead - 1.5% (Table 5). For the 831 sublegal size chinook observed, injury category percentages were: minor - 73.0%; serious - 17.9%; dead - 9.0%.

Observer condition ratings in 1987 were similar to those reported by Davis et al. (1987) for 1985 and 1986 as shown below:

Comparison of Observer Condition Ratings for Chinook Salmon Hooked and Released During Chinook Non-Retention Periods of the Southeast Alaska Troll Fishery, 1985-87

Year	Sample Size	Condition Categories: Minor	Serious	Dead	Serious + Dead
		Legal Size (28 inches or larger)			
1985	373	86.8%	10.7%	2.4%	13.1%
1986	121	84.3%	11.6%	4.1%	15.7%
1987	763	89.3%	9.0%	1.5%	10.5%
Weighted Averages[1/]		88.1%	9.8%	2.0%	11.8%
		Sublegal Size (less than 28 inches)			
1985	791	71.8%	17.5%	12.9%	28.1%
1986	318	75.8%	12.9%	11.3%	24.2%
1987	831	73.0%	17.9%	9.0%	26.9%
Weighted Averages[1/]		73.0%	16.9%	11.0%	27.9%

[1/] Annual averages weighted by samples sizes.

A higher percentage of sublegal size chinook were recorded by observers as dead when released than for legal size chinook in each of the three years; on average 11.0 percent versus 2.0 percent. Davis et al. (1986) noted "The higher percent of sublegal size chinook categorized as dead appeared to be the result of more of the smaller fish drowning while being dragged on the gear". It is also noted that the percentage of seriously wounded was higher for sublegal chinook (average 16.9 versus 9.8 percent). Consequently, the percentage of seriously wounded plus dead was also higher, with an average of 26.9 percent for sublegal versus 11.8 percent for legal size chinook.

Estimation of Hook and Release Mortalities Rates

To estimate total mortalities resulting from hook and release of chinook salmon by all vessels during troll chinook non-retention periods, it is necessary to estimate (1) total numbers of chinook hooked and released; and (2) total (immediate plus delayed) mortality rates for those fish. Numbers of chinook salmon hooked and released during 1987 chinook non-retention periods can be estimated directly from the observer program as described above. However, observer data does not allow direct estimation of total mortality rates. Although "immediate" mortality rates can be estimated from the percentage of chinook observed to be dead when released, the "delayed" mortality rate for chinook which are

alive when released but subsequently die due to injuries cannot be estimated from the observer study.

Numerous studies have been conducted which provide some information on hook and release mortalities. Based on an extensive review of most studies conducted prior to 1970, Wright (1970) concluded that 15 to 45 percent was the most probable range of mortality rates for hook and release fisheries. He further concluded however, that for studies reviewed, "estimates above 30% are probably somewhat excessive since they are based either on control group experiments where seriously injured fish were included as total mortalities or on tank-holding experiments where the stress caused by artificial experimental conditions may have contributed materially to observed losses".

During 1986 and 1987, Wertheimer (1988) conducted studies in Southeast Alaska designed specifically to estimate total mortality rates of chinook salmon hooked and released by commercial troll gear. In these studies, chinook salmon hooked by chartered commercial troll vessels were transferred to large (1700 cubic meter) holding pens and held for five days to observe delayed mortalities. In 1986 observations were made on 506 chinook (108 legal size; 398 sublegal size) and in 1987 on 913 chinook (550 legal and 363 sublegal), for a total of 1,419 chinook of all sizes.

Maximum likelihood estimates of mortality rates (with 95% confidence intervals in parentheses) from the 1987 holding pen study were: legal size chinook - 19.0% (15.5 - 22.5%); sublegal size chinook - 18.3% (14.0 - 22.6%). By comparison, corresponding estimates from the 1986 study were: legal size chinook - 20.4% (9.0 - 31.9%); sublegal size chinook - 24.6% (20.1 - 29.0%).

In an attempt to adjust for potential negative bias in mortality rate estimates due to unmeasured mortalities occurring after the five-day holding period, Wertheimer also utilized information from two earlier tag/recovery studies used to estimate hook and release mortalities (Butler and Loeffel 1972 and Wright 1970).
Based on his 1986-87 studies, and information from the two earlier mortality studies, Wertheimer (op cit.) concluded that the most likely range of total (immediate plus delayed) hook and release mortality rates for troll gear is as follows:

Total Mortality Rate Estimates

Chinook Size Category	Low	Point	High
Legal size (≥ 28 inch.)	18.5%	22.1%	26.0%
Sublegal size (< 28 inch.)	22.1%	26.0%	26.4%

All studies used to estimate hook and release mortality rates contain some potential for bias due to different handling procedures used in the studies and normal commercial trolling operations. For example, additional handling and holding of chinook salmon during the studies would be expected to contribute some positive bias (overestimation), while shorter time on gear would be expected to result in some negative bias (underestimation). However, the combined effect of these biases is thought to be small relative to the effects estimated by the Wertheimer studies.

The Wertheimer studies are considered to provide the best current information on probable mortality rates of chinook salmon hooked and released in the Southeast Alaska troll fishery. Therefore, mortality rate estimates provided by Wertheimer (op cit.) were used to derive estimates of total chinook hook and release mortalities during chinook non-retention periods of the 1987 troll fishery.

Estimation of Total Hook and Release Mortalities

Total mortalities of chinook salmon hooked and released during chinook non-retention periods of the 1987 Southeast Alaska troll fishery were estimated using (1) total numbers of chinook hooked and released calculated from the 1987 onboard observer data, and (2) estimates of total mortality rates reported by Wertheimer (1988). Minimum and maximum estimates of total mortalities were also calculated using 90 percent lower and upper confidence interval estimates of total chinook hooked and released, and minimum and maximum mortality rate estimates from Wertheimer (op cit.). Computations are summarized in Table 6.

An estimated 42.8 thousand legal size ($\geq$ 28 inch.) chinook salmon incurred fatal hook and release injuries during chinook non-retention periods of the 1987 Southeast Alaska troll fishery. Minimum and maximum mortality estimates for legal size chinook were 28.0 and 52.2 thousand respectively (Table 6).

A point estimate of 45.8 thousand was calculated for sublegal chinook (< 28 inch.) incurring fatal hook and release injuries during 1987 chinook non-retention periods. Minimum and maximum estimates for sublegal size chinook mortalities were 34.2 and 52.2 thousand respectively (Table 6).

No estimate of the stock composition of chinook salmon hooked and released during 1987 chinook non-retention periods is available from this study. However, these chinook would be expected to originate from a large number of natural and hatchery systems in the Pacific Northwest, British Columbia and Southeast Alaska.

DISCUSSION

Chinook salmon catch limits and other conservation measures have become progressively more restrictive in Southeast Alaska since 1980. These actions have been taken in response to both regional and coastwide conservation problems which developed during the 1970s and early 1980s for many natural chinook salmon stocks from Southeast Alaska to the Columbia River. Since 1985, coordinated conservation measures have been implemented for U.S. and Canadian fisheries from central Oregon to Southeast Alaska as part of a coastwide 15-year natural chinook stock rebuilding program initiated under the Pacific Salmon Treaty (Anon. 1985). Because of their wide-ranging ocean migration patterns, many north migrating chinook stocks contribute to fisheries in jurisdictions north of their river of origin thus necessitating a coordinated, coastwide management approach. As a result of these conservation measures, escapements have increased substantially for

many natural chinook salmon stocks during the past several years. However, incidental fishing mortalities of chinook salmon have also increased.

Because the troll fishery is the major directed chinook salmon fishery in Southeast Alaska, accounting for approximately 80 to 90 percent of the region's chinook harvest, this fishery has been the most heavily impacted by recent chinook conservation measures. Chinook catch ceilings and other conservation measures imposed on the Southeast Alaska troll fishery in recent years have significantly reduced fishery impacts on chinook stocks contributing to this fishery. However, shortened chinook seasons and increased chinook abundance have resulted in increased incidental chinook mortalities.

Although incidental chinook mortalities have increased, total Southeast Alaska fishery impacts on chinook salmon have been reduced. For example, the 1987 troll fishery operating under imposed catch limits harvested 242.3 thousand chinook salmon of which 209.5 thousand or about 86 percent occurred during a 23-day summer season. By comparison, the Southeast Alaska troll fishery operating year around during 1951-53 harvested annually approximately 450 thousand chinook salmon. As recently as 1978, the troll harvest reached 375 thousand during a year around fishery. Given current fleet efficiency and chinook abundance, it is likely that the 1987 troll harvest in the absence of any conservation measures would have substantially exceeded these levels. Thus, even taking into account the estimated 1987 hook and release mortality of approximately 43 thousand legal size chinook, the total potential impact of the 1987 troll fishery on legal size chinook was reduced by perhaps as much as half through imposition of catch ceilings and other conservation measures.

Although it is apparent that savings of chinook salmon due to conservation measures implemented in the Southeast Alaska troll fishery outweigh losses due to associated incidental mortalities, the magnitude of such mortalities is still substantial. Such mortalities should be reduced and minimized to the extent possible within constraints imposed by basic conduct of the fishery.

Measures Taken to Minimize Incidental Chinook Mortalities in the Southeast Alaska Troll Fishery

Efforts have been made to structure the overall Southeast Alaska troll season in a manner which minimizes incidental mortalities of chinook salmon. This structuring has taken into account the following overall troll fishery management objectives: (1) allow a troll chinook harvest consistent with all-gear catch ceilings established under the Pacific Salmon Treaty, and with catch allocations established by the Board of Fisheries; (2) provide troll fishery access to chinook salmon produced by Alaska hatcheries; (3) provide for a historical winter troll chinook season; (4) provide for troll harvest of coho and other non-chinook salmon species consistent with conservation objectives and Board-established catch allocations.

Chinook fishing time during the general, all-species summer troll season, defined by regulation as April 15 through September 30, has been reduced 86 percent from a full season of 169 days prior to 1980 to 23 days in 1987 (Figure 3). To accomplish this, the opening date of the summer troll season has been progressively delayed, from April 15 in 1980 to June 20 in 1986 and 1987. For the last two years, this represented a delay of five days in the beginning of the troll coho season which normally opened June 15 by regulation.

A winter troll season also occurs in Southeast Alaska from October 1 through April 14 during which approximately 10 to 15 percent of the troll chinook catch normally occurs. (This percentage increased to about 25 percent in 1988 as a result of increased chinook abundance and fishing effort and mild weather conditions.) The Board has placed a high priority on maintaining the winter troll fishery because of its historical importance to the small rural communities of Southeast Alaska. The proportion of Alaska hatchery chinook is also higher during the winter fishery which occurs in inside waters than in the summer fishery, and this percentage has been increasing as Alaska hatchery chinook production has increased. Under catch ceiling management, increased winter troll catches reduce the number of chinook available for the summer season thereby increasing the potential for chinook non-retention. The Board of Fisheries has considered the need to limit winter catches if they continue to increase above historical levels.

As Southeast Alaska troll chinook seasons have been reduced in response to decreasing chinook catch ceilings, the duration of chinook non-retention periods has increased. In 1987, 60 days of chinook non-retention occurred compared to 42 days in 1986 and 48 days in 1985 (Figure 3). The chinook non-retention problem was particularly exacerbated in 1987 by a large increase in chinook abundance which resulted in a troll fleet catch rate of 9,100 chinook per day. This was an increase of about 50 percent compared to the 1986 rate of 6,000 during a similar June 20 to mid-July period (Figure 4). Although some areas of high chinook abundance were closed beginning July 4 to reduce fleet catch rates, the allowable chinook catch was still taken by July 12, and chinook non-retention occurred for the remainder of the season (except for a 10-day all-species closure Aug. 3-12) while the fleet continued to fish for coho and other non-chinook species.

To further reduce chinook non-retention and minimize associated hook and release mortalities, the Alaska Board of Fisheries has delayed the opening of the 1988 general summer troll season from June 20 until July 1. Given chinook abundance and fishing effort similar to 1987, 11 fewer days of chinook non-retention would be expected to occur in 1988. Chinook hook and release mortalities would be expected to be reduced accordingly.

In 1988, as in previous years, the Board again authorized closure of several outer coastal areas of frequent high chinook abundance to all trolling during any chinook non-retention periods when the fleet is fishing for other species. This is expected to reduce incidental hook and release of chinook salmon and help minimize associated incidental mortalities.

Coastwide Incidental Chinook Salmon Mortalities

One objective of the coordinated, coastwide chinook salmon management program implemented under the Pacific Salmon Treaty is minimization of incidental chinook mortalities. Of immediate concern is the potential impact of such mortalities on the Treaty's 15-year coastwide natural chinook stock rebuilding program. A more general, long term concern, however, is the potential loss of chinook resource benefits resulting from incidental fishing mortalities.

Incidental chinook salmon mortalities occur to some extent in virtually all commercial and recreational fisheries. The most common and probably largest source is that due to catch and release of sublegal size chinook salmon in fisheries with regulated chinook size limits. Incidental mortalities due to release of both legal and sublegal size chinook in chinook non-

retention fisheries targeting on other species is also an importance source, and one which has increased with implantation of chinook catch ceilings under the Treaty. There is concern that this latter source of mortalities will increase further as chinook abundance increases in response to Treaty-imposed chinook conservation measures.

At the request of the Pacific Salmon Commission, the Chinook Technical Committee conducted an initial investigation into the coastwide problem of incidental chinook mortalities in all troll, net and recreational fisheries from Southeast Alaska to central Oregon. The initial focus was on potential effects of such mortalities on the coastwide natural chinook stock rebuilding program.

Although complete information on coastwide mortalities was not available, the Chinook Technical Committee (1987) did conclude that: "Information available from agency reports indicate that the coastwide magnitude of incidental fishing mortality for all sizes of fish is likely to be in the range of 30 to 50 percent of the reported catch." The Committee further noted "Although a large portion of this incidental catch is young fish, this still represents a significant source of mortality." (For 1987, a preliminary catch of 2.2 million chinook salmon was reported to the Commission for U.S. and Canadian fisheries from central Oregon to Southeast Alaska.)

It is not possible to totally eliminate all incidental fishing mortalities and still allow conduct of fisheries to harvest chinook and other species of salmon surplus to spawning needs. However, to the extent that losses due to such mortalities can be reduced and minimized, additional resource benefits can be realized. In its report, the Chinook Technical Committee concluded: "The most practical and productive approach to address incidental mortality is to minimize such losses so as to achieve maximum productive utilization of the available abundance." The Committee further recommended: "In particular, research and management programs to develop ways of minimizing incidental mortality losses should be designed in cooperation with the industry. Also, educational programs should be developed and expanded to disseminate information on methods of minimizing incidental mortalities."

The Pacific Salmon Commission is currently investigating ways in which positive incentives can be provided to jurisdictions which regulate and structure fisheries to reduce incidental chinook mortalities. The positive incentives are intended to help offset associated adverse impacts on fisheries such as loss of harvest of other species, disruption of marketing structures, and other disruption of historical fisheries.

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Table 1. Preliminary 1987 Southeast Alaska Troll Fishery chinook and coho salmon catches by period. (Revised: 10/16/87)

PERIOD (NO. OF DAYS)	THOUSANDS OF FISH CHINOOK	COHO
WINTER SEASON (OCT. 1, 1986 - APR. 14, 1987)	28.4	-
SUMMER SEASON		
APR 15 - MAY 30 (46 DAYS)	- CLOSED ALL SPECIES -	
JUNE EXPER. HATCHERY FISHERIES (FOUR NEAR-TERMINAL HATCHERY AREAS OPENED SEVERAL DAYS PER WEEK DURING FIRST THREE WEEKS OF JUNE)	4.4	
JUN 20 - JUL 12 (23 DAYS)	209.5	145.6[1/]
JUL 13 - AUG 2 (21 DAYS)	-CLOSED-	506.5
AUG 3 - 12 (10 DAYS)	- CLOSED ALL SPECIES -	
AUG 13 - SEP 20 (39 DAYS)	-CLOSED-	388.0
SEP 21-30 (10 DAYS)	- CLOSED ALL SPECIES -	
SUMMER SEASON SUBTOTALS	213.9	1040.1
1987 SEASON TOTALS	242.3	1040.1

[1/] COHO CATCHES REPORTED ON FISH TICKETS BY DATE OF CATCH THROUGH STAT. WEEK 28 ENDING JULY 11.

NOTE: TROLL CATCHES OF OTHER SPECIES INCLUDED: SOCKEYE - 7,200; PINK - 410,000; CHUM - 8,800.

Table 2. Observations on incidental hook and release rates for chinook salmon, and coho salmon catch rates in the 1987 Southeast Alaska troll fishery from July 13 through September 20.

Sample Period: July 13 through August 2

Area	Boat Days	Gear Days Observed[1/]	Average Catch Per Gear Day Chinook	Coho	-Chinook/Coho Ratio- Chinook Per 100 Coho	Coho Per Chinook
Outside						
Central	33	26.74	16.4	25.9	63.1	1.5
Southern	13	10.98	10.5	39.0	27.0	3.7
Inside						
Northern	2	1.55	11.5	11.5	100.0	1.0
Central	6	4.92	9.5	25.3	37.6	2.6
Southern	6	5.00	9.2	60.4	15.2	6.5
Subtotal	60	49.20				

Sample Period: August 13 through September 20

Area	Boat Days	Gear Days Observed	Average Catch Per Gear Day Chinook	Coho	-Chinook/Coho Ratio- Chinook Per 100 Coho	Coho Per Chinook
Outside						
Central	49	35.72	11.5	22.5	50.9	1.9
Southern	31	22.84	4.5	29.1	15.4	6.4
Inside						
Northern	16	13.31	14.0	30.9	45.3	2.2
Central	11	7.53	9.9	6.9	144.2	0.6
Southern	5	4.01	37.8	31.3	120.6	0.8
Subtotal	112	83.42				
Totals	172	132.62				

1/ An average gear day of 13.7 fishing hours is used based on past fishery performance data.

Table 3. Numbers of chinook salmon hooked and released by onboard observer vessels during chinook only closures of the 1987 Southeast Alaska summer troll fishery.

Period 1: July 13 - August 2 (21 days)

Area[1/]	Observer Gear Days[2/]	Total Chinook Hooked and Released: All Sizes	Less than 28": Number	Less than 28": Percent	28 " or larger: Number	28 " or larger: Percent	Chinook Per Gear Day: All Sizes	Less than 28 Inches	28 Inches or Larger
Outside									
North	NA								
Central	26.74	439	175	39.9%	264	60.1%	16.4	6.5	9.9
South	10.98	116	79	68.1%	37	31.9%	10.6	7.2	3.4
Inside									
North	1.55	18	10	55.6%	8	44.4%	11.6	6.5	5.2
Central	4.92	47	27	57.4%	20	42.6%	9.6	5.5	4.1
South	5.00	46	43	93.5%	3	6.5%	9.2	8.6	0.6
Subt.	49.19	666							

Period 2: August 13 - September 20 (39 days)

Area[1/]	Observer Gear Days[2/]	Total Chinook Hooked and Released: All Sizes	Less than 28": Number	Less than 28": Percent	28 " or larger: Number	28 " or larger: Percent	Chinook Per Gear Day: All Sizes	Less than 28 Inches	28 Inches or Larger
Outside									
North	NA								
Central	35.72	411	87	21.2%	324	78.8%	11.5	2.4	9.1
South	22.84	103	58	56.3%	45	43.7%	4.5	2.5	2.0
Inside									
North	13.31	187	167	89.3%	20	10.7%	14.0	12.5	1.5
Central	7.53	75	51	68.0%	24	32.0%	10.0	6.8	3.2
South	4.01	152	134	88.2%	18	11.8%	37.9	33.4	4.5
Subt.	83.41	928							
Totals	132.60	1594							

[1/] Refer to Figure 2 for description of areas.

[2/] One gear day defined as 13.7 fishing hours.

1987CHINOOK MORT./TAB3.FRE

Table 4. Estimated numbers of chinook salmon hooked and released by all vessels during chinook only closures of the 1987 Southeast Alaska summer troll fishery.

Period 1: July 13 - August 2 (21 days)

Area[1]	Estimated Chinook Hooked and Released Per Gear Day[2]			Estimated Fleet Gear Days[3]	Estimated Total Numbers of Chinook Hooked and Released		
	Total	Less Than 28 inch.	28 Inch. or Larger		All Sizes	Under 28 inch.	28 Inch. or over
Outside							
North	16.4[4]	6.5[4]	9.9[4]	1,155	18,942	7,508	11,435
Central	16.4	6.5	9.9	2,583	42,361	16,790	25,572
South	10.6	7.2	3.4	2,541	26,935	18,295	8,639
Inside							
North	11.6	6.5	5.2	1,449	16,808	9,419	7,535
Central	9.6	5.5	4.1	1,953	18,007		
South	9.2	8.6	0.6	1,134	10,433	9,752	680
Subtotals	12.4[3]	6.7[3]	5.7[3]	10,815	134,228	72,505	61,868

Period 2: August 13 - September 20 (39 days)

Area	Estimated Chinook Hooked and Released Per Gear Day[1]			Estimated Fleet Gear Days[2]	Estimated Total Numbers of Chinook Hooked and Released		
	Total	Less Than 28 inch.	28 Inch. or Larger		All Sizes	Under 28 inch.	28 Inch. or over
Outside							
North	11.5[4]	2.4[4]	9.1[4]	7,722	88,803	18,533	70,270
Central	11.5	2.4	9.1	5,031	57,857	12,074	45,782
South	4.5	2.5	2.0	3,237	14,567	8,093	6,474
Inside							
North	14.0	12.5	1.5	3,549	49,686	44,363	5,324
Central	10.0	6.8	3.2	546	5,460	3,713	1,747
South	37.9	33.4	4.5	507	19,215	16,934	2,282
Subtotals	11.4[3]	5.0[3]	6.4[3]	20,592	235,587	103,709	131,879

--Continued--

Table 4. (page 2 of 2.)

Periods Combined: July 13 - Aug. 2, Aug. 13 - Sept. 20; (60 days)

Area	Estimated Chinook Hooked and Released Per Gear Day[1/]			Estimated Fleet Gear Days[2/]	Estimated Total Numbers of Chinook Hooked and Released		
	Total	Less Than 28 inch.	28 Inch. or Larger		All Sizes	Under 28 inch.	28 Inch. or over
Outside							
North	12.1[4/]	2.9[4/]	9.2[4/]	8,877	107,745	26,040	81,705
Central	13.2	3.8	9.4	7,614	100,218	28,864	71,354
South	7.2	4.6	2.6	5,778	41,501	26,388	15,113
Inside							
North	13.3	10.8	2.6	4,998	66,494	53,781	12,858
Central	9.7	5.8	3.9	2,499	24,209	14,454	9,755
South	18.1	16.3	1.8	1,641	29,648	26,686	2,962
Subtotals	11.8[3/]	5.6[3/]	6.2[3/]	31,407	369,815	176,213	193,747

1/ Estimated chinook hook and release catch rates from Table 2.
2/ Estimated fleet gear days from Appendix C.
3/ Weighted by fleet gear days.
4/ Observed catch rate and size composition in the central outside area used for northern outside area due to lack of observations in that area.

Table 5. Comparisons of the injuries inflicted on chinook salmon less than 28 inches versus chinook 28 inches or greater; which were hooked incidentally while fishing for other species in the 1987 Southeast Alaska troll fishery from July 13 through September 20.

Sample Period: July 13 through August 2

Chinook Size	Chinook in Period Number Hooked	Percent	Injury Status: Minor Number	Minor Percent	Serious Number	Serious Percent	Dead Number	Dead Percent	Serious and Dead Number	Serious and Dead Percent
28 Inches or Longer	332	49.8%	290	87.3%	36	10.8%	6	1.8%	42	12.6%
Less than 28 Inches	334	50.1%	255	76.3%	44	13.1%	35	10.4%	79	23.6%

Sample Period: August 13 through September 20

Chinook Size	Chinook in Period Number Hooked	Percent	Injury Status: Minor Number	Minor Percent	Serious Number	Serious Percent	Dead Number	Dead Percent	Serious and Dead Number	Serious and Dead Percent
28 Inches or Longer	431	46.4%	392	90.9%	33	7.6%	6	1.3%	39	9.0%
Less than 28 Inches	497	53.5%	352	70.8%	105	21.1%	40	8.0%	145	29.1%

1987 SUMMARY

Chinook Size	Chinook in Period Number Hooked	Percent	Injury Status: Minor Number	Minor Percent	Serious Number	Serious Percent	Dead Number	Dead Percent	Serious and Dead Number	Serious and Dead Percent
28 Inches or Longer	763	47.8%	682	89.3%	69	9.0%	12	1.5%	81	10.6%
Less than 28 Inches	831	52.1%	607	73.0%	149	17.9%	75	9.0%	224	26.9%

Table 6. Estimates of total mortalities of chinook salmon hooked and released during chinook non-retention periods of the 1987 Southeast Alaska summer troll fishery.

		Chinook 28" or longer	Chinook less than 28"
(1)	Estimated total chinook hooked and released (Table 4 and Appendix 4)		
	Point estimates	193,747	176,213
	Lower 90% confid. interval	151,086	154,791
	Upper 90% confid. interval	236,407	197,636
(2)	Estimated mortality rates (Wertheimer 1988)		
	Point estimate	22.1%	26.0%
	Minimum estimate	18.5%	22.1%
	Maximum estimate	26.4%	26.4%
(3)	Estimated total hook and release mortalities [(1) x (2)]		
	Point estimate[1/]	42,818	45,815
	Minimum estimate[2/]	27,951	34,209
	Maximum estimate[3/]	62,411	52,176

1/ Point estimate of total mortalities calculated as product of point estimate of number of chinook hooked and released and the point estimate of the mortality rate.

2/ Minimum estimate of total mortalities calculated as product of lower 90% confidence interval estimate of number of chinook hooked and released and the minimum mortality rate estimate.

3/ Maximum estimate of total mortalities calculated as product of upper 90% confidence interval estimate of number of chinook hooked and released and the maximum mortality rate estimate.

Figure 1

Daily Data Log
Troll Fishery Observer Program
Incidental Hook and Release of Chinook Salmon

Date____/_____/_____ Approx. Hours Fished_____

Locations Fished: Stat. Area(s)_____
Common Names (Nearest headlands)_____

Catch of non-chinook species: Coho_____; Pink_____; Chum_____; Sockeye_____

Incidental Chinook Hook and Release Data

	Size		Injuries			Distance to Shore	Gear Depth	Depth Fish Hooked	Gear				Gear Description / Comments
	Legal	Sublegal	Minor	Serious	Dead	(miles)	(fath.)	(fath.)	Herring	Hootchy	Spoon	Plug	
1.													
2.													
3.													
4.													
5.													
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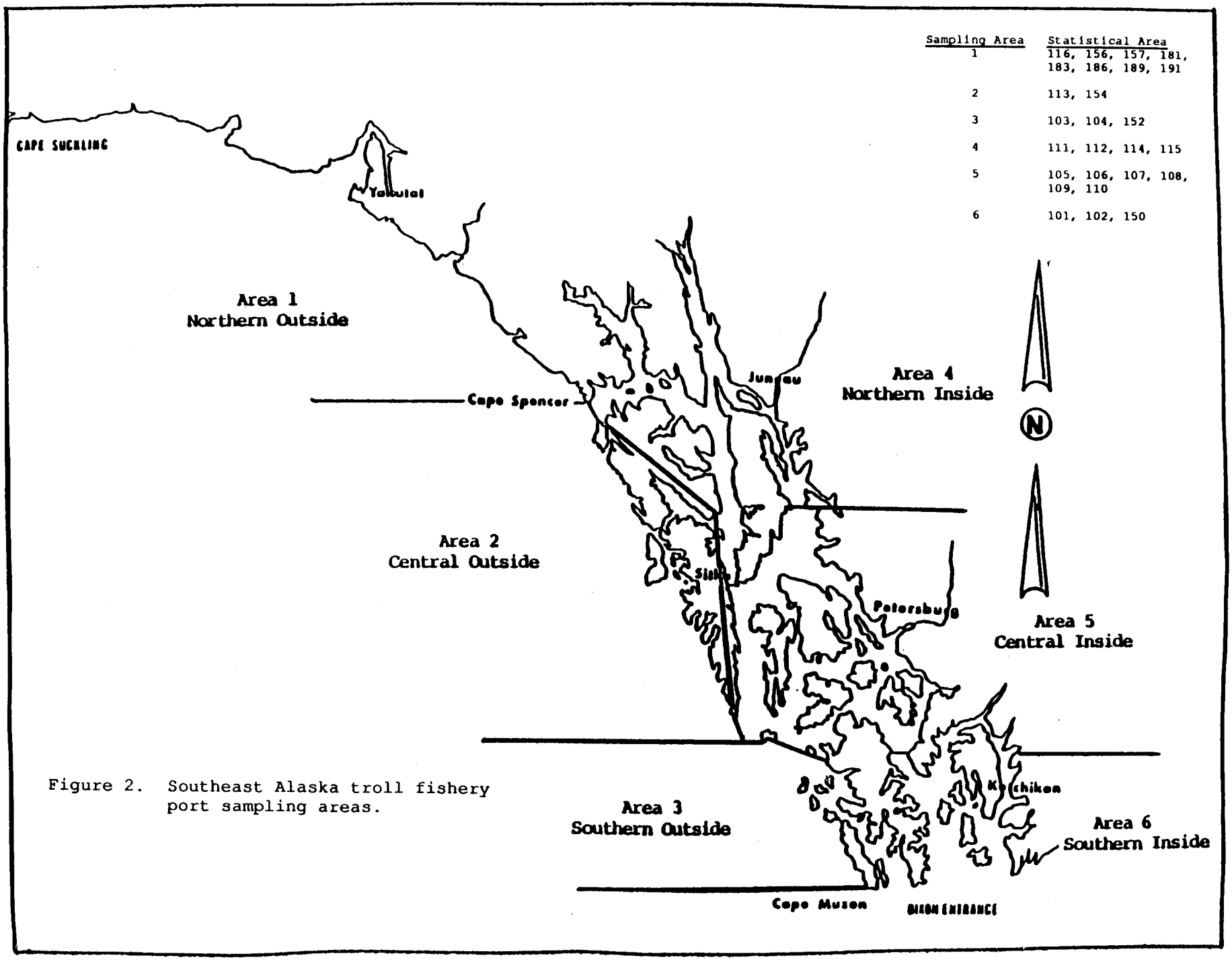
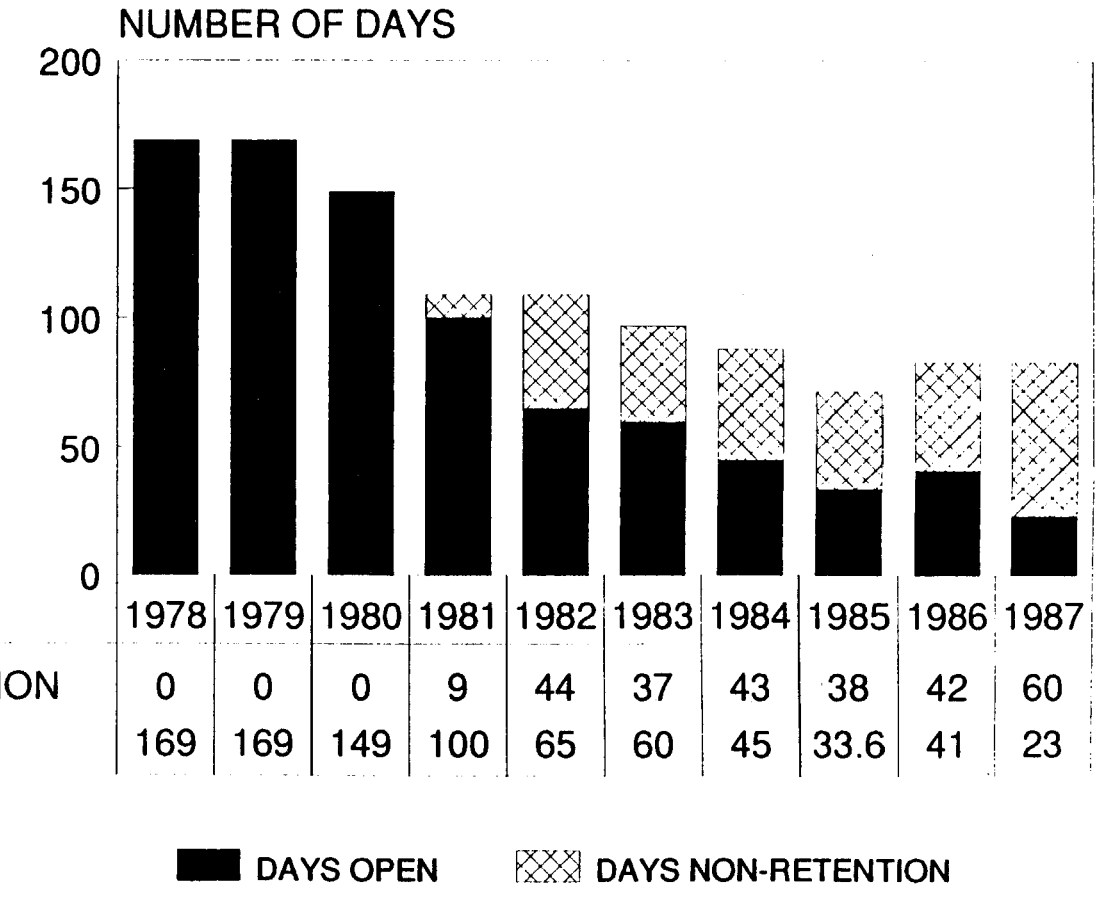


Figure 2. Southeast Alaska troll fishery port sampling areas.

Figure 3.

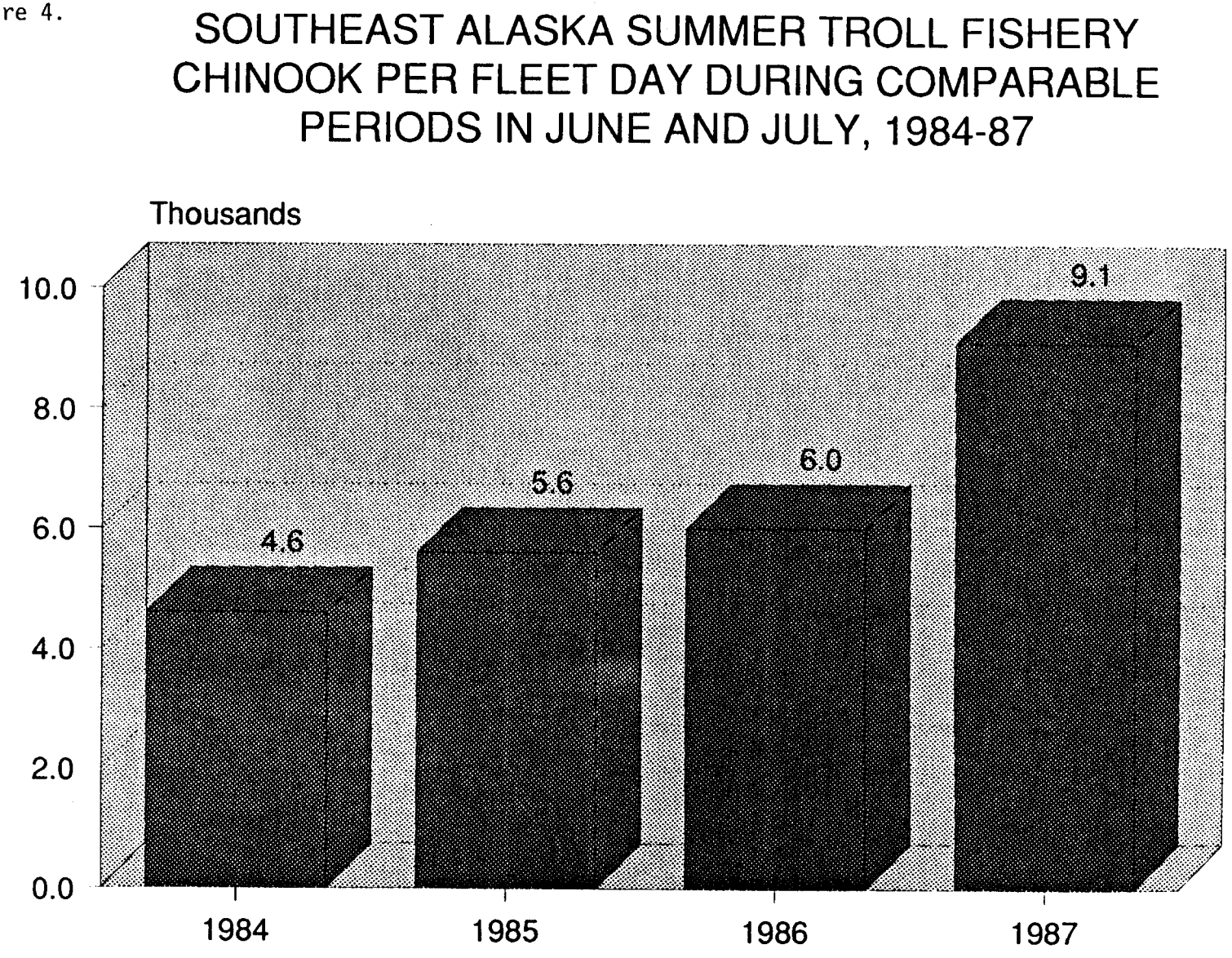
Southeast Alaska Summer Troll Season Days Open for Chinook Fishing and Days of Chinook Non-retention, 1978-87



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
DAYS NON-RETENTION	0	0	0	9	44	37	43	38	42	60
DAYS OPEN	169	169	149	100	65	60	45	33.6	41	23

[FILE: DAYS.CHT; DISK: 1987 CHIN. MORT.]

Figure 4.



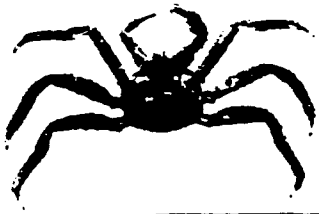
[FILE: FIG4.CHT; DISK: 1987 CHIN MORT]

APPENDICES

APPENDIX A

Area Closures implemented during the 1987 Southeast Alaska Summer troll fishery to minimize incidental hook and release mortalities of chinook salmon.

COMMERCIAL FISHERIES



NEWS RELEASE

ALASKA DEPARTMENT OF FISH & GAME

STATE OF ALASKA
Department of Fish and Game
Don W. Collinsworth, Commissioner

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FOR IMMEDIATE RELEASE

July 2, 1987

SOUTHEAST ALASKA COMMERCIAL TROLL FISHERY AREA CLOSURES ANNOUNCED

Juneau . . . The Alaska Department of Fish and Game announced today the Southeast Alaska commercial troll fishery will be closed in the following areas effective 12:01 a.m. Saturday, July 4, 1987:

1. Waters off the west coast of Baranof Island between the latitude of Point Lauder and the latitude of Redfish Cape to a distance of three miles off the shore.
2. Waters off the Kruzof Island shore from Shoals Point west to Cape Edgecumbe and from Cape Edgecumbe north to Cape Georgiana to a distance of three miles off the shore.
3. Waters off the west coast of Yakobi Island between the latitude of Yakobi Rock and the latitude of Cape Cross to a distance of one mile from the main Yakobi Island shore.
4. The waters of Palma Bay, Dixon Harbor, Torch Bay, Murk Bay and Graves Harbor will be closed east of a line beginning at the mouth of Kaknau Creek located approximately one mile northeast of Icy Point at 58°23'53" north latitude, 137°04'27" W. longitude to Astrolabe Point to a point on the south shore of Dixon Harbor at 58°20' N. latitude, 136°51'10" W. longitude to Venisa Point to the westernmost tip of Polka Point.
5. The inner and outer banks of the Fairweather Grounds, bounded by the following lines:

    Loran C line 7960-Y-29700 on the north.
    Loran C line 7960-X-14440 on the seaward side.
    Loran C line 7960-Y-29200 on the south.

These area closures are necessary to reduce the chinook catch rate and extend the chinook fishery. The Board of Fisheries directed the Department to attempt to extend the chinook fishery until at least July 26. The closures are designed to delay achievement of the chinook quota while minimizing the impacts on harvest of coho.

The closure of the area between Icy Point and Cape Fairweather is included to help reduce the overall fleet catch rate for chinook salmon. Once the

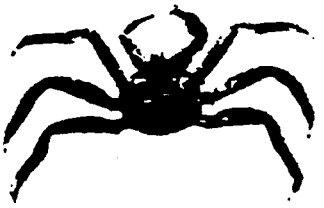
chinook fishery is closed it is anticipated that this area will reopen to allow normal coho harvesting. Area closures the same or similar to those used in recent years will be utilized following the chinook closure to minimize the chinook hook and release rate.

Catch rates during the first 10 days of the summer troll season are estimated to have been over 30 percent higher than the 1986 rates. Reduced catches as a result of announced area closures are expected to extend the fishery. However, the chinook season will be closed whenever the chinook quota is taken. These closures will remain in effect until the chinook quota is taken. At that time trolling will remain open to retention of salmon species other than chinook but fishermen will have to unload any chinook aboard before continuing to fish.

Area closures to reduce the number of chinook hooked and released after achievement of the chinook quota will be announced later.

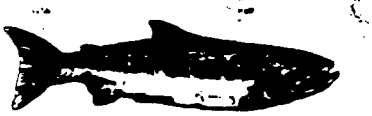
Recorded messages may be heard by calling 586-3505 in Juneau, 225-6870 in Ketchikan, 747-5022 in Sitka and 772-3700 in Petersburg.

COMMERCIAL FISHERIES



NEWS RELEASE

ALASKA DEPARTMENT OF FISH & GAME



STATE OF ALASKA
Department of Fish and Game
Don W. Collinsworth, Commissioner

Ken Parker
Director

Southeast Regional Office
P. O. Box 20
Douglas, Alaska 99824

Contact: Paul Larson
(907) 465-4250

FOR IMMEDIATE RELEASE

July 10, 1987

SOUTHEAST ALASKA TROLL FISHERY CLOSED TO CHINOOK SALMON

The Alaska Department of Fish and Game and the National Marine Fisheries Service announced today the Southeast Alaska and Yakutat troll fishery will be closed to the taking of chinook salmon effective 12:01 a.m. Monday, July 13. Preliminary catch reports and catch projections indicate this action is necessary to ensure that the chinook salmon catch by all Southeast Alaska fisheries does not exceed the catch ceiling established by the U.S./Canada Pacific Salmon Commission and approved by the Alaska Board of Fisheries. If complete catch tabulations after the closure indicate that the allowable chinook harvest has not been fully taken, an additional trolling period for chinook will be announced later in the season.

In addition to the region wide troll closure for chinook salmon only, a number of areas of frequent high chinook availability will be closed to all trolling. These area closures, the same as utilized during the 1986 season, are intended to help minimize the incidental hook and release of chinook which occurs as trollers continue to harvest coho salmon and other non-chinook species. Areas closed to all trolling effective 12:01 a.m. Monday, July 13 are as follows:

1. Waters off the west coast of Baranof Island between the latitude of Point Lauder and the latitude of Redfish Cape to a distance of one mile off the shore.

2. Waters off the Kruzof Island shore from Shoals Point west to Cape Edgecumbe and from Cape Edgecumbe north to Cape Georgiana to a distance of one mile off the shore.

3. Waters off the west coast of Yakobi Island between the latitude of Yakobi Rock and the latitude of Cape Cross to a distance of one mile from the main Yakobi Island Shore.

4. The waters off Palma Bay, Dixon Harbor, Torch Bay, Murk Bay and Graves Harbor will be closed east of a line beginning at the mouth of Kaknau Creek located approximately one mile northeast of Icy Point at 58°23'53" N. latitude, 137°04'27" W. longitude to Astrolabe Point to a point on the south shore of Dixon Harbor at 58°20' N. latitude, 136°51'10" W. longitude to Venisa Point to the westernmost tip of Polka Point.

5. The outer banks of the Fairweather Grounds bounded by the following lines:

   Loran C line 7960-Y-29800 on the north
   Loran C line 7960-Y-29150 on the south
   Loran C line 7960-X-14660 on the inshore side
   Loran C line 7960-X-14400 on the seaward side

6. That portion of Section 14-B in Icy Strait north of the latitude of Noon Point on Pleasant Island and east of 135°40' W. longitude. This closes the Icy Passage - Excursion Point area.

Fishermen should note that a portion of the "Inner Fairweather grounds" which, in addition to several other areas, was closed to all fishing since July 4 to slow the chinook catch rate, will be open for all species except chinook beginning July 13. This action has been taken to allow harvest of coho salmon in areas normally utilized by the troll fishery for that purpose. Fishermen should also note that the Icy Straits Pleasant Island area closure used in 1986 will also be effective beginning July 13; this area was not closed earlier in the season.

Fishermen are reminded that during the chinook salmon closure, chinook salmon may not be on board a vessel which is fishing for other species. All chinook salmon incidentally hooked during the closure must be released. Fishermen are encouraged to utilize fishing techniques which minimizes the incidental hooking of chinook and to carefully release any chinook which are hooked.

The Department of Fish and Game wishes to contact fishermen willing to participate in an onboard observer program to monitor incidental chinook hook and release as required under the Pacific Salmon Treaty. Fishermen will be reimbursed for expenses incurred while participating in the program. Fishermen interested in participating should contact Al Davis, Troll Fishery Biologist, at the Sitka ADF&G office (ph. 747-6688) or biologists at other Department offices.

APPENDIX B

Informational leaflet distributed to fishermen during the 1987 Southeast Alaska summer troll fishery suggesting ways to reduce and minimize incidental hook and release mortalities of chinook salmon.

APPENDIX B.1

Alaska
Trollers
Association

SUBJECT: COHO ONLY FISHERY

The ATA Board of Directors has determined through our experience that the following guidelines, when adopted, will greatly reduce the likelihood of hooking king salmon and will virtually eliminate the mortality of king salmon caught during a coho only fishery.

Although mortality caused by hook wounds decreases as fish size increases, we have found that mortality increases with the size of fish due to fighting of the gear. Therefore, large fish must be released as soon as they hit the gear. How? By breaking them off. Use small hooks (No. 6) on your coho spoons (No. 5 spoon). Use DURANICKEL brand hooks on your coho spoons or hootchies. These are a soft hook which king salmon will straighten out, or use blued or bright hooks (not stainless) behind your flashers; these will quickly disappear from the fish's mouth. Use light leaders for flasher tails (50-60 lb. test). In the event you hook a large king that is sluggish and doesn't break off, release it without lifting it out of the water. This is easy on a boat with a low stern, If your boat has a high stern, we recommend that you make a fish releaser, which looks like this:

The handle should be wood and the length to suit your individual needs. The business end is: 1/8 inch by 1 inch by 6 inch flat bar with a notch. By inserting the "V" notch in the bend of the hook and giving a sharp push, the fish is released. This also works well for saving that favorite spoon, plug, etc.. from a big halibut.

Since the general rule is that greater catches of king salmon will occur closer to the beach and closer to the bottom; it is best to stay at least 1/2 to 3/4 miles from shore. Stay out of shallow beach drags such as: Surge Bay, Hoktahine, Soapstone, the immediate area of Cape Edgecumbe, Cape Addington, Noyes, Whale Bay, Redfish Cape, Etc... Fish shallow in deeper water!!!! The coho catch is primarily along the 100 fathom edge; here you would fish from 24 fathoms to the surface. In a 50-60 fathom drag, fish only 18-20 fathoms from the surface.

Use short leaders, spaced close together on your wire; use more flashers. The leader length should be 1 1/2 to 2 fathoms. The spacing of leaders down the wire should be 1 1/2 to 2 1/2 fathoms.

The shaking of king salmon off coho gear will give a very high survival rate due to the lighter gear and smaller hooks

which have shallow penetration into the fish's mouth. If all else fails, cut off the spoon or hootchie to release the fish; don't lift the fish out of the water.

There are undoubtedly other ideas within the fleet, and we would like to hear of them. If you have one, call or write the office, or call your board member.

APPENDIX C

Estimated number of gear days by period and area
in the 1987 Southeast Alaska troll fishery
during chinook non-retention periods.

Table C-1. Estimated number of gear days by period and area in the 1987 Southeast Alaska troll fishery during chinook salmon non-retention periods. (ADF&G 11/9/87)
(FILE: TAB187.WK1; DISK: 1987 CHINOOK MORTALITIES)

Period: July 13 - August 2 (21 days)

Area 1/	Average No. Boats 2/	Days	Estimated Gear Days
North Outside	55	21	1,155
Central Outside	123	21	2,583
South Outside	121	21	2,541
Outside Areas Subtotal	299	21	6,279
North Inside	69	21	1,449
Central Inside	93	21	1,953
South Inside	54	21	1,134
Inside Areas Subtotals	216	21	4,536
Period Subtotals	515	26	10,815

Period: August 13 - Sept. 20; (39 days)

Area 1/	Average No. Boats 2/	Days	Estimated Gear Days
North Outside	198	39	7,722
Central Outside	129	39	5,031
South Outside	83	39	3,237
Outside Areas Subtotal	410	39	15,990
North Inside	91	39	3,549
Central Inside	14	39	546
South Inside	13	39	507
Inside Areas Subtotals	118	39	4,602
Period Subtotals	528	39	20,592

1/ Area boundaries shown in Figure 2.
2/ Number of boats estimated from aerial overflights; numbers shown represent average number of boats actually fishing on a given day.

APPENDIX D

Estimated numbers, and associated precision, of chinook salmon hooked and released during chinook non-retention periods of the 1987 Southeast Alaska troll fishery.

APPENDIX D

Precision associated with estimates of total hooked and released chinook salmon during chinook non-retention periods of the 1987 Southeast Alaska troll fishery.

Replicate measurements of the number of chinook salmon hooked and released in an area stratum result in an estimate of the precision of the total estimated number of chinook salmon hooked and released in the troll non-retention fishery. sample variances, standard errors of the means, and confidence limits were calculated by standard methods using each observer day or partial observer day as an observation. Because no samples were recorded from Northern Outside Area (Area 1), the numbers of gear-days from this area were combined with those of the Central Outside Area (Area 2) to calculate estimates of total catches and precision of these estimates. The variances of total catches across all area strata and across the two time strata are calculated by summing the variances of each of the statistically independent strata. Total boat-days in each time-area stratum are assumed to be known constants although some uncertainty is associated with these values.

Appendix Tables D.1 to D.4 present the average catch by period of legal (greater than or equal to 28 inches) chinook salmon per observer day, the estimated total catch by area, and the precision associated with these estimates in 1987. The coefficient of variation of individual area estimates of catch ranged from 8% to 42% but generally was from 15% to 30%. The total estimated catch of sublegal-size chinook salmon was 176,213 fish with an associated standard error of 13,023 fish, or a coefficient of variation of 7.4%. The corresponding values for legal-size fish were 193,747 fish with a standard error of 25,933 fish and a coefficient of variation of 13.6%.

A cursory examination of the variances when compared to the corresponding mean values show that larger mean values tend to have larger variances associated with them. this result is what might be expected from sampling theory. The large number of samples in the Central Outside Area resulted in estimates of mean catch per gear-day which were similar in level of precision to those of other areas, although the variability in individual observations tended to be greater for Area 2.

Appendix Table D.1. Estimated catch and associated precision of legal chinook salmon in the period 1 non-retention troll fishery (July 13 to August 2).

Area	Number Sampled	Average	Minimum	Maximum	Sampled Variance	Standard Error	90% Conf. Interval
1 & 2	34	9.9	0.0	25.0	40.3	1.1	1.8
3	13	3.4	0.0	10.4	11.9	1.0	1.7
4	2	5.2	5.0	5.8	0.3	0.4	2.5
5	6	4.1	0.0	8.8	11.2	1.4	2.7
6	6	0.6	0.0	1.2	0.3	0.2	0.5

Area	Gear Days	Estimated Catch	Standard Deviation	Standard Error	Confidence Interval Upper	Lower
1 & 2	3,738	37,006	23,743	4,072	43,892	30,121
3	2,541	8,639	8,755	2,428	12,966	4,312
4	1,449	7,535	806	570	11,133	3,936
5	1,953	8,007	6,527	2,665	13,377	2,638
6	1,134	680	667	272	1,229	132
Total	10,815	61,642	26,031	6,733	69,954	47,801

Appendix Table D.2. Estimated catch and associated precision of legal chinook salmon in the period 1 non-retention troll fishery (August 13 to September 20).

Area	Number Sampled	Average	Minimum	Maximum	Sampled Variance	Standard Error	90% Conf. Interval
1 & 2	50	9.1	0.0	58.7	185.1	1.9	3.2
3	31	2.0	0.0	12.6	10.3	0.6	1.0
4	16	1.5	5.0	9.7	6.5	0.6	1.1
5	11	3.2	0.0	9.6	7.9	0.8	1.5
6	5	4.5	1.3	8.2	9.6	1.4	2.9

Area	Gear Days	Estimated Catch	Standard Deviation	Standard Error	Confidence Interval Upper	Lower
1 & 2	12,753	116,052	173,490	24,535	151,173	74,931
3	3,237	6,474	10,402	1,868	9,645	3,303
4	3,549	5,324	9,021	2,255	9,277	1,370
5	546	1,747	1,534	463	2,585	909
6	507	2,282	1,567	701	3,776	787
Total	20,592	131,879	173,964	25,044	173,076	90,681

Total estimated legal catch (combined periods) is 193,747 chinook salmon.
Associated standard error of 25,933 chinook salmon.
Upper 90% confidence interval of 236,407 chinook salmon.
Lower 90% confidence interval of 151,086 chinook salmon.
Coefficient of variation of 13.6%.

Appendix Table D.3. Estimated catch and associated precision of sublegal chinook salmon in the period 1 non-retention troll fishery (July 13 to August 2).

Area	Number Sampled	Average	Minimum	Maximum	Sampled Variance	Standard Error	90% Conf. Interval
1 & 2	34	6.5	0.0	17.8	33.7	1.0	1.7
3	13	7.2	1.0	18.0	24.3	1.4	2.4
4	2	6.5	5.8	7.5	1.5	0.9	5.4
5	6	5.5	1.4	10.0	10.2	1.3	2.6
6	6	8.6	2.0	16.7	28.9	2.2	4.4

Area	Gear Days	Estimated Catch	Standard Deviation	Standard Error	Confidence Interval Upper	Lower
1 & 2	3,738	24,297	21,710	3,723	30,593	18,001
3	2,541	18,295	12,538	3,477	24,492	12,099
4	1,449	9,419	1,746	1,235	17,215	1,622
5	1,953	10,742	6,246	2,555	15,879	5,604
6	1,134	9,752	6,096	2,489	14,767	4,738
Total	10,815	72,505	27,646	8,466	86,432	58,577

Appendix Table D.4. Estimated catch and associated precision of sublegal chinook salmon in the period 2 non-retention troll fishery (August 13 to September 20).

Area	Number Sampled	Average	Minimum	Maximum	Sampled Variance	Standard Error	90% Conf. Interval
1 & 2	50	2.4	0.0	12.1	10.6	0.5	0.8
3	31	2.5	0.0	13.7	14.1	0.7	1.1
4	16	12.5	3.0	24.4	39.8	1.6	2.8
5	11	6.8	0.0	15.1	26.7	1.6	2.8
6	5	33.4	23.0	43.8	96.5	4.4	9.4

Area	Gear Days	Estimated Catch	Standard Deviation	Standard Error	Confidence Upper	Interval Lower
1 & 2	12,753	30,607	41,439	5,860	40,429	20,785
3	3,237	8,093	12,156	2,183	11,797	4,388
4	3,549	44,363	22,393	5,598	54,176	34,549
5	546	3,713	2,823	851	5,255	2,170
6	507	16,934	4,980	2,227	21,682	12,186
Total	20,592	103,709	48,557	9,895	119,986	87,432

Total estimated legal catch (combined periods) is 176,213 chinook salmon.
Associated standard error of 13,023 chinook salmon.
Upper 90% confidence interval of 197,636 chinook salmon.
Lower 90% confidence interval of 154,791 chinook salmon.
Coefficient of variation of 7.4%.