ESTIMATION OF CHINOOK CATCH AND RELEASE AND THE STOCK COMPOSITION OF SUBLEGAL SIZE CHINOOK IN THE 2001 SOUTHEAST ALASKA SUMMER TROLL FISHERY

by

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and

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ABSTRACT

A voluntary logbook program was conducted by the Alaska Department of Fish and Game (ADF&G) during the 2001 Southeast Alaska summer commercial troll fishery (July through September). The study estimated the number of legal and sublegal (<28 inches total length) chinook salmon incidentally hooked and released during (CR) periods (period one = July 1–6; period two = August 18–September 5) and chinook non-retention (CNR) periods (period one = July 7–August 12; period two = September 6–September 30). A total of 968 fishing days were logged during 362 fishing trips aboard 146 different hand and power troll vessels. An estimated 59,535 legal and 89,239 sublegal-size chinook salmon were hooked and released. Trollers encountered 2.9 sublegal and 3.9 legal chinook salmon per day during CNR periods, and 6.0 sublegal chinook salmon per day during CR periods. Twenty-two coded wire tags from 14 hatchery locations were recovered from sublegal-sized chinook salmon (N=336) retained by logbook participants for genetic stock identification sampling.

PREFACE

The Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) calculates total mortality (the sum of landed and incidental mortality) from estimates of landed and incidental mortality. Currently, incidental mortality is estimated by multiplying an assumed post release mortality rate with estimates of the number of chinook salmon released. Prior to the initiation of this study, first funded in 1998 with federal funding resulting from a letter of agreement (LOA) among U.S. parties of the Pacific Salmon Commission, estimates of the number of chinook salmon encountered (i.e., hooked and released) were based upon data collected from 1985 through 1988. The primary objective of this logbook program is to directly estimate encounter rates through current logbook data, such that estimates will be within +/-25% of the true value 90% of the time. This report covers the fourth year of the program.

Under the LOA, agencies are to utilize opportunities provided by an abundance-based management approach to minimize incidental mortality. To accomplish this objective, current estimates of incidental mortality are required. Estimation of the number of chinook salmon encountered is integral to estimation of incidental mortality in PSC fisheries, including the Southeast Alaska troll fishery. This study is intended to provide direct measures of encounter rates for the CTC chinook cohort analysis model.

A secondary objective of this study is to obtain genetic stock identification (GSI) samples for the estimation of the stock composition of sublegals encountered by the fishery. The sublegal size fish that were sampled for GSI were also examined for a missing adipose fin, indicating presence of a coded wire tag (CWT). Maturity and sex composition data collected in previous years of the program was not collected in 2001 since onboard observers were not utilized.

INTRODUCTION

During the 1998, 1999, and 2000 troll fisheries, an onboard observer and logbook program was conducted by ADF&G to monitor the incidental hook and release of chinook salmon during the Southeast Alaska summer commercial troll season. Incidental catch of sublegal-size chinook salmon occurs during the entire summer season due to regulations which prohibit trollers from retaining chinook salmon that are less than 28 inches in total length (sublegal). In addition, one or more chinook salmon non-retention (CNR) periods occur each year to prevent exceeding the annual chinook catch ceiling determined by the PSC. During CNR periods trollers target primarily coho salmon. In 2001 the use of observers was discontinued, and data was collected entirely from logbooks. The use of logbooks has the advantage of allowing for increased data collection at a greatly reduced cost. The three initial years of observer and logbook data indicated that there was no detectable bias in logbooks when compared to observer data (Bloomquist and Carlile 2001).

A pilot study to determine the feasibility of an observer program was conducted in 1978 (ADF&G 1979). An observer program was conducted from 1983–1989 during CNR periods (Davis et al. 1985, Davis et al. 1986, Davis et al. 1987, Seibel et al. 1988, Seibel et al. 1989). Since 1988, annual chinook salmon encounter estimates for CNR periods have been calculated using encounter rates derived from the observer studies conducted from 1985–1988. However, the Southeast Alaska troll fishery has changed since those studies occurred. The length and timing of the fishery has been modified to minimize the incidental catch of chinook salmon during CNR periods, and areas of frequent high chinook salmon abundance have been closed for most of the summer season to reduce encounter rates. The number of vessels participating in the fishery has declined. Trollers, increasingly dependent on coho salmon due to chinook quota reductions, have likely improved selective fishing techniques for coho salmon during CNR periods. Finally, ecological factors may have affected the regional distribution of immature chinook salmon and altered encounter rates in some areas.

The primary objective of the observer/logbook program was to update estimates of chinook salmon catch and release encounters in the Southeast Alaska summer troll fishery. The data collected during 1998–2001 confirmed the need to obtain current encounter rate data. Estimates derived from direct observational data in these years were significantly different from those calculated using the regression method based on historical encounter rates (Table 6). In 1999 a revised version of the Pacific Salmon Treaty (PST) was ratified. Annex IV of the treaty mandates that chinook fishery management should be based upon knowledge of total abundance and mortalities, requiring the direct measurement of these parameters when possible.

During the 1998–2000 seasons onboard observers collected genetic stock identification (GSI) samples, coded-wire tag (CWT), age, sex, and maturity data for the secondary objectives of developing a method to assess coho run timing, determining maturity rates in the fishery, and estimating the stock composition of the sublegal size chinook salmon encountered in the fishery (Bloomquist et al. 1999, Stopha et al. 1999, Bloomquist and Carlile 2001). The collection of age, sex, and maturity data was discontinued in 2001 since onboard observers were not utilized. A subset of troll logbook program participants retained sublegal size chinook salmon for the purpose of continuing sublegal chinook GSI and CWT sampling.

METHODS

The ADF&G notified Southeast Alaska trollers about the logbook program through the Alaska Trollers Association, public meetings in trolling communities, an ADF&G news release, port sampling staff, and various other media. Regional ADF&G port sampling staff in the Southeast Alaska fishing communities of Sitka, Elfin Cove, Hoonah, Yakutat, Ketchikan, Petersburg, Craig, Pelican, Port Alexander, and Wrangell assisted with the distribution and collection of logbooks. Locations with adequate cold storage facilities were utilized for receiving and processing sublegal fish retained by a subset of logbook participants. ADF&G port sampling staff conducted the GSI and CWT sampling of these fish. GSI samples were sent to the ADF&G genetics lab in Anchorage for analysis. Coded-wire tag data and heads from adipose-clipped fish were sent to the ADF&G tag and age laboratory in Juneau for processing. Logbook effort was to be distributed as similar as possible to vessel effort in the fishery.

Trollers were required to record at least three days of data, including the number of each species of salmon caught by day and by area fished, the number of hours fished in each day and area, and the number of legal and sublegal-size chinook salmon that were hooked and released. Logbooks contained six pages for data recording. Individual fishing days were recorded on separate pages and trollers were also asked to record data on a separate page if they moved from one fishing district to another in a given day. Each troller who fully completed and turned in a standard logbook was compensated $115 dollars. Logbooks were distributed to both power-troll and hand-troll vessels.

A subset of the trollers participating in the program retained sublegal chinook for GSI and CWT sampling. This sampling was only conducted in ports that possessed an adequate cold storage facility to keep fish for a short period of time until they could be processed. Sublegal retention logbooks were handed out and sublegals were subsequently processed in Yakutat, Pelican, Petersburg, Sitka, Craig, and Ketchikan. Sublegal retention logbooks were identical to the standard logbooks except for an additional set of instructions provided for explaining how to handle the sublegal chinook salmon. Trollers were provided with fifteen cinch straps (plastic cable ties) with numbered labels attached. Logbook participants were instructed to apply the tag by cinching it around the jaw of the fish, thereby assigning each fish a unique identifying number. The troller was then instructed to write this identifying number on the page of the logbook pertaining to the day and area where the fish was caught. The sample goal for the season was 400 sublegal chinook. Based upon encounter rates of recent years it was estimated that this goal could be reached by obtaining approximately 200 fishing days of retention logbook effort.

Chinook Encounter Data Analyses

During the 2001 summer troll season, significant fishing effort occurred in a terminal area near Sitka named Eastern Channel (District 113, Subdistrict 41). The fishers in this area were targeting chum salmon and there was virtually no chinook salmon harvest. It did not seem reasonable to include the landings from this area when expanding the troll observer chinook salmon non-retention encounter estimates to the total estimates for the troll fishery. Therefore, landings from this area were excluded from the total landings for each summer troll period. The majority of the troll fish tickets that are recorded in the ADF&G catch database contain information about the district that was fished, but do not contain information about the subdistrict fished. However it was obvious which landings were from District 113,

Eastern Channel, due to large numbers of chum salmon listed on the fish ticket. The rule used to identify District 113 landings had three aspects and was as follows:

1. The landing must have come from District 113.
2. The chum salmon catch was required to be at least twice the catch of all other species combined.
3. The landing must have reported no chinook salmon catch.

No observer effort or logbooks were expended on the Eastern Channel chum salmon fishery.

Comparison of Historical Catch and Release Estimates

Beginning in 1998, the observer program study treated the daily observations from a particular boat trip as subsampling units of the primary sampling unit, the boat trip. Prior studies from 1983–1989 had used the daily observations as the primary sampling unit (Bloomquist et al. 1999).

The number of legal and sublegal chinook salmon encountered per boat day and per boat trip was collected for inside and outside area strata during the CNR period. These encounter rates were expanded to estimate the total number of area strata encounters based on the total number of boat days of effort for each area strata. The total encounters for the period were obtained by summing the area strata estimates. In addition, estimates of sublegal encounters were made for the two CR periods using the same method. The estimated variance for the total number of chinook salmon encounters was constructed by summing the individual variance estimates from each strata. The variances were then used to estimate confidence intervals. Separate estimates of encounters were made for hand-troll and power-troll vessels in each period/area strata. The hand-troll and power-troll estimates were then combined within each period/area strata. The estimates and their associated variances were computed using a ratio estimator with subsampling as outlined in Cochran (1977). The exact formulation as it was applied to this problem appears below. The estimate of encounters for each stratum was constructed as follows:

$$\hat{Y}_R = X\,\frac{\hat{Y}_u}{\hat{X}_u},$$

$$\hat{Y}_u = \left(\frac{N}{n}\right)\sum_{i=1}^{n} M_i \bar{y}_i = \left(\frac{N}{n}\right)\sum_{i=1}^{n} \hat{Y}_i,$$

$$\hat{X}_u = \left(\frac{N}{n}\right)\sum_{i=1}^{n} M_i \bar{x}_i = \left(\frac{N}{n}\right)\sum_{i=1}^{n} \hat{X}_i,$$

$$\bar{y}_i = \sum_{j=1}^{m_i} \frac{y_{ij}}{m_i},$$

$$\bar{x}_i = \sum_{j=1}^{m_i} \frac{x_{ij}}{m_i}.$$

Where:

$\hat{Y}_R$ = Ratio estimate of the total number of chinook salmon encounters.

X = The total number of boat days of effort.

$\hat{Y}_u$ = The estimated total number of chinook salmon encounters from sampled boat trips.

$\hat{X}_u$ = The estimated total number of boat days from sampled boat trips.

N = The total number of boat trips.

n = The number of boat trips that were sampled.

M_i = The trip length in days for sampled boat trip i.

m_i = The number of days subsampled from boat trip i.

$\bar{y}_i$ = The average number of chinook salmon encounters from sampled boat trip i.

y_{ij} = The number of chinook salmon encounters from sampled boat trip i and subsampled day j.

$\hat{Y}_i$ = The estimated total number of chinook salmon encounters from sampled boat trip i.

$\bar{x}_i$ = The average number of boat days from sampled boat trip i.

x_{ij} = The number of boat days from sampled boat trip i and subsampled day j.

$\hat{X}_i$ = The estimated total number of boat days from sampled boat trip i.

The variance of the estimated number of chinook salmon encounters in a particular stratum was computed as follows:

$$v\left(\hat{Y}_R\right) \doteq \frac{N^2(1-f_1)}{n}\frac{\sum\left(\hat{Y}_i - \hat{R}\hat{X}_i\right)^2}{n-1} + \frac{N}{n}\sum^{n}\frac{M_i^2(1-f_{2i})s_{d'2i}^2}{m_i},$$

$$s_{d'2i}^2 = \frac{1}{M_i - 1}\sum_{i=1}^{M_i}\left[\left(y_{ij} - \hat{R}x_{ij}\right) - \left(\bar{y}_i - \hat{R}\bar{x}_i\right)\right]^2,$$

where:

f_1 = $\dfrac{n}{N}$,

$\hat{R}$ = $\dfrac{\hat{Y}_u}{\hat{X}_u}$,

f_{2i} = $\dfrac{m_i}{M_i}$.

This new estimation method was also applied retroactively to the data collected from the 1985–1988 sampling programs. Although data was collected in 1983, 1984, and 1989, the sample data could not be located for 1983 and 1984, and the 1989 sample data was incomplete.

Previous encounter estimates were obtained from several sources. The 1981–1984 estimates are from an unpublished 1987 ADF&G report on associated fishing induced mortality of chinook salmon. The 1985–1988 estimates were based on observer studies conducted in those years (Davis et al. 1985, Davis et al. 1986, Davis et al. 1987, Seibel et al. 1988, Seibel et al. 1989). Data from a 1989 limited survey of the CNR fishery indicated the encounter rates were similar to those that had occurred in previous years. For this reason, in 1989, the number of encounters was estimated by multiplying the 1985–1988 average CNR encounters per gear day by the gear days for 1989. The number of legal and sublegal encounters during the CNR fishery in 1990–1998 was estimated from a linear regression on the number of boat days of CNR effort. The new method estimates are all derived directly from observer data for those years using the 1998 analysis method.

RESULTS

Season Overview

The 2001 summer troll chinook salmon catch (95,363 fish) and coho salmon catch (1,840,464 fish) were the fifth lowest and seventh highest summer harvests for those species since the signing of the Pacific Salmon Treaty (PST) in 1985. The 2001 summer troll fishery consisted of two fishing periods for chinook salmon and three for coho salmon. The CR periods occurred during July 1–July 6 and August 18–September 5. The coho salmon retention periods occurred from July 1–August 12, August 18–September 20, and September 25-September 30. Coho and chinook salmon harvest data by period are presented in Table 1. Two CNR periods occurred from July 7 through August 17, and from September 6 through September 30. By Alaska Board of Fisheries (BOF) regulation, areas considered to be of high chinook salmon abundance were closed following the first CR period.

Fishery and Logbook Effort

Estimated boat days of effort during the 2001 summer troll fishery increased about 3% from 2000 (Table 1). About 68% of the effort occurred during CNR periods and 32% during CR periods. Total number of trips sampled was 362, 106% greater than 1998 (176 trips; Table 2), 49% greater than 1999 (243 trips) and 56% greater than 2000 (231 trips). The program sampled 1.0% of the CNR fishing effort in 1998, 1.4% in 1999, 2.1% in 2000, and 3% in 2001. CR effort has been sampled at a higher rate during the past four years of the program: 2.2% in 1998, 5.7% in 1999, 6.1 % in 2000, and 6.2% in 2001. Chinook salmon encounter rates tend to be more variable during CR periods due to the fact that some trollers are targeting chinook while others are targeting coho salmon, therefore sampling rates during CR periods are increased. The distribution of logbook effort generally approximated that of the fleet by period (Figure 2). Over the entire summer season the distribution of logbook effort closely matched the distribution of the fleet effort by big six area (Figure 3).

Sublegal Retention Logbooks

A total of 40 sublegal retention logbooks were completed during the 2001 season, and 336 sublegals were retained for GSI and CWT sampling. The ADF&G genetics laboratory in Anchorage processed 301 GSI samples and the results are currently being analyzed. The season objective of 400 sublegal samples was not achieved. This was the first year that logbook participants were utilized for obtaining sublegal samples, and specific logistical problems needed to be solved, including determination of sampler time involved and selection of appropriate participants. Participating boats were required to deliver their fish to the port from which they received the logbook, and skippers were required to diligently follow a longer list of instructions than for the standard logbook participants. Sublegal retention logbooks were not dispersed until the end of the first CR period, because there were concerns that this sampling would interfere with ongoing sampling programs during the busiest portion of the season. The actual time and difficulty involved with this sampling was later determined to be insignificant. Sublegal data analyzed so far indicates that the stock composition of sublegals encountered in the fishery is different than that of the legal catch (Seeb et al. 1999, Seeb et al. *in press*). It is currently assumed in the CTC cohort analysis model that the stock composition of the sublegals encountered by the troll fishery and that of the legal catch similar. Therefore this subject invites further investigation.

Chinook Salmon Catch and Release Estimates

A total of 7,898 legal and 3,787 sublegal chinook salmon were documented during 362 fishing trips in the 2001 season. Estimates for the total number of catch and release encounters in the 2001 troll fishery were 59,535 legal-sized fish during CNR periods and 89,239 sublegal-sized fish during both CR and CNR periods (Table 3). The estimate of legal encounters during CR periods was within 0.5% (500 fish) of the actual reported harvest (Table 4). This is the closest estimate for CR chinook salmon obtained so far in this study, and is an indication that the logbook chinook salmon encounter rate estimates are accurate. The confidence interval for this estimate in 1998 and 1999 encompassed the reported harvest but the harvest in 2000 was outside the confidence interval.

Encounter Rate Comparisons

Weighting of chinook salmon encounter estimates by trip (new estimation method) showed no consistent increase or decrease in encounter rate when compared to those estimates weighted by days fished (old estimation method; Table 6). The 2001 CNR encounter rate for legal-sized fish (3.9 fish per day) was higher than any other year when direct estimates were made. The 2001 CR and CNR sublegal encounter rates were higher than any other year since the current study began in 1998, however the CNR sublegal encounter rate (2.9 fish per day) was lower than all other years when direct estimates were performed in the 1980s.

Coded Wire Tag Recoveries

A total of 56 heads from marked sublegal-size chinook salmon were recovered from a total of 336 sublegal fish examined on observer boats (Table 7). Of these, thirty-four heads contained no tags.

Only 336 sublegal chinook salmon were examined out of a total estimated 89,239 sublegal chinook encountered in the fishery, for a sampling rate of less than 1%, and therefore too low for reliable estimates of stock composition. For hatchery stocks, based on the sum of tag ratios for each state or province divided by the sum of the tag ratios for all recoveries (N=22), stocks from British Columbia contributed 21.2%, Oregon contributed 21.9%, Washington contributed 27.4%, and Alaska accounted for 29.3%. These results, though very inconclusive, support previous years of CWT and GSI data collected by the project, which indicate higher representation by northern stocks and spring run chinook salmon in the sublegal encounters than is the case for the legal-size chinook salmon catch.

DISCUSSION

Estimation of Chinook Encounters

The precision objective for the direct chinook salmon encounter estimates in the 2001 summer fishery was that the 90% confidence interval should be +/-25% of the estimate. The objective was met for legal (+/-24%) size fish. The objective was not met for sublegals in the CR period (+/-32%) or in the CNR period (+/-30%). However for the two periods combined the precision of the estimate is within the objective (+/-22%). The variability of encounter rates within and between seasons and areas of the fishery is unpredictable and depends on a variety of factors that change year to year. It is therefore difficult to set a reasonable precision objective. However, our current precision objectives seem reasonable based upon four years of project data and our current rate of sampling.

2002 Season Observer Program

The 2002 troll logbook program is currently ongoing at a similar level of funding to the 2001 season. It is anticipated that the department will obtain a total of approximately 300 logbooks in the 2002 season, including 67 sublegal retention logbooks. The overall sampling effort will be similar to the 2001 season, however the number of sublegal retention logbooks, and subsequently the number of sublegals sampled for GSI, is anticipated to be greater. The season objective is to sample 400 sublegal chinook salmon for GSI and CWT. Retention logbooks and standard logbooks were both issued starting with the initial summer opening on July 1.

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Table 1. Chinook and coho salmon catch and boatdays of effort by period in the 1998, 1999, 2000, and 2001 summer seasons of the Southeast Alaska troll fishery.

Year	Fishing Period	Chinook	Coho	Effort (boat days)
1998	CR Period (7/1-7/12)	102,773	472,134	4,991
	CNR Period (7/13-8/11)	0	733,075	11,914
	Second CR Period (8/20-9/30)	35,967	430,010	7,549
	1998 Totals:	138,740	1,635,219	24,454
1999	CR Period (7/1-7/6)	78,058	160,744	2,515
	CNR Period (7/7-8/12)	0	1,317,568	14,004
	Second CR Period (8/18-8/22)	16,394	260,734	2,109
	Second CNR Period (8/23-9/30)	0	521,292	7,577
	1999 Totals:	94,452	2,260,338	26,205
2000	CR Period (7/1-7/5)	50,768	74,487	2,406
	CNR Period (7/6-8/10)	0	804,545	13,202
	Second CR Period (8/11-8/12)	12,423	38,892	937
	Third CR Period (8/23-8/30)	24,895	127,776	2,514
	Second CNR Period (8/31-9/11)	0	57,165	2,163
	Fourth CR Period (9/12-9/20)	5,679	21,061	960
	2000 Totals:	93,765	1,123,926	22,183
2001	CR Period (7/1-7/6)	65,854	100,422	2,189
	CNR Period (7/7-8/12)	0	1,196,152	12,432
	Second CR Period (8/18-9/5)	30,509	352,732	5,166
	Second CNR Period (9/6-9/30)	0	191,159	2,989
	2001 Totals:	95,363	1,840,464	22,776

Table 2. Number of trips and observed number of legal and sublegal chinook salmon encountered during the 1998, 1999, 2000, and 2001 Southeast Alaska summer troll fishery observer/logbook program.

Year	Data Type	Vessels	Trips	Boatdays	Legal	Sublegal
1998	Log Book	60	103	223	1,225	394
	Observer	36	73	184	1,678	292
	Total	93	176	407	2,903	686
1999	Log Book	78	154	355	2,820	1,021
	Observer	36	89	211	1,014	435
	Total	111	243	566	3,834	1,456
2000	Log Book	92	176	531	4,302	2,326
	Observer	25	55	214	2,209	309
	Total	117	231	745	6,511	2,635
2001	Log Book	146	362	968	7,898	3,787
	Observer	N/A	N/A	N/A	N/A	N/A
	Total	146	362	968	7,898	3,787

Table 3. Chinook salmon catch and release estimates for legal and sublegal sized fish during the 1998, 1999, 2000, and 2001 summer seasons of the Southeast Alaska troll fishery.

Year	Summer Period	Legal Encounters	90% Confidence Interval	Sublegal Encounters	90% Confidence Interval
1998	Retention Periods			28,436	18,941 to 37,930
	Non-Retention Period	29,462	22,577 to 36,346	11,400	7,563 to 15,238
	1998 Total:	29,462	22,577 to 36,346	39,836	29,596 to 50,077
1999	Retention Periods			11,603	5,743 to 17,463
	Non-Retention Periods	51,087	35,139 to 67,036	42,034	27,057 to 57,011
	1999 Total:	51,087	35,139 to 67,036	53,637	37,554 to 69,720
2000	Retention Periods			32,995	21,206 to 44,783
	Non-Retention Periods	39,484	29,118 to 49,850	28,549	19,328 to 37,770
	2000 Total:	39,484	29,118 to 49,850	61,544	46,577 to 76,510
2001	Retention Periods			44,167	30,165 to 58,169
	Non-Retention Periods	59,535	45,464 to 73,606	45,072	31,467 to 58,677
	2001 Total:	59,535	45,464 to 73,606	89,239	69,716 to 108,762

Table 4. Chinook salmon encounter estimates for legal sized fish during chinook retention periods, and the reported harvest during retention periods, for the 1998, 1999, 2000, and 2001 summer seasons of the Southeast Alaska troll fishery.

Year	Summer Period	Legal Encounters	90% Confidence Interval	Reported Harvest
1998	Retention Periods	126,961	60,380 to 193,543	139,000
1999	Retention Periods	70,761	42,929 to 98,594	94,500
2000	Retention Periods	79,149	65,787 to 92,511	93,765
2001	Retention Periods	95,845	79,617 to 112,073	95,363

Table 5. Comparison of chinook salmon catch and release encounter rates during chinook non-retention (CNR) and chinook retention (CR) periods, 1985–2001.

CNR	Year	Boatdays	Legal Chinook	Legals Per Day	Sublegal Chinook	Sublegals Per Day
	1985	35,725	84,489	2.3	174,498	4.9
	1986	34,173	98,477	2.9	156,453	4.6
	1987	37,214	171,254	4.6	215,586	5.8
	1988	27,275	57,976	2.1	79,604	2.9
	1998	11,928	29,462	2.5	11,400	1.0
	1999	21,581	51,150	2.4	41,682	1.9
	2000	15,365	39,484	2.6	28,549	1.9
	2001	15,421	59,535	3.9	45,072	2.9
CR	1998	11,400			28,436	2.3
	1999	4,624			11,213	2.4
	2000	6,817			32,995	4.8
	2001	7,354			44,167	6.0
Combined	1998	23,328	29,462		39,836	1.7
	1999	26,205	51,087		53,637	2.0
	2000	22,182	39,484		61,544	2.8
	2001	22,776	59,535		89,239	3.9

Table 6. Southeast Alaska chinook salmon encounter estimates during chinook salmon non-retention periods for the old estimation method, which used the fishing day as the sample unit versus the new estimation method, which treated the trip as the sample unit, 1981–2001.

OLD METHOD			NEW METHOD								
YEAR	ESTIMATES		YEAR	ESTIMATES		YEAR	DIFFERENCE		YEAR	% DIFFERENCE	
	LEGAL	SUBLEGAL		LEGAL	SUBLEGAL		LEGAL	SUBLEGAL		LEGAL	SUBLEGAL
	CNR	CNR		CNR	CNR		CNR	CNR		CNR	CNR
1981	18,225	18,578 [a]	1981	18,225	18,578 [a]	1981	0	0	1981	0%	0%
1982	89,100	90,827 [a]	1982	89,100	90,827 [a]	1982	0	0	1982	0%	0%
1983	74,925	76,378 [a]	1983	74,925	76,378 [a]	1983	0	0	1983	0%	0%
1984	87,075	88,763 [a]	1984	87,075	88,763 [a]	1984	0	0	1984	0%	0%
1985	118,191	131,011 [b]	1985	84,489	174,498 [e]	1985	-33,702	43,487	1985	-29%	33%
1986	78,763	104,820 [b]	1986	98,477	156,453 [e]	1986	19,714	51,633	1986	25%	49%
1987	191,956	171,156 [b]	1987	171,254	215,586 [e]	1987	-20,702	44,430	1987	-11%	26%
1988	60,930	91,200 [b]	1988	57,976	79,604 [e]	1988	-2,954	-11,596	1988	-5%	-13%
1989	150,600	162,900 [c]	1989	117,398	192,735 [f]	1989	-33,202	29,835	1989	-22%	18%
1990	100,617	107,718 [d]	1990	90,256	127,920 [f]	1990	-10,361	20,202	1990	-10%	19%
1991	110,978	118,809 [d]	1991	99,550	150,113 [f]	1991	-11,428	31,303	1991	-10%	26%
1992	123,725	132,456 [d]	1992	110,984	177,419 [f]	1992	-12,741	44,962	1992	-10%	34%
1993	103,945	111,281 [d]	1993	93,241	135,049 [f]	1993	-10,704	23,769	1993	-10%	21%
1994	121,716	130,305 [d]	1994	109,182	173,114 [f]	1994	-12,534	42,809	1994	-10%	33%
1995	79,862	85,498 [d]	1995	71,638	83,461 [f]	1995	-8,224	-2,037	1995	-10%	-2%
1996	78,949	84,521 [d]	1996	70,819	81,507 [f]	1996	-8,130	-3,014	1996	-10%	-4%
1997	60,158	64,403 [d]	1997	53,963	41,254 [f]	1997	-6,195	-23,149	1997	-10%	-36%
1998	40,648	43,516 [d]	1998	29,462	11,400 [g]	1998	-11,186	-32,116	1998	-28%	-74%
1999	74,560	79,822 [d]	1999	51,334	42,138 [g]	1999	-23,226	-37,683	1999	-31%	-47%
2000	53,194	56,948 [d]	2000	39,618	28,693 [g]	2000	-13,576	-28,255	2000	-26%	-50%
2001	52,554	56,263 [d]	2001	59,535	45,072 [g]	2001	6,981	-11,191	2001	13%	-20%

[a] Logbook estimates.
[b] 1985–1988 observer estimates using the old methodology.
[c] Average encounter rates for 1985–1988 expanded by the effort for 1989.
[d] Regression estimates of encounters from CNR effort using the years 1981–1989 to define the relationship.
[e] Reanalysis of the 1985–1988 observer data using the new methodology.
[f] Regression estimates of encounters from CNR effort using the years 1985–1988 and 1998–2001 to define the relationship.
[g] 1998–2001 observer/logbook estimates using the new methodology.

Table 7. The number of coded wire tag recoveries of sublegal chinook salmon (< 28 inches total length), the total tag ratio, and the contribution of the total tag ratio from a location to the sum of tag ratios from all tag recoveries, sampled from the 2001 Southeast Alaska summer troll fishery (N=336). The number of hatchery stocks represented by the CWT recoveries is likely much less than the number of stocks present and harvested during the Southeast Alaska summer fishery due to the low number of sublegal fish sampled and the tagged to untagged ratio of many stocks.

State/ Province	Location	Tag Recoveries	Sum Tag Ratio	Contribution to Grand Total of Tag Ratio
AK	Gastineau	1	9.5	14.8%
	Whitman Lake	1	9.3	14.5%
AK Total		2	18.8	29.3%
BC	H-Quinsam River	1	13.6	21.2%
BC Total		1	13.6	21.2%
OR	McKenzie	1	2.7	4.2%
	Bonneville Hatchery	1	8.7	13.6%
	Elk River Hatchery	1	1.7	2.6%
	Round Butte	1	1.0	1.6%
OR Total		4	14.1	21.9%
WA	Grovers Cr Hatchery	1	2.9	4.5%
	Bernie Gobin Hatchery	1	1.1	1.7%
	Similkameen Hatchery	3	3.1	4.8%
	Chelan Pud Hatchery	2	2.0	3.1%
	Wells Hatchery	5	5.3	8.3%
	Dryden Pond	2	2.1	3.2%
	Turtle Rock Hatchery	1	1.1	1.7%
WA Total		15	17.6	27.4%
Grand Total		22	64.1	100%

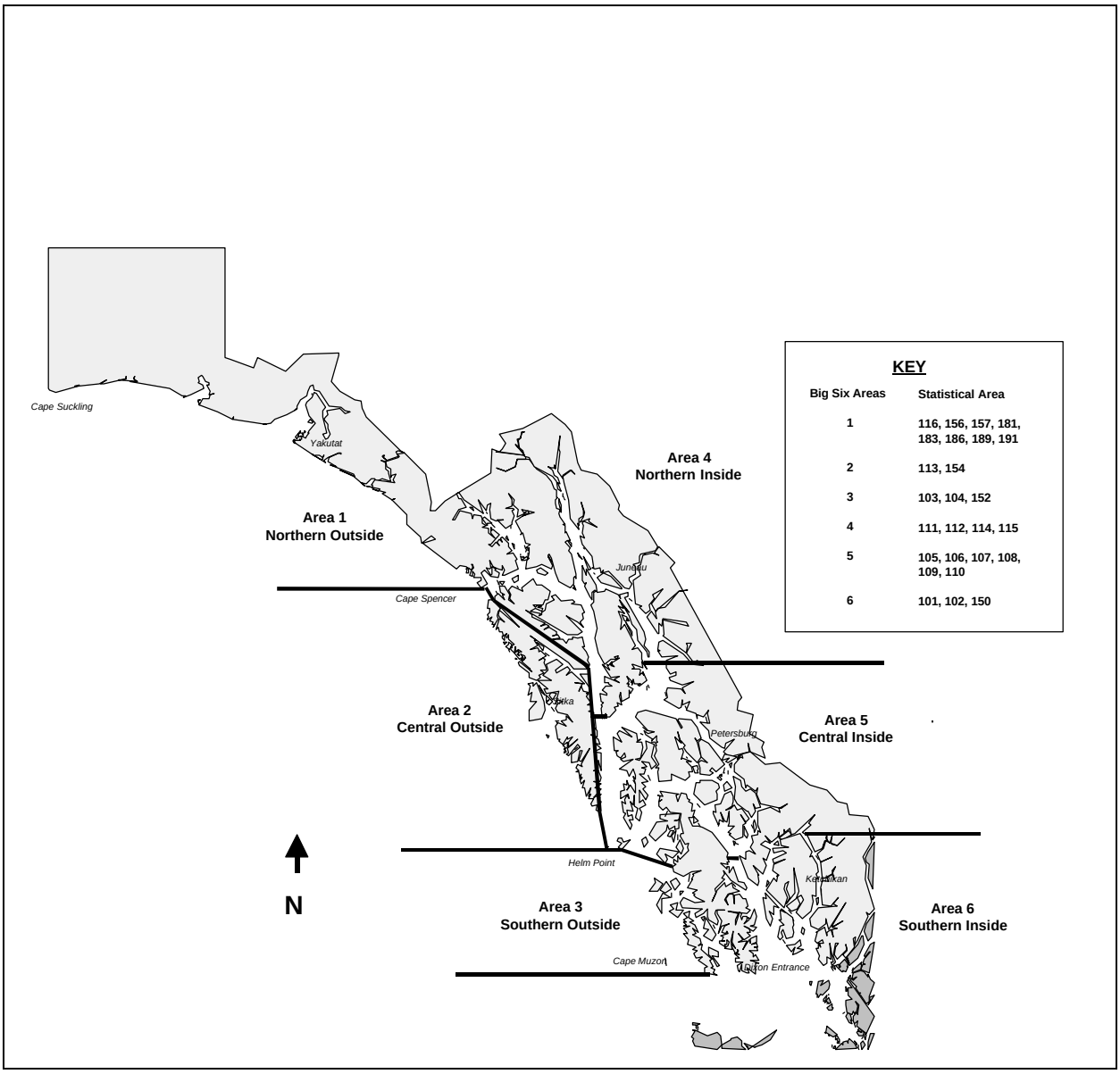
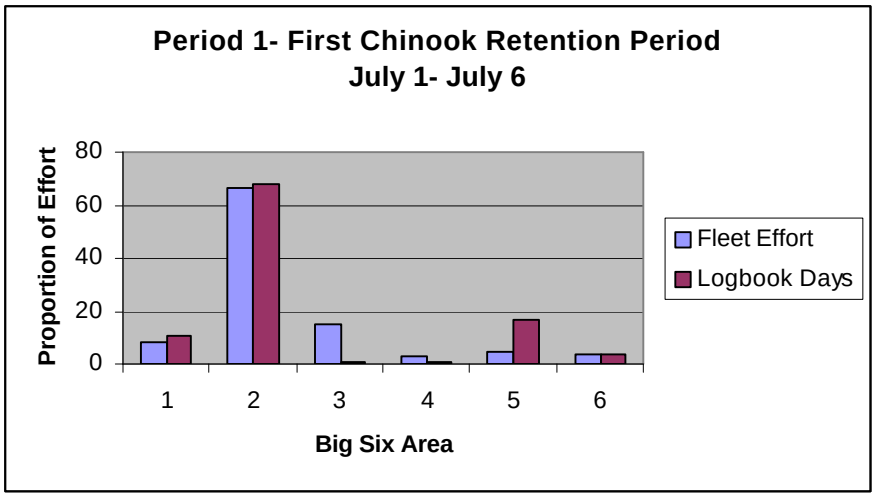


Figure 1. Map showing big-six areas in Southeast Alaska.



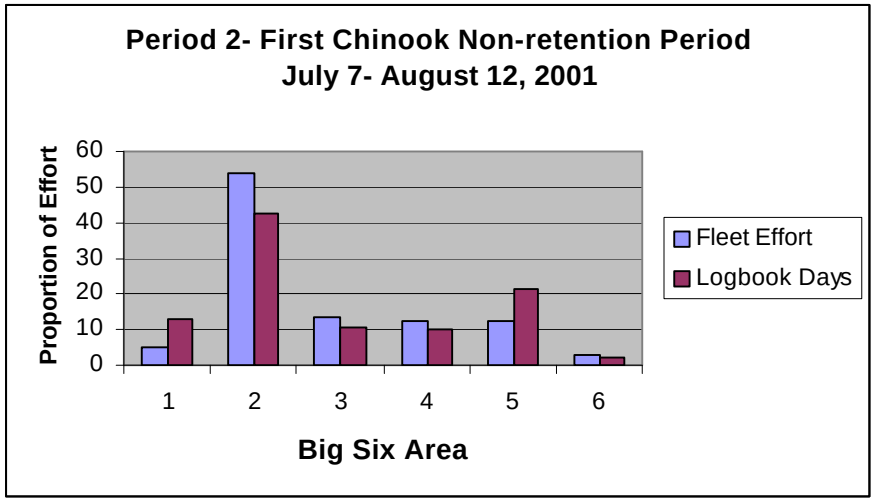


Figure 2. Proportion of fishing effort based on dockside interviews (fleet effort) and proportion of effort sampled during the 2001 observer program.

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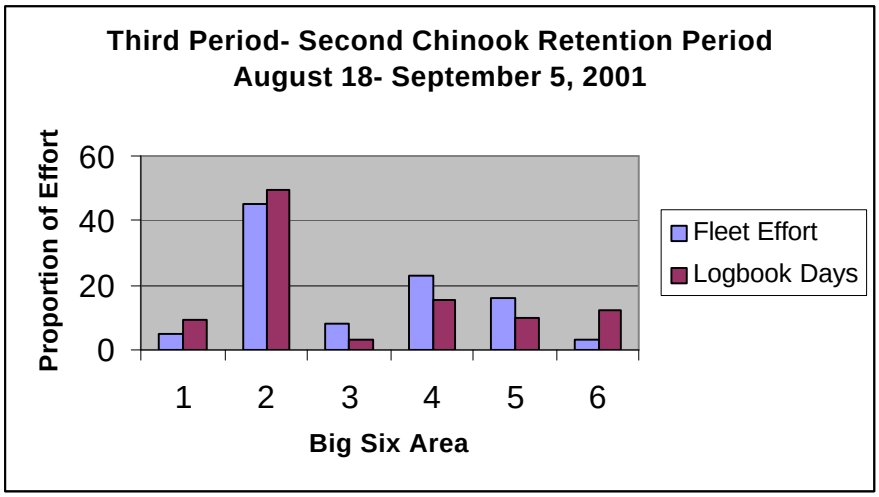

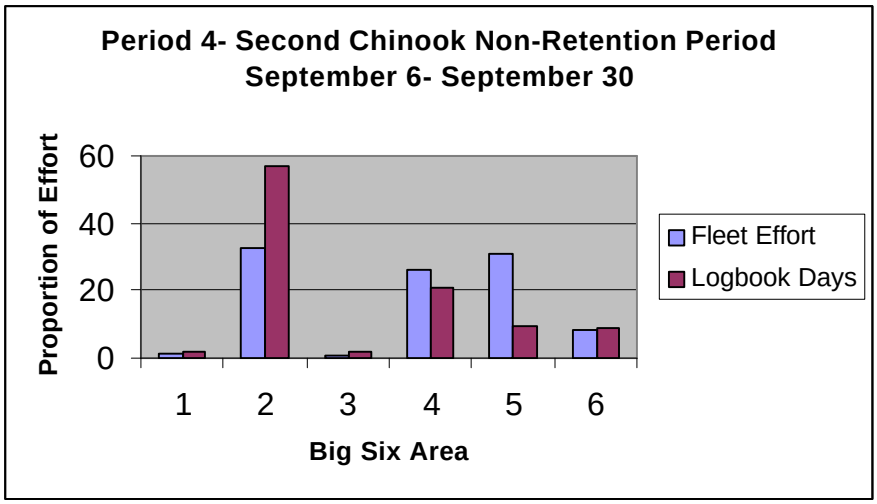

Figure 2. (page 2 of 2)

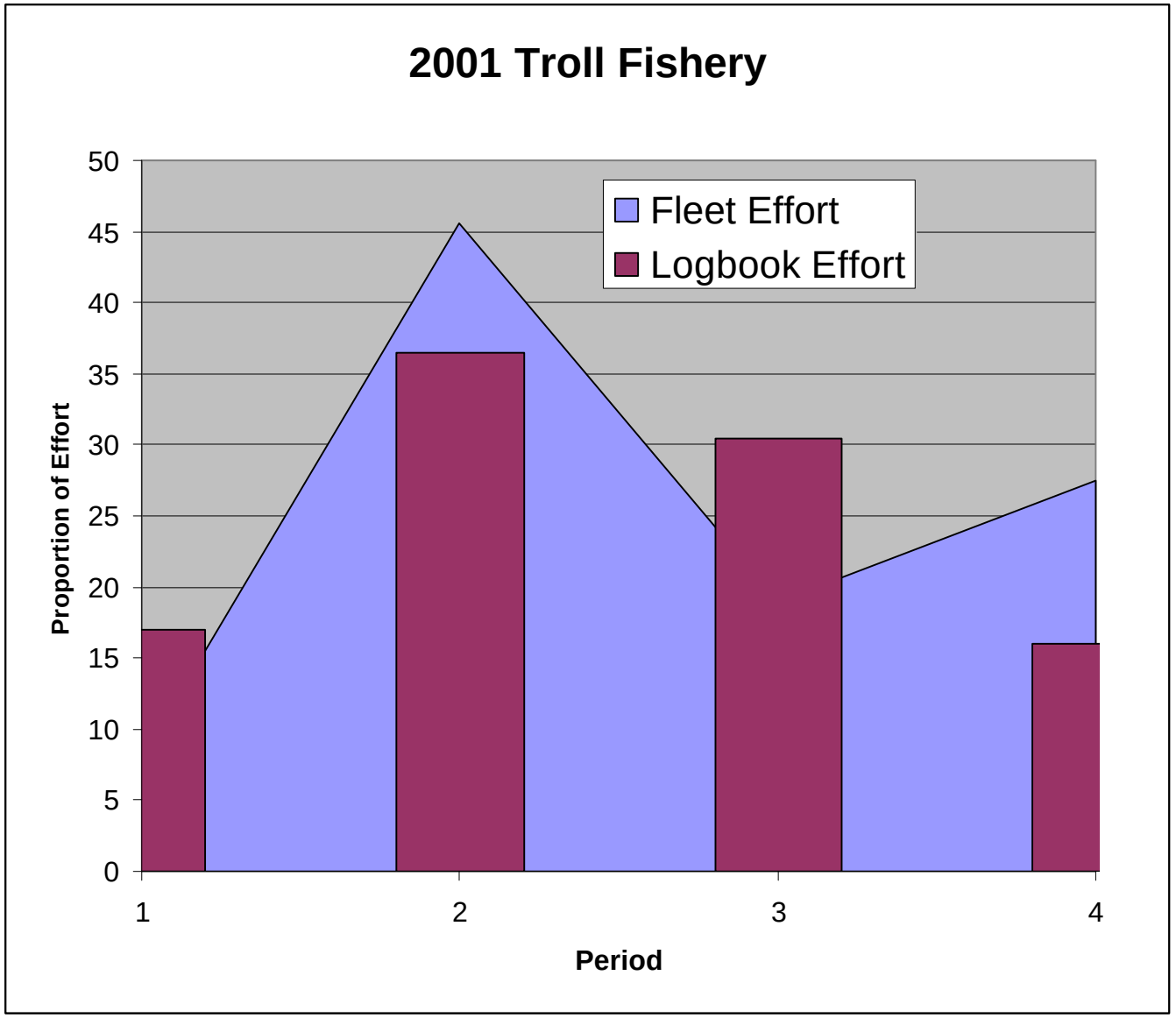

Figure 3. Number of logbook trips (column) and boatdays of fleet effort (gray area) during the 2001 Southeast Alaska summer troll fishery.

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