THE 2000 SOUTHEAST ALASKA

TROLL OBSERVER PROGRAM STUDY

by

Richard Bloomquist

and

John Carlile

Regional Information Report[1] No. 1J01-32

Southeast Region
Division of Commercial Fisheries
Alaska Department of Fish and Game
Juneau, Alaska

October 2001

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AUTHORS

Richard Bloomquist is a fishery biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 240020, Douglas, Alaska 99824. E-mail: richard_bloomquist@fishgame.state.ak.us.

John Carlile is a biometrician for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 240020, Douglas, Alaska 99824. E-mail: john_carlile@fishgame.state.ak.us.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance of commercial trollers who volunteered to participate in the observer program. Appreciation is also extended to ADF&G fishery technicians who served as onboard observers and to other ADF&G staff who provided logistical support. Pattie Skannes and Scott Kelley edited the report.

PROJECT SPONSORSHIP

This investigation was financed with U.S./Canada Salmon Treaty funds under NOAA Award NA07FP0397.

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ABSTRACT

An onboard observer and voluntary logbook program was conducted by the Alaska Department of Fish and Game (ADF&G) during the 2000 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, and the maturity and sex composition of chinook salmon during chinook retention (CR) periods (Period one = July 1–5; Period two = August 11–12; Period three = August 23–30, Period four = September 12–September 20) and chinook non-retention (CNR) periods (Period one = July 6–August 10; Period two = August 31–September 11). A total of 214 observer days were logged during 55 fishing trips aboard 25 different power troll vessels. A total of 531 logbook days were logged during 176 fishing trips aboard 92 different power and hand troll vessels. An estimated 39,484 legal and 60,860 sublegal-size chinook salmon were hooked and released. Trollers encountered 1.8 sublegal and 2.5 legal chinook salmon per day during CNR periods, and 5.4 sublegal chinook salmon per day during CR periods. An estimated 79% of the chinook harvest from inside waters and 80% of the harvest from outside waters were maturing fish during the CR period one. An estimated 79% of the chinook harvest from outside waters were maturing fish during the August and September CR periods. Coded wire tags from 21 hatchery locations and two wild stock locations were recovered from sublegal-sized chinook salmon (N=333) examined by onboard observers.

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 calculated using data collected from 1985 through 1988. The primary objective of this observer program is to update estimated encounter rates through an onboard observer and logbook program, such that estimates will be within +/-33% of the true value 90% of the time. This report covers the third year of an anticipated four-year observer 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.

Secondary objectives of the study are estimation of sex composition (within 10% of the true value 95% of the time) and maturity composition (within 5% of the true value 95% of the time) of the landed chinook harvest, and estimation of the stock composition of sublegal fish through coded wire tag (CWT) recoveries. Troll-caught legal chinook salmon are eviscerated at sea, and sublegal chinook must be released at sea; therefore, sampling for sex composition, maturity, and CWTs for sublegal fish cannot be conducted by the port sampling program.

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-sized 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.

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 current observer/logbook program is to update estimates of chinook salmon catch and release encounters in the Southeast Alaska summer troll fishery. Secondary objectives included collecting a variety of other data (sex composition and maturity data) that can only be gathered while onboard a fishing vessel at sea because trollers eviscerate their catch shortly after it comes aboard. In addition, observers collected CWT samples and random genetic stock identification (GSI) tissue samples from sublegal chinook salmon.

Following the 1998 season, project staff made several suggestions for improving the observer program (Bloomquist et al. 1999). All of these recommendations were incorporated into the 1999 study. Further modifications to the methodology were implemented in the 2000 season.

METHODS

The ADF&G notified Southeast Alaska trollers about the observer and logbook program through the Alaska Trollers Association, public meetings in trolling communities, an ADF&G news release, and port sampling staff. A total of eight observers were hired, and they operated out of several Southeast fishing communities, including Sitka, Elfin Cove, Hoonah, Yakutat, Ketchikan, Petersburg, and Craig. Other ADF&G staff participated as observers when available. Vessel operators were paid one hundred dollars a day for taking on an observer. All boats that took observers were required to have Coast Guard inspection certification and standard safety gear. ADF&G supplied each observer with a survival suit, strobe light,

and sampling equipment. Observer and logbook effort was to be distributed as similar as possible to vessel effort in the fishery.

Observer Catch Data

Trollers were asked to fish as they normally would, and observers were instructed to observe and gather data with as little interference as possible with the standard fishing operations of the vessel. Observers were expected to work on deck during all hours that fishing occurred. Data collection included: the catch, and catch and release, of legal and sublegal chinook, coho, pink, sockeye, and chum salmon, the location(s) fished (statistical area), and the number of hours fished per area per day. Sublegal chinook salmon were retained for CWT and GSI sampling. The Alaska Department of Public Safety, Division of Fish and Wildlife Protection, was notified of boats with observers. About 200 observer days were allocated in project funding. All encountered sublegal chinook salmon were retained for CWT and GSI sampling, when possible. The preseason goal for GSI sampling (cheek muscle, eye retinal fluid, and liver tissue) was 400 sublegal chinook salmon.

Logbooks

Logbooks were issued in order to boost sample sizes in all areas. Logbooks were distributed at area ADF&G offices and through ADF&G port sampling staff throughout the region. Each troller who fully completed and turned in a logbook was compensated $115 dollars. 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 salmon that were hooked and released. Logbooks were distributed to power troll and hand troll vessels too small to accommodate an observer, and to large power troll vessels in order to supplement observer data. About 300 logbook days were allocated for in the project funding. Additional logbooks were distributed during the 2000 season in order to obtain adequate coverage through each period of the fishery.

Chinook Encounter Data Analyses

Log linear regressions were fit to predict legal and sublegal chinook encounter rates using fishing period, one of six geographic areas (big-six area, Figure 1), fishing vessel, and observer type (logbook or onboard observer). Due to low sample size and effort in some big-six areas, the three outer coast (outside) big-six areas (Areas 1 through 3; Figure 1) and the three inside waters (inside) big-six areas (Areas 4 through 6) were pooled separately to form both an inside and an outside strata. Encounter estimates between observer type (logbook versus observer) for both legal and sublegal chinook salmon were compared by strata and period using a general linear model.

During the 2000 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 harvest. It did not seem reasonable to include the landings from this area when expanding the troll observer chinook 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 catch was required to be at least twice the catch of all other species combined.
3. The landing must have reported no chinook 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. Due to the low numbers of participating hand troll vessels, the power troll estimates of encounters were expanded to the total estimates based on the ratio of the total troll effort to the power troll effort 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 = $\frac{n}{N}$,

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

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

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.

Chinook Maturity and Sex Composition

Chinook sex determinations were made by direct examination of the gonads. Maturity measurements consisted of milt sac width measurements (nearest .5 mm) and skein width measurements (nearest .5 mm). A single "representative" egg was measured from a location approximately in the middle of a skein on each female. Milt sac and skein widths were measured at what visually appeared to be the widest section along the length of one gonad. Only one maturity measurement was taken per fish.

Maturing fish were presumed to spawn during the 2000 calendar year. Immature fish included all fish that would not spawn in 2000. Gonad development is highly accelerated during the last few months prior to spawning, while very little development occurs during the previous periods of the chinook life cycle (Rich 1925). Therefore, the distribution of gonad size measurements in ocean-caught chinook is approximately bimodal between fish considered to be current year spawners and those that will not spawn this year. However, some error may be expected in the assessment of fall spawners, because accelerated gonad development would not be expected to begin until the early summer.

Use of male gonad width measurements as an index of male maturity was not found in the fisheries literature. Width measurements were used for this study in 1999, and the method proved both practical and effective, whereas volumetric and/or weight measurements would be difficult to obtain under the typical conditions aboard an observer vessel (Stopha et al. 2000). A single milt sac from each of a total of 1,441 male chinook was measured in 1999 and 2000. Length frequency distributions were created for each month (July–September) where sampling occurred. The frequency distribution for July (Figure 2) shows the least evidence of a bimodal relationship useful for identifying mature versus immature fish. A bimodal trend is more evident in August, as the gonad development of maturing fish continues to accelerate. In September there was a wide gap between the two modes of distribution. Based upon the evidence of these distributions, males with gonad width measurements greater than 11 mm were classified as mature. Males with a gonad width less than or equal to 11 mm were assigned to the immature category.

In the 1998 and 1999 seasons female maturity was determined using egg diameter measurements and the egg maturity criteria used by Kissner (1973). However, the egg diameter measurements recorded by observers, were not sufficiently precise to develop size-frequency graphs that would indicate whether our egg diameter-maturity categories were appropriate. Moreover, observers were unable to take several egg

diameter measurements per fish in order to insure a representative egg diameter was recorded for that skein. Since the milt sac width measurement worked well for males, skein width data was gathered from females during the 2000 season, in addition to egg diameter data. Length frequency distributions were created for each month of the fishery (Figure 3), as was done for the male milt sac widths. All females with a skein width measurement of 21 mm or less were assigned to the immature category and those with measurements greater than 21 mm were assigned to the mature category.

RESULTS

Season Overview

The 2000 summer troll chinook salmon catch (93,765 fish) and coho salmon catch (1,123,926 fish) were the third lowest summer harvest for those species since the signing of the Pacific Salmon Treaty (PST) in 1985. The 2000 summer troll fishery consisted of four fishing periods for chinook salmon and two for coho salmon. The CR periods occurred during July 1–July 5, August 11–August 12, August 23–August 30, and September 12–September 20. The coho retention periods occurred from July 1–August 12 and from August 18–September 20. Coho and chinook salmon harvest data by period are presented in Table 1. Two CNR periods occurred from July 7 through August 10, and from August 31 through September 20. By Alaska Board of Fisheries (BOF) regulation, areas considered to be of high chinook salmon abundance were closed following the first CR period.

Observer and Logbook Analyses

Estimated boat days of effort during the 2000 summer troll fishing season decreased by about 16% from 1999 and about 10% from 1998 (Table 1). About 70% of the effort occurred during CNR periods and 30% during CR periods. Total number of trips sampled was 231, 31% greater than 1998 (176 trips) and 5% less than 1999 (243 trips; Table 2). Observers logged 214 fishing days, 16% more than 1998 (184 days) and 1% more than 1999 (211 days). A total of 531 fishing days were obtained from logbooks, 138% more than 1998 (223 days) and 31% more than 1999 (355 days). As a percentage of estimated boat-days of effort, the program sampled 1.7% of the CR fishing effort in 1998, 4.0% in 1999, and 6.2% in 2000. The program sampled 1.0% of the CNR fishing effort in 1998, 1.4% in 1999, and 2.1% in 2000. The distribution of observer and logbook effort generally approximated that of the fleet by period, with the exception of a few strata in periods 3 and 5 (Figure 4). Over the entire summer season the distribution of observer/logbook effort closely matched the distribution of the fleet effort by big six area (Figure 5).

No significant difference was detected (alpha=0.05) between logbook and observer estimates of chinook encounter rates by big six area/period. The encounter rate data gathered from logbooks was therefore pooled with the observer data for calculation of the final estimates. This is the same procedure that was followed in 1998, when no differences were detected, and in 1999, when there were some explainable differences in specific strata, but the data was still assumed to be complimentary (Stopha 2000).

Chinook Salmon Catch and Release Estimates

A total of 6,511 legal and 2,645 sublegal chinook salmon were observed during the 2000 season through a total of 231 trips. Logbooks accounted for 66% of the legal chinook observations, 88% of the sublegal chinook observations, and 76% of the trips (Table 2).

Estimates for the total number of catch and release encounters in the 2000 troll fishery were 39,484 legal-sized fish during CNR periods and 61,544 sublegal-sized fish during both CR and CNR periods (Table 3). The upper limit of the 90% confidence interval for the estimate of legal encounters during CR periods was 1% below the actual reported harvest (Table 4). The confidence interval for this estimate in 1998 and 1999 encompassed the reported harvest.

Encounter Rate Comparisons

Weighting of chinook 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 5). The 2000 CNR encounter rate for legal-sized fish was lower than any other year since direct estimates were first performed in 1985. The 2000 CNR sublegal encounter rate was greater than 1998, but less than all other years since 1985. However, when adjusted for effort, the number of legal-size fish encountered per day during the CNR periods is the third highest for the seven years where direct estimates were made (Table 6). The sublegal encounter rate during the CNR periods is the same as 1999 (1.9 fish per day) and is lower than all other years where direct estimates were made, except 1998 (1.7 fish per day).

Chinook Salmon Maturity and Sex Composition

The sex composition estimates in period one were 56% male for the inside stratum and 44% male for the outside stratum (Table 7). The sex composition estimates were 46% male for the outside stratum in the August and September CR periods. No sex composition estimate was made for the inside stratum in the later periods due to a lack of samples (only 2% of the total chinook catch occurred here).

During the first CR periods, the majority of the fish observed were mature (79-80%) in both inside and outside strata (Table 8). However, as with the sex composition data, no samples were taken for the later CR periods in the inside stratum.

Coded Wire Tag Recoveries

A total of 46 heads from marked sublegal-size chinook salmon were recovered from a total of 333 sublegal fish examined on observer boats (Table 9). Of these, seven heads contained no tags.

Only 333 sublegal chinook salmon were examined out of a total estimated 61,544 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=39), stocks from British Columbia accounted for 40% of the total tag ratios, followed by Washington (33%), Alaska (24%), and Oregon (3%). Two tagged wild stock fish were also recovered, one from Taku River and one from Skagit River.

DISCUSSION

Estimation of Chinook Encounters

The precision objective for the direct chinook salmon encounter estimates in the 2000 summer fishery was that the 90% confidence interval should be +/-35% of the estimate. The objective was met for both sublegal (+/-24%) and legal (+/-26%) size fish. The precision objective for 2000 was lowered from the 1998 and 1999 objective (+/-25%) because the initial goal did not seem consistently achievable given budget/sample size limitations and unpredictable variability in the fishery (Stopha et al. 2000).

Sex Composition and Maturity

Pooled maturity estimates were within the +/- 5% precision goal in 1999 and 2000. The pooled male and female maturity rate was higher for the 2000 summer fishery (80% mature) than the maturity rate estimate for the 1999 summer fishery (75%).

Confidence intervals for sex composition estimates for all periods and areas averaged about +/- 10% in both 1998 and 1999, and were higher than the 5% objective precision goals. The precision goal for 2000 was lowered to +/-10% and this goal was achieved for all strata except the second period inside stratum, where no sampling and little chinook salmon catch occurred.

2001 Season Observer Program

Three years of observer program chinook encounter data collected so far do not indicate the presence of bias or significant under-reporting of chinook salmon encounters in logbooks (Bloomquist et al. 1999; Stopha et al. 2000). Therefore, the 2001 program will seek to obtain higher levels of precision in the encounter estimates by avoiding the expense of onboard observers and collecting a much larger quantity of logbook data. Some logbook program participants will be requested to retain and bring sublegal samples into port for the purpose of continued CWT sampling and to provide data for the ongoing GSI sampling program conducted by the ADF&G genetics laboratory (Seeb et al. 1999). Collection of sex composition and maturity data is not anticipated to occur in 2001.

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Table 1. Chinook and coho salmon catch and boatdays of effort by period in the 1998, 1999, and 2000 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

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

Table 3. Chinook salmon catch and release estimates for legal and sublegal sized fish during the 1998, 1999, and 2000 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

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, and 2000 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

Table 5. Southeast Alaska chinook salmon encounter estimates during chinook 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, 1981–2000.

OLD ESTIMATES			NEW ESTIMATES		
YEAR	LEGAL	SUBLEGAL	YEAR	LEGAL	SUBLEGAL
1981	18,225	18,578	1981	18,225	18,578
1982	89,100	90,827	1982	89,100	90,827
1983	74,925	76,378	1983	74,925	76,378
1984	87,075	88,763	1984	87,075	88,763
1985	118,191	131,011	1985	84,489	174,498
1986	78,763	104,820	1986	98,477	156,453
1987	191,956	171,156	1987	171,254	215,586
1988	60,930	91,200	1988	57,976	79,604
1989	150,600	162,900	1989	116,877	191,957
1990	100,617	107,718	1990	89,855	127,485
1991	110,978	118,809	1991	99,108	149,560
1992	123,725	132,456	1992	110,492	176,722
1993	103,945	111,281	1993	92,827	134,577
1994	121,716	130,305	1994	108,697	172,440
1995	79,862	85,498	1995	71,320	83,262
1996	78,949	84,521	1996	70,505	81,317
1997	60,158	64,403	1997	53,723	41,277
1998	40,648	43,516	1998	29,462	11,400
1999	74,562	79,824	1999	51,334	42,138
2000	44,702	47,856	2000	39,484	28,549

Table 6. Comparison of chinook salmon catch and release encounter rates during chinook non-retention (CNR) and chinook retention (CR) periods, 1985–2000.

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
CR	1998	11,400			28,436	2.3
	1999	4,624			11,213	2.4
	2000	6817			32,995	4.8
Total:	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

Table 7. Sex composition of chinook salmon sampled during the first and second chinook retention periods of the 1998, 1999, and 2000 summer troll fishery. There were four chinook retention periods in the 2000 season and the last three are pooled to create the second period.

Year		Stratum	Proportion Male	95% C.I.	n
1998	7/1-7/12	Inside	39%	30% to 48%	119
		Outside	40%	36% to 44%	629
	8/20-9/30	Inside	47%	39% to 55%	173
		Outside	47%	38% to 56%	128
1999	7/1-7/6	Inside	39%	31% to 47%	169
		Outside	46%	41% to 51%	363
	8/18-8/22	Inside	47%	35% to 59%	76
		Outside	38%	28% to 48%	100
2000	7/1-7/5	Inside	56%	47% to 64%	126
		Outside	44%	40% to 48%	643
	8/11-9/20	Inside	56%	N/A	N/A
		Outside	46%	43% to 49%	930

Table 8. Proportion of mature female and male chinook salmon in the catch of observer boats, 1998, 1999, and 2000.

Year	Period	Area	Females Mature	n	Males Mature	n	Combined Sexes Mature	95% C.I.	n
1998	7/1-7/12	Inside	36%	73	11%	46	26%	a	119
		Outside	90%	376	72%	237	83%		613
	8/20-9/30	Inside	18%	92	5%	80	12%	a	172
		Outside	83%	66	74%	50	79%		116
1999	7/1-7/6	Inside	73%	103	74%	66	73%	66% to 80%	169
		Outside	77%	196	77%	166	77%	73% to 81%	362
	8/18-8/22	Inside	47%	40	34%	35	41%	30% to 52%	75
		Outside	68%	62	78%	37	71%	62% to 80%	99
1999 Combined Periods/Combined Area:							75%	71% to 79%	705
2000	7/1-7/5	Inside	85%	53	74%	70	79%	71% to 86%	123
		Outside	80%	233	81%	266	80%	77% to 84%	499
	8/12-9/20	Inside	N/A	N/A	N/A	N/A	N/A	N/A	0
		Outside	86%	501	70%	416	79%	76% to 84%	917
2000 Combined Periods/Combined Area:							80%	76% to 84%	1539

[a] Confidence intervals were not calculated in 1998 due to an unknown (and presumably highly variable) amount of observer error in making visual determinations of male gonadal maturity. In 1999, visual estimation was replaced by physical measurement.

Table 9. 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 2000 Southeast Alaska summer troll fishery (N=333). 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. Two wild stock tags (Taku River and Skagit River) were also recovered.

State/ Province	Location	Tag Recoveries	Sum Tag Ratio	Contribution to Grand Total of Tag Ratio
AK	Crystal Lake	2	26	23%
	Little Port Walter	2	2	2%
AK Total		4	28	24%
BC	H-Kincolith Cdp	2	4	3%
	H-Puntledge River	2	9	8%
	H-Quinsam River	3	31	27%
	H-Robertson Creek	1	2	2%
BC Total		8	45	40%
OR	Clackamas Hatchery	2	2	2%
	Marion Forks	1	1	1%
OR Total		3	3	3%
WA	Eastbank Hatchery	6	6	5%
	Grays River Hatchery	1	1	1%
	Grovers Cr Hatchery	2	5	5%
	Hoko Falls Hatchery	1	1	1%
	Kalama Falls Hatchery	1	1	1%
	Lewis River Hatchery	1	1	1%
	Nisqually Hatchery	1	13	11%
	Pittsburg Landing PD	1	1	1%
	Ringold Springs Hatchery	1	1	1%
	Salmon River	1	1	1%
	Soos Creek Hatchery	1	1	1%
	Turtle Rock Hatchery	3	3	3%
	Wells Dam SP Channel	2	2	2%
WA Total		22	38	33%
Grand Total		37	114	100%

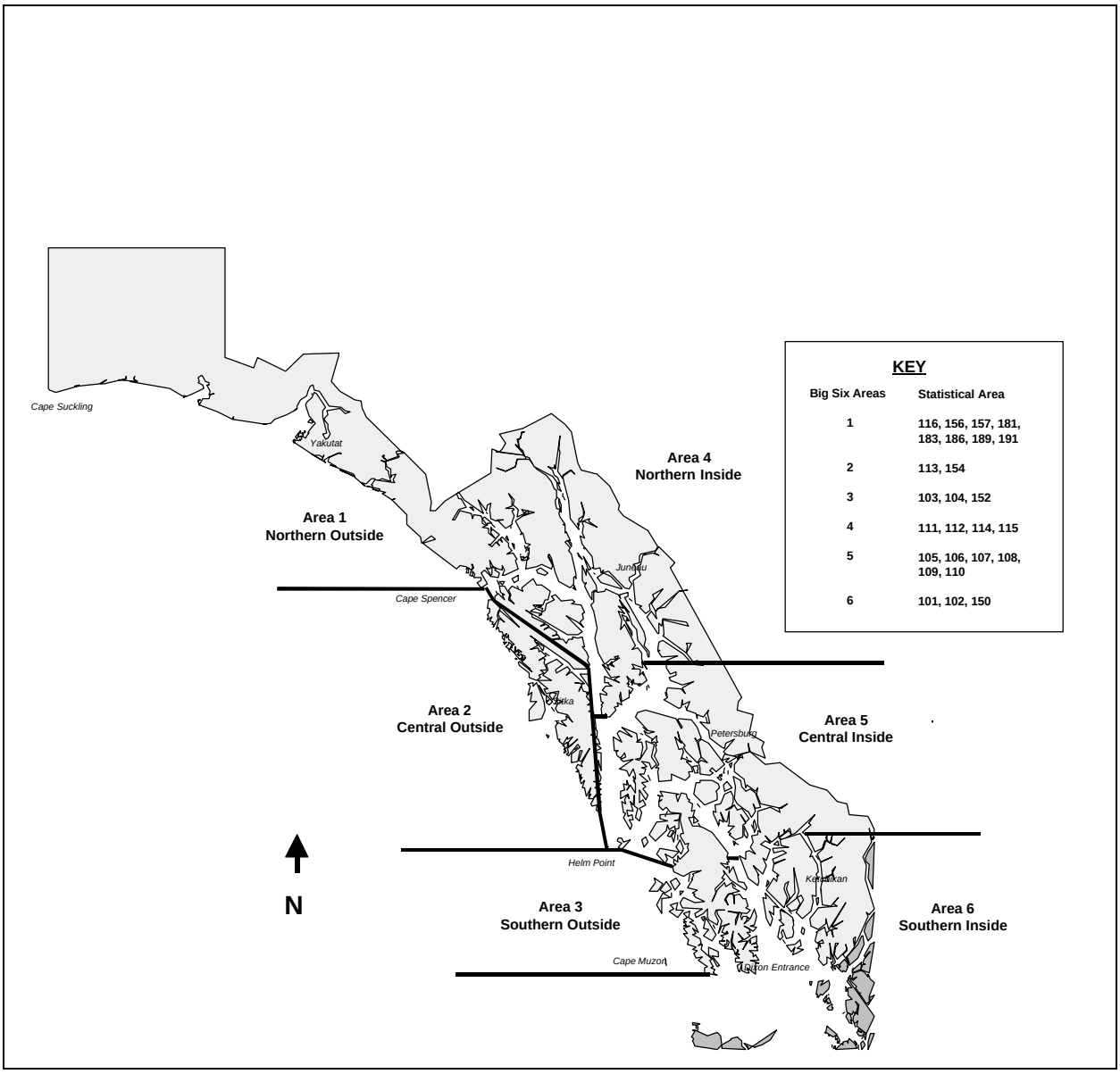
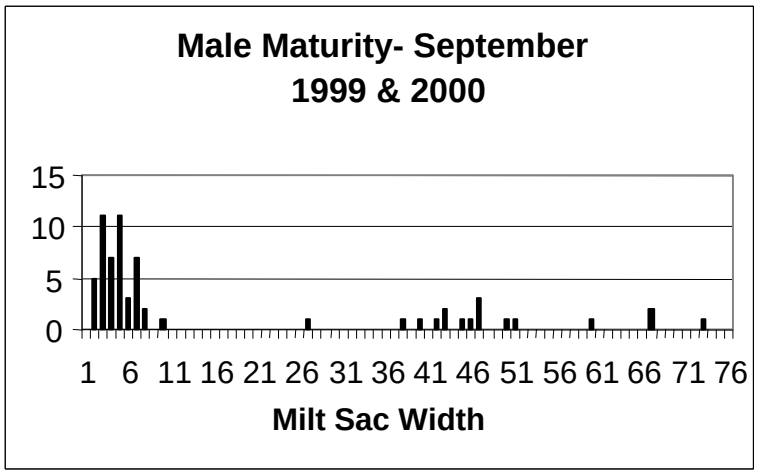
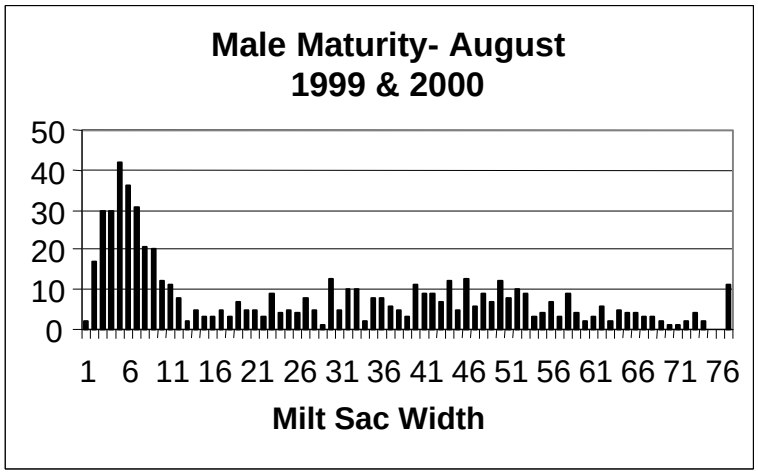


Figure 1. Map showing big-six areas in Southeast Alaska.





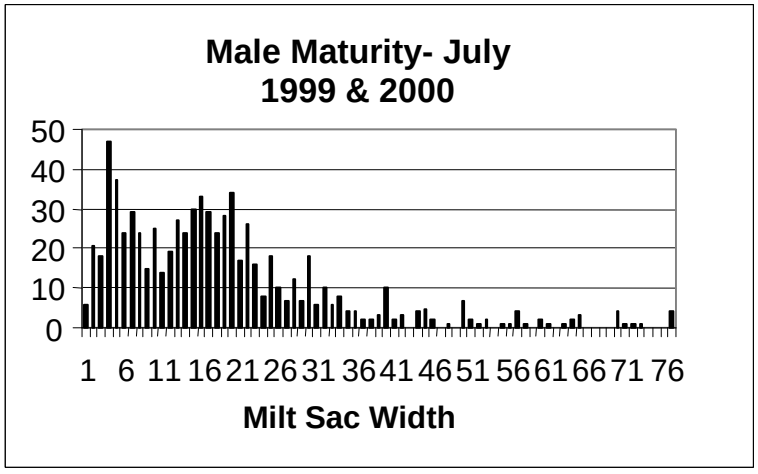
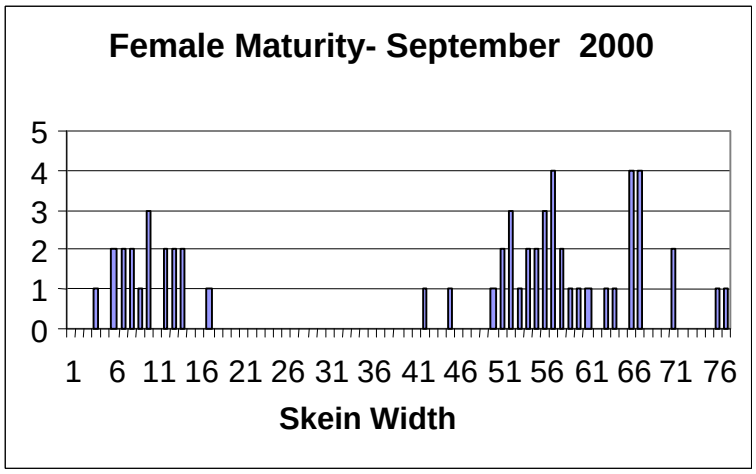
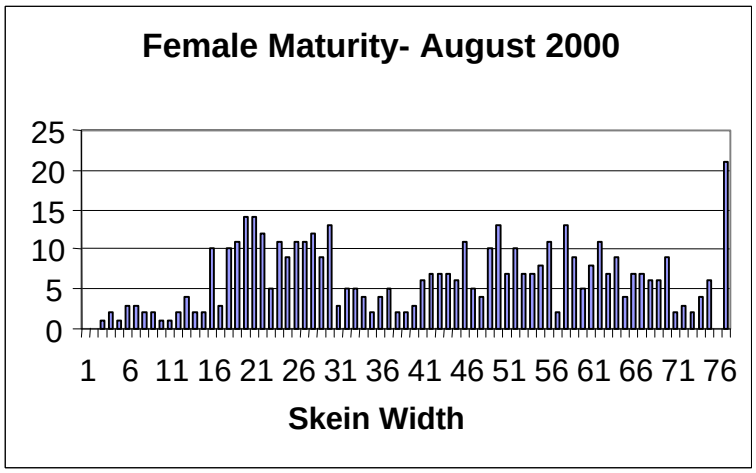


Figure 2. Milt sac widths for chinook salmon caught in the 1999 and 2000 summer troll fisheries.





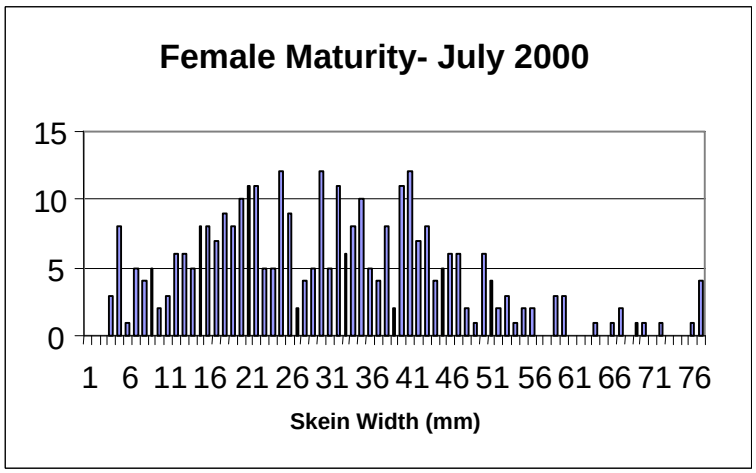
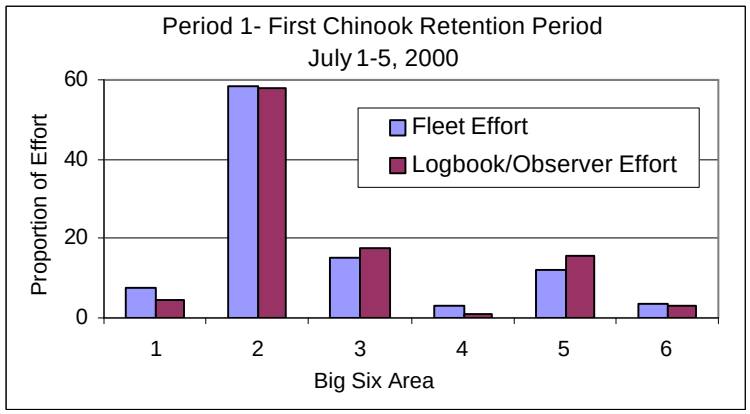
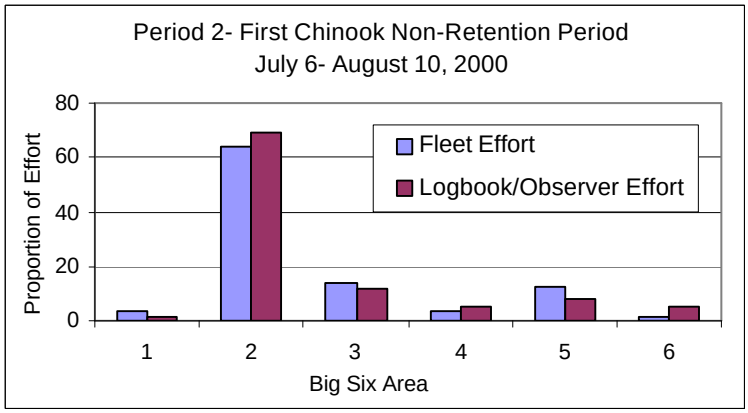


Figure 3. Skein width data for chinook salmon caught in the 2000 summer troll fishery.





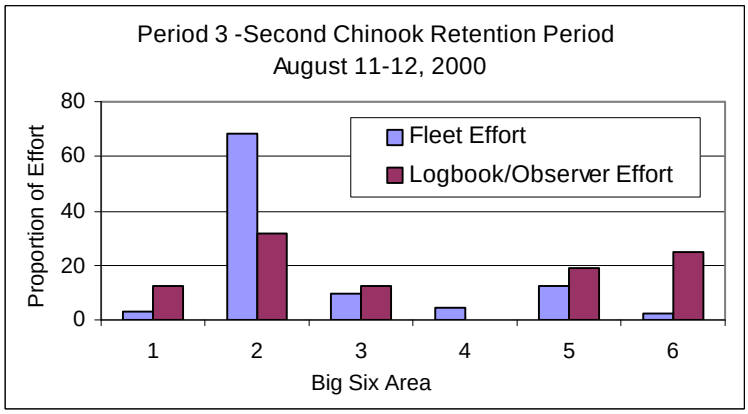


Figure 4. Proportion of fishing effort based on dockside interviews (fleet effort) and proportion of effort sampled during the 2000 observer program.

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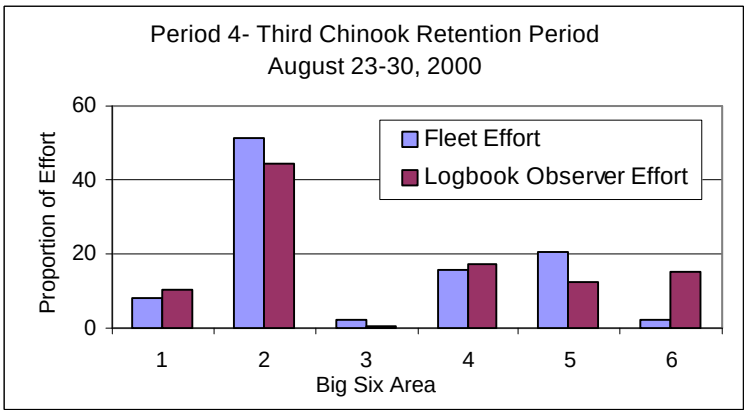

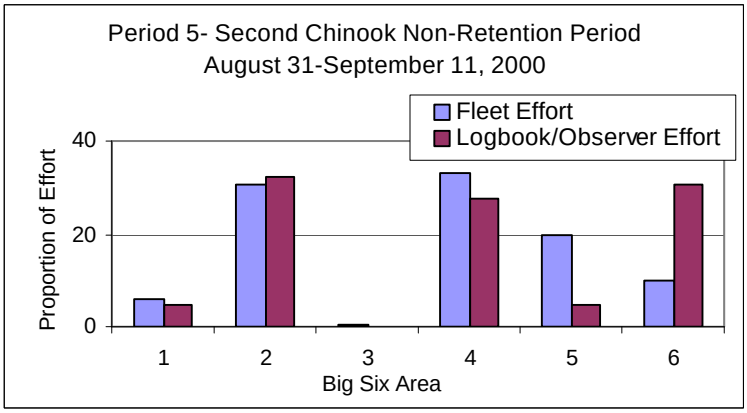

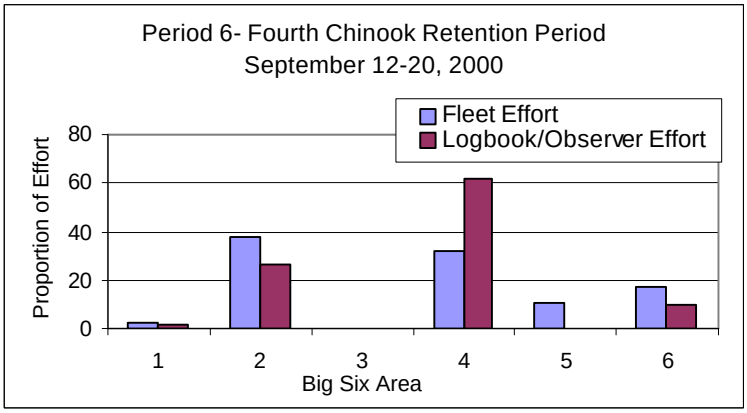

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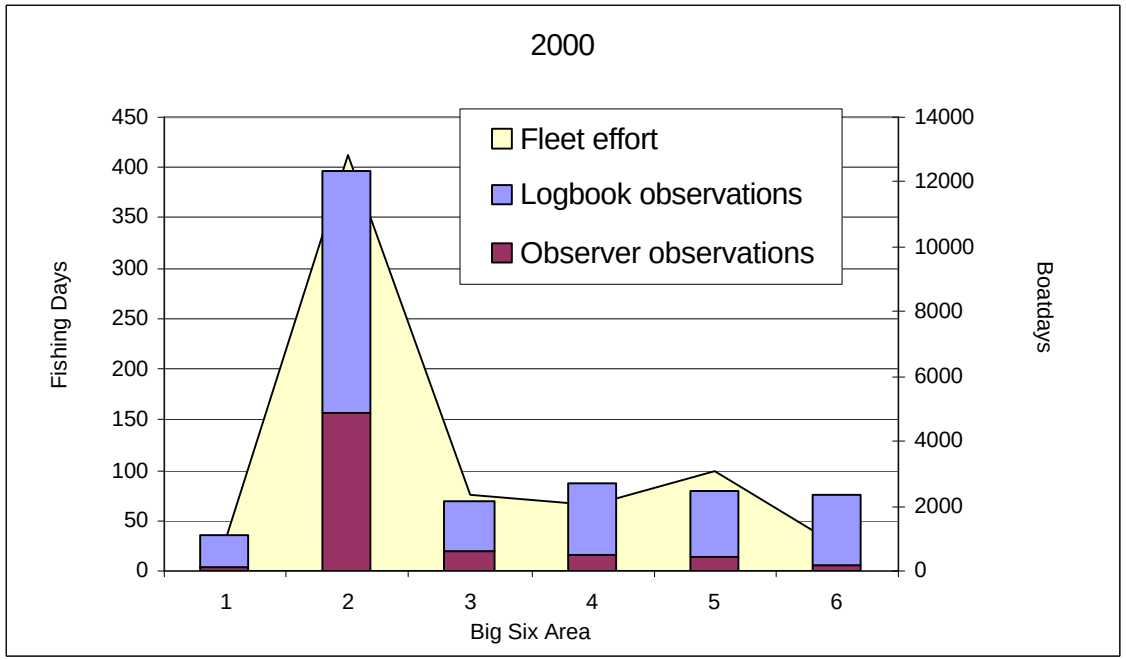

Figure 5. Observer and logbook number of trips (stacked column) and boatdays of fleet effort (gray area) during the 2000 Southeast Alaska summer troll fishery.

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