FISHERY DATA SERIES NO. 39

SPORT HARVESTS OF COHO *Oncorhynchus kisutch* AND CHINOOK *O. tshawytscha* SALMON IN RESURRECTION BAY, ALASKA DURING 1987[1]

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ABSTRACT

There were an estimated 8,439 boat-trips of effort in the Resurrection Bay boat fishery from 6 July through 13 September 1987. This fishery harvested an estimated 22,402 coho salmon *Oncorhynchus kisutch*. About half the effort (38 percent) and coho salmon harvest (46 percent) occurred during the 11-day Seward Silver Salmon Derby. Hatchery coho salmon from Bear Lake, Seward Lagoon, and Box Canyon Creek contributed 12, 15, and 13 percent, respectively, to the boat harvest. The majority of harvested coho salmon in the boat fishery were age 1.1 (73 percent). In the beach fisheries for chinook salmon *Oncorhynchus tshawytscha* estimated effort and harvest were 4,542 angler-hours and 649 fish, respectively. Estimated effort and harvest in the beach fishery for coho salmon were 11,767 angler-hours and 1,545 fish, respectively. Bear Lake, Seward Lagoon, and Box Canyon Creek coho salmon stocks contributed 4, 58, and 15 percent, respectively, to the beach harvest of coho salmon. The majority of harvested coho and chinook salmon in the beach fisheries were age 1.1 (71 percent) and age 0.2 (60 percent), respectively.

KEY WORDS: coho salmon, *Oncorhynchus kisutch*, chinook salmon, *Oncorhynchus tshawytscha*, Resurrection Bay, sport effort, sport harvest, age, length, hatchery contribution.

INTRODUCTION

The recreational fishery for coho salmon *Oncorhynchus kisutch* in Resurrection Bay is one of the largest sport fisheries in effort and harvest for this species in Alaska (Mills 1986). Historically, most of the effort in Resurrection Bay and surrounding waters has been from anglers fishing from privately owned boats. A growing charter boat industry has also developed around this fishery. Additionally, the United States Army and Air Force maintain recreation camps in Seward where boats are made available to military personnel and their dependents. The harvest of coho salmon by the boat fishery has averaged 15,231 coho salmon annually from 1968 to 1986 (Table 1), with annual harvests ranging from 8,861 in 1976 to 22,932 in 1968. A major portion of the effort and harvest occurs during the annual Seward Silver Salmon Derby. In addition to the boat fishery, some anglers fish from shore for coho salmon during and after the Salmon Derby. Although sport effort and harvest by the shore fishery has been monitored only since 1986, historical observations suggest that harvests of coho salmon by this fishery are much lower than by the boat fishery.

To increase the number of coho salmon available for sport harvest, an enhancement program was begun in 1962. Bear Lake (Figure 1) was poisoned to eradicate competing species and has been stocked annually with coho salmon fingerlings. Hatchery-reared coho salmon smolts have also been planted at various locations throughout Resurrection Bay. Since 1968, hatchery fish have contributed an average of 22% annually to the harvest of coho salmon by the boat fishery (Vincent-Lang 1987).[1] Hatchery-reared chinook salmon *O. tshawytscha* smolts have also been released in an effort to diversify and seasonally extend the Resurrection Bay sport fishery. These releases, begun in 1983, have resulted in returns large enough to support a shore fishery.

Three major life history events of Resurrection Bay salmon must be monitored to evaluate enhancement efforts: (1) freshwater survival, (2) harvest in the sport fishery, and (3) escapement from the sport fishery. Numbers (1) and (3) are largely accomplished by a weir program on Bear Creek. The weir program for 1987 is described in a separate report (Vincent-Lang et al. 1988). Number (2) is accomplished by creel surveys of the boat and shore sport fisheries. These surveys are designed to estimate: (1) angler effort and harvests of coho and chinook salmon in each fishery, (2) the biological characteristics of harvested salmon, and (3) the hatchery contributions to the harvests. The harvests of ling cod *Ophidon elongatus* and pink salmon *O. gorbuscha* are also estimated. The creel surveys are the subject of this report.

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[1] A summary of all coho salmon enhancement activities in Resurrection Bay (including estimates of survival rates and contributions to the sport fishery) is presented in Vincent-Lang (1987).

Table 1. Harvest and effort statistics for the Resurrection Bay boat fishery for coho salmon, 1968-1987.[1]

Year	Effort		Harvest			
	Boat-Trips	Standard Error	Number	Standard Error	95% Confidence Interval	
1968	8,518	89.3	22,932	744.7	21,473 -	24,392
1969	7,717	160.6	14,444	585.2	13,297 -	15,591
1970	8,921	133.9	15,027	555.8	13,938 -	16,116
1971	8,041	110.8	19,264	754.3	17,786 -	20,743
1972	9,297	183.1	15,383	760.0	13,894 -	16,873
1973	7,730	117.6	13,931	579.8	12,795 -	15,068
1974	7,520	141.3	17,550	839.0	15,906 -	19,195
1975	5,351	108.1	16,817	892.2	15,068 -	18,566
1976	5,953	87.7	8,861	441.7	7,995 -	9,727
1977	7,113	131.6	16,003	601.8	14,824 -	17,182
1978	6,280	124.0	15,819	617.0	14,610 -	17,029
1979	7,163	151.0	16,532	779.9	15,003 -	18,060
1980	7,657	191.4	18,918	1,079.1	16,803 -	21,033
1981	6,682	134.4	14,087	785.6	12,548 -	15,627
1982	7,948	164.5	16,160	929.7	14,338 -	17,982
1983	8,479	139.9	13,780	897.1	12,022 -	15,538
1984	6,996	128.7	10,445	627.4	9,215 -	11,674
1985	6,848	209.6	10,332	765.7	8,832 -	11,833
1986	5,950	274.7	13,107	759.4	11,618 -	14,596
Mean	7,377		15,231			
1987	7,661	352.4	22,224	1,325.0	19,627 -	24,821

[1] Source: Vincent-Lang, 1987.

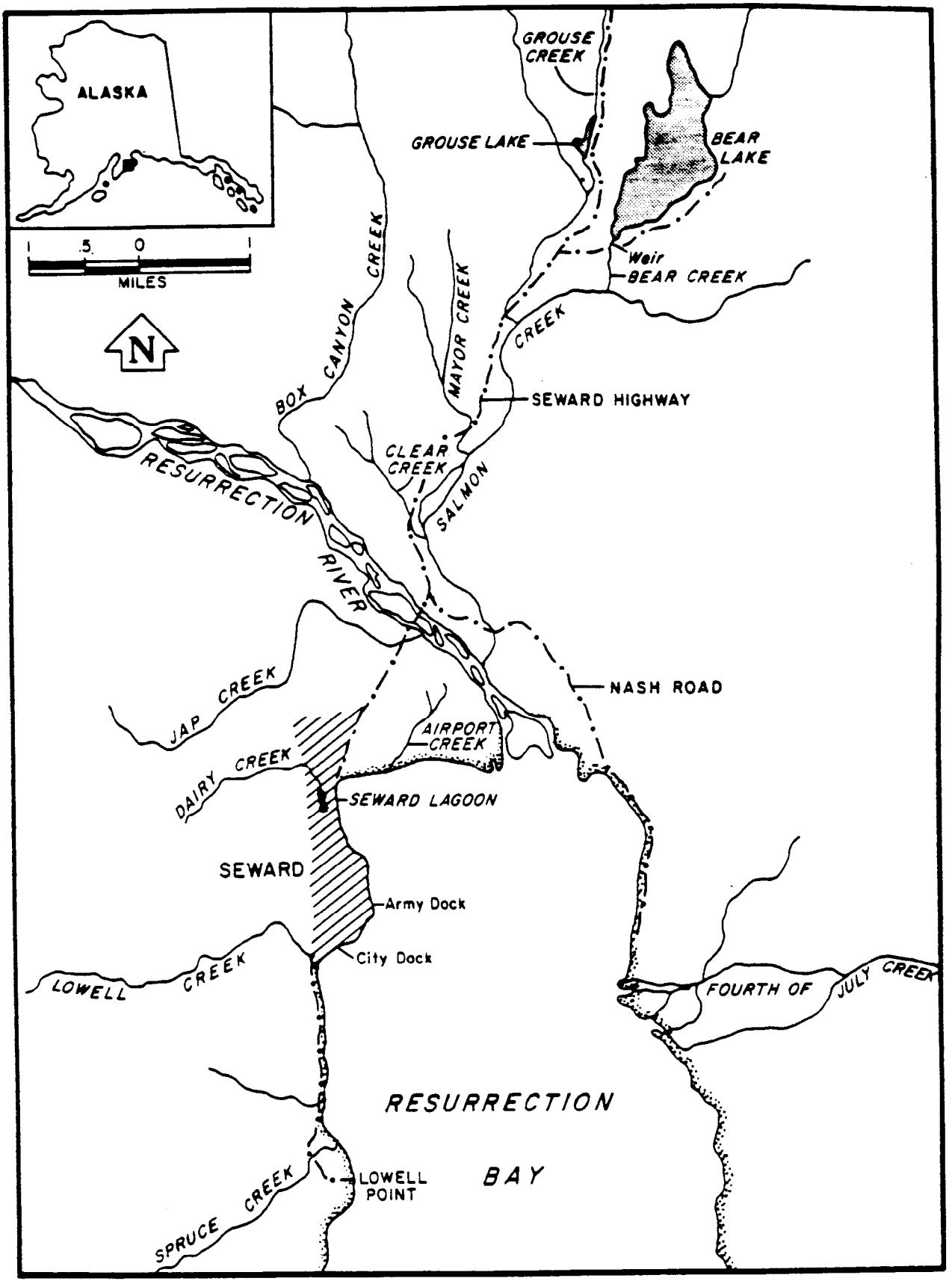

Figure 1. Map of Resurrection Bay, Alaska.

METHODS

The bag limits for coho and pink salmon in Resurrection Bay during 1987 were 6 per day, 6 in possession (ADF&G 1987). The bag limit for chinook salmon and ling cod was 2 per day, 2 in possession. Anglers could use any conventional sport fishing methods including snagging.

Boat Fishery Creel Survey

The boat fishery in Resurrection Bay was surveyed from 6 July through 13 September. The fishery was stratified into three temporal segments:

(1) Pre-Derby boat fishery, 6 July - 7 August;
(2) Derby boat fishery, 8 August - 1200 hour on 16 August; and,
(3) Post-Derby boat fishery, 1201 hour on 16 August - 13 September.

Each segment was further stratified into weekdays and weekends/holidays.

The boat creel survey used a stratified random sampling design to collect the data necessary to estimate sport fishing effort, in units of boat-trips, and coho salmon harvest. The fishing day was defined to be 14 hours long (from 0800 to 2200 hours). Each day was divided into four, 3.5-hour time periods: (A) 0800 - 1129 hours, (B) 1130 - 1459 hours, (C) 1500 - 1829 hours, and (D) 1830 - 2200 hours. Units to be surveyed were randomly selected without replacement from those available in each period subject to the constraint that a maximum of two sample units could be surveyed on any day (except during the Derby). Sampling effort was allocated approximately equally among time periods.

Two people usually conducted the creel survey during each sampled period. One person counted all sport fishing boats entering the Seward small boat harbor and conducted interviews of boat anglers (hereafter referred to as "boat interviews") at two docking sites. The second person conducted boat interviews at the three remaining docking sites. As many returning boats as possible were interviewed. An equal amount of time was spent conducting interviews at each docking site when it was not possible to interview all returning boats.

All boat interviews were completed trip interviews. Interviews for effort and harvest information were party interviews for all anglers in a returning boat. For each boat, the following information was collected: number of anglers in the boat; number of hours fished; total number of coho, chinook, and pink salmon and ling cod harvested; and whether the boat was a chartered fishing boat or a private boat. Coho salmon were examined for an adipose finclip. If a finclip was observed, the fish's snout was removed (upon permission of the angler) and stored for later removal and decoding of the coded wire tag (CWT).

For each fishery segment (Pre-Derby, Derby, and Post-Derby) and stratum (weekday and weekend/holiday), the mean number of boats returning during each period (A, B, C, or D) was calculated. The number of boat-trips of effort in fishery stratum i (B_i) was estimated by:

$$(1) \quad \hat{B}_i = \sum_{j=1}^{4} N_{ij} \bar{b}_{ij},$$

where:

$\bar{b}_{ij}$ = the mean number of boats returning during period j in stratum i and

N_{ij} = the total number of sample units (3.5 hour time periods) possible during period j in stratum i.

The variance of $\hat{B}_i$ was estimated in the following manner (Schaeffer et al. 1979):

$$(2) \quad V(\hat{B}_i) = \sum_{j=1}^{4} N^2_{ij} \, [s^2_{ij}/n_{ij}][1 - (n_{ij}/N_{ij})],$$

where:

N_{ij} is defined as above,

n_{ij} = the total number of sample units surveyed during period j in fishery stratum i, and

s^2_{ij} = the sample variance for the mean number of boats returning during period j in fishery stratum i.

The total number of boat-trips for the Resurrection Bay fishery was estimated by summing the estimates for each stratum for all segments of the fishery. These are considered independent estimates and the estimated variance of the total is the sum of the variances.

Catch per unit effort (CPUE) was estimated as mean catch per boat-trip for each stratum in each fishery segment. Mean CPUE for stratum i ($\overline{CPB}_i$) was calculated by:

$$(3) \quad \overline{CPB}_i = \left(\sum_{k=1}^{t_i} c_{ik}\right)/t_i \ ,$$

where:

t_i = the total number of boats interviewed during stratum i and

c_{ik} = the catch of coho salmon by boat k interviewed during stratum i.

$\overline{CPB}_i$ was estimated by a two-stage sample design with days being the first stage sample unit (of which there are a finite number available to be sampled) and boats being the second stage sample unit (of which there are an unknown number available to be sampled on any given day).

The variance of $\overline{CPB}_i$ was estimated in the following manner (Von Geldern and Tomlinson 1973):

$$(4)\quad V(\overline{CPB}_i) = [1 - (d_i/D_i)]\, s_B^2/d_i + \left(\sum_{j=1}^{d_i} s_{ij}^2/m_{ij}\right)/d_i D_i \ ,$$

where:

d_i = the number of days in stratum i during which interviews were conducted,
D_i = the total number of days in stratum i,
s_B^2 = the between-day variance of $\overline{CPB}_i$ in stratum i,
s_{ij}^2 = the sample variance of $\overline{CPB}_{ij}$ on day j in stratum i, and
m_{ij} = the number of boats interviewed during day j of stratum i.

Between-day variance was calculated as:

$$(5)\quad s_B^2 = \left[\sum_{i=1}^{d_i} (\overline{CPB}_{ij} - \overline{CPB}_i)^2\right]/(d_i - 1).$$

The number of coho salmon harvested during the weekday or weekend/holiday stratum of each fishery segment ($\hat{C}_i$) was calculated as follows:

$$(6)\quad \hat{C}_i = \hat{B}_i \overline{CPB}_i \ .$$

The variance of $\hat{C}_i$ was estimated using the formula for the product of two independent random variables (Goodman 1960):

$$(7)\quad V(\hat{C}_i) = [\hat{B}_i^2\, V(\overline{CBP}_i)] + [\overline{CPB}_i^2\, V(\hat{B}_i)] - [V(\hat{B}_i)\, V(\overline{CPB}_i)] \ .$$

The total coho salmon harvest by all segments of the boat fishery ($\hat{C}_T$) was estimated as follows:

$$(8)\quad \hat{C}_T = \sum_{i=1}^{6} \hat{C}_i$$

where i is one of six fishery strata. Because these are independent estimates, the estimated variance of the total is the sum of the variances. Harvests of other species were estimated using these same procedures.

Number of boat-trips and the harvests of coho, chinook, and pink salmon and ling cod by military personnel and their dependents were obtained from dispatch officers at the military recreation camps. These counts were obtained for every day and represented tallies for the entire day.

Assumptions necessary for the boat creel survey analyses include:

1. Interviewed boats were representative of the total population.

2. No significant fishing effort occurred between 2000 and 0800 hours.
3. Boat counts and catch per boat were normally distributed random variables.

Beach Fishery Creel Survey

A roving creel survey (Neuhold and Lu 1957) was used to count anglers and conduct angler interviews at selected Resurrection Bay shore locations. The creel survey followed a stratified random sampling design. Angler counts were used to estimate fishing effort in units of angler-hours. Angler interviews were used to estimate the harvest rates of chinook and coho salmon. These fisheries are directed at chinook salmon during June and early July and at coho salmon during late August and early September.

The beach fishery for chinook salmon was surveyed from 15 June through 5 July and was divided into two areas: (1) the Lowell Creek Outfall or Waterfall and (2) the Boat Harbor. The beach fishery for coho salmon was surveyed from 8 August to 13 September and included only one area: the Seward beach area[2]. Each beach fishery was further stratified by weekdays and weekends/holidays. The fishing day was defined to be 14 hours long and was stratified into the same daily time periods used for the boat fishery. Periods to be surveyed were selected using the procedure described previously for the boat creel survey.

For surveys during the coho salmon fishery, 3.5 hours were spent surveying the beach. However, for surveys during the chinook salmon fishery, 1.5 hours were spent at each beach during each sampled time period. The beaches were surveyed in random order and the angler count was conducted during a randomly selected 10 minute interval at each beach. Individual anglers were contacted during the survey and the following information was collected: the number of hours fished, the number of fish harvested and released by species, and whether the interview was a completed-trip interview or not. The majority of the interviews were incomplete trip interviews.

The total number of angler-hours ($\hat{E}_i$) for fishery stratum i in any beach fishery was calculated in the following manner:

$$(9) \quad \hat{E}_i = \sum_{j=1}^{4} H_{ij}\bar{x}_{ij},$$

where:

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2 The Lowell and Fourth of July beach fisheries were surveyed in 1986 (Sonnichsen et. al. 1987). These fisheries target primarily on pink salmon and few coho salmon are harvested, therefore, these fisheries were not surveyed in 1987.

$\bar{x}_{ij}$ = the mean number of anglers for counts during period j of stratum i and
H_{ij} = the total number of hours possible for fishing in period j of stratum i.

The variance for the estimate of total effort was calculated in the following manner:

$$(10)\quad V(\hat{E}_i) = \sum_{j=1}^{4} H_{ij}^2 \, s_{ij}^2/n_{ij},$$

where:

s_{ij}^2 = the sample variance for $\bar{x}_{ij}$ and
n_{ij} = the number of angler counts during period j of fishery stratum i.

Catch per unit effort (catch per angler-hour) was estimated for each stratum at each beach in the following manner:

$$(11)\quad CPUE_i = \sum_{k=1}^{m_i} c_{ik} / \sum_{k=1}^{m_i} e_{ik},$$

where:

m_i = the number of anglers interviewed during stratum i,
c_{ik} = the catch of coho salmon by angler k interviewed during stratum i, and
e_{ik} = the effort (number of hours expended) by angler k at the time of the interview.

Omitting the finite population correction factor, the variance of $CPUE_i$ was approximated in the following manner (Jessen 1978):

$$(12)\quad \hat{V}(CPUE_i) \approx (\bar{C}_i/\bar{E}_i)^2 \, [s_C^2/\bar{C}_i^2 + s_E^2/\bar{E}_i^2 - (2r_i s_C s_E/\bar{C}_i\bar{E}_i)],$$

where:

$\bar{C}_i$ = the mean catch of coho salmon by anglers in stratum i,

$\bar{E}_i$ = the mean effort by anglers in stratum i,

s_C^2 = the two-stage variance of the mean catch ($\bar{C}_i$),

s_E^2 = the two-stage variance of the mean effort ($\bar{E}_i$), and
r_i = the correlation coefficient for the c_{ik} and e_{ik}.

The total coho salmon harvest ($\hat{C}_i$) for each stratum of the beach fisheries was calculated by:

(13) $\hat{C}_i = \hat{E}_i CPUE_i$.

The variance of $\hat{C}_i$ was estimated using the formula for the product of two random variables from Goodman (1960), provided earlier.

The harvest was estimated for all strata of the beach fisheries and then summed to estimate the total season harvest. These are considered independent estimates, therefore, the estimated variance of the total was the sum of the variances.

The major assumptions for the beach creel survey analyses include:

1. Incomplete trip angler interviews provided an unbiased estimate of completed-trip CPUE.
2. Catch rate and length of fishing trip were independent.
3. Interviewed anglers were representative of the total angler population and anglers were interviewed in proportion to their abundance.
4. No significant fishing effort occurred between 2000 and 0800 hours.
5. For the angler interview data, effort and catch were normally distributed random variables.

Biological Data

Biological data were collected from coho salmon harvested in the boat and beach fisheries and chinook salmon harvested in the beach fishery. The objective was to sample 150 coho salmon during each temporal segment of the boat fishery and as many coho and chinook salmon as possible from the beach fisheries. Sampled fish were measured for mid-eye to fork-of-tail length to the nearest millimeter. Scales were taken for aging from the preferred area (Clutter and Whitesel 1956) and mounted on adhesive-coated cards. The cards were thermohydraulically pressed against plastic cards and the resulting scale impressions were displayed on a microfiche projector for age determination.

The proportional age composition of the sport harvest was estimated for each fishery stratum. Letting $\hat{p}_{hi}$ equal the estimated proportion of age group h in stratum i, the variance of $\hat{p}_{hi}$ was estimated using the normal approximation to the binomial (Scheaffer et al. 1979):

(14) $\hat{V}(p_{hi}) = \hat{p}_{hi}(1-\hat{p}_{hi})/(n_{Ti}-1)$,

where n_{Ti} is the total number of coho salmon sampled during stratum i.

The number harvested during a stratum was multiplied by the estimated age composition to estimate the number of fish harvested by age group. The variance of the number harvested by age group was estimated using Goodman's (1960) formula.

Mean length at age by sex and its variance were estimated using standard normal procedures.

Estimation of Hatchery Contributions to the Fishery

The contributions of the coho salmon from Bear Lake, Seward Lagoon, and Box Canyon Creek enhancement sites to the boat and beach harvests were calculated using the procedure of Clark and Bernard (1987). The numbers of unmarked and adipose finclipped coho salmon observed during the Pre-Derby/Derby and Post-Derby segments of the boat fishery were compared with a chi-square statistic to determine if the proportions of finclipped fish present in the segments were equal. The proportions were significantly different ($p < 0.01$), therefore, the hatchery contributions were estimated separately for these segments of the boat fishery. The contribution of a site under evaluation ($\hat{C}_s$) was estimated in the following manner:

$$(15) \qquad \hat{C}_s = (m_1/m_2)\ (a_1/a_2)\ (\hat{C}_T/n_2)\ (\hat{m}_c/\theta_s)$$

where $\hat{C}_T$ is as defined previously and:

n_2 = number of coho salmon examined in the boat or beach sport harvest,
m_1 = number of snouts from fish with adipose (Ad) finclips collected from the fishery and sent to the lab for processing that have a coded wire tag (CWT) present,
m_2 = number of snouts from fish with adipose finclips collected from the fishery and sent to the lab for processing that have decodeable CWTs,
a_1 = number of fish with adipose finclips observed in the fishery,
a_2 = number of snouts from fish with adipose finclips collected from the fishery and sent to lab for processing that arrive at the lab,
m_c = number of snouts from fish with adipose finclips collected from the fishery, sent to the lab for processing, and decoded as a unique tag code,
θ_s = for each tag code, the proportion of the total fish released that were marked with a CWT at the time of stocking. For Bear Lake θ_s is the proportion of coho salmon adults with Ad clips observed in the Bear Lake immigration.

The variance of $\hat{C}_s$ was calculated by:

$$(16) \quad V(\hat{C}_s] = [\hat{C}_T^2\ V(\hat{m}_c) + \hat{m}_c^2\ V(\hat{C}_T) - V(\hat{m}_c)\ V(\hat{C}_T)]\ [(m_1\ a_1)/(m_2\ a_2\ n_2\ \theta_s)]^2$$

and the variance of $\hat{m}_c$ (Clark and Bernard 1987) was calculated as follows:

$$(17)\quad V[m_c] = \left[\frac{m_2\,[m_2\text{-}1]\,a_2\,[a_2\text{-}1]\,n_2\,[n_2-1]\,\hat{C}_s\,[\hat{C}_s-1]\theta_s^2}{m_1\,[m_1\text{-}1]\,a_1\,[a_1\text{-}1]\,\hat{C}_T\,[\hat{C}_T\text{-}1]} \right] + \left[\frac{m_2\,a_2\,n_2\,\hat{C}_s\,\theta_s}{m_1\,a_1\,\hat{C}_T} \right] - \left[\frac{(m_2\,a_2\,n_2\,\hat{C}_S\,\theta_s)^2}{(m_1\,a_1\,\hat{C}_T)^2} \right] .$$

The estimates for each of the enhancement sites were summed to estimate the total number of hatchery coho salmon in the harvests by the boat and beach fisheries. The variance of the total was the sum of the variances for the individual estimates plus the covariances for the three combinations of the three enhancement sites possible. The equation used to estimate the covariance between $\hat{C}_{r1}$ and $\hat{C}_{r2}$ was (Clark and Bernard 1987):

$$(18)\quad \mathrm{Cov}(\hat{C}_{r1};\hat{C}_{r2}) = \hat{C}_{r1}\,\hat{C}_{r2} \left[\frac{m_1\,(m_2\text{-}1)\,a_1\,(a_2\text{-}1)\,\hat{C}_T\,(n_2\text{-}1)}{m_2\,(m_1\text{-}1)\,a_2\,(a_1\text{-}1)\,n_2\,(\hat{C}_T\text{-}1)} \right]$$

RESULTS

Boat Fishery Creel Survey

Most private and charter boats in the Resurrection Bay fishery returned during the C period. Effort during the C period was 3,414 boat-trips, accounting for 44.6% of the total effort (Table 2). Effort during the remaining three time periods was 1,930 boat-trips (25.2%), 1,815 boat-trips (23.7%), and 502 boat-trips (6.5%) for the D, B, and A periods, respectively. Effort by private and charter boats during the Derby segment of the fishery was 3,070 boat-trips, which was 40.1% of the total private and charter boat effort during the entire Resurrection Bay boat fishery (Table 3). Effort by private and charter boats during the Post-Derby and Pre-Derby segments were 2,814 boat-trips (36.7%) and 1,777 boat-trips (23.2%), respectively. Within each segment, the effort during weekends was slightly higher than effort during weekdays. Boats from the military recreation camps accounted for only 778 boat-trips during the entire fishery (Table 4).

The mean harvest of coho salmon per boat-trip for all civilian boat anglers (private and charter boats combined) ranged from 1.6 fish per boat-trip during weekends of the Pre-Derby segment to 3.7 fish per boat-trip during weekdays of the Derby (Table 5). The mean harvest of coho salmon per boat-trip for charter boat anglers was larger than estimates for private boat anglers in all segments of the fishery but one. Very few charter boat anglers were interviewed, however, and the precision of the estimates for their mean harvests were correspondingly poor.

Table 2. Estimated number of boat-trips by private and charter boat anglers, by period, for each segment of the Resurrection Bay fishery, 1987.

Segment	Period A	B	C	D	Total
PRE-DERBY					
Weekdays:					
Number of counts	5	7	10	8	30
Effort	25	139	433	272	869
Standard error	7.1	23.5	61.2	52.0	84.0
Weekends:					
Number of counts	4	4	4	4	16
Effort	20	106	514	268	908
Standard error	9.4	24.5	82.4	38.9	94.9
DERBY					
Weekdays:					
Number of counts	3	3	4	4	14
Effort	103	415	595	350	1,463
Standard error	8.4	40.0	23.7	26.8	54.3
Weekends:					
Number of counts	4	3	3	3	13
Effort	237	311	663	396	1,607
Standard error	48.3	0.0	0.0	0.0	48.3
POST-DERBY					
Weekdays:					
Number of counts	4	4	7	6	21
Effort	68	347	543	294	1,252
Standard error	34.0	98.9	120.6	70.4	174.5
Weekends:					
Number of counts	4	6	5	4	19
Effort	49	497	666	350	1,562
Standard error	14.1	142.6	153.0	168.8	269.1
TOTAL					
Number of counts	24	27	33	29	113
Effort	502	1,815	3,414	1,930	7,661
Standard error	62.4	181.3	221.5	195.9	352.4

Table 3. Summary of the number of boat-trips of effort by private and charter boat anglers during the Resurrection Bay fishery, 1987.

Segment	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
PRE-DERBY				
Weekdays	869	84.0	704 - 1,033	19.0%
Weekends	908	94.9	722 - 1,094	20.5%
Total	1,777	126.7	1,528 - 2,025	14.0%
DERBY				
Weekdays	1,463	54.3	1,357 - 1,570	7.3%
Weekends	1,607	48.3	1,513 - 1,702	5.9%
Total	3,070	72.7	2,928 - 3,213	4.6%
POST-DERBY				
Weekdays	1,252	174.5	910 - 1,594	27.3%
Weekends	1,562	269.1	1,035 - 2,090	33.8%
Total	2,814	320.7	2,185 - 3,443	22.3%
GRAND TOTAL	7,661	352.4	6,971 - 8,352	9.0%

Table 4. Number of boat-trips and harvest of coho, chinook, and pink salmon and ling cod by military anglers and their dependents in all segments of the Resurrection Bay fishery, 1987.

Segment	Number of		Number of Fish Harvested[1]			
	Boat-Trips	Anglers	Coho	Chinook	Pink	Ling Cod
PRE-DERBY	400	2,465	0	0	41	185
DERBY	109	898	0	0	6	55
POST-DERBY	269	1,577	178	0	131	251
TOTAL	778	4,940	178	0	178	491

[1] Harvest includes only those fish reported as kept.

Table 5. Estimated mean harvest of coho salmon per boat-trip for each segment of the Resurrection Bay fishery, 1987.

Segment	Days d[1]	Days D[2]	Number of Interviews	Mean Harvest[3]	Standard Error
PRE-DERBY					
Weekdays:					
Private boat anglers	15	25	151	2.16	0.320
Charter boat anglers	15	25	61	3.82	1.145
All civilian anglers[4]	15	25	213	2.62	0.388
Weekends:					
Private boat anglers	8	8	232	1.70	0.216
Charter boat anglers	8	8	28	0.79	0.633
All civilian anglers[4]	8	8	261	1.61	0.215
DERBY					
Weekdays:					
Private boat anglers	5	5	547	3.56	0.145
Charter boat anglers	5	5	25	5.16	0.672
All civilian anglers[4]	5	5	573	3.65	0.146
Weekends:					
Private boat anglers	4	4	660	2.99	0.141
Charter boat anglers	4	4	26	6.85	1.246
All civilian anglers[4]	4	4	687	3.13	0.144
POST-DERBY					
Weekdays:					
Private boat anglers	11	19	186	2.93	0.519
Charter boat anglers	11	19	16	5.25	1.969
All civilian anglers[4]	11	19	207	3.10	0.537
Weekends:					
Private boat anglers	9	10	347	2.60	0.211
Charter boat anglers	9	10	15	5.87	1.390
All civilian anglers[4]	9	10	367	2.70	0.215

[1] Number of days on which interviews were collected.

[2] Number of days possible for collecting interviews.

[3] Mean harvest includes fish reported as kept only.

[4] Includes private and charter boat anglers, plus anglers who were not specified as private, charter, or military.

Daily summary statistics for angler effort and coho salmon harvest per boat-trip for interviewed anglers are presented in Appendix Tables 1 through 4. Daily summary statistics for catch per boat-trip of other species harvested during the Resurrection Bay boat fishery are presented in Appendix Table 5.

The estimated harvest of coho salmon by anglers fishing on private and charter boats from 6 July through 13 September was 22,224 fish (Table 6). The harvest of coho salmon by anglers fishing on boats from the military recreation camps was 178 fish (Table 4), yielding a total harvest of 22,402 coho salmon. The largest harvest of coho salmon occurred during the Derby fishery. Private and charter boat anglers harvested 10,383 coho salmon during the Derby, which was 46.7% of the total coho salmon harvest. Harvest of coho salmon in each segment of the boat fishery corresponded approximately to the amount of effort expended in the segment (Figure 2).

Chinook salmon, pink salmon, and ling cod were also harvested by anglers during the boat fishery. Of these species, the harvest of ling cod was the largest, with 1,651 fish being harvested by private and charter boat anglers and 491 by anglers on boats from the military recreation camps (Tables 4 and 7). Harvests of pink and chinook salmon by all anglers were 1,762 and 115 fish, respectively.

Beach Fishery Creel Survey

The beach fishery for chinook salmon was surveyed from 15 June to 5 July. The beach fishery for coho salmon was surveyed from 8 August to 13 September.

Chinook Salmon:

The weekday stratum of the beach fishery for chinook salmon received more effort than the weekend/holiday stratum at both the Waterfall and Boat Harbor beaches. Anglers fishing during weekdays expended 2,814 angler-hours of effort, or 61.9% of the total effort (Table 8). Of the four time periods, the most effort was expended during D period in every stratum but one. Anglers fishing during the D period expended 1,547 angler-hours of effort, or 34.1% of the total effort. Efforts expended during the B, C, and A time periods were 1,286 angler-hours (28.3%), 1,186 angler-hours (26.1%), and 522 angler-hours (11.5%), respectively. Of the two beaches, Waterfall Beach received the largest amount of angler-effort with an estimated 2,446 angler-hours or 53.9% of the total effort (Table 9, Figure 3). Boat Harbor Beach received 2,096 angler-hours of effort or 46.1% of the total effort. Daily angler counts at each beach are summarized in Appendix Table 6.

The estimated harvest of chinook salmon per angler-hour was highest during the weekday strata at both beaches (Table 10). The highest harvest rate was observed at Waterfall Beach during the weekday stratum (0.22 chinook salmon harvested per angler-hour). Few chinook salmon were reported released by beach anglers. Daily summary statistics of mean effort and mean harvest per angler-hour for chinook salmon at each of the beaches are presented in Appendix Table 7. The largest harvest of chinook salmon occurred at Waterfall Beach where anglers harvested 401 chinook salmon or 61.8% of the total harvest (Table 11, Figure 3). The percentage of the

Table 6. Estimated number of coho salmon harvested by private and charter boat anglers during each segment of the Resurrection Bay fishery, 1987.

Segment	Harvest[1]	Standard Error	95% Confidence Interval	Relative Precision
PRE DERBY				
Weekdays	2,280	401.5	1,493 - 3,067	34.5%
Weekends	1,461	246.7	978 - 1,945	33.1%
Total	3,741	471.2	2,817 - 4,665	24.7
DERBY				
Weekdays	5,349	291.4	4,778 - 5,920	10.7%
Weekends	5,034	276.2	4,493 - 5,575	10.8%
Total	10,383	401.5	9,596 - 11,170	7.6%
POST DERBY				
Weekdays	3,882	857.5	2,201 - 5,563	43.3%
Weekends	4,218	798.1	2,318 - 5,446	37.1%
Total	8,100	1,171.5	5,804 - 10,396	28.3%
GRAND TOTAL	22,224	1,325.0	19,627 - 24,821	11.7%

[1] Harvest includes only those fish reported as kept.

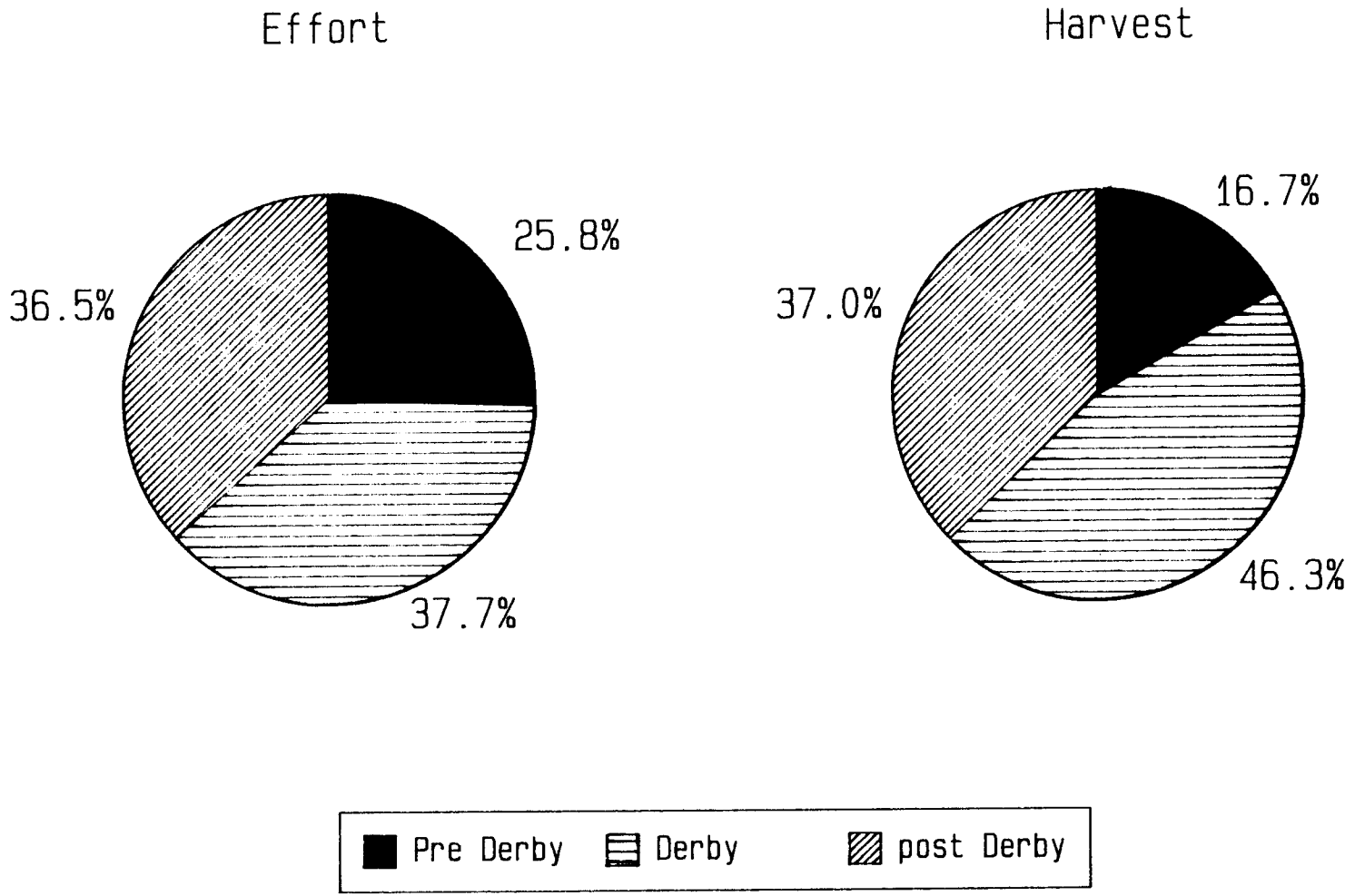

Figure 2. Percentage of total angler effort and coho salmon harvest by boat anglers during each segment of the boat fishery in Resurrection Bay, 1987.

Table 7. Estimated number of chinook salmon, pink salmon, and ling cod harvested by private and charter boat anglers during the Resurrection Bay fishery, 1987.

Segment	Chinook Salmon		Pink Salmon		Ling Cod	
	Harvest	SE[1]	Harvest	SE[1]	Harvest	SE[1]
PRE-DERBY						
Weekday	20	9.9	546	173.7	498	136.6
Weekend	7	5.0	382	80.8	480	89.9
Total	27	11.1	928	191.6	978	163.6
DERBY						
Weekday	38	14.8	246	37.2	45	18.3
Weekend	37	17.0	225	28.4	149	33.2
Total	75	22.5	471	46.8	194	38.0
POST-DERBY						
Weekday	13	4.8	133	134.9	224	85.1
Weekend	0	0.0	52	17.4	255	73.5
Total	13	4.8	185	136.0	479	112.5
GRAND TOTAL	115	25.5	1,584	239.6	1,651	202.4

[1] Standard error

Table 8. Estimated number of angler-hours of effort, by period, for each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Segment	Period A	Period B	Period C	Period D	Total
WATERFALL BEACH					
Weekend					
Number of counts	3	3	4	3	13
Effort	65	253	282	335	935
Standard error	21.6	81.7	73.8	159.0	194.6
Weekday					
Number of counts	2	3	3	4	12
Effort	220	474	327	490	1,511
Standard error	171.5	214.2	208.5	181.1	389.4
BOAT HARBOR BEACH					
Weekends:					
Number of counts	3	2	5	3	13
Effort	41	282	250	220	793
Standard error	21.6	281.7	113.2	127.3	329.9
Weekdays:					
Number of counts	2	3	3	4	12
Effort	196	278	327	502	1,303
Standard error	98.0	114.3	81.7	128.7	214.2
TOTAL					
Number of counts	10	11	15	14	50
Effort	522	1,287	1,186	1,547	4,542
Standard error	199.9	380.8	261.5	301.4	586.7

Table 9. Summary of the number of angler-hours of effort during each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Stratum	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
WATERFALL BEACH				
Weekends	935	194.6	554 - 1,317	40.8%
Weekdays	1,511	389.4	748 - 2,274	40.0%
Total	2,446	435.3	1,593 - 3,299	34.9%
BOAT HARBOR BEACH				
Weekends	793	329.9	146 - 1,440	81.5%
Weekdays	1,303	214.2	883 - 1,722	32.2%
Total	2,096	393.4	1,325 - 2,867	36.8%
GRAND TOTAL	4,542	586.7	3,392 - 5,691	25.3%

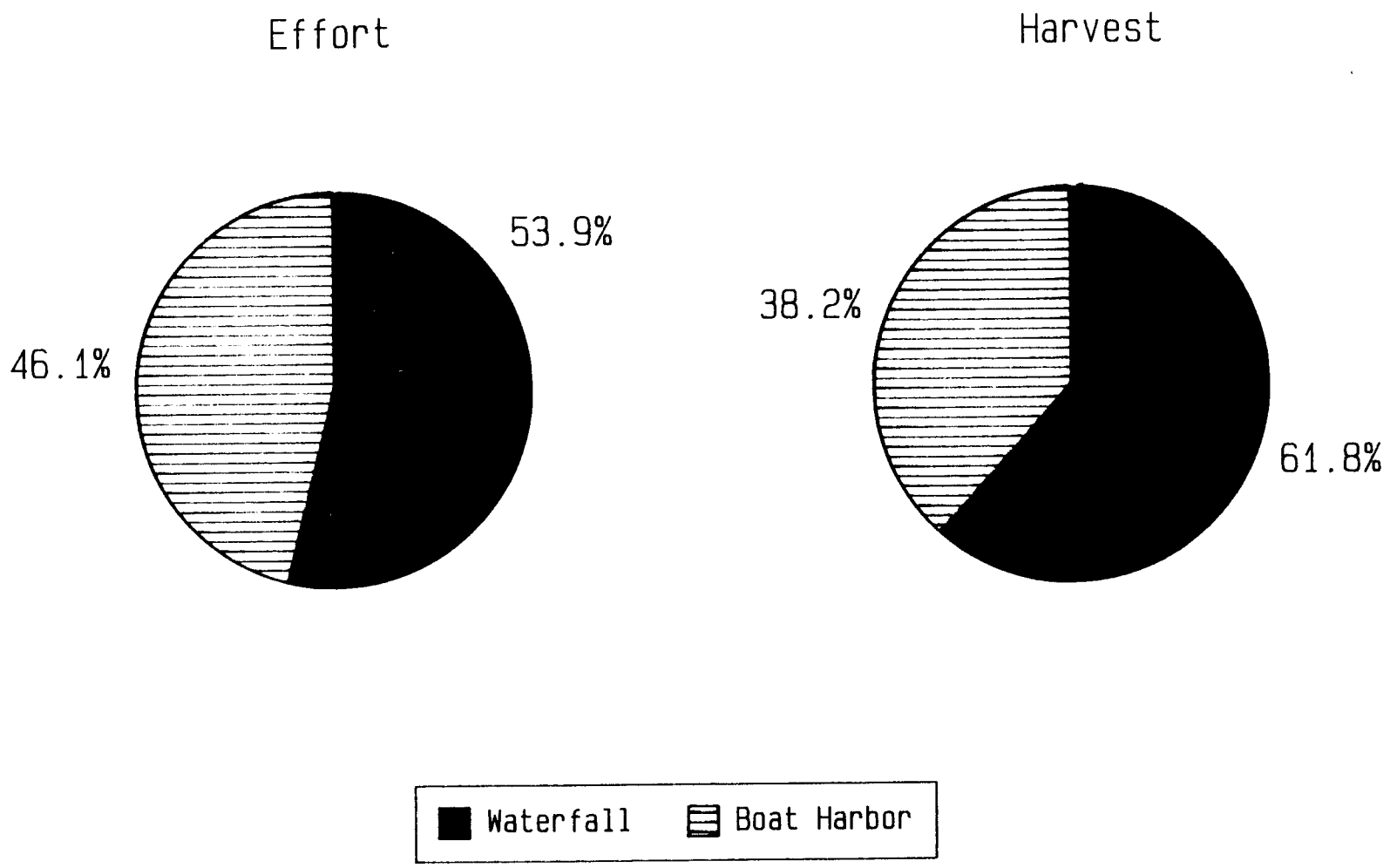

Figure 3. Percentage of total angler effort and chinook salmon harvest by anglers at the Waterfall and Boat Harbor beaches during the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Table 10. Estimated harvest of chinook salmon per angler-hour (CPUE) for each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Stratum	Days d[1]	Days D[2]	Number of Interviews	Harvest[3] CPUE	Standard Error
WATERFALL BEACH					
Weekends	7	7	149	0.075	0.0426
Weekdays	8	14	148	0.219	0.0876
BOAT HARBOR BEACH					
Weekends	7	7	137	0.086	0.0260
Weekdays	8	14	115	0.139	0.0734

1 Number of days on which interviews were collected.

2 Number of days possible for collecting interviews.

3 Harvest CPUE includes fish reported as kept only.

Table 11. Estimated number of chinook salmon harvested during each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Stratum	Harvest[1]	Standard Error	95% Confidence Interval	Relative Precision
WATERFALL BEACH				
Weekends	70	41.6	0 - 152	116.5%
Weekdays	331	153.7	30 - 632	91.0%
Total	401	159.2	89 - 713	77.8%
BOAT HARBOR BEACH				
Weekends	68	34.0	1 - 135	98.0%
Weekdays	180	98.9	0 - 374	107.7%
Total	248	104.6	43 - 453	82.7%
GRAND TOTAL	649	190.5	276 - 1,022	57.5%

[1] Harvest includes only those fish reported as kept.

total harvest during weekdays was 78.7% (511 chinook salmon). Both harvest and effort were distributed approximately in proportion to the time available on weekdays and weekends.

Coho Salmon:

Unlike the beach fishery for chinook salmon, proportionally more effort was expended during weekends than weekdays in the coho salmon beach fishery (Tables 12 and 13). Anglers fishing during weekdays expended 5,794 angler-hours of effort (49.2%) while anglers fishing during weekends expended 5,973 angler-hours of effort (51.8%). Of the four time periods, the most effort was expended during the C period when 3,414 angler-hours of effort were expended which was 29.0% of the total effort. Effort expended during the B, D, and A time periods were 3,189 angler-hours (27.1%), 2,931 angler-hours (24.9%), and 2,233 angler-hours (19.0%), respectively. Daily angler counts at each beach are summarized in Appendix Table 8.

The harvest of coho salmon per angler-hour was highest during the weekend stratum with 0.164 fish being harvested per angler-hour compared to 0.097 for the weekday stratum (Table 14). Few coho salmon were reported released by beach anglers. Daily summary statistics of mean effort, mean harvest per angler, and catch per angler-hour for coho salmon are presented in Appendix Table 9. An estimated 1,545 coho salmon were harvested by beach anglers (Table 15). Nearly two-thirds (63.5%) of the total harvest occurred during weekends (Figure 4).

Biological Data

The majority of coho salmon harvested by the boat fishery were age 1.1[3] (Table 16). The mean length for age 1.1 males in the boat fishery varied from 594 mm during the Derby to 623 mm during the Pre-Derby whereas the mean length for age 1.1 females varied from 592 mm during the Derby to 604 mm during the Pre-Derby (Table 17). The mean length for age 2.1 males in the boat fishery varied from 655 mm during the Post-Derby to 676 mm during the Pre-Derby whereas the mean length for age 2.1 females varied from 652 mm during the Derby to 656 during the Pre-Derby (Table 17). The sex composition of coho salmon harvested by the boat fishery was nearly equal (Table 16).

Age 0.2 chinook salmon accounted for 60.0% of the chinook salmon harvest at the beaches with age 0.3 and age 0.1 fish accounting for 24.0% and 16.0% of the harvest, respectively (Table 18). Mean lengths of harvested chinook salmon increased by age class (Table 19). Since the older age classes were not avaliable for harvest, most of the harvest (76%) was comprized of males (Table 18).

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[3] Numeral preceding the decimal is the number of freshwater annuli whereas the numeral following the decimal is the number of marine annuli (European method). Total age from brood year is the sum of the two numerals plus one.

Table 12. Estimated number of angler-hours of effort, by period, for the beach fishery for coho salmon in Resurrection Bay, 1987.

Stratum	Period A	Period B	Period C	Period D	Total
SEWARD BEACH					
Weekend					
Number of counts	5	4	6	6	21
Effort	1,192	1,285	2,010	1,486	5,973
Standard error	296.1	436.6	305.5	249.1	658.5
Weekday					
Number of counts	5	6	7	5	23
Effort	1,041	1,904	1,404	1,445	5,794
Standard error	181.3	397.4	261.6	398.8	646.7
TOTAL					
Number of counts	10	10	13	11	44
Effort	2,233	3,189	3,414	2,931	11,767
Standard error	347.2	590.4	402.2	470.2	923.0

Table 13. Summary of the number of angler-hours of effort during the beach fishery for coho salmon in Resurrection Bay, 1987.

Segment	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
SEWARD BEACH				
Weekends	5,973	658.5	4,683 - 7,264	21.6%
Weekdays	5,794	646.7	4,527 - 7,062	21.9%
Total	11,767	923.0	9,959 - 13,577	15.4%

Table 14. Estimated harvest of coho salmon per angler-hour (CPUE) for the beach fishery for coho salmon in Resurrection Bay, 1987.

Stratum	Days d[1]	Days D[2]	Number of Interviews	Harvest[3] CPUE	Standard Error
SEWARD BEACH					
Weekends	13	13	635	0.164	0.0150
Weekdays	13	24	436	0.097	0.0372

1 Number of days on which interviews were collected.

2 Number of days possible for collecting interviews.

3 Harvest CPUE includes fish reported as kept only.

Table 15. Estimated number of coho salmon harvested during the beach fishery for coho salmon in Resurrection Bay, 1987.

Stratum	Harvest[1]	Standard Error	95% Confidence Interval	Relative Precision
SEWARD BEACH				
Weekends	981	140.0	707 - 1,255	28.0%
Weekdays	564	223.1	127 - 1,001	77.5%
Total	1,545	263.4	1,029 - 2,061	33.4%

[1] Harvest includes only those fish reported as kept.

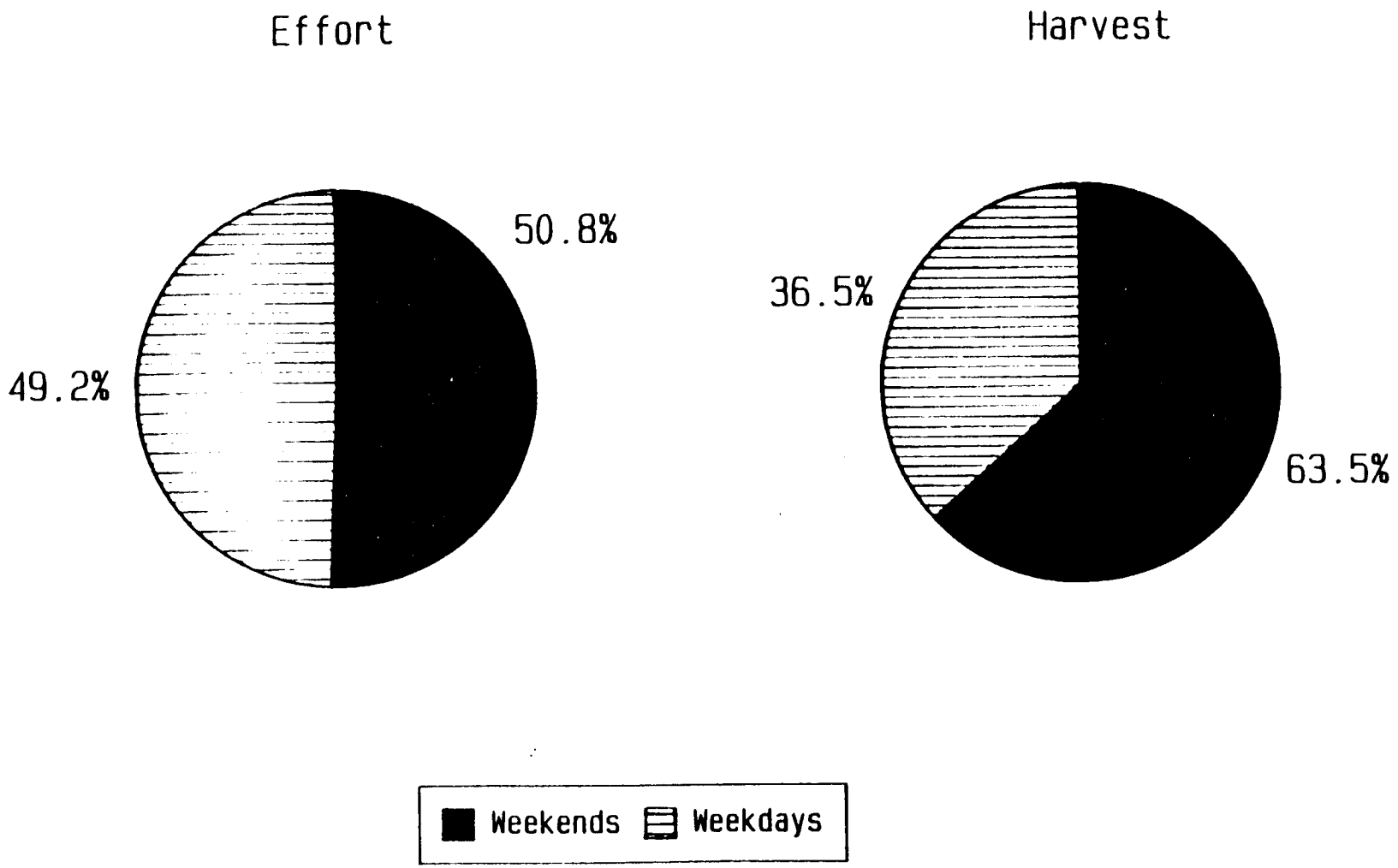

Figure 4. Percentage of total angler effort and coho salmon harvest on weekends and weekdays by anglers at Seward beach during the beach fishery for coho salmon in Resurrection Bay, 1987.

Table 16. Estimated age composition and numbers by sex for the coho salmon harvest by the boat fishery in Resurrection Bay, 1987.

Period[1]	Sex		Brood Year/ Age Group 1984 1.1	1983 2.1	Total
Pre-Derby (n = 129)	Male	Percent	38.0	11.6	49.6
		Number	1,422	434	1,856
		Standard error	239	118	--
	Female	Percent	41.9	8.5	50.4
		Number	1,567	318	1,885
		Standard error	255	100	--
	Combined	Percent	79.9	20.1	100.0
		Number	2,989	752	3,741
		Standard error	349	155	--
Derby (n = 141)	Male	Percent	34.0	18.5	52.5
		Number	3,530	1,921	5,451
		Standard error	437	348	--
	Female	Percent	36.9	10.6	47.5
		Number	3,831	1,101	4,932
		Standard error	448	273	--
	Combined	Percent	70.9	29.1	100.0
		Number	7,361	3,022	10,383
		Standard error	626	443	--
Post-Derby (n = 139)	Male	Percent	42.4	20.9	63.3
		Number	3,434	1,693	5,127
		Standard error	600	370	--
	Female	Percent	28.8	7.9	36.7
		Number	2,333	640	2,973
		Standard error	457	206	--
	Combined	Percent	71.9	28.8	100.0
		Number	5,767	2,333	8,100
		Standard error	755	423	--
Total	Male	Percent	37.7	18.2	55.9
		Number	8,386	4,048	12,434
		Standard error	780	522	--
	Female	Percent	34.8	9.3	44.1
		Number	7,731	2,059	9,790
		Standard error	689	356	--
	Combined	Percent	72.5	27.5	100.0
		Number	16,117	6,107	22,224
		Standard error	1,041	632	--

[1] n = sample size.

Table 17. Mean length[1] by sex and age group of the coho salmon sampled from the sport harvest by boat anglers in Resurrection Bay, 1987.

Period	Sex		Brood Year/ Age Group 1984 1.1	1983 2.1
Pre-Derby	Male	Length	623	668
		Standard error	6.3	8.2
		Sample size	49	15
	Female	Length	604	656
		Standard error	5.1	5.7
		Sample size	54	11
Derby	Male	Length	594	676
		Standard error	8.9	7.3
		Sample size	48	26
	Female	Length	592	652
		Standard error	7.3	10.0
		Sample size	52	15
Post-Derby	Male	Length	599.5	655.0
		Standard error	5.2	5.1
		Sample size	59	29
	Female	Length	594.6	653.2
		Standard error	5.5	4.1
		Sample size	40	11

[1] Length measured from mid-eye to fork-of-tail in millimeters.

Table 18. Estimated age composition and numbers by sex of hatchery chinook salmon harvested by the beach fisheries in Resurrection Bay, 1987.

Sex		Brood Year and Age Group 1985 0.1	1984 0.2	1983 0.3	Total
Male	Percent	16.0	46.0	14.0	76.0
	Number	104	298	91	493
	Standard error	48	112	44	--
Female	Percent	0.0	14.0	10.0	24.0
	Number	0	91	65	156
	Standard error	0	44	34	--
Combined (n = 50)[1]	Percent	16.0	60.0	24.0	100.0
	Number	104	389	156	649
	Standard error	48	120	56	--

[1] n = sample size.

Table 19. Mean length[1] by sex and age group of hatchery chinook salmon harvested by the beach fisheries in Resurrection Bay, 1987.

Sex		Brood Year and Age Group		
		1985 0.1	1984 0.2	1983 0.3
Male	Length	378	641	736
	Standard Error	7.9	5.3	25.5
	Sample Size	8	23	7
Female	Length	--	604	784
	Standard Error	--	8.6	10.3
	Sample Size	--	7	5

[1] Length measured in millimeters from mid-eye to fork-of-tail.

As in the boat fishery, most coho salmon harvested in the beach fishery were age 1.1. Age 1.1 fish comprised 71.2% of the coho salmon beach harvest whereas age 2.1 fish comprised only 28.8% of the harvest (Table 20). The mean lengths for age 1.1 male and female coho salmon in the beach fishery were 601 mm and 600 mm respectively and for age 2.1 fish mean lengths were 649 mm and 643 mm respectively (Table 21). The sex composition of coho salmon harvested by the beach fishery was nearly equal (Table 20).

Hatchery Contributions to the Fishery

The data used to estimate the contributions of hatchery coho salmon from Bear Lake, Seward Lagoon, and Box Canyon Creek to the 1987 boat and beach fisheries is summarized in Appendix Table 10. The Bear Lake coho salmon emmigration of 72,685 smolts in 1986 (Conrad et al. 1987) contributed adult coho salmon to the Resurrection Bay sport fishery and Bear Lake immigration in 1987. The majority of these smolts were from the 1984 and 1985 Bear Lake fingerling plants. Hatchery-reared smolts released in Seward Lagoon (51,500 smolts) and Box Canyon Creek (53,600 smolts) in 1986 also contributed to the sport fishery in 1987.

Hatchery fish comprised nearly half (43%) of the total coho salmon harvest (Tables 22 and 23). In the boat fishery, hatchery fish comprized approximately 40% of the harvest whereas in the beach fishery they comprised more than three-quarters of the harvest (Figure 5). Hatchery fish from Seward Lagoon were the largest contributor to both fisheries followed by hatchery fish from Box Canyon Creek and Bear Lake. As measured by percentage of smolts contributing to the harvest, the Seward Lagoon stocking was most efficient (8.0%) followed by Box Canyon (6.0%) and Bear Lake (3.9%).

Chinook salmon returns in 1987 were from hatchery-reared smolts stocked in Box Canyon rearing pond in 1983 (54,500 fish), Thumb Cove in 1984 (70,000 fish), and Lowell Creek outlet in 1984 (40,600 fish), 1985 (132,700 fish), and 1986 (101,000 fish). The estimated harvest of chinook salmon by the beach and boat sport fisheries was 649 and 115, respectively (Tables 7 and 11). Since none of the hatchery-reared smolts released were marked, it was not possible to partition the catch by individual release sites.

DISCUSSION

Effort in the boat fishery in 1987 (8,439 boat-trips) was above the 19-year average annual effort of 7,377 boat-trips (Figure 6). The harvest of 22,402 coho salmon by the boat fishery in 1987 approached the record harvest of 22,932 fish in 1968 (Figure 6). The reason for this is due partially to a large contribution of hatchery fish. Hatchery fish contributed more than 40% to the total harvest in 1987 as opposed to the 19-year average annual hatchery contribution of approximately 22% (Vincent-Lang 1987).

The harvest of coho salmon by the beach fishery in 1987 was 1,545 fish. This is similar to the harvest of 1,925 coho salmon by the beach fishery in 1986 (Sonnichsen et al. 1987). As in 1986, approximately three-quarters of this harvest were hatchery stocks.

Table 20. Estimated age composition and numbers by sex for coho salmon harvested by the beach fishery in Resurrection Bay, 1987.

Sex		Brood Year and Age Group 1984 1.1	1983 2.1	Total
Male	Percent	35.6	14.8	50.4
	Number	550	229	779
	Standard error	111	59	--
Female	Percent	35.6	14.0	49.6
	Number	550	216	766
	Standard error	111	57	--
Combined (n = 149)[1]	Percent	71.2	28.8	100.0
	Number	1,100	445	1,545
	Standard error	157	82	--

[1] n = sample size.

Table 21. Mean length[1] by sex and age group of coho salmon harvested by the beach fishery in Resurrection Bay, 1987.

Sex		Brood Year and Age Group	
		1984	1983
		1.1	2.1
Male	Length	601	649
	Standard error	4.7	7.0
	Sample size	53	22
Female	Length	600	643
	Standard error	3.2	6.3
	Sample size	53	21

1 Length measured in millimeters from mid-eye to fork-of-tail.

Table 22. Estimated contribution of coho salmon from the Bear Lake, Seward Lagoon, and Box Canyon Creek release sites, by strata, to the Resurrection Bay boat fishery, 1987.

Strata	Number	Standard Error	Covariance
PRE-DERBY & DERBY			
Bear Lake	1,438	197	-0.0024
Seward Lagoon	1,465	180	-0.0024
Box Canyon Creek	1,530	187	-0.0024
Total	4,433	301	
POST-DERBY			
Bear Lake	1,354	282	-0.0017
Seward Lagoon	1,785	330	-0.0017
Box Canyon Creek	1,468	286	-0.0017
Total	4,607	508	
SEASON			
Bear Lake	2,792	344	
Seward Lagoon	3,250	376	
Box Canyon Creek	2,998	342	
Total	9,040	590	

Table 23. Estimated contribution of coho salmon from the Bear Lake, Seward Lagoon, and Box Canyon Creek release sites to the Resurrection Bay boat and beach fisheries, 1987.

Source	Boat Fishery		Beach Fishery		Total[1]	
	Number	SE[2]	Number	SE[2]	Number	SE[2]
Bear Lake	2,792	344	68	48	2,860	347
Seward Lagoon	3,250	376	888	196	4,138	424
Box Canyon Creek	2,998	342	236	87	3,234	353
Total Enhanced	9,040	590	1,192	212	10,232	627
Wild[3]	13,362	1,450	353	338	13,715	1,489
Total Harvest	22,402	1,325	1,545	265	23,947	1,351

1 Total harvest by boat fisheries and beach fisheries combined.

2 Standard error.

3 Computed as the difference of total harvest less enhanced harvest.

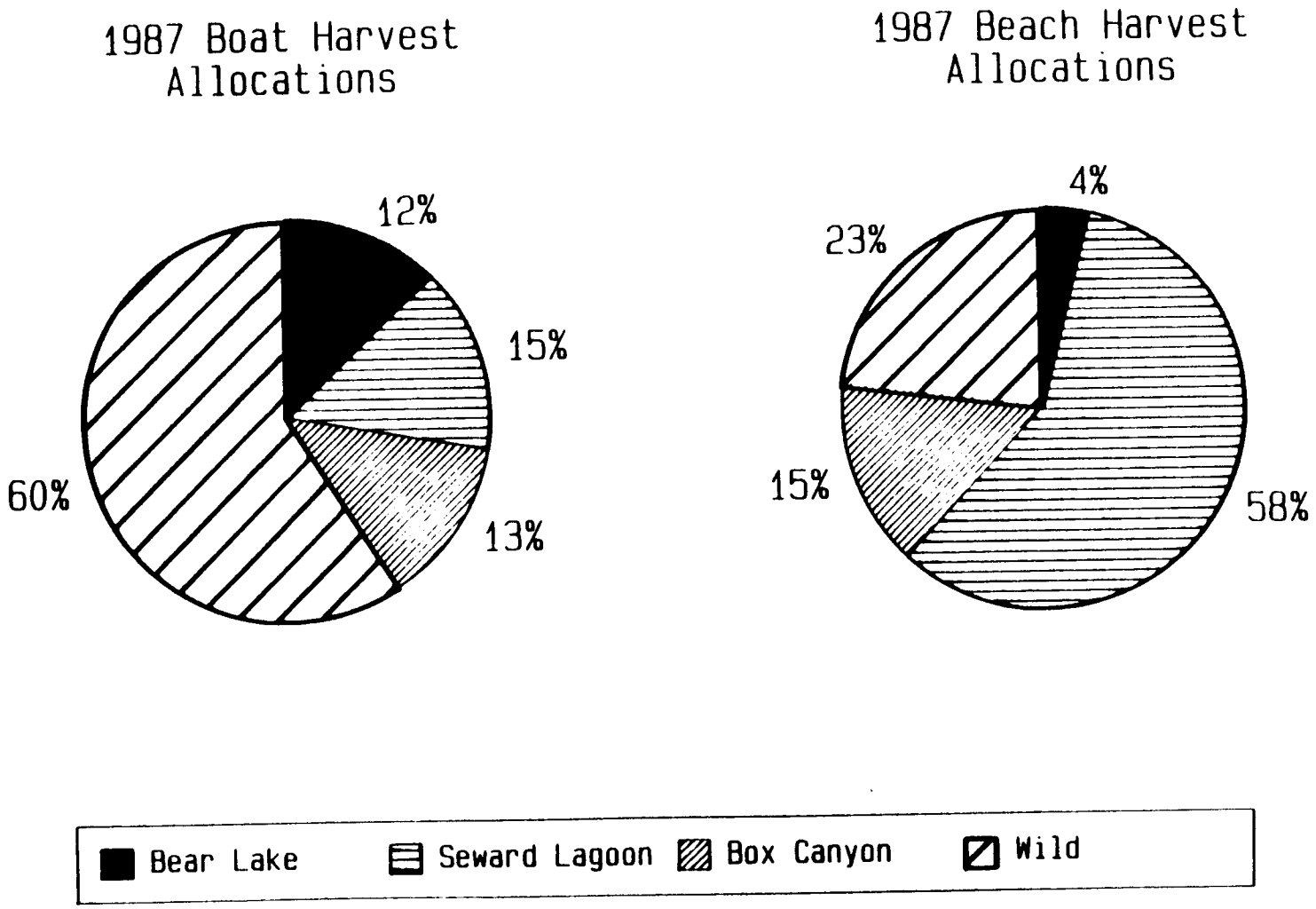

Figure 5. Estimated contribution of hatchery stocks to the coho salmon harvest in Resurrection Bay boat and beach fisheries, 1987.

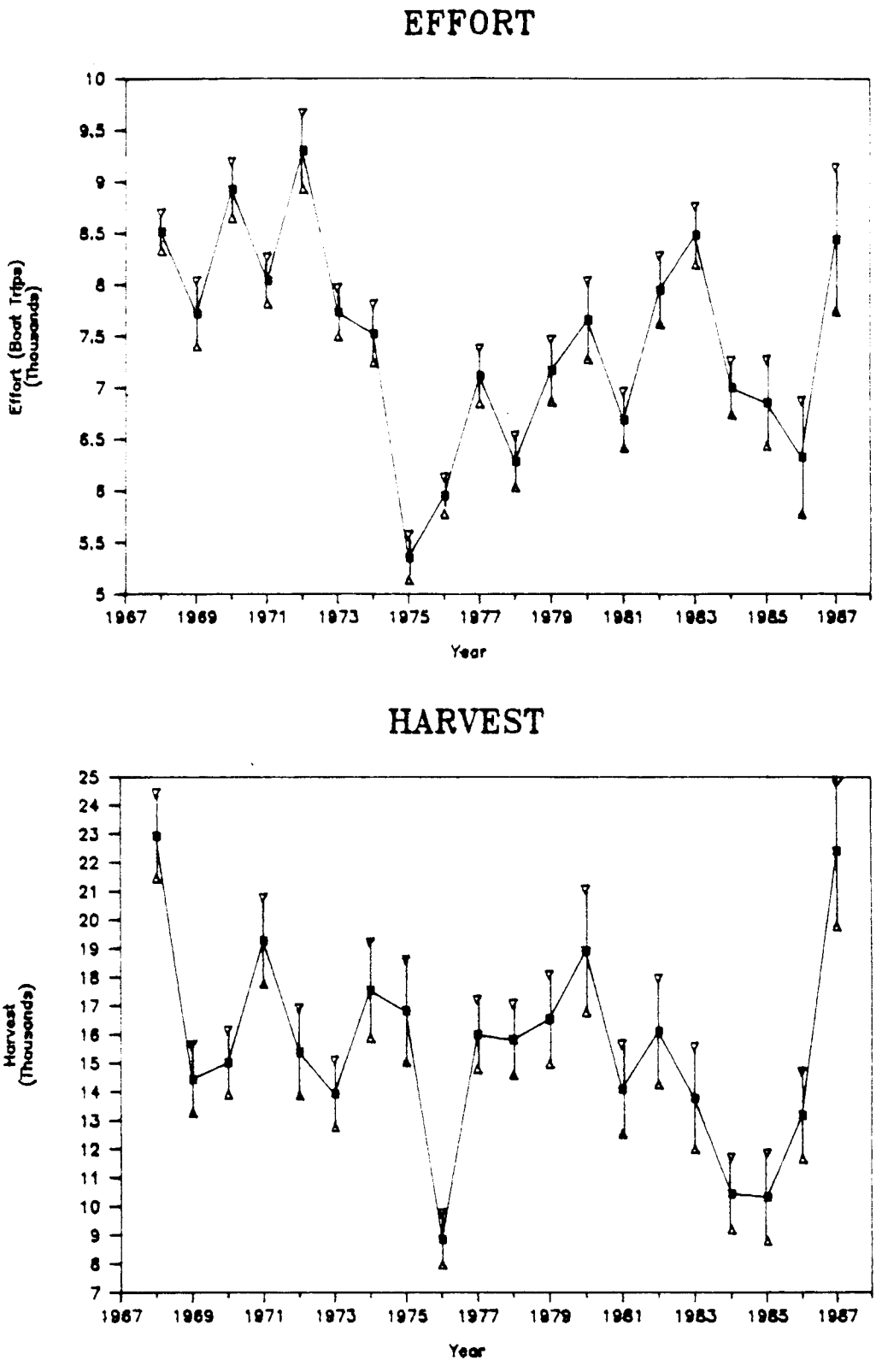

Figure 6. Effort and coho salmon harvest in the Resurrection Bay boat sport fishery, 1968-1987. Bars represent 95% confidence intervals.

The recently developed beach fishery for chinook salmon continued its growth in 1987. Over 600 hatchery chinook salmon were harvested off Seward beaches in 1987. These fish, predominantly age 0.2 and 0.3, were larger (632 mm and 756 mm, respectively) than the predominantly age 0.1 fish harvested in 1986 (411 mm). Given this, we recommend that the hatchery chinook salmon program be continued.

ACKNOWLEDGEMENTS

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APPENDIX

Appendix Table 1. Counts of private and charter boats during the Resurrection Bay fishery, 1987.

Date	Wd/We[1]	Period A	B	C	D
7/08	Wd	0		5	
7/09	Wd			5	4
7/10	Wd		3		12
7/11	We		1		41
7/12	We	7		52	
7/13	Wd			8	3
7/14	Wd	1	9		
7/15	Wd		1	12	
7/16	Wd				
7/17	Wd				
7/18	We	0		39	
7/19	We		21		
7/20	Wd				17
7/21	Wd				
7/22	Wd	1	9		
7/23	Wd			18	7
7/24	Wd			24	11
7/25	We		14		48
7/26	We	0		60	
7/27	Wd	2			18
7/28	Wd				
7/29	Wd				
7/30	Wd		6	19	
7/31	Wd		5	32	
8/01	We	3	17		
8/02	We			106	28
8/03	Wd			32	8
8/04	Wd		6	18	
8/05	Wd				24
8/06	Wd				
8/07	Wd	1			
8/08	We	21	72	188	165
8/09	We		119	245	75
8/10	Wd	26		111	38
8/11	Wd		59		73

-continued-

Appendix Table 1. Counts of private and charter boats during the Resurrection Bay fishery, 1987 (continued).

Date	Wd/We[1]	Period A	B	C	D
8/12	Wd	18		128	73
8/13	Wd	18	102	94	
8/14	Wd		88	143	96
8/15	We	53	120	230	156
8/16	We	104	148		
8/17	Wd	4			15
8/18	Wd		27	18	
8/19	Wd				
8/20	Wd				
8/21	Wd			48	28
8/22	We		57		100
8/23	We	10		140	
8/24	Wd	8	18		
8/25	Wd		19	32	
8/26	Wd				
8/27	Wd				
8/28	Wd			51	22
8/29	We		66	75	
8/30	We	8			10
8/31	Wd				
9/01	Wd				
9/02	Wd			20	3
9/03	Wd			2	
9/04	Wd	1			11
9/05	We		23	58	
9/06	We			54	20
9/07	We	1	1		
9/08	Wd			10	5
9/09	Wd				
9/10	Wd				
9/11	Wd	0	2		
9/12	We	3			10
9/13	We		3	6	

[1] Weekday (Wd) or weekend-holiday (We).

Appendix Table 2. Daily mean effort and coho salmon harvest per boat-trip for anglers fishing from private boats during the Resurrection Bay fishery, 1987.

Date	We/Wd[1]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Mean Harvest (harvest/trip)	SE Harvest
708	Wd	4	4.5	0.96	0.00	0.000
709	Wd	3	6.3	0.67	0.33	0.333
710	Wd	7	4.9	0.73	0.00	0.000
711	We	22	6.2	0.81	0.09	0.063
712	We	27	4.4	0.51	0.04	0.037
713	Wd	5	5.0	0.71	0.20	0.200
714	Wd	6	3.6	0.74	0.00	0.000
715	Wd	6	4.5	0.62	0.00	0.000
718	We	21	5.0	0.35	1.00	0.420
719	We	21	5.8	0.41	1.67	0.558
722	Wd	7	3.6	0.24	1.00	0.845
723	Wd	11	5.2	0.63	1.18	0.600
724	Wd	20	6.3	0.49	2.15	0.844
725	We	30	5.8	0.43	0.30	0.109
726	We	32	5.9	0.51	0.91	0.267
727	Wd	7	6.5	0.67	0.00	0.000
730	Wd	14	5.8	0.44	3.29	0.691
731	Wd	19	5.4	0.47	5.11	1.414
801	We	12	5.1	0.69	6.75	1.483
802	We	67	6.5	0.35	3.24	0.462
803	Wd	20	6.5	0.41	2.75	0.692
804	Wd	10	5.0	0.67	1.80	0.533
807	Wd	12	5.3	0.60	3.75	0.808
808	We	155	6.2	0.20	2.91	0.263
809	We	202	6.3	0.20	2.80	0.246
810	Wd	88	7.1	0.31	3.57	0.364
811	Wd	82	6.5	0.34	3.32	0.338
812	Wd	110	7.5	0.29	4.44	0.361
813	Wd	108	5.1	0.23	3.00	0.289
814	Wd	159	6.9	0.25	3.45	0.261
815	We	245	6.3	0.18	3.20	0.218
816	We	58	4.5	0.14	2.98	0.375
816	We	40	5.3	0.25	1.48	0.232
817	Wd	10	5.8	0.77	2.40	1.067
818	Wd	33	4.8	0.40	2.42	0.715
821	Wd	33	4.5	0.36	1.21	0.278
822	We	68	4.7	0.27	2.31	0.346

-continued-

Appendix Table 2. Daily mean effort and coho salmon harvest per boat-trip for anglers fishing from private boats during the Resurrection Bay fishery, 1987 (continued).

Date	We/Wd[1]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Mean Harvest (harvest/trip)	SE Harvest
823	We	81	5.9	0.26	2.81	0.350
824	Wd	17	4.4	0.57	3.12	0.581
825	Wd	27	4.5	0.35	3.78	0.556
828	Wd	34	4.9	0.38	4.44	0.695
829	We	63	4.8	0.25	4.00	0.540
830	We	14	4.4	0.85	1.57	0.716
902	Wd	11	4.8	0.78	1.91	0.653
903	Wd	2	4.5	0.50	1.50	0.500
904	Wd	7	5.6	0.93	4.29	1.248
905	We	34	4.9	0.36	2.91	0.808
906	We	33	5.1	0.45	2.18	0.503
908	Wd	10	3.3	0.58	2.80	1.254
911	Wd	2	5.0	1.00	6.50	5.500
912	We	8	5.4	1.04	0.88	0.479
913	We	6	3.8	0.48	1.17	0.749

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 3. Daily mean effort and coho salmon harvest per boat-trip for anglers fishing from charter boats during the Resurrection Bay fishery, 1987.

Date	We/Wd[1]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Mean Harvest (harvest/trip)	SE Harvest
709	Wd	4	4.8	1.03	0.00	0.000
710	Wd	4	4.4	0.90	0.00	0.000
711	We	9	6.1	0.26	0.00	0.000
712	We	3	5.7	1.20	0.00	0.000
713	Wd	5	6.8	0.58	0.00	0.000
715	Wd	4	6.5	0.50	1.25	1.250
719	We	3	7.0	1.00	0.00	0.000
723	Wd	5	6.2	0.37	3.60	1.691
724	Wd	10	6.7	0.26	3.50	1.910
725	We	7	7.1	0.66	1.57	1.110
726	We	3	3.7	0.67	0.00	0.000
727	Wd	6	6.3	0.17	2.17	0.792
730	Wd	3	6.0	1.15	1.67	1.667
731	Wd	4	10.6	4.88	15.00	10.932
802	We	3	6.7	1.20	3.67	3.667
803	Wd	6	6.8	0.31	7.00	2.633
804	Wd	7	7.6	0.47	7.29	2.078
807	Wd	3	6.7	1.33	1.33	1.333
808	We	9	8.1	0.63	8.11	1.783
809	We	4	6.9	0.97	5.50	3.403
810	Wd	4	10.5	0.87	3.25	0.479
811	Wd	3	8.5	1.26	6.00	1.000
813	Wd	5	8.0	0.00	5.80	2.083
814	Wd	13	7.1	0.83	5.31	1.365
815	We	13	7.1	0.35	6.38	1.430
821	Wd	4	6.5	0.96	0.50	0.500
822	We	7	4.9	0.55	4.86	2.143
823	We	4	5.3	0.75	6.25	3.902
828	Wd	6	5.5	0.85	9.33	3.451
904	Wd	3	5.7	1.20	6.77	4.410
905	We	2	8.0	0.00	9.50	1.500
906	We	2	8.0	0.00	5.00	5.000
908	Wd	3	7.7	1.33	2.00	2.000

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 4. Daily mean effort and coho salmon harvest per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay fishery, 1987.

Date	We/[1] Wd	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Mean Harvest (harvest/trip)	SE Harvest
708	Wd	5	5.2	1.02	0.00	0.000
709	Wd	7	5.4	0.69	0.14	0.143
710	Wd	11	4.7	0.55	0.00	0.000
711	We	31	6.2	0.58	0.06	0.045
712	We	30	4.6	0.47	0.03	0.033
713	Wd	10	5.9	0.53	0.10	0.100
714	Wd	6	3.6	0.74	0.00	0.000
715	Wd	10	5.3	0.52	0.50	0.500
718	We	22	5.0	0.33	1.09	0.410
719	We	24	6.0	0.38	1.46	0.500
722	Wd	7	3.6	0.24	1.00	0.845
723	Wd	16	5.5	0.46	1.94	0.698
724	Wd	30	6.4	0.33	2.60	0.838
725	We	37	6.0	0.38	0.54	0.231
726	We	35	5.7	0.48	0.83	0.248
727	Wd	13	6.4	0.36	1.00	0.467
730	Wd	17	5.9	0.40	3.00	0.636
731	Wd	23	6.3	0.94	6.83	2.197
801	We	12	5.1	0.69	6.75	1.483
802	We	70	6.5	0.34	3.26	0.461
803	Wd	26	6.6	0.32	3.73	0.853
804	Wd	17	6.1	0.53	4.06	1.103
807	Wd	15	5.6	0.54	3.27	0.727
808	We	164	6.3	0.19	3.20	0.281
809	We	206	6.4	0.20	2.85	0.249
810	Wd	92	7.2	0.31	3.55	0.348
811	Wd	85	6.6	0.33	3.41	0.331
812	Wd	111	7.5	0.29	4.57	0.381
813	Wd	113	5.3	0.22	3.12	0.293
814	Wd	172	7.0	0.24	3.59	0.263
815	We	259	6.3	0.18	3.35	0.222
816	We	58	4.5	0.14	2.98	0.375
816	We	41	5.3	0.24	1.44	0.229
817	Wd	11	6.0	0.73	2.18	0.989
818	Wd	34	4.8	0.39	2.41	0.694
821	Wd	37	4.8	0.35	1.14	0.255
822	We	75	4.7	0.25	2.55	0.375

-continued-

Appendix Table 4. Daily mean effort and coho salmon harvest per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay fishery, 1987 (continued).

Date	We/Wd[1]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Mean Harvest (harvest/trip)	SE Harvest
823	We	85	5.9	0.25	2.98	0.378
824	Wd	18	4.3	0.54	3.56	0.701
825	Wd	28	4.6	0.36	3.64	0.562
828	Wd	41	4.9	0.34	5.05	0.799
829	We	65	4.9	0.25	3.88	0.531
830	We	15	4.7	0.85	1.47	0.675
902	Wd	11	4.8	0.78	1.91	0.653
903	Wd	2	4.5	0.50	1.50	0.500
904	Wd	10	5.6	0.71	5.00	1.468
905	We	36	5.1	0.36	3.28	0.806
906	We	35	5.3	0.44	2.34	0.528
908	Wd	13	4.3	0.73	2.62	1.035
911	Wd	2	5.0	1.00	6.50	5.500
912	We	9	5.7	0.96	0.78	0.434
913	We	6	3.8	0.48	1.17	0.749

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 5. Daily harvest of chinook and pink salmon and ling cod per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay fishery, 1987.

Date	We/ Wd[1]	Chinook Salmon		Pink Salmon		Ling Cod	
		Harvest	SE	Harvest	SE	Harvest	SE
708	Wd	0.00	0.000	0.00	0.000	1.00	0.775
709	Wd	0.00	0.000	0.00	0.000	1.86	0.769
710	Wd	0.00	0.000	0.27	0.237	1.55	0.545
711	We	0.00	0.000	0.32	0.323	1.23	0.320
712	We	0.00	0.000	0.03	0.033	1.23	0.400
713	Wd	0.00	0.000	0.00	0.000	2.00	0.943
714	Wd	0.00	0.000	0.00	0.000	0.00	0.000
715	Wd	0.00	0.000	0.00	0.000	1.10	0.526
718	We	0.00	0.000	0.77	0.322	0.50	0.277
719	We	0.00	0.000	0.33	0.143	0.21	0.134
722	Wd	0.14	0.042	0.57	0.571	0.00	0.000
723	Wd	0.00	0.000	3.13	1.805	0.13	0.085
724	Wd	0.00	0.000	0.70	0.366	1.10	0.422
725	We	0.00	0.000	0.51	0.289	0.32	0.178
726	We	0.00	0.000	0.66	0.174	0.26	0.132
727	Wd	0.00	0.000	2.31	1.129	0.54	0.268
730	Wd	0.00	0.000	0.41	0.243	0.24	0.235
731	Wd	0.09	0.060	0.04	0.043	0.00	0.000
801	We	0.00	0.000	0.33	0.188	0.00	0.000
802	We	0.01	0.014	0.40	0.096	0.37	0.174
803	Wd	0.04	0.038	0.27	0.118	0.31	0.182
804	Wd	0.06	0.059	0.53	0.259	0.12	0.081
807	Wd	0.00	0.000	0.13	0.091	0.00	0.000
808	We	0.02	0.012	0.17	0.035	0.03	0.018
809	We	0.02	0.010	0.21	0.050	0.17	0.072
810	Wd	0.10	0.044	0.21	0.065	0.07	0.040
811	Wd	0.02	0.017	0.26	0.071	0.07	0.040
812	Wd	0.03	0.015	0.19	0.059	0.00	0.000
813	Wd	0.01	0.009	0.12	0.040	0.02	0.018
814	Wd	0.00	0.000	0.12	0.028	0.02	0.018
815	We	0.03	0.014	0.08	0.019	0.09	0.034
816	We	0.05	0.038	0.03	0.024	0.00	0.000
816	We	0.00	0.000	0.12	0.062	0.00	0.000
817	Wd	0.00	0.000	1.18	1.182	0.45	0.282
818	Wd	0.03	0.029	0.06	0.041	0.00	0.000

-continued-

Appendix Table 5. Daily harvest of chinook and pink salmon and ling cod per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay fishery, 1987 (continued).

Date	We/ Wd[1]	Chinook Salmon		Pink Salmon		Ling Cod	
		Harvest	SE	Harvest	SE	Harvest	SE
821	Wd	0.00	0.000	0.08	0.081	0.54	0.192
822	We	0.00	0.000	0.05	0.042	0.32	0.106
823	We	0.00	0.000	0.02	0.017	0.15	0.110
824	Wd	0.00	0.000	0.00	0.000	0.00	0.000
825	Wd	0.00	0.000	0.07	0.050	0.07	0.071
828	Wd	0.02	0.024	0.00	0.000	0.07	0.054
828	Wd	0.02	0.024	0.00	0.000	0.07	0.054
829	We	0.00	0.000	0.00	0.000	0.25	0.140
830	We	0.00	0.000	0.00	0.000	0.00	0.000
902	Wd	0.00	0.000	0.18	0.182	0.64	0.472
903	Wd	0.00	0.000	0.00	0.000	0.00	0.000
904	Wd	0.00	0.000	0.00	0.000	0.00	0.000
905	We	0.00	0.000	0.03	0.028	0.11	0.111
906	We	0.00	0.000	0.00	0.000	0.00	0.000
908	Wd	0.00	0.000	0.00	0.000	0.00	0.000
911	Wd	0.00	0.000	0.00	0.000	0.00	0.000
912	We	0.00	0.000	0.00	0.000	0.03	0.236
913	We	0.00	0.000	0.00	0.000	0.00	0.000

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 6. Counts of anglers during the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Date	Wd/We[1]	Waterfall Beach				Boat Harbor Beach			
		A	B	C	D	A	B	C	D
6/17	We			1				5	
6/18	We		15				10		
6/19	Wd	8			21	6			15
6/20	Wd				26				18
6/21	Wd		7	20			23	27	
6/22	Wd		13				2		
6/25	Wd			15	7			10	13
6/26	We	1			7	2			3
6/27	We			11	11			9	9
6/28	Wd	4		17		2		11	
6/29	Wd		1		5		5		10
6/30	Wd			4				5	
7/03	Wd	3	7			3	0		
7/04	Wd	1		9		0		4	
7/05	We			6	4			0	0

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 7. Daily mean effort, mean chinook salmon harvest, and chinook salmon harvest per angler-hour (CPUE) for anglers fishing in the beach fisheries for chinook salmon in Resurrection Bay, 1987.

Date	We/[1] Wd	Sample Size	Mean Effort (Hours)	SE Effort	Mean Harvest	SE Harvest	Harvest CPUE
Waterfall Beach							
617	Wd	10	0.6	0.10	0.10	0.100	0.182
618	Wd	25	1.2	0.28	0.12	0.066	0.101
619	Wd	45	0.7	0.06	0.09	0.043	0.126
620	We	31	0.8	0.13	0.06	0.065	0.082
621	We	36	1.0	0.20	0.06	0.056	0.053
622	Wd	17	0.7	0.18	0.65	0.256	0.880
625	Wd	25	1.4	0.24	0.08	0.055	0.056
626	Wd	9	0.9	0.20	0.78	0.324	0.903
627	We	15	0.9	0.13	0.07	0.067	0.074
628	We	27	0.6	0.08	0.00	0.000	0.000
629	Wd	11	0.8	0.15	0.00	0.000	0.000
630	Wd	6	0.8	0.20	0.33	0.211	0.444
703	We	15	1.3	0.22	0.00	0.000	0.000
705	Wd	16	0.6	0.10	0.13	0.085	0.211
706	We	9	1.4	0.17	0.33	0.236	0.245
Boat Harbor Beach							
617	Wd	8	0.9	0.09	0.50	0.267	0.552
618	Wd	12	1.2	0.32	0.25	0.131	0.211
619	Wd	31	1.1	0.15	0.06	0.045	0.060
620	We	21	1.5	0.24	0.24	0.118	0.161
621	We	70	1.4	0.13	0.07	0.031	0.050
622	Wd	2	2.0	1.00	0.00	0.000	0.000
625	Wd	30	1.0	0.11	0.03	0.033	0.034
626	Wd	5	0.4	0.06	0.40	0.245	1.000
627	We	14	1.1	0.25	0.29	0.125	0.254
628	We	25	1.3	0.25	0.08	0.055	0.062
629	Wd	23	1.1	0.25	0.13	0.072	0.121
630	Wd	4	1.8	0.12	0.50	0.500	0.276
703	We	3	1.2	0.33	0.00	0.000	0.000
705	We	4	0.9	0.07	0.00	0.000	0.000
706	We	0	0.0	0.00	0.00	0.000	0.000

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 8. Counts of anglers during the beach fishery for coho salmon in Resurrection Bay, 1987.

Date	Wd/We[1]	Period A	Period B	Period C	Period D
8/08	We		20		33
8/09	We	5		27	
8/10	Wd	5		17	
8/11	Wd		33		22
8/12	Wd			24	
8/13	Wd				17
8/14	Wd		39		
8/15	We	28			
8/16	We		32	25	41
8/18	Wd	16			30
8/21	Wd		18	22	
8/22	We			41	52
8/23	We	25			
8/25	Wd		24		16
8/28	Wd	15		28	
8/29	We		53	62	
8/30	We				28
9/03	Wd	10		10	1
9/04	Wd		10	7	
9/05	We			47	12
9/06	We	27			
9/07	We		8		
9/08	Wd		12	9	
9/11	Wd	16			
9/12	We			63	30
9/13	We	46			

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 9. Daily mean effort, mean coho salmon harvest, and coho salmon harvest per angler-hour (CPUE) for anglers fishing in the beach fishery for coho salmon in Resurrection Bay, 1987.

Date	We/Wd[1]	Sample Size	Mean Effort (Hours)	SE Effort	Mean Harvest	SE Harvest	Harvest CPUE
808	We	42	4.8	0.55	0.00	0.000	0.000
809	We	32	3.3	0.34	0.06	0.043	0.019
810	Wd	31	3.0	0.38	0.03	0.032	0.011
811	Wd	91	3.1	0.28	0.05	0.024	0.018
812	Wd	54	2.6	0.31	0.04	0.026	0.014
813	Wd	7	0.9	0.07	0.14	0.143	0.154
814	Wd	45	2.1	0.29	0.40	0.133	0.193
815	We	61	2.7	0.27	0.13	0.049	0.049
816	We	61	3.0	0.42	0.20	0.087	0.066
818	Wd	50	2.1	0.19	0.26	0.080	0.125
821	Wd	27	2.6	0.35	0.04	0.037	0.014
822	We	109	2.6	0.23	0.17	0.050	0.068
823	We	24	1.0	0.15	0.00	0.000	0.000
825	Wd	18	2.3	0.49	0.22	0.129	0.096
828	Wd	50	2.1	0.29	0.28	0.103	0.133
829	We	88	2.5	0.22	0.20	0.073	0.083
830	We	20	2.4	0.44	0.90	0.280	0.375
903	Wd	14	0.8	0.14	0.07	0.071	0.089
904	Wd	17	1.3	0.18	0.35	0.209	0.282
905	We	67	2.7	0.33	0.24	0.068	0.090
906	We	35	1.4	0.18	0.06	0.040	0.039
907	We	9	1.4	0.35	0.44	0.242	0.308
908	Wd	21	1.3	0.23	0.81	0.400	1.630
911	Wd	11	2.1	0.22	1.45	0.340	0.696
912	We	57	3.4	0.33	2.39	0.254	0.692
913	We	30	3.5	0.22	1.80	0.281	0.519

[1] Weekend-Holiday (We) or weekday (Wd).

Appendix Table 10. Summary of data used to calculate the estimated contribution of Bear Lake, Seward Lagoon, and Box Canyon Creek coho salmon to the Resurrection Bay boat and beach fisheries, 1987.

Fishery	Stock	Variable[1]						
		a_1	a_2	m_1	m_2	m_c	n_2	H_s
Boat: Pre Derby & Derby Strata								
	Bear Lake-1986	380	206	176	176	50	3,666	0.25[3]
	Seward Lagoon-1986	380	206	176	176	61	3,666	0.30
	Box Canyon-1986	380	206	176	176	62	3,666	0.29
	Other[2]	380	206	176	176	3	3,666	
Boat: Post Derby Stratum								
	Bear Lake-1986	208	173	147	147	38	1,130	0.25[3]
	Seward Lagoon-1986	208	173	147	147	60	1,130	0.30
	Box Canyon-1986	208	173	147	147	48	1,130	0.29
	Other[2]	208	173	147	147	1	1,130	
Beach								
	Bear Lake-1986	74	46	41	41	2	293	0.25[3]
	Seward Lagoon-1986	74	46	41	41	31	293	0.30
	Box Canyon-1986	74	46	41	41	8	293	0.29

1 See text for definition of variables.
2 Strays from stockings outside of Resurrection Bay, disregarded in analyses.
3 H calculated as the proportion of adipose clipped fish observed in the Bear Lake escapement (1,488/6,021), Vincent-Lang and McHenry (in preparation).