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SPORT EFFORT FOR AND HARVEST OF COHO SALMON, HALIBUT, ROCKFISH, AND LINGCOD IN RESURRECTION BAY SPORT FISHERIES, ALASKA, DURING 1989[1]

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ABSTRACT

Creel surveys were conducted to determine sport effort and harvest in the various marine fisheries of Resurrection Bay, Alaska. Based on these surveys, an estimated 5,904 boat-trips were expended by private and charter boat sport anglers in the marine boat fishery in Resurrection Bay from 1 June through 10 September 1989. This is the lowest level of fishing effort dating back to 1968 and is probably due to the EXXON-Valdez oil spill. This fishery harvested an estimated 14,861 coho salmon *Oncorhynchus kisutch*, 3,010 halibut *Hippoglossus stenolepis*, 3,485 lingcod *Ophiodon elongatus*, and 6,232 rockfish *Sebastes* spp. An additional 688 boat trips were expended by military personnel fishing from boats operated by the local Army and Air Force recreation camps. Military personnel harvested 746 halibut, 2,020 lingcod, and 10,927 rockfish. In total, eleven species of rockfish were identified in the sport harvest with the primary species harvested being black *S. melanops*, dusky *S. ciliatus*, and yelloweye *S. ruberimus*.

During the coho salmon season (1 July through 10 September), half the effort (50 percent) and nearly two-thirds of the coho salmon harvest (62 percent) occurred during the 9-day Seward Silver Salmon Derby. Over 29 percent of the harvest of coho salmon were stocked fish with the Bear Lake, Seward Lagoon, and Lowell Creek stocking sites contributing 8, 15, and 6 percent of the coho salmon harvested, respectively. The majority of coho salmon harvested in the boat fishery were age 1.1 (69 percent).

Estimated effort and harvest in the beach fishery for coho salmon in Resurrection Bay were 8,662 angler-hours and 2,568 fish, respectively. About 73 percent of the harvested coho salmon in this fishery were stocked fish with the Bear Lake, Seward Lagoon, and Lowell Creek stocking sites having contributed 2, 56, and 15 percent of the coho salmon harvested, respectively. Similar to the boat fishery, the majority of the coho salmon harvested in this fishery were age 1.1 (95 percent).

In the beach fisheries for chinook salmon in Resurrection Bay, estimated effort and harvest were 6,868 angler-hours and 811 fish, respectively. The majority of harvested chinook salmon in the beach fisheries were age 0.3 and 0.4 (48 and 45 percent, respectively). It is assumed that all the harvested chinook salmon were hatchery-reared stocked fish.

KEY WORDS: Coho salmon, *Oncorhynchus kisutch*, chinook salmon, *Oncorhynchus tshawytscha*, halibut, *Hippoglossus stenolepis*, lingcod, *Ophiodon elongatus*, Resurrection Bay, sport effort, sport harvest, age, length, hatchery contribution.

INTRODUCTION

The recreational fishery in Resurrection Bay is one of the largest marine sport fisheries in Alaska (Mills 1988). Historically, most of the effort in this fishery has been by private boat anglers; however, a growing private and military-administered charter boat industry has also developed in recent years. Historically, most of the effort by the boat fishery has targeted coho salmon *Oncorhynchus kisutch* during the months of July through September. In recent years, however, local stocks of halibut *Hippoglossus stenolepis*, lingcod *Ophiodon elongatus*, rockfish *Sebastes spp.*, and chinook salmon *O. tshawytscha* have been increasingly targeted during June and early July, before the coho salmon arrive in catchable numbers.

Effort in the July through September boat fishery has averaged nearly 7,400 boat-trips annually from 1968 to 1988 with harvests of coho salmon in this fishery averaging about 15,300 coho salmon over the same time period (Table 1). In addition to the boat fishery, anglers also fish from shore for coho and chinook salmon. Effort and harvest in the shore fishery are small compared to the boat fishery.

To increase and stabilize the numbers of coho salmon available to the sport fisheries in Resurrection Bay, a stocking program for coho salmon was initiated in 1962. Bear Lake was chosen as the initial focus of the stocking effort (Figure 1). To increase the rearing capacity of the lake for young coho salmon, the lake was rehabilitated to eradicate competing threespine stickleback *Gasterosteus aculeatus* and an annual coho salmon fingerling stocking program begun. Survivals of fingerlings to smolts from these efforts have averaged 35% since 1971 (Vincent-Lang 1988). Bear Lake also supports a small run of sockeye salmon *O. nerka* which, in past years, has contributed to both commercial and personal-use fisheries.

Additional stockings of coho salmon in Resurrection Bay began in 1968 with annual releases of hatchery-reared smolts of Bear Lake origin at other sites. Release sites have varied annually and have included Seward Lagoon, the Lowell Creek outfall, Grouse Lake, and Bear and Box Canyon Creeks. Hatchery-reared chinook salmon smolts have been released in the 1970's and annually since 1983 in an effort to lengthen and diversify the Resurrection Bay sport fishery.

In conjunction with the stocking program, the Alaska Department of Fish and Game, Sport Fish Division, has conducted an ongoing research program with the objectives of: (1) monitoring effort and harvest in the sport fisheries in Resurrection Bay, and (2) determining the most effective stocking strategies by estimating the return of stocked fish. These objectives have principally been accomplished by monitoring the three major life history events of stocked salmon in the Resurrection Bay drainage: (1) freshwater residency and emigration, (2) harvest in the marine sport fishery, and (3) immigration. Numbers (1) and (3) are currently accomplished by operating a weir on the outlet of Bear Lake (Figure 1) to collect data needed to estimate the abundance and biological characteristics (age, sex, and size composition) of the smolt emigrations and the adult salmon immigrations. Number (2) is currently accomplished through a creel survey. The survey is designed to estimate

Table 1. Coho salmon harvest and effort statistics for the Resurrection Bay boat fishery during July through September, 1968-1989.

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
1987	7,661	352.4	22,224	1,325.0	19,627 -	24,821
1988	6,654	228.0	9,809	676.4	8,483 -	11,135
Mean	7,356		15,318			
1989	5,022	123.3	14,861	583.9	13,717 -	16,005

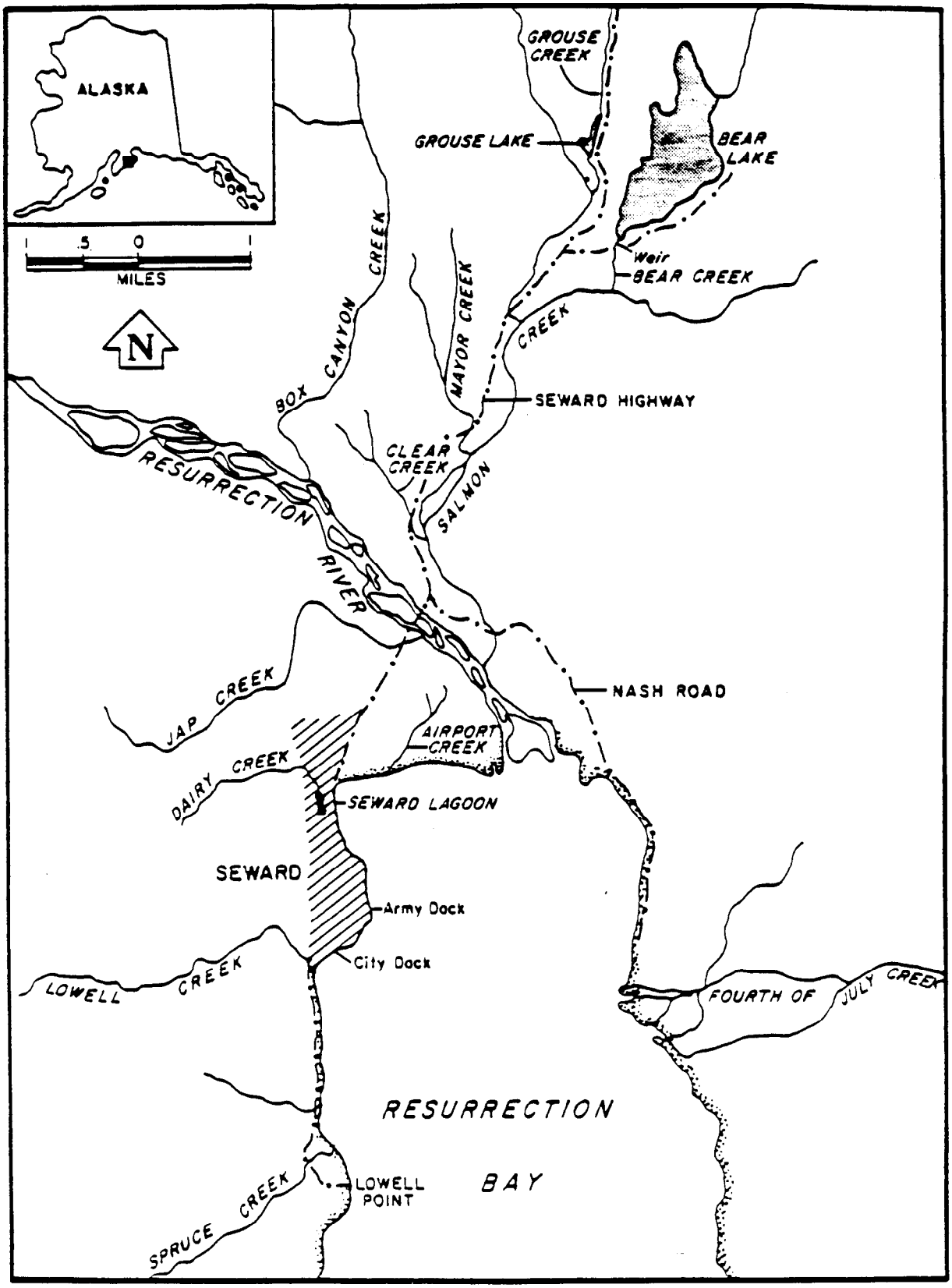

Figure 1. Map of Resurrection Bay, Alaska.

angler-effort and harvest of coho and chinook salmon, halibut, rockfish, and lingcod by the sport fisheries in Resurrection Bay, the biological characteristics of the harvest, and the site-specific (by stocking location) contribution of stocked salmon to the harvest.

The objective of this report is to summarize data collected in conjunction with the creel survey during 1989. Migrations and freshwater residency are the subject of a separate report (Carlon and Vincent-Lang in press). Vincent-Lang (1987, 1988) presents a complete summary of past salmon stocking activities in Resurrection Bay, including estimates of survival rates and contributions to the sport fishery.

METHODS

The bag limit for coho, sockeye, chum *O. keta*, and pink *O. gorbuscha* salmon in combination in Resurrection Bay during 1989 was six per day, six in possession (ADF&G 1989). The bag limit for chinook salmon, halibut, and lingcod was two each per day, two each in possession and the rockfish bag limit was reduced from the prior year's limit of ten per day to five per day, ten 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 3 June through 10 September. The fishery was stratified into four temporal segments:

1. June, 1 June-30 June;
2. Pre-Derby boat fishery, 1 July-11 August;
3. Derby boat fishery, 12 August-1200 hour on 20 August; and,
4. Post-Derby boat fishery, 1201 hour on 20 August-10 September.

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

The survey used a stratified random sampling design to estimate sport fishing effort in units of boat-trips and the numbers of coho salmon, halibut, rockfish, and lingcod harvested by private and charter boat anglers. The fishing day was defined to be 14 hours long (from 0800 to 2200 hours) and 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. Sampling effort was allocated optimally among periods based on standard errors of the effort estimates for each period and fishery segment in the years 1986 (Sonnichsen et al. 1987) and 1987 (Vincent-Lang et al. 1988). Harvest and effort by military anglers was determined from recreational camp records and are thus a complete census of military fishing activities.

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 harbor exit sites. The second person assisted with interviews and biological sampling of the harvest. Anglers from as many returning boats as possible were interviewed. An equal amount of time was spent conducting interviews at each exit site when it was not possible to survey 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: the number of anglers in the boat, the number of hours fished, the total number of fish harvested by species, whether the boat was chartered or private, and the number of days fished. As many harvested coho salmon as possible were examined for a missing adipose fin. Snouts were removed from a portion of coho salmon having a missing adipose fin (upon permission of the angler) and labelled and stored. Fish missing their adipose fin were assumed to have had a coded-wire tag (CWT) implanted into their snouts to indicate their date and location of stocking. All collected snouts were sent to the ADF&G tag lab in Juneau for removal and decoding of the CWT.

For each fishery segment (June, Pre-Derby, Derby, and Post-Derby) and stratum (weekday and weekend/holiday), the mean number of non-military sport 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 as:

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

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 as (Scheaffer et al. 1979):

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

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.

Harvest per unit effort ($\overline{HPB}_i$) was estimated as mean harvest per boat-trip for each stratum in each fishery segment as:

$$\overline{HPB}_i = \left(\sum_{k=1}^{t_i} h_{ik}\right)/t_i \ , \qquad (3)$$

where:

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

h_{ik} = the harvest of a species by boat k interviewed during stratum i.

$\overline{HPB}_i$ 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 $\overline{HPB}_i$ was estimated as (Von Geldern and Tomlinson 1973):

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

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 $\overline{HPB}_i$ in stratum i,

s_{ij}^2 = the sample variance of $\overline{HPB}_{ij}$ 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:

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

The number of fish harvested by species during the weekday or weekend/holiday stratum of each fishery segment (H_i) was calculated as follows:

$$\hat{H}_i = \hat{B}_i \overline{HPB}_i \quad . \tag{6}$$

The variance of this estimate was estimated using the formula for the product of two independent random variables (Goodman 1960):

$$V(\hat{H}_i) = [\hat{B}_i^2 \, V(\overline{HPB}_i)] + [\overline{HPB}_i^2 \, V(\hat{B}_i)] - [V(\hat{B}_i) \, V(\overline{HPB}_i)] \quad . \tag{7}$$

The total harvest by all segments of the boat fishery ($\hat{H}_T$) was estimated for each species as:

$$\hat{H}_T = \sum_{i=1}^{8} \hat{H}_i \tag{8}$$

where i is one of eight fishery strata. Because these are independent estimates, the estimated variance of the total is the sum of the variances.

Number of boat-trips and the harvests of coho and chinook salmon, halibut, and lingcod by military personnel and their dependents were obtained from dispatch officers at the military recreation camps. Data collected from dispatch officers represent a census of harvest and effort by military personnel. Records documenting post-derby harvest and effort of Air Force personnel were unavailable. However, the military fishing effort typically declines during this segment and effort is considered relatively low.

Assumptions necessary for the creel survey of the boat fishery include:

1. Surveyed boats were representative of the total population of fishing boats.
2. No significant fishing effort occurred between the hours 2200 and 0800.
3. Boat counts and harvest 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 September.

The beach fishery for chinook salmon was surveyed from 2 June through 9 July and was divided into two areas: (1) the Lowell Creek outfall or waterfall beach, and (2) the boat harbor beach. The beach fishery for coho salmon was surveyed from 23 August through 1 October and included only one area, the

Seward beach area[1,2]. 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. Sampling effort was allocated approximately equally over time periods. Optimal allocation of sampling effort among periods was not attempted because this is a developing fishery and regular use patterns have not been established.

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:

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

where:

$\bar{x}_{ij}$ = 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:

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

[1] The Lowell Point 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. No significant effort or harvest was detected at these areas by periodic monitoring during surveys of the Seward area beaches in 1988 and 1989. Therefore, they were not surveyed in 1989.

[2] Typically, coho salmon are not harvested in significant numbers until early July. This was the case in 1989 and harvest and effort estimates for coho salmon are for the six fishery strata during the period from 1 July to 10 September.

where:

s^2_{ij} = the sample variance for $\bar{x}ij$ and

n_{ij} = the number of angler counts during period j of fishery stratum i.

Harvest per unit effort ($\overline{HPUE}$) was estimated as the harvest per angler-hour for each stratum at each beach in the following manner:

$$\overline{HPUE}i = \sum_{k=1}^{m_i} h_{ik} / \sum_{k=1}^{m_i} e_{ik} , \qquad (11)$$

where:

m_i = the number of anglers interviewed during stratum i,

h_{ik} = the harvest of 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 $\overline{HPUE}i$ was approximated in the following manner (Jessen 1978):

$$V(\overline{HPUE}_i) = (\bar{H}_i/\bar{E}_i)2 \left[s^2_H/\bar{H}_i{}^2 + s^2_E/\bar{E}_i^2 - (2r_i s_H s_E/\bar{H}_i\bar{E}_i)\right] , \qquad (12)$$

where:

$\bar{H}i$ = the mean harvest of salmon by anglers in stratum i,

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

s^2_H = the two-stage variance of the mean harvest ($\bar{H}_i$),

s^2_E = the two-stage variance of the mean effort ($\bar{E}_i$), and

r_i = the correlation coefficient for hik and eik.

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

$$\hat{H}_i = \hat{E}_i \overline{HPUE}_i . \qquad (13)$$

The variance of $\hat{H}_i$ 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 HPUE[3].
2. Interviewed anglers were representative of the total angler population and anglers were interviewed in proportion to their abundance.
3. No significant fishing effort occurred between 2200 and 0800 hours.
4. For the angler interview data, effort and harvest 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 acetate 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 p_{hi} equal the estimated proportion of age group h in stratum i, the variance of p_{hi} was estimated using the normal approximation to the binomial (Scheaffer et al. 1979):

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

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

[3] A sign test of the mean daily HPUE of uncompleted and completed trip interviews indicated there were no significant differences between the harvest rates of the two groups ($p=0.58$ for coho salmon fishery, $p=0.98$ for chinook salmon fishery).

using standard normal procedures. All rockfish were speciated using several available keys (Hart 1973, Eschemeyer et. al. 1983, Kramer and O'Connell 1988).

Estimation of Hatchery Contributions to the Fishery

The contributions of hatchery-reared coho salmon stocked into Bear Lake, Seward Lagoon, and Lowell Creek to the boat and beach harvests were calculated using the procedure of Clark and Bernard (1987). For the boat fishery, the estimates were stratified by temporal segment with the Pre-Derby and Derby temporal segments being pooled due to small sample sizes. For the beach fishery for coho salmon, one estimate was derived for all time periods.

The contribution of stocked coho salmon by site under evaluation (Cs) was estimated as:

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

where $\hat{H}_T$ 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 missing adipose (Ad) fins 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 missing adipose fins collected from the fishery and sent to the lab for processing that have decodable CWTs,

a_1 = number of fish with missing adipose fins observed in the fishery,

a_2 = number of snouts from fish with missing adipose fins collected from the fishery and sent to lab for processing that arrive at the lab,

m_c = number of snouts from fish with missing adipose fins collected from the fishery, sent to the lab for processing, and decoded as a unique tag code,

H_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, H_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:

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

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

$$V[m_c] = \left[\frac{m_2 [m_2-1] a_2 [a_2-1] n_2 [n_2 - 1] \hat{C}_s [\hat{C}_s - 1] H_s^2}{m_1 [m_1-1] a_1 [a_1-1] \hat{H}_T [\hat{H}_T-1]} \right] +$$

$$\left[\frac{m_2 a_2 n_2 \hat{C}_s H_s}{m_1 a_1 \hat{H}_T} \right] - \left[\frac{(m_2 a_2 n_2 \hat{C}_S H_s)^2}{(m_1 a_1 \hat{H}_T)^2} \right] . \quad (17)$$

The estimates for each of the stocking sites were summed to estimate the total number of stocked coho salmon in the harvests of 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 stocking sites possible. Covariance was estimated as (Clark and Bernard 1987):

$$Cov(\hat{Cr}_1;\hat{Cr}_2) = \hat{Cr}_1 \hat{Cr}_2 \left[\frac{m_1 (m_2-1) a_1 (a_2-1) \hat{H}_T (n_2-1)}{m_2 (m_1-1) a_2 (a_1-1) n_2 (\hat{H}_T-1)} \right] \quad (18)$$

RESULTS

Boat Fishery Creel Survey

The creel survey monitored the June component of Resurrection Bay fisheries for the first time in 1989. Effort during June is primarily directed at groundfish (mostly halibut, rockfish, and lingcod) as returning adult coho salmon are not typically present in catchable numbers in the bay until July. During June, an estimated 882 boat trips were made by private and charter boat anglers (Table 2). This comprised 14.9% of the total effort expended by private and charter boats during the entire season (Figure 2). A total of 1,901 rockfish, 1,395 halibut, and 1,288 lingcod were harvested by private and charter boat anglers during June. This represented 31%, 46%, and 37% of the entire season's harvest of these species, respectively (Table 3 and Figure 2). The military recreation camps accounted for an additional 266 boat trips during late May and June (Table 4). This represents 39% of the total effort expended by military personnel during 1989 (Figure 3). During this time, military personnel harvested 4,574 rockfish, 244 halibut, and 671

Table 2. Summary of the number of boat-trips of effort by private and charter boat anglers during the Resurrection Bay boat fishery, 1989.

Segment	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
JUNE				
Weekdays	431	50.5	332 - 530	23.0%
Weekends	451	46.6	360 - 542	20.3%
Total	882	68.8	747 - 1,017	15.3%
PRE-DERBY				
Weekdays	769	47.9	675 - 863	12.2%
Weekends	1,019	89.7	843 - 1,195	17.3%
Total	1,788	101.7	1,589 - 1,987	11.1%
DERBY				
Weekdays	1,221	0.0	1,221 - 1,221	0.0%
Weekends	1,283	0.0	1,283 - 1,283	0.0%
Total	2,504	0.0	2,504 - 2,504	0.0%
POST-DERBY				
Weekdays	350	54.1	244 - 456	30.3%
Weekends	380	43.9	294 - 466	22.6%
Total	730	69.7	593 - 867	18.7%
GRAND TOTAL	5,904	141.2	5,627 - 6,181	4.7%

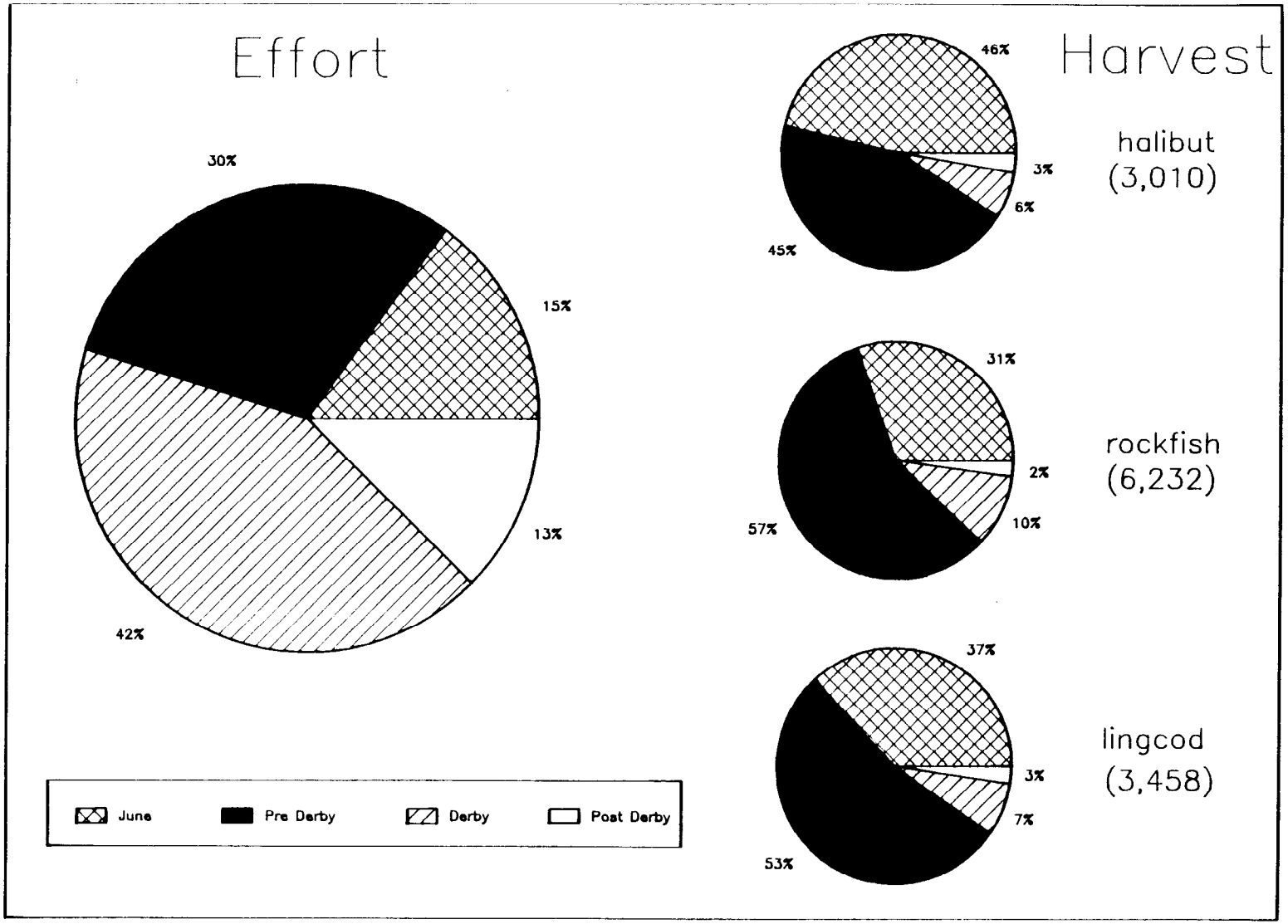

Figure 2. Percentage of effort and harvest of groundfish by private and charter boat anglers during the four temporal segments of the Resurrection Bay boat fishery, 1989 (absolute harvest in parentheses).

Table 3. Estimated number of halibut, rockfish, and lingcod harvested by private and charter boat anglers during the Resurrection Bay boat fishery, 1989.

Segment	Halibut		Rockfish		Lingcod	
	Harvest	SE	Harvest	SE	Harvest	SE
JUNE						
Weekdays	809	216.1	1,073	255.7	581	166.1
Weekends	586	137.3	828	248.3	707	180.4
Total	1,395	256.0	1,901	356.4	1,288	245.2
PRE-DERBY						
Weekdays	652	115.5	1,461	332.3	644	151.5
Weekends	692	132.4	2,121	430.4	1,219	202.9
Total	1,344	175.7	3,582	543.7	1,863	253.2
DERBY						
Weekdays	85	27.0	127	56.0	106	29.6
Weekends	104	25.5	488	113.3	146	54.4
Total	189	37.1	615	126.3	252	61.9
POST-DERBY						
Weekdays	25	20.4	5	7.3	30	42.2
Weekends	57	18.0	129	39.7	52	17.4
Total	82	27.2	134	40.4	82	45.6
GRAND TOTAL	3,010	313.9	6,232	663.5	3,485	360.8

Table 4. Number of boat-trips and harvest of coho salmon, rockfish, halibut, and lingcod by military anglers and their dependents in all segments of the Resurrection Bay boat fishery, 1989.

Segment	Number of		Number of Fish Harvested[a]			
	Boat-Trips	Anglers	Coho	Halibut	Rockfish	Lingcod
JUNE[b]						
Air Force Personnel	127	1,302	0	164	2,586	440
Army Personnel	139	645	0	80	1,988	231
Total	266	1,947	0	244	4,574	671
PRE-DERBY						
Air Force Personnel	131	1,361	10	243	2,346	386
Army Personnel	189	1,049	78	126	2,995	559
Total	320	2,410	88	369	5,341	945
DERBY						
Air Force Personnel	30	354	30	64	511	171
Army Personnel	47	217	42	44	372	104
Total	77	571	72	108	883	275
POST-DERBY						
Air Force Personnel[c]	10	139	0	9	101	61
Army Personnel	15	82	3	16	28	68
Total	25	221	3	25	129	129
GRAND TOTAL	688	5,149	163	746	10,927	2,020

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

[b] Military recreation camps began fishing on May 7. This harvest and effort is included in the "June" fishery segment.

[c] Air Force personnel continued to fish through September 10, but records were available only through August 24.

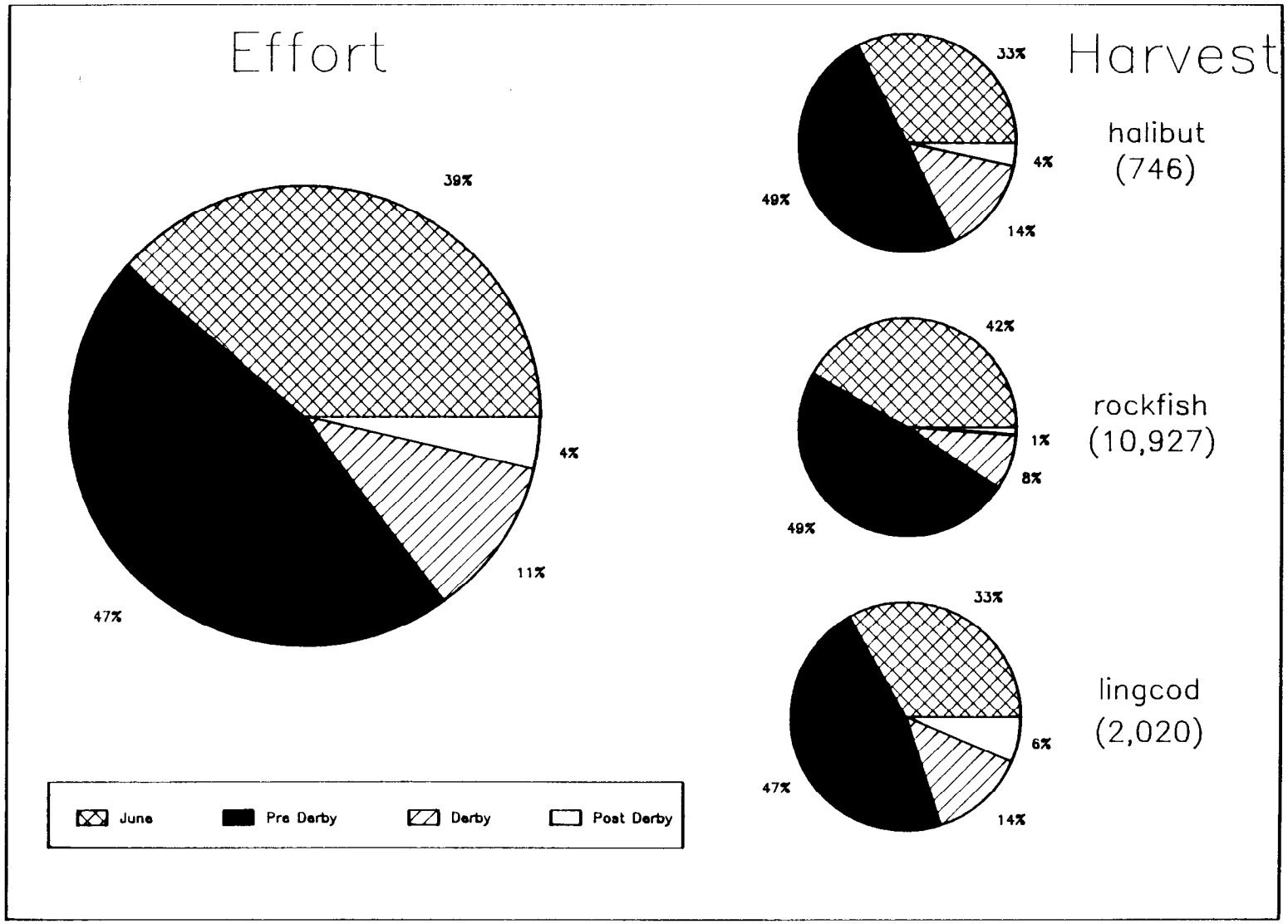

Figure 3. Percentage of effort and harvest of groundfish by military anglers during the four temporal segments of the Resurrection Bay boat fishery, 1989 (absolute harvest in parentheses).

lingcod. This represented 42%, 33%, and 33% of the entire season's harvest of these species, respectively, by military personnel (Table 4 and Figure 3). Combined, anglers fishing from military, private, and charter boats expended an estimated 1,048 boat-trips to harvest an estimated 6,475 rockfish, 1,639 halibut, and 1,959 lingcod (Table 5 and Figure 4).

The 1 July through 10 September segments of the boat fishery occur during the period when coho salmon are present in the bay in catchable numbers. Most private and charter boat anglers are targeting salmon during this time. Military boat anglers continue to target groundfish species during this time. The following results apply only to the 1 July through 10 September time period (Pre-Derby, Derby, and Post-Derby fishery segments) as, historically, the creel survey has estimated harvest and effort during this period only.

As in the past, most private and charter boats in the Resurrection Bay fishery returned during the C period in 1989. Effort during the C period totaled 2,394 boat-trips, accounting for 47.6% of the July through September effort (Table 6). Effort during the remaining three time periods was 1,280 boat-trips (25.5%), 968 boat-trips (19.3%), and 380 boat-trips (7.6%) for the B, D, and A periods, respectively. Effort by private and charter boats during the Derby segment of the fishery was 2,504 boat-trips, which was 49.9% of the private and charter boat effort during the July through September Resurrection Bay boat fishery (Table 2). Effort by private and charter boats during the Pre-Derby and Post-Derby segments was 1,788 boat-trips (35.6%) and 730 boat-trips (14.5%), respectively. Within each segment, the effort during weekends was slightly higher than effort during weekdays. Boats from the military recreation camps accounted for an additional 422 boat-trips during the July through September fishery with most of this effort (320 boat-trips) occurring during the Pre-Derby segment (Table 4).

The mean harvest of coho salmon per boat-trip for all civilian boat anglers (private and charter boats combined) ranged from 1.4 fish per boat-trip during weekends of the Pre-Derby segment to 4.4 fish per boat-trip during weekdays of the Derby (Table 7). The mean harvest of coho salmon per boat-trip for charter boat anglers was larger than estimates for private boat anglers in four of the six segments of the fishery. Relatively few charter boat anglers were interviewed, however, and the precision of the estimates for their mean harvests were correspondingly poor. Daily summary statistics for angler effort and coho salmon, halibut, rockfish, and lingcod harvest per boat-trip for interviewed anglers are presented in Appendices A2 through A4.

The estimated harvest of coho salmon by anglers fishing on private and charter boats from 1 July through 10 September was 14,861 fish (Table 8). This estimate of the civilian harvest accounts for virtually all of the coho salmon harvested in the boat fishery as military records show that only 163 coho salmon were harvested by Army and Air Force personnel during the entire 1989 season. The largest harvest of coho salmon occurred during the Derby fishery. Private and charter boat anglers harvested 9,280 coho salmon during the Derby. This comprised 62.4% 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 5).

Table 5. Estimated number of halibut, rockfish, and lingcod harvested by military and civilian anglers during all segments of the Resurrection Bay boat fishery, 1989.

	Halibut		Rockfish		Lingcod	
Segment	Harvest	SE	Harvest	SE	Harvest	SE
JUNE						
Total	1,639	256.0	6,475	356.4	1,959	245.2
PRE-DERBY						
Total	1,713	175.7	8,923	543.7	2,808	253.2
DERBY						
Total	297	37.1	1,498	126.3	527	61.9
POST-DERBY						
Total	107	27.2	263	40.4	211	45.6
GRAND TOTAL	3,756	313.9	17,159	663.5	5,505	360.8

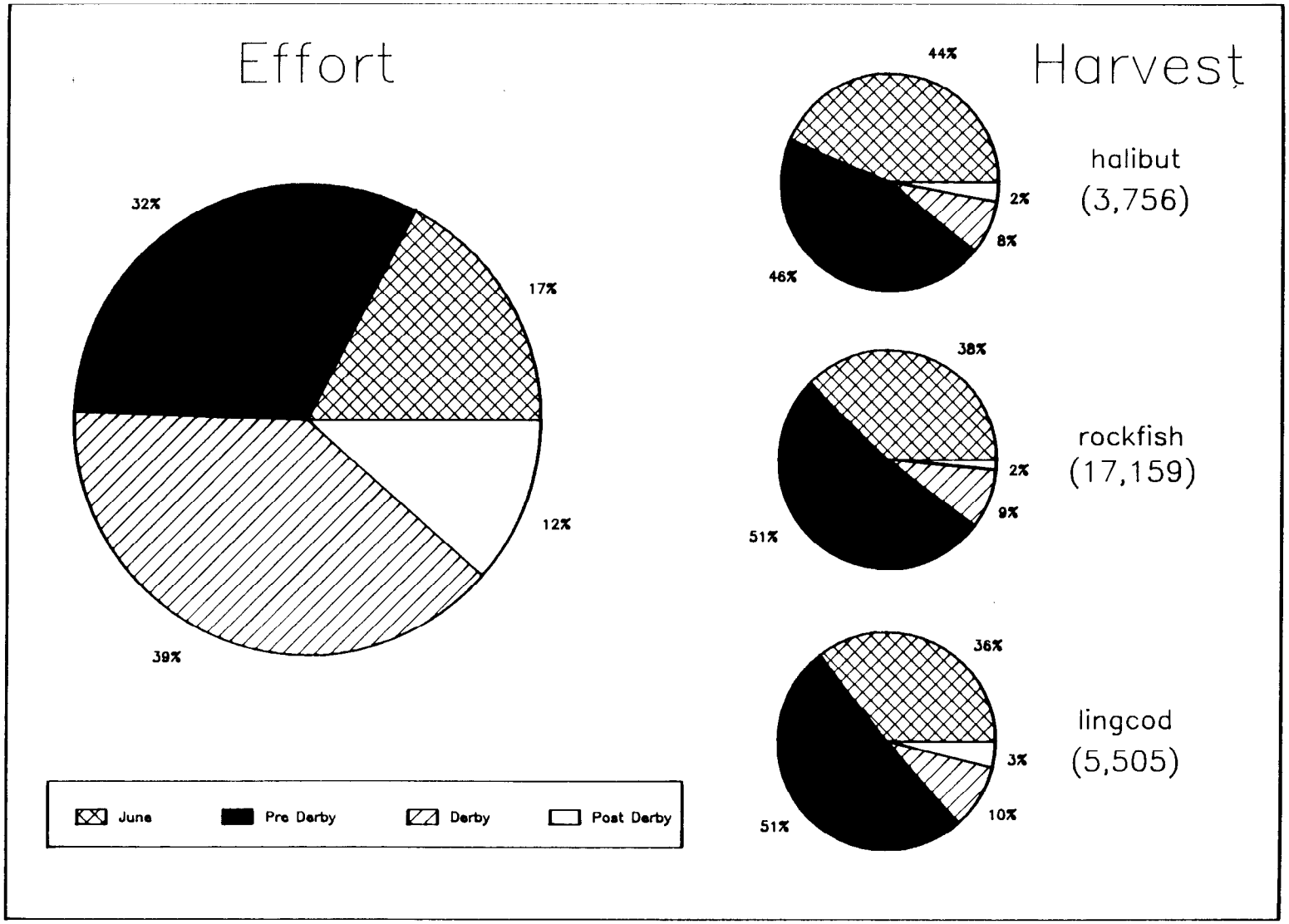

Figure 4. Percentage of effort and harvest of groundfish by military and civilian anglers during the four temporal segments of the Resurrection Bay boat fishery, 1989 (absolute harvest in parentheses).

Table 6. Estimated number of boat-trips by private and charter boat anglers, by period, for each segment of the Resurrection Bay boat fishery during July through September 1989.

Segment	Period A	B	C	D	Total
PRE-DERBY					
Weekdays:					
Number of counts	2	7	17	13	39
Effort	29	128	435	177	769
Standard error	0.0	27.5	26.9	28.6	47.9
Weekends:					
Number of counts	3	5	9	9	26
Effort	43	304	522	150	1,019
Standard error	10.1	73.2	48.3	16.4	89.7
DERBY					
Weekdays:					
Number of counts	5	5	5	5	20
Effort	56	319	604	242	1,221
Standard error	0.0	0.0	0.0	0.0	0.0
Weekends:					
Number of counts	4	3	3	3	13
Effort	214	314	546	209	1,283
Standard error	0.0	0.0	0.0	0.0	0.0
POST-DERBY					
Weekdays:					
Number of counts	2	7	6	2	17
Effort	21	96	121	112	350
Standard error	19.4	34.0	26.9	25.9	54.1
Weekends:					
Number of counts	2	6	4	4	16
Effort	17	119	166	78	380
Standard error	3.0	18.2	9.6	38.7	43.9
TOTAL					
Number of counts	18	28	41	35	122
Effort	380	1,280	2,394	968	5,022
Standard error	22.1	87.2	62.2	57.1	123.4

Table 7. Estimated mean harvest of coho salmon per boat-trip for each segment of the Resurrection Bay boat fishery, 1989.

Segment	Days d[a]	Days D[b]	Number of Interviews	Mean Harvest[c]	Standard Error
PRE-DERBY					
Weekdays:					
Private boat anglers	17	29	157	3.00	0.431
Charter boat anglers	17	29	52	2.73	0.591
All civilian anglers	17	29	209	2.95	0.358
Weekends:					
Private boat anglers	12	13	259	1.43	0.163
Charter boat anglers	12	13	38	1.16	0.523
All civilian anglers	12	13	297	1.44	0.165
DERBY					
Weekdays:					
Private boat anglers	5	5	560	4.24	0.185
Charter boat anglers	5	5	29	6.72	0.858
All civilian anglers	5	5	589	4.37	0.184
Weekends:					
Private boat anglers	4	4	507	2.97	0.145
Charter boat anglers	4	4	13	6.00	1.442
All civilian anglers	4	4	520	3.08	0.148
POST-DERBY					
Weekdays:					
Private boat anglers	6	14	62	1.86	0.479
Charter boat anglers	6	14	8	11.25	4.797
All civilian anglers	6	14	70	2.94	0.781
Weekends:					
Private boat anglers	7	7	140	2.01	0.218
Charter boat anglers	7	7	7	5.14	3.685
All civilian anglers	7	7	147	2.18	0.227

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

[b] Number of days possible for collecting interviews.

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

Table 8. Estimated number of coho salmon harvested by private and charter boat anglers in each segment of the Resurrection Bay boat fishery during July through September 1989.

Segment	Harvest[a]	Standard Error	95% Confidence Interval	Relative Precision
PRE-DERBY				
Weekdays	2,270	309.1	1,664 - 2,876	26.7%
Weekends	1,468	211.2	1,054 - 1,882	28.2%
Total	3,738	374.3	3,004 - 4,472	19.6%
DERBY				
Weekdays	5,331	225.0	4,890 - 5,772	8.3%
Weekends	3,949	189.9	3,577 - 4,321	9.4%
Total	9,280	294.4	8,703 - 9,857	6.2%
POST-DERBY				
Weekdays	1,015	312.4	403 - 1,627	60.3%
Weekends	828	128.4	576 - 1,080	30.4%
Total	1,843	337.8	1,181 - 2,505	35.9%
GRAND TOTAL	14,861	583.9	13,717 - 16,005	7.7%

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

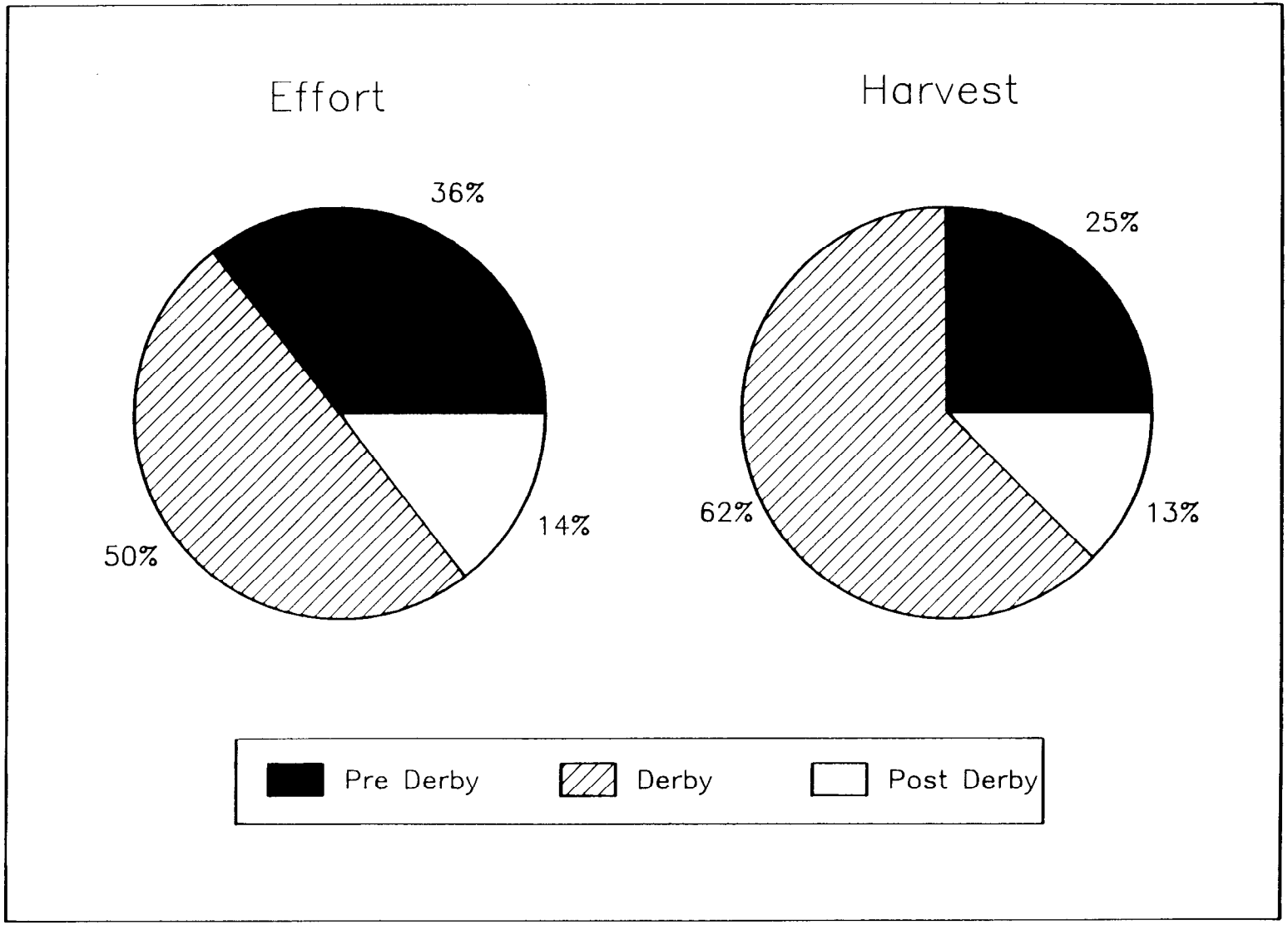

Figure 5. Percentage of coho salmon harvest and effort by private and charter boat anglers during each segment of the boat fishery in Resurrection Bay, 1989.

Beach Fishery Creel Survey

The beach fishery for chinook salmon was surveyed from 2 June to 9 July. The beach fishery for coho salmon was surveyed from 23 August to 1 October.

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 3,900 angler-hours of effort, or 56.8% of the total effort (Table 9). Of the four time periods, the most effort was expended during D period. Anglers fishing during the D period expended 2,272 angler-hours of effort, or 33.1% of the total effort. Effort expended during the C, B, and A time periods totaled 2,088 angler-hours (30.4%), 1,503 angler-hours (21.9%), and 1,005 angler-hours (14.6%), respectively. Of the two beaches, the waterfall beach received the largest amount of angler effort with an estimated 4,111 angler-hours or 59.9% of the total effort (Table 10 and Figure 6). The boat harbor beach received 2,757 angler-hours of effort or 40.1% of the total effort. Daily angler counts at each beach are summarized in Appendix A6.

The estimated harvest of chinook salmon per angler-hour was highest during the weekday strata at both beaches (Table 11). The highest harvest rate was observed at the boat harbor beach during the weekday stratum (0.17 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 A7. The harvest of chinook salmon was split approximately equally between the two beaches (Table 12 and Figure 6). The percentage of the total harvest during weekdays was 74.5% (604 chinook salmon). Both effort and harvest on weekdays and weekends were distributed approximately in proportion to the time available on weekdays and weekends.

Coho Salmon:

More effort was expended during weekdays than weekends in the coho salmon beach fishery (Tables 13 and 14). Anglers fishing during weekdays expended 5,271 angler-hours of effort (60.9%) while anglers fishing during weekends expended 3,391 angler-hours of effort (39.1%). Of the four time periods, the most effort was expended during the C period when 2,164 angler-hours (30.6% of total) of effort were expended. Effort expended during the D, B, and A time periods totaled 2,288 angler-hours (26.4%), 2,164 angler-hours (25.0%), and 1,488 angler-hours (18.0%), respectively. Daily angler counts for the coho salmon beach fishery are summarized in Appendix A8.

The harvest of coho salmon per angler-hour was highest during the weekday stratum with 0.314 fish being harvested per angler-hour compared to 0.262 for the weekend stratum (Table 15). Few coho salmon were reported released by beach anglers. Daily summary statistics of mean effort, mean harvest per angler, and harvest per angler-hour for coho salmon are presented in Appendix A9. An estimated 2,568 coho salmon were harvested by beach anglers

Table 9. Estimated number of angler-hours of effort, by period, for each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1989.

Segment	Period A	B	C	D	Total
WATERFALL BEACH					
Weekends					
Number of counts	2	7	2	3	14
Effort	387	377	614	592	1,970
Standard error	113.7	75.4	22.8	302.9	333.1
Weekdays					
Number of counts	4	5	5	4	18
Effort	241	473	858	569	2,141
Standard error	90.2	194.9	246.6	314.5	453.6
BOAT HARBOR BEACH					
Weekends:					
Number of counts	2	7	2	3	14
Effort	114	338	91	455	998
Standard error	113.7	133.5	91.0	367.8	417.5
Weekdays:					
Number of counts	4	5	5	4	18
Effort	263	315	525	656	1,759
Standard error	208.3	232.5	296.7	426.4	606.1
TOTAL					
Number of counts	12	24	14	14	64
Effort	1,005	1,503	2,088	2,272	6,868
Standard error	278.2	339.9	397.0	712.6	926.5

Table 10. Summary of the number of angler-hours of effort during each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1989.

Stratum	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
WATERFALL BEACH				
Weekends	1,970	333.1	1,317 - 2,623	33.1%
Weekdays	2,141	453.6	1,252 - 3,030	41.5%
Total	4,111	562.8	3,008 - 5,214	26.8%
BOAT HARBOR BEACH				
Weekends	998	417.5	180 - 1,816	82.0%
Weekdays	1,759	606.1	571 - 2,947	67.5%
Total	2,757	735.9	1,314 - 4,200	52.3%
GRAND TOTAL	6,868	926.5	5,052 - 8,684	26.4%

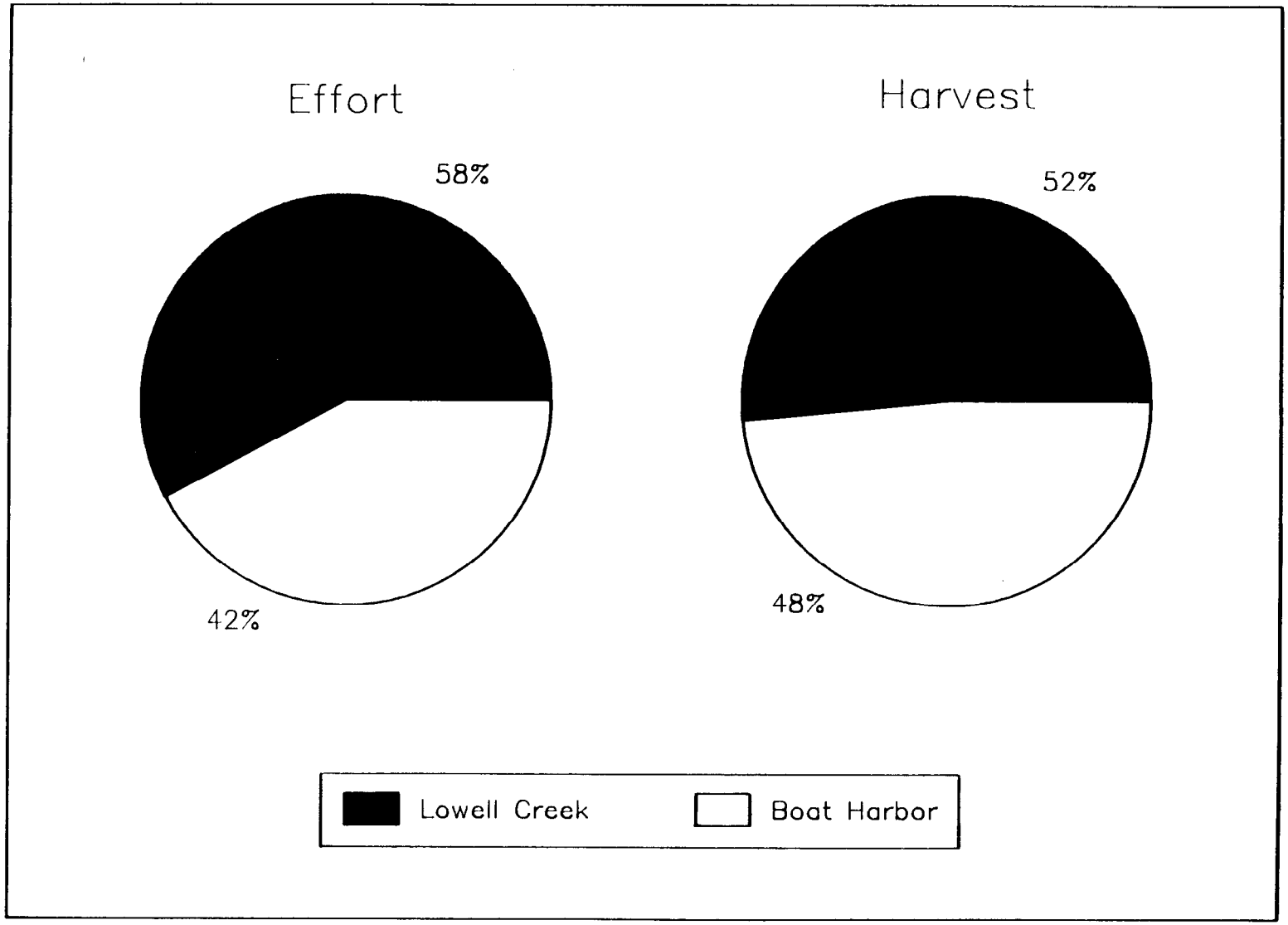

Figure 6. Percentage of chinook salmon harvest and effort by anglers fishing at the Lowell Creek and boat harbor beaches in Resurrection Bay, 1989.

Table 11. Estimated harvest of chinook salmon per angler-hour (HPUE) for each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1989.

Stratum	Days d[a]	Days D[b]	Number of Interviews	Harvest[c] HPUE	Standard Error
WATERFALL BEACH					
Weekends	9	13	130	0.062	0.0216
Weekdays	14	25	94	0.142	0.0400
BOAT HARBOR BEACH					
Weekends	9	13	66	0.085	0.0189
Weekdays	14	25	58	0.170	0.0512

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

[b] Number of days possible for collecting interviews.

[c] Includes fish reported as kept only.

Table 12. Estimated number of chinook salmon harvested during each segment of the beach fisheries for chinook salmon in Resurrection Bay, 1989.

Stratum	Harvest[a]	Standard Error	95% Confidence Interval	Relative Precision
WATERFALL BEACH				
Weekends	112	46.8	20 - 214	75.1%
Weekdays	304	105.6	97 - 511	68.1%
Total	426	115.5	200 - 652	53.2%
BOAT HARBOR BEACH				
Weekends	85	39.5	8 - 162	91.1%
Weekdays	300	133.5	38 - 562	87.2%
Total	385	139.3	112 - 658	70.9%
GRAND TOTAL	811	180.9	456 - 1,166	43.7%

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

Table 13. Estimated number of angler-hours of effort, by period, for the beach fishery for coho salmon in Resurrection Bay, 1989.

Stratum	Period A	Period B	Period C	Period D	Total
SEWARD BEACH					
Weekends					
Number of counts	3	9	6	3	21
Effort	501	683	1,100	1,107	3,391
Standard error	410.3	154.5	297.3	433.5	684.5
Weekdays					
Number of counts	9	12	6	6	33
Effort	987	1,481	1,622	1,181	5,271
Standard error	358.8	319.5	635.5	200.8	821.6
TOTAL					
Number of counts	12	21	12	9	54
Effort	1,488	2,164	2,722	2,288	8,662
Standard error	545.1	354.9	701.6	477.7	1,069.4

Table 14. Summary of the number of angler-hours of effort during the beach fishery for coho salmon in Resurrection Bay, 1989.

Segment	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
SEWARD BEACH				
Weekends	3,391	684.5	2,049 - 4,733	39.6%
Weekdays	5,271	821.6	3,661 - 6,881	30.6%
Total	8,662	1,069.4	6,566 - 10,758	24.2%

Table 15. Estimated harvest of coho salmon per angler-hour (HPUE) for the beach fishery for coho salmon in Resurrection Bay, 1989.

Stratum	Days d[a]	Days D[b]	Number of Interviews	Harvest[c] HPUE	Standard Error
SEWARD BEACH					
Weekends	13	13	312	0.269	0.0301
Weekdays	17	27	401	0.314	0.0439

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

[b] Number of days possible for collecting interviews.

[c] Includes fish reported as kept only.

(Table 16). The proportions of the total weekend harvest and effort were somewhat higher than the time available on weekends during this fishery (Figure 7).

Biological Data

The majority (68.9%) of coho salmon harvested by the boat fishery were age 1.1[4] (Table 17). The mean length for age 1.1 males in the boat fishery varied from 595 mm during the Pre-Derby to 611 mm during the Post-Derby and the mean length for age 1.1 females varied from 577 mm during the Pre-Derby to 605 mm during the Post-Derby (Table 18). The mean length for age 2.1 males in the boat fishery varied from 595 mm during the Pre-Derby to 631 mm during the Post-Derby and the mean length for age 2.1 females varied from 580 mm during the Pre-Derby to 617 during the Post-Derby (Table 18). Males comprised an estimated 52.8% of the July through September boat fishery harvest (Table 17).

Age 0.3 and 0.4 chinook salmon accounted for 47.8% and 45.4% of chinook salmon harvested in the beach fisheries (Table 19). Ages 0.2 and 0.1 respectively accounted for 4.5% and 2.3% of the harvest. Females comprised 63.7% of the harvest. Mean lengths of harvested chinook salmon increased by age class (Table 20).

As in the boat fishery, most coho salmon harvested in the beach fishery were age 1.1. Age 1.1 fish comprised 95.2% of the coho salmon beach harvest and age 2.1 fish comprised the remaining 4.8% (Table 21). Males comprised 62.1% of the harvest. Mean lengths were similar (591 mm to 601 mm) for both sexes and age groups (Table 22).

Eleven species of rockfish were identified in the harvest (Table 23). An unknown number of dusky rockfish were misidentified as black rockfish, but it is felt that the dusky rockfish comprised the minority of the fish identified as black rockfish. The black and dusky rockfish comprised the majority (68.7%) of the harvest and the yelloweye rockfish comprised the second largest component of the harvest (28.7%) (Table 24).

Hatchery Contributions to the Fishery[5]

The Bear Lake coho salmon emigration of 63,775 smolts in 1989 (Carlon and Vincent-Lang 1989a) contributed adult coho salmon to the Resurrection Bay sport fishery and the Bear Lake immigration in 1989. The majority of these smolts were from the 1986 and 1987 Bear Lake fingerling plants. Hatchery-

[4] The numeral preceding the decimal represents the number of freshwater annuli and the numeral following the decimal represents the number of marine annuli (European method). Total age from brood year is the sum of the two numbers plus one.

[5] The data used to estimate the contributions of hatchery coho salmon from Bear Lake, Seward Lagoon, and Lowell Creek to the 1989 boat and beach fisheries are summarized in Appendix Table 10.

Table 16. Estimated number of coho salmon harvested during the beach fishery for coho salmon in Resurrection Bay, 1989.

Stratum	Harvest[a]	Standard Error	95% Confidence Interval	Relative Precision
SEWARD BEACH				
Weekends	911	365.3	195 - 1,627	78.6%
Weekdays	1,657	344.9	981 - 2,333	40.8%
Total	2,568	502.4	1,583 - 3,553	38.3%

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

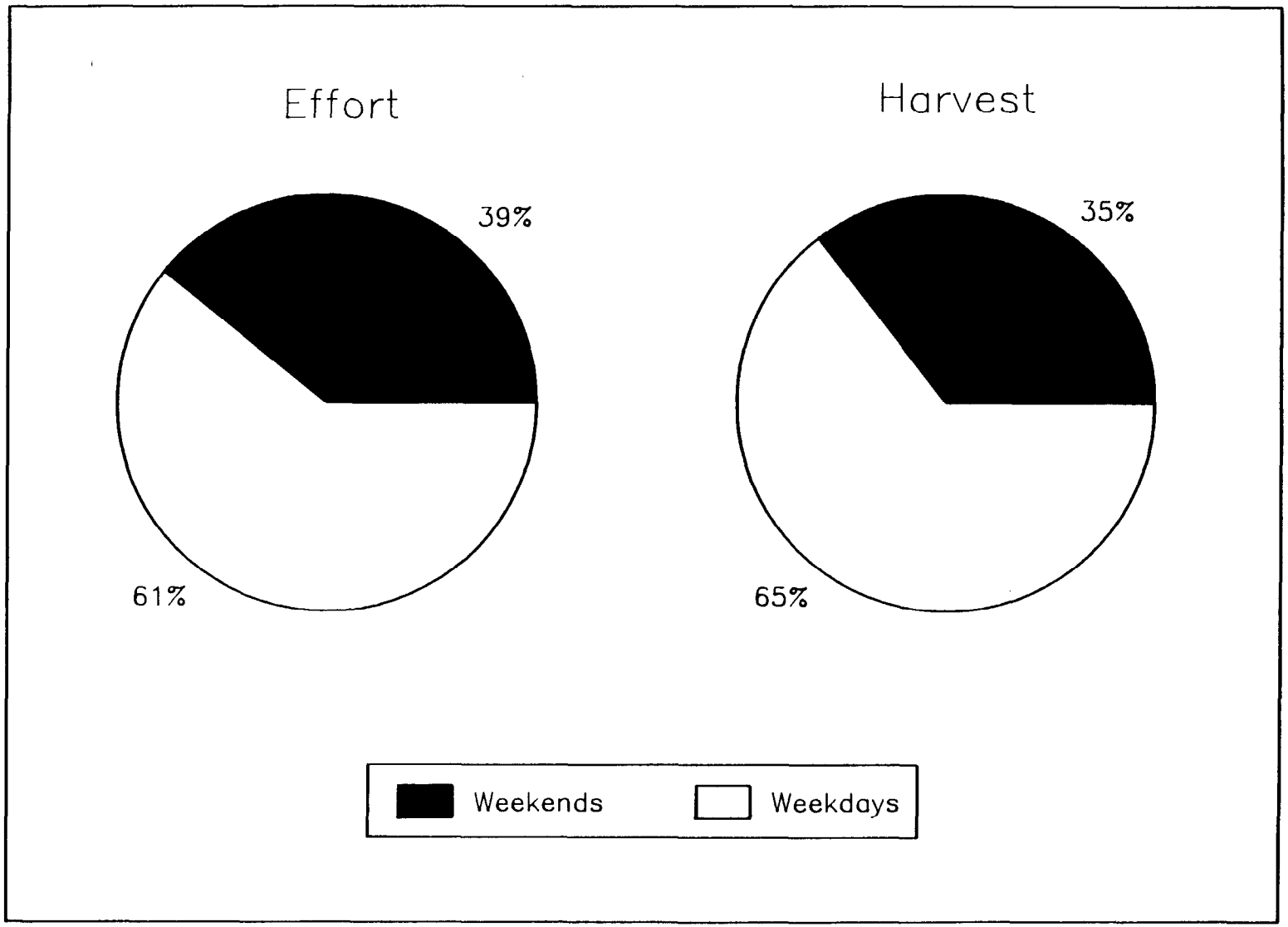

Figure 7. Percentage of coho salmon harvest and effort by anglers on weekends and weekdays during the beach fishery for coho salmon in Resurrection Bay, 1989.

Table 17. Estimated age composition and numbers by sex for the coho salmon harvest by the boat fishery in Resurrection Bay, 1989.

Period[a]	Sex		Brood Year/ Age Group 1986 1.1	1985 2.1	Total
Pre-Derby (n = 106)	Male	Percent	23.6	21.7	45.3
		Number	882	811	1,693
		Standard error	178	170	--
	Female	Percent	31.1	23.6	54.7
		Number	1,163	882	2,045
		Standard error	204	178	--
	Combined	Percent	54.7	45.3	100.0
		Number	2,045	1,693	3,738
		Standard error	271	246	--
Derby (n = 139)	Male	Percent	39.6	20.1	59.7
		Number	3,675	1,865	5,540
		Standard error	403	322	--
	Female	Percent	25.2	15.1	40.3
		Number	2,339	1,401	3,740
		Standard error	351	286	--
	Combined	Percent	64.8	35.2	100.0
		Number	6,014	3,266	9,280
		Standard error	534	431	--
Post-Derby (n = 128)	Male	Percent	43.8	7.8	51.6
		Number	807	144	951
		Standard error	168	50	--
	Female	Percent	41.4	7.0	48.4
		Number	763	129	892
		Standard error	161	47	--
	Combined	Percent	85.2	14.8	100.0
		Number	1,570	273	1,843
		Standard error	232	69	--
Total	Male	Percent	36.7	16.1	52.8
		Number	5,454	2,393	7,847
		Standard error	426	296	--
	Female	Percent	32.2	15.0	47.2
		Number	4,785	2,229	7,014
		Standard error	403	286	--
	Combined	Percent	68.9	31.1	100.0
		Number	10,239	4,622	14,861
		Standard error	587	412	--

[a] n = sample size.

Table 18. Mean length[a] by sex and age group of the coho salmon sampled from the sport harvest of boat anglers in Resurrection Bay, 1989.

Period	Sex		Brood Year/ Age Group 1986 1.1	1985 2.1
Pre-Derby	Male	Length	595	595
		Standard error	8.4	8.7
		Sample size	25	23
	Female	Length	577	580
		Standard error	7.6	7.4
		Sample size	33	25
Derby	Male	Length	599	596
		Standard error	8.6	10.6
		Sample size	55	28
	Female	Length	598	611
		Standard error	7.6	9.4
		Sample size	35	21
Post-Derby	Male	Length	611	631
		Standard error	6.2	12.3
		Sample size	55	10
	Female	Length	605	617
		Standard error	5.9	13.9
		Sample size	53	9

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

Table 19. Estimated age composition and numbers by sex of hatchery chinook salmon harvested by beach anglers in Resurrection Bay, 1989.

Sex		Brood Year and Age Group 1987 0.1	1986 0.2	1985 0.3	1984 0.4	Total
Male	Percent	2.3	4.5	20.5	11.3	38.6
	Number	19	36	166	92	313
	Standard error	18	26	61	44	----
Female	Percent			27.3	34.1	61.4
	Number			221	277	498
	Standard error			73	84	----
Combined	Percent	2.3	4.5	47.8	45.4	100.0
(n = 44)[a]	Number	19	36	387	369	811
	Standard error	18	26	95	95	----

[a] n = sample size.

Table 20. Mean length[a] by sex and age group of hatchery chinook salmon sampled from the sport harvest of beach anglers in Resurrection Bay, 1989.

Sex		Brood Year and Age Group			
		1987	1986	1985	1984
		0.1	0.2	0.3	0.4
Male	Length	370	745	757	858
	Standard Error		85.0	19.6	24.4
	Sample Size	1	2	9	5
Female	Length			783	851
	Standard Error			9.2	8.2
	Sample Size			12	15

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

Table 21. Estimated age composition and numbers by sex for coho salmon harvested by beach anglers in Resurrection Bay, 1989.

Sex		Brood Year and Age Group: 1986 1.1	1985 2.1	Total
Male	Percent	58.1	4.0	62.1
	Number	1,492	103	1,595
	Standard error	313	49	--
Female	Percent	37.1	0.8	37.9
	Number	952	21	973
	Standard error	216	21	--
Combined (n = 124)[a]	Percent	95.2	4.8	100.0
	Number	2,444	124	2,568
	Standard error	380	53	--

[a] n = sample size.

Table 22. Mean length[a] by sex and age group of coho salmon sampled from the sport harvest of beach anglers in Resurrection Bay, 1989.

Sex		Brood Year and Age Group	
		1986 1.1	1985 2.1
Male	Length	601	601
	Standard error	5.2	18.5
	Sample size	72	5
Female	Length	591	601
	Standard error	5.5	4.3
	Sample size	46	7

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

Table 23. Species list of rockfish sampled from the marine sport harvest of the Resurrection Bay boat fishery, 1989.

Common Name	Scientific Name[a]
yelloweye rockfish	*Sebastes ruberrimus*
bocaccio rockfish	*Sebastes paucispinis*
tiger rockfish	*Sebastes nigrocinctus*
china rockfish	*Sebastes nebulosus*
vermillion rockfish	*Sebastes miniatus*
black rockfish	*Sebastes melanops*
quillback rockfish	*Sebastes maliger*
copper rockfish	*Sebastes caurinus*
silvergray rockfish	*Sebastes brevispinis*
Pacific ocean perch	*Sebastes alutus*
dusky rockfish	*Sebastes ciliatus*

[a] Source: Hart 1973.

Table 24. Estimated species composition and numbers by species[a] for the sport harvest of rockfish in the Resurrection Bay marine boat fishery, 1989.

Fishery Period[b]	Species										
	Pacific Ocean Perch	Silvergray	Copper	Quillback	Black[c]	Vermillion	China	Tiger	Bocaccio	Yelloweye	Total
May-June (5/7 - 6/30) (n=132)											
Percent		1.5		2.3	55.2	0.8	0.8			39.4	100.0
Number		97		149	3,574	52	52			2,551	6,475
Standard error		69		85	343	50	50			310	
Pre-Derby (7/1 - 8/11) (n=435)											
Percent		0.7	0.5	1.6	69.9		0.7	0.2	0.7	25.7	100.0
Number		62	45	143	6,237		62	18	62	2,294	8,923
Standard error		36	30	54	428		36	19	36	233	
Derby (8/12 - 8/20) (n=73)											
Percent				2.7	82.2				11.0	4.1	100.0
Number				40	1,231				165	62	1,498
Standard error				29	124				57	35	
Post-Derby (8/21 - 9/10) (n=177)											
Percent	0.6			2.3	87.5		1.7		1.1	6.8	100.0
Number	2			6	230		4		3	18	263
Standard error	2			3	36		3		2	6	
Total											
Percent	<0.1	0.9	0.3	2.0	65.7	0.3	0.7	0.1	1.3	28.7	100.0
Number	2	159	45	338	11,272	52	118	18	230	4,925	17,159
Standard error	2	78	30	105	563	50	62	19	67	389	

[a] Total harvest being apportioned by species includes both civilian and military rockfish harvest.
[b] n = sample size.
[c] Includes both black and dusky rockfish; dusky rockfish were misidentified as black rockfish.

reared smolts released in Seward Lagoon (118,700 smolts) and Lowell Creek (63,800 smolts) in 1988 (Carlon and Vincent-Lang 1989a) also contributed to the sport fishery in 1989.

Hatchery fish comprised an estimated 35.6% of the total recreational harvest of coho salmon in Resurrection Bay (Tables 25 and 26). Hatchery fish comprised an estimated 29.2% of the boat fishery harvest and 72.7% of the beach fishery harvest (Figure 8). The Seward Lagoon release site was the largest contributor to both fisheries followed in order by the Lowell Creek and Bear Lake release sites. As measured by percentage of smolts contributing to the harvest, the Seward Lagoon stocking was most efficient (3.0%) followed by Lowell Creek and Bear Lake (both 2.0%).

Chinook salmon returning to the beach fishery in June and July in 1989 were originally released as hatchery-reared smolts at the Lowell Creek outlet in 1985 (132,700 fish), 1986 (100,900 fish), 1987 (96,000 fish), and 1988 (95,700 fish), and Seward Lagoon in 1988 (109,000 fish). The estimated harvest of chinook salmon by the beach fisheries was 811 (Table 12).

The Lowell Creek release site was first utilized for chinook salmon in 1984 and since 1986, when age 0.2 fish returned, there have been enough returning fish present to support a sport fishery on the Seward beaches. The Seward Lagoon was first stocked with chinook salmon in 1988 and while a small number of age 0.1 fish were harvested in 1989, significant contribution of this release site isn't expected until 1991 when age 0.3 fish first return.

The 1985 Seward Lagoon release of hatchery-reared, Kenai River late run chinook salmon contributed little to the harvest as these fish returned to the area after the early chinook salmon fishery had concluded and anglers began participating in other fisheries.

DISCUSSION

Participation in the July through September segments of the boat fishery reached a record low in 1989 as indicated by the estimated number of boat-trips of effort (5,022). However, the harvest of coho salmon was near average (14,861) (Figure 9) indicating a strong return to Resurrection Bay. Effort was down approximately 30% from the historical average, but the 1989 catch rate was 50% higher than the historical average. One possible reason for the observed decrease in effort during 1989 was the increase in employment opportunities to local residents associated with the cleanup of oil from the tanker EXXON Valdez.

Age 2.1 coho salmon returning to Resurrection Bay in 1989 survived the 1986 flood as age 0^+ juveniles. This age group comprised approximately 30% of the boat harvest. This is near the historical average reported by Vincent-Lang (1986) indicating that the flood may not have had a significant deleterious effect on this age group.

Participation in the 1989 beach fisheries for coho and chinook salmon declined from high levels in 1988. The 1989 harvest of coho salmon in the

Table 25. Estimated contribution of coho salmon from the Bear Lake, Seward Lagoon, and Lowell Creek release sites, by fishery segment, to the Resurrection Bay boat fishery, 1989.

Strata	Number	Standard Error	Covariance
PRE-DERBY & DERBY			
Bear Lake	1,042	126	0.0013
Seward Lagoon	1,749	190	0.0013
Lowell Creek	655	90	0.0013
Total	3,446	245	
POST-DERBY			
Bear Lake	204	86	-0.0137
Seward Lagoon	431	147	-0.0137
Lowell Creek	264	94	-0.0137
Total	899	195	
SEASON			
Bear Lake	1,246	153	
Seward Lagoon	2,180	240	
Lowell Creek	919	130	
Total	4,345	313	

Table 26. Estimated contribution of coho salmon from the Bear Lake, Seward Lagoon, and Lowell Creek release sites to the Resurrection Bay boat and beach fisheries, 1989.

	Boat Fishery		Beach Fishery		Total[a]	
Source	Number	SE	Number	SE	Number	SE
Bear Lake	1,246	153	54	54	1,300	162
Seward Lagoon	2,180	240	1,438	401	3,618	467
Lowell Creek	919	130	374	145	1,293	195
Total Enhanced	4,345	313	1,866	430	6,211	532
Wild[b]	10,516	663	702	661	11,218	936
Total Harvest	14,861	584	2,568	502	17,429	770

[a] Total harvest by boat fisheries and beach fisheries combined.

[b] Computed as the difference of total harvest less enhanced harvest.

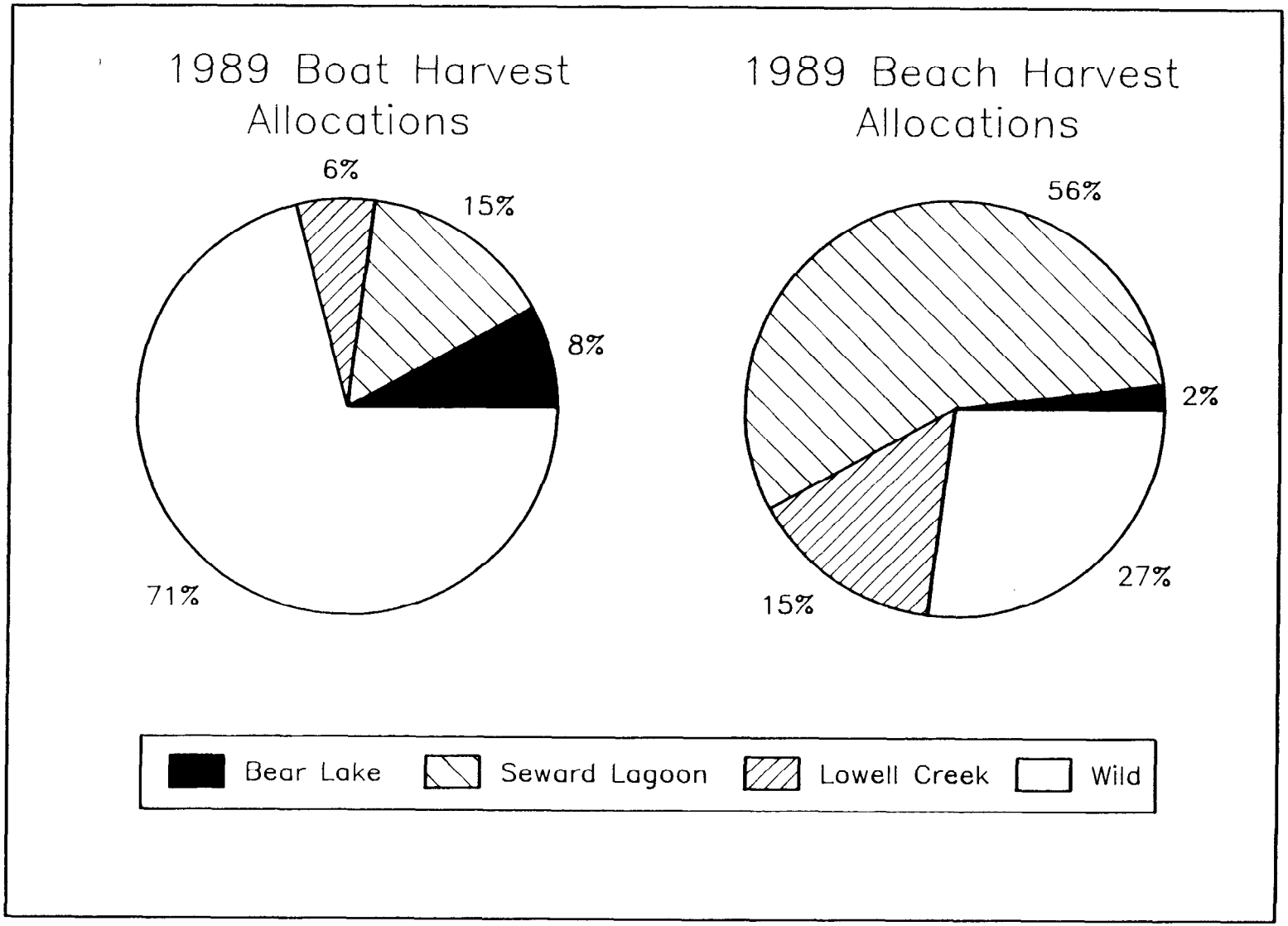

Figure 8. Estimated contribution of hatchery stocks to the coho salmon harvest of the Resurrection Bay boat and beach fisheries, 1989.

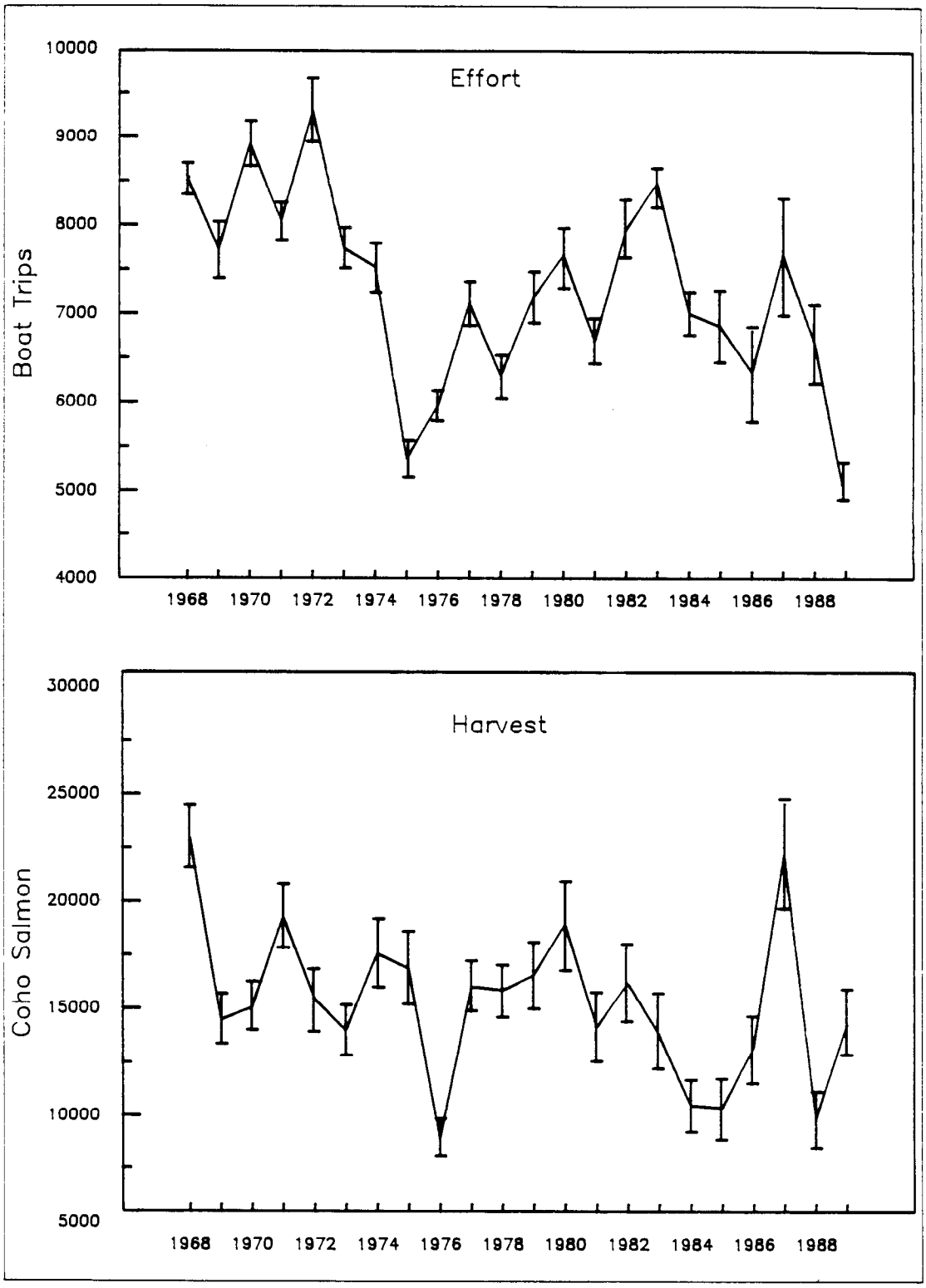

Figure 9. Historical coho salmon harvest and effort estimates for the Resurrection Bay boat fishery, 1968-1989 (vertical bars represent 95% confidence intervals).

beach fishery represents a 45% decline in harvest while effort declined by 49%. Catch rates between the two years were similar and the number of smolts released to support the 1989 fishery (182,000) was greater than the number released to support the 1988 fishery (123,000). The chinook salmon fishery exhibited a similar decline in harvest (38% decline) and effort (36% decline) from 1988 levels. As was the case with the boat fishery, one possible reason for the observed decrease in effort during 1989 was the increase in employment opportunities to local residents associated with the cleanup of oil from the tanker EXXON Valdez.

The return of age 0.4 late run chinook salmon from the 1985 release Kenai River late run fish did not result in a targeted fishery. Several large fish were captured incidentally and, as in 1988 when several age 0.3 fish were captured, the capture of these large fish generated much local interest. With continued stocking and publicity, a viable fishery will likely develop around late run timing.

RECOMMENDATIONS

1. It is our recommendation that the creel surveys of the marine sport fisheries in Resurrection Bay be discontinued. Estimates of harvest in these fisheries can be generated using the Statewide mail-out harvest survey (SHS) (Mills 1989). This survey has generated harvest estimates for coho salmon that are comparable to those generated from the on-site creel survey (Table 27). This action would result in the loss of the capability of determining harvest in-season (the SHS estimates are a year late), which could hurt inseason management of the coho fisheries. However, since the inception of the creel survey, no Emergency Orders have been issued inseason with respect to the marine sport fisheries.

2. The estimation of marked-to-unmarked ratios of stocked fish harvested in the marine fisheries should be continued as well as the collection of heads from fish missing their adipose fins. This information is needed to continue the assessment of stocking strategies in the bay for coho salmon.

3. Continue the speciation of rockfish harvested in the marine sport fisheries and initiate an age and length data base for groundfish harvested in the marine sport fisheries of Resurrection Bay. Harvests of halibut and rockfish in marine sport fisheries of Resurrection Bay are increasing (Figure 10). To assure that these stocks are not being overexploited, it is necessary to initiate a data base on age and length information on these species.

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Table 27. Comparison of estimates of harvest of coho salmon in the marine sport fisheries of Resurrection Bay generated from the Statewide Mail Survey (SHS) and the on-site creel survey.

Year	SHS[a]	CREEL SURVEY	DIFFERENCE
1977	14,528	16,003	9.2%
1978	16,731	15,819	-5.8%
1979	14,315	16,532	13.4%
1980	19,665	18,918	-3.9%
1981	14,721	14,087	-4.5%
1982	18,518	16,160	-14.6%
1983	11,277	13,780	18.2%
1984	9,727	10,445	6.9%
1985	11,227	10,332	-8.7%
1986	14,418	15,191[b]	5.1%
1987	24,220	23,769[b]	-1.9%
1988	17,626	14,527[b]	-21.3%
MEAN	15,581	15,464	-0.8%

[a] From Mills (1978-1989)
[b] Includes estimates from beach and boat creels.

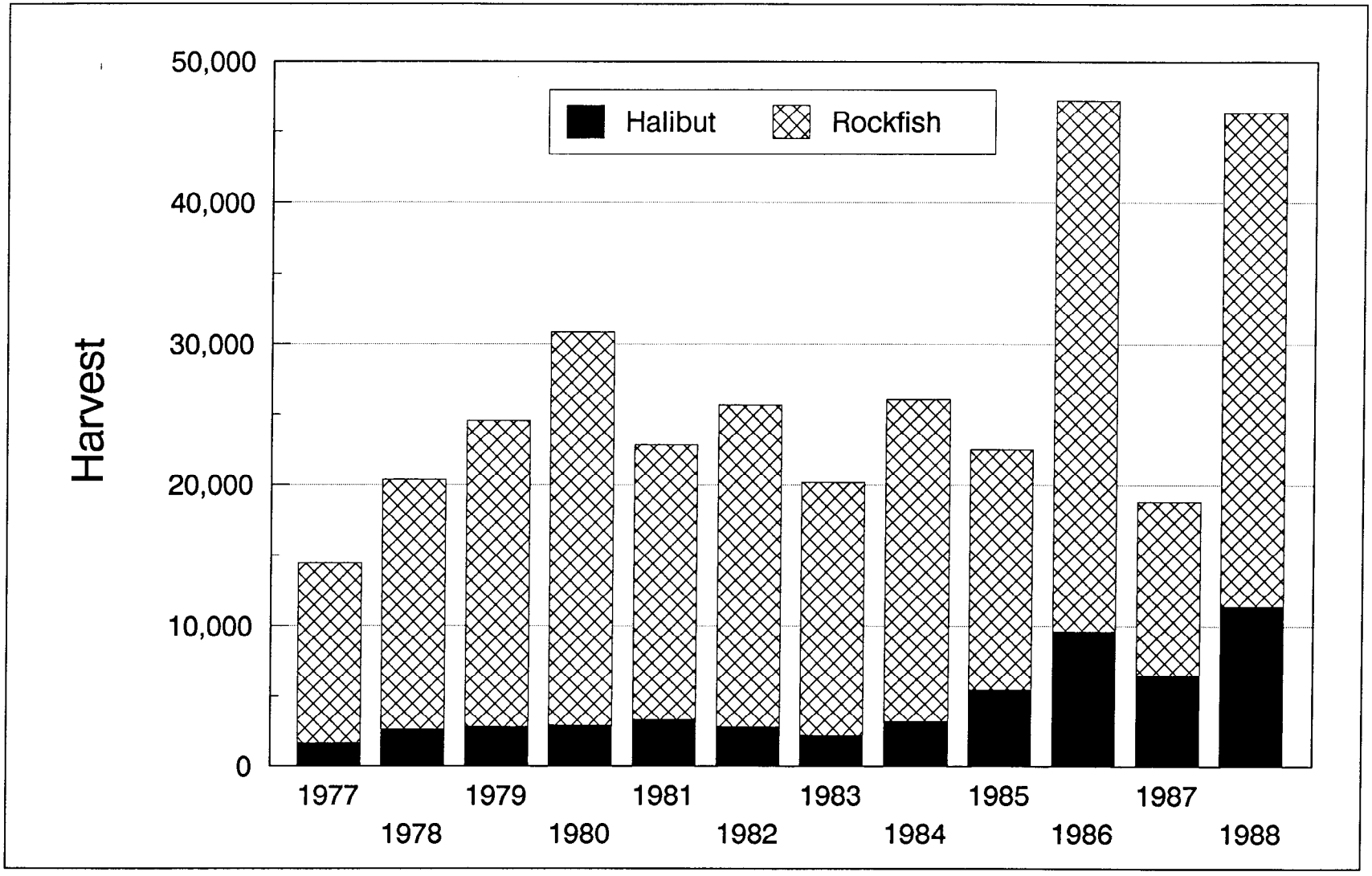

Figure 10. Harvests of halibut and rockfish in the marine sport fisheries of Resurrection Bay, Alaska (Mills 1978-1989).

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APPENDIX A

Appendix A1. Counts of private and charter boats made during the creel survey of the Resurrection Bay boat fishery, 1989.

Date	Wd/[a] We	Period A	B	C	D
6/03	We			2	0
6/04	We			38	7
6/05	Wd	0		31	3
6/06	Wd				
6/07	Wd				
6/08	Wd	1			8
6/09	Wd		2	3	10
6/10	We	0		59	21
6/11	We				19
6/12	Wd				
6/13	Wd				
6/14	Wd			5	
6/15	Wd	1		10	
6/16	Wd			14	12
6/17	We		9	33	
6/18	We			18	
6/19	Wd			8	1
6/20	Wd			10	
6/21	Wd				
6/22	Wd				
6/23	Wd		4	11	
6/24	We		9	58	
6/25	We	2			
6/26	Wd		7		
6/27	Wd		2	7	
6/28	Wd			9	4
6/29	Wd				
6/30	Wd				
7/01	We			18	18
7/02	We	5		34	5
7/03	Wd			17	20
7/04	We		23		12
7/05	Wd			12	5
7/06	Wd				
7/07	Wd				
7/08	We		11	24	14
7/09	We			46	

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Appendix A1. (page 2 of 3)

Date	Wd/[a] We	Period A	B	C	D
7/10	Wd				
7/11	Wd				
7/12	Wd		4	13	
7/13	Wd			6	1
7/14	Wd		2	5	2
7/15	We	3	5	18	
7/16	We		34		
7/17	Wd				
7/18	Wd				
7/19	Wd		3	13	5
7/20	Wd			12	5
7/21	Wd	1	2	12	
7/22	We	2		33	11
7/23	We		44		3
7/24	Wd				
7/25	Wd				
7/26	Wd		9	23	5
7/27	Wd			26	
7/28	Wd			23	4
7/29	We			50	8
7/30	We			62	8
7/31	Wd			17	8
8/01	Wd		3	9	5
8/02	Wd			16	6
8/03	Wd				
8/04	Wd				
8/05	We				
8/06	We			76	25
8/07	Wd			22	10
8/08	Wd	1	8	16	
8/09	Wd			13	3
8/10	Wd				
8/11	Wd				
8/12	We	27	83	188	58
8/13	We	19	142	138	38
8/14	Wd	10	60	127	49

-Continued-

Appendix A1. (page 3 of 3)

Date	Wd/[a] We	Period A	B	C	D
8/15	Wd	13	87	129	32
8/16	Wd	10	74	86	30
8/17	Wd	11	36	143	70
8/18	Wd	12	62	119	61
8/19	We	17	89	220	113
8/20	We	151			
8/21	Wd				
8/22	Wd				
8/23	Wd		27	9	
8/24	Wd			21	10
8/25	Wd	3	7	6	
8/26	We		9	25	
8/27	We	3		22	5
8/28	Wd	0	5		
8/29	Wd		2	5	6
8/30	Wd				
8/31	Wd				
9/01	Wd		3	6	
9/02	We		7		30
9/03	We		28		
9/04	We	2	30	18	4
9/05	Wd		1		
9/06	Wd		3	5	
9/07	Wd				
9/08	Wd				
9/09	We		5		0
9/10	We		10	18	

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

Appendix A2. Daily mean effort and harvest of coho salmon, halibut, rockfish, and lingcod per boat-trip for anglers fishing from private boats during the Resurrection Bay boat fishery, 1989.

Date[a]	We/ Wd[b]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
6/04	We	5	4.5	0.67	0.00	0.000	0.40	0.245	1.00	0.447	0.20	0.200
6/05	Wd	2	4.5	2.50	0.00	0.000	0.50	0.500	1.50	1.500	2.50	2.500
6/10	We	10	6.9	0.97	0.00	0.000	1.30	1.193	0.50	0.269	1.80	1.093
6/11	We	6	5.3	1.15	0.00	0.000	1.00	1.000	3.17	1.515	5.83	0.601
6/16	Wd	7	19.5	6.00	0.00	0.000	1.43	0.528	0.00	0.000	1.00	0.488
6/17	We	9	6.8	0.75	0.00	0.000	1.56	0.530	0.78	0.547	0.56	0.242
6/18	We	6	3.9	0.95	0.00	0.000	0.83	0.477	6.67	4.364	2.17	0.946
6/19	Wd	4	4.0	1.40	0.00	0.000	0.00	0.000	2.00	1.414	1.50	0.957
6/24	We	12	6.8	0.78	0.00	0.000	1.08	0.633	1.42	0.679	1.58	0.988
6/26	Wd	6	4.3	0.73	0.00	0.000	0.17	0.167	1.67	1.085	0.33	0.211
6/27	Wd	2	5.8	0.25	0.00	0.000	0.00	0.000	4.50	4.500	0.50	0.500
6/28	Wd	4	5.3	1.83	0.00	0.000	0.75	0.750	8.00	4.708	1.25	0.946
7/01	We	7	3.8	1.04	0.00	0.000	1.43	0.685	2.43	2.429	0.57	0.571
7/02	We	15	4.8	0.49	0.00	0.000	0.60	0.254	3.53	1.621	1.60	0.821
7/03	Wd	11	6.7	1.04	0.09	0.091	0.27	0.141	2.64	1.410	1.64	0.742
7/04	We	18	6.8	1.25	0.00	0.000	0.39	0.143	2.22	0.717	2.00	0.836
7/05	Wd	10	6.0	0.52	0.00	0.000	0.60	0.306	3.70	1.528	0.90	0.605
7/08	We	26	5.4	0.43	0.23	0.231	0.85	0.371	4.73	1.699	1.73	0.619
7/09	We	23	6.3	0.55	1.04	0.539	0.65	0.256	2.96	0.856	2.17	0.543
7/12	Wd	4	6.0	0.41	8.25	3.326	0.00	0.000	2.50	2.500	1.00	1.000
7/13	Wd	2	7.5	2.50	0.00	0.000	0.50	0.500	6.50	6.500	0.00	0.000
7/14	Wd	4	3.1	1.05	1.00	1.000	0.00	0.000	0.25	0.250	0.00	0.000
7/15	We	14	5.7	0.52	1.57	0.875	0.29	0.163	0.79	0.300	0.00	0.000
7/16	We	14	5.9	0.38	1.71	0.815	0.14	0.143	0.71	0.641	0.29	0.194
7/19	Wd	9	7.2	0.54	1.44	0.959	0.67	0.441	4.00	1.826	2.44	0.766
7/20	Wd	5	6.1	0.81	1.20	0.970	0.80	0.490	10.00	8.361	2.20	1.114

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Date[a]	We/ Wd[b]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
7/21	Wd	4	5.8	0.25	3.00	1.780	0.50	0.289	4.25	2.394	2.00	1.225
7/22	We	16	6.5	0.45	1.25	0.588	0.44	0.258	8.44	3.567	1.38	0.645
7/23	We	26	4.3	0.40	1.00	0.304	0.15	0.072	1.54	0.791	0.92	0.359
7/26	Wd	18	5.8	0.39	3.56	0.981	0.28	0.226	1.89	1.029	0.50	0.218
7/27	Wd	11	7.1	1.38	5.27	1.280	0.00	0.000	0.82	0.553	0.18	0.122
7/28	Wd	11	7.5	1.24	3.91	1.534	0.55	0.247	1.82	1.016	1.27	0.915
7/29	We	26	5.7	0.42	3.12	0.643	0.23	0.160	0.12	0.085	0.38	0.242
7/30	We	29	6.2	0.27	2.28	0.534	0.48	0.190	0.14	0.108	1.00	0.455
7/31	Wd	11	5.9	0.83	1.91	0.694	0.82	0.724	0.36	0.364	0.00	0.000
8/01	Wd	9	6.3	0.60	3.89	1.982	0.11	0.111	0.56	0.556	0.00	0.000
8/02	Wd	13	6.1	0.46	5.46	1.101	0.00	0.000	0.00	0.000	0.08	0.077
8/06	We	45	6.3	0.56	2.27	0.331	0.40	0.129	0.82	0.427	0.40	0.154
8/07	Wd	12	4.3	0.75	2.33	0.655	1.00	0.537	0.08	0.083	0.08	0.083
8/08	Wd	14	4.4	0.44	3.14	0.818	0.57	0.571	0.07	0.071	0.07	0.071
8/09	Wd	9	3.0	0.45	4.22	1.631	0.00	0.000	0.11	0.111	0.00	0.000
8/12	We	137	6.7	0.21	2.85	0.266	0.07	0.033	0.32	0.099	0.06	0.027
8/13	We	124	6.1	0.23	2.64	0.287	0.10	0.056	0.65	0.296	0.24	0.166
8/14	Wd	117	6.6	0.24	3.26	0.318	0.09	0.055	0.04	0.035	0.07	0.036
8/15	Wd	83	6.8	0.26	4.49	0.492	0.01	0.012	0.30	0.154	0.13	0.076
8/16	Wd	104	6.6	0.25	4.79	0.490	0.04	0.038	0.02	0.014	0.01	0.010
8/17	Wd	125	7.2	0.31	4.62	0.381	0.00	0.000	0.04	0.040	0.05	0.030
8/18	Wd	131	6.8	0.56	4.15	0.354	0.08	0.045	0.02	0.011	0.02	0.011
8/19	We	171	6.9	0.21	3.69	0.288	0.08	0.043	0.40	0.187	0.08	0.038
8/20	We	75	3.4	0.21	2.00	0.315	0.01	0.013	0.04	0.030	0.00	0.000
8/23	Wd	21	4.1	0.45	1.19	0.335	0.00	0.000	0.00	0.000	0.00	0.000
8/24	Wd	18	4.8	0.53	3.94	0.884	0.06	0.056	0.00	0.000	0.00	0.000
8/25	Wd	7	3.6	0.61	0.57	0.571	0.29	0.286	0.00	0.000	0.00	0.000

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Date[a]	We/ Wd[b]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
8/26	We	23	5.0	0.51	0.78	0.295	0.30	0.193	0.35	0.348	0.09	0.087
8/27	We	18	6.4	0.83	3.00	0.804	0.17	0.121	0.33	0.333	0.11	0.111
8/29	Wd	6	4.5	1.25	1.67	1.054	0.00	0.000	0.00	0.000	0.00	0.000
9/01	Wd	6	4.2	0.95	0.67	0.333	0.00	0.000	0.00	0.000	0.00	0.000
9/02	We	22	5.9	2.29	0.68	0.232	0.00	0.000	0.14	0.136	0.14	0.136
9/03	We	13	3.6	0.47	1.15	0.406	0.08	0.077	0.62	0.538	0.31	0.237
9/04	We	41	5.1	0.55	3.44	0.583	0.12	0.052	0.44	0.273	0.20	0.117
9/06	Wd	4	2.9	1.16	0.25	0.250	0.00	0.000	0.00	0.000	0.00	0.000
9/09	We	4	3.8	1.26	0.75	0.750	0.00	0.000	0.00	0.000	0.00	0.000
9/10	We	19	5.4	0.56	1.89	0.692	0.32	0.217	0.16	0.158	0.05	0.053

a Excludes days on which only one private boat was interviewed.

b Weekend-Holiday (We) or weekday (Wd).

Appendix A3. Daily mean effort and harvest of coho salmon, halibut, rockfish, and lingcod per boat-trip for anglers fishing from charter boats during the Resurrection Bay boat fishery, 1989.

Date[a]	We/ Wd[b]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
6/10[c]	We	5	4.2	1.08	0.00	0.000	0.00	0.000	1.80	1.200	0.20	0.200
6/11	We	3	7.2	0.60	0.00	0.000	4.67	1.764	0.00	0.000	0.00	0.000
6/16	Wd	4	6.5	0.29	0.00	0.000	1.75	0.479	2.75	1.702	2.00	0.707
6/17	We	2	8.5	0.50	0.00	0.000	1.00	1.000	1.50	1.500	0.50	0.500
6/18	We	5	8.0	0.95	0.00	0.000	3.20	1.241	2.40	1.939	0.00	0.000
6/19	Wd	2	8.0	2.00	0.00	0.000	5.00	5.000	5.50	2.500	4.00	4.000
6/20	Wd	3	7.7	0.93	0.00	0.000	1.67	1.202	1.67	0.667	1.33	1.333
6/23	Wd	4	7.4	0.63	0.00	0.000	0.75	0.750	0.50	0.500	2.75	1.377
6/24	We	4	7.0	0.61	0.00	0.000	0.50	0.500	1.50	1.500	3.00	2.677
6/27	Wd	2	4.5	1.50	0.00	0.000	8.00	4.000	2.50	2.500	0.00	0.000
6/28	Wd	5	5.6	0.48	0.20	0.200	6.20	2.154	4.00	2.510	1.40	0.872
7/01	We	2	8.5	1.50	0.00	0.000	5.50	0.500	0.50	0.500	0.00	0.000
7/02	We	6	6.0	1.22	0.17	0.167	1.50	0.500	5.33	3.383	0.50	0.342
7/03	Wd	7	7.6	0.32	0.71	0.714	4.14	1.370	3.86	2.293	0.71	0.565
7/04	We	2	6.0	2.00	0.00	0.000	7.50	2.500	0.00	0.000	5.00	5.000
7/05	Wd	3	8.0	0.00	1.00	1.000	0.67	0.667	12.67	1.667	0.67	0.667
7/08	We	4	5.8	1.11	0.00	0.000	1.50	1.190	3.25	1.601	3.75	2.496
7/12	Wd	2	9.5	4.50	0.00	0.000	3.50	3.500	0.50	0.500	0.00	0.000
7/13	Wd	2	9.0	0.00	0.00	0.000	1.00	1.000	0.00	0.000	6.00	0.000
7/16	We	3	6.0	1.53	3.00	3.000	1.00	1.000	0.00	0.000	4.67	4.667
7/19	Wd	3	8.3	0.33	4.67	4.177	2.67	2.186	0.67	0.333	2.00	2.000
7/20	Wd	5	6.6	0.51	4.00	4.000	2.60	2.112	2.20	2.200	2.40	1.600
7/21	Wd	2	7.0	0.00	0.00	0.000	3.50	0.500	0.00	0.000	2.00	0.000
7/22	We	5	6.0	0.77	0.00	0.000	3.20	1.393	0.00	0.000	6.00	2.470
7/23	We	3	4.2	1.42	0.33	0.333	0.00	0.000	1.00	0.577	1.33	1.333

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Date[a]	We/ Wd[b]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
7/26	Wd	4	5.1	1.66	3.50	3.500	1.00	0.707	4.75	3.816	1.25	1.250
7/27	Wd	5	6.5	0.50	3.00	3.000	1.80	0.860	0.20	0.200	2.80	1.960
7/28	Wd	6	8.2	0.48	3.00	2.160	1.17	1.167	1.67	1.667	2.00	1.483
7/29	We	2	8.0	0.00	8.50	1.500	0.00	0.000	1.00	1.000	0.00	0.000
7/30	We	5	6.9	0.78	1.80	1.114	0.80	0.800	3.00	1.483	1.00	1.000
7/31	Wd	3	6.7	0.88	4.00	2.082	0.67	0.667	3.67	3.180	0.33	0.333
8/01	Wd	2	6.0	1.00	4.00	4.000	1.00	1.000	1.00	0.000	0.00	0.000
8/06	We	6	7.3	0.68	1.17	1.167	3.17	1.276	1.50	1.147	1.17	0.749
8/07	Wd	5	6.8	0.80	4.20	2.691	3.20	1.497	1.80	1.356	0.40	0.400
8/08	Wd	3	6.7	0.88	4.00	2.082	2.33	2.333	0.00	0.000	0.33	0.333
8/12	We	3	7.0	0.00	8.67	3.180	0.33	0.333	0.00	0.000	0.00	0.000
8/13	We	5	8.4	0.40	6.60	1.749	0.40	0.400	0.00	0.000	0.40	0.400
8/14	Wd	9	6.9	0.77	7.67	1.810	1.00	1.000	0.00	0.000	0.78	0.662
8/15	Wd	5	8.0	0.00	10.40	1.833	0.00	0.000	0.00	0.000	0.00	0.000
8/16	Wd	4	6.3	1.18	5.50	2.255	0.75	0.750	0.00	0.000	1.50	1.500
8/17	Wd	5	6.7	0.44	2.20	1.428	0.80	0.490	4.40	4.400	1.40	0.927
8/18	Wd	6	7.5	0.50	6.83	2.151	0.00	0.000	0.00	0.000	0.50	0.500
8/19	We	5	8.3	0.66	3.80	2.375	0.60	0.400	0.00	0.000	1.20	1.200
8/23	Wd	3	6.0	1.00	12.00	1.528	0.00	0.000	0.00	0.000	0.00	0.000
8/24	Wd	3	6.7	1.33	18.00	3.786	0.00	0.000	0.00	0.000	0.00	0.000
8/26	We	4	7.3	0.75	1.50	1.190	0.00	0.000	0.00	0.000	0.00	0.000
8/27	We	3	6.0	1.15	10.00	2.082	0.00	0.000	0.00	0.000	0.00	0.000
8/29	Wd	2	6.3	1.25	0.00	0.000	1.00	1.000	0.50	0.500	3.00	2.000

[a] Excludes days on which only one charter boat was interviewed.

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

[c] First day on which charter boat anglers were interviewed.

Appendix A4. Daily mean effort and harvest of coho salmon, halibut, rockfish, and lingcod per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay boat fishery, 1989.

Date	We/ Wd[a]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
6/04	We	5	4.5	0.67	0.00	0.000	0.40	0.245	1.00	0.447	0.20	0.200
6/05	Wd	2	4.5	2.50	0.00	0.000	0.50	0.500	1.50	1.500	2.50	2.500
6/09	Wd	2	5.8	2.75	0.00	0.000	0.50	0.500	0.50	0.500	0.00	0.000
6/10	We	15	6.0	0.80	0.00	0.000	0.87	0.798	0.93	0.441	1.27	0.746
6/11	We	9	5.9	0.82	0.00	0.000	2.22	1.024	2.11	1.111	3.89	1.047
6/16	Wd	11	14.8	4.20	0.00	0.000	1.55	0.366	1.00	0.701	1.36	0.411
6/17	We	11	7.1	0.65	0.00	0.000	1.45	0.455	0.91	0.495	0.55	0.207
6/18	We	11	5.8	0.91	0.00	0.000	1.91	0.694	4.73	2.516	1.18	0.600
6/19	Wd	6	5.3	1.33	0.00	0.000	1.67	1.667	3.17	1.327	2.33	1.308
6/20	Wd	3	7.7	0.93	0.00	0.000	1.67	1.202	1.67	0.667	1.33	1.333
6/23	Wd	5	8.3	1.04	0.00	0.000	1.40	0.872	1.00	0.632	2.60	1.077
6/24	We	16	6.8	0.59	0.00	0.000	0.94	0.487	1.44	0.605	1.94	0.959
6/26	Wd	7	4.4	0.62	0.00	0.000	0.14	0.143	1.71	0.918	0.29	0.184
6/27	Wd	4	5.1	0.72	0.00	0.000	4.00	2.828	3.50	2.179	0.25	0.250
6/28	Wd	9	5.4	0.79	0.11	0.111	3.78	1.516	5.78	2.437	1.33	0.601
7/01	We	8	5.4	1.02	0.00	0.000	2.63	0.844	2.25	2.111	0.50	0.500
7/02	We	21	5.2	0.49	0.05	0.048	0.86	0.242	4.05	1.471	1.29	0.598
7/03	Wd	18	7.1	0.65	0.33	0.280	1.78	0.689	3.11	1.207	1.28	0.504
7/04	We	20	6.7	1.14	0.00	0.000	1.10	0.538	2.00	0.661	2.30	0.859
7/05	Wd	13	6.4	0.47	0.23	0.231	0.62	0.266	5.77	1.626	0.85	0.478
7/08	We	30	5.5	0.39	0.20	0.200	0.93	0.352	4.53	1.484	2.00	0.623
7/09	We	23	6.3	0.55	1.04	0.539	0.65	0.256	2.96	0.856	2.17	0.543
7/12	Wd	6	7.2	1.40	5.50	2.729	1.17	1.167	1.83	1.641	0.67	0.667
7/13	Wd	4	8.3	1.11	0.00	0.000	0.75	0.479	3.25	3.250	3.00	1.732
7/14	Wd	4	3.1	1.05	1.00	1.000	0.00	0.000	0.25	0.250	0.00	0.000
7/15	We	14	5.7	0.52	1.57	0.875	0.29	0.163	0.79	0.300	0.00	0.000

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Appendix A4. (page 2 of 3)

Date	We/ Wd[a]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
7/16	We	17	5.9	0.38	1.94	0.811	0.29	0.206	0.59	0.529	1.06	0.825
7/19	Wd	12	7.5	0.43	2.25	1.213	1.17	0.626	3.17	1.419	2.33	0.711
7/20	Wd	10	6.3	0.46	2.60	1.996	1.70	1.065	6.10	4.278	2.30	0.920
7/21	Wd	6	6.2	0.31	2.00	1.291	1.50	0.671	2.83	1.759	2.00	0.775
7/22	We	21	6.4	0.39	0.95	0.460	1.10	0.447	6.43	2.814	2.48	0.850
7/23	We	29	4.3	0.38	0.93	0.276	0.14	0.065	1.48	0.710	0.97	0.342
7/26	Wd	22	5.7	0.42	3.55	0.978	0.41	0.225	2.41	1.066	0.64	0.276
7/27	Wd	16	6.9	0.95	4.56	1.255	0.56	0.329	0.63	0.386	1.00	0.652
7/28	Wd	17	7.7	0.81	3.59	1.216	0.76	0.425	1.76	0.851	1.53	0.768
7/29	We	28	5.8	0.40	3.50	0.658	0.21	0.149	0.18	0.104	0.36	0.225
7/30	We	34	6.3	0.26	2.21	0.479	0.53	0.195	0.56	0.281	1.00	0.409
7/31	Wd	14	6.1	0.67	2.36	0.700	0.79	0.576	1.07	0.745	0.07	0.071
8/01	Wd	11	6.2	0.50	3.91	1.692	0.27	0.195	0.64	0.453	0.00	0.000
8/02	Wd	13	6.1	0.46	5.46	1.101	0.00	0.000	0.00	0.000	0.08	0.077
8/06	We	51	6.4	0.50	2.14	0.322	0.73	0.219	0.90	0.397	0.49	0.162
8/07	Wd	17	5.1	0.63	2.88	0.887	1.65	0.606	0.59	0.421	0.18	0.128
8/08	Wd	17	4.8	0.44	3.29	0.741	0.88	0.606	0.06	0.059	0.12	0.081
8/09	Wd	10	3.3	0.50	4.20	1.459	0.00	0.000	0.10	0.100	0.00	0.000
8/12	We	140	6.7	0.21	2.97	0.276	0.07	0.033	0.31	0.097	0.06	0.026
8/13	We	129	6.2	0.23	2.79	0.290	0.12	0.056	0.62	0.285	0.25	0.160
8/14	Wd	126	6.7	0.23	3.58	0.335	0.15	0.087	0.04	0.033	0.12	0.058
8/15	Wd	88	6.9	0.25	4.81	0.496	0.01	0.011	0.28	0.145	0.13	0.072
8/16	Wd	108	6.6	0.25	4.81	0.477	0.06	0.046	0.02	0.013	0.06	0.056
8/17	Wd	130	7.2	0.29	4.52	0.371	0.03	0.022	0.21	0.173	0.10	0.049
8/18	Wd	137	6.9	0.54	4.27	0.352	0.07	0.044	0.01	0.010	0.04	0.024
8/19	We	176	6.9	0.20	3.69	0.286	0.09	0.044	0.39	0.182	0.11	0.050
8/20	We	71	3.6	0.20	2.20	0.327	0.01	0.014	0.04	0.031	0.00	0.000

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Date	We/ Wd[a]	No. Boats Interviewed	Mean Effort (hrs/trip)	SE Effort	Coho Salmon Mean Harvest (harvest/trip)	Coho Salmon SE Harvest	Halibut Mean Harvest (harvest/trip)	Halibut SE Harvest	Rockfish Mean Harvest (harvest/trip)	Rockfish SE Harvest	Lingcod Mean Harvest (harvest/trip)	Lingcod SE Harvest
8/23	Wd	24	4.3	0.43	2.54	0.816	0.00	0.000	0.00	0.000	0.00	0.000
8/24	Wd	21	5.1	0.50	5.95	1.408	0.05	0.048	0.00	0.000	0.00	0.000
8/25	Wd	7	3.6	0.61	0.57	0.571	0.29	0.286	0.00	0.000	0.00	0.000
8/26	We	26	5.6	0.44	0.92	0.308	0.27	0.171	0.31	0.308	0.08	0.077
8/27	We	21	6.3	0.72	4.00	0.913	0.14	0.104	0.29	0.286	0.10	0.095
8/29	Wd	8	4.9	0.99	1.25	0.818	0.25	0.250	0.13	0.125	0.75	0.620
9/01	Wd	6	4.2	0.95	0.67	0.333	0.00	0.000	0.00	0.000	0.00	0.000
9/02	We	22	5.9	2.29	0.68	0.232	0.00	0.000	0.14	0.136	0.14	0.136
9/03	We	13	3.6	0.47	1.15	0.406	0.08	0.077	0.62	0.538	0.31	0.237
9/04	We	41	5.1	0.55	3.44	0.583	0.12	0.052	0.44	0.273	0.20	0.117
9/06	Wd	4	2.9	1.16	0.25	0.250	0.00	0.000	0.00	0.000	0.00	0.000
9/09	We	4	3.8	1.26	0.75	0.750	0.00	0.000	0.00	0.000	0.00	0.000
9/10	We	20	5.5	0.55	1.80	0.663	0.30	0.206	0.35	0.244	0.05	0.050

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

Appendix A5. Daily mean harvest of chinook and pink salmon per boat-trip for anglers fishing from private and charter boats during the Resurrection Bay boat fishery, 1989.

Date	We/ Wd[a]	Chinook Salmon		Pink Salmon	
		Harvest	SE	Harvest	SE
6/04	We	0.00	0.000	0.00	0.000
6/05	Wd	0.00	0.000	0.00	0.000
6/09	Wd	0.00	0.000	0.00	0.000
6/10	We	0.20	0.145	0.00	0.000
6/11	We	0.00	0.000	0.00	0.000
6/16	Wd	0.00	0.000	0.00	0.000
6/17	We	0.00	0.000	0.00	0.000
6/18	We	0.00	0.000	0.00	0.000
6/19	Wd	0.00	0.000	0.00	0.000
6/20	Wd	0.00	0.000	0.00	0.000
6/23	Wd	0.00	0.000	0.00	0.000
6/24	We	0.00	0.000	0.00	0.000
6/26	Wd	0.00	0.000	0.00	0.000
6/27	Wd	0.00	0.000	0.00	0.000
6/28	Wd	0.00	0.000	0.00	0.000
7/01	We	0.00	0.000	0.00	0.000
7/02	We	0.00	0.000	0.10	0.095
7/03	Wd	0.00	0.000	0.00	0.000
7/04	We	0.00	0.000	0.00	0.000
7/05	Wd	0.00	0.000	0.00	0.000
7/08	We	0.00	0.000	0.03	0.033
7/09	We	0.04	0.043	0.00	0.000
7/12	Wd	0.00	0.000	0.00	0.000
7/13	Wd	0.00	0.000	0.00	0.000
7/14	Wd	0.00	0.000	0.00	0.000
7/15	We	0.07	0.071	0.00	0.000
7/16	We	0.00	0.000	0.59	0.298
7/19	Wd	0.00	0.000	0.25	0.131
7/20	Wd	0.00	0.000	0.30	0.300
7/21	Wd	0.00	0.000	0.00	0.000
7/22	We	0.00	0.000	0.14	0.104
7/23	We	0.03	0.034	0.14	0.082
7/26	Wd	0.00	0.000	0.32	0.166
7/27	Wd	0.00	0.000	0.38	0.180
7/28	Wd	0.12	0.081	0.06	0.059
7/29	We	0.00	0.000	0.29	0.113
7/30	We	0.00	0.000	0.21	0.101
7/31	Wd	0.00	0.000	0.07	0.071

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Date	We/ Wd[a]	Chinook Salmon Harvest	Chinook Salmon SE	Pink Salmon Harvest	Pink Salmon SE
8/01	Wd	0.18	0.122	0.36	0.152
8/02	Wd	0.00	0.000	0.38	0.180
8/06	We	0.00	0.000	0.10	0.051
8/07	Wd	0.00	0.000	0.06	0.059
8/08	Wd	0.00	0.000	0.12	0.118
8/09	Wd	0.00	0.000	0.10	0.100
8/12	We	0.01	0.007	0.19	0.045
8/13	We	0.01	0.008	0.12	0.038
8/14	Wd	0.01	0.008	0.13	0.041
8/15	Wd	0.00	0.000	0.07	0.027
8/16	Wd	0.00	0.000	0.06	0.027
8/17	Wd	0.01	0.008	0.05	0.024
8/18	Wd	0.00	0.000	0.04	0.016
8/19	We	0.00	0.000	0.07	0.024
8/20	We	0.00	0.000	0.01	0.013
8/23	Wd	0.00	0.000	0.04	0.042
8/24	Wd	0.00	0.000	0.00	0.000
8/25	Wd	0.00	0.000	0.00	0.000
8/26	We	0.00	0.000	0.00	0.000
8/27	We	0.00	0.000	0.00	0.000
8/29	Wd	0.00	0.000	0.00	0.000
9/01	Wd	0.00	0.000	0.00	0.000
9/02	We	0.00	0.000	0.00	0.000
9/03	We	0.00	0.000	0.00	0.000
9/04	We	0.00	0.000	0.00	0.000
9/06	Wd	0.00	0.000	0.00	0.000
9/09	We	0.00	0.000	0.00	0.000
9/10	We	0.00	0.000	0.00	0.000

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

Appendix A6. Counts of anglers made during the creel survey of the beach fishery for chinook salmon in Resurrection Bay, 1989.

Date	Wd/[a] We	Waterfall Beach A	B	C	D	Boat Harbor Beach A	B	C	D
6/02	Wd	1				0			
6/03	We		12				2		
6/04	We		9				3		
6/05	Wd								
6/06	Wd								
6/07	Wd								
6/08	Wd		12				0		
6/09	Wd			2	0			1	1
6/10	We								
6/11	We	11		13		5		0	
6/12	Wd								
6/13	Wd								
6/14	Wd		8	15			14	0	
6/15	Wd	1				0			
6/16	Wd				16				22
6/17	We								
6/18	We		9		12		17		0
6/19	Wd			13				18	
6/20	Wd	5				2			
6/21	Wd								
6/22	Wd								
6/23	Wd		0				0		
6/24	We								
6/25	We		5		25		1		26
6/26	Wd	4	1			10	1		
6/27	Wd		6				3		
6/28	Wd			4				2	
6/29	Wd								
6/30	Wd								
7/01	We		11				18		
7/02	We		0				11		
7/03	Wd				8				4
7/04	We	6			14	0		4	
7/05	Wd			15				9	
7/06	Wd								
7/07	Wd				2				3
7/08	We								
7/09	We		12		2		0		4

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

Appendix A7. Daily mean effort, mean chinook salmon harvest, and chinook salmon harvest per angler-hour (HPUE) for anglers fishing in the beach fishery for chinook salmon in Resurrection Bay, 1989.

Date	We/[a] Wd	Sample Size	Mean Effort (Hours)	SE Effort	Mean Harvest	SE Harvest	Harvest HPUE
Waterfall Beach							
6/02	Wd	2	0.6	0.13	1.00	0.000	1.600
6/03	We	16	0.9	0.16	0.00	0.000	0.000
6/04	We	14	1.1	0.16	0.00	0.000	0.000
6/08	Wd	13	1.3	0.21	0.08	0.077	0.062
6/11	We	18	1.5	0.28	0.00	0.000	0.000
6/14	Wd	25	1.3	0.22	0.40	0.115	0.310
6/16	Wd	14	1.7	0.57	0.14	0.097	0.085
6/18	We	20	1.4	0.23	0.15	0.082	0.111
6/19	Wd	10	1.7	0.27	0.40	0.163	0.235
6/20	Wd	3	1.0	0.00	0.00	0.000	0.000
6/25	We	21	1.7	0.31	0.10	0.066	0.056
6/26	Wd	4	1.5	0.29	0.00	0.000	0.000
6/27	Wd	6	1.2	0.17	0.00	0.000	0.000
6/28	Wd	4	2.1	0.72	0.00	0.000	0.000
7/01	We	7	1.2	0.24	0.29	0.184	0.235
7/02	We	4	0.5	0.00	0.00	0.000	0.000
7/03	Wd	5	1.3	0.30	0.00	0.000	0.000
7/04	We	16	1.3	0.19	0.06	0.063	0.048
7/05	Wd	8	1.6	0.29	0.13	0.125	0.080
7/09	We	14	1.9	0.32	0.07	0.071	0.037
Boat Harbor Beach							
603	We	2	0.9	0.63	0.00	0.000	0.000
604	We	3	0.6	0.08	0.00	0.000	0.000
611	We	6	3.3	0.60	0.17	0.167	0.051
614	Wd	13	1.3	0.19	0.31	0.208	0.242
616	Wd	8	1.1	0.20	0.00	0.000	0.000
618	We	11	1.5	0.22	0.00	0.000	0.000
619	Wd	14	1.7	0.25	0.36	0.133	0.208
620	Wd	2	2.3	0.25	0.00	0.000	0.000
625	We	16	2.0	0.43	0.06	0.063	0.032
626	Wd	7	1.7	0.38	0.29	0.184	0.167
627	Wd	4	1.3	0.14	0.50	0.289	0.400
628	Wd	2	2.3	0.25	0.00	0.000	0.000
701	We	16	2.1	0.33	0.38	0.180	0.179
702	We	8	1.1	0.29	0.00	0.000	0.000
703	Wd	3	1.7	0.33	0.00	0.000	0.000
704	We	2	1.0	0.00	0.00	0.000	0.000
705	Wd	5	1.6	0.40	0.00	0.000	0.000
709	We	2	1.3	0.25	0.00	0.000	0.000

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

Appendix A8. Counts of anglers during the beach fishery for coho salmon in Resurrection Bay, 1989.

Date	Wd/ We[a]	Period A	B	C	D
8/23	Wd	38	20		
8/24	Wd		46	49	
8/25	Wd		16		
8/26	We		18		
8/27	We		20	16	
8/28	Wd	3	5		
8/29	Wd			11	
8/30	Wd				
8/31	Wd				
9/01	Wd	4			9
9/02	We		24		
9/03	We			45	38
9/04	We			30	
9/05	Wd	11	23		9
9/06	Wd		19	16	
9/07	Wd				
9/08	Wd				
9/09	We			12	
9/10	We	29			29
9/11	Wd	14			22
9/12	Wd	14		11	
9/13	Wd		18		11
9/14	Wd				
9/15	Wd				
9/16	We		31		
9/17	We		21	38	
9/18	Wd	5	10		
9/19	Wd				
9/20	Wd			15	9
9/21	Wd		15		15
9/22	Wd				
9/23	We		9		6
9/24	We		8	4	
9/25	Wd	3	10		
9/26	Wd		3	1	
9/27	Wd				
9/28	Wd				
9/29	Wd	2	3		
9/30	We	1	2		
10/01	We	3	2		

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

Appendix A9. Daily mean effort, mean coho salmon harvest, and coho salmon harvest per angler-hour (HPUE) for anglers fishing in the beach fishery for coho salmon in Resurrection Bay, 1989.

Date	We/[a] Wd	Sample Size	Mean Effort (Hours)	SE Effort	Mean Harvest	SE Harvest	Harvest CPUE
8/23	Wd	59	1.6	0.15	0.29	0.080	0.184
8/24	Wd	70	3.0	0.26	0.56	0.121	0.186
8/25	Wd	9	1.7	0.61	0.00	0.000	0.000
8/26	We	20	3.4	0.47	0.05	0.050	0.015
8/27	We	19	1.6	0.29	0.05	0.053	0.032
8/28	Wd	8	1.4	0.22	0.00	0.000	0.000
8/29	Wd	3	1.3	0.17	0.00	0.000	0.000
9/01	Wd	15	1.2	0.36	0.13	0.133	0.114
9/02	We	21	1.5	0.26	0.14	0.078	0.092
9/03	We	56	2.1	0.29	0.23	0.072	0.110
9/04	We	19	5.1	0.70	0.47	0.177	0.092
9/05	Wd	32	1.9	0.30	0.47	0.155	0.250
9/06	Wd	36	2.5	0.39	1.31	0.255	0.514
9/09	We	15	3.6	0.58	2.07	0.473	0.574
9/10	We	47	2.0	0.20	0.70	0.146	0.354
9/11	Wd	31	1.9	0.28	0.87	0.277	0.454
9/12	Wd	23	2.4	0.37	0.70	0.147	0.284
9/13	Wd	29	2.2	0.26	0.38	0.104	0.174
9/16	We	35	1.3	0.22	0.86	0.221	0.663
9/17	We	42	1.6	0.18	0.90	0.180	0.580
9/18	Wd	16	3.0	0.45	2.44	0.500	0.821
9/20	Wd	20	1.6	0.23	0.95	0.266	0.594
9/21	Wd	21	2.2	0.22	1.14	0.326	0.530
9/23	We	13	1.4	0.42	0.23	0.166	0.164
9/24	We	17	1.0	0.12	0.59	0.258	0.571
9/25	Wd	19	1.9	0.52	0.53	0.328	0.284
9/26	Wd	5	1.6	0.29	0.00	0.000	0.000
9/29	Wd	5	0.9	0.19	0.40	0.400	0.444
9/30	We	3	0.8	0.14	0.00	0.000	0.000
10/01	We	5	1.0	0.22	0.40	0.400	0.400

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

Appendix A10. Summary of data used to calculate the estimated contribution of Bear Lake, Seward Lagoon, and Lowell Creek coho salmon to the Resurrection Bay boat and beach fisheries, 1989.

Fishery	Stock	Variable[a]						
		a_1	a_2	m_1	m_2	m_c	n_2	H_s
Boat: Pre-Derby & Derby Strata								
	Bear Lake-1988	182	248	236	236	77	3,714	0.19[c]
	Seward Lagoon-1988	182	248	236	236	102	3,714	0.15
	Lowell Creek-1988	182	248	236	236	56	3,714	0.22
	Other[b]	182	248	236	236	1	3,714	
Boat: Post-Derby Stratum								
	Bear Lake-1988	37	26	25	25	6	406	0.19[c]
	Seward Lagoon-1988	37	26	25	25	10	406	0.15
	Lowell Creek-1988	37	26	25	25	9	406	0.22
Beach								
	Bear Lake-1988	33	30	30	30	1	275	0.19[c]
	Seward Lagoon-1988	33	30	30	30	21	275	0.15
	Lowell Creek-1988	33	30	30	30	8	275	0.22

[a] See text for definition of variables.

[b] Strays from stockings outside of Resurrection Bay, disregarded in analyses.

[c] H_s calculated as the proportion of adipose clipped fish observed in the Bear Lake escapement (954/5,106), Carlon and Vincent-Lang (in press).