

FISHERY DATA SERIES NO. 90-36

HARVEST ESTIMATES FOR SELECTED SPORT
FISHERIES IN YAKUTAT, ALASKA IN 1989¹

By

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September 1990

¹ This investigation was partially financed by the Federal Aid in Fish Restoration Act (16 U.S.C. 777-77K) under Project F-10-5, Job Number S-1-9.

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ABSTRACT

Harvest surveys of three major roadside recreational fisheries near Yakutat, Alaska were conducted during 1989. Estimated effort and harvest of chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, and steelhead *Oncorhynchus mykiss* in the Situk River, and of coho salmon in Lost River/Tawah Creek, was determined using direct expansion type creel surveys. Effort and harvest for coho salmon in the Ankau Lagoon was determined with a roving type survey.

An estimated total of 46,374 angler hours of fishing were monitored in the harvest surveys during 1989. Approximately 24,705 of these fishing hours (standard error = 2,353) are due to anglers exiting the Situk River Lower Landing between 4 April and 8 October 1989. Another 10,339 of these hours are attributed to coho salmon anglers on the Lost River/Tawah Creek (standard error = 1,088) between 14 August and 8 October 1989. Almost as many hours (8,740, standard error = 1,109) are attributed to coho salmon anglers in the Ankau Lagoon.

Total catch in the monitored fisheries is estimated at 22,328 salmon and trout. Of this total, anglers harvested an estimated 8,594 coho salmon and 4,034 trout and other salmon species. An estimated 2,416 steelhead were caught (standard error = 462) and 2,055 of these released (standard error = 458) on the Situk River. The spring Situk steelhead fishery was not strong in 1989, in part because heavy snows delayed the fishery. The ratio of the number of steelhead released to the number kept was the lowest (6:1) since harvest surveys began in 1985.

The recreational fishery for Situk River chinook salmon was restricted to catch-and-release fishing only on 19 June, when it was evident from the lack of returning adults that the run was well below average.

Approximately 11,238 coho salmon were caught in the fisheries surveyed. Catch rates for coho salmon were well above recent averages for the systems surveyed.

KEY WORDS: Harvest survey, angler effort, angler harvest, recreational fishery, catch rates, catch-and-release, direct expansion survey, roving survey, chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, steelhead *Oncorhynchus mykiss*, pink salmon *Oncorhynchus gorbuscha*, sockeye salmon *Oncorhynchus nerka*, Dolly Varden *Salvelinus malma*, Ankau Lagoon, Situk River, Lost River, Tawah Creek, Yakutat.

INTRODUCTION

Yakutat is a community of approximately 650 people located on the Gulf of Alaska between Juneau and Cordova (Figure 1). During the last decade sport fishing in Yakutat has developed rapidly as a result of advertizing in recreational magazines and television programs, an improved air service, and construction of four lodges. The Situk River steelhead *Oncorhynchus mykiss* sport fishery, once enjoyed by only a few anglers, now enjoys a world-class reputation. Sport fisheries for chinook *O. tshawytscha* and coho salmon *O. kisutch* near Yakutat are also acquiring international reputations.

The Situk River provides the primary freshwater fishing opportunity for chinook salmon near Yakutat. The Alaska Department of Fish and Game (ADF&G) has monitored harvests of wild chinook salmon in the Situk River since 1985, and has taken in-season management action to curtail sport and commercial harvests being taken in 1986, 1988, and 1989. In March 1989, a Situk River Sport Fishing Management Plan was adopted by the Alaska Board of Fisheries. This plan sets daily and seasonal bag limits, establishes catch and release only sport fishing periods, or closes the fishery depending on an estimated escapement of chinook salmon in the river.

Sport fisheries for coho salmon in the Situk River, Lost River/Tawah Creek system, and in Ankau Lagoon (Figure 1) currently rival the fisheries for steelhead and chinook salmon in terms of angler effort, and exceed them in terms of numbers of fish harvested.

Salmon stocks that are targeted by sport fisheries in Yakutat have historically supported important local subsistence and commercial fisheries. Surveys of angler effort and harvests in Yakutat sport fisheries began in 1985. Information from the surveys is used as a basis for in-season management actions, such as closing the fisheries to ensure adequate escapements, and to help formulate new regulations.

The objectives for the 1989 Yakutat harvest surveys were:

1. To estimate the total angler effort and harvest of steelhead in the Situk River from 4 April to 19 June 1989.
2. To estimate the total angler effort and harvest of chinook salmon in the Situk River from 5 June to 13 August 1989.
3. To estimate the total angler effort and harvest of coho salmon in the Situk River, Lost River, and Ankau Lagoon from 13 August to 8 October 1989.

Although not primary objectives, effort and harvest of pink salmon *O. gorbuscha* and Dolly Varden *Salvelinus malma* are also estimated during the Situk River, Lost River, and Tawah Creek survey.

METHODS

Two estimation procedures were employed to estimate total angler effort and harvests in the Yakutat harvest surveys. Direct expansions of angler counts and harvests obtained during interviews conducted at randomly selected times were

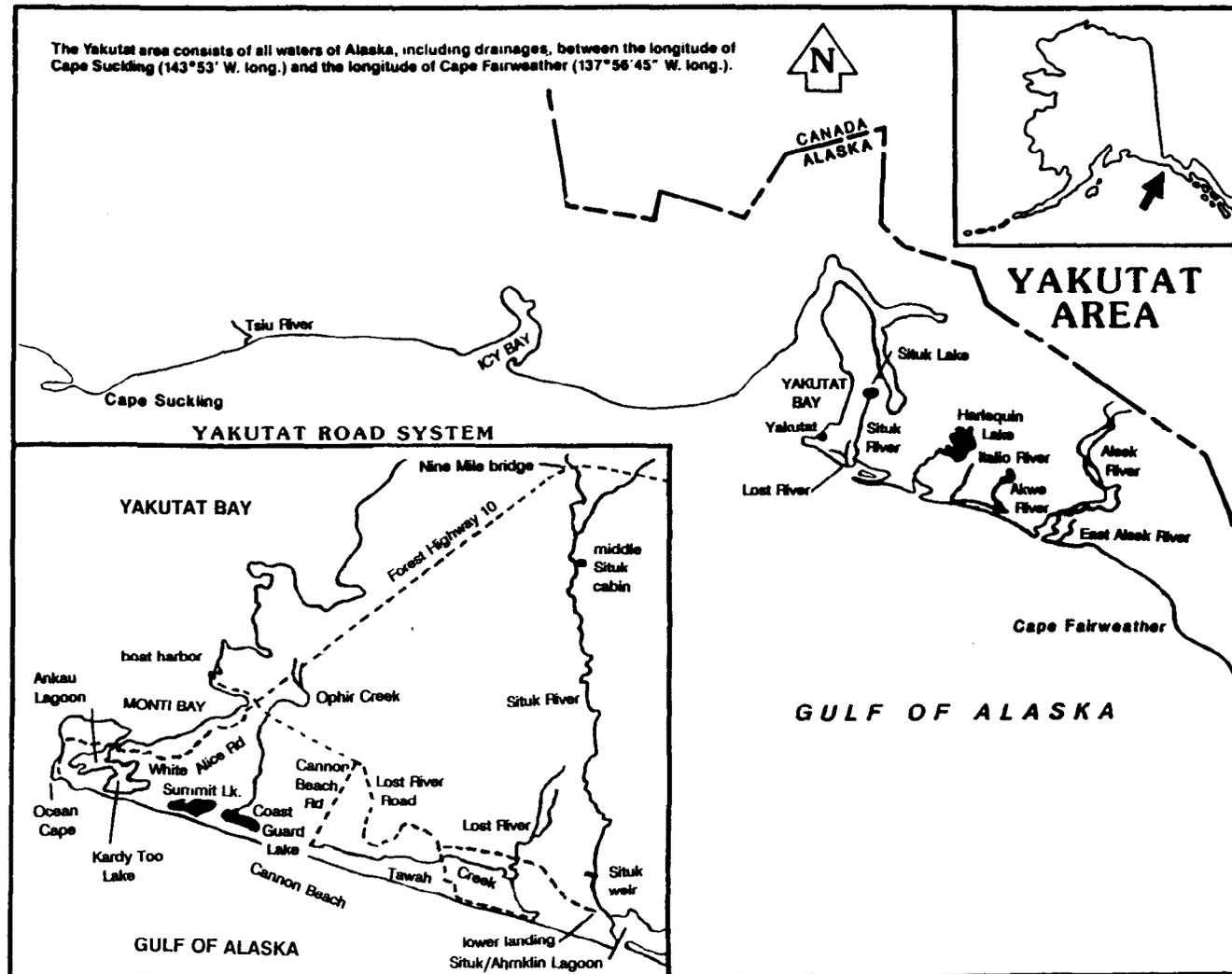


Figure 1. The Yakutat road system and sport fishing areas, 1989.

used to estimate parameters in steelhead and chinook salmon fisheries, and in the Lost River/Tawah Creek coho salmon fishery. All anglers exiting these fisheries at specified locations and times were counted and interviewed to estimate harvests.

In contrast, a technician roved through a maze-like estuarine area interviewing anglers to estimate mean angler success rate for coho salmon in the Ankau Lagoon fishery. These estimates (by sample period) were multiplied by estimates of angler effort to estimate total harvest in Ankau Lagoon. This procedure was used because a variety of access routes exist for the Ankau lagoon.

Situk River, Lost River, and Tawah Creek

Access to the Situk River is provided at the "Nine Mile Bridge" on Forest Highway 10 and at the "Lower Landing" near the river mouth (Figure 1). Very few anglers harvest chinook or coho salmon from the Nine Mile Bridge area, however, because the fish have achieved an advanced stage of sexual maturity and the skin color is dark at this point in the river. In contrast, many anglers fishing for steelhead float the river from the Nine Mile Bridge down to the Lower Landing, then return toward town on the Lost River Road. We therefore assumed that parameters estimates for Situk River fisheries of interest will be unbiased as a result of sampling only at the Lower Landing, except during steelhead season. Steelhead anglers who do fish and exit the Situk River at the Nine Mile Bridge do so largely before the second week in June (near the end of the steelhead fishery).

Nearly all anglers exiting coho salmon fisheries on the Lost River and Tawah Creek return toward Yakutat via the Lost River Road. Since nearly all coho salmon anglers on the Situk River also return toward Yakutat via this route, anglers from all three locations can be intercepted at one location on the Lost River Road. A sampling station on the Lost River Road has been established for this purpose since 1985. Fisheries on the Lost River and Tawah Creek were treated as one unit during the interview and estimation procedures.

A stratified simple random sampling design was used to estimate total effort and harvests in the fisheries. Each fishing day was subdivided into 3 or 4 sampling periods (primary sampling units) of equal length, depending on the seasonal strata. Together the periods in a day spanned a time from about 0800 to civil twilight on the average day in the strata. On the Situk River, access areas (2 levels) and 14-day (biweekly) periods (13 levels) defined strata. The Nine Mile Bridge access location area was sampled the first 4 biweeks during the fishery. There were thus $4 + 13 = 17$ distinct time-area strata between 4 April and 8 October 1989. A simple random selection of primary units to sample was constrained to insure that one pair of contiguous days was not sampled in each week (Monday-Sunday) and that a maximum of 2 samples could be selected in one day.

One technician was available to sample 12 of 42 possible primary units in each biweek. During the steelhead fishery (prior to 5 June) 9 samples were selected in each biweek for sampling at the Lower Landing and 3 were selected for sampling at the Nine Mile Bridge. After 5 June all available sampling time (12 samples) was spent at the Lower Landing (or the Lost River Road between 14 August and 8 October).

During each sampling period every angler exiting the fisheries was interviewed to determine how many hours were fished, and how many fish were kept and released by species and fishing area.

The harvest for each stratum was estimated:

$$\hat{C}_h = \bar{C}_h D_h \quad (1)$$

$$\bar{C}_h = \frac{\sum_{i=1}^{d_h} C_{hi}}{d_h} \quad (2)$$

where C_{hi} was the harvest by all anglers exiting during sample period i , stratum h , D_h was the number of primary units (possible sampling periods) in stratum h , and d_h was the number of periods actually sampled. The variance of the harvest by stratum was estimated:

$$V[\hat{C}_h] = (1-f_h) D_h^2 \left(\frac{\sum_{i=1}^{d_h} (C_{hi} - \bar{C}_h)^2}{d_h (d_h - 1)} \right) \quad (3)$$

where $f_h =$ sampling fraction (d_h/D_h).

Angler effort and its variance, and number of fish released and its variance were estimated using equations 1-3 with E (or R) substituted for C . Estimates for the season and their variances were the sums across strata $\sum C_h$ and $\sum V[C_h]$ for harvest, $\sum E_h$ and $\sum V[E_h]$ for effort, or $\sum R_h$ and $\sum V[R_h]$ for releases.

Ankau Lagoon

A stratified two-stage roving type creel survey based on the expansion of sample ratios was used to estimate harvest and effort in the Ankau lagoon. Sampling periods in the stratum were primary units and anglers within sampling periods were secondary units. Four 14-day (biweekly) seasonal strata occurred from 14 August to 8 October 1989. Fishing days were defined as for the direct expansion surveys, but sampling periods were only two hours in length. Within strata, a simple random sampling design was used to select periods. Sampling was constrained, however, such that one pair of contiguous days was not sampled within each week (Monday-Sunday), and a maximum of one period was selected per sampled day.

One technician with assistance of the project biologist was available to sample 8 of the 84 to 98 possible primary units in each biweek, depending on the seasonal strata. Anglers who completed their fishing trips and anglers who were in the process of fishing were interviewed during sample periods. Angler counts were randomly taken at either the beginning or end of the sample period.

During each sampling period, anglers were asked how many hours they fished, how many coho salmon they kept and released, and whether their fishing trip was complete or not.

The harvest for each stratum was estimated:

$$\hat{C}_h = \bar{C}_h D_h \quad (4)$$

$$\bar{C}_h = \frac{\sum_{i=1}^{d_h} \hat{C}_{hi}}{d_h} \quad (5)$$

where C was harvest, C_h was harvest in a stratum, D_h was the number of primary units (sample periods) in a stratum, d_h was the number of primary units in a stratum actually sampled, and C_{hi} was the harvest during stratum h, sample period i.

The harvest in each sampling period was estimated:

$$\hat{C}_{hi} = \hat{E}_{hi} \overline{CPUE}_{hi}^* \quad (6)$$

where \overline{CPUE}_{hi}^* was the "jackknife" estimate of mean CPUE during stratum h sample period i, and E_{hi} was the fishing effort in angler hours during the same period. Since anglers were counted only once in each period, the variance of C_{hi} was:

$$\hat{V}[\hat{C}_{hi}] = \hat{V}[\overline{CPUE}_{hi}^*] \hat{E}_{hi}^2 \quad (7)$$

\overline{CPUE}_{hi}^* and its variance were calculated according to the jackknife procedures in Efron (1982). Expansion of ratios so calculated have an inherent correctable bias of the m_{hi}^{-2} (the number of interviews in a sampling period); traditional methods have an uncorrectable bias of $1/m_{hi}$ (Cochran 1977). The jackknife procedure was conducted once for each sampling period with a FORTRAN program CPUEJACK (Allen Bingham, Division of Sport Fish, Anchorage, Alaska, personal communication); bias was corrected during execution of the program. CPUE was computed from completed trip interview data unless harvest rates were found not to differ statistically between interview types. Independent-sample t-tests ($\alpha=.05$) were used to test the null hypotheses of no significant difference between mean angler CPUE by interview type.

Total angler effort in each sample period was estimated:

$$\hat{E}_{hi} = H x_{hi} \quad (8)$$

where x_{hi} was the number of anglers counted during stratum h sampling period i, and H was the number of hours in a sampling period.

The variance of the harvest by stratum was estimated:

$$V[\hat{C}_h] = (1-f_h) D_h^2 \left(\frac{\sum_{i=1}^{d_h} (C_{hi} - \bar{C}_h)^2}{d_h(d_h-1)} \right) + D_h \left(\frac{\sum_{j=1}^{d_h} \hat{V}[\hat{C}_{hj}]}{d_h} \right) \quad (9)$$

where $f_{1h} = d_h/D_h$. The estimate of harvest for the season and its variance were the sums across strata ΣC_h and $\Sigma V[C_h]$.

E_h was estimated with equations 4, 5, and 8 (with E substituted for C). The variance of E_{hi} was not estimable since only one count occurred in a period: the variance of E_h was thus computed with equation 9 where the second term on the right hand side of the equation equaled 0. Effort for the season and its

variance were sums across strata ΣE_h and $\Sigma V[E_h]$.

Standard Error, Relative Precision, and CPUE

Standard errors for effort, harvest, and release estimates were:

$$\text{Std. Err.} = (\text{Variance})^{\frac{1}{2}} \quad (10)$$

Relative precision (95% confidence interval) for effort, harvest, and release estimates were:

$$\text{Rel. Precision} = \frac{2 \text{ Std. Err.}}{\text{Estimate}} \quad (11)$$

Overall catch rates were obtained by dividing the total estimated catch by the total estimated effort:

$$\text{CPUE} = \frac{\Sigma \hat{C}}{\Sigma \hat{E}} \quad (12)$$

While this was not a measure of the success of the average angler, it served to provide a measure of the overall catch rate.

RESULTS

Sampling at the Situk River Lower Landing site began on 17 April after access roads were plowed following heavy snows. Sampling at the lower landing continued through 14 August (Table 1). Sampling at the Nine Mile Bridge on the Situk River began on 24 April and continued through 4 June. The entire April fishery, which began as soon as roads were plowed, was for steelhead (Table 1).

The sport fishery for chinook salmon on the Situk River was closed by emergency order on June 19 due to a lack of spawning escapement, as measured by the number of chinook salmon counted through a weir operated by the ADF&G Division of Commercial Fisheries.

All anglers exiting the major coho fisheries in the Situk, Lost, and Tawah systems during the specified sampling periods were counted and interviewed as they passed the Lost River Road survey station. Nearly all catch and harvest was for coho salmon (Table 2).

Most anglers counted in the coho salmon fishery in Ankau Lagoon during the specified sampling periods were interviewed. All reported catch and harvest was for coho salmon (Table 3).

Angler Effort

A total 24,705 fishing hours were estimated to have been spent by Situk River anglers leaving the Lower Landing (SE = 2,353) between 4 April and 8 October 1989 (Table 4). About 2,590 hours were estimated to have been spent by steelhead anglers leaving the Nine Mile Bridge area (SE = 802) between 24 April and 4 June

Table 1. Observed angler effort, number of periods sampled, number of possible sampling periods, and observed catch (number kept and number released) by species for the Situk River creel survey by site and sampling period, 1989.

LOWER LANDING				Observed Catch													
Sampling Period	Angler Hours	Periods Sampled	Samples Possible														
				SHK	SHR	DVK	DVR	KSK	KSR	JKK	JKR	RSK	RSR	PSK	PSR	SSK	SSR
4/17-4/23	588.5	6	21	18	154	0	0	0	0	0	0	0	0	0	0	0	0
4/24-5/07	1,113.5	9	42	30	191	0	0	0	0	0	0	0	0	0	0	0	0
5/08-5/21	139.5	9	56	11	20	21	7	0	0	0	0	0	0	0	0	0	0
5/22-6/04	58.5	9	56	3	24	9	45	0	0	0	0	0	0	0	0	0	0
6/05-6/18	139.25	12	42	3	4	2	2	0	0	0	1	0	0	0	0	0	0
6/19-7/02	396.5	12	42	5	19	13	4	0	4	0	0	78	91	0	0	0	0
7/03-7/16	743.0	12	42	0	0	2	40	0	7	0	9	125	175	7	0	0	7
7/17-7/30	293.5	11	42	0	0	14	38	0	6	0	0	40	32	127	144	0	6
7/31-8/13	248.5	12	42	0	0	3	14	0	0	0	0	4	1	271	162	16	6
8/14-8/27	883.5	13	42	0	0	12	23	0	0	0	0	1	0	97	270	168	30
8/28-9/10	1,317.0	12	42	0	0	7	20	0	0	0	0	0	0	24	90	411	123
9/11-9/24	584.0	12	42	0	0	2	5	0	0	0	0	0	0	1	14	144	31
9/25-10/8	29.0	12	42	0	2	0	9	0	0	0	0	0	0	0	0	2	21

NINE MILE				Observed Catch			
Sampling Period	Angler Hours	Periods Sampled	Samples Possible				
				SHK	SHR	DVK	DVR
4/24-5/07	139.0	3	42	3	18	0	0
5/08-5/21	35.0	3	56	0	1	3	16
5/22-6/04	1.5	3	56	0	0	0	1

Code: K=kept, R=released; SH=steelhead, DV=Dolly Varden, KS=king salmon, JK=jack king salmon, RS=sockeye salmon, PS=pink salmon, SS=coho salmon.

Table 2. Observed angler effort, number of periods sampled, number of possible sampling periods, and observed catch (number kept and number released) by species for the Lost River/Tawah Creek creel survey by site and sampling period, 1989.

LOST RIVER/TAWAH CREEK				Observed Catch					
Sampling Period	Angler Hours	Periods Sampled	Samples Possible						
				DVK	DVR	PSK	PSR	SSK	SSR
8/14-8/27	348.2	13	42	1	21	4	9	70	10
8/28-9/10	749.5	12	42	0	4	2	2	251	126
9/11-9/24	1,411.0	12	42	0	7	1	3	481	175
9/25-10/8	445.5	12	42	0	2	0	0	113	27

Code: K=kept, R=released; DV=Dolly Varden, PS=pink salmon, SS=coho salmon.

Table 3. Number of samples (2 hour periods), number of interviews by type, effort (angler hours), and catch observed at Ankau Lagoon, 1989.

Date	Samples ^a		Interviews ^b		Observed ^c				
	d	D	m	M	Complete Trips	Incomplete Trips	Angler Hours	Harvest	Releases
8/14-8/27	8	98	56	82	10	46	128	27	3
8/28-9/10	8	98	143	153	30	113	339	107	55
9/11-9/24	8	84	90	109	37	53	214	81	22
9/25-10/8	8	84	29	33	6	23	58	4	1

^a d periods sampled and D possible sampling periods

^b m interviews conducted and M anglers counted

^c observed during the d periods and m interviews

Table 4. Estimated effort, harvests, and releases of important species in the Situk River Lower Landing creel survey by sampling period, 4 April through 8 October, 1989.

	04 April 23 April	24 April 07 May	08 May 21 May	22 May 04 June	05 June 18 June	19 June 02 July	03 July 16 July	17 July 30 July	31 July 13 July	14 Aug 27 Aug	28 Aug 10 Sept	11 Sept 24 Sept	25 Sept 08 Oct	Total
ANGLER HOURS														
ESTIMATE	2,060	5,196	868	364	487	1,388	2,572	1,121	803	3,092	4,609	2,044	101	24,705
VARIANCE	475,936	3,054,148	102,502	111,202	48,113	171,954	755,364	107,221	22,854	357,297	215,830	106,963	6,824	5,536,208
SE	690	1,748	320	333	219	415	869	327	151	598	465	327	83	2,353
REL. PREC.	0.66	0.66	0.73	1.80	0.89	0.59	0.66	0.58	0.37	0.38	0.20	0.32	1.60	0.19
STEELHEAD KEPT														
ESTIMATE	63	140	68	19	11	18	0	0	0	0	0	0	0	319
VARIANCE	252	1,694	861	292	79	104								3,283
SE	16	41	29	17	9	10								57
REL. PREC.	0.50	0.58	0.85	1.77	1.59	1.12								0.36
STEELHEAD RELEASED														
ESTIMATE	539	891	124	149	14	67	0	0	0	0	0	0	0	1,784
VARIANCE	57,323	121,728	3,274	18,716	140	3,159								204,340
SE	239	349	57	137	12	56								452
REL. PREC.	0.88	0.77	0.91	1.81	1.66	1.65								0.51
DOLLY VARDEN KEPT														
ESTIMATE	0	0	131	56	7	46	7	53	10	42	25	7	0	384
VARIANCE			6,726	2,632	35	1,040	16	405	34	515	66	16		11,484
SE			82	51	6	32	4	20	6	23	8	4		107
REL. PREC.			1.23	1.80	1.66	1.38	1.12	0.75	1.14	1.06	0.64	1.12		0.56
DOLLY VARDEN RELEASED														
ESTIMATE	0	0	44	280	7	14	140	145	45	81	70	18	32	876
VARIANCE			861	65,800	16	64	6,784	4,364	273	1,918	827	66	709	81,681
SE			29	257	4	8	82	66	17	44	29	8	27	286
REL. PREC.			1.31	2.15	1.12	1.12	1.16	0.90	0.72	1.07	0.81	0.89	1.64	0.65
JACK CHINOOK KEPT														
ESTIMATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK CHINOOK RELEASED														
ESTIMATE	0	0	0	0	4	0	32	0	0	0	0	0	0	36
VARIANCE					11		365							376
SE					3		19							19
REL. PREC.					1.62		1.17							1.08
CHINOOK SALMON KEPT														
ESTIMATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHINOOK SALMON RELEASED														
ESTIMATE	0	0	0	0	0	14	25	23	0	0	0	0	0	62
VARIANCE						83	85	127						295
SE						9	9	11						17
REL. PREC.						1.28	0.73	0.97						0.55

-(Continued)-

Table 4. (page 2 of 2)

	04 April 23 April	24 April 07 May	08 May 21 May	22 May 04 June	05 June 18 June	19 June 02 July	03 July 16 July	17 July 30 July	31 July 13 July	14 Aug 27 Aug	28 Aug 10 Sept	11 Sept 24 Sept	25 Sept 08 Oct	Total
SOCKEYE SALMON KEPT														
ESTIMATE	0	0	0	0	21	273	438	153	134	4	0	0	0	1,023
VARIANCE					143	12,438	13,735	5,546	115	9				31,986
SE					12	112	117	74	11	3				179
REL. PREC.					1.12	0.80	0.53	0.96	1.63	1.46				0.35
SOCKEYE SALMON RELEASED														
ESTIMATE	0	0	0	0	0	319	599	122	3	0	0	0	0	1,043
VARIANCE						18,813	39,215	8,959	7					66,995
SE						137	198	95	3					259
REL. PREC.						0.85	0.65	1.53	1.76					0.50
PINK SALMON KEPT														
ESTIMATE	0	0	0	0	0	0	25	485	876	340	84	4	0	1,814
VARIANCE							314	13,384	52,621	5,297	458	9		72,083
SE							18	116	229	73	21	3		268
REL. PREC.							1.40	0.47	0.52	0.42	0.50	1.46		0.30
PINK SALMON RELEASED														
ESTIMATE	0	0	0	0	0	0	0	588	523	945	315	49	0	2,420
VARIANCE							0	33,402	18,202	43,804	12,991	1,047		109,446
SE							0	183	135	209	114	32		331
REL. PREC.							0.00	0.61	0.51	0.44	0.71	1.30		0.27
COHO SALMON KEPT														
ESTIMATE	0	0	0	0	0	0	0	4	52	588	1,439	504	7	2,594
VARIANCE								11	533	13,516	29,059	6,185	35	49,340
SE								3	23	116	170	79	6	222
REL. PREC.								1.62	0.91	0.39	0.23	0.31	1.66	0.17
COHO SALMON RELEASED														
ESTIMATE	0	0	0	0	0	0	0	8	19	105	431	109	74	746
VARIANCE								43	135	1,594	9,185	1,097	3,859	15,912
SE								7	12	40	96	33	62	126
REL. PREC.								1.62	1.20	0.75	0.44	0.60	1.65	0.34

(Table 5). This was 40% of the 6,428 effort (SE = 1,808) leaving the Lower Landing area during the same period.

An estimated 10,339 fishing hours were estimated to have been spent by Lost River/Tawah Creek anglers (SE = 1,088) between 14 August and 8 October 1989 (Table 6). Almost as many fishing hours (8,740, SE = 1,109) were estimated to have been spent in the Ankau Lagoon (Table 7). Both fisheries were primarily for coho salmon.

Situk River Steelhead Fishery

Anglers caught an estimated 2,416 steelhead during the 1989 spring fishery in the Situk River (SE = 462), of which an estimated 2,055 (85%) were released (Tables 4 and 5). Most of the steelhead catch occurred in April and early May. Overall angler success (CPUE) was nearly constant prior to 22 May at the Lower Landing, but dropped off sharply in early May at the Nine Mile Bridge (Appendix A1).

Situk River Chinook Salmon Fishery

The return of chinook salmon to the Situk River in 1989 was below the minimum number (1,000) required for escapement by the Situk River management plan. Thus, harvests of chinook salmon in the Situk River were limited by an emergency order on 19 June 1989 that prohibited the retention of chinook salmon over 16 inches in length. No large chinook salmon (>16 inches) were harvested in the Situk River during the 1989 season due to the early closure (Table 4). There was also no reported jack (<16 inches) chinook salmon harvest during the 1989 season. An estimated 62 large and 36 jack chinook salmon were, however, caught and released (Table 4).

Coho Salmon Fisheries

Wild stocks of coho salmon produced an estimated catch of 11,238 fish for sport anglers in the Situk River, Lost/Tawah Rivers, and Ankau Lagoon fisheries during 1989 (Tables 4, 6, and 7). Of those coho, an estimated 2,644 (24%) were released. Overall angler success (CPUE) for coho salmon in all fisheries monitored was highest in early September (Appendices A2 and A3).

In the 1989 Ankau Lagoon survey, t-tests to determine if HPUE differed between complete and incomplete interviews showed significant results, indicating that harvest rates estimated by the two types of interviews are different. For all data combined, HPUE for completed trips was 0.406 (n=82, SD=0.306) and HPUE for incomplete trips was 0.246 (n=234, SD=0.511) yielding a probability of only 0.001 that the population means were the same. T-tests for means within biweekly strata were less conclusive. In the strata having the largest number of anglers and greatest estimated harvest (9/11-9/24) a similar p-value was found (p<0.001), but in the biweeks just before and just after the peak week, null hypotheses could not be rejected (p=0.751 and 0.307, respectively). During the last biweek no harvest was observed in 6 completed trip interviews, but an HPUE of 0.203 (SD=0.575) was found across 23 incomplete angler interviews. Thus, in estimating harvest (and catch) for this study, completed angler interview data was used for all calculations except in the last biweekly period when both types were

Table 5. Estimated effort, harvests, and releases of steelhead and Dolly Varden char in the Situk River Nine Mile Bridge creel survey by sampling period, 24 April through 4 June, 1989.

	24 April 07 May	08 May 21 May	22 May 04 June	Total
Angler Hours				
Estimate	1,946	616	28	2,590
Variance	594,367	48,477	742	643,586
SE	771	220	27	802
Rel.Prec.	0.78	0.70	1.92	0.62
Steelhead Kept				
Estimate	42	0	0	42
Variance	546			546
SE	23			23
Rel.Prec.	1.10			1.10
Steelhead Released				
Estimate	252	19	0	271
Variance	4,914	330		5,244
SE	70	18		72
Rel.Prec.	0.55	1.88		0.53
Dolly Varden Kept				
Estimate	0	56	0	56
Variance		989		989
SE		31		31
Rel.Prec.		1.11		1.11
Dolly Varden Released				
Estimate	0	299	19	318
Variance		84,423	330	84,753
SE		291	18	291
Rel.Prec.		1.91	1.88	1.83

Table 6. Estimated effort, harvests, and releases of coho salmon, Dolly Varden char, and pink salmon in the Lost River/Tawah Creek creel survey by sampling period, 14 August through 8 October, 1989.

	14 Aug 27 Aug	28 Aug 10 Sept	11 Sept 24 Sept	25 Sept 08 Oct	Total
Angler Hours					
Estimate	1,219	2,623	4,938	1,559	10,339
Variance	109,146	426,235	530,898	116,422	1,182,701
SE	330	653	729	341	1,088
Rel.Prec.	0.53	0.49	0.29	0.43	0.21
Coho Salmon Kept					
Estimate	245	879	1,684	396	3,204
Variance	4,808	37,389	24,006	7,053	73,256
SE	69	193	155	84	271
Rel.Prec.	0.56	0.43	0.18	0.42	0.17
Coho Salmon Released					
Estimate	35	441	613	95	1,184
Variance	169	17,745	31,031	1,129	50,074
SE	13	133	176	34	224
Rel.Prec.	0.73	0.60	0.57	0.70	0.38
Dolly Varden Kept					
Estimate	4	0	0	0	4
Variance	9				9
SE	3				3
Rel.Prec.	1.46				1.46
Dolly Varden Released					
Estimate	74	14	28	7	123
Variance	3,859	45	159	35	4,097
SE	621	7	13	6	64
Rel.Prec.	1.65	0.94	0.89	1.66	1.04
Pink Salmon Kept					
Estimate	14	7	4	0	25
Variance	45	16	9		69
SE	7	4	3		8
Rel.Prec.	0.94	1.12	1.46		0.67
Pink Salmon Released					
Estimate	32	7	11	0	50
Variance	251	16	41		307
SE	16	4	6		18
Rel.Prec.	0.97	1.12	1.13		0.70

Table 7. Estimated effort, harvest, and release of coho salmon in the Ankau Lagoon creel survey by sampling period, 14 August through 8 October, 1989.

	14 Aug 27 Aug	28 Aug 10 Sept	11 Sept 24 Sept	25 Sept 08 Oct	Total
Angler Hours					
Estimate	2,009	3,749	2,289	693	8,740
Variance	627,165	266,411	289,047	46,911	1,229,534
SE	792	516	538	217	1,109
Rel.Prec.	0.77	0.27	0.46	0.61	0.25
Coho Salmon Catch					
Estimate	549	1,805	1,067	89	3,510
Variance	154,806	343,127	151,435	2,219	651,587
SE	394	586	389	47	807
Rel.Prec.	1.41	0.64	0.71	1.04	0.46
Coho Salmon Kept					
Estimate	376	1,480	856	84	2,796
Variance	60,062	255,299	110,593	2,305	428,259
SE	245	505	333	48	654
Rel.Prec.	1.28	0.67	0.76	1.12	0.47

combined.

Other Roadside Fisheries

The estimated catch of sockeye salmon in the Lower Landing fishery was 2,066 during the 1989 season (SE = 315, Table 4). The estimated release rate for sockeye salmon is 51%. The estimated catch of pink salmon at the Situk River Lower Landing is 4,234 (SE = 426) with a release rate of 57%. An estimated 440 Dolly Varden were harvested from the Situk River (SE = 112), with an additional 1,194 (SE = 408) released (73%, Tables 4 and 5).

DISCUSSION

A total of 46,374 angler hours of fishing effort was estimated by harvest surveys for 1989 fisheries (Table 8). The total estimated harvest of coho salmon (8,594 fish) far exceeded the total for all other species combined (4,034 fish). However the fisheries for steelhead and chinook salmon, though much smaller, attracted far more attention due to their reputations or because of conservation problems.

Major growth has occurred in certain sport fisheries near Yakutat over the past decade, resulting in competition within and among user groups for available fish stocks. The thrill of angling exclusively for wild stock salmon, trout, and char in a scenic but accessible location is a major part of the growing attraction of the Yakutat area sport fisheries.

Sport fisheries in the Yakutat area are dependent upon stocks of fish that have traditionally been important for local subsistence and commercial utilization, both of which are of great interest to the community of Yakutat. As a result, the Ankau Lagoon system, Situk and Lost Rivers, and Tawah Creek will require continued monitoring to prevent excessive exploitation of fish stocks. Specific results and conclusions from the 1989 harvest studies are as follows:

Situk River Steelhead Fishery

The 1989 sport fishery for steelhead in the Situk River was one of the poorest in recent years. Overall catch rates were at a five year low (0.19 steelhead per angler-hour) and perhaps as a result, anglers kept more of their catch (Table 9). During 1989, approximately 6 steelhead were released for every one kept. This was the lowest ratio since the survey began in 1985, and this statistic should be watched in the future. Seasonal harvest limits may be necessary if the fishery develops a "take home" orientation.

When compared with prior years, the surprisingly high estimate of effort (2,590 hours) expended in the Nine Mile Bridge area between 24 April and 4 June, 1989 demonstrates the expanding popularity of this fishery. This estimate is 1.88 times the estimated 1,376 hours of effort spent at the Nine Mile Bridge area during the same period in 1988 (Suchanek and Bingham 1989).

Table 8. Summary of estimated angler effort and harvest by location for Yakutat area sport fisheries in 1989.

Species		Situk River		Lost River-Tawah Creek ^c	Ankau ^d	Total
		Lower Landing ^a	9 Mile ^b			
Angler Hours		24,705	2,590	10,339	8,740	46,374
Steelhead	Kept	319	42	-	-	361
	Released	1,784	271	-	-	2,055
Dolly Varden	Kept	384	56	4	-	444
	Released	876	318	123	-	1,317
Sockeye Salmon	Kept	1,023	-	-	-	1,023
	Released	1,043	-	-	-	1,043
Chinook Salmon	Kept	0	-	-	-	0
	Released	62	-	-	-	62
Chinook Salmon (Jacks)	Kept	0	-	-	-	0
	Released	36	-	-	-	36
Coho Salmon	Kept	2,594	-	3,204	2,796	8,594
	Released	746	-	1,184	714	2,644
Pink Salmon	Kept	1,814	-	4	-	2,206
	Released	2,420	-	123	-	2,543

^a April 4 - October 8.

^b April 24 - June 4.

^c July 17 - October 8.

^d August 14 - October 8.

Table 9. Summary of estimated sport-fishing catch and catch rates for steelhead in the Situk River, 1985-1989.

Year	Survey Dates	Effort (Hrs)	Kept	Released	Total	Catch Per Hour	Released to Kept ratio
1985 ^a	4/15-7/07	12,664	428	4,584	5,012	0.40	10.7
1986 ^b	4/14-7/06	12,283	287	2,094	2,381	0.19	7.3
1987 ^c	4/06-6/28 ^e	10,542	391	3,791	4,182	0.40	9.7
1988 ^d	3/28-7/03	16,379	423	4,991	5,414	0.33	11.8
1989	4/17-7/02	10,988	361	2,055	2,416	0.22	5.6
Mean	1985-1988	12,967	382	3,865	4,247	0.33	9.9

^a Mecum and Suchanek 1986.

^b Mecum and Suchanek 1987.

^c Bingham, Suchanek, Sonnichsen, and Mecum 1988.

^d Suchanek and Bingham 1989.

^e No survey between 5/26 and 6/14 (1987).

Situk River Chinook Salmon Fishery

A small escapement of chinook salmon in 1989 forced a complete closure of the fishery, and resulted in the worst sport fishing in the Situk River in recent years (Table 10).

Coho Salmon Fisheries

Coho salmon fisheries are extremely popular in the Yakutat area. Sport fishermen spent an estimated 30,850 hours angling primarily for coho salmon in the Yakutat area from 17 July through 8 October 1989 (Table 11). This represents 67% of the total sport angling effort estimated by the creel surveys in 1989. The 1989 season was the most productive, as indicated by overall catch rates, since 1985 (Table 11).

Catches have apparently doubled in the Ankau Lagoon system over the past four years. This could be due to larger returns of coho salmon to the system, but we also that anglers may be learning the specialized techniques required for successful angling in the area (Table 11). Monitoring escapement to these streams will be difficult due to the darkly stained water in the streams.

ACKNOWLEDGEMENTS

Allen Bingham of the Alaska Department of Fish and Game, Division of Sport Fish, in Anchorage, Alaska provided the design for the surveys. Al Didier of the Division of Sport Fish in Juneau, Alaska made editorial contributions to the draft report.

Table 10. Summary of estimated sport-fishing catch and harvest of chinook salmon in the Situk River, 1985-1989.

Year	Survey Dates	Effort (Hrs)	Kept			Released			Caught		
			>16"	<16"	Total	>16"	<16"	Total	>16"	<16"	Total
1985 ^a	6/10-7/21	4958	294	217	511	123	210	333	417	427	844
1986 ^b	6/09-7/13	3568	0	37	37	704	0	704	704	37	741
1987 ^c	6/15-8/09	3852	75	319	319	270	90	360	345	409	754
1988 ^d	6/06-8/14	6715	185	3	188	124	31	155	309	34	343
1989	6/05-7/30	5568	0	0	0	62	36	98	62	36	98
Mean	1985-1988	4773	139	144	264	305	83	388	444	227	671

^a Mecum and Suchanek 1986.

^b Mecum and Suchanek 1987.

^c Bingham, Suchanek, Sonnichsen, and Mecum 1998.

^d Suchanek and Bingham 1989.

Table 11. Summary of estimated sport-fishing catch and catch rates for coho salmon in the Situk River, Lost River, and Ankau Lagoon, 1985-1989.

Area	Year	Survey Dates	Effort (Hrs)	Kept	Released	Total	Catch/ Hour
Situk River	1985 ^a	8/05-10/13	15,099	3,074	1,086	4,160	0.28
	1986 ^b	8/16-10/15	12,267	1,448	192	1,640	0.13
	1987 ^c	7/27-10/11	8,122	1,770	365	2,135	0.26
	1988 ^d	8/01-10/09	11,678	1,886	631	2,517	0.22
	1989	7/17-10/08	11,770	2,594	746	3,340	0.28
	Mean	1985-1988		11,792	2,045	569	2,613
Lost River	1985	8/12-10/13	10,666	4,001	1,256	5,257	0.49
	1986	8/16-10/15	8,428	1,339	127	1,466	0.17
	1987	8/17-10/11	6,741	1,839	114	1,953	0.29
	1988	8/15-10/09	7,373	1,800	268	2,068	0.28
	1989	7/17-10/08	10,340	3,204	1,184	4,388	0.42
	Mean	1985-1988		8,302	2,245	441	2,686
Ankau Lagoon	1985	-	-	-	-	-	-
	1986	8/16-10/15	8,083	1,384	480	1,864	0.23
	1987	8/17-10/11	6,615	1,377	347	1,724	0.26
	1988	8/15-10/09	11,526	2,429	536	2,965	0.26
	1989	7/17-10/08	8,740	2,796	714	3,510	0.40
	Mean	1986-1988		8,741	1,730	454	2,184

^a Mecum and Suchanek 1986.

^b Mecum and Suchanek 1987.

^c Bingham, Suchanek, Sonnichsen, and Mecum 1998.

^d Suchanek and Bingham 1989.

LITERATURE CITED

- Bingham, A.E., P. M. Suchanek, S. Sonnichsen, and R. D. Mecum. 1988. Harvest estimates for selected sport fisheries in southeast Alaska in 1987. Alaska Department of Fish and Game. Fishery Data Series No. 72. 182 pp.
- Cochran, W. E. 1977. Sampling techniques, 3rd ed. John Wiley and Sons, Inc. New York. 428 pp.
- Efron, B. I. 1982. On the jackknife, bootstrap, and other resampling plans. Publication Society Industrial Applied Mathematics, Philadelphia. 92 pp.
- Mecum, R. D., and P. M. Suchanek. 1986. Southeast Alaska sport harvest estimates. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1985-1986, Project F-10-1, Volume 27 (S-1-1), Juneau, Alaska. 73 pp.
- Mecum, R. D., and P. M. Suchanek. 1987. Harvest estimates of selected sport fisheries in Southeast Alaska in 1986. Alaska Department of Fish and Game, Fishery Data Series No. 72. 182 pp.
- Suchanek, P. M., and A. E. Bingham. 1989. Harvest estimates for selected sport fisheries in southeast Alaska in 1988. Alaska Department of Fish and Game. Fishery Data Series No. 114, Juneau, Alaska. 120 pp.

APPENDIX A

Appendix A1. Overall catch per unit effort estimates for Situk River fisheries by period and species, 1989.

Stratum	Steelhead	Dolly Varden	Large Chinook Salmon	Small Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon
SITUK LOWER LANDING							
4/17-4/23	0.292						
4/24-5/07	0.199						
5/08-5/21	0.222	0.201					
5/22-6/04	0.462	0.923					
6/05-6/18	0.050	0.029	0.000	0.007			
6/19-7/02	0.063	0.044	0.010	0.000	0.441		
7/03-7/16		0.057	0.009	0.012	0.404	0.009	
7/17-7/30		0.177	0.020	0.000	0.245	0.923	0.010
7/31-8/13		0.068	0.000	0.000	0.020	1.742	0.089
8/14-8/27		0.040			0.001	0.415	0.224
8/28-9/10		0.021				0.087	0.406
9/11-9/24		0.012				0.026	0.300
9/25-10/8	0.067	0.300					0.767
SITUK NINE MILE BRIDGE							
4/24-5/07	0.151						
5/08-5/21	0.029	0.543					
5/22-6/04	0.000	0.667					

Appendix A2. Overall catch per unit effort estimates for Lost River/Tawah Creek fisheries by period and species, 1989.

Stratum	Dolly Varden	Pink Salmon	Coho Salmon
8/14-8/27	0.063	0.037	0.230
8/28-9/10	0.005	0.005	0.503
9/11-9/24	0.005	0.003	0.465
9/25-10/8	0.004	0.000	0.314

Appendix A3. Overall catch per unit effort estimates in the Ankau Lagoon coho salmon fishery by period, 1989.

Stratum	Coho Salmon
8/14-8/27 ^a	0.270
8/28-9/10 ^a	0.480
9/11-9/24 ^a	0.470
9/25-10/8 ^b	0.010

^a completed-trip interviews.

^b completed- and incomplete-trip interviews.

