

**Fishery Data Series No. 92-47**

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# **Situk River Steelhead Trout and Chinook Salmon Creel Surveys and Weir, 1991**

by

**Brian Glynn**

November 1992

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Alaska Department of Fish and Game

Division of Sport Fish



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SITUK RIVER STEELHEAD TROUT AND CHINOOK SALMON  
CREEL SURVEYS AND WEIR, 1991<sup>1</sup>

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Alaska Department of Fish and Game  
Division of Sport Fish  
Anchorage, Alaska

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<sup>1</sup> This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Projects F-10-6 and F-10-7, Job Nos. S-1-9 and S-1-10.

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## ABSTRACT

Angler effort for and catch of steelhead trout *Oncorhynchus mykiss* and angler effort for and catch and harvest of chinook salmon *Oncorhynchus tshawytscha* in recreational fisheries on the Situk River near Yakutat, Alaska were estimated using creel surveys. Steelhead trout escapements were indexed using float surveys, and the numbers of steelhead trout kelts emigrating from the system were counted at a weir located in the lower end of the river.

Steelhead trout anglers expended an estimated 4,618 hours (SE = 784) to catch 1,055 steelhead trout (SE = 198) between April 08 and June 02. Harvest of steelhead trout was prohibited by emergency order. Access to the Nine Mile Bridge site was restricted early in the season due to deep snow conditions on Forest Highway 10. A peak escapement index of 973 steelhead trout was obtained during float surveys conducted on May 12 and May 14. A total of 2,490 steelhead trout kelts emigrated downstream through the Situk River weir between May 9 and July 27, although the weir was inoperable due to high water from May 28 through June 10.

Chinook salmon anglers expended an estimated 2,469 hours (SE = 445) to catch 84 chinook salmon (SE = 198) and to harvest 12 (SE = 7) of these fish between July 04 and July 31. Harvest of chinook salmon greater than 16 inches in length before June 30 was prohibited by emergency order.

KEY WORDS: Creel survey, Situk River, chinook salmon, *Oncorhynchus tshawytscha*, steelhead trout, *Oncorhynchus mykiss*, angler effort, harvest, catch, catch-and-release, float survey, weir, Yakutat, Alaska.

## INTRODUCTION

The Situk River flows across the Yakutat Foreland approximately 13 km (8 mi) east of Yakutat, Alaska—a community of about 650 people located on the Gulf of Alaska between Juneau and Cordova (Figure 1). The Situk River provides anglers the greatest opportunity for char *Salvelinus* spp., trout, and salmon *Oncorhynchus* spp. fishing near Yakutat.

The sport fishery for steelhead trout *Oncorhynchus mykiss* on the Situk River was pioneered in the late 1940's, remained small for about three decades following World War II, and developed rapidly during the 1980's to acquire a world-class reputation. Concurrently, regulations on the sport fishery have gradually become more restrictive. Daily bag limits have been reduced, from three trout or char  $\geq 16$  inches in length per day in 1974, to two trout or char  $\geq 16$  inches per day in 1975, to one steelhead trout per day in 1980, to catch-and-release with artificial lures only in 1991.

The sport fishery for steelhead trout on the Situk River has been monitored through harvest and effort surveys by the Alaska Department of Fish and Game (ADF&G) Division of Sport Fish since 1985. Emigrating steelhead trout kelts have been counted since 1989 at a weir located in the lower river just above tidal influence and operated by the ADF&G Commercial Fisheries Division. Prior to these counts, monitoring was accomplished through counts at a similar weir located in the upper river, and through float surveys. The combined data from sport angler creel surveys, weir counts, and float surveys suggest a declining trend in the numbers of Situk River steelhead trout.

The ADF&G has also monitored sport harvests of chinook salmon *Oncorhynchus tshawytscha* since 1985 and has taken inseason management action to curtail sport and commercial harvests in 1986, and again in 1988 through 1991. This sport fishery is regulated by the Situk-Ahrnklin Inlet and Lost River King Salmon Commercial Fishery Management Plan (5 AAC 30.365), which was adopted by the Alaska Board of Fisheries in March 1991 and replaced an earlier plan (5 AAC 49.025) dealing only with sport fishing. The current plan sets daily and seasonal bag limits, establishes catch-and-release-only sport fishing periods, or closes the fishery, based on projections of chinook salmon escapement. Through implementation of the plan, the 1991 chinook salmon sport fishery began with a catch-and-release restriction that was later rescinded to allow retention of one chinook salmon per day and two fish seasonally. As in previous years, chinook salmon anglers in the Situk River were limited to fishing with artificial lures only.

The research objectives for 1991 were to:

1. estimate sport angler effort for and the catch and harvest of steelhead trout in the Situk River from April 1 to June 15, 1991;
2. count the emigration of steelhead trout kelts from the Situk River between May 9 and July 27, 1991;
3. index the peak escapement of steelhead trout in the Situk River in 1991; and
4. estimate sport angler effort for and the catch and harvest of chinook salmon in the Situk River from June 5 to July 31, 1991.

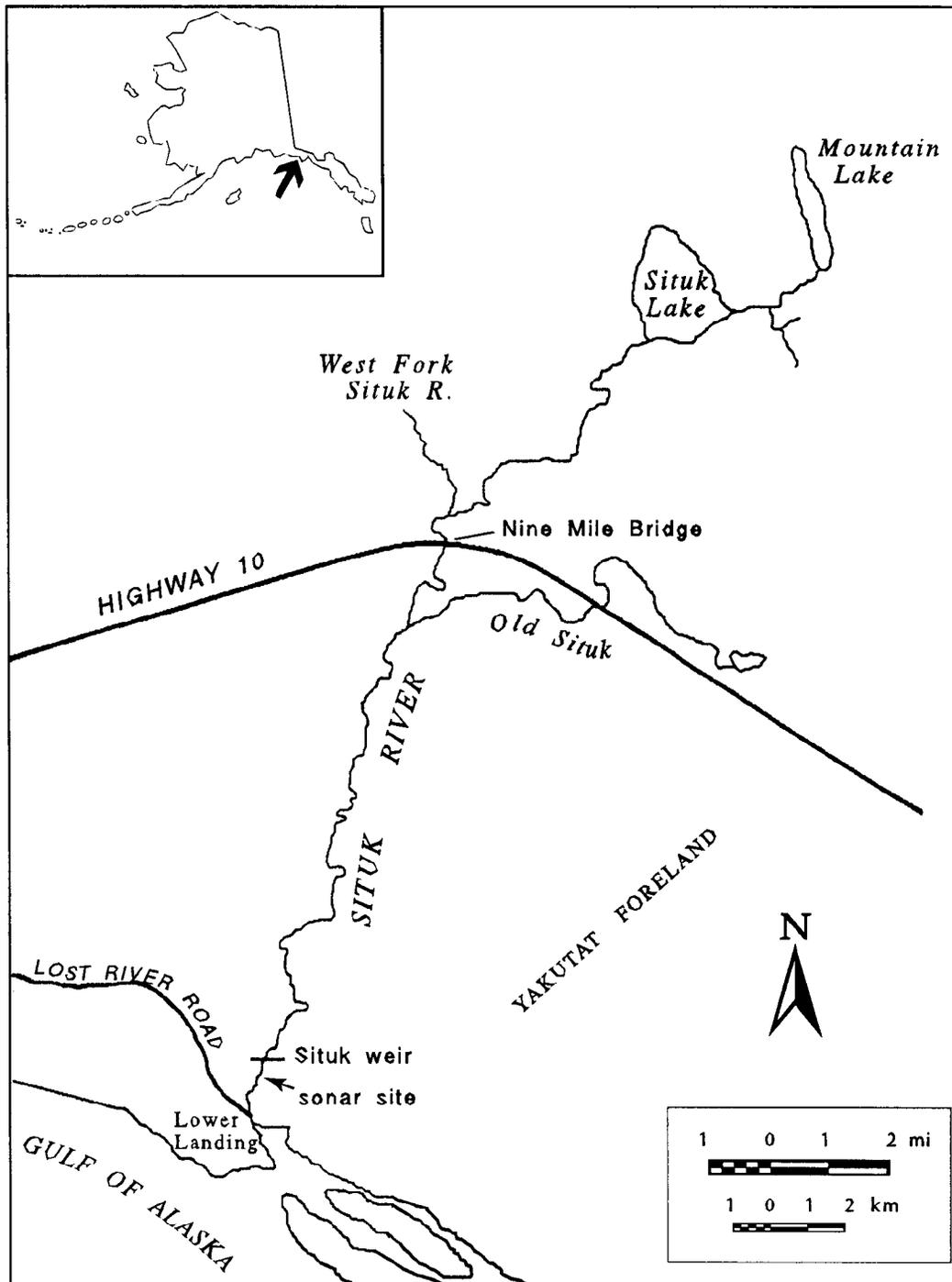


Figure 1. The Yakutat road system and sport fishing areas.

These studies document trends in the escapement and emigration of steelhead trout, and in the effort, catch and harvest statistics of Situk River recreational fisheries to provide a basis for inseason management of these fisheries.

## METHODS

### Steelhead Trout and Chinook Salmon Creel Survey Design

Two-stage "direct expansion" type surveys were used (independently) to estimate statistics for steelhead trout and chinook salmon fisheries accessed at the Lower Landing and for the steelhead trout fishery accessed at Nine Mile Bridge. The survey of steelhead trout anglers at the Lower Landing was conducted from April 8 through June 2. The survey of steelhead trout anglers at the Nine Mile Bridge was conducted from May 13 to June 2. Deep snow on the Forest Highway 10 prevented access by ADF&G until May 13. The chinook salmon fishery at the Lower Landing was to be monitored only in the event of a retention type fishery. Biweekly (14-day) seasonal stratification was used during the survey of steelhead trout anglers; temporal stratification was to be used for the survey of chinook salmon anglers.

Within the two-stage sampling designs, days were the primary sampling units, and periods within days were the secondary sampling units. During each day selected for sampling, two of four possible periods were randomly selected for sampling. Sampling periods during the survey of steelhead trout anglers were equal in length and fixed at between 200 and 231 minutes, depending on the strata. The available periods in a day together equaled the length of time from 0800 hours to civil twilight on the average day in a biweekly season. Sampling periods during the survey of chinook salmon anglers were fixed at 225 minutes, and equaled the length of time from 0800 hours to 30 minutes before civil twilight on the average day during the survey. All anglers exiting the river during each sampled period were interviewed<sup>1</sup> and had completed their trip.

Sampling intensity for each survey was limited by available technician time. Six days in each biweekly period were randomly selected for sampling steelhead trout anglers exiting at the Lower Landing, except between April 22 and May 5, when seven days were sampled. Four days in each biweekly period were randomly selected for sampling anglers at Nine Mile Bridge; however, we only sampled 1.5 days (three periods) between May 13 and May 19 because access was limited. Chinook salmon anglers were sampled every other day under a systematic design.

Angler catch,  $C$ , in each stratum of a multistage survey was estimated by

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

---

<sup>1</sup> One angler was not surveyed during one sample period. Estimates in this stratum were made using a similar design with 3 sampling stages (Cochran 1977).

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

$$\hat{C}_{hi} = P_h \bar{C}_{hi} \quad (3)$$

$$\bar{C}_{hi} = \frac{\sum_{j=1}^{P_h} C_{hij}}{P_h} \quad (4)$$

where  $C_{hij}$  is the catch in period  $j$  day  $i$  stratum  $h$ ,  $p_h$  is the number of secondary units actually sampled in any day in stratum  $h$ ,  $P_h$  is the number of secondary units (periods) within days in stratum  $h$ ,  $d_h$  is the number of primary units actually sampled in stratum  $h$ , and  $D_h$  is the number of primary units (days) in stratum  $h$ .

The variance of catch in each stratum of the survey of steelhead trout anglers is estimated by

$$V[\hat{C}_h] = (1-f_{1h}) D_h^2 \frac{\sum_{i=1}^{d_h} (\hat{C}_{hi} - \bar{C}_h)^2}{d_h (d_h - 1)} + (1-f_{2h}) D_h \sum_{i=1}^{d_h} P_h^2 \frac{\sum_{j=1}^{P_h} (C_{hij} - \bar{C}_{hi})^2}{d_h P_h (P_h - 1)} \quad (5)$$

where  $f_{1h}$  = the sampling fraction for days ( $d_h/D_h$ ) and  $f_{2h}$  = the sampling fraction for periods ( $p_h/P_h$ ). Variance for the chinook salmon survey was estimated by

$$V[\hat{C}_h] = (1-f_{1h}) D_h^2 \frac{\sum_{i=2}^{d_h} (\hat{C}_{hi} - \hat{C}_{hi-1})^2}{2 d_h (d_h - 1)} + (1-f_{2h}) D_h \sum_{i=1}^{d_h} P_h^2 \frac{\sum_{j=1}^{P_h} (C_{hij} - \bar{C}_{hi})^2}{d_h P_h (P_h - 1)} \quad (5)$$

Total catch, effort, or harvest for the season (and their variances) are the sum of the estimates for each strata. Equations 1-5 were also used to estimate angler effort and harvest, with  $C$  now representing effort or harvest.

Standard errors for catch, effort, and harvest estimates are

$$SE = (\text{Variance})^{\frac{1}{2}} \quad (6)$$

Relative precision (95% confidence interval) for catch, effort, and harvest estimates are

$$\text{Relative Precision} = \frac{1.96 SE}{\text{Estimate}} \quad (7)$$

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

$$CPUE = \frac{\sum \hat{C}}{\sum \hat{E}} \quad (8)$$

While this estimate of CPUE is not success of the average angler, it serves to provide a measure of the overall catch rate.

#### Steelhead Trout Weir

During the first week of May an aluminum bipod, channel, and picket weir were constructed on the Situk River approximately 2.4 km (1.5 mi) upstream of the Lower Landing to census steelhead trout kelts emigrating from the Situk River and to establish the timing of that emigration. Several pickets were removed from the weir each evening from dusk until approximately 0200, and steelhead trout were counted as they passed downstream. Water level (nearest centimeter) and water temperature (nearest 0.1°C) were measured each morning at a staffing gauge located just upstream of the weir at approximately 0800. The numbers of steelhead trout traveling upstream were also recorded daily. All steelhead trout mortalities observed in the stream were sampled for scales, otoliths, and lengths.

#### Steelhead Trout Escapement Indices

Surveys to record the number of observed steelhead trout were conducted approximately every ten days from Nine Mile Bridge to Lower Landing during the in-migration and, on three occasions, from Situk Lake to Nine Mile Bridge near the peak of the escapement. The surveys from Nine Mile Bridge to Lower Landing were accomplished with the use of a canoe powered by a small outboard motor, while the Situk Lake to Nine Mile Bridge portions were done with an inflatable raft. A typical survey consisted of two observers recording the number of steelhead seen during an uninterrupted trip down the river. One of the surveys from Nine Mile Bridge to Lower Landing was made with the use of only one observer. Each observer wore polarized sun glasses.

## RESULTS

#### Steelhead Trout Creel Survey

The harvest of steelhead trout during the 1991 fishing season at the Situk River was prohibited by ADF&G Emergency Order 1-02-91. Effective April 13, 1991, anglers were restricted to catch-and-release using unbaited artificial lures only. Harvest of steelhead trout was not observed during the two days of angler interviews that occurred prior to this restriction.

Steelhead trout anglers were interviewed for four complete biweekly sampling periods at the Lower Landing from April 08 through June 02, 1991. The 128 anglers observed at this site fished 1,043 hours and caught 234 steelhead trout (Table 1). Total effort at this site was an estimated 4,487 hours (SE = 780), with an estimated catch of 1,034 steelhead trout (SE = 197)(Table 2). Estimated angler effort at the Lower Landing peaked during the second biweek (April 22 through May 5) with 2,270 angler hours (SE = 628). The estimated peak catch of 459 steelhead trout (SE = 137) occurred during the third biweek (May 6 through May 19).

Table 1. Observed angler effort (hours), number of interviews, number of periods sampled, number of possible sampling periods, and observed catch and harvest by species, site, and sampling strata for the Situk River creel survey, April 8 through July 31, 1991.

Sampling strata	Angler effort	Anglers interviewed <sup>a</sup>	Periods sampled	Samples possible	Steelhead trout		Chinook salmon	
					Catch	Harvest	Catch	Harvest
<u>Lower Landing</u>								
4/08-4/21	199	24	12	56	47	0		
4/22-5/05	568	56	14	56	89	0		
5/06-5/19	271	46	12	56	98	0		
5/20-6/02	5	2	12	56	0	0		
Subtotal	1,043	128	50	224	234	0		
7/04-7/31	617	154	28	112			21	3
<u>Nine Mile Bridge</u>								
5/13	45	7	1	4	3	0		
5/18	32	5	2	4	23	0		
5/20-6/02	19	9	12	56	3	0		
Subtotal	96	21	15	64	29	0		

<sup>a</sup> Number of interviews = number of possible interviews (except on May 8, when one angler was missed).

Table 2. Estimated angler effort, catch, and harvest of steelhead trout and chinook salmon on the Situk River by sampling period and site, April 8 through July 31, 1991.

	08 Apr 21 Apr	22 Apr 05 May	06 May 19 May	20 May 02 Jun	04 Jul 31 Jul	Total
<u>Angler hours</u>						
<b>Lower Landing</b>						
Estimate	929	2,270	1,265	23	2,469	6,956
Variance	110,509	394,787	102,837	428	198,229	806,790
SE	332	628	321	21	445	898
Relative precision <sup>a</sup>	0.70	0.54	0.50	1.76	0.35	0.25
<b>Nine Mile Bridge</b>						
Estimate				131		131
Variance				5,589		5,589
SE				75		75
Relative precision <sup>a</sup>				1.12		1.12
<u>Steelhead trout catch</u>						
<b>Lower Landing</b>						
Estimate	219	356	459	0		1,034
Variance	5,630	14,487	18,698	0		38,815
SE	75	120	137	0		197
Relative precision <sup>a</sup>	0.67	0.66	0.58			0.37
<b>Nine Mile Bridge</b>						
Estimate				21		21
Variance				378		378
SE				19		19
Relative precision <sup>a</sup>				1.81		1.81
<u>Chinook salmon harvest</u>						
Estimate					12	12
Variance					46	46
SE					7	7
Relative precision <sup>a</sup>					1.11	1.11
<u>Chinook salmon catch</u>						
Estimate					84	84
Variance					3,237	3,237
SE					57	57
Relative precision <sup>a</sup>					1.33	1.33

<sup>a</sup> SE = standard error.

<sup>b</sup> Relative precision = 1.96 SE/estimate.

Prior to May 08 (third biweek), angling effort at Nine Mile Bridge was considered infrequent enough to be insignificant, due to deep snow conditions on Forest Highway 10. Sampling at this site was delayed until the road was plowed on May 13. However, this resulted in a sampling of only three periods (Table 1) during that biweek. Because of the low rate of sampling, estimates for this biweek were not computed.

In the fourth biweek, only nine anglers were interviewed at Nine Mile Bridge. Estimated effort and catch, respectively, were 131 angler hours (SE = 75) and 21 steelhead trout (SE = 19).

Total angler effort during the steelhead trout fishery (April 08 through June 02) was an estimated 4,618 angler hours (SE = 784), with a total catch of 1,055 steelhead trout (SE = 198). The Lower Landing estimates comprised 97% of the total estimated effort for the fishery and 98% of the total estimated catch for both data collection sites.

Estimated variances for effort and catch of steelhead trout by site, stratum, and sampling stage, which may be useful for designing future surveys, are presented in Appendix A1.

#### Chinook Salmon Creel Survey Statistics

In accordance with the Situk-Ahrnklin Inlet and Lost River King Salmon Commercial Fishery Management Plan (5 AAC 30.365), ADF&G Emergency Order 1-05-9, effective June 4, 1991, prohibited the harvest of chinook salmon >16 inches in length in the Situk River until a projected escapement of at least 750 of these large fish was made. That projection was made, and the catch-and-release restriction was rescinded by ADF&G Emergency Order 1-06-91 effective June 30, 1991.

Between July 4 and July 31 1991, 154 anglers interviewed at the Lower Landing caught 21 large chinook salmon and kept 3 of these fish (Table 1). A portion of these 154 anglers also fished for sockeye salmon, which are present in large numbers during this same time period. Effort for sockeye salmon and chinook salmon was not differentiated. The combined estimated angler effort for these species during this period was 2,469 angler hours; the catch of chinook salmon was an estimated 84 fish (SE = 57), and the harvest was an estimated 12 fish (SE = 7)(Table 2).

The purpose of the chinook salmon creel survey was to estimate effort, catch, and harvest in the event that the catch and release restriction was lifted rescinded and a harvest of chinook salmon was anticipated. However, the lack of personnel caused a late start in the creel survey, and the first four days (June 30-July 3) of harvest were not monitored. During this time, staff observed 11 chinook salmon harvested.

#### Steelhead Trout Weir

The Situk River weir was operated from May 9 to June 1 by ADF&G Division of Sport Fish staff and from June 1 until July 27 by ADF&G Commercial Fisheries Division staff. During this period, 2,490 steelhead trout kelts were counted as they passed downstream through the weir (Appendix A). The weir was inoperable from May 28-June 9 because of high water; an unknown number of steelhead trout emigrated from the system during that period. Seventy-one steelhead trout kelts emigrated through the weir before the flood event, and 2,419 emigrated through the weir after the event.

Large numbers of steelhead trout were generally not allowed to pass downstream just before and during commercial fishery openings at the river mouth. On June 16, however, 83 steelhead trout were passed downstream the evening before a morning commercial fishery opening.

By the time the weir was installed, the spring immigration of steelhead trout was well underway. From that time and until the flood event on May 28, 387 immigrating steelhead trout were counted. After the weir was reinstalled on June 10, another 7 immigrating steelhead trout were counted.

#### Steelhead Trout Escapement Indices

The lower Situk River section (from Nine Mile Bridge to Lower Landing) was surveyed on seven occasions during 1991, while the upper river section (from Situk Lake to Nine Mile Bridge) was surveyed on three occasions (Table 3). The three upper river surveys generally occurred one to two days after a lower river survey, and the counts obtained in adjacent surveys were combined to obtain an overall count for the river. Total river surveys conducted on the same day were not possible due to shortages in manpower and difficulty in accessing Situk Lake in the deep snow conditions. The largest of these three counts occurred on May 12 and May 14 when 593 steelhead trout were observed in the lower river and 386 were observed in the upper river, for a total of 979 steelhead trout.

### DISCUSSION

#### Steelhead Trout and Chinook Salmon Creel Surveys

Anglers tended to exit the Situk River Lower Landing during afternoon and evening sampling periods in 1991 (Figure 2). Thus, morning-evening stratification might be adopted in future surveys if conflicts in the allocation of manpower between sampling sites and temporal periods can be resolved. Since sampling effort was evenly divided between morning (periods 1 and 2) and evening (periods 3 and 4) sampling periods in 1991, the estimates are not biased due to nonproportional sampling of the four periods.

#### Steelhead Trout Creel Survey:

Both the estimated peak season catch and effort in the 1991 Situk River steelhead trout survey were lower than any estimates of the previous six seasons, and about 35% to 40% of the 1985-1990 average (Table 4). This is in part due to accumulations of snow that remained in the area well into the fishing season, complicating the logistics and increasing the cost for anglers accessing the steelhead trout fishery. This decrease was further compounded by the ADF&G emergency order that restricted fishermen on the Situk River to catch-and-release steelhead trout fishing using artificial lures only. Some fishermen may have abandoned plans to fish at the Situk River when they learned that a strong steelhead trout run was not expected and that catch-and-release fishing had been imposed on the fishery.

The catch per unit effort (CPUE) of 0.23 during the peak of the 1991 season, although slightly lower than the 1985-1990 average, was better than that observed in either 1990 or 1989 (Table 4). Since effort levels were down in 1991, the fishery was comparatively less crowded than in the previous year. The increased CPUE suggests that those fishermen who chose to fish despite weather conditions and regulatory changes may have benefitted from that condition.

Table 3. Counts of steelhead trout observed while floating the Situk River during 1991.

	Apr 04	Apr 09	Apr 17	Apr 28	May 12	May 14	May 25	May 26	June 13	June 14
<u>Nine Mile Bridge to Lower Landing (lower river)</u>										
Water conditions	Poor	Normal	Poor	Poor	Excellent		Poor		Normal	
Nine Mile to USFSC	70	116	58	32	252		86		35	
USFSC to Milky Creek	120	178	53	76	184		160		123	
Milky Creek to Lower Landing	24	33	53	129	157		118		321	
Subtotal: lower river	214	327	164	237	593		364		479	
<u>Situk Lake to Nine Mile Bridge</u>										
Water conditions						Poor		Normal		Excellent
Situk Lake to Nine Mile						386		463		106
<u>Total Situk Lake to Lower Landing</u>										
Survey dates					May 12 - May 14		May 25 - May 26		June 13 - June 14	
Total steelhead trout counted					979		827		585	

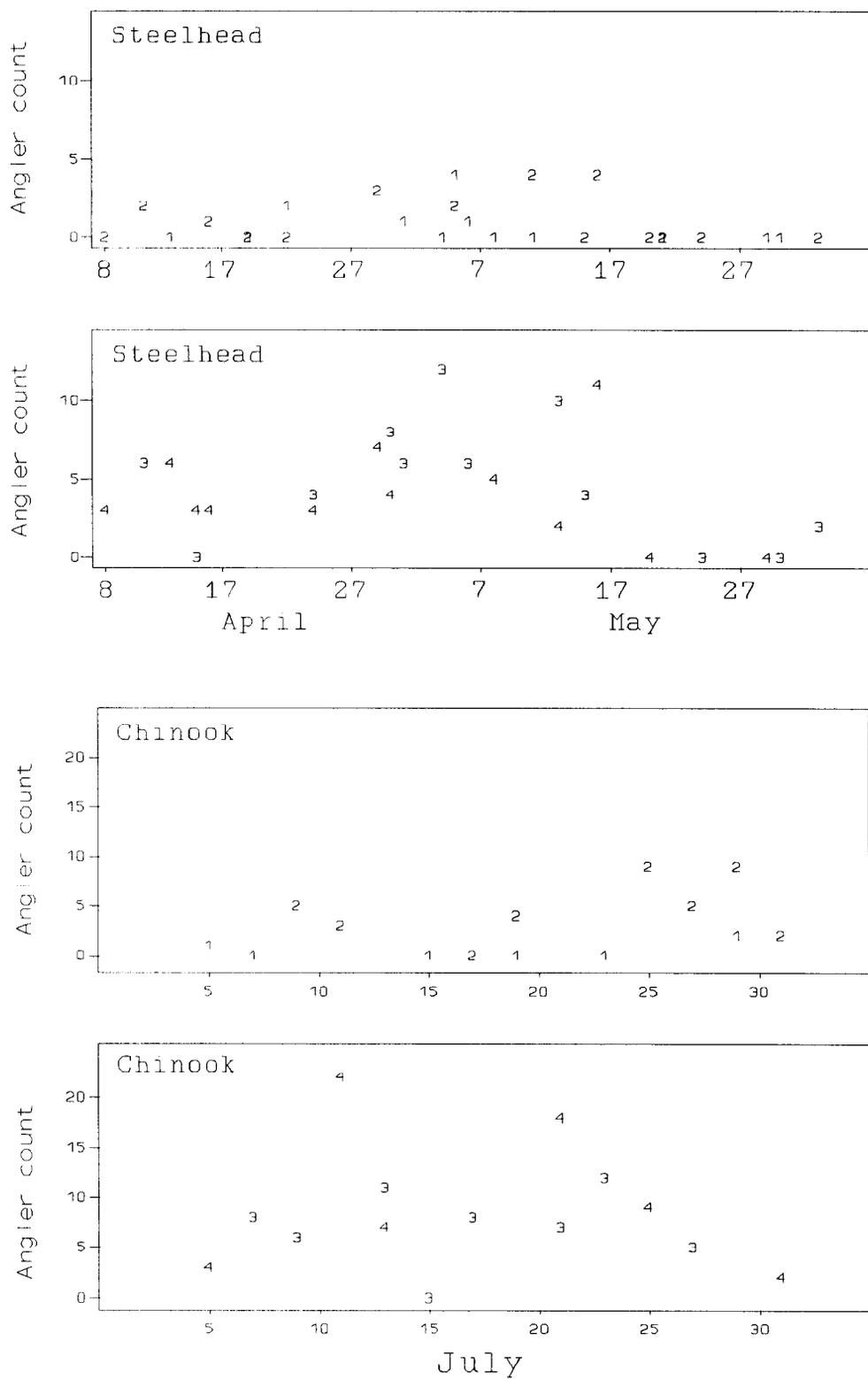


Figure 2. Number of anglers exiting the Situk River at Lower Landing during periods sampled in 1991. Numbers in each plot indicate period sampled (1=early morning, 2=late morning, 3=early afternoon, 4=evening). Anglers tend to exit the fishery in the afternoon and evening.

Table 4. Summary of Situk River steelhead trout sport fishery statistics during the peak of the season, 1985-1991.

Year	Survey dates included	Effort (hrs)	Steelhead trout			CPUE	Percent kept
			Kept	Released	Catch		
1985 <sup>a</sup>	April 29-June 02	6,490	201	2,485	2,686	0.41	7.5
1986 <sup>b</sup>	April 14-June 01	9,338	239	2,025	2,264	0.24	10.6
1987 <sup>c</sup>	April 06-May 17	10,466	391	3,785	4,176	0.40	9.4
1988 <sup>d</sup>	March 28-June 05	12,995	417	4,980	5,397	0.42	7.7
1989 <sup>e</sup>	April 04-June 04	11,078	332	1,974	2,306	0.21	14.4
1990 <sup>f</sup>	March 29-May 27	15,661	321	1,139	1,460	0.09	22.0
Mean	1985 - 1990	11,005	317	2,731	3,048	0.28	10.4
1991 <sup>g</sup>	April 08-June 02	4,618	0 <sup>h</sup>	1,055	1,055	0.23	0 <sup>h</sup>

<sup>a</sup> Mecum and Suchanek (1986). The survey missed the early part of the season.

<sup>b</sup> Mecum and Suchanek (1987).

<sup>c</sup> Bingham et al. (1988).

<sup>d</sup> Suchanek and Bingham (1989).

<sup>e</sup> Johnson and Marshall (1990).

<sup>f</sup> Johnson and Marshall (1991).

<sup>g</sup> Estimates may be biased low due to undersampling at the Nine Mile Bridge site.

<sup>h</sup> Harvest of steelhead trout prohibited by emergency order.

The estimates of catch and effort at Nine Mile Bridge are minimum estimates as they do not include the effort that occurred in the third biweek. Furthermore, angler effort during the third biweek was probably significantly higher than that observed in the fourth biweek. In the third biweek, 12 anglers were interviewed in only three sample periods (4 anglers per period), compared to only 9 anglers interviewed in the complete eight sample periods of the fourth biweek (1.13 anglers per period). There was also unmonitored effort in the area, since we later learned that some anglers were able to access the fishery via logging roads during the period just before the road was plowed (May 8-May 12). Approximately 58 anglers from Glacier Bear Lodge entered and exited the fishery at Nine Mile Bridge via logging roads from May 8 until the Forest Highway 10 was plowed on May 13 (Glacier Bay Lodge, Yakutat, Alaska, personal communication); other anglers probably gained similar access using two other available sources of transportation (Western Rentals and Yakutat Lodge). If the averages of four anglers per period and 6.4 hours per angler observed during the three sampled periods of the third biweek were maintained throughout the entire May 8-19 period, the underestimate of effort at the Nine Mile Bridge site is substantial. However, the significantly low estimate of effort for the entire 1991 Situk River steelhead trout survey is not a result of the underestimated value at the Nine Mile site.

The proportion of total Situk River steelhead trout angler effort that occurs at Nine Mile Bridge has increased from 12% when it was first surveyed in 1987 to 20% in 1990. We believe that the popularity of the Nine Mile Bridge fishery is continuing, and that an increasing number of fishermen are using air charter to access the upper Situk River. This potential increase of effort on the upper Situk River may need to be monitored more closely in the future.

#### Chinook Salmon Creel Survey:

Considering the 11 harvested chinook salmon that were observed by ADF&G staff during the four days of unmonitored fishing prior to the start of the creel survey, the estimated catch of 12 chinook salmon (Table 5) appears to be quite low. However, based on an assumption that a large proportion of the harvest occurs below the weir where densities of fish are greatest, and that by the time the survey began 75% of the run had passed through the weir (674 chinook salmon out of the total 897; Appendix A2), a lower catch for the period surveyed might be expected.

#### Steelhead Trout Weir and Escapement Counts

Due to high water levels that disabled the Situk River weir for 13 days, census of the total number of emigrant steelhead trout kelts was not possible. It is highly likely that some fish emigrated from the system during the period that the weir was inoperable. However, the very low emigration rates that were occurring before the wash-out and the increasing number of emigrants that were counted after the weir was reinstalled (Figure 3) would indicate that only several hundred steelhead trout (or less) were missed. Evidence from the float surveys suggests that this is reasonable, since the ratio of the number of steelhead trout observed in the float counts to the number of kelts counted at the weir in 1991 is similar to that observed in 1989 and 1990 (0.39 in 1991 versus 0.39 in 1989 and 0.45 in 1990; Table 6). Applying the 1989-1990 average ratio of 0.42 to the 1991 float count of 979 would suggest that the 1991 kelt count at the weir would be 2,331 steelhead trout; the actual number of kelts counted at the weir was 2,490. This observed similarity may be merely fortuitous since we do not know what effect certain factors, such as varying water depth and visibility,

Table 5. Summary of estimated sport-fishing harvest, release, and catch of chinook salmon in the Situk River, 1985-1991.

Year	Survey dates	Effort (hrs)	Harvest			Release			Catch		
			<16"	>16"	Total	<16"	>16"	Total	<16"	>16"	Total
1985 <sup>a</sup>	6/10-7/21	4,958	217	294	511	210	123	333	427	417	844
1986 <sup>b</sup>	6/09-7/13	3,568	37	0	37	0	704	704	37	704	741
1987 <sup>c</sup>	6/15-8/09	3,852	319	75	394	90	270	360	409	345	754
1988 <sup>d</sup>	6/06-8/14	6,715	3	185	188	31	124	155	34	309	343
1989 <sup>e</sup>	6/05-7/30	5,568	0	0	0	36	62	98	36	62	98
1990 <sup>f</sup>	6/11-7/22	3,260	0	0	0	0	24	24	0	24	24
Mean	1985-1990	4,654	96	92	188	61	218	279	157	310	467
1991 <sup>g</sup>	7/04-7/31	2,469	0	12	12	0	72	72	0	84	84

<sup>a</sup> Mecum and Suchanek (1986).

<sup>b</sup> Mecum and Suchanek (1987).

<sup>c</sup> Bingham et al. (1988).

<sup>d</sup> Suchanek and Bingham (1989).

<sup>e</sup> Johnson and Marshall (1990). Harvest of chinook salmon >16" prohibited by emergency order after June 19.

<sup>f</sup> Johnson and Marshall (1991). Harvest of chinook salmon >16" prohibited by emergency order after June 8.

<sup>g</sup> Harvest of chinook salmon >16" prohibited by emergency order before June 30. Early portion of the fishery not monitored.

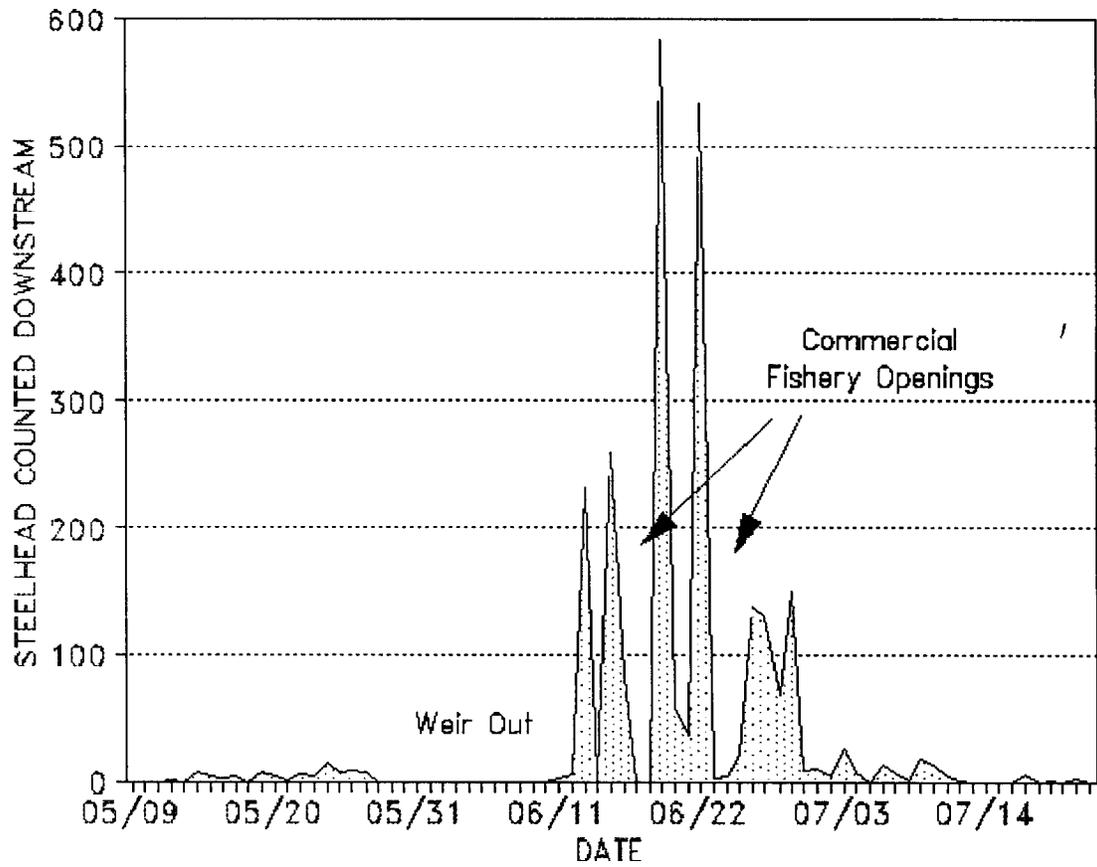


Figure 3. Daily emigration of steelhead trout kelts through the weir in the lower Situk River, 1991. Steelhead trout were not allowed to pass downstream during open commercial salmon fishing periods at the mouth of the Situk River.

Table 6. Counts of steelhead trout made during float surveys, counts of steelhead trout kelts at the Situk River weir, and estimated emigrations of steelhead trout from the Situk River, 1984-91.

Year	Peak float count	Weir count	Ratio float to weir	Estimated emigration <sup>a</sup>
1984	2,889	-- <sup>b</sup>		7,025
1985	2,048	-- <sup>b</sup>		4,980
1986	-- <sup>c</sup>	-- <sup>b</sup>		
1987	3,206	-- <sup>b</sup>		7,796
1988	2,595	-- <sup>b</sup>		6,310
1989	2,251	5,755	0.39	
1990	1,640	3,630	0.45	
1991	973	2,490 <sup>d</sup>	0.39	

<sup>a</sup> Estimated for years in which no weir was operated, using 1989-91 average ratio (0.41) between float count and weir count.

<sup>b</sup> No weir operated during steelhead trout emigration.

<sup>c</sup> No float count due to high water levels.

<sup>d</sup> Count is low since the weir was inoperable from May 28 through June 10.

employment of different index survey observers, and obtaining total river escapement counts from survey segments made on different days, have on the outcome of the escapement counts. Factors such as these are difficult to quantify, and their implication is probably not significant when considering the consistent downward trend that is apparent in the surveys made from 1984-1990.

On the basis of this year's escapement data, it would appear that the 1991 steelhead trout emigration on the Situk River has not varied significantly from the 1984-1990 decline. This trend is of concern, and it is likely that restrictions imposed on the 1991 fishery will be continued or expanded during 1992.

Of specific concern was the observation of steelhead trout kelt mortalities at the weir site: 27 mortalities were observed at the weir during the 1991 emigration study. Johnson reports observing 121 and 19 kelt mortalities, respectively, during the weir counts of 1989 and 1990 (Johnson 1990, 1991). Natural post-spawn mortality, hooking mortalities, and delay of the emigration at the weir are possible reasons for this incident.

#### ACKNOWLEDGMENTS

Bob Marshall and Al Didier reviewed and edited early drafts of this report.

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APPENDIX A



Appendix A1. Estimated variances for effort, catch, and harvest of steelhead trout and chinook salmon >16" on the Situk River, by site, stratum, and sampling stage, 1991.<sup>a</sup>

Sampling stratum	Effort		Harvest		Catch	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
<u>Steelhead trout-Lower Landing</u>						
4/08-4/21	71,162	39,347	0	0	3,208	2,422
4/22-5/05	190,724	204,063	0	0	8,283	6,204
5/06-5/19	58,992	43,846	0	0	9,307	9,390
5/20-6/02	311	117	0	0	0	0
<u>Steelhead trout-Nine Mile Bridge</u>						
5/20-6/02	4,325	1,264	0	0	315	63
<u>Chinook salmon-Lower Landing</u>						
7/04-7/31	119,705	78,524	26	20	2,145	1,092

<sup>a</sup> Stage 1 = days within 14-day seasons; stage 2 = sample periods within days.

Appendix A2. Daily weir record, Situk River, 1991.

Date	Daily steelhead trout		Cumulative steelhead trout		Chinook salmon counts		Water level (cm)	Water temp. (°C)	Comm. fish. open (hrs.)	Remarks
	Up	Down	Up	Down	Daily	Cum.				
	09-May		0		0					
10-May	0	0	0	0				3.0		Fish tight up and down.
11-May	0	0	0	0			85	3.0		
12-May	52	1	52	1			78	3.0		
13-May	46	0	98	1			73	3.5		
14-May	24	6	122	7			73	4.0		
15-May	19	4	141	11			75	4.5		
16-May	23	2	164	13			88	3.5		
17-May	44	3	208	16			78	4.5		
18-May	8	0	216	16			73	5.0		
19-May	20	6	236	22			71	5.0		
20-May	24	4	260	26			74	4.5		
21-May	21	1	281	27			68	5.5		
22-May	61	5	342	32			65	5.0		1 SH mortality, no otolith
23-May	15	3	357	35			63	6.0		
24-May	8	15	365	50			63	7.0		
25-May	5	7	370	57			61	7.0		
26-May	13	8	383	65			60	5.0		
27-May	4	6	387	71			58	5.5		1st sockeye.
28-May			387	71			116	6.0		High water, weir out
29-May			387	71			198	5.0		
30-May			387	71						
31-May			387	71	0	0	91			
01-Jun			387	71	0	0				
02-Jun			387	71	0	0				
03-Jun			387	71	0	0	70	6.8		
04-Jun			387	71	0	0	64	7.0		
05-Jun			387	71	0	0				
06-Jun			387	71	0	0				
07-Jun			387	71	0	0				
08-Jun			387	71	0	0				
09-Jun			387	71	0	0				Weir in, 99% fish tight, No fish above, poor visibility.

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Date	Daily steelhead trout		Cumulative steelhead trout		Chinook salmon counts		Water level (cm)	Water temp. (°C)	Comm. fish. open (hrs.)	Remarks
	Up	Down	Up	Down	Daily	Cum.				
10-Jun	0	0	387	71	0	0	87	7.0		Weir fish tight, ≈10 SH seen above weir, poor visibility. 1st chinook.
11-Jun	0	2	387	73	0	0	81	7.0		≈35 SH seen above weir, 1 SH mortality.
12-Jun	1	5	388	78	4	4	75	8.5		2 SH mortalities.
13-Jun	4	231	392	309	0	4	67	9.0		2 SH mortalities.
14-Jun	0	1	392	310	0	4	64	9.0		
15-Jun	1	260	393	570	3	7	61	9.5		2 SH mortalities.
16-Jun	0	83	393	653	2	9	59	9.0		3 SH mortalities.
17-Jun	0	0	393	653	1	10	56	9.0	18	3 SH mortalities.
18-Jun	0	0	393	653	2	12	55	9.0	24	2 SH mortalities.
19-Jun	1	582	394	1,235	9	21	54	9.0	18	1 SH mortality.
20-Jun	0	59	394	1,294	38	59	53	11.0		
21-Jun	0	35	394	1,329	20	79	50	12.5		3 SH mortalities.
22-Jun	0	533	394	1,862	30	109	50	14.0		
23-Jun	0	2	394	1,864	6	115	50	13.0		3 SH mortalities.
24-Jun	0	3	394	1,867	73	188	49	11.0	18	
25-Jun	0	21	394	1,888	85	273	47	11.5	24	1 SH mortality.
26-Jun	0	137	394	2,025	24	297	47	12.0	18	
27-Jun	0	130	394	2,155	31	328	47	11.5		1 SH mortality.
28-Jun	0	68	394	2,223	29	357	46	12.0		
29-Jun	0	149	394	2,372	92	449	49	11.5		
30-Jun	0	8	394	2,380	51	500	53	11.0		
01-Jul	0	10	394	2,390	26	526	56	10.5	18	1 SH mortality.
02-Jul	0	4	394	2,394	34	560	52	12.5	24	1 SH mortality.
03-Jul	0	26	394	2,420	114	674	52	11.5	18	
04-Jul	0	7	394	2,427	9	683	49	12.5		
05-Jul	0	0	394	2,427	0	683	49	11.0		
06-Jul	0	13	394	2,440	21	704	46	10.5		
07-Jul	0	6	394	2,446	41	745	46	11.5	18	
08-Jul	0	1	394	2,447	10	755	44	12.0	24	
09-Jul	0	18	394	2,465	11	766	46	11.5	24	
10-Jul	0	13	394	2,478	20	786	50	11.0	24	
11-Jul	0	3	394	2,481	11	797	88	11.0	24	
12-Jul	0	1	394	2,482	5	802	70	12.0	24	
13-Jul	0	0	394	2,482	17	819	70	12.5	24	
14-Jul	0	0	394	2,482	6	825	69	12.0	24	

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Appendix A2. (Page 3 of 3).

Date	Daily steelhead trout		Cumulative steelhead trout		Chinook salmon counts		Water level (cm)	Water temp. (°C)	Comm. fish. open (hrs.)	Remarks
	Up	Down	Up	Down	Daily	Cum.				
	15-Jul	0	0	394	2,482	10				
16-Jul	0	0	394	2,482	9	844	57	11.0	24	
17-Jul	0	5	394	2,487	12	856	58	11.5	24	
18-Jul	0	0	394	2,487	11	867	66	11.0	24	
19-Jul	0	1	394	2,488	5	872	64	11.0	24	
20-Jul	0	0	394	2,488	4	876	59	11.0	24	
21-Jul	0	2	394	2,490	15	891	55	12.5	24	
22-Jul	0	0	394	2,490	4	895	52	12.0	24	
23-Jul	0	0	394	2,490	1	896	50	11.0	24	
24-Jul	0	0	394	2,490	0	896	85	11.5	24	
25-Jul	0	0	394	2,490	0	896	59	11.5	24	
26-Jul	0	0	394	2,490	0	896	56	10.0	24	
27-Jul	0	0	394	2,490	1	897	58	10.0	24	

