

AN ESTIMATE OF ANGLER PRESSURE AND SPORT FISH HARVEST FROM THE
KLAMATH RIVER BETWEEN IRON GATE DAM AND DUTCH CREEK, INCLUDING
DATA DESCRIBING THE SIZE OF ANADROMOUS FISH
SPAWNING MIGRATIONS 1

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SUMMARY

This study was conducted to obtain estimates of angler pressure, sport fish harvest, and the percent of adult steelhead (Salmo gairdneri) and adult king salmon (Oncorhynchus tshawytscha) harvested by anglers. This data will be used to evaluate water projects proposed for the Klamath River System and to evaluate current management of the Klamath River aquatic resources.

The study area included 23.5 miles of the Klamath River in northwestern California from Iron Gate Dam downstream to the confluence of Dutch Creek. The study period extended from September 1, 1967, through August 31, 1968. A total of 58,379 angler hours were estimated to have been spent harvesting an estimated 6,710 adult steelhead, 20,002 juvenile steelhead, 314 adult king salmon, 46 juvenile king salmon, and 345 juvenile silver salmon (Oncorhynchus kisutch). Also harvested were 1,958 non-salmonids.

Anglers harvested approximately 32 percent of the adult steelhead entering the study area (estimated 6,710 of 20,841) and about two percent of the adult king salmon entering the study area in the fall of 1967 (estimated 278 of 16,909). Of 28,688 juvenile steelhead released into the Klamath River on May 6, 1968, from Iron Gate Hatchery, 2,869, or 11 percent, were harvested by anglers within the study area.

It was concluded that the sport harvest of juvenile steelhead may have an effect on the number of adult steelhead comprising future upstream migrations, and recommendations were made for further study in this area.

The sport harvest of adult steelhead did not appear to be excessive because of the large numbers of these fish present during the study, however, a similar percent harvest during years when the run is small might cause a significant reduction in the numbers of adult steelhead returning in future runs. The sport harvest of king salmon was not large enough to have any significant effect on the size of future spawning migrations.

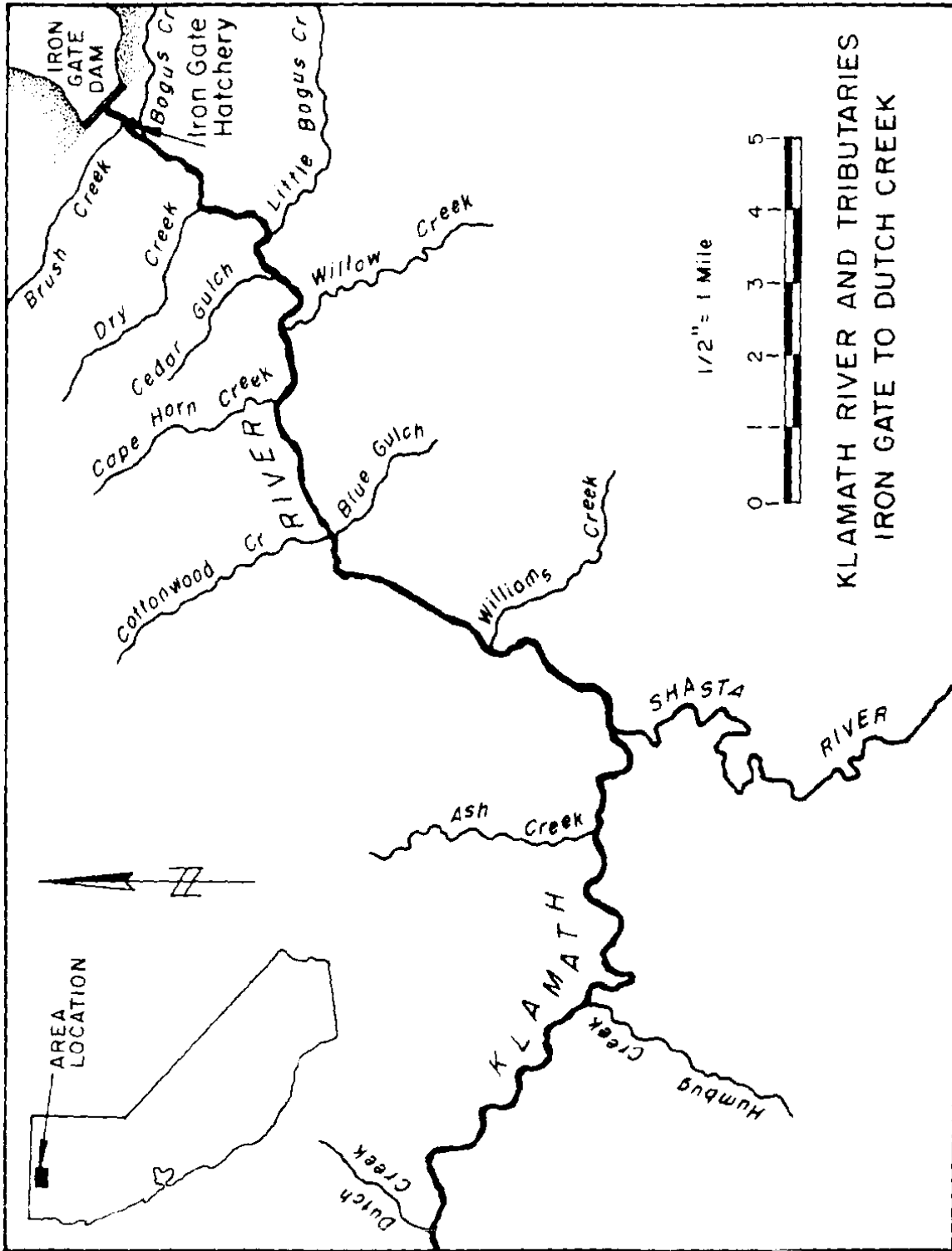


Figure 1. Map of study area.

INTRODUCTION

The Klamath River in northwestern California is one of the most important anadromous fish streams in the United States. This river system provides spawning habitat for hundreds of thousands of steelhead and salmon annually and affords quality angling for these fish.

Various state and federal agencies have proposed a series of dams and reservoirs for the Klamath River which would seriously affect, if not completely eliminate, anadromous fish spawning runs above a point some fifteen miles upstream from the mouth of the river. Knowledge of the sport fish harvest and angler pressure is vital if this department is to effectively and intelligently evaluate the effects of these proposed water projects. This information also provides a basis for evaluating current fishery management practices.

OBJECTIVES

The primary objectives of the present study were to determine angler use and sport fish harvest in the area involved, and to determine the total number of upstream migrating anadromous fish of each species entering the study area.

ACKNOWLEDGMENTS

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DESCRIPTION OF THE STUDY AREA

The Klamath River originates in Lake Ewauna near Klamath Falls, Oregon. After entering northern California, the river flows through Copco and Iron Gate Reservoirs and then continues for about another 188 miles through Siskiyou, Humboldt and Del Norte Counties to the Pacific Ocean.

The study area extends from Iron Gate Dam downstream 23.5 miles to the confluence of Dutch Creek (Figure 1). Mean width of the Klamath River in the study area is approximately 160 feet. The elevation of the river is about 2,200 feet at Iron Gate Dam and 1,840 feet at Dutch Creek, a mean gradient of about fifteen feet per mile. During the study period, releases from Iron Gate Dam ranged from 3,099 cfs in December to 715 cfs in June and July. The water temperature ranged from 74° F. at various times during June, July and August to 35° F. in December. Air temperatures in the study area ranged from 103° F. in July to 30° F. in December. Precipitation occurred in the form of rain and snow and totaled between 15 and 20 inches of moisture.

All-weather roads parallel the Klamath River on one or both sides throughout the study section, except for a stretch of river of about one mile near the town of Hornbrook. Temporary Interstate 5 (Old Highway 99) crosses the Klamath River at the mouth of the Shasta River. The permanent Interstate 5 (under construction) will cross the Klamath River at the mouth of Williams Creek.

ANGLING REGULATIONS IN STUDY AREA

This 23.5 mile section of the Klamath River was open all year to angling with the following two exceptions: (a) from Iron Gate Dam to a point 3,500 feet downstream was closed to all angling, and (b) from a point 250 feet upstream to a point 250 feet downstream from the mouth of the Shasta River was closed to all angling from September 1 through October 31.

Bag limits for trout and salmon, individually or in the aggregate, in the study area were:

General trout season (April 27 through October 31)
Either (a) ten fish, or
(b) ten pounds and one fish, or
(c) at least three fish, irrespective of size

November 1 through April 26
Three fish, irrespective of size.

Other pertinent angling regulations regarding trout and salmon were:

- (a) Fish must voluntarily take hook in its mouth.
- (b) Snagging was unlawful. Unintentionally snagged fish were to be returned unharmed to the river or stream.
- (c) Any multiple hook with shortest distance between hook points greater than 1- $\frac{1}{4}$ inches, or shank longer than two inches was unlawful for use in the Klamath River or tributaries.

No minimum size limits were in effect for any species of fish.

DESCRIPTION OF ANGLING METHODS

Angling by boat in the study area consisted of usually two, sometimes one or three, anglers plus an oarsman in heavy double ender wooden boats about 15 feet long. The boat is allowed to drift with the current with the oarsman determining the speed of drift. The boat is usually held over favorite holes or pools for a time while the anglers cast with lures. Very infrequently anglers would be encountered in other types of boats. Almost every boat observed during the study was under the control of a professional guide extremely familiar with the study area.

Angling from shore involved both angling from the river bank and angling by wading into the river with the aid of a wading staff. The more common baits for both adult and juvenile steelhead included various metal and plastic spinning lures, single salmon eggs, flies, and night crawlers. Artificial roe clusters and fresh or cured roe were used successfully to take adult steelhead. The most popular method of angling for king salmon was with fresh or cured roe, although large heavy metal lures were also used. Juvenile silver salmon were taken incidentally while angling for juvenile steelhead.

SURVEY METHODS

The use count and creel survey portion of this study was conducted on the Klamath River main stem and did not include any of the tributaries. The estimates of the total number of adult fish migrating into the study area did include the contributions of the various tributaries. In the tributaries there was probably a significant amount of angling effort for juvenile trout but not for adult steelhead or salmon. Unlike the Klamath, the tributaries are closed to angling at a time when the spawning adults would otherwise be available.

Angler use counts were conducted by automobile and were combined with the angler interview portion of the program. Combining these two aspects into one operation may seem unusual; however, all anglers were not visible from the road although their vehicles were. Because the checker was required to leave the road and walk the river bank to count the number of anglers, it was decided to interview the anglers at the same time.

The number of days sampled in the use count creel survey per month varied somewhat because of variations in available manpower. From September through January, six weekend days and six to nine weekdays were sampled each month. Fewer days were sampled each month during the balance of the study (Table 1). Sample days were not randomly selected because of conflicts with other work. Each sample day was divided into three time periods, each of which was sampled independently (Table 1). These time periods varied in length according to the length of day in a particular month.

This study was designed to include all daylight hours from sunrise to sunset. Although lawful fishing time began one hour before sunrise and ended one hour after sunset, it was felt that angler pressure during these two one-hour periods would not be significant. Impressions received during the course of this study indicated angling effort before sunrise is nil. Some angling effort does take place after sunset, but it is doubtful that such effort would ever equal five percent of the total angler hours in any month.

Samples were drawn from the following time strata: (a) month, (b) weekday, (c) weekend day, and (d) time period on any sample day. Additionally, the spawning weekend of general trout season, April 26 and 27, 1968 was sampled as a separate stratum. Anglers were also stratified into boat and shore anglers.

TABLE 1

Number of Days Sampled Each Month

	<u>Weekend Days*</u>		<u>Weekdays</u>		<u>Total Days</u>	
	Sampled	In Strata	Sampled	In Strata	Sampled	In Strata
September, 1967	6	10	6	20	12	30
October	6	9	6	22	12	31
November	6	10	6	20	12	30
December	6	11	9	20	15	31
January, 1968	6	9	9	22	15	31
February	3	9	6	20	9	29
March	3	10	6	21	9	31
April (except 26 & 27)	3	6	6	22	9	28
April 26 & 27	2	2	0	0	2	2
May	3	9	6	22	9	31
June	2	10	4	20	6	30
July	2	9	4	22	6	31
August	2	9	4	22	6	31
Total	50	113	72	253	122	366

* Holidays were not sampled.

Time Periods in Sample Day for Each Month of Study

	<u>Time Period 1</u>	<u>Time Period 2</u>	<u>Time Period 3</u>
September, 1967	0700-1100	1100-1500	1500-1900
October	0700-1100	1100-1400	1400-1830
November	0700-1000	1000-1300	1300-1700
December	0700-1000	1000-1300	1300-1700
January, 1968	0730-1100	1100-1400	1400-1700
February	0700-1000	1000-1400	1400-1800
March	0700-1000	1000-1400	1400-1830
April	0500-0900	0900-1500	1500-1900
May	0600-0900	0900-1500	1500-2030
June	0600-1000	1000-1700	1700-2030
July	0600-1000	1000-1700	1700-2100
August	0600-1000	1000-1700	1700-2030

An angler was defined as any person actively engaged in angling or a related activity such as baiting a hook, changing a lure, or walking along the river bank while carrying fishing gear.

Juvenile trout were classified as those steelhead rainbow trout less than one pound in weight. Steelhead rainbow trout weighing one pound or more were classified as adult steelhead.

RESULTS

Angler Effort

This creel survey sampled ten percent of the total estimated boat angler hours and eight percent of the total estimated shore angler hours. The percent of the estimated total angler hours which were actually sampled during angler interviews are as follows:

	Estimated Total Angler Hours	During Creel Survey	Percent of Total Estimated Angler Hours Sampled
Boat	6,786	689	10
Shore	51,593	3,914	8
Combined	58,379	4,603	8

Total angler effort for the twelve-month study period was estimated to be 58,379 angler hours. Boat anglers contributed 12 percent of 6,786 hours while shore anglers contributed 88 percent or 51,593 hours. From completed trip data, it was learned a shore angler day equalled 2.5 hours and a boat angler day was equivalent to 3.7 hours.

Angler effort showed two peak periods; one, during October and November, was primarily the result of fishing for adult steelhead, while the second represents angling effort which was almost entirely for juvenile steelhead during May. There was a sudden decrease in angler effort in December and January, probably because of very cold, wet weather and the shortness of the day. An increase in effort during February may be attributed to the combination of excellent angling and mild weather. Low angler pressure during the summer months was due to uncomfortable, hot weather, an abundance of attached algae and other aquatic plants in the river, and the virtual absence of large salmonids (Figure 2).

Of interest is the almost perfect division of total angler pressure between weekend anglers and weekday anglers. Each category made up 50 percent of the total angler hours; weekend anglers with 29,199 hours and weekday anglers with 29,180 hours. Of the total angler hours estimated, 20 percent or 11,789 hours were spent in the morning time period, 39 percent or 22,886 in the midday time period, and 41 percent or 23,704 in the late afternoon and early evening time period (Table 2).

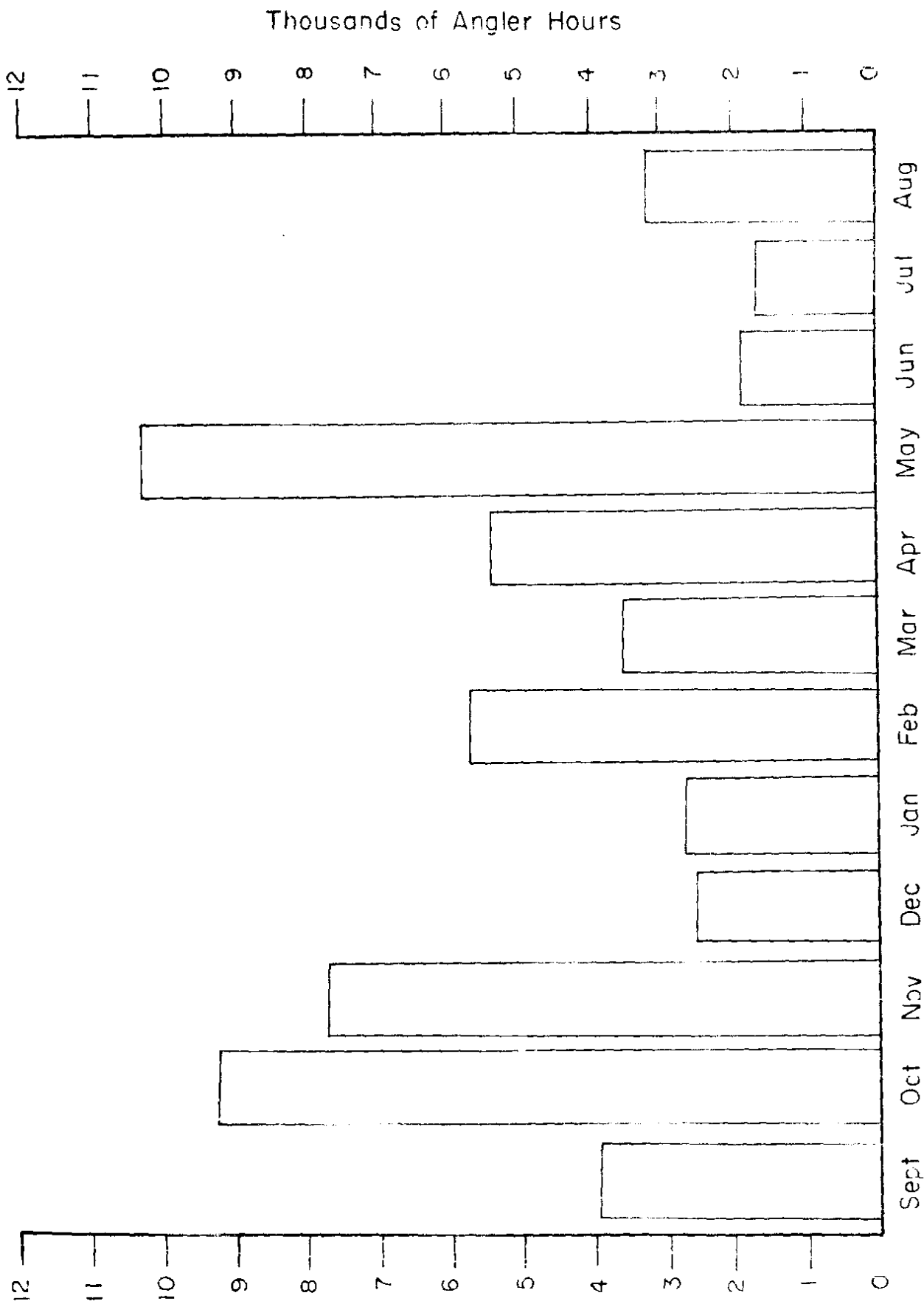


Figure 2. Angler use by month.

TABLE 2

Angler Hours Per Time Period by Month

	<u>Time Periods</u>			Total
	1 Morning	2 Midday	3 - Late Afternoon	
September, 1967	2,160	1,036	732	3,928
October	2,967	2,295	4,028	9,290
November	1,812	1,785	4,160	7,757
December	589	817	1,202	2,608
January, 1968	474	1,421	844	2,739
February	798	2,743	2,185	5,726
March	657	1,846	1,176	3,679
April	435	2,959	2,050	5,444
May	720	4,255	5,291	10,275
June	260	1,008	682	1,950
July	464	780	552	1,796
August	444	1,941	802	3,187
Total	11,789	22,886	23,704	58,379
Percent of Total	20	39	41	100

If one feels the necessity of categorizing the total angler hour figure of 58,379 into time spent fishing for each species, an attempt can be made in that direction. However, it must be noted that such categorization will be largely artificial. Although most anglers were fishing for steelhead, they were also fishing for one of the other species of salmonids thought to be in the river. If a fisherman is fishing for king salmon in October, he is using a bait or lure that is also used for silver salmon, steelhead, and probably juvenile steelhead, and if he hooks a salmonid other than a king salmon, he will probably keep it, excepting juvenile steelhead in some cases. May steelhead anglers caught and kept juvenile steelhead, and certainly a great many juvenile steelhead anglers in April and May were hoping to land an adult steelhead. The point is that many times it is impossible to place the hours an angler spends in one fish species category. However, for those who have need to categorize these angler hours, the following arbitrary percentages seem about right: 60 percent of the total angler hours were spent fishing for steelhead, 30 percent for juvenile steelhead, and 10 percent for king salmon. Less than one percent was spent fishing for silver salmon, non-salmonid fish, such as, yellow perch and frogs. Elsewhere in this paper, catch per angler hour for each species is based on the total effort, not on the percentage breakdown just given.

Angler Harvest

Contrary to popular opinion, October was not the best month for steelhead fishing. Catch per angler hour was highest in January for boat anglers and in February for shore anglers (Table 3). The total adult steelhead catch per hour during the study period is best represented by including only those months in which a significant number of adult steelhead were present in the study section. Adult steelhead were not present to any significant degree during May, June, July, and August. The estimated catch of king salmon was less than 0.1 fish per angler hour for boat and shore anglers combined (Table 3).

Boat anglers harvested an estimated 4,025 salmonids weighing 7,183 pounds, while shore anglers harvested an estimated 23,392 salmonids weighing 42,203 pounds for a combined total estimated harvest of 27,417 salmonids weighing 49,386 pounds (Table 4).

Boat anglers contributed 12 percent of the total angling effort, while harvesting 15 percent of the total number of salmonids and 27 percent of their total weight.

Adult steelhead observed during this study ranged in weight from 1.0 to 5.6 pounds and averaged 2.9 pounds, while adult king salmon ranged from 1.0 to 17.5 pounds and averaged 6.7 pounds. Weights (in pounds and tenths of pounds) of adult steelhead and king salmon are as follows:

TABLE 3

Adult Steelhead Catch Per Hour for Boat and Shore Anglers

	Estimated Angler Hours		Estimated Harvest		Estimated Catch/Hr.	
	Boat	Shore	Boat	Shore	Boat	Shore
September, 1967	100	3,828	0	29	.000	.008
October	752	3,538	210	1,109	.287	.130
November	577	7,189	363	765	.629	.106
December	332	2,276	162	803	.488	.221
January, 1968	412	2,327	273	313	.663	.134
February	1,070	4,656	313	1,068	.292	.229
March	1,270	2,409	443	415	.349	.173
April	1,361	4,083	397	340	.292	.083
Total	5,874	35,297	2,167	4,543	.369	.129

King Salmon Catch Per Hour for Boat and Shore Anglers

September, 1967	100	3,828	0	128	.000	.033
October	752	3,538	4	146	.005	.017
August, 1968	244	2,943	36	0	.148	.000
Total	1,096	15,309	40	274	.036	.018

TABLE 4

Estimated Angler Sport Catch of Salmonids

	Adult Steelhead		Juvenile Trout		King Salmon		Silver salmon		All	
	No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.
<u>BOAT CATCHES</u>										
September, 1967	0	0	0	0	0	0	0	0	0	0
October	216	578	0	0	4	30	0	0	220	608
November	363	1,099	0	0	0	0	0	0	363	1,098
December	162	512	0	0	0	0	0	0	162	512
January, 1968	273	817	0	0	0	0	0	0	273	815
February	312	967	0	0	0	0	0	0	312	957
March	443	1,254	0	0	0	0	0	0	443	1,260
April	397	1,113	25	5	0	0	0	0	422	1,118
May	0	0	1,189	298	0	0	0	0	1,189	298
June	0	0	0	0	0	0	0	0	0	0
July	0	0	38	12	0	0	0	0	38	12
August	0	0	587	117	36	378	0	0	623	495
Total	2,167	6,337	1,818	438	40	408	0	0	4,025	7,183
<u>SHORE CATCHES</u>										
September, 1967	29	46	493	133	128	1,022	0	0	650	1,201
October	1,109	3,004	522	122	146	929	0	0	1,777	4,055
November	765	2,185	5	2	0	0	0	0	770	2,187
December	563	1,548	12	3	0	0	0	0	575	1,451
January, 1968	313	922	0	0	0	0	0	0	313	922
February	1,068	3,339	18	4	0	0	0	0	1,086	3,343
March	426	1,062	179	47	0	0	0	0	605	1,109
April	340	1,040	2,121	395	0	0	213*	33	2,674	1,465
May	0	0	12,789	2,898	46*	1	85*	8	12,920	2,907
June	0	0	744	292	0	0	0	0	744	292
July	0	0	155	41	0	0	0	0	155	41
August	0	0	1,446	354	0	0	47*	3	1,493	227
Total	4,543	12,045	18,184	4,161	320	1,052	345*	44	22,302	10,203
<u>COMBINED CATCHES</u>										
September, 1967	29	46	493	133	128	1,022	0	0	650	1,201
October	1,328	3,582	522	122	150	959	0	0	2,097	4,053
November	1,128	3,283	5	2	0	0	0	0	1,133	3,285
December	667	1,960	12	3	0	0	0	0	677	1,963
January, 1968	586	1,737	0	0	0	0	0	0	586	1,737
February	1,381	4,306	18	4	0	0	0	0	1,399	4,310
March	859	2,316	188	47	0	0	0	0	1,047	2,363
April	737	2,143	2,141	395	0	0	213*	33	3,086	2,880
May	0	0	12,978	2,896	46*	1	85*	8	13,109	3,205
June	0	0	744	292	0	0	0	0	744	292
July	0	0	193	51	0	0	0	0	193	51
August	0	0	1,593	351	36	378	47*	3	1,736	722
Total	6,710	19,381	20,902	4,599	320	2,363	345*	44	27,417	26,386

*In vivo loss

STEELHEAD

KING SALMON

	Number Sampled	Weight Pounds			Number Sampled	Weight Pounds		
		Min.	Mean	Max.		Min.	Mean	Max.
September	4	3.1	1.6	2.1	11	3.5	8.9	12.5
October	77	1.0	2.6	4.0	11	1.0	4.0	12.0
November	113	1.0	3.0	8.0				
December	70	1.0	3.0	5.8				
January	51	1.8	2.9	4.4				
February	44	1.8	3.1	6.2				
March	27	1.7	2.7	5.3				
April	10	1.9	2.8	5.1				
Season	405	1.0	2.9	8.0	22	1.0	6.5	12.5

The estimated 46 king salmon taken in May by shore anglers were the young of the year. This estimate was based on the observation of a single specimen (3.4 inches FL). All silver salmon observed during the creel survey were juveniles and were seen only in the catch of shore anglers. These juvenile silver salmon ranged from 4.9 inches FL to 8.2 inches FL. Juvenile steelhead were taken by both boat and shore anglers and ranged from 4.9 inches FL to 11.8 inches FL with a mean fork length of 7.3 inches.

Non-Salmonids

In addition to salmonids, shore anglers reported catching 1,958 non-salmonid fish weighing 722 pounds (Table 5). Non-salmonid fish were not observed in boat angler catches. The catch estimates for large-mouth bass and green sunfish were based on the observation of a single specimen each.

Marked Juvenile Steelhead

On May 6, 1968, 28,688 one-year-old steelhead were released into the Klamath River from Iron Gate Salmon and Steelhead Hatchery. These fish were marked with an adipose fin clip and averaged 8.0 fish per pound. The following estimated numbers of these marked fish were taken by anglers.

	May	2,605
	June	112
(1968)	July	35
	August	5
	Total	2,860

TABLE 5
 Estimated Shore Angler Sport Catch
 of Non-Salmonids*

	Klamath sucker (<u>Catostomus</u> <u>rimicellus</u>)		Yellow Perch (<u>Percas</u> <u>flavescens</u>)		Green sunfish (<u>Lepomis</u> <u>cyaneollus</u>)		Targemouth bass (<u>Micropterus</u> <u>salmoides</u>)		All	
	No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.
September, 1967	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0
January, 1968	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0
March	17	34	0	0	0	0	0	0	17	34
April	0	0	73	22	0	0	0	0	73	22
May	0	0	732	230	0	0	0	0	732	230
June	0	0	347	109	0	0	0	0	347	109
July	32	32	226	71	32	6	0	0	290	109
August	88	88	382	121	0	0	29	0	409	218
Total	137	154	1,760	553	32	6	29	0	1,958	722

* None observed in boat angler catches.

During the study, an estimated 2,869 adipose fin-clipped juvenile steelhead, or approximately 11 percent of the original 25,688, were harvested in the study section.

From the middle of February through April, very few steelhead were taken below the mouth of Cottonwood Creek. This was due to heavily silt-laden water, from natural runoff, emanating from Cottonwood Creek, and causing the Klamath River below the confluence to become turbid.

Estimate of Total Adult Steelhead and King Salmon in Study Area

An estimated 20,841 steelhead spawners and 16,909 king salmon spawners entered the study area during the twelve-month study period (Table 6). These estimates include those fish entering tributaries and spawning, those spawning in the main stem Klamath River, those taken at Iron Gate Hatchery, and those fish harvested by anglers. Methods used to obtain these estimates are described in Table 7.

It was estimated that anglers harvested 32 percent, or 6,710 of the adult steelhead which entered the study area. Of the 6,710 adult steelhead, 1,741 were spent. Thus, 4,969 adult steelhead, or 24 percent, of the total number entering the study area were caught prior to spawning. Repeat spawning steelhead comprise an unknown percent of any steelhead spawning migration in the Klamath River. The significance of the 1,741 spent steelhead to future spawning runs is not known. Less than two percent, (1.6 percent) of the estimated number of adult king salmon entering the study area in the fall of 1967 were taken by anglers.

DISCUSSION

Counts at the Shasta River Counting Station indicated that adult king salmon entered the study area about September 1, and were available to the angler until about October 31, although they appeared in the creel survey samples from September 20 through October 20. Adult steelhead began to enter the study area about the same time as the king salmon, and remained available to the angler through May. ^{2/} No sport-caught adult silver salmon were observed during the study although a few are known to enter Iron Gate Hatchery, Bogus Creek, and Shasta River.

King salmon young of the year entered the sport catch only in May, and then insignificantly. Juvenile steelhead entered the catch to some degree throughout the study, but contributed most significantly in May, when 13,978 were harvested. Juvenile silver salmon comprised a very minor part of the sport catch and were taken in April, May and August.

^{2/} A few adult steelhead were reported caught through May, but none appeared in the creel survey samples after April 28, 1968.

TABLE 4

Steelhead Spawning Migration
Klamath River - Iron Gate Dam to Hatch Creek

Spring 1965

<u>Tributary Streams</u>	<u>Number of fish</u>		
Brush Creek ²	600	Shasta River (system) ¹	6,000
Bogus Creek ¹	2,000	Ash Creek ¹	30
Box Creek ¹	800	Harting Creek (system) ²	300
Little Bogus Creek ⁴	850		
Cedar Gulch ¹	10	Total Tributaries	12,147
Willow Creek ¹	500	Klamath River main stem ¹	1,000
Cape Horn Creek ¹	10	Entering Iron Gate Hatchery ¹	954
Cottonwood Creek (system) ¹	750	Estimated Angler Harvest	1,710
Blue Gulch ¹	30	Total entering Klamath River above Hatch Creek	20,841
Williams Creek ⁴	202		
Sharps Gulch ¹	5		

King Salmon Spawning Migration
Klamath River - Iron Gate Dam to Hatch Creek

Autumn 1967

<u>Tributary Streams</u>	<u>Number of fish</u>		
Bogus Creek ²	1,000	Entering Iron Gate Hatchery	2,007
Shasta River ¹	12,314	Estimated Angler Harvest	278
Total Tributaries	13,314	Total entering Klamath River above Hatch Creek	16,909
Klamath River main stem ³	50		

¹ Fish were counted at a hatchery or counting station.² Estimate made by walking in or along stream once at end of spawning period, counting carcasses, and including an estimate of carcasses not seen.³ Airplane count of redds. Final estimate includes a factor for those not seen.⁴ Estimate made by walking in or along stream more than once, usually just after a heavy rain when it was assumed many spawners would be visible. Many of these streams flow less than 70% at high water. Usually covered entire area available to upstream migrants. Final estimate factored to allow for fish and/or redds not seen.⁵ Estimate based on counts or estimates made by other years or in similar streams.⁶ Estimate based on that published in California Fish and Wildlife Plan.⁷ No counts made - estimate not based on data.

Al Kutzkey, a fishing guide in the study section kept records of his catch from day to day. Although no accurate check was kept, this guide and his customers accounted for at least 6,500 of the total estimated 6,786 boat angler hours. The boat operator's records show 2,147 steelhead were taken by his boats during the study period, while the estimates of this study showed 2,167 taken by all boat anglers. The boat operator's records also show 31 king salmon were harvested by his boats, while the estimates of this study showed 40 king salmon were harvested by all boat anglers. Although each month's estimate of sport catch of adult steelhead or adult king salmon by boat anglers was sometimes considerably more or less than the actual catch as reported by the guide, the total estimate for the season was remarkably close to his recorded total catch. The similarity of his records and the estimates of this study regarding harvest of adult salmonids, lends confidence to the other estimates in this report.

Of the 25,688 yearling steelhead released from Iron Gate Hatchery, 11 percent, or 2,869 of them were harvested in the four-month period between the time of their release and the end of the study. It is not likely that the surviving fish would move downstream so slowly as to lose their numbers at the same rate per mile, but it is not unreasonable to consider the possibility of a total harvest of hatchery-reared (and wild) juveniles high enough to cause a decrease in numbers of returning adult steelhead populations.

The harvest of 32 percent of the adult steelhead (24 percent of ripe adults) entering the study area was probably not an excessive harvest because of the very large number of steelhead present during the study. However, in years when adult spawning steelhead are not so numerous, a 32 percent harvest could conceivably reduce that spawning population to a point where that crop of juveniles would not be sufficient to replace the total number of adults making up the original run.

The harvest of less than two percent of the adult king salmon entering the study area during the fall of 1967 does not appear likely to have any detrimental effect on the size of future king salmon runs.

RECOMMENDATIONS

1. Data similar to that obtained from this study will be needed for the entire Klamath River System. Planning should begin soon to develop a program which will supply this information.
2. The harvest rate of juvenile steelhead for the entire Klamath River should be determined and its probable effect on the corresponding upstream migrations of adult steelhead. If the harvest rate of juvenile steelhead appears to be causing a significant decrease in numbers of adults, then steps should be taken to restrict the harvest of these juveniles.

REFERENCES

- Rayne, Dr. D. W., et al. 1961. A problem on stratified sampling for creel census of trout fishing, Black River, Mackinac County. April 25 to July 15, 1959. Michigan Institute for Fisheries Research. Methods Memo No. 20.