

An Evaluation of the 1996
Upper Grande Ronde and Catherine Creek
Trout Fishery

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INTRODUCTION

Stocking legal-size (yearling) rainbow trout (*Oncorhynchus mykiss*) has been an important aspect of fishery management in the Grande Ronde River drainage (Union County, Oregon). This program has provided anglers the opportunity to catch fish where the number of large wild rainbow trout was limited. In 1996, an intensive creel survey was implemented in the upper Grande Ronde and Catherine Creek to evaluate the trout stocking program. This creel survey was intended to determine whether legal-size trout releases in the Grande Ronde and Catherine Creek met standards of the Oregon Trout Plan and Wild Fish Management Policy (Oregon Department of Fish and Wildlife 1987). We also used creel survey results to address concerns regarding the potential impact of stocking programs and associated fisheries on steelhead and listed spring chinook salmon in the basin. The objectives of the creel survey were:

- 1) Estimate trout angler effort on Catherine Creek and the upper Grande Ronde River.
- 2) Estimate catch rate, total catch, and harvest of stocked rainbow trout.
- 3) Estimate catch rate, total catch, and harvest of wild salmonids.
- 4) Estimate mortality of wild salmonids.
- 5) Determine demographics and preferences of anglers participating in the fishery.

STUDY AREA

The Grande Ronde River is located primarily in northeast Oregon, with the lower 60 kilometers in southeast Washington. The Grande Ronde River is a tributary of the Snake River, entering the Snake River at river kilometer 272. The upper Grande Ronde River and Catherine Creek are located in Union County, Oregon (Figure 1). The upper Grande Ronde River subbasin extends from the town of La Grande upstream. Catherine Creek is a tributary to the Grande Ronde River, joining the river in the Grande Ronde valley. Both subbasins contain native populations of resident rainbow trout and steelhead trout, bull trout (*Salvelinus confluentus*), and chinook salmon (*O. tshawytscha*). Steelhead trout, bull trout, and chinook salmon are listed as threatened under the Endangered Species Act (ESA).

Historically, both Catherine Creek and the upper Grande Ronde River were managed to provide a hatchery-based consumptive sport fishery while maintaining wild trout production. This is described as management for Basic Yield in the Oregon Trout Plan, and Option B of the Wild Fish Management Policy (Oregon Department of Fish and Wildlife, 1987). Rainbow trout were stocked since the mid-1940s over much of the upper Grande Ronde River and Catherine Creek. In the 1980s and early 1990s, up to 10,000 legal-size rainbow trout were released in each system. This was reduced to 5,000 fish and stocking locations were moved downstream from the primary spring chinook spawning areas when spring chinook salmon were listed as threatened under the ESA in

1992. These changes were implemented to concentrate angling effort outside primary chinook spawning areas, and minimize potential for predation of juvenile chinook by stocked rainbow trout.

At the time of this study, trout season opened in late May. The minimum length limit for trout was 6 inches (15.24 cm) total length. These regulations were intended to protect migrating wild steelhead smolts by focusing trout angling after the main migration period and preventing harvest of steelhead parr and smolts. At the time of the study, the Oregon Department of Fish and Wildlife (ODFW) proposed increasing minimum size to 8 inches (20.32 cm) to provide additional protection for wild steelhead juveniles. The 8 inch minimum size was implemented in 1997. When steelhead were listed in 1997, ODFW ceased stocking legal-size rainbow trout in the upper Grande Ronde River and Catherine Creek to minimize potential for competition and incidental harvest of listed steelhead.

METHODS

We evaluated: return to angler, angler effort and catch; impacts on wild salmonids; and angler demographics and preferences.

Return to angler, angler effort, total catch, and catch rate

We conducted an angler creel survey on Catherine Creek and the upper Grande Ronde River from May 25 through September 15, 1996. Trout angling on these streams was open from May 25 through October 31 in 1996, but effort in the fall fishery was expected to be low, and funding precluded sampling the entire season. All rainbow trout stocked in 1996 were identified with adipose and right ventral fin clips. All steelhead trout stocked in 1996 were identified with adipose fin clips. The sampled areas included the portions of stream stocked with legal-size rainbow trout and extended downstream to clearly defined points with angler access. Catherine Creek was sampled from the Swackhammer diversion structure (~rk 29, ~rm 18) just upstream from the town of Union to the Highway 203 bridge (~rk 44, ~rm 27.3) above Catherine Creek State Park, covering approximately 15 kilometers (~9.3 miles). The upper Grande Ronde River was sampled from Hilgard State Park (~rk 266, ~rm 165.3) upstream to the Forest Service Boundary just below Vey Meadows (~rk 309, ~rm 192), covering approximately 40 kilometers (~24.9 miles) (Figure 1).

Creel survey personnel sampled each weekend day and two randomly chosen weekdays each week. On each sample day, survey timing was randomly selected to either start at dawn or end at dusk. Both streams were surveyed on each sample day. For each sample day, we randomly selected which stream to sample first. Two pressure counts were conducted for each stream on each sample day. Pressure counts were conducted by driving along the road, locating vehicles or anglers, and then stopping to determine the number of anglers in the vicinity. During the time between pressure counts, anglers were interviewed and queried about their catch, time spent fishing, and angling gear. Catch

was identified by species and hatchery fin mark. Fin mark was used to identify hatchery fish as either stocked rainbow or residual steelhead, which did not migrate to the ocean. We could not distinguish wild rainbow trout and wild juvenile steelhead, so these were grouped as trout for the analyses in this report. Angler interviews were classified as completed trips if they were finished fishing for the day or incomplete if they were still fishing.

Data for each stream were stratified by area, month and day type. Catch rate was estimated for each species and fin mark, kept or released, within each stratum by summing catch and dividing by angler hours sampled. Completed and incomplete angler trips were pooled. Catch rate per angler hour was estimated as:

$$(C / H)_k = \sum_{i=1}^n \sum_{j=1}^m C_{ijk} / \sum_{i=1}^n \sum_{j=1}^m H_{ijk}$$

where

C/H_k = catch per angler hour of species k within a stratum

C_{ijk} = total catch of species k by party j on day k within a stratum

H_{ijk} = total hours fished by party j on day k within a stratum

Average daily angler hours of effort was estimated by calculating the area under the curve (AUC) of a trapezoid formed by the average stratum pressure during four time intervals: before 9:00 AM, 9:00AM – 1:30 PM, after 1:30 PM – 5:30 PM, and after 5:30 PM. Angling pressure was assumed to be zero at the legal start and end of the fishing day. AUC within a stratum was estimated as:

$$AUC = 1/2 \sum_{h=1}^5 (T_h - T_{h-1}) * (E_h + E_{h-1})$$

where

T_h = Average time of day of count h within a stratum, h = 1–4,
 T_0 = Start time of angling, and T_5 = End time of angling

E_h = Average count of anglers at count h within a stratum, h = 1– 4,
 $E_0 = 0$ = Count at start time of angling, and $E_5 = 0$ = Count at end time of angling

Total stratum pressure was estimated as average daily pressure multiplied by the number of days in the stratum. Total catch by species and fin mark, kept and released within a stratum was estimated as the product of the catch rate and the hours of effort. Catch of each species and fin mark by gear type was estimated by summing the catch by gear type,

dividing by the hours fished by the gear type, and multiplying by the estimated hours of effort by that gear type. Hours of effort for each gear type was estimated by multiplying the stratum AUC by the proportion of hours fished using a particular gear type. Angler trips were estimated by calculating average trip length from completed angler trips and dividing this into the estimated hours of effort.

Angler effort was determined for both stream length and stream area. Effort per kilometer was determined by dividing angler hours by kilometers sampled. This data was then converted to angler hours per hectare using unpublished habitat survey data (wetted width) from the United States Forest Service and ODFW.

Mortality of wild salmonids

Catch and release (hooking) mortality was estimated by determining total catch, harvest, and release numbers by gear type for wild rainbow trout, and then applying hooking mortality estimates described in Wydoski (1977). Mortality estimates used were: 25% for bait, 6% for lures, and 4% for flies. For the “other” gear type, and when gear type was missing, we applied a 15% hooking mortality rate as described by Knox (2000).

The estimates of hooking mortality used by Wydoski (1977) and in this study are supported by other recent studies. Schill (1996) caught wild rainbow trout on worm-baited hooks, collected them with electrofishing gear, and estimated 16% hooking mortality. Schisler and Bergersen (1996) evaluated hooking mortality for rainbow trout caught on scented artificial baits and flies. In their study, average hooking mortalities were 32.1%, 21.6%, and 3.9% for passively fished artificial bait, actively fished artificial bait, and flies respectively.

Angler demographics and angler preferences

We interviewed a subset of anglers to assess demographics and preferences and recorded data on the social creel survey form in Appendix 1. Anglers were interviewed as time allowed during the statistical creel. We interviewed individual anglers only once during the season to avoid response bias for repeat anglers. This survey was conducted to determine angler residence, angler preference, and whether our management program was meeting angler expectations.

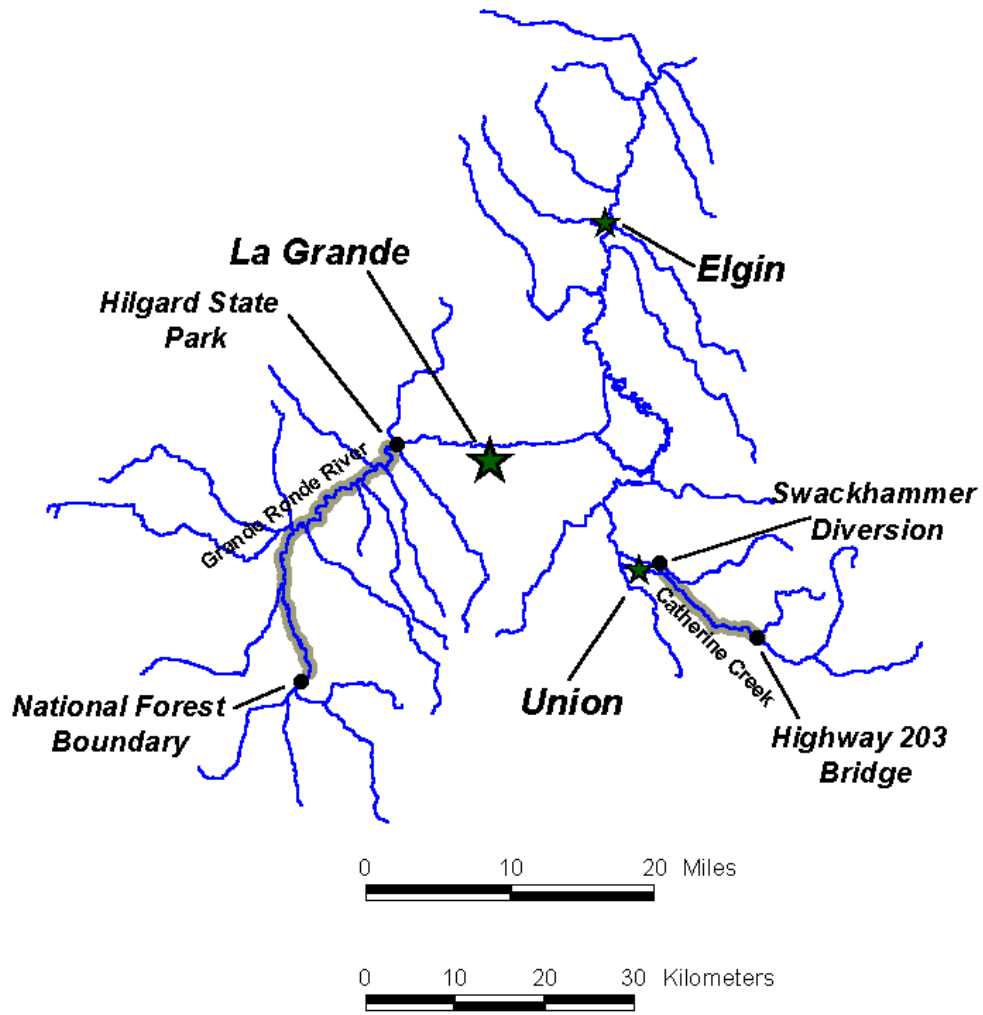
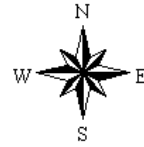


Figure 1. Map of the upper Grande Ronde subbasin, including Catherine Creek. 1996 trout creel study areas are highlighted.

RESULTS

We evaluated: return to angler, angler effort and catch; impacts on wild salmonids; and angler demographics and preferences.

Return to angler, angler effort, total catch, and catch rate

Hatchery rainbow trout utilization was limited on both streams. We stocked 5,604 legal rainbow trout in the Grande Ronde River in 1996. Of these fish, 14.9% were harvested, and 10.2% were caught and released. We stocked 4,004 legal rainbow trout in Catherine Creek in 1996. Of these fish, 11.1% were harvested, and 4.0% were caught and released (Figure 2).

Angling effort on the upper Grande Ronde River was higher, and peaked earlier in the year than on Catherine Creek. Anglers fished approximately 1,961 hours on the upper Grande Ronde River and 1,275 hours on Catherine Creek. Sampling rates of the angler hours averaged about 24% on each stream. Angling effort peaked in June and July on the upper Grande Ronde River, and in July on Catherine Creek (Figure 3). Angler effort during the study period (excluding late September and October) on the upper Grande Ronde River was 49 hours per kilometer per year (30.7 hours/hectare/year). Angler effort on Catherine Creek was 85 hours per kilometer per year (107.1 hours/hectare/year).

Wild rainbow (including steelhead) provided a substantial proportion of total catch on both streams. An estimated 3,301 rainbow trout caught on the upper Grande Ronde River, and 1,653 (50.1%) were wild (Figure 4). An estimated 1,274 (77.1%) of the wild fish caught were released, but 1,003 (79%) of the released fish were considered “sublegal” (less than six inches) by the anglers (Figure 4). Grande Ronde River anglers caught an estimated 650 legal-sized (6 inches or greater) wild rainbow trout, and released 271 (41.7%) of the legal-sized wild rainbow trout (Figure 4).

An estimated 2,523 rainbow trout were caught on Catherine Creek, and 1,764 (69.9%) were wild (Figure 4). An estimated 1,503 (85.2%) of the wild fish caught were released, but 813 (54.1%) of the released fish were considered “sublegal” by the anglers. Catherine Creek anglers caught an estimated 951 legal-sized wild rainbow trout, and released 690 (72.5%) (Figure 4).

Overall catch rates were 1.68 to 1.98 fish per angler hour on the upper Grande Ronde and Catherine Creek, respectively. For both streams, catch rate for wild rainbow trout exceeded that for hatchery rainbow trout. Most of the wild catch consisted of sublegal rainbow trout (Table 1).

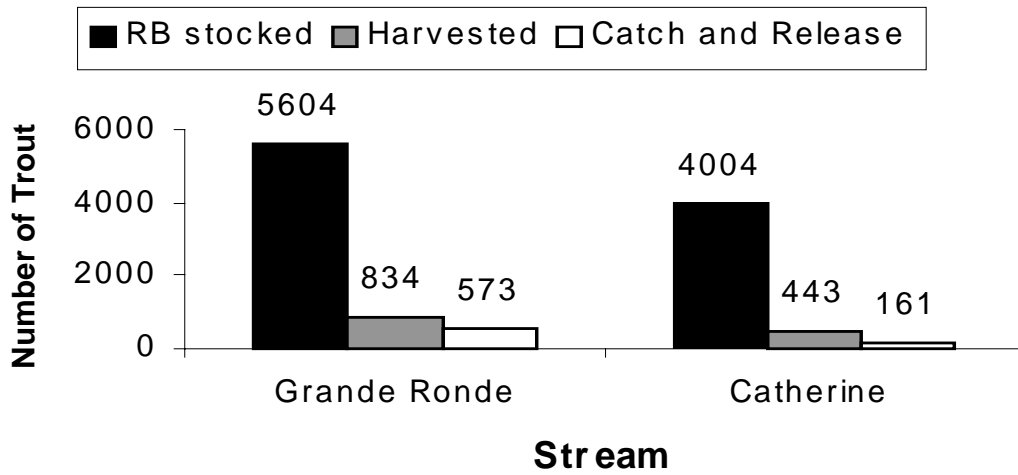


Figure 2. Utilization of hatchery rainbow trout on the upper Grande Ronde River and Catherine Creek, 1996. Survey conducted May 25 to September 15.

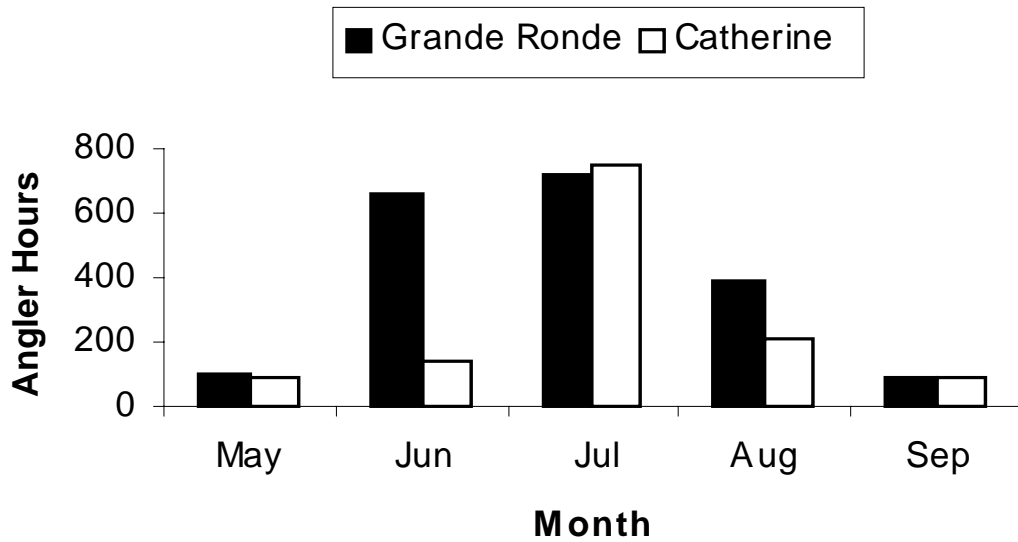


Figure 3. Monthly distribution of angler hours in the upper Grande Ronde River and Catherine Creek trout fisheries, 1996. Survey conducted May 25 to September 15.

Table 1. Upper Grande Ronde River and Catherine Creek trout fishery catch rates in 1996. (Unkn = unknown)

Stream	Fish per Angler Hour						
	Wild Rainbow/Steelhead			Hatchery Rainbow	Hatchery (Residual) Steelhead	Unkn	Total
	Legal	Sublegal	Total				
Grande Ronde	0.33	0.51	0.84	0.72	0.03	0.09	1.68
Catherine Creek	0.75	0.64	1.38	0.47	0.10	0.02	1.98

Mortality of wild salmonids

This study suggests that in 1996, anglers on the Grande Ronde River and Catherine Creek harvested less than 400 wild rainbow trout on each stream (Figure 4). Anglers on both streams tended to keep a higher proportion of the legal-size hatchery trout than the legal-size wild rainbow trout. However, this difference was more pronounced on Catherine Creek. On the Grande Ronde River, anglers kept 834 (77.1%) of the 1,082 legal-size hatchery rainbow trout caught, while anglers kept 379 (58.3%) of the 650 wild legal-size rainbow caught (Figure 4). On Catherine Creek, anglers kept 443 (89.7%) of the 494 legal-size hatchery rainbow trout caught, while anglers kept only 261 (27.4%) of the 951 legal-size wild rainbow caught (Figure 4).

Bait angling was most popular on both streams, comprising 56% to 61% of angler hours on the upper Grande Ronde and Catherine Creek, respectively (Figure 5). Use of flies and lures was approximately equal on both streams, ranging from 12.8% to 15.4% of total angler hours (Figure 5).

On the Grande Ronde River, estimated hooking mortality of sublegal (less than 6 inch) wild rainbow caught and released was 146 fish, or 14.5% of the catch. Approximately 48% of that mortality could be attributed to bait anglers, with 40% attributed to anglers for which we had no data on gear type (missing) or anglers using more than one gear type (combination). (Figure 6). On Catherine Creek, estimated hooking mortality of sublegal wild rainbow caught and released was 83 fish, or 10.2% of the catch. Approximately 66% of that mortality could be attributed to bait anglers, with 3.6% attributed to anglers with missing or combination gear type (Figure 6).

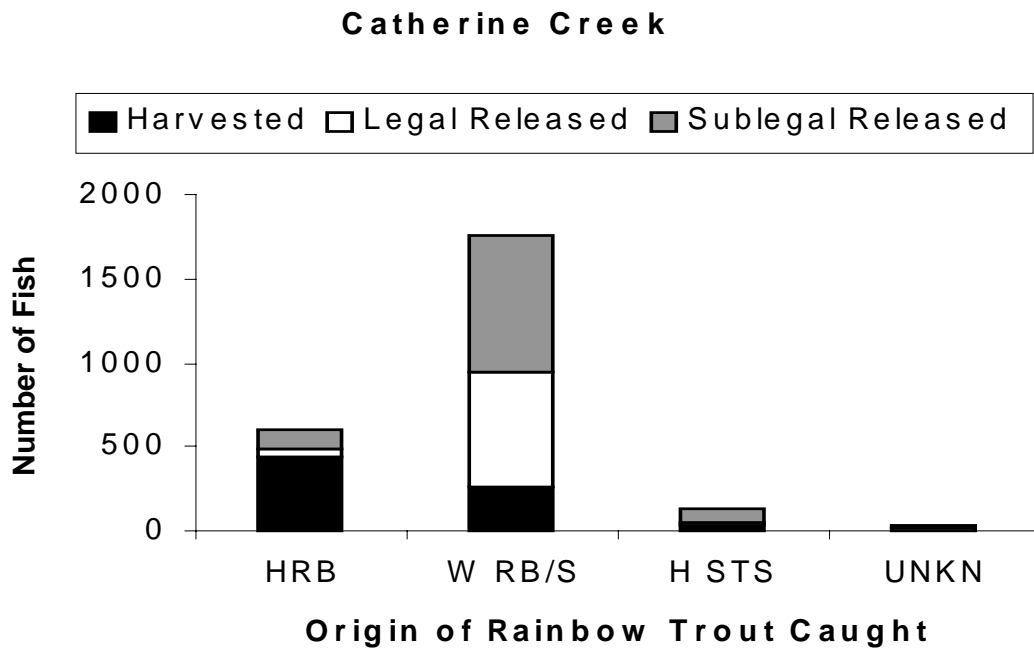
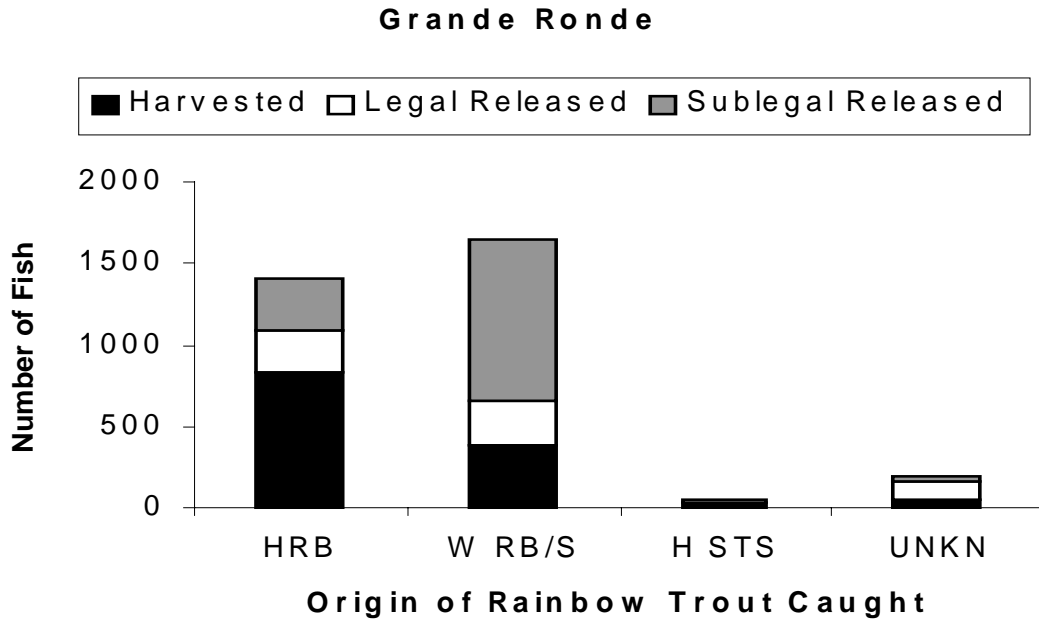


Figure 4. Catch composition in the trout fishery on the upper Grande Ronde River and Catherine Creek, May 25 to September 15, 1996. H RB = hatchery rainbow; W RB/S = wild rainbow trout or steelhead; H STS = hatchery steelhead; and UNK = unknown.

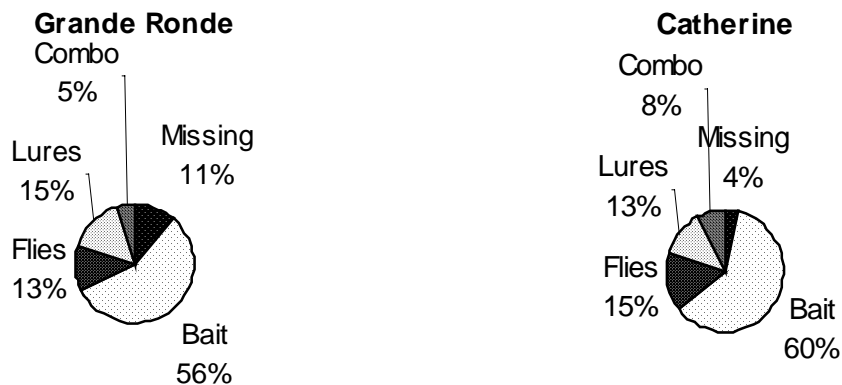


Figure 5. Percent angler hours by gear type for the trout fishery on the upper Grande Ronde River and Catherine Creek, 1996. Survey conducted May 25 to September 15.

On the upper Grande Ronde River, estimated hooking mortality of legal-size (6 inch or larger) wild rainbow trout caught and released was 37 fish, or 13.6% of the catch. Approximately 43% of that mortality could be attributed to bait anglers, with 46% attributed to anglers with missing or combination gear type (Figure 7). On Catherine Creek, estimated hooking mortality of legal-size wild rainbow caught and released was 64 fish, or 9.3% of the catch. Approximately 64% of that mortality could be attributed to bait anglers, with 3% attributed to anglers with missing or combination gear type (Figure 7).

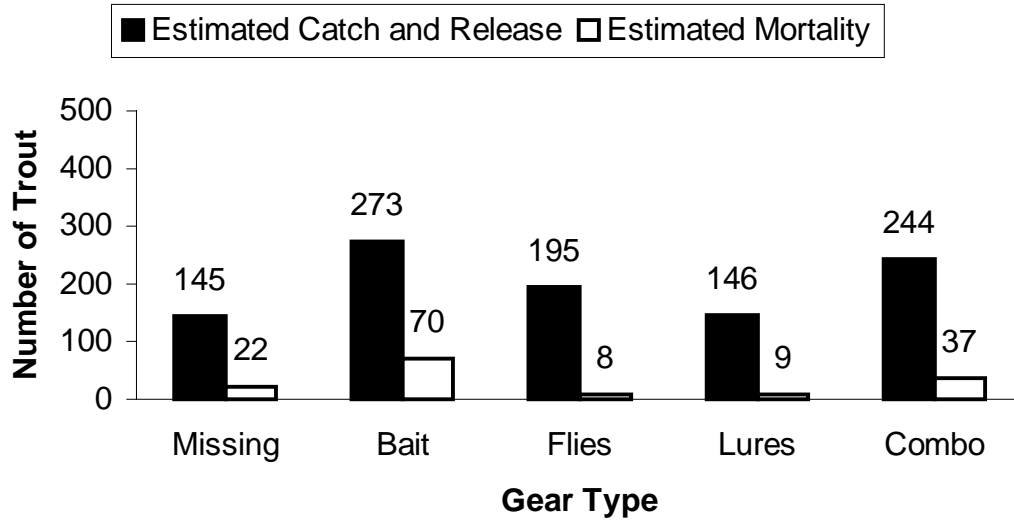
On the upper Grande Ronde, we estimated that 562 wild rainbow were harvested or died after being caught and released, while 834 hatchery trout were harvested. On Catherine Creek, we estimated that 408 wild rainbow trout were harvested or died after being caught and released, while 443 hatchery rainbow trout were harvested.

Angler demographics and angler preferences

We interviewed 228 anglers for angler demographics and angler preferences. Most of those anglers (143) were interviewed on the upper Grande Ronde River, while 85 anglers were interviewed on Catherine Creek. Assuming that estimated angler trips represent the number of anglers on the stream, this yielded a sample rate of 11.8% on the upper Grande Ronde River, and 8.1% on Catherine Creek. The sample rate of individual anglers is probably higher, since many anglers made repeat trips to each stream.

Most anglers on both streams made repeat trips during the season, but a substantial number were fishing the stream for the first time. According to angler response, 56% and 44% of anglers on the upper Grande Ronde River and Catherine Creek, respectively,

Grande Ronde River



Catherine Creek

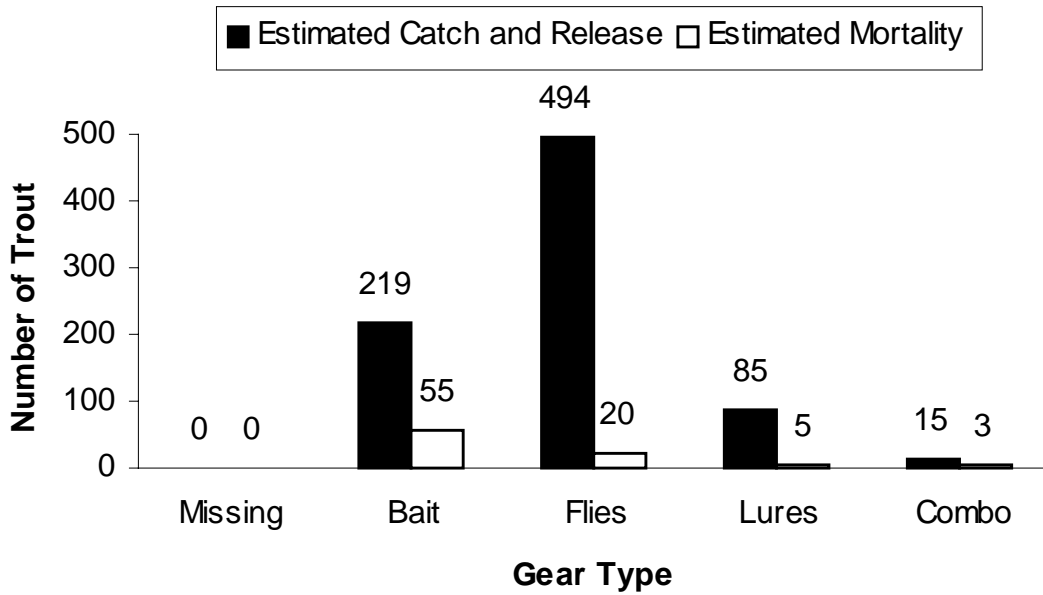
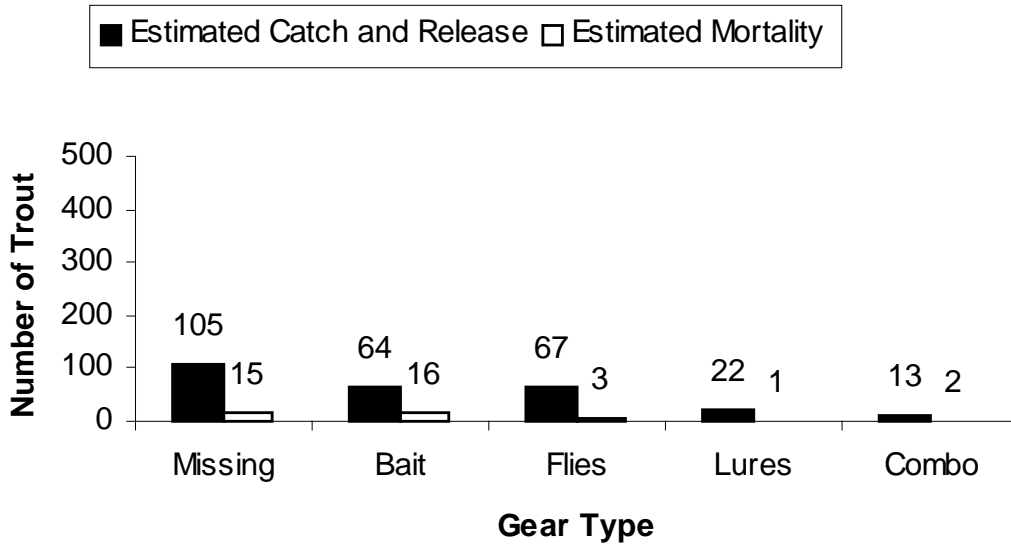


Figure 6. Estimated catch and release and hooking mortality of sublegal wild rainbow trout on the upper Grande Ronde River and Catherine Creek, 1996.

Grande Ronde



Catherine Creek

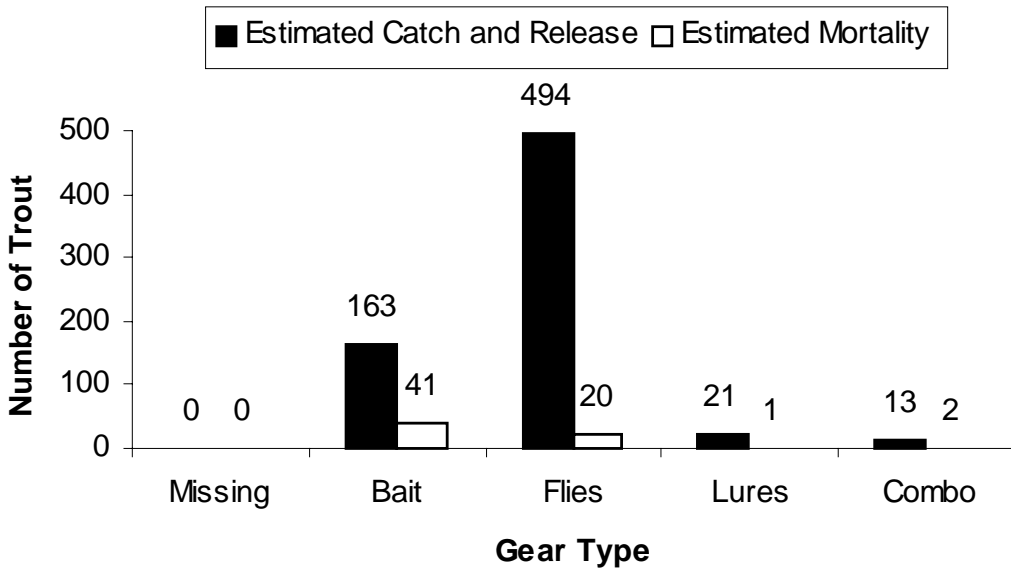


Figure 7. Estimated catch and release and hooking mortality of legal wild rainbow trout on the upper Grande Ronde River and Catherine Creek, 1996.

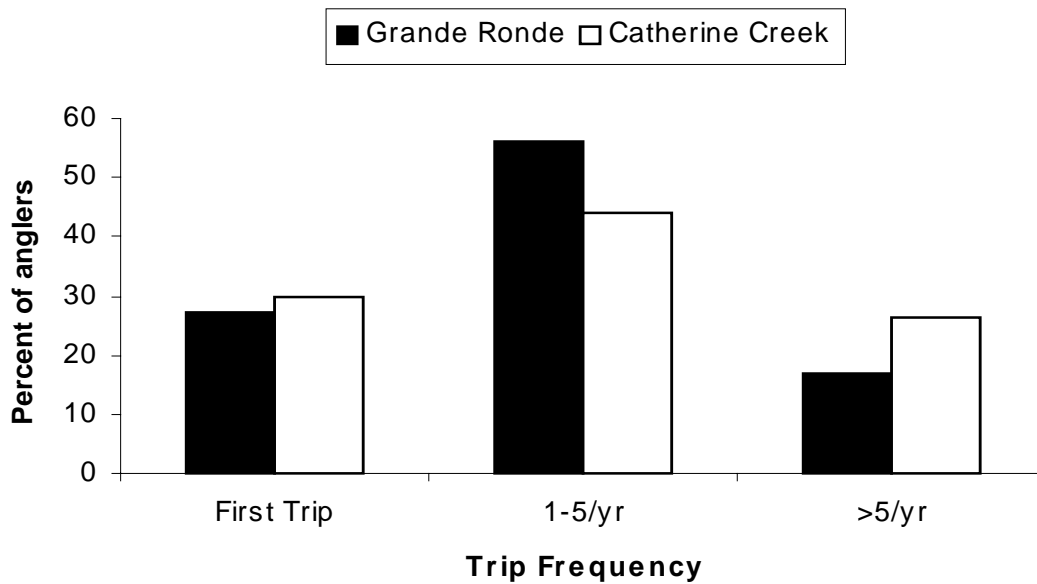


Figure 8. Trip frequency for anglers on the upper Grande Ronde River and Catherine Creek, 1996.

fished the stream from one to five times per year (Figure 8). In addition, 17% and 26.2% of anglers on the upper Grande Ronde and Catherine Creek, respectively, fished the stream greater than five times per year. On both streams between 27% and 30% of the anglers were fishing the stream for the first time.

Anglers varied in the primary purpose of their outing. Most anglers on the Grande Ronde River were on a family outing (40%), followed by those fishing to catch and release (28.5%), and catching fish to eat (19.5%) (Figure 9). On Catherine Creek, a similar number of anglers stated that their purpose was a family outing (31.3%) or fishing to catch and release (31.3%). However, catching fish to eat was the primary purpose for 28.8% of the Catherine Creek anglers (Figure 9).

When asked about the stocking program, most anglers were aware that fish were stocked in these streams, and considered the stocking program beneficial. On the upper Grande Ronde River, 55.9% of the anglers were aware that the stream was stocked with legal-size rainbow trout. On Catherine Creek 74.1% of the anglers were aware of the trout stocking program (Figure 10). On both streams, over 80% of the anglers said they would continue to fish these streams if the stocking program was discontinued (Figure 10). In addition, approximately 74% of the anglers stated that the trout stocking program improved the fishing experience, while 20% to 22% said it had no impact on the fishing experience (Figure 11). A small number (0.7% on the upper Grande Ronde, and 3.5% on Catherine Creek) thought the stocking program detracted from the fishing experience.

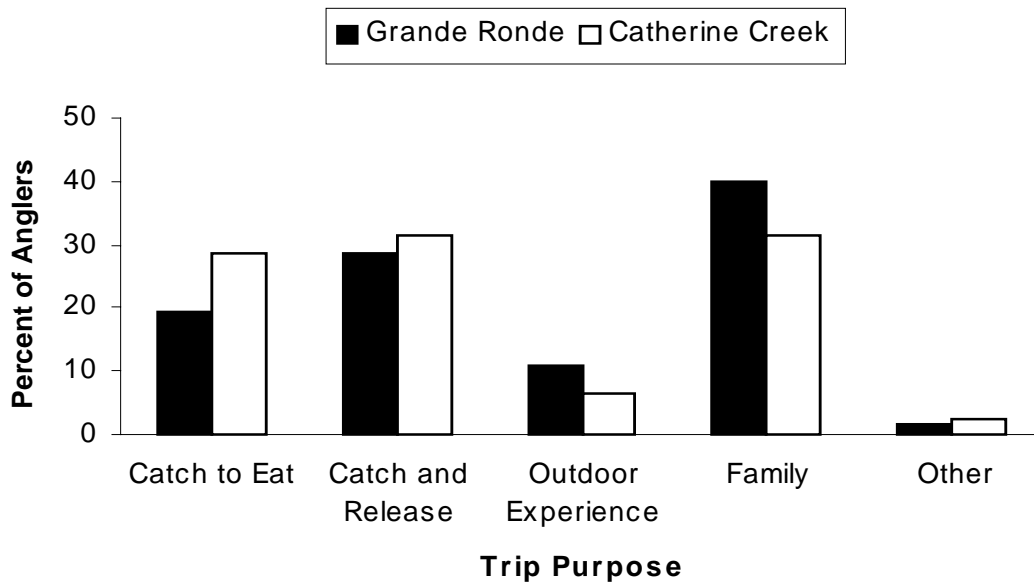


Figure 9. Trip purpose for anglers on the upper Grande Ronde River and Catherine Creek, 1996.

At the time this creel survey was conducted, ODFW was proposing increasing the trout minimum length from 6 inches to 8 inches. Most anglers supported the change. On both streams, 69% to 73% of the anglers supported increasing the minimum length, while 15% to 19% said it did not matter. Only 12.6% on the upper Grande Ronde River and 3.5% on Catherine Creek opposed the proposed change (Figure 12).

On both streams, the majority of anglers were from Oregon. On the upper Grande Ronde, 90.9% were Oregon residents, while 82.1% of the anglers on Catherine Creek were Oregon residents (Figure 13). Non-resident anglers fishing the upper Grande Ronde River came from as far away as Hawaii and Germany, while non-resident anglers fishing Catherine Creek came from as far away as Virginia and Louisiana. When looking at both streams, Oregon anglers came from 15 of the 36 counties in Oregon. The majority of Oregon anglers on the upper Grande Ronde River came from Umatilla County (53.8%), with 26.9% coming from Union County and 19.2% from other Oregon counties. Most Oregon anglers on Catherine Creek came from Union County (62.3%), with 20.3% coming from Umatilla County and 17.4% coming from other Oregon counties (Figure 13).

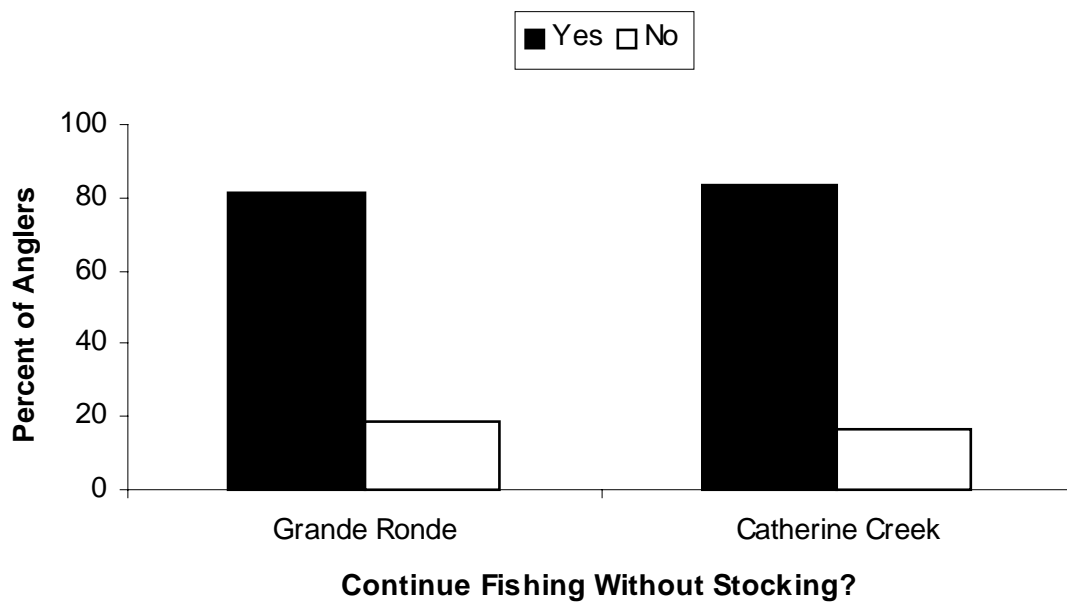
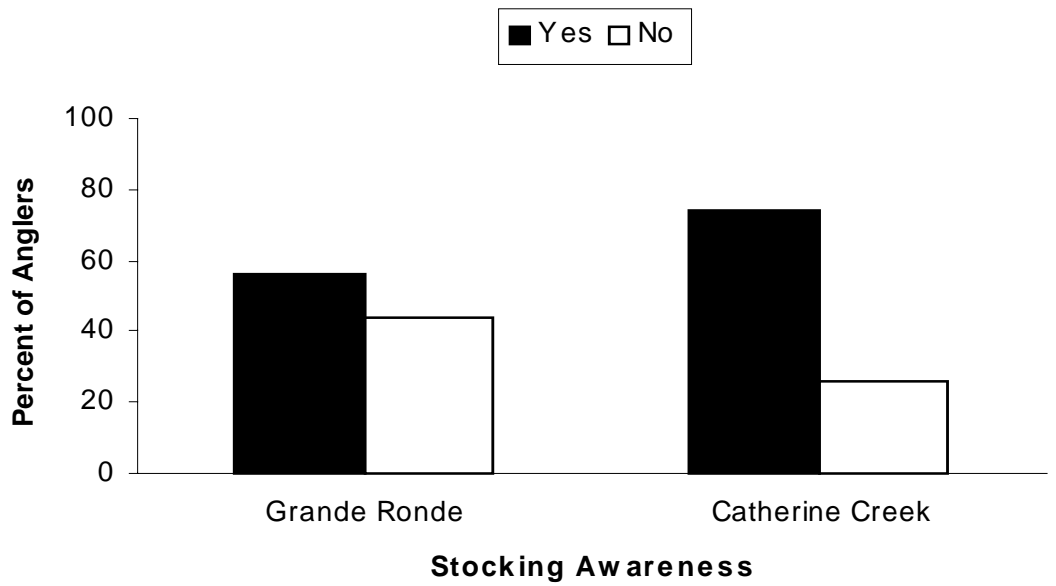


Figure 10. Angler awareness of rainbow trout stocking and willingness to fish if stocking was discontinued on the Grande Ronde River and Catherine Creek, 1996.

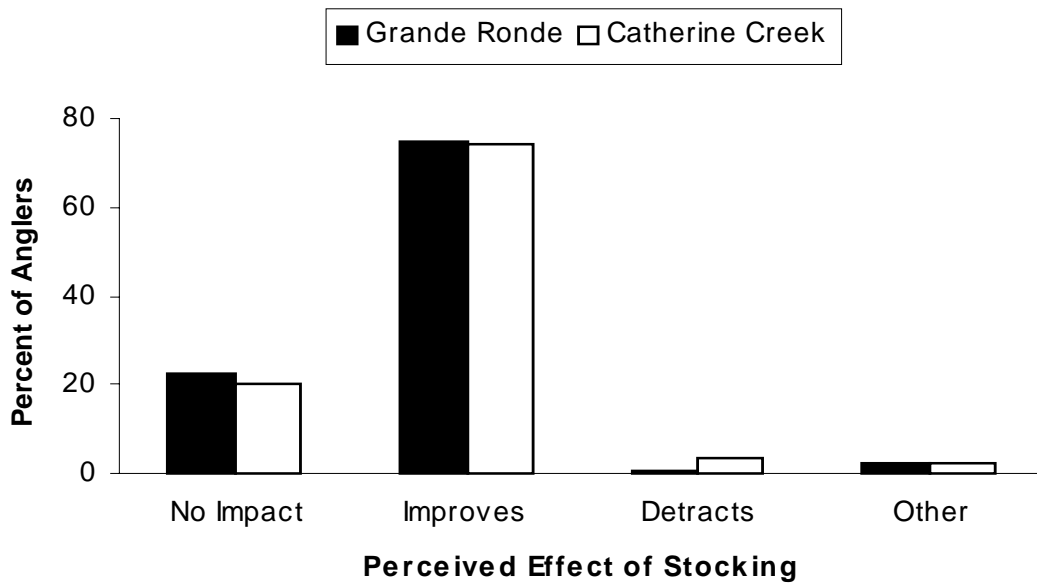


Figure 11. Angler perception of rainbow trout stocking on the upper Grande Ronde River and Catherine Creek, 1996.

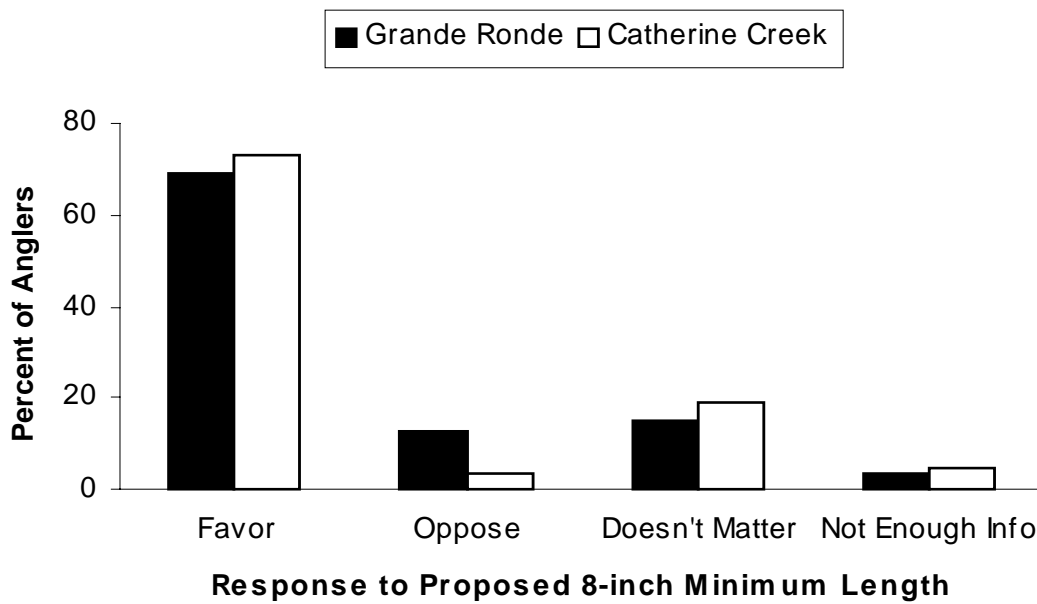


Figure 12. Response of anglers on the upper Grande Ronde River and Catherine Creek in 1996 to a proposed increase in minimum trout size from 6 inches to 8 inches.

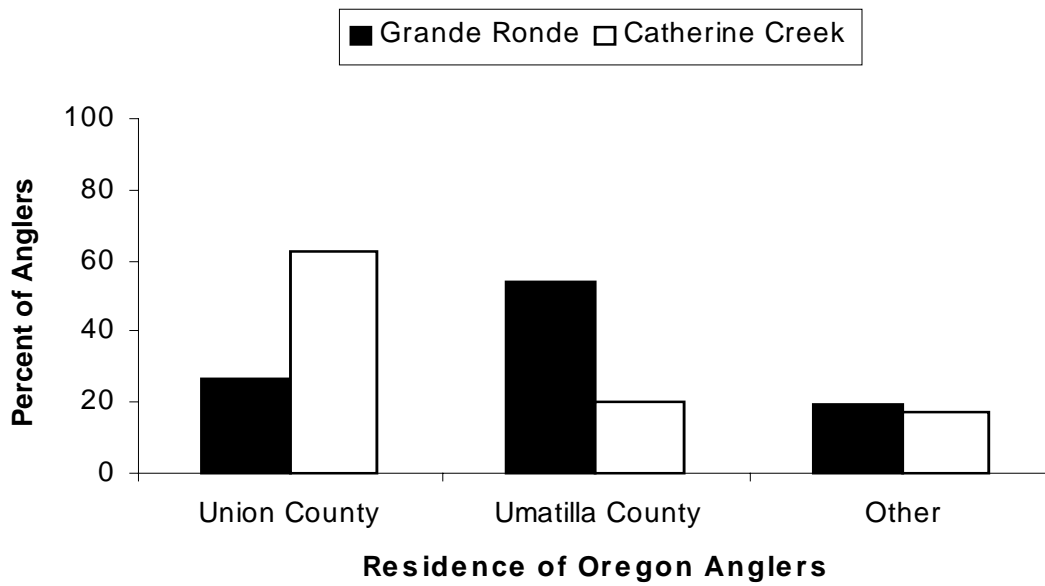
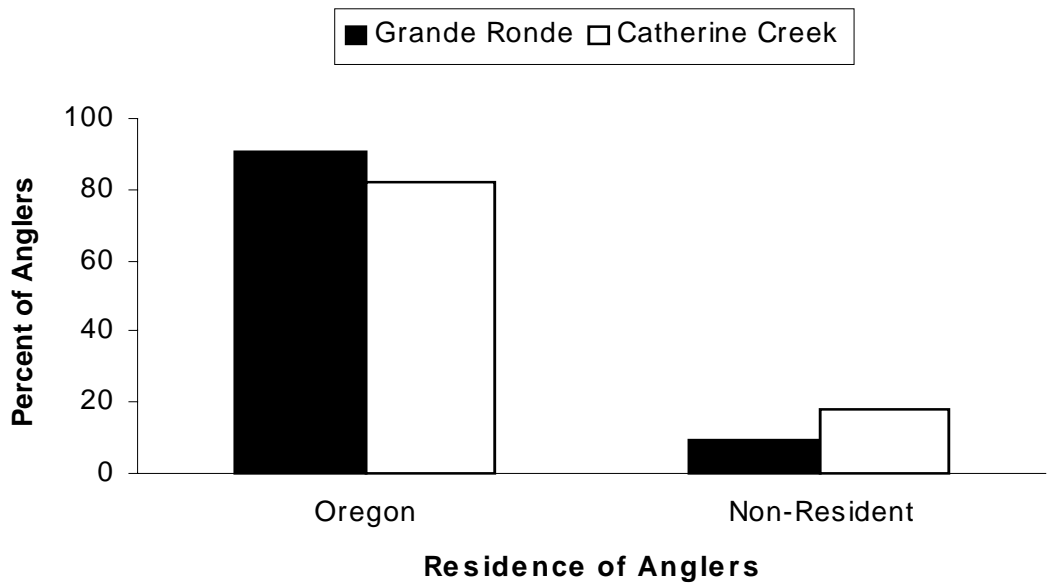


Figure 13. Residence of trout anglers on the upper Grande Ronde River and Catherine Creek, 1996.

DISCUSSION

Return to angler, angler effort, total catch, and catch rate

The return to angler of harvested and released fish combined in the upper Grande Ronde and Catherine Creek creels, respectively, was 29.1% and 15.1%. Utilization of hatchery rainbow trout was low in comparison to other Oregon streams. Kinunen (1975) summarized data from statistical creel surveys conducted statewide between 1947 and 1970. In those studies, return to anglers ranged from a low of 22.5% to a high of 50.7%, and averaged 37.2%. In addition, Schroeder and Smith (1989) documented hatchery rainbow trout returns to angler of 54% to 82% on the Deschutes River in the late 1960's and early 1970's. Finally, Anderson (1982) noted hatchery rainbow trout return to angler was 40% to 63.3% on the Imnaha, Wallowa, and Lostine Rivers in the late 1970's. Guidelines in the Oregon Trout Plan suggest that yearling (legal-size) rainbow trout stocking must be discontinued or modified if return to angler is consistently less than 40% of the fish released (ODFW, 1987).

Timing of angler effort on the two streams may have been related to differences in stream flow. The highest angler effort in the upper Grande Ronde River was concurrent with decreased flow in June, and high angling effort persisted into July. Flow on Catherine Creek declined in July, and peak angling effort was concurrent with that decline in flow.

Angler effort on both the upper Grande Ronde River (49 hours/km) and Catherine Creek (85 hours/km) was low compared to other fisheries in Oregon and Idaho. Anderson (1982) reported angler effort from the late 1970's on the Lostine, Imnaha, and Wallowa Rivers. Effort (determined from his survey distances and estimates of angler hours) ranged from 270 hours per kilometer per year on the Imnaha River to just over 430 hours per kilometer per year on the Wallowa River. Knox (2000) surveyed the Wallowa River in 1995 and 1998, and noted that trout angler effort was 300 to 400 hours per stream kilometer (150 to 200 hours per hectare). Effort on Idaho streams ranged from 96 to 2,726 hours per kilometer per year, with a median effort around 500 hours per kilometer per year (Schill 1991). Thurow and Schill (1994) stated that average effort on the Big Wood River was 800 hours per kilometer per year, but effort exceeded 2,000 hours per kilometer per year in some reaches.

Comparing effort in hours per hectare allows more accurate comparisons of effort per unit area between streams of various sizes. When compared in this way, effort on Catherine Creek (107.1 hours/hectare/year) and the upper Grande Ronde (30.7 hours/hectare/year) is at the lower end of that recorded for Idaho streams. Schill (1992) examined effort for 30 Idaho streams. Effort ranged from 14 to 1,110 hours per hectare per year, with 35% of general regulation waters receiving effort exceeding 200 hours per hectare per year.

Catch rates for rainbow trout (hatchery and wild combined) on the Grande Ronde River (1.68 fish per angler hour) and Catherine Creek (1.98 fish per angler hour) exceeded historic catch rates in central and eastern Oregon. When Kinunen (1975) summarized

data from non-statistical creels in northeast Oregon from 1965 to 1972, catch rates of wild and hatchery rainbow ranged from 0.68 to 1.72 fish per hour, and averaged 1.14 fish per hour. Kinunen (1975) also noted that catch rate on the Grande Ronde River was only 0.72 fish per hour. Rainbow trout catch rates on the Lostine, Imnaha, and Wallowa Rivers in the late 1970's were 0.9, 0.9, and 1.3 fish per hour, respectively (Anderson 1982). In addition, overall catch rates on the Deschutes River, Oregon in the 1960s and early 1970's ranged from 0.35 to 0.5 trout per hour (Schroeder and Smith 1989).

The high catch rate for rainbow trout in both the upper Grande Ronde River and Catherine Creek did not correspond to high utilization of hatchery fish. Several factors probably contributed to this scenario. Angler effort was low on both streams. Low angler effort in conjunction with high catch rates for wild rainbow trout may have resulted in low utilization of hatchery rainbow trout. In fact, overall catch rates for wild rainbow trout on both streams exceeded catch rates for hatchery rainbow trout.

Mortality of wild salmonids

The relatively low estimate of wild sublegal (less than 6 inch) rainbow trout mortality (83 on Catherine Creek and 146 on the upper Grande Ronde) from the trout fishery indicates that impacts on wild rainbow/juvenile steelhead were probably minimal. This is supported by recent estimates of juvenile steelhead outmigrants. From July 1997 through June 2000 (migration years 97, 98, and 99), annual estimates of rainbow/steelhead outmigrants from Catherine Creek ranged from 19,059 ($\pm 4,179$) to 22,310 ($\pm 4,657$) (Van Dyke et al. 2001). Annual estimates of rainbow/steelhead outmigrants from the upper Grande Ronde River were 12,835 ($\pm 2,257$), 6,125 ($\pm 1,047$), and 6,131 ($\pm 3,865$) in migration years 97, 98, and 99, respectively (Van Dyke et al. 2001). These estimates were developed using captures in screw traps in conjunction with trap efficiency estimates. Using the most conservative point estimates of steelhead outmigrants reported by Van Dyke et al. (2001), during the 1996 trout fishery less than 0.5% and 2.5% of the sublegal population died as a result of hooking mortality on Catherine Creek and the upper Grande Ronde River, respectively.

The impact of the trout fishery on legal-size wild rainbow trout in Catherine Creek appeared to be minimal. Using angling and seining in the summer of 2000, ODFW conducted a population estimate on in mainstem Catherine Creek. There was no way to distinguish wild resident rainbow trout and wild juvenile steelhead, so these are grouped as rainbow trout in this population estimate. They estimated that there were 22,393 (95% CI 17,467-28,697) wild rainbow trout from approximately 3 kilometers above the town of Union to the confluence of the North and South Forks (ODFW unpublished data). Length of recaptured wild rainbow was not recorded, so the population estimate cannot be separated by size groups. However, averaging the size of rainbow/steelhead collected by angling and seining, 12.3% (approximately 2,748) of those fish exceeded 153 mm (6 inches). We estimated that 325 legal-size wild rainbow on Catherine Creek were either harvested or died as a result of hooking mortality, which represents an 11.8% angler-

induced mortality rate. This mortality rate is low in comparison to estimates of natural mortality in other studies. Thurow and Schill (1994) estimated a natural mortality rate of 65% on a catch and release segment of the Big Wood River, Idaho. Schroeder and Smith (1989) estimated that natural mortality of rainbow trout greater than 31 cm on the Deschutes River was 50.3%.

Angler demographics and angler preferences

Most anglers on both rivers were fishing as a recreational family outing, followed by fishing to catch and release. The relatively low percentage of anglers fishing for food in this study reflects that found in other studies. Lowry (1978) noted that only 15% of Oregon resident anglers stated that getting fish for food was their primary reason for angling. In Michigan, Gigliotti and Peyton (1993) determined that most trout anglers on the Au Sable River did not view catching fish to eat as important.

Angler attitude towards the trout stocking program is similar to that exhibited in a 1977 Oregon resident angler survey. In that survey, resident trout anglers preferred more stocking of salmon, steelhead, and trout. Approximately 77% of anglers wanted to increase resident trout hatchery production, with 15% wanting to maintain production, and 2% wanting a decrease (Lowry 1978).

Anglers supported proposed regulations that would protect 6-8 inch rainbow trout, indicating that although anglers want more fish available, they would accept restrictions that may limit harvest. In contrast, a 1977 survey indicated that 63% of Oregon resident trout anglers wanted no increase in minimum sizes, while 25% wanted minimum sizes increased (Lowry 1978).

Most anglers participating in these fisheries were Oregon residents (>80%) and most of the anglers (67-70%) fished the streams more than once. The percentage of Oregon anglers participating in these fisheries is similar to that reported in a statewide survey. In a survey conducted by the U.S. Fish and Wildlife Service and the Bureau of the Census (1996), 79% of the freshwater anglers in Oregon were Oregon residents. In addition, Oregon residents comprised 95% of the days fished in Oregon freshwater.

The majority of Oregon anglers on Catherine Creek and the upper Grande Ronde River resided within two local counties. However, the primary county of residence differed between the two streams. Most of the upper Grande Ronde River anglers came from Umatilla County, while most of the Catherine Creek anglers came from Union County. This difference may be a result of proximity to the fishery or local knowledge of the fishery.

CONCLUSIONS

Angler effort, catch rate, total catch, and harvest

1. The trout fishery on the upper Grande Ronde River and Catherine Creek did not meet management objectives as described by the Oregon Trout Plan. Utilization rates were much less than 40%.
2. Angler effort on the upper Grande Ronde River and Catherine Creek was low compared to other fisheries in Oregon and Idaho.
3. Total catch rate on the upper Grande Ronde River and Catherine Creek exceeded that noted in other eastern and central Oregon streams.
4. Catch rate for legal-size wild rainbow/steelhead exceeded that for hatchery rainbow on Catherine Creek, but was less than half that for hatchery rainbow/steelhead on the upper Grande Ronde River.

Mortality of wild salmonids

5. The trout fishery appeared to have little or no impact on wild rainbow/steelhead parr or migrants.
6. The trout fishery appeared to have little impact on legal-size wild rainbow/steelhead.
7. Given high population estimates for rainbow/steelhead parr and migrants on Catherine Creek, and low estimates of hooking mortality, eliminating bait angling to minimize hooking mortality would have little or no impact on the wild steelhead population.

Angler demographics and angler preferences

8. Anglers varied in the purpose of their outing, but most were there for a family outing or to catch and release fish.
9. Anglers tended to support the rainbow trout stocking program.
10. The majority of anglers said they would continue to fish if the trout stocking program was discontinued. It would be beneficial to determine whether anglers have continued to fish for trout on these streams. Stocking was discontinued in 1997 after steelhead were listed as threatened under the Endangered Species Act. If angling continued at the 1996 rates, impacts on the wild population could increase.

11. Most anglers were Oregon residents, and resided in either Union County or Umatilla County.

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REFERENCES

- Anderson, G.A. 1982. Catchable rainbow trout studies for the Lostine, Imnaha, and Willowa Rivers. Oregon Department of Fish and Wildlife Information Report Number 82-9. Portland, Oregon.
- Gigliotti, L.M., and R.B. Peyton. 1993. Values and behaviors of trout anglers, and their attitudes toward fishery management, relative to membership in fishing organizations: A Michigan case study. *North American Journal of Fisheries Management* 13:492-501.
- Kinunen, W. 1975. A review of rainbow trout stocking and catch statistics in Oregon streams, 1952-1975. Progress Memorandum, Fisheries Number 6, 1975. Portland.
- Knox, W.J. 2000. Management history and angler behavior in a northeast Oregon trout fishery with implications for setting wild trout regulations. Pages 42-50 in D. Schill, S. Moore, P. Byorth, and B. Hamre, editors. *Wild Trout VII: Management in the New Millennium: Are we Ready?* Yellowstone National Park, Wyoming.
- Lowry, H.M. 1978. Survey of Oregon resident annual angler license holders: Recreational fishery use and preferences among management options. Survey Research Center, Oregon State University, Corvallis.
- Oregon Department of Fish and Wildlife (ODFW). 1987. Oregon's Trout Plan. Oregon Department of Fish and Wildlife, Portland.
- Schill, D.J. 1991. Wild trout investigations. Idaho Department of Fish and Game. Job Performance Report. Project F-73-R-13. Boise, Idaho.
- Schill, D.J. 1992. Wild trout investigations. Idaho Department of Fish and Game. Job Performance Report. Project F-73-R-13. Boise, Idaho.
- Schill, D.J. 1996. Hooking mortality of bait-caught rainbow trout in an Idaho trout stream and a hatchery: Implications for special-regulation management. *North American Journal of Fisheries Management* 16:348-356.
- Schisler, G.J., and E.P. Bergersen. 1996. Postrelease hooking mortality of rainbow trout caught on scented artificial baits. *North American Journal of Fisheries Management* 16:570-578.
- Schroeder, R.K. and L.H. Smith. 1989. Life history of rainbow trout and effects of angling regulations, Deschutes River, Oregon. Oregon Department of Fish and Wildlife Information Report Number 89-6. Portland, Oregon.

Thurrow, R.F. and D.J. Schill. 1994. Conflicts in allocation of wild trout resources: an Idaho case history. Pages 132-140 in R. Barnhart, B. Shake, and R.H. Hamre, editors. Wild Trout V: Wild Trout in the 21st Century. Yellowstone National Park, Wyoming.

U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. 1996. 1996 National Survey of Fishing, Hunting, and Wildlife-associated Recreation.

Van Dyke, E., M. Keefe, B.C. Jonasson, and R.W. Carmichael. 2001. Aspects of life history and production of juvenile *Oncorhynchus mykiss* in the Grande Ronde River basin, northeast Oregon. Summary Report, Bonneville Power Administration, Portland, OR.

Wydoski, R.S. 1977. Relation of hooking mortality and sublethal hooking stress to quality fishery management. Pages 43-87 in R.A. Barnhart and T.D. Roelofs, editors. Catch-and-release fishing as a management tool. California Cooperative Fishery Research Unit, Humboldt State University, Arcata, California.

Appendix 1. Social Creel Survey Form

Stream: _____ Section _____ Date: _____ Fish Form Pg _____ Line _____

The Oregon Department of Fish and Wildlife is conducting a study of the trout fishery on Catherine Creek and the Grande Ronde River. We are evaluating angling effort, catch rate, and angler preference. *Thank you for helping us by completing this questionnaire.*

1. How often do you fish this stream for trout? *(Circle one number)*
 - 1 THIS IS MY FIRST TRIP TO THIS STREAM
 - 2 ONE TO FIVE TIMES A YEAR
 - 3 MORE THAN FIVE TIMES A YEAR

2. Which of the following statements best describes the purpose of your outing today?
(Circle one number)
 - 1 CATCH FISH TO EAT
 - 2 CATCH AND RELEASE
 - 3 PERSONAL OUTDOOR EXPERIENCE
 - 4 FAMILY OUTING
 - 5 OTHER (Please specify _____)

3. Were you aware this stream is stocked with rainbow trout? *(Circle one number)*
 - 1 YES
 - 2 NO

4. Would you continue to fish this stream if it were not stocked with rainbow trout?
(Circle one number)
 - 1 YES, WOULD
 - 2 NO, WOULD NOT

5. Which one of the following statements best describes how stocking this stream with trout effects your fishing experience? *(Circle one number)*
 - 1 STOCKING HAS NO EFFECT ON FISHING EXPERIENCE
 - 2 STOCKING IMPROVES FISHING EXPERIENCE
 - 3 STOCKING DETRACTS FROM FISHING EXPERIENCE
 - 4 OTHER (please specify _____)

6. We are proposing an 8 inch minimum size limit for trout on streams in Oregon. Do you favor or oppose this proposed change? *(Circle one number)*
 1. FAVOR
 2. OPPOSE
 3. DOES NOT MATTER TO ME
 4. I DON'T HAVE ENOUGH INFORMATION ABOUT THE PROPOSAL

7. What is your ZIP code?
_____ HOME ZIP CODE

8. Is there anything else you would like to add about fishing this stream? (use back if necessary).