



## Angler Behavior Studies

### The Ability of Southwest Idaho Anglers To Identify Five Species of Trout

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**Project 5. Angler Behavior Studies:  
The Ability of Southwest Idaho Anglers to Identify  
Five Species of Trout**

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### ABSTRACT

We quantified regulation awareness and rates of trout species identification by 671 anglers along eight sections of the Middle and South forks of the Boise River drainage as well as two adjoining reservoirs. When not considering the statewide no-harvest regulation for bull trout *Salvelinus confluentus*, between 32.7% and 69.2% of anglers interviewed on general regulation study sections could successfully recite the sole restriction, the six-fish bag limit. Section-specific regulation awareness increased to 74.2%-79.6% on two special regulations sections despite more complex restrictions. Bull trout regulation awareness ranged from 50.0% on Arrowrock Reservoir to a high of 82.1% on the Middle Fork Boise River (MFBR) above Kirby Dam. About one-third of anglers interviewed on both streams were able to correctly recite both the appropriate section-specific regulation and the statewide bull trout regulation.

During interviews, anglers were asked to identify five different trout replicas using either color prints or fish mounts. On five MFBR sections, we obtained a correct identification by the majority of anglers interviewed for only one of five species, the rainbow trout *Oncorhynchus mykiss* at 80.7%. Bull trout were correctly identified the least (30.0%), a value nearly identical to that of brook trout *Salvelinus fontinalis*. Identification rates for brown *Salmo trutta* and cutthroat trout *Oncorhynchus clarki* were intermediate at 44.0% and 44.5%. Only 10.4% of all MFBR anglers interviewed were able to correctly identify all five species of trout and a nearly equal number of anglers (8.7%) identified them all incorrectly.

The species most often incorrectly associated with the bull trout replica was the brook trout at 8.4%. However, a greater proportion of anglers incorrectly identified the bull trout mount as a variety of other species, many of them vastly different from bull trout in appearance. We found strong statistical associations between angler trout identification ability and most demographic variables examined; results were similar for regulation awareness. Female anglers were 3.7 times less likely to correctly identify the bull trout image than their male counterparts. Anglers less than 25 years of age were significantly less likely to recite the bull trout regulation and only about half as likely to correctly identify the bull trout. These two variables may hold promise in directing mass mailing of education information in the future. Additional variables associated with regulation awareness or identification ability included gear type used, years of education, and years of angling experience.

Despite the poor bull trout identification rates above, only 1.5% of MFBR anglers and 0.9% of South Fork Boise River anglers had creelred bull trout. Few anglers catch bull trout; they therefore have limited opportunity to misidentify them and violate the no-harvest regulation.

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## INTRODUCTION

In January 1994, the Idaho Fish and Game (IDFG) Commission adopted a statewide no-harvest regulation for bull trout *Salvelinus confluentus* in all but one Idaho water, Lake Pend Oreille, where limited harvest was allowed. In 1996, IDFG closed that fishery to bull trout harvest as well. These actions were intended to enhance bull trout populations and assist with rebuilding of depressed stocks where necessary.

An implicit assumption of the above no-harvest restriction, or any regulation requiring the release of most or all fish, is that anglers can correctly identify various species. In Idaho, there was some question about angler ability to discriminate among trout species, particularly between brook trout *S. fontinalis* and bull trout. Because of this concern, a signing program using an approach originally conceived in Alberta was implemented in Idaho during 1995 (Bill Horton, Idaho Department of Fish and Game, personal communication). Under this program, important bull trout waters also containing brook trout were signed with 28 cm x 43 cm posters that provided pictures of the two species and noted important features anglers could use to differentiate them. The poster also employed the slogan “no black, put it back” to aid anglers in recalling an obvious difference in fins between these two species.

Nevertheless, angler misidentification of bull trout remains a concern, as other agencies have conducted similar poster efforts and subsequent studies that have noted poor rates of correct bull trout identification by anglers. In Alberta, 77%-83% of anglers in the Highwood River and Sheep River drainages were able to correctly identify bull trout from pictures (Isley 1997). Similar results were obtained for other species, including brook trout, rainbow *Oncorhynchus mykiss* and cutthroat trout *Oncorhynchus clarki*. In a larger study, a much lower proportion of Montana anglers (44%) were able to correctly identify bull trout from a variety of replicas, including photographs, drawings, mounts, live fish in aquariums, or fish-in-the-creel (Schmetterling and Long 1999). However, it is unclear how many of the anglers involved in that study actually fished on waters that contained bull trout and would thus be required to identify them. It is possible that anglers fishing waters actually harboring bull trout might be better at identifying them than an angler who has never fished waters containing them. Thus, it is possible the Montana estimate is a worst case one. Nonetheless, the Montana results and those of Isley (1997) suggest there is a possibility that high rates of bull trout misidentification and resultant noncompliance could be occurring in Idaho. Misidentification at a high enough rate could result in sufficient illegal harvest to negate or reduce potential benefits of the no-harvest regulations and slow recovery of depressed bull trout stocks.

This study was initiated to determine if misidentification of bull trout by anglers in Idaho occurs at a rate sufficient to hamper protection and recovery efforts. Additionally, demographic information was sought to guide future angler education efforts if necessary.

## OBJECTIVES

1. Quantify rates of bull trout and other salmonid species misidentification by anglers in typical Idaho fisheries where bull trout occur.
2. Identify demographic variables that might be useful in concentrating future education efforts should species misidentification rates prove to be unacceptable.



## STUDY AREA

Angler interviews were conducted on 10 discrete sections of the upper Boise River drainage (Figure 1). These 10 sections were characterized by different water types (reservoir or stream) and overall management approaches (stocked/yield or special regulations).

### **Sections 1-5: Middle Fork Boise River**

The entire pool of 24.9 km long Arrowrock Reservoir (1275 ha) comprised Section 1. Section 2 began at the beginning of flowing water for the Middle Fork Boise River (MFBR) immediately below Willow Creek campground and extended 16.9 km upstream to the North Fork Boise confluence. Section 3 on the MFBR began at the North Fork confluence and ended at Kirby Dam (56.3 km). Section 4 began at Kirby Dam on the MFBR and included only the next 1 km area of slack water immediately upstream. Section 5 included the roaded portion of the North Fork of the Boise River from the Rabbit Creek confluence to Deer Park Bridge, a distance of 25.1 km.

### **Sections 6-10: South Fork Boise River**

Section 6 on the South Fork Boise River (SFBR) began at Danskin Bridge and ended at Anderson Ranch Dam, an 18 km stream length. The entire pool of 21 km Anderson Ranch Dam (1918 ha) comprised Section 7. Section 8 began at the start of flowing water for the SFBR at Pine and extended upstream 35.2 km to the confluence of Beaver Creek and the SFBR. Section 9 on the SFBR began at the Beaver Creek confluence and ended at the confluence of the SFBR and Big Smokey Creek (15.8 km). Section 10 included that portion of Big Smokey Creek upstream of the SFBR confluence to the Canyon Campground at the end of the road (4.9 km) and the roaded portion of Little Smokey Creek (8.8 km).

### **Angling Regulations (All Sections)**

Anglers fishing in sections 1, 2, 4, and 5 of the MFBR were all subjected to the general-regulation bag limit of six trout with no size or gear restrictions. On the SFBR, sections 7, 8, and 10 were all managed under the same general regulation (Table 1). Section 3 anglers on the MFBR and Section 9 anglers on the SFBR were restricted to harvest of two trout over 355 mm. In addition, both bait and barbed hook use were prohibited on these two sections. Given the size of trout in the two streams, this special regulation results in the vast majority of all trout caught being released. Section 6 anglers on the SFBR were restricted by a slot limit (harvest of two trout less than 305 mm or greater than 508 mm), and bait and barbed hooks were prohibited. As noted above, statewide angling regulations for bull trout in all sections completely restrict harvest.

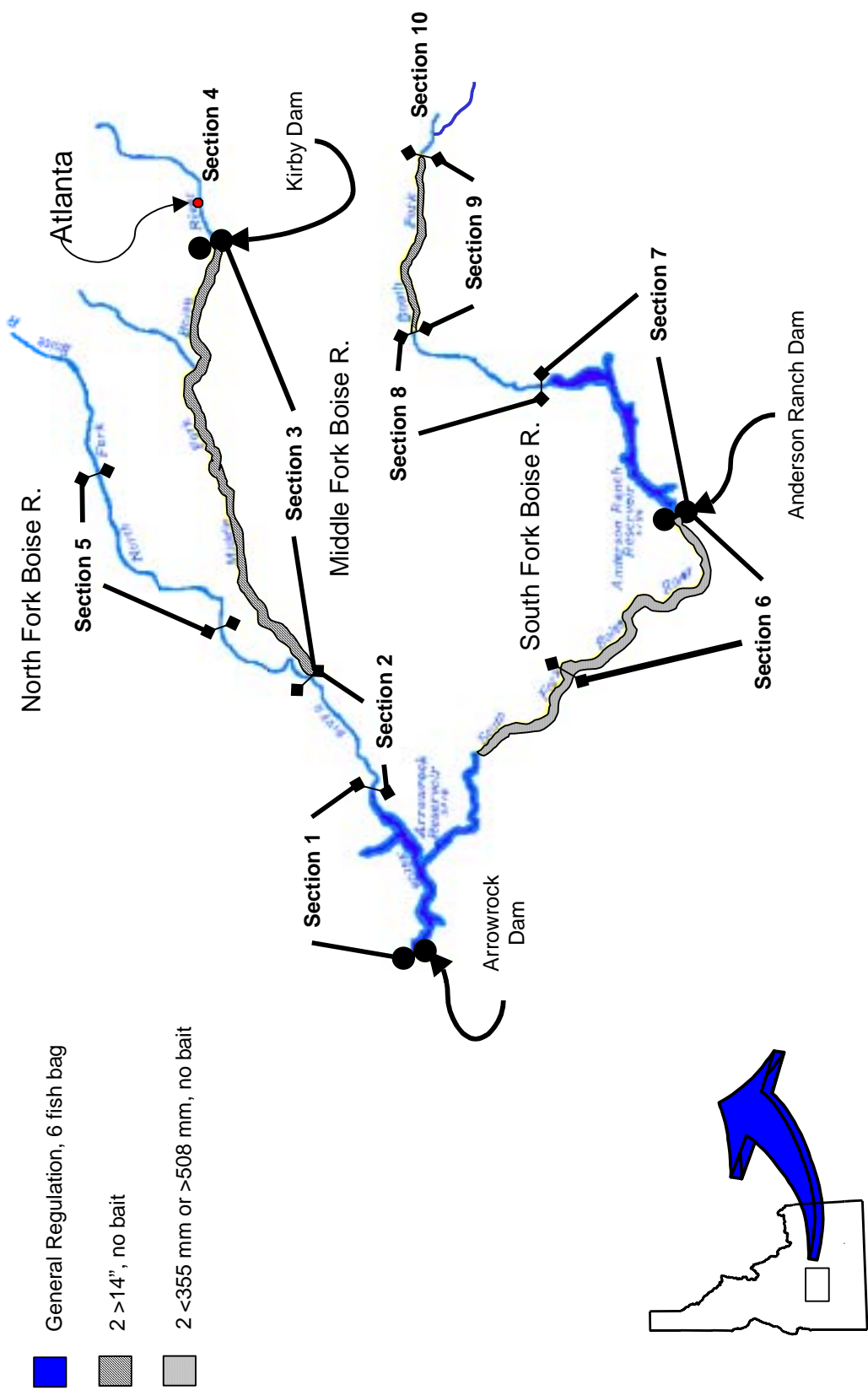


Figure 1. The Middle Fork and South Fork Boise River drainages and sections used in the 1998 fish identification survey

Table 1. Angling regulations for individual sections in the study area, Middle Fork and South Fork Boise River, 1998<sup>a</sup>.

Regulation	MFBR Section	SFBR Section
General trout limit (no size or gear restrictions)	1, 2, 3, 4	7, 8, 10
Two trout over 355 mm, (artificial fly or lure only, no bait and barbless hooks)	3	9
Two trout slot limit, <305 mm or >508 mm, (artificial fly or lure only, no bait and barbless hooks)	none	6

<sup>a</sup> No bull trout harvest allowed statewide.

## METHODS

### Angler Interviews

During spring 1998, we implemented a field interview approach designed to ascertain individual angler ability to identify different trout species including bull trout. We followed the basic approach of Schmetterling and Long (1999) with the exception that all interviews were conducted on-site along waters known to contain bull trout. Interviews were conducted on the MFBR from the general fishing season opener on May 23 through October 17, 1998. Angler contacts were made on two randomly-assigned days per week, one weekend day, and one weekday during the entire study period. On the SFBR, we obtained interviews intermittently between July 9 and November 2 as manpower availability permitted.

Project personnel drove the length of the study area each sampling day and approached individual anglers in the various study sections. We interviewed those anglers observed fishing and interviewed individuals in campgrounds adjacent to the various study sections when they indicated they normally fished the stream or reservoir in the vicinity. Anglers interviewed while fishing were first asked a series of standard creel survey questions including residency, hours fished, gear type, number and species of salmonids kept, and number released. The intention of this effort was to estimate the bull trout harvest rate (fish/h) due to anglers misidentifying them and to provide Southwest Regional management with other standard creel data. Anglers interviewed but not observed fishing that day were asked only the residency and gear type questions.

The second portion of the interview pertained largely to fish identification. All anglers were first asked their age, years of angling experience, and if they would recite the fishing regulations for the area that they were fishing. Next, we asked them to rate their ability to identify various kinds of trout on a scale of 1-5, with 5 being most confident (Appendix 1). For anglers with fish-in-the-creel, we observed their catch, recorded the species, and then asked anglers if they could identify the fish they had kept. Their species observations were recorded next to those of the project clerk. Next, we asked anglers to identify five different trout replicas. During the first two weeks of the season, we used individual 75 mm x 150 mm cards with colored prints of brook trout, bull trout, rainbow trout, cutthroat trout, and brown trout *Salmo trutta*. Although all of these species are present in the

Boise River drainage, brown trout were not present in the actual study area and cutthroat trout are very rare. The print images were the same ones used in the Idaho regulation pamphlet, but were considerably clearer due to their enhanced size. After the second week of the angling season, we obtained fabricated taxidermist mounts of the same fish species 250 mm to 280 mm in length. The mounts appeared to be more readily identifiable, at least to project personnel, and were subsequently used in all future angler contacts. By the end of the study period, 91% of anglers interviewed had responded to the mounts rather than the cards. All five fish mounts were attached to a 1 x 1 m board with a handle on top for easy transport. Each of the five replicas (mount or card) was covered individually with light fabric, and anglers were only permitted to view and identify one at a time. To eliminate potential bias from guessing, we systematically varied the order of presentation to anglers so each fish had the same probability of being viewed first.

Following the identification exercise, we asked several questions pertaining specifically to bull trout. We inquired whether the angler was or had ever specifically fished for bull trout/dolly varden, whether they believed they had ever caught one, and if they could recite the regulation for the species. We concluded the interview by asking anglers how many years of education they had completed.

### **Data Analysis**

We summarized angler responses to regulation knowledge and fish identification questions by study section and gear type for both study waters. For MFBR anglers, we also calculated the proportion of demographic groups (sex, age, residence, years of angling experience, years of education) that could accurately recite the appropriate angling regulation and that could correctly identify the various trout replicas. We pooled data for MFBR study sections and tested relations among demographic variables and questionnaire responses. A chi-square test of association was used to make statistical comparisons at the 0.05 significance level using Yates Correction when necessary (Zar 1974). Other than gear type, we made no attempt to summarize questionnaire responses by demographic groups for the SFBR due to limited sample sizes.

We constructed 95% confidence limits around all proportions using the standard binomial approximation (Zar 1974):

$$p \pm 1.96\sqrt{pq/n}$$

p = the proportion in question  
q = the complement proportion of p  
n = sample size

For proportions less than 0.10 we used the more complex formula of Fleiss (1981) for values approaching zero.

## **RESULTS**

A total of 671 anglers were interviewed within the 10 study sections. About two-thirds (68.3%) of these individuals were interviewed while actually fishing. The remaining 213 anglers were interviewed in campgrounds along the various sections. Some of these anglers were

interviewed at their vehicles preparing to fish. Others reported typically fishing the stream in the vicinity and were planning on doing so later in the day after the interview period. Others were not fishing that day for a variety of reasons.

### Regulation Awareness

Overall, 46.5% of MFBR anglers and 65.2% of SFBR anglers could correctly recite the regulation specific to the section they were fishing. These results do not include correct responses to the bull trout no-harvest regulation for those sections. Between 32.7% and 69.2% of anglers interviewed on general-regulation sections successfully recited the six-fish bag limit (Figure 2). Regulation awareness increased to 74.2%-79.6% for anglers fishing two special regulation sections despite more complex restrictions.

Anglers were more likely to recite the no-harvest restriction for bull trout correctly than section-specific fishing regulations, but awareness of bull trout regulations was also limited. For all sections, a total of 64.5% of MFBR and 67.8% of SFBR anglers correctly recited the no-harvest regulation for bull trout. Bull trout regulation awareness ranged from 50.0% in Section 1 (Arrowrock Reservoir) to 82.1% on Section 4, located immediately above Kirby Dam. Both of these sections were managed under general regulations (Figure 3). Bull trout regulation awareness was lowest on Sections 1 and 7, the only reservoir sections.

Correct recitation of all regulations, e.g., the appropriate section-specific regulation and the statewide no-harvest regulation for bull trout, was accomplished successfully by fewer anglers than either regulation individually. Only 37.5% of MFBR anglers were able to do so. Virtually the same proportion (37.3%) of SFBR anglers fishing on stream sections with the same section-specific regulations as on the MFBR could correctly recite both. When including interviews from the slot regulation section (Section 6) into the average, SFBR angler ability to correctly recite both regulations increased to 52.1%.

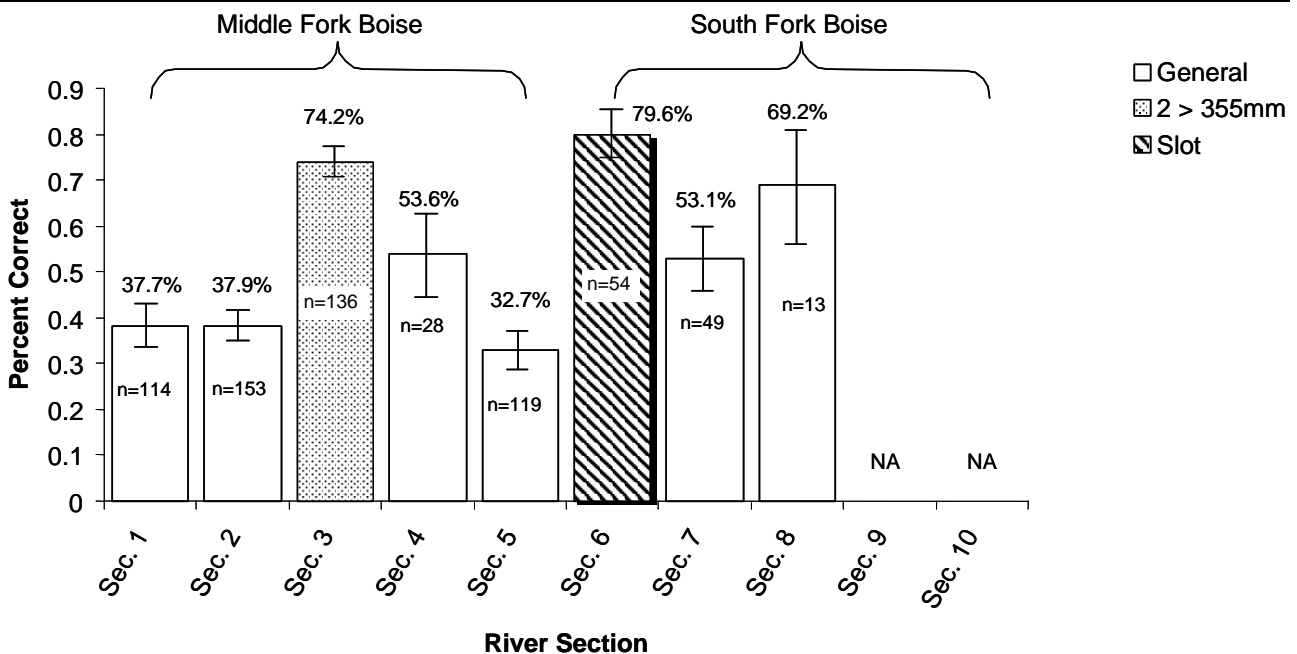


Figure 2. Percent of Middle Fork and South Fork Boise River anglers able to correctly recite the regulation for the various sections in which they were fishing, May 23 to October 17, 1998. Bars denote 95% confidence limits; NA = insufficient sample size (n<10).

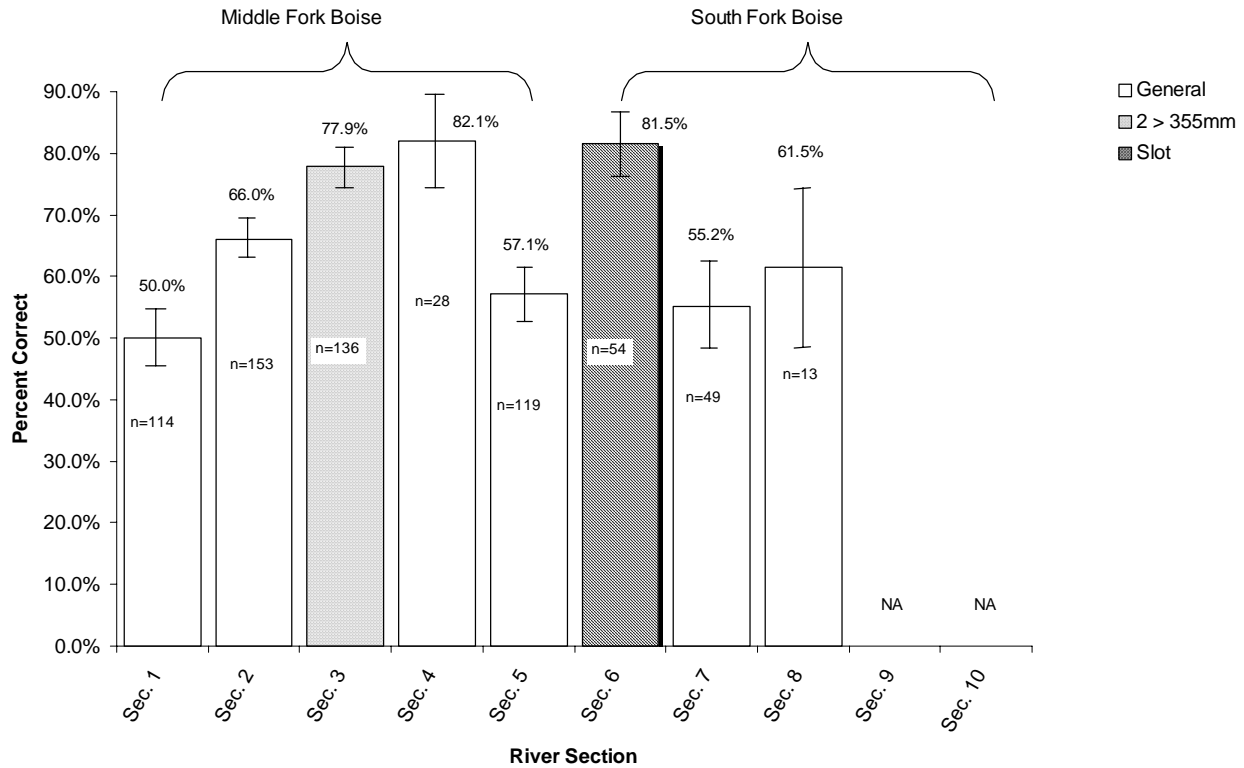


Figure 3. Percentage of Middle Fork and South Fork Boise River anglers able to correctly recite the statewide bull trout regulation (no harvest) in various river sections managed under different regulations, May 23 to October 17, 1998. Bars denote 95% confidence limits; NA = insufficient sample size (n<10).

### Ability to Identify Trout

Prior to the realization that they were going to be asked to actually identify trout replicas, anglers on both study waters rated themselves slightly above average in their ability to identify trout. On a scale from 1-5, with 5 being an expert, the average self-reported ability to identify different trout species was 3.3 for MFBR anglers and 3.3 for SFBR anglers. For both streams combined, self-reported identification of fly anglers was greater (3.6, n = 231) than either lure anglers (3.3, n = 99) or bait anglers (3.1, n = 282).

Our comparison of biologist versus angler identifications of trout created by anglers was hampered by limited sample size. Thirty-two of 36 (88.9%, CL  $\pm$  10.5%) MFBR anglers had one or

more rainbow trout in the creel and correctly identified them as rainbow trout (Table 2). Sample sizes for other species observed in the creel were too small to calculate useful proportions. Of note however, two bull trout creeled by separate anglers were incorrectly identified as a rainbow trout and a brook trout.

Table 2. Species in angler creels as identified by both biologists and anglers, Middle and South Forks Boise River, May 23 to October 17, 1998. Biologist identification assumed to be correct.

Water	Species	Biologist Identification <sup>a</sup>	Angler Identification	
			Correct	% Correct
MFBR	Rainbow Trout	36	32	88.9
MFBR	N. Pikeminnow	1	0	0
MFBR	Cutthroat Trout	2	2	100
MFBR	Bull Trout	2	0	0
MFBR	Kokanee	1	1	100
SFBR	Rainbow Trout	4	4	100
SFBR	Kokanee	6	6	100

<sup>a</sup> Number of times one or more fish of species X observed in creel.

Overall, a surprisingly small proportion of anglers could correctly identify the trout replicas. On the MFBR, we obtained a correct identification by the majority of anglers interviewed for only one of five species, the rainbow trout at 80.7%. Bull trout were correctly identified the least (30.0%), a value similar to that of brook trout (Figure 4). Identification rates for brown trout and cutthroat on the MFBR were intermediate and nearly identical at 44.0% and 44.5%. Only 10.4% of all MFBR anglers interviewed were able to correctly identify all five species of trout. Nearly equal number of anglers (8.7%) identified them all incorrectly.

South Fork Boise River anglers fishing sections of the river with the same regulations as those on the MFBR identified virtually the same proportions of the various species mounts (Figure 4). Confidence limits for species identification rates for the two waters overlapped in all but one instance in these cases. However, when including anglers from the slot zone in the analysis, SFBR anglers identified significantly higher proportions of the trout replicas than MFBR anglers based on confidence limits (Figure 4).

Rates of correct bull trout identification varied over three-fold among the individual study sections in a manner similar to regulation awareness. Reservoir anglers were the least likely to identify the bull trout replicas (18.4% to 26.5%) (Figure 5). As a group, anglers fishing from shore in Arrowrock Reservoir had the poorest identification rate (15.4%, n = 78), while 25.0% of boat anglers could identify the replica. Anglers in general regulation sections were intermediate at bull trout identification, while those fishing in special regulation sections of streams were the most adept.

When presented with the bull trout replica for identification, angler responses were quite varied. As noted above, 30.0% MFBR anglers correctly identified the mount as a bull trout or a dolly varden trout. The largest proportion of MFBR anglers (48.4%) responded “don’t know” when presented with the replica (Figure 6). The species most often incorrectly associated with the bull

trout replica was the brook trout at 8.4%. However, a greater proportion (13.2%) of anglers incorrectly identified the bull trout mount as a variety of other species, many of them vastly different from bull trout in appearance. South Fork Boise River anglers fishing in sections 7-10 (n = 67) identified the bull trout replica in similar fashion with 52.9%, 32.8%, 4.5%, and 10.5% responding “don’t know,” bull trout, brook trout and other, respectively.

Despite the inability of most anglers interviewed to identify the bull trout replica, those indicating they had prior experience or interest in catching them were, in fact, more proficient in doing so. Of the 225 MFBR anglers reporting that they had caught a bull trout/dolly varden in the past, 50.6% correctly identified the bull trout image. Only 36 of 550 total MFBR anglers reported fishing specifically for bull trout on the present trip or in the past; 55.6% of these anglers correctly identified the bull trout image. Thus, ability of these anglers to correctly identify bull trout was 67%-89% greater than for those anglers who said they had never caught a bull trout.

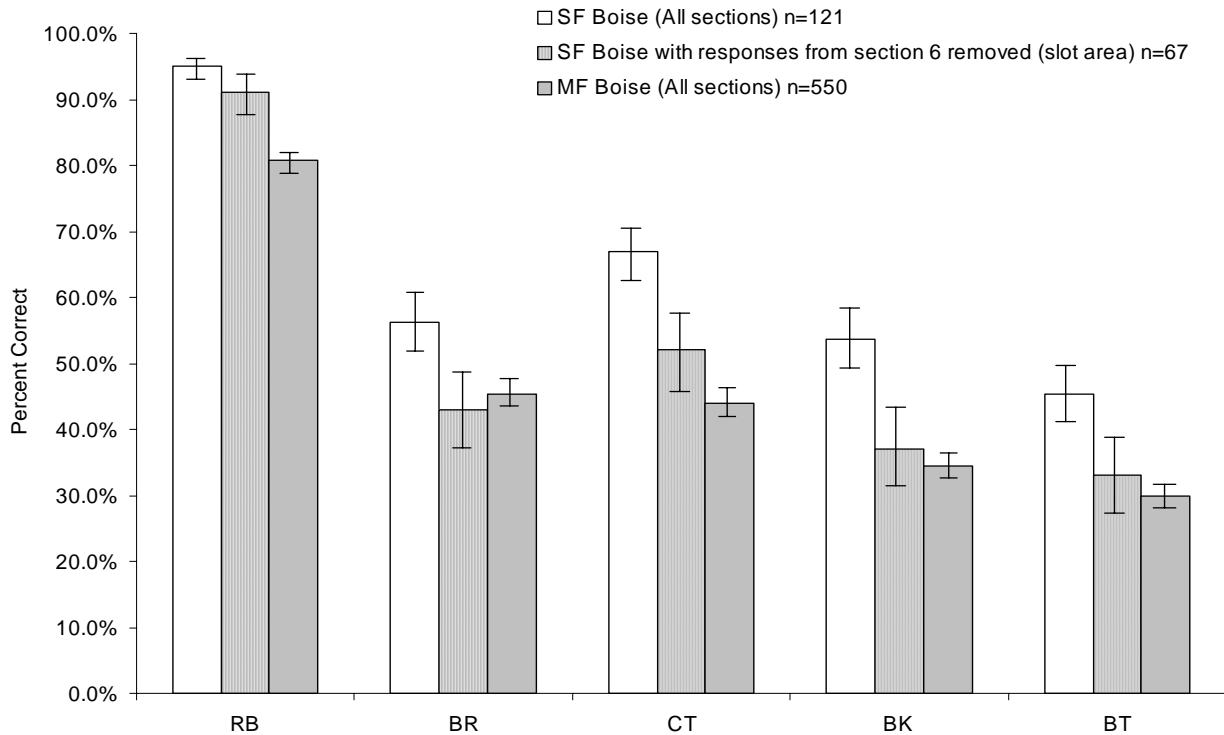


Figure 4. Percentage of all Middle Fork and South Fork Boise River anglers interviewed that identified individual species replicas correctly, May 23 to October 17, 1998. Bars denote 95% confidence limits.



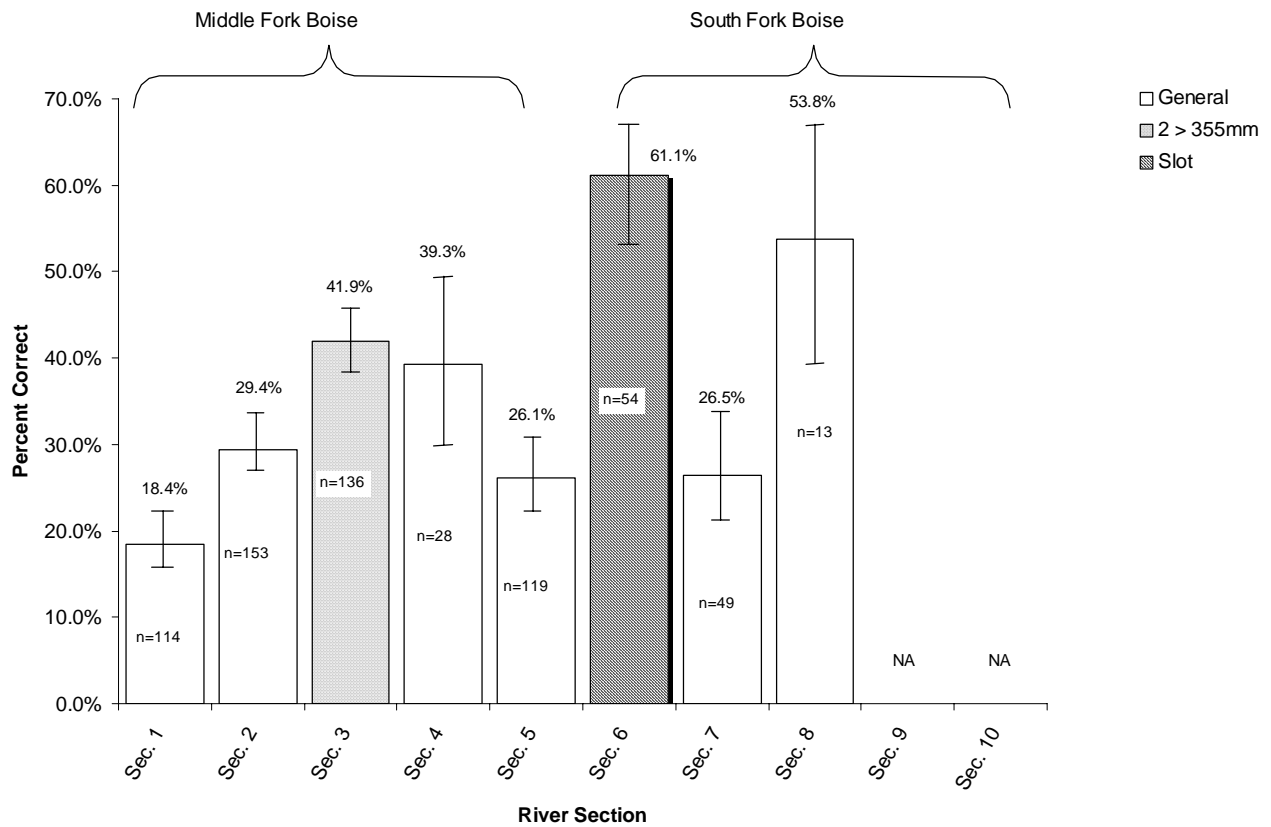


Figure 5. Percentage of Middle Fork and South Fork Boise River anglers able to correctly identify the bull trout replica in various river sections managed under different regulations, May 23 to October 17, 1998. Bars denote 95% confidence limits; NA = insufficient sample ( $n < 10$ ).

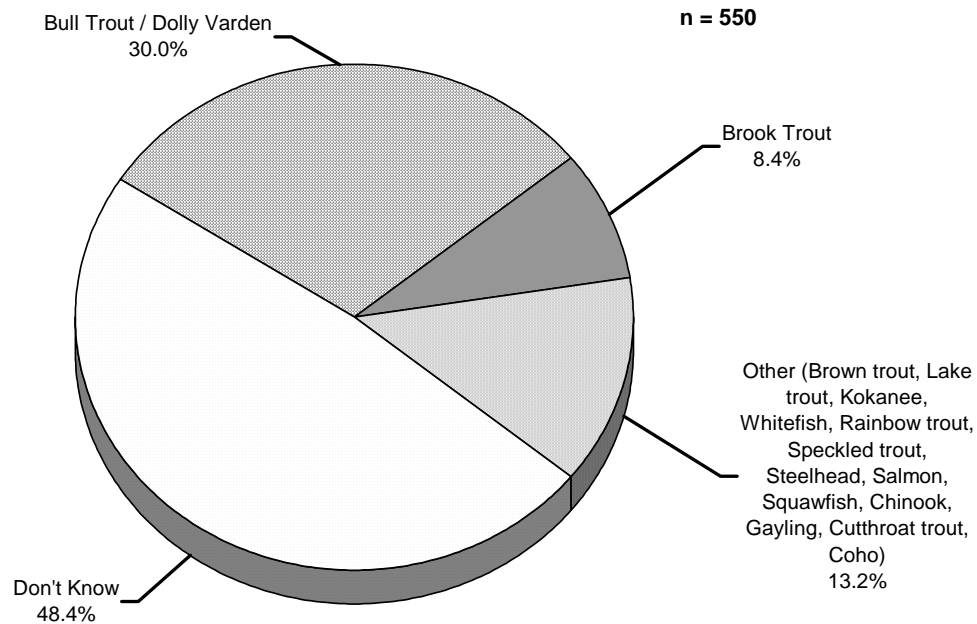


Figure 6. Distribution of responses to the bull trout replica by Middle Fork Boise River anglers, May 23 to October 17, 1998.

### **Angler Demographics**

We found strong statistical associations between angler trout identification ability and most demographic variables examined. Likewise strong associations were detected between regulation awareness and demographic variables (Table 3). Female MFBR anglers were 29.5% less likely than males to correctly recite the bull trout regulation and 42.9% less likely to be aware of other appropriate regulations in the section they were fishing. In addition, female anglers were 3.6 times less likely to correctly identify the bull trout image than their male counterparts. The variables angler age, education, and years of angling experience were all positively associated with correct answers to the questions of interest. Anglers less than 25 years of age were significantly ( $p = 0.00001$ ) less likely to recite the bull trout regulation and only about half as likely to correctly identify the bull trout replica as older angler groups. In general, incremental improvements in identification ability and regulation awareness were observed in age categories over 25, but these gains were marginal overall (Table 3). The variable, years of education, was highly associated with the probability of correct response for all three questions. Anglers with over 16 years of education were 30%-40% more likely to respond correctly than groups with less education. In contrast, additional years of angling experience often resulted in a meaningfully higher proportion of correct angler responses across all group categories. Anglers with less than five years of fishing experience were

particularly poor at identifying bull trout, being 3.7 times less likely to do so than anglers with 5-10 years of experience and nine times less likely than those with over 40 years of experience (Table 3). Nonresidents were only slightly less likely than residents to correctly answer questions concerning regulation awareness or bull trout identification, and results were not significantly different (Table 3).

Gear type used by MFBR anglers played a strong role in correct identification rates for the various species. Middle Fork Boise River fly anglers identified the five separate species correctly more often than either lure or bait anglers (Figure 7). For example, fly anglers correctly identified rainbow trout 91.3% of the time, about one-fifth more often than the lure or bait anglers. Also, 21.5% of MFBR fly anglers correctly identified all five species, compared to 6.0% and 1.6% for lure and bait anglers, respectively. In addition, only 2.3% of MFBR fly anglers misidentified all five species, while 14.5% of lure and 11.1% of bait anglers did.

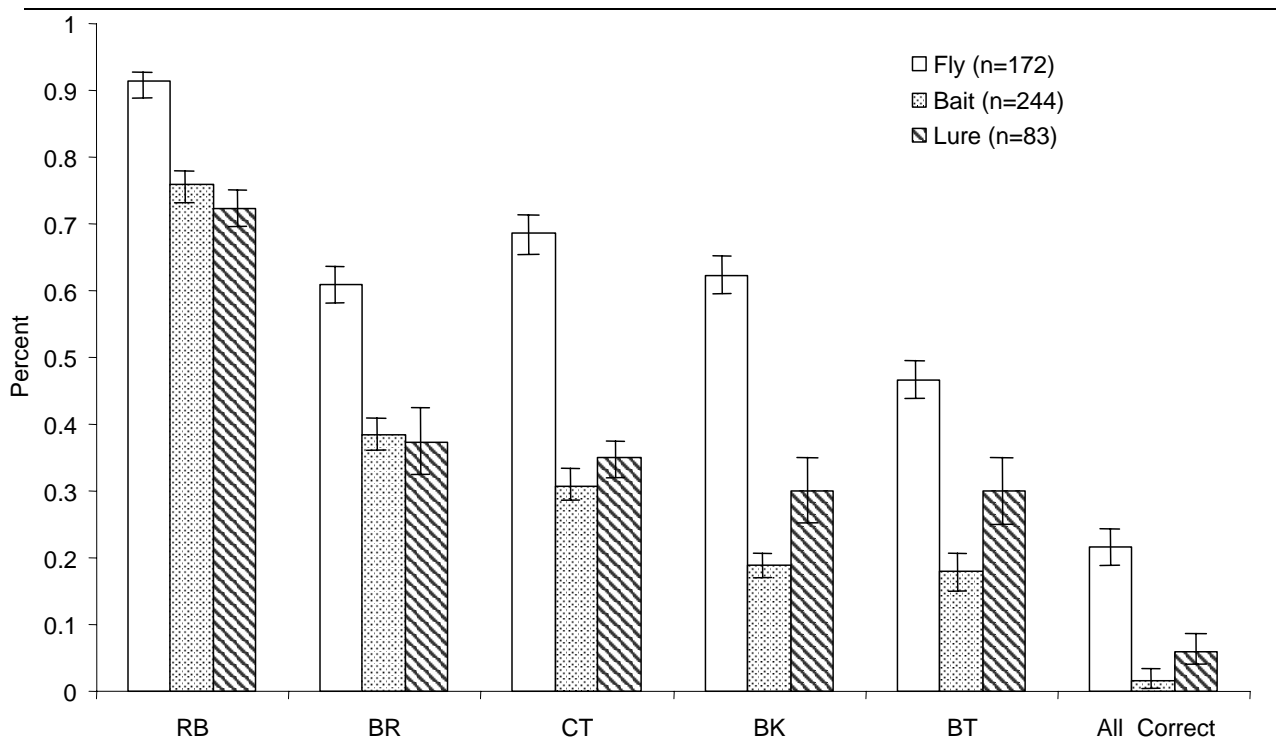


Figure 7. Percentage of anglers from the Middle Fork Boise River using different types of gear that correctly identified each individual species, May 23 to October 17, 1998. Bars represent 95% confidence limits.



The response of anglers using various gear types to questions regarding bull trout identification and regulation awareness were consistent across the two study streams. A strong majority of MFBR and SFBR fly anglers, 80.2% and 81.3%, respectively, were able to correctly recite the no-harvest bull trout regulation (Figure 8). The rate of correct regulation response for lure and bait anglers were also virtually identical on both streams, and about one-fourth to one-third less than the above rate for flies. A similar relationship among gear types was observed for bull trout identification rates.

### **Bull Trout Harvest Rates**

On the MFBR, 344 anglers interviewed while fishing had expended a total of 861.5 hours (mean = 2.5 h) and had five bull trout in possession. Two of the above bull trout were alive on stringers and were immediately released upon observation by project personnel. However, they would have been harvested without the interview. Thus, 1.5% (95% CL = 0.5%-3.6%) of anglers fishing the MFBR in 1998 had a bull trout in possession for a total illegal harvest rate of 0.0058 fish/h.

On the SFBR, 114 anglers interviewed while fishing had expended a total of 241 hours (mean = 2.1 h), and a single bull trout was observed in their possession. This fish was also found on a stringer and subsequently released. Thus, 0.9% (95% CL = 0.1%-5.5%) of SFBR anglers had a bull trout in possession for a total illegal harvest rate of 0.0041 fish/h.

## **DISCUSSION**

### **Angler Trout Identification**

Of the 671 anglers contacted during the angling season, a sole angler refused to participate in the identification portion of the survey. Initially, many anglers were concerned about the replicas being a test and some seemed embarrassed about the potential of misidentifying fish in front of companions or the interviewer. To help overcome such fears, it was stressed that we were not interested in individual angler results but, instead, were attempting to measure identification ability for anglers in general and to assist them in identifying trout caught on future trips. After the interview, most anglers expressed support for the interview process and the chance to improve their fish identification skills.

Angler ability to identify the various trout replicas varied little between streams. This was especially true when comparing identification rates for those sections with the same suite of regulations. In this case, confidence limits overlapped on all but rainbow trout (Figure 4). However, SFBR anglers fishing with flies on Section 6 (slot limit) were considerably more proficient at identifying the various species than other anglers in either water. This segment of the SFBR appears to receive use from more specialized and purist fly-fishing anglers. Inclusion of the fly anglers from Section 6 in the comparison between SFBR and MFBR identification rates results in statistically significant differences for all species (Figure 4). However, these differences probably are not large enough to be meaningful from a management perspective.

While fly anglers were clearly the most proficient at identifying the five species of trout we presented, there is considerable room for improvement in that group as well. Overall, only 46.5%

and 62.7% of fly anglers on the MFBR and SFBR, respectively, correctly identified bull trout, and excepting rainbow trout, rates for the remaining species ranged from 61.0%-81.6%.

To provide additional geographic perspective on identification rates, we provided a fish identification board and survey techniques to a northern Idaho Panhandle enforcement officer. The officer surveyed 43 anglers at a county fair and on Lake Pend Oreille during July and August 1998. Correct identification rates for these anglers were 88.5% for rainbow trout, 58.1% for cutthroat trout, and 41.9% for bull trout (Brian Johnson, Idaho Department of Fish and Game, unpublished data). These rates were within confidence bounds of our own observations (Figure 4).

The rates of correct bull trout identification by Idaho anglers during 1998 were poor in general and clearly well below desired levels to protect a threatened species. For the two Boise River streams, the bull trout was the least likely fish to be correctly identified, perhaps, in part, to both its overall nondescript appearance and relative rarity. Overall, MFBR and SFBR anglers identified 30.0%-45.4% of the bull trout replicas they were presented, while northern Idaho anglers were correct 41.9% of the time. These results were very similar to the 44% correct bull trout identification rate of Schmetterling and Long (1999) for west-central Montana anglers. However, all of these estimates were well below the 77%-83% correct rates observed for Alberta anglers (Isley 1997).

It is possible the trout identification rates for upper Boise River anglers as described in this study are negatively biased for several reasons. Although the prints and mounts we used in the study appeared fairly easy to identify for fishery biologists, anglers may be more accurate when dealing with a real trout. On the MFBR, 88.9% of 36 anglers had rainbow trout in their creel and correctly identified them as such before completing the rest of the fish identification portion of the interview with replicas. This value is slightly greater than the 80.7% correct identification rate for rainbow trout we observed using the replicas ( $n = 550$ ), but confidence limits easily overlap. As yet, we have observed insufficient fish-in-the-creel to compare actual trout identification rates to those of the replicas we presented. Our inability to observe fish-in-the-creel may be due, in part, to the angling clientele on the two streams, many of which were not harvest-oriented.

A second reason why the identification rates could be biased low relates to the interview procedure. To aid future education efforts if study results warranted, we sought to determine if demographic variables such as age, sex, years of angling, etc., were significantly associated with correct identification rates. For this reason, we interviewed individual anglers and did not permit additional input from peripheral anglers in a group observing the interviews. However, Isley (1997) suggests that generally at least one angler in a group of Alberta anglers could correctly identify all of the species. Additional thought should be given in any follow-up surveys on ways to evaluate both group and individual trout identification rates. Ideally, group data would be collected only from a group of anglers fishing close enough along a water to aid each other in visual identification.

The variety of incorrect responses anglers gave to the bull trout replica suggest a change in the approach currently being used to educate Idaho anglers on bull trout identification. Prior to initiating this study, a large portion of IDFG signing and poster efforts was aimed at reducing angler confusion between bull trout and brook trout. Because both species were char with somewhat similar overall background colors, helping anglers identify key differences between them was thought to be crucial. This seemed especially true when considering that bull trout are currently managed under a statewide no-harvest restriction, while heavy brook trout harvest is encouraged via a statewide "bonus" regulation that permits the daily harvest of up to 16 brook trout. Our MFBR results show that, while anglers most commonly misidentified bull trout replicas as brook trout (8.4%), even more anglers (13.2%) called the bull trout replica a variety of less related species

(Figure 5). Thus focusing signing or poster programs solely on differentiating the two char species may be less desirable than previously thought. In addition, the past signing program also made use of the slogan “no black on the fin, put it back in.” Unfortunately, a number of anglers we interviewed had seen this sign and had forgotten the crucial first word “no,” thus completely changing the harvest implications. We suggest this slogan be discontinued in the future because of the drastic difference in meaning if anglers fail to recall it exactly.

Although the primary focus of this work has been an evaluation of bull trout identification rates due to the statewide no-harvest regulation, the poor results observed for other species in the present effort suggests additional research in other portions of the state be considered. Special regulations have been imposed over large areas in other portions of the state with the assumption that anglers can identify target species. For example, with a few exceptions, the vast majority of Yellowstone cutthroat trout streams in eastern Idaho are managed under broad geographic regulations that require the release of most fish caught. Based on the results of this study and those of Schmetterling and Long (1999), the ability of anglers fishing those waters to identify cutthroat trout should be evaluated.

### **Regulation Awareness**

Angler ability to correctly recite the statewide six-trout bag limit regulations in general regulation sections of the MFBR and SFBR as reported in this study (37.7%-69.2%) is similar to results reported for angler awareness of applicable statewide regulations in other states. Schramm and Dennis (1988) reported that only 41% of urban lake anglers in Lubbock, Texas were able to recite the statewide bag or size limit for largemouth bass. In the same study, only 56% of anglers were able to correctly state *any* fishing regulation. Helfrich et al. (1987) reported that only 30% of anglers fishing one length of the Shenandoah River were aware that no minimum size limit existed there for bass.

Findings of this study and others show that a higher percentage of anglers fishing in special regulation waters can recite the regulations compared to simpler general regulation situations discussed above. Between 74.2% and 79.6% of MFBR and SFBR anglers in the more complex two-fish over 355, no-bait sections were able to recite water-specific regulations correctly. These rates were similar to the 68%-72% awareness rate reported for two special regulation waters managed under a one cutthroat trout >356 mm regulation in northern Idaho (Schill and Kline 1995). Regulation awareness on two Shenandoah River sections managed under more complex slot and minimum size limits were also within the above range at 71%. Schill and Kline (1995) reported 91%-96% regulation awareness for anglers fishing on two catch-and-release waters where no harvest was permitted and suggested that such high rates may have been due to the relatively simple regulation concept compared to the 1>356 zones where anglers were also permitted to harvest six hatchery rainbow trout.

Glass and Maughn (1984) suggested three principal reasons for illegal bass harvest in an Oklahoma lake, including lack of angler knowledge and poor understanding of the purpose of the regulations. Clearly, a first step towards improved bull trout identification ability by Idaho anglers is their improved understanding of the no-harvest regulation.

### **Demographics and Education Options**

Our goal in collecting demographic information was to ascertain if any particular angler characteristics could be used to focus education efforts should they be deemed necessary. The

variables age, sex, and residence were considered the most promising demographic variables in this regard, because this information is available for all anglers via the statewide license database. Mailing bull trout education information to all 400,000 Idaho anglers is probably cost prohibitive, but mailings to a demographic subsample with relatively poor regulation awareness or identification ability may be more economically feasible. Of the three variables with mass-mailing potential, angler gender and age proved to be significantly associated with correct angler responses (Table 3). Assuming our results are applicable statewide, mailing of educational material to female anglers or all anglers under 25 years of age would likely be the most cost effective in increasing bull trout compliance if mail survey education is considered in the future. Although nonresident anglers were slightly less proficient in answering regulation awareness or identification questions than Idaho residents, the observed difference was small and not meaningful from a management perspective. However, these results point to the local nature of the upper Boise River fisheries; only 7.6% of MFBR anglers were nonresidents, despite a fairly large length of special regulation water. Our finding that years of angler experience was strongly associated with angler identification ability was similar to that reported by Schmetterling and Long (1999), although anglers in our surveys had considerably more experience as a group. Middle Fork Boise River anglers interviewed in the survey averaged 25.6 years of angling experience.

One way for potentially improving bull trout identification ability and regulation awareness of Idaho anglers would be to construct signs of sufficient quality to garner the attention of most anglers and locate the signs where the preponderance of anglers would view them. Other options may be distributing adhesive-sticker bull trout pictures to license vendors that anglers could attach to tackle boxes or personally handing out small cards with identification pictures on them as is done in northern Idaho on Lake Pend Oreille. Another approach being considered is putting bull trout identification information on the front cover of the regulation booklet where it is most likely to be seen by anglers. Whatever education approach is chosen, the message should be clear and concise enough to be accurately recalled by anglers after entering a fishery.

### **Illegal Bull Trout Harvest**

Our estimated illegal harvest rate for bull trout (0.0058 fish/h) due to misidentification is well below the legal bull trout harvest rate of 0.03/h reported by Rohrer (1989) during the 1988 angling season prior to implementation of the no-harvest rule. The latter rate was calculated for slightly different sections of the MFBR. Neither of these estimates includes harvest from concealed poaching. However, Schill and Kline (1995) reported low rates of illegal trout harvest, including deliberate concealment on two Idaho rivers where trout could not be legally kept.

Estimates of illegal bull trout harvest resulting from angler misidentification could be important given preliminary identification rates reported here. However, creel survey data from the 1998 angling season suggests that few anglers catch bull trout and therefore have limited opportunity to misidentify them and violate the no-harvest regulation. Results of the creel survey including approximate annual effort estimates and harvest by species will also be completed in the coming year.

## **RECOMMENDATIONS**

1. Develop approaches to remedy the poor trout identification rates in the waters evaluated to date.



2. Evaluate the success of these measures in improving angler regulation awareness and fish identification ability in the upcoming angling season (2000).
3. Evaluate angler regulation awareness and trout identification ability in other geographic regions of the state.

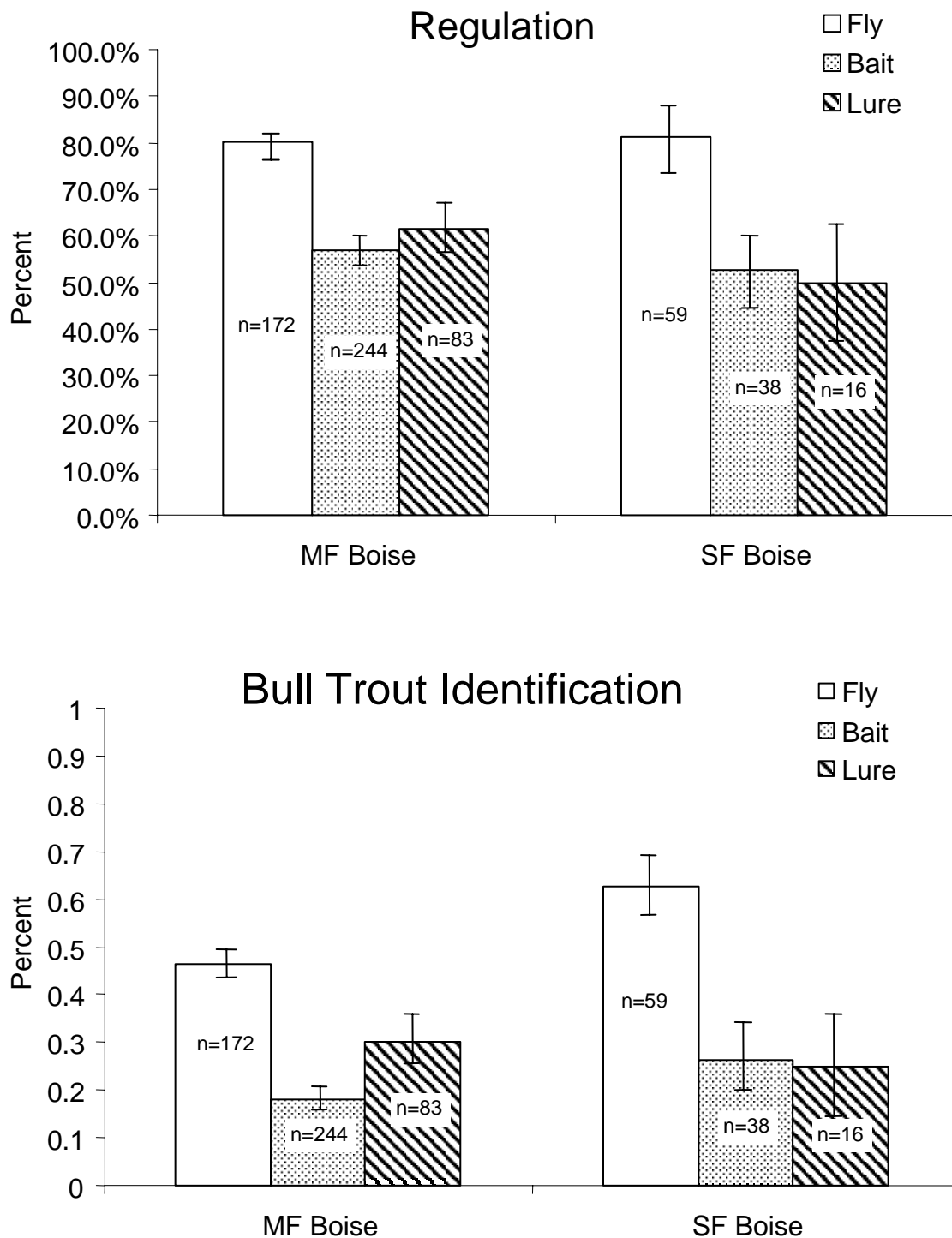


Figure 8. Percentage of Middle Fork and South Fork Boise River anglers that could correctly recite the bull trout regulation and identify the bull trout replica according to gear type, May 23 to October 17, 1998. Bars denote 95% confidence limits.

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## APPENDICES



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IDAHO DEPARTMENT OF FISH AND GAME

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