Salmonid Fish Recognition Skills
Of Anglers at Swan Lake, Montana

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ABSTRACT

During the summer of 2005, we conducted interviews at a heavily-used public access site on Swan Lake, Montana, in order to assess the ability of anglers and to accurately identify salmonid fishes found there. A total of 188 participants provided demographic information and then completed an identification test, based on a display of art prints that graphically illustrated species present in Swan Lake. Highest recognition levels were achieved for rainbow trout (95.2%) and westslope cutthroat trout (60.1%), which the authors attributed in part to the descriptive names and word association with colorful identifying characteristics of these species. Considerably lower levels of recognition skills were exhibited for the three *Salvelinus* species. Adult bull trout (53.7% correct responses), lake trout (39.9% correct), and brook trout (34.6% correct) were frequently misidentified, with the most common wrong response being "don't know". By far the lowest rate of correct response was achieved for a caricature of a juvenile bull trout (26.1%), with respondents actually more likely to call this fish a brook trout (34.0%). The authors identify some of the concerns that this high level of misidentification presents, especially if targeting unwanted lake trout for removal by anglers. They suggest some possible approaches to improve species recognition skills by anglers on Swan Lake.

Introduction

Bull trout (*Salvelinus confluentus*) were historically widely distributed in the Columbia River Basin, including nearly all of western Montana. However, bull trout populations have seen broad declines in portions of their range over the last 100 years. As a result, in 1998 the U.S. Fish and Wildlife Service listed bull trout in the Columbia River basin as a threatened species under the U.S. Endangered Species Act (USFWS 1998). In some cases, bull trout population declines have been strongly correlated with the proliferation of non-native fish species, particularly other *Salvelinus spp.* (Donald and Alger 1993, USFWS 2002). Lake trout (*Salvelinus namaycush*) introduction and establishment has been documented to represent a serious threat to bull trout populations in headwater lakes of the Flathead River system (Fredenberg 2002).

Swan Lake (2,680 acres) is located in the Swan River Valley of northwest Montana. The Swan drainage forms a major tributary to Flathead Lake. Swan Lake historically contained one of the strongest bull trout populations in the entire Columbia River Basin (Frissell et al. 1995, MBTSG 1996). However, there is concern that the recent invasion and establishment of nonnative lake trout in the Swan system might challenge the future existence of a healthy bull trout population in the drainage (FVTU 2004).

Swan Lake hosts a diverse assemblage of fish species. Westslope cutthroat trout (*Oncorhynchus clarki lewisi*), mountain whitefish (*Prosopium coulteri*) and pygmy whitefish (*P. Williamsoni)* are part of the native fish community. A variety of non-native game fish have also become established as a result of introductions in the past century, including kokanee (*O. nerka*), rainbow trout (*O. mykiss*), brook trout (*S. fontinalis*), and northern pike (*Esox lucius*) (FVTU 2004).

Swan Lake is considered a popular angling destination (Rumsey and Werner 1997) and is open to fishing year-round. The legal harvest of bull trout has been restricted in Montana since the early 1990's. However, because of the stable and high quality bull trout population in Swan Lake, that fishery has been maintained as the only lake in Montana where angling for and harvest of bull trout (one fish a day) has been legal since the 1998 listing.

Overharvest and illegal harvest of bull trout, due primarily to misidentification, has previously been identified as a significant threat to bull trout recovery in Montana and elsewhere (Schmetterling and Long, 1999, USFWS 2002). The primary purpose of this survey was to examine the ability of anglers to distinguish between salmonid species; uniquely because it occurs in a lake fishery where bull trout are a commonly encountered species. Furthermore, the ability of anglers to identify both mature and juvenile bull trout was tested.

Methods

An angler survey was conducted from July to August 2005, at the U.S. Forest Service access, the only public boat access site on Swan Lake. Anglers were contacted at the boat ramp, while either entering or exiting Swan Lake. Rumsey and Werner (1997) suggested that over 90% of the anglers obtain access at that location.

Swan Lake users were approached and asked to take part in an anonymous survey conducted by volunteers for the U.S. Fish and Wildlife Service. Respondents were told that the study was for educational purposes and that they would not be penalized for incorrect answers. Small prizes (bull trout tattoos, bookmarks, and postcards) were offered as an incentive for participation in the survey.

In order to assess angler demographics and their relative level of angling experience, respondents were asked to answer a few questions to establish an anonymous background profile, including age, place of origin, and questions about current fishing activities and practices. Participants were also asked whether they had been interviewed at Swan Lake before. This information was recorded on a data sheet by individual interviewee.

A poster board was prepared, with ten removable 5-inch by 10-inch, Velcro-backed, laminated color art prints of fish species. All were drawn by graphic artist Joe Tomelleri. These renditions have been widely used in educational and outreach materials and are considered to be very lifelike renditions of the fish species present in Swan Lake. Included amongst the prints were an adult bull trout, juvenile bull trout, brook trout, lake trout, rainbow trout, westslope cutthroat trout, kokanee, and mountain whitefish. A yellow perch (*Perca flavescens*) and northern pike were added, as we perceived these to

be easily recognizable species that would help instill confidence in anglers that they could score right answers on the quiz. At least twice daily, the order of the fish prints was randomly shuffled on the board so that bias would not be introduced because of location or association.

Those willing to participate in the quiz were asked to identify each of the ten species on the poster. At the beginning of the quiz each contestant was told that these fish species are commonly found in Swan Lake and that some of the fish might be represented in more than one picture. All pictures remained visible at all times to the contestants. Anglers' responses to identification of the eight salmonid species were recorded on a tally sheet.

After the test, interviewees were offered education on the correct identification and key characteristics that would help them in future recognition of these species. In addition, contestants received printed and verbal information about the problems the establishment of lake trout will likely cause for native bull trout and other species in Swan Lake. Due to the relatively recent nomenclature change separating Dolly Varden (*Salvelinus malma*) as a distinct species from bull trout, and the formerly common usage of the name Dolly Varden in the Flathead region, that answer was counted as correct for bull trout identification. After taking the survey, contestants giving the answer Dolly Varden were instructed on the difference between the two species. Salmon, whitefish, and cutthroat were also counted as correct answers when responded to for kokanee, mountain whitefish, and westslope cutthroat trout, respectively.

Responses were analyzed by residency status, age classes (less than 20, 21-40 years, 41-60 years, and greater than 60 years) and frequency of current fishing activities (less than 10 days per year, 11-25 days per year, 26-50 days, 51-75 days, 75-100 days and greater than 100 days per year). The mean number of correct answers was calculated for each group and comparisons were made. Identification skills of Montana residents and non-residents were examined.

Results

A total of 468 people were contacted by the surveyor on Swan Lake. Only 188 people (40.4%) were willing to conduct complete interviews. Another 176 contacts

(37.6%) refused to participate at all in the survey. The remainder of respondents (22.0%) expressed interest in the different identification characteristics, but were not willing to take the quiz for a score. Eighty-seven percent of the 188 completed interviews were obtained from men and 13 percent from women. Only four previously tested participants retook the test a second time.

The summer months predominantly attracted people from across Montana to Swan Lake (79.8%; Table 1). Thirty-seven people we surveyed had visited Swan Lake from other U.S. States (29 responses) or Canada (8 responses), and one was from Europe.

An average of 50.1% correct answers were given for identification of the eight salmonid fish species (Table 1). Montana residents showed a slightly better ability to identify the different fish species (53.3%; Table 1), than did nonresidents (36.8%).

Among the eight salmonid species shown on the identification board, Swan Lake quiz contestants were best at recognizing rainbow trout (Table 2), which were correctly identified 95.2% of the time (Figure 1). Only 9 of 188 respondents erred on the correct identification of this nonnative species. Westslope cutthroat trout were the second most often correctly identified species (60.1%; Figure 2), followed by kokanee (55.3%; Figure 3). The adult bull trout was recognized by 53.7% of the 188 people surveyed (Figure 4). Conversely, juvenile bull trout received the lowest number of correct answers (26.1%; Figure 5), and were misidentified nearly three-fourths of the time. Less than half (39.9%; Figure 6) of respondents correctly identified lake trout. Mountain whitefish (Figure 7) and brook trout (Figure 8) had nearly identical correct response rates of 35.6% and 34.6%, respectively.

Among the 87 respondents who misidentified the adult bull trout, the most common answers for it were: 'don't know' (49 times), lake trout (22 times) and brook trout (8 times). More survey respondents (64 times) confused juvenile bull trout with brook trout, than got the species identification correct (49 times). Other responses for juvenile bull trout were: 'don't know' (38 times), and brown trout (21 times). Only five participants falsely responded with Dolly Varden to identify bull trout; two of whom were from Washington State where Dolly Varden are commonly found.

As noted, about 60.1% of anglers misidentified lake trout. Other responses among the 113 incorrect answers included: 'don't know' (72 times), and bull trout (12

times). The brook trout print was incorrectly identified 65.4% of the time. Of the 123 respondents misidentifying this fish, "don't know" was the most common response (63 times) and 29 other respondents mistook it for a bull trout.

Participants differed in distribution of their age, fishing experience and angling preferences. Over two-thirds of anglers (71.8%) were between 21-60 years of age. The heaviest concentration of respondents (42%) were between 41 and 60. There was no observed difference among the broad age classes of anglers we chose in terms of their ability to identify the eight salmonid species. Each age class had a mean number of correct responses of about half correct.

The majority of interviewees (82.4%) fish almost exclusively in Montana, but only a little over half (58.5%) routinely fish on Swan Lake. A small minority (11.7%) of respondents reported that they never fish, but took the survey out of curiosity. Most participants (74.5%) fished less than 25 days per year. There was also no observed difference between the amount of fishing experience and the ability to correctly identify different fish species. Swan Lake anglers reported they generally keep some fish if they are big enough (78%), but catch and release practices were favored by some.

Discussion

These results provide a baseline upon which to evaluate anglers' ability to identify different fish species found in Swan Lake, Montana. Results of this survey closely paralleled results obtained by Schmetterling and Long (1999) as well as others, and they collectively suggest that anglers consistently confuse the different salmonid species. Although most anglers seem to be aware of the special status for bull trout, nearly half failed to correctly identify a graphic representation of an adult fish of this species.

We believe the use of standardized, high quality art prints, such as those produced by Joe Tomelleri, were effective for this survey. While no single picture can accurately portray the tremendous amount of morphological and phenotypic variation seen in salmonid fishes, these art prints do a very good job of highlighting key identification characteristics (such as spotting patterns, fin conformation, etc.) and are thus most useful for follow-up educational efforts.

Consistent with the results of Schmetterling and Long (1999), our results indicate a surprisingly high ability to identify rainbow trout (95% correct; Figure 1). It was observed that because the name of the species is so descriptive, and the art print depicts a broad pink band on the side of the fish, the word association naturally leads people to a nearly fail-proof conclusion. Rainbow trout was often the first species they identified. This type of word association may also explain why cutthroat trout recognition skills were fairly high (60% correct; Figure 2), due to the presence of a red throat slash. However, for the three *Salvelinus* species (bull, brook, and lake trout) no such verbal cues are present, and all three were identified with considerably lower proficiency (26%-54% correct).

Angler familiarity with the local fishery and their expectation of species likely to be encountered must also play a key role in species recognition. Kokanee provide no particularly obvious verbal cues from their name and have few descriptive physical attributes, yet 55% of those surveyed still identified this species correctly (Figure 3). Kokanee are the most sought after fish in the summer fishery on Swan Lake (Rumsey and Werner 1997).

Confusion amongst the three *Salvelinus* species (bull, brook, and lake trout) now present in Swan Lake is the most perplexing issue from a regulatory standpoint. For all three species (Figures 4, 5, 6, and 8) the proportion of survey participants to whom the species was unknown (26%-38%) was almost as high as the proportion that got the correct answer (34%-54%). On the one hand, only 6% of participants in the survey misidentified the lake trout as a bull trout. However, about 12% inaccurately considered the adult bull trout to be a lake trout. This could infer that regulatory changes to encourage anglers to keep lake trout might lead to substantial illegal or inadvertent legal harvest of bull trout. If there is a desire to encourage anglers remove lake trout from the system with a low error rate, then a simple educational theme must be promoted to reliably identify this species. Keying in on the deeply forked tail of lake trout might be the most effective approach. A catchy new slogan, along the lines of "no black, put it back", with accompanying outreach material needs to be developed.

It is also clear from the responses we received that anglers had very poor recognition skills for juvenile bull trout (26% correct; Figure 5). Anglers appear to be

about as likely to confuse a juvenile bull trout with a brook trout as they were to identify it correctly (Figure 8). Since brook trout do not occur in the lake with high frequency, this may not seem like a problem. However, substantial numbers of juvenile and subadult bull trout may be harvested by anglers who think they are simply "nice brookies." Inclusion of artist's renderings of two bull trout in our survey (one adult and one smaller juvenile or resident), as opposed to one of each of the other species, may have inadvertently contributed to the high rate of misidentification of the smaller bull trout. However, those who know the species key characteristics should not have been confused.

One problem with our access-based survey protocol was that a high percentage of the participants we surveyed had limited, or even no fishing experience. The survey may have provided a more accurate assessment of angler proficiency had we conducted a roving style survey on the lake and limited participation to anglers who were actually fishing at the time of contact. Swan Lake is heavily used for other recreational purposes during the summer months, with many of the "serious" fishermen focusing their efforts in the spring and fall. As this survey had a secondary objective of accomplishing educational outreach, it was still considered effective in that regard.

It was somewhat surprising that only a minority of those contacted (40%) were willing to participate in this survey. However, lack of interest in fishing activities, limited time, and the possible fear by anglers of failure or punishment were considered possible reasons that many declined. Despite the low number of participants in our survey, a little over half (55%) expressed active interest in learning more about the different fish identification characteristics. Responses such as "I had this in school" or "I remember the slogan about No Black" implied some success in educational outreach programs, amongst both anglers and non-anglers. Outreach programs presented in the schools appeared to be partially effective among younger participants ($\leq$20 years old), helping them to properly identify at least some of the fish displayed.

In conclusion, there is valid concern that present levels of fish identification skills of Swan Lake recreational users are currently inadequate to protect and maintain the bull trout population. Our survey results were closely aligned in many respects with those obtained by Schmetterling and Long (1999), who conducted a similar survey with a

larger sample size on streams in western Montana. It does not appear that species recognition skills at this lake-based fishery are much different than for the streams that Schmetterling and Long (1999) surveyed. Anglers may unintentionally harvest bull trout because of their inability to identify them. Further education efforts are needed.

The reintroduction of a minimum creel size for bull trout (traditionally 18 inches) is one approach that might help to reduce the impact misidentification may have, since our observations indicate recognition skills are much poorer for smaller bull trout. Alberta instituted a program that required anglers to pass a species identification proficiency exam in order to be allowed to fish on Quirk Creek (Stelfox et al. 2000). Results showed that mandatory training could be effective.

While it is clear that fish identification skills amongst anglers and other recreationists at Swan Lake are poor, it is somewhat encouraging that a substantial portion of the public is interested in learning more. We must continue to explore avenues to upgrade fish identification skills and to effectively distribute messages about the importance of native fish in mixed species assemblages.

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Table 1.   Percent correct species identification of artist drawings of eight salmonid species, by 188 respondents surveyed on Swan Lake, Montana.

		Montana resident	Nonresident	Overall
	Sample size	150	38	188
	Rainbow Trout	98.7	81.6	95.2
	Westslope Cutthroat	66.7	34.2	60.1
	Kokanee	60.7	34.2	55.3
Species correctly identified (%)	Adult Bull Trout	58.0	36.8	53.7
	Lake Trout	41.3	34.2	39.9
	Mountain Whitefish	40.0	18.4	35.6
	Brook Trout	36.7	21.1	34.6
	Juvenile Bull Trout	24.0	34.2	26.1
	Average	53.3	36.8	50.1
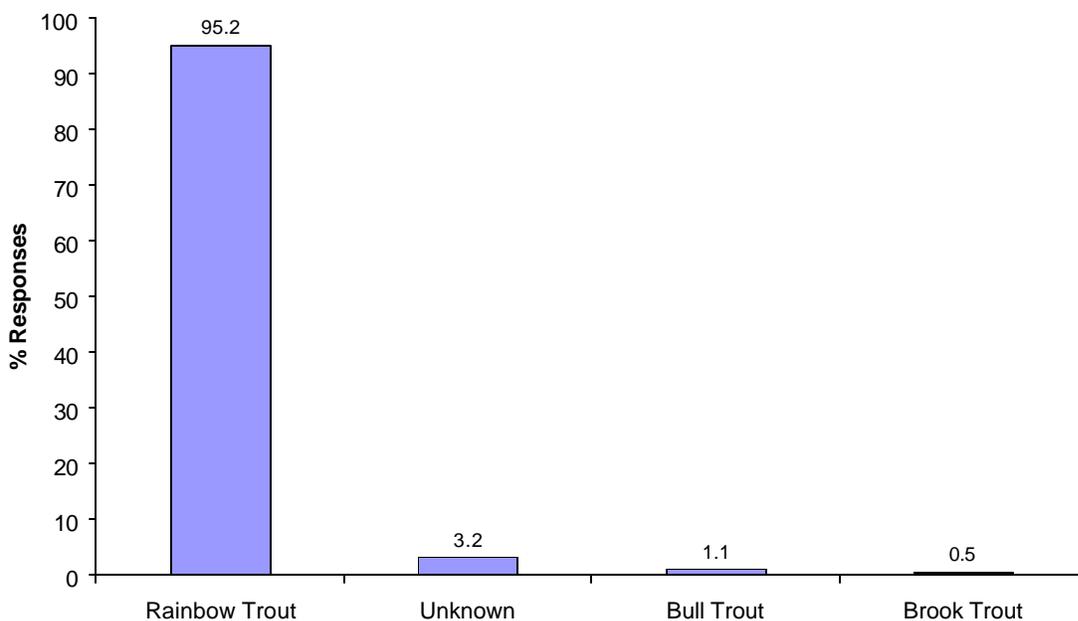
Figure 1. Distribution of identification responses for rainbow trout (n=188).
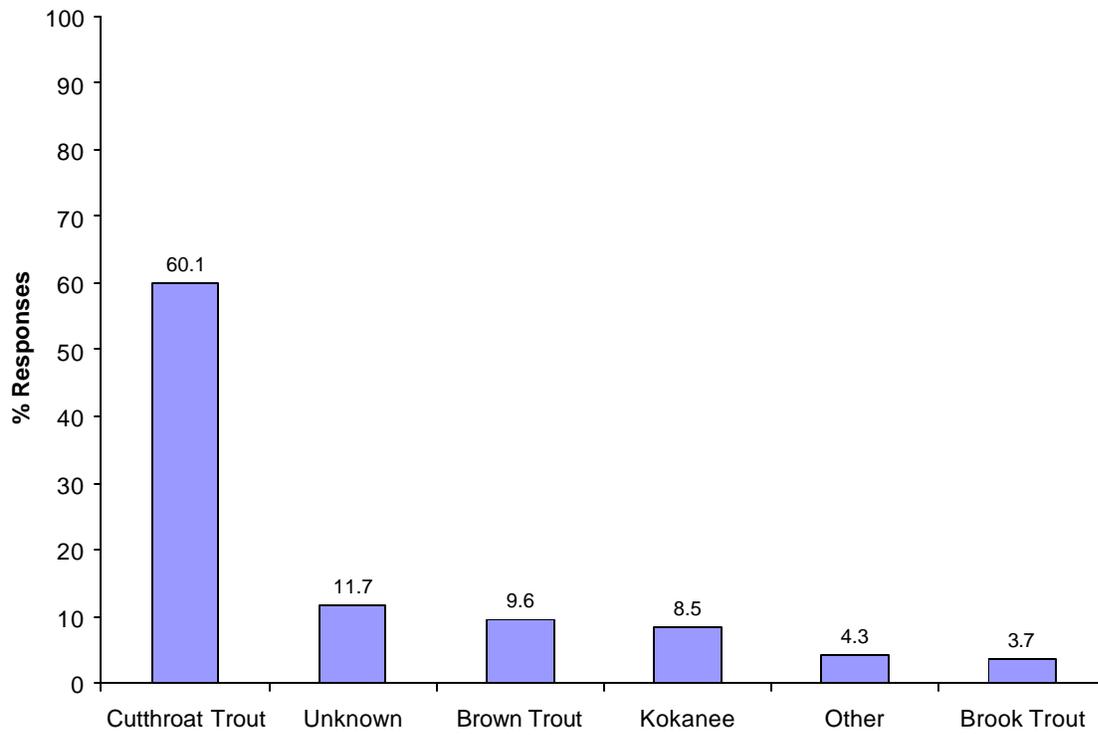
Figure 2. Distribution of identification responses for westslope cutthroat trout (n=188).
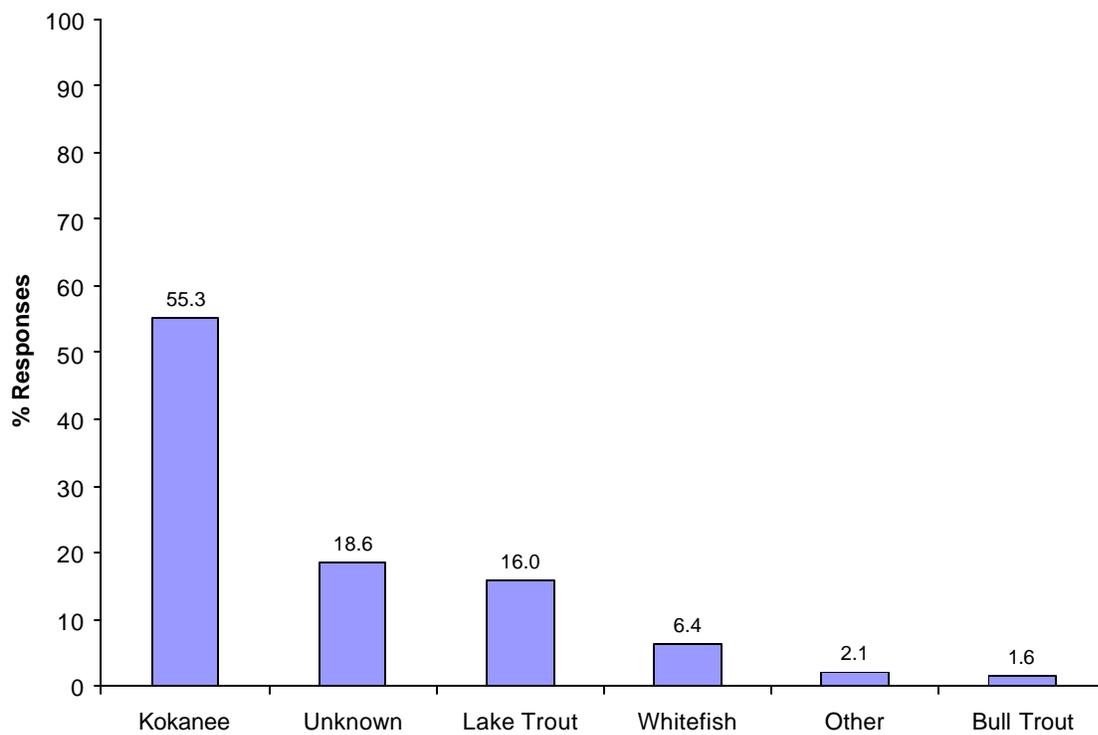
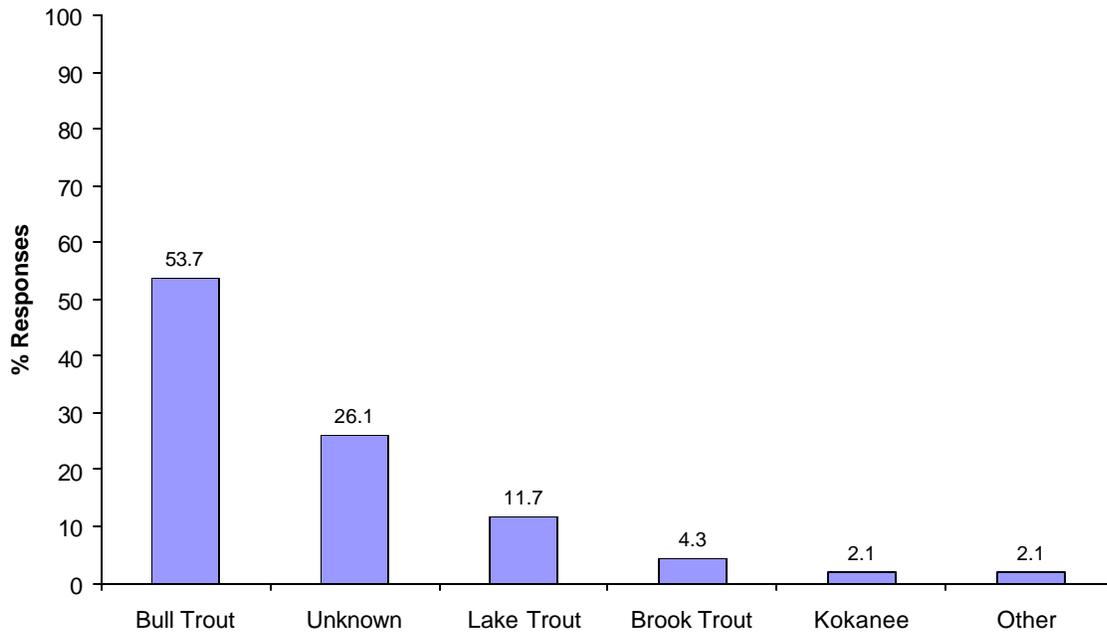**Figure 3.** Distribution of identification responses for kokanee (n=188).

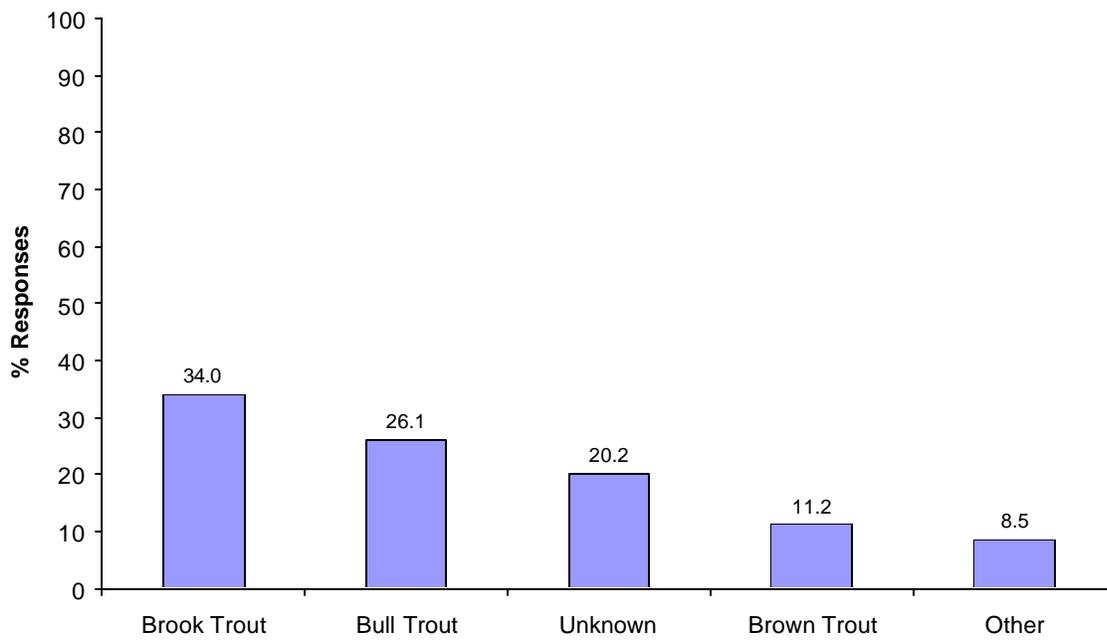**Figure 4.** Distribution of identification responses for adult bull trout (n=188).

Figure 5. Distribution of identification responses for juvenile bull trout (n=188).
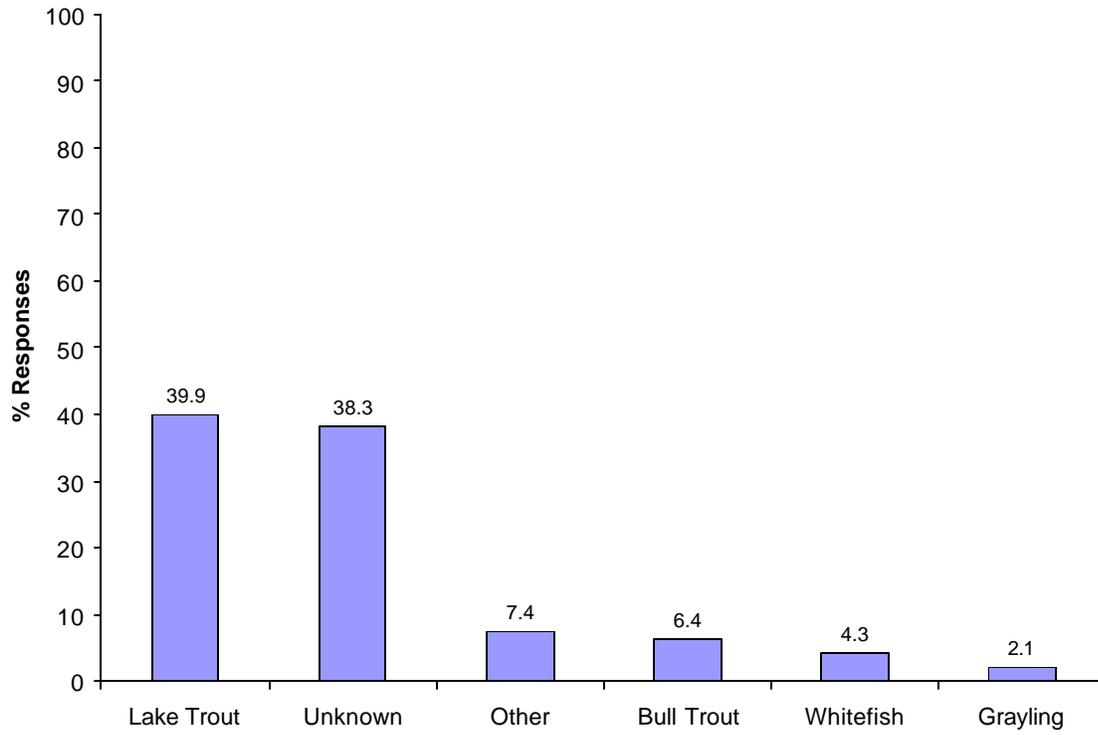
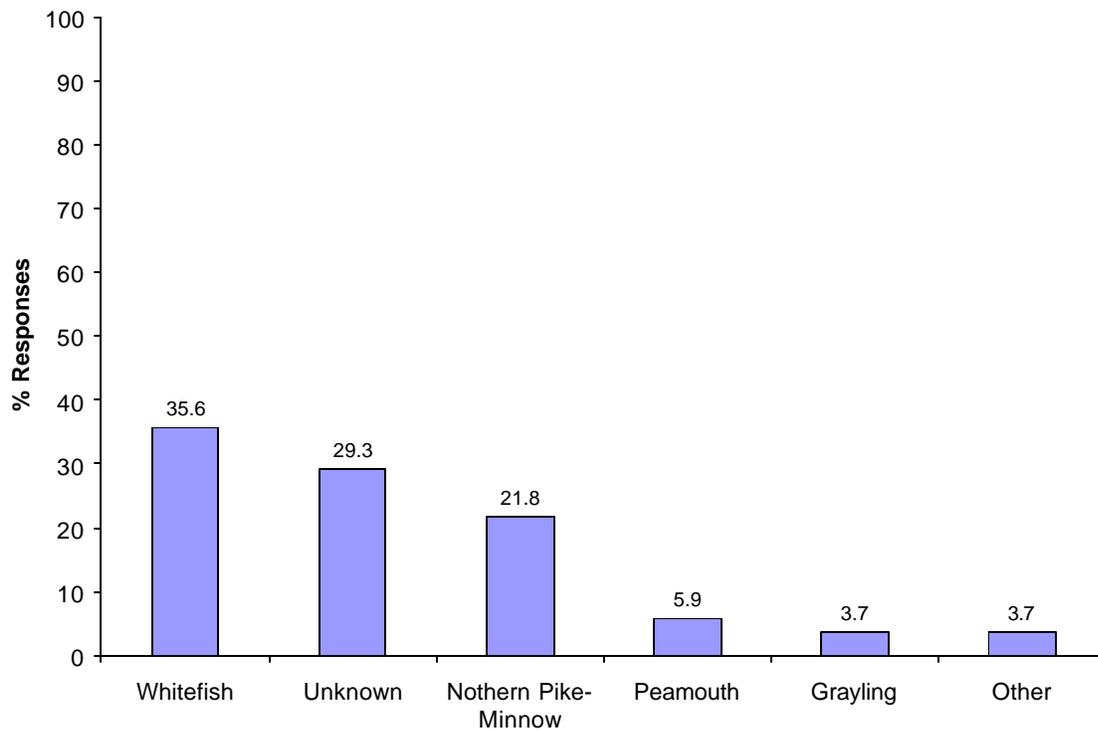**Figure 6.** Distribution of identification responses for lake trout (n=188).

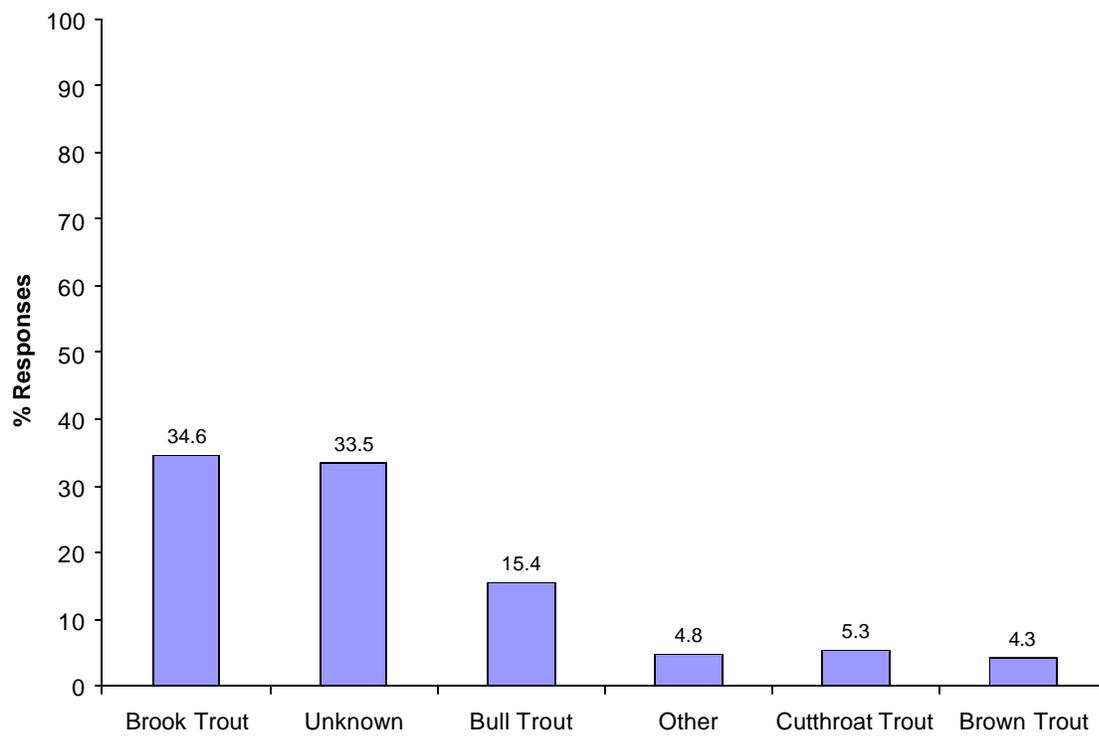**Figure 7.** Distribution of identification responses for mountain whitefish (n=188).

Figure 8. Distribution of identification responses for brook trout (n=188).