IDAHO DEPARTMENT OF FISH AND GAME
FISHERY MANAGEMENT REPORT

2005 UPPER SNAKE REGION

By

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MOUNTAIN LAKES INVESTIGATIONS

ABSTRACT

We sampled seven mountain lakes in the Upper Snake Region during 2005 as part of a three-year comprehensive assessment. Lakes surveyed were Aldous, Big Creek, Corral Creek, Grant Creek, Hancock, Packsaddle and Upper Swauger. Surveys consisted of population monitoring using gill nets, angling and visual observations as well as habitat assessment, amphibian presence/absence surveys and evaluations of human use and impacts. Data were used to assess current stocking rates and resulting fisheries. Angler catch rates ranged from 0 to 10.0 fish per hour in the seven lakes surveyed. Our catch rate objective of at least one fish per hour was met in four of the seven lakes (Aldous, Corral Creek, Grant Creek and Packsaddle Lakes). Three lakes (Big Creek, Hancock and Upper Swauger) were below our catch rate objective. Big Creek Lake and Hancock Lake should be dropped from the stocking rotation as previous stockings have not established a fishable population. We may be able to improve the fishery in Aldous and Upper Swauger lakes by increasing the stocking frequency to every other year. Grant Creek Lake can withstand a reduction in stocking rate based on angler catch rates and use. Natural reproduction was evident in three lakes (Corral Creek, Grant Creek and Packsaddle lakes), but not in sufficient quantity to support the fisheries. Amphibians (either Columbia Spotted Frogs *Rana luteiventris* or Tiger Salamanders *Ambystoma tigrinum*) were found in Aldous, Hancock and Upper Swauger lakes.

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INTRODUCTION

Fishing is a popular attraction at many of the mountain lakes in the Upper Snake Region of Idaho. However, current data describing these fisheries is limited. Prior to the 2002 sampling season, we met with the United States Forest Service fisheries biologist out of the Salmon/Challis Region to agree on a collaborative sampling methodology for mountain lakes. Guidelines for regional mountain lake management were jointly established, and include the following:

1. Maximize the effective use of hatchery introductions
2. Manage for a diversity of species within given drainages
3. Maintain catch rates of one fish per hour or better
4. Maintain some lakes in each drainage as fishless for native aquatic species

OBJECTIVE

To obtain current information for fishery management decisions on mountain lakes, including angler use and success, fish population characteristics, spawning potential, stocking success, limnology, morphology, and notes on other aquatic life and develop appropriate management recommendations.

METHODS

To gather fish population information, mountain lake sampling consisted of an overnight gill net set with a standard experimental gill net (20 m by 1.5 m, with mesh sizes of 2.5 cm, 5 cm and 7.5 cm bar mesh) set perpendicular to the shore in combination with visual observations of fish presence and a minimum of one hour of angling. We interviewed all anglers encountered while surveying a lake for catch rate information, which was combined with results from our own angling efforts. We estimated physical parameters such as lake type, aspect and depth profile by on-site observations while surface area and shoreline distance were measured using Maptech Terrain Navigator Pro (2005) distance measuring tool. We classified depth profile as shallow (< 25% of the lake is over 6 m), moderate (< 50% of the lake is over 6 m) or deep (75% of the lake is over 6 m), and estimated while on-site. We collected amphibian presence/absence data by walking shoreline areas and recording species encountered. Conductance and temperature were measured with appropriate meters. We estimated the potential for natural recruitment by ranking the quality of habitat present in the inlets and outlets. We defined quality habitat as having clean pebble or cobble substrate with sufficient flows to allow adult fish to spawn, and offspring to migrate into the lake. We estimated the length of habitat present in the inlets/outlets, and ranked it according to quality and abundance (Excellent - abundant spawning habitat present; Good - enough habitat present to maintain a fishery; Fair - habitat present, but limited in abundance; Poor - no suitable habitat). Additionally, the timing of surveys was scheduled to correspond to the third year following stocking and prior to the current

years stocking. This provides the best opportunity to document natural reproduction by analyzing length frequencies and visually observing fish. If recruitment were strictly dependent on stocking, only one or possibly two size classes of fish should be present. We measured human use and impacts by walking the shoreline and recording information on trail condition, litter amounts and the number of campfire rings. Although subjective, we estimated access difficulty as easy (access less than two km with low to moderate elevation gain), moderate (two to five km access with moderate elevation gain), and difficult (> 5 km approach with substantial elevation gains).

RESULTS

Survey results are summarized in Table 1. Our samples collected rainbow trout *Oncorhynchus mykiss* and Yellowstone cutthroat trout *O. clarkii bouvieri*. Survey results indicate the management objective of at least one fish per hour is being met on Aldous Lake, Corral Creek Lake, Grant Creek Lake and Packsaddle Lake. The catch rate objective is not being met on Big Creek Lake, Hancock Lake or Upper Swauger Lake. Natural reproduction was found in Corral Creek Lake, Grant Creek Lake and Packsaddle Lake. Amphibian populations (either Columbia Spotted Frogs *Rana luteiventris* or Tiger Salamanders *Ambystoma tigrinum*) were found in Aldous Lake, Hancock Lake and Upper Swauger Lake. Data on individual lakes are presented in Appendix A.

DISCUSSION

Survey results show our catch rate objective is being met on the majority of the seven lakes sampled in 2005. The goal of our mountain lakes management program is to use angler catch rates, angler use and available lake habitat to tailor our stocking rates and obtain the best return on our stocked fish while providing a quality angling experience. Lakes such as Grant Creek Lake which exceed our catch rate goals and show little evidence of human use may be able to sustain a quality angling experience with decreased stockings of trout. Conversely, lakes such as Aldous and Upper Swauger which show evidence of significant angler use may benefit from an alternate year stocking schedule even though they currently meet our catch rate objective. Angler use appears to be heaviest in lakes that require little effort to reach. Although our sample size is low, there is evidence suggesting lakes with difficult access provide higher catch rates, possibly as a result of decreased effort. Future analysis should explore the relations among access, catch rates and angler use. In addition to catch rate objectives, established guidelines call for some lakes to remain fishless to provide areas of refuge for amphibians. Two of the seven lakes sampled had both fish and amphibians present. One other lake had amphibians present without fish. The remaining lakes all had a spring or lake in the drainage within three km that was fishless and could provide additional opportunities for amphibians and native species, thereby meeting our objective. We do not currently monitor these fishless waterbodies, but may incorporate them in future surveys.

RECOMMENDATIONS

1. Maintain current stocking rates in Corral Creek Lake and Packsaddle Lake.

2. Reduce stocking rate on Grant Creek Lake from 1,000 to 500 cutthroat trout every three years.

3. Increase stocking frequency on Aldous and Upper Swauger lakes from every third year to every other year.

4. Remove Big Creek Lake and Hancock Lake from the stocking rotation.

5. Compile all mountain lakes data from the past three years and adjust stocking protocol as necessary.

LITERATURE CITED

Maptech 2005. Maptech Terrain Navigator Pro Version 7.0. Amesbury Massachusetts http//www.maptech.com

Table 1. Results from lake surveys in the Upper Snake Region, Idaho 2005.

Lake Name	Surface Area (ha)	Depth[a]	Species Present[b]	Natural Production	Amphibians Present[c]	Angling CPUE	Gill Net CPUE	Campfire Rings (No.)	Access Difficulty	Angler Use
Aldous	2.4	Shallow	YCT	None	Yes (CSF)	10.0	--	2	Easy	High
Big Creek	0.9	Shallow	NONE	None	No	0	0	0	Moderate	Low
Corral Creek	1.8	Moderate	YCT	Mimimal	No	2.3	--	1	Difficult	Low
Grant Creek	0.2	Shallow	YCT RBT	Common	No	4.0	11	2	Difficult	Moderate
Hancock	1.4	Moderate	NONE	None	Yes (TIG)	0	0	2	Easy	Moderate
Packsaddle	1.9	Moderate	YCT	Common	No	3.5	10	4	Easy	High
Upper Swauger	0.8	Moderate	YCT	None	Yes (CSF)	0	4	6	Easy	High

[a] – Depth was estimated as shallow (<25% of lake over 6 m), moderate (<50% of lake over 6 m) or deep (75% of lake over 6 m)
[b] – Species abbreviations: RBT = rainbow trout; YCT = Yellowstone cutthroat trout;
[c] – Amphibian abbreviations: LTS = long-toed salamander; CSF = Columbia spotted frog; TIG = tiger salamander

Appendix A. Mountain lake report

Aldous (Mickey's) Lake

432,561 E 4,929,982 N Z 12

Aldous (Mickey's) Lake is located in the headwaters of Ching Creek in the Camas Creek drainage near Kilgore, Idaho. The lake measures 726 m in circumference (2.4 ha), at an elevation 2,309 m. Surrounding habitat consists of rocky forest and coniferous trees (lodgepole pine, subalpine and douglass fir) nearby. There was a well-used, complete trail around the shoreline, moderate litter, and 2 well-developed campsites with fire rings and picnic tables suggesting a high degree of human use. There was 1 inlet with no suitable spawning habitat and 1 high gradient outlet with no suitable, accessible spawning habitat. Access is very easy consisting of an easy drive north of Kilgore and a 2.5 km hike along a well maintained trail (with boardwalks over boggy areas and streams). The trail head is clearly marked (as Aldous Lake trail).

On August 6-7, 2005, we surveyed Aldous Lake. The fishery survey consisted of angling and visual observations of fish. During the evening of August 6, the lake surface was largely covered by floating masses of algae. Three fish were observed, but fishing would have been difficult because of the algae. The following morning, the algae had sunk, and we fished for ½ hour. We caught five Yellowstone cutthroat trout, all between 375-420 mm. No smaller fish were observed, and it seems evident that no natural reproduction occurs. We conducted an amphibian survey and observed 20-50 Columbia spotted-frog adults and 50-100 tadpoles. We also observed numerous clusters of eggs, presumably from Columbia spotted-frogs.

Our data indicate Aldous Lake exceeds the fishery objective of at least one fish per hour (actual catch rate 10.0 fish/hour), though fishing in the afternoon would not have been nearly as productive. Because of the easy access and high degree of use of Aldous Lake, it may benefit from an alternate year stocking schedule.

Year	Species	No. of fish
2005	YCT	1,500
2002	YCT	1,500
1999	YCT	1,500
1996	YCT	1,500

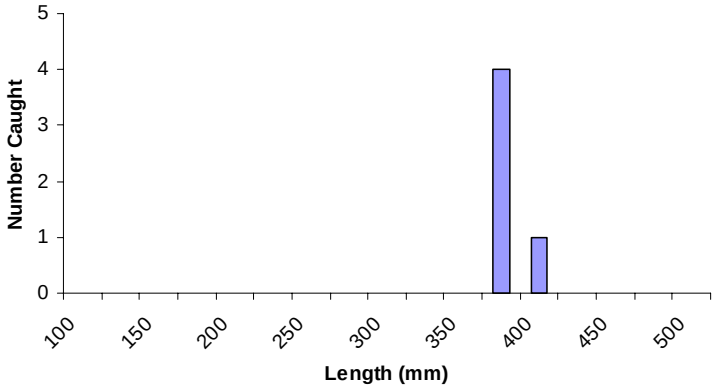

Table 1 and Figure 1. Recent stocking history for Aldous Lake, Idaho and length frequency of fish collected in 2005 survey work.

Big Creek Lake

297,476 E 4,879,155 N Z 12

Big Creek Lake is located in the headwaters of Big Creek in the Little Lost River drainage East of Mackay, Idaho. The lake measures 340 m in circumference (0.9 ha), at an elevation of 2,804 m. Surrounding habitat consists of rocky forest and coniferous trees (lodgepole pine, subalpine and douglass fir) nearby. There was no shoreline trail, no litter, no camping spots and no fire rings, all suggesting very limited human use. We found no inlet with suitable spawning habitat and one outlet that provided about 15 m of poor quality spawning habitat. Access is moderate, consisting of an easy drive through Pass Creek (East of Mackay) to the confluence with Big Creek followed by a 4.2 km cross-country hike.

On August 16, 2005, we surveyed Big Creek Lake. The fishery survey consisted of angling and visual observations of fish in combination with a gill net set overnight. We did not observe any fish in the clear water of the lake, nor did we capture any fish in the gill net or during four hours of angling. It seems evident that no natural reproduction occurs, and survival of stocked fish was not evident. We observed very few aquatic insects (a few caddis and diving beetles), and could not identify a good forage base for trout. We found no amphibians on our two-hour shoreline survey.

Our data indicate Big Creek Lake does not meet the fishery objective of at least one fish per hour (actual catch rate 0 fish/hour). Several experimental stockings have occurred in the past, but apparently none were successful. We recommend dropping Big Creek Lake from the stocking rotation given the limited human use and the inability of stocked trout to survive.

Stocking History

Year	Species	No. of fish
2002	RBT	500
1996	RBT	756
1993	RBT	300

Table 1. Recent stocking History for Big Creek Lake, Idaho.

Corral Creek Lake
278,094 E 4,859,100 N Z 12

Corral Creek Lake is located in the headwaters of Corral Creek, a tributary to the East Fork Big Lost River near Mackay, Idaho. The lake measures 690 m in circumference (1.8 ha), at an elevation of 3,068 m. Surrounding habitat consists of rocky moraine and scree fields, with a few small conifer trees nearby. There was no trail around the shoreline, no litter, and only one old fire ring suggesting limited human use. There were no inlets or outlets with quality spawning habitat. Access is difficult, consisting of a rough 4-wheel drive trail up Alder Creek to the Stewart Canyon trailhead. An ATV trail departs from here, going 5 km to the divide between Stewart Canyon and Corral Creek. A moderately difficult hike across country approximately 1.5 km gives access to Corral Creek Lake.

On August 2, 2005, we surveyed Corral Creek Lake. The fishery survey consisted of angling and visual observations of fish. We observed numerous fish (300-350 mm) rising throughout the lake, and what appeared to be spawning activity at the western end. One 100 mm fish was observed, suggesting some limited reproduction occurs, although this reproduction is not likely to support the population. Angling produced nine Yellowstone cutthroat trout ranging in size from 310 to 350 mm over the four hours of fishing time. We observed no amphibians on our shoreline survey.

Our data indicate Corral Creek Lake exceeds the fishery objective of at least one fish per hour (actual catch rate 2.3 fish/hour). The lake was last surveyed in 2002, and has since doubled in size as a result of better annual precipitation. However, catch rates remain high, in part due to apparent limited use based on the human impacts to the area. We recommend continued stocking of Corral Creek Lake at the current rate of 1,000 Yellowstone cutthroat trout every three years.

Stocking History

Year	Species	No. of fish
2005	YCT	1,000
2002	YCT	500
1999	YCT	1,000
1996	YCT	600

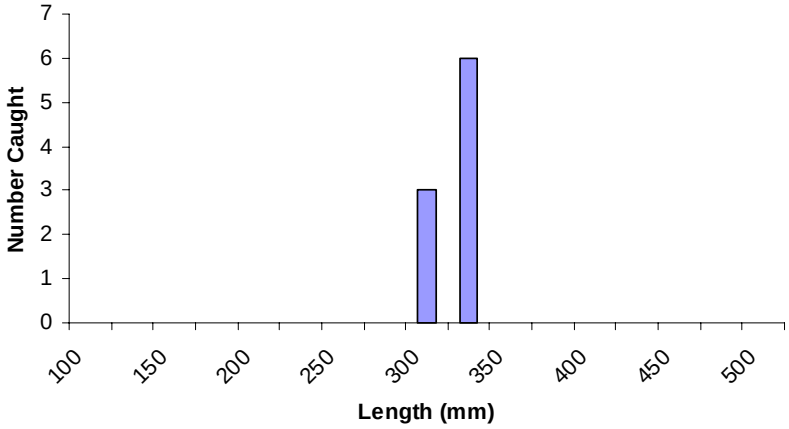

Table 1 and Figure 1. Recent stocking history for Corral Creek Lake, Idaho and length frequency of fish collected during 2005 survey work.

Grant Creek Lake

261,438 E 4,871,766 N Z 12

Grant Creek Lake is located in the headwaters of Grant Creek, a tributary to the Mainstem Big Lost River near Mackay, Idaho. The lake measures 270 m in circumference (0.2 ha), at an elevation of 2,484 m. Surrounding habitat consists of coniferous trees and mixed brush and meadows nearby. There was no trail around the shoreline, no litter, and only two fire rings suggesting limited human use. There was one inlet and one outlet that provided approximately 10 m^2 of marginal spawning habitat. Access is difficult, consisting of a rough 4-wheel drive trail up Grant Creek followed by an approximate ½ km moderate cross-country hike.

On July 28, 2005, we surveyed Grant Creek Lake. The fishery survey consisted of angling and visual observations in combination with a gill net set for four hours. We observed numerous fish (200-300 mm) rising throughout the lake. We fished for four hours, and caught 16 fish ranging in size from 210 to 290 mm. Our gill net yielded 11 fish ranging in size from 215 to 300 mm over the four hours the net was deployed. Species composition was mainly cutthroat trout (70%) with a few hybrid and rainbow trout (30%). We observed no amphibians on our shoreline survey.

Our data indicate Grant Creek Lake exceeds the fishery objective of at least one fish per hour (actual catch rate 4 fish/hour). Natural reproduction appears to be adding to the population, as rainbow trout have not been stocked since 1994, and were captured in the current survey. Trout may also move upstream from a series of beaver ponds thereby contributing to the fishery. Natural reproduction is unlikely to sustain the population, even under the low effort we suspect Grant Creek Lake sustains. Based on visual observations, trout condition was low indicating a lack of forage. We recommend continued stocking of Grant Creek Lake but reducing fish numbers from 1,000 fish to 500 fish every three years.

Stocking History

Year	Species	No. of fish
2005	YCT	1,000
2002	YCT	500
1999	YCT	1,000
1996	YCT	600

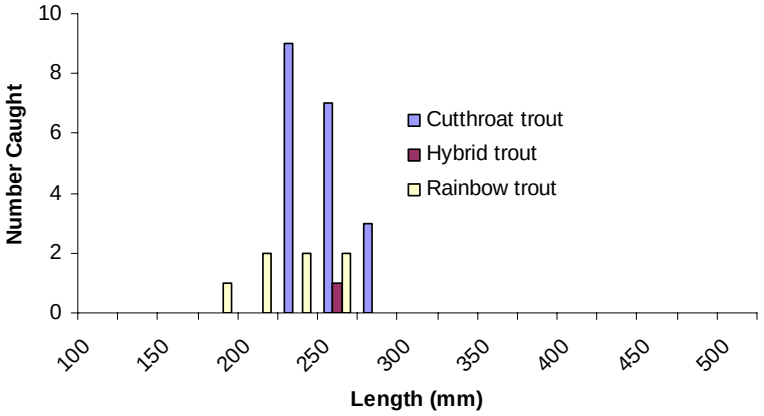

Table 1 and Figure 1. Recent stocking history for Grant Creek Lake, Idaho and length frequency for fish collected during 2005 sampling efforts.

Hancock Lake

432,183 E 4,931,050 N Z 12

Hancock Lake is located in the headwaters of Ching Creek in the Camas Creek drainage near Kilgore, Idaho. The lake measures 523 m in circumference (1.4 ha), at an elevation 2,474 m. Surrounding habitat consists of rocky moraine and some coniferous trees (lodgepole pine, subalpine and douglass fir) nearby. There was a partial trail around the shoreline, minimal litter, and only 2 campsites with fire rings suggesting moderate human use. There were no inlets or outlets. The lake has a high degree of natural fluctuation. It appeared that the high water mark was about 2 m above the level during our survey, but we also observed fire rings in 1 m of water, indicating a fluctuation of around 3 m. Access is fairly easy. Hancock is approximately 1.6 km beyond Aldous Lake, which is about 2 km from trailhead. The trail from Aldous to Hancock Lake is moderately steep. The trail head is clearly marked (as Aldous Lake trail).

On August 6-7, 2005, we surveyed Hancock Lake. The fishery survey consisted of angling and visual observations of fish. We observed no fish during the evening and following morning and caught no fish in a half hour of angling. Given the clarity of the water and good viewing conditions, it is very unlikely there were any fish present. We conducted an amphibian survey and observed 20-30 salamander larvae.

Our data indicate Hancock Lake does not meet the fishery objective of at least one fish per hour (actual catch rate 0.0 fish/hour). Despite stocking 500 Yellowstone cutthroat fry on a 3-year basis, no fish were observed and other anglers report never having seen fish in Hancock Lake. The extensive natural fluctuation of the lake indicates that low water may lead to annual or frequent winterkill. Given the extensive use by salamanders and the apparent inability of the lake to support fish, we recommend deleting Hancock Lake from the stocking rotation.

Table 1. Recent stocking information for Hancock Lake, Idaho

Stocking History

Year	Species	No. of fish
2005	YCT	500
2002	YCT	500
1999	YCT	500
1996	YCT	500

Packsaddle Lake

472,683 E 4,846,227 N Z 12

Packsaddle Lake is located in the headwaters of Packsaddle Creek, a tributary to the Teton River near Tetonia, Idaho. The lake measures 675 m in circumference (1.9 ha), at an elevation of 2,271 m. Surrounding habitat consists of coniferous and willow trees and mixed brush and meadow. There was a partial trail around the shoreline, high amounts of litter, and four fire rings suggesting a high degree of human use. There were two inlets and one outlet that provided approximately 100 m of good spawning habitat. Access is easy, consisting of a rough 4-wheel drive trail through Rammell Canyon that ends approximately ½ km from the lake followed by a moderate cross-country hike.

On July 28, 2005, we surveyed Packsaddle Lake. The fishery survey consisted of angling and visual observations of fish in combination with an overnight gill net set. We observed numerous fish (≈200 mm) rising throughout the lake. We fished for two hours, and caught seven cutthroat trout ranging in size from 180 to 240 mm. Our gill net yielded 10 fish ranging in size from 230 to 260 mm. We observed no amphibians on our shoreline survey.

Our data indicate Packsaddle Lake exceeds the fishery objective of at least one fish per hour (actual catch rate 3.5 fish/hour). Natural reproduction may be adding to the population, although not significantly enough to support the fishery. Based on visual observation, trout condition was low overall indicating minimal forage. Given the evidence of high angler use, we recommend continued stocking of Packsaddle Lake at the current rate of 2,000 Yellowstone cutthroat trout every three years.

Stocking History

Year	Species	No. of fish
2005	YCT	2,000
2002	YCT	2,000
1999	YCT	2,000
1996	YCT	2,000

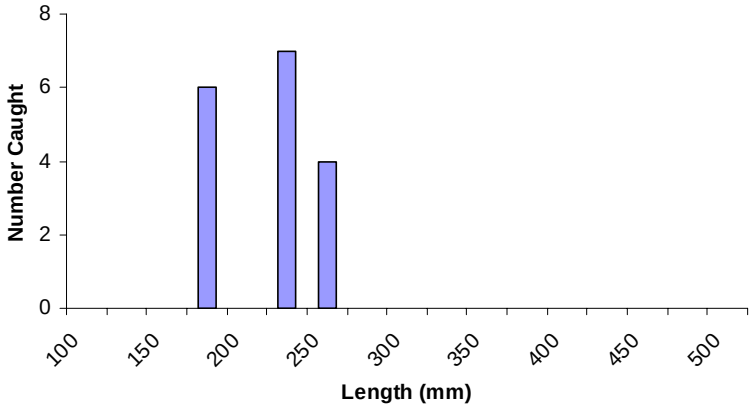

Table 1 and Figure 1. Recent stocking data and length frequency of fish collected during 2005 sampling efforts in Packsaddle Lake, Idaho.

Upper Swauger Lake
293,302 E 4,883,946 N Z 12

Upper Swauger Lake is located in the headwaters of Dry Creek in the Little Lost River drainage East of Mackay, Idaho. The lake measures 400 m in circumference (0.8 ha), at an elevation of 2,758 m. Surrounding habitat consists of open sagebrush and a few coniferous trees nearby. There was a complete shoreline trail, large amounts of litter, two camping spots and six fire rings, all suggesting extensive human use. We found no inlet with suitable spawning habitat and one outlet that provided about one meter of marginal spawning habitat. Access is easy, consisting of a rough drive up Dry Creek and Long Lost Creek to the trailhead, followed by an easy 2.5 km hike to the lake. Motorized access via a motorcycle trail in combination with Illegal access from four-wheel ATV's may be responsible for an increase in human activity when compared to our 2002 survey.

On July 27, 2005, we surveyed Upper Swauger Lake. The fishery survey consisted of angling and visual observations of fish in combination with an overnight gill net set. We only observed two fish while conducting our survey, and failed to catch any during our three hours of angling. Our gill nets captured four cutthroat trout ranging in size from 395 to 415 mm. Based on visual observations of fish condition, adequate forage is present. We observed numerous aquatic insects (caddis, mayflies and damselflies), as well as grasshoppers, ants and spiders. Seasonal staff reported observing one unidentified tadpole on our one-hour shoreline survey.

Our data indicate Upper Swauger Lake does not meet the fishery objective of one fish per hour (actual catch rate 0 fish/hour). Previous surveys indicated a higher density of fish, reflected in a higher catch rate. It is likely that the new motorcycle trail makes it possible for anglers to more easily access the lake, and has increased fishing pressure to the point of impacting the population. If motorized access increases angling effort, it may be necessary to increase the frequency of stocking to every other year to provide a quality fishery or limit harvest with more restrictive regulations.

Stocking History

Year	Species	No. of fish
2005	YCT	3,000
2002	YCT	3,000
1999	YCT	3,000
1996	YCT	3,000

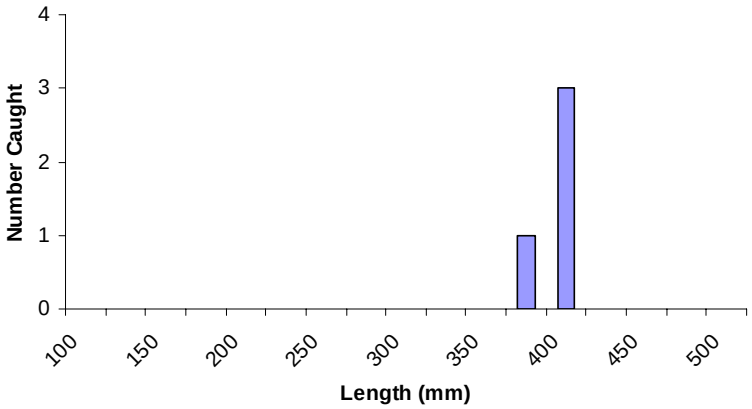

Table 1 and Figure 1. Recent stocking information and length frequency of fish collected in Upper Swauger Lake, Idaho during 2005 sampling efforts.

HENRYS LAKE

ABSTRACT

We used 46 standard experimental gill nets (22 sinking, 24 floating) to assess fish populations and relative abundance in Henrys Lake during May 2005. We captured brook trout *Salvelinus fontinalis*, Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri*, hybrid trout (rainbow trout *O. mykiss* x Yellowstone cutthroat trout) and Utah chub *Gila atraria*. Catch rates for all trout combined were not statistically different from levels recorded in 2004. We then separated catch rates by species and found no statistical differences in catch rates for cutthroat trout, hybrid trout or brook trout compared to 2004 catch rates. Relative weight for all fish > 200 mm exceeded 100 for all trout species. Median catch rate for Utah chub was significantly greater than that from 2004, and shows an increase in abundance. We had 160 Utah chub otoliths aged, and found Utah chubs to be long-lived and have a low mortality rate.

We conducted a creel survey during 2005 and found catch rates much improved over our 2003 survey. Clerks interviewed 1,272 anglers, and estimated the seasonal catch rate at 0.48 fish per hour. Anglers caught 45,044 fish, of which 8,991 were harvested. Harvest composition was 53% cutthroat trout, 42% hybrid trout, and 5% brook trout.

We monitored dissolved oxygen levels to assess the possibility of a winterkill event from Dec 23 through February 2. Based on depletion estimates, we predicted dissolved oxygen would not reach critical levels (10 g/m^3) until the end of March at Hatchery Creek, and mid to late April at the remainder of our monitoring sites. Therefore, we did not implement the helixor aeration system during 2005.

The 2005 spawning operations at Henrys Lake produced 1,270,914 eyed Yellowstone cutthroat trout eggs and 331,452 eyed hybrid trout eggs. Cutthroat trout in the Hatchery Creek run averaged 444 mm total length (TL), while hybrid trout averaged 559 mm TL. The percentages of adipose fin clipped Yellowstone cutthroat returning to the ladder were recorded daily throughout the 2005 spawning run and ranged from 11% to 48%. Pathology reports for viral or bacterial presence detected positive results from 13 families of Yellowstone cutthroat eggs and two families of hybrid eggs (bacterial presence), and all positive groups were subsequently destroyed.

Riparian tributary fencing was maintained at ten locations around the lake. Fencing was removed from three sites where new conservation agreements made the fences obsolete, and new fencing was installed on one new site near the William Frome County Park. Nine fish diversion screens were maintained and run over the course of the year. We also conducted spawning fish surveys in Targhee and Duck Creeks to assess use in these tributaries. We found 75 trout below the culvert blockage on Targhee Creek, and were able to relocate 25 trout above this blockage. We found no adult trout in Duck Creek. We provided technical assistance to Idaho Transportation Department in a project to replace two culverts that were barriers to fish migration with open-bottom bridges on Targhee and Howard creeks.

Authors

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METHODS

Population Monitoring

As part of routine population monitoring, we collected gill net data from six standardized locations (Appendix A; Figure 1) for a total of 46 net nights in Henrys Lake on May 10, 11, 13, 14, 15, 17, 19 and 21, 2005. Gill nets consisted of either floating or sinking types measuring 46 m by 2 m, with mesh sizes of 2 cm, 2.5 cm, 3 cm, 4 cm, 5 cm and 6 cm bar mesh. Nets were set at dusk and retrieved the following morning. We identified captured fish to species and recorded total lengths (TL). We calculated catch rates as fish per net night and also calculated 95% confidence intervals. We assumed a non-normal distribution to our data and used a Kruskal-Wallis one-way analysis of variance to detect differences in population trends among data collected from 1993 to present.

We examined all captured Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* and brook trout *Salvelinus fontinalis* for adipose fin clips as part of our evaluation of natural reproduction. To monitor natural reproduction we estimated the ratio of marked to unmarked fish collected in annual gill net surveys, creel surveys and in the spawning operation. Because ten percent of all stocked cutthroat trout and brook trout are marked with an adipose fin clip prior to stocking, a ratio of 10% or greater indicates low levels of natural reproduction.

We assessed age and growth by analyzing otoliths removed from captured fish. Otoliths were removed, stored in envelopes and aged using a dissecting scope. Otoliths were read in whole view if distinct growth rings were present. All otoliths that gave conflicting results when read twice were sectioned, polished and read in cross section. We also contracted ageing of 160 Utah chub *Gila atraria* otoliths to Auburn University's Fisheries Department. Otoliths were mounted in epoxy, sectioned and read using two readers and a pattern recognition computer program.

Relative weights were calculated by dividing the actual weight of each fish (in grams) by a standard weight for the same length for that species multiplied by 100 (Anderson and Gutreuter 1983). Relative weights were then averaged for each length class (< 200 mm, 200-299 mm, 300-399 mm and fish > 399 mm).

We began an evaluation of spring vs. fall fingerling brook trout stockings by batch-marking all brook trout prior to stocking in 2005. We marked one group of brook trout with calcein by immersing fish in a 1.5% salt solution for 3.5 minutes, followed by a brief rinse in freshwater and then transfer to a 0.5% calcein solution for 3.5 minutes. We stocked 91,936 marked fingerlings in May and an additional 59,826 unmarked fingerlings in September of 2005. We will collect scales and otoliths from all brook trout captured in subsequent surveys and analyze for marks using fluorescent microscopy.

Creel Survey

Henrys Lake hatchery personnel conducted a creel survey throughout the fishing season to collect effort, catch and harvest information. We stratified the sample into seven periods to account for unequal angler effort through the season and to comply with previously used

methodology. Strata consisted of a three-day period on the opening weekend, a 13-day period following the opener, four 28-day periods and a 29-day period at the end of the season. We conducted interviews on 30% of days in each stratum. We generated instantaneous counts using randomly selected dates and times, and counted anglers twice per day from a point overlooking the lake with the aid of binoculars and spotting scopes. A boat was subsequently used to count any anglers not visible from shore. Counts were completed within one half hour. Angler interviews were conducted at random throughout the day using roving methods and a boat. Creel clerks intercepted anglers during their fishing trip to obtain method of fishing, time spent fishing, and number, species and length of fish both caught and released. We analyzed data using standard methodology and the Idaho Department of Fish and Game creel census program (McArthur 2005).

Water Quality

We measured winter dissolved oxygen concentrations, snow depth, ice thickness and water temperatures at established sampling sites on Henrys Lake (Appendix A). Holes were drilled in the ice with a gas-powered ice auger prior to sampling. We used a YSI model 550-A oxygen probe to collect dissolved oxygen samples and estimated total g/m3 of oxygen by averaging dissolved oxygen readings at ice bottom and one meter below ice bottom, and summing readings at subsequent one-meter intervals to the bottom.

Spawning Operation

We operated the Hatchery Creek fish ladder for the spring spawning run from February 12 through May 10. Fish ascending the ladder were identified as Yellowstone cutthroat trout or hybrid trout (rainbow trout *O. mykiss x* Yellowstone cutthroat trout) and counted. We measured total length for a sub-sample (10%) of each group. Yellowstone cutthroat trout were produced using ripe females spawned into seven-fish pools and fertilized with pooled milt from four to seven males. Hybrid trout were produced with Yellowstone cutthroat trout eggs and Kamloops rainbow trout milt obtained from Hayspur Hatchery. Hybrid trout were sterilized by inducing a triploid condition using pressure to shock the eggs post-fertilization. Once hybrid trout eggs reached 47 minutes and 45 seconds post-fertilization, the eggs were placed in the pressure treatment machine at 10,000 psi and held at this pressure for 5 minutes. Random samples of eggs were sent to the Eagle Fish Health Lab to test induction rates of sterilization. The remaining Hybrid trout eggs were shipped to Ashton and Mackay Hatcheries for hatching, rearing and subsequent release back into Henrys Lake and other local waters. Yellowstone cutthroat trout eggs were shipped to Mackay and American Falls Hatcheries for hatching, rearing and release back into Henrys Lake.

We took disease samples from the spring spawning run. Ovarian fluids were collected from seven female egg pools of Yellowstone cutthroat trout during spawning. All combined batches were tested. Random viral samples were taken from 25 seven-female egg pools in the spring run. All samples were sent to the Eagle Fish Health Laboratory.

Riparian Fencing, Fish Screening and Tributary Spawning Surveys

Electric fencing has been in place at Henrys Lake since the early 1990's to protect riparian areas from grazing livestock. We stretched fencing and installed solar panels, batteries, and connections during May 2005 at ten sites on the tributaries of Henrys Lake as established in routine maintenance guidelines. We routinely checked fencing during the summer and fall for proper voltage and function.

Fish diversion screens are located at nine sites on the tributaries of Henrys Lake. Screens were routinely maintained, cleaned and checked for proper operation.

Tributary spawning surveys were conducted on Targhee Creek and Duck Creek. Counts were conducted with one staff member walking along the shoreline with polarized glasses to observe redds and spawning fish. All adult trout observed were recorded, as were identified redds. We surveyed approximately ½ km of Targhee Creek below the intersection with State Route 287, and surveyed Duck Creek from its mouth to the intersection of Henrys Lake road and Bootjack Pass road (approximately 3.0 km).

We provided technical assistance to Idaho Transportation Department in a fish passage improvement project. Two culverts on tributaries that were barriers to fish migration were removed during 2005. One culvert on Targhee Creek and another on Howard Creek were removed and replaced with open-bottom bridges. The removal of these barriers should improve trout migrations to these spawning tributaries, and eventually enhance natural reproduction and recruitment. We used backpack electrofishers to collect 25 cutthroat trout below the culvert barrier on Targhee Creek during the 2005 spawn and moved them upstream approximately 3.5 km before release.

RESULTS

Population Monitoring

We collected 1,081 fish in 46 net nights of gill net effort. Catch composition was 28% cutthroat trout, 12% hybrid trout, 3% brook trout, and 56% Utah chub. Cutthroat trout ranged from 158 to 580 mm TL (Figure 2), hybrid trout 177 to 689 mm (Figure 3), and brook trout 172 to 571 mm (Figure 4). Brook trout catch rates in gill nets have declined significantly from 2000 levels ($p < 0.003$, Kruskal-Wallis one-way AOV; Figure 5). Catch rates for cutthroat trout were greater than in 2004 (Figure 6), while hybrid trout were lower compared to 2004 (Figure 7). However, neither of these changes were statistically significant at the alpha = 0.05 level. Although hybrid trout catch rates were below the 14-year average, they were not statistically different from last year or the 14-year average. Cutthroat trout were well above the 14-year average, and captured at their highest rate since 1997. However, this increase was only significant at the alpha = 0.20 level. Further analysis showed that catch of age one and two cutthroat trout were well above the five-year mean for these age classes (Figures 8 and 9). The proportion of Utah chub in the gill net catch is increasing (Figure 10) although the mean gill net catch rate was slightly lower than in 2004 (Figure 11). However, the difference in mean catch rates is not significant ($p = 0.84$, Kruskal-Wallis one-way AOV). Due to the high variability of gill net catch rates on Utah chub, it may be more appropriate to look at median catch. Our median

catch rate in 2005 was 5.5 fish per net night, significantly greater than the 2.5 median catch rate from 2004 ($p = 0.03$, Kruskal-Wallace one-way AOV, Figure 12). Median catch rates remain below the peak of abundance documented in 2002 of 7.5 fish per net.

Relative weights for all species exceeded 100 for all size classes with the exception of Yellowstone cutthroat trout < 200 mm (Table 1). This suggests an abundance of available forage for trout (Flickinger and Bulow 1993).

Mean length at age three was 433 mm, 500 mm and 473 mm for Yellowstone cutthroat trout, hybrid trout and brook trout, respectively. Mean length for all ages and trout species is presented in Table 2. Analysis of Utah chub otoliths showed chubs to live in excess of 16 years (Table 3).

Results from our fin clip information showed 33 of 305 (11%) Yellowstone cutthroat trout collected with gill nets were adipose-clipped fish. Of the 2,138 fish observed during the spawning run, 629 (29%) were adipose-clipped. Of the 204 fish observed in the creel survey, 22 (11%) were adipose-clipped fish.

Creel Survey

Creel clerks interviewed 2,970 people in 1,270 parties from May 28 through October 31. Residents comprised 66% of interviewed anglers. We used the department creel program to extrapolate and summarize estimates (McArthur, 2005). Anglers caught an estimated 45,044 fish and harvested 8,991 for an overall release rate of 80% with 94,783 hours of angling effort (Table 5). Catch composition was 53% Yellowstone cutthroat trout, 42% hybrid trout and 5% brook trout, and was close to our management objectives of 65% cutthroat trout, 20% hybrid trout and 15% brook trout. Mean size was 413 mm, 497 mm and 379 mm for cutthroat, hybrid and brook trout respectively. Only 4% of harvested Yellowstone cutthroat trout exceeded 500 mm, which falls short of our management goal of 10% exceeding this benchmark. No brook trout harvested exceeded our benchmark of 450 mm. However, 38% of harvested hybrid trout were over 500 mm, which is nearly double our management goal of 20% of harvested hybrids exceeding this length. We estimated catch rates at 0.48 fish per hour for the season, which is close to the 19-year average of 0.58 fish per hour and approaches our management goal of 0.7 fish per hour. Separate intervals ranged from a low of 0.35 fish per hour during the 6th interval to a high of 0.75 fish per hour in the 2nd interval. Nearly 13% of the total season effort occurred during the first three days of the opening weekend. Twenty percent of anglers fished with bait during 2005, while 25% used lures, 50% used flies, and 5% used a combination of these methods.

Water Quality

We recorded oxygen profiles during December 2004 through February 2005 at three standard sites (Pittsburgh Creek, County Boat Dock and Wild Rose), as well as occasional readings at the Hatchery and Outlet. Total oxygen diminished from 32.5 g/m^3 to 22.7 g/m^3 at the Pittsburgh Creek site, 25.9 g/m^3 to 18.4 g/m^3 at the County dock, and 29.0 g/m^3 to 19.9 g/m^3 at the Wild Rose site (Table 6). Based on depletion estimates, we predicted our monitoring sites would not approach 10.0 g/m^3 (our level of concern) before mid-April (Figure 13). Therefore, we did not implement the Helixor aeration system during 2005.

Spawning Operation

Between February 12 and May 10, 2,297 Yellowstone cutthroat trout ascended the hatchery spawning ladder. Of these, 55% were males and 45% were females. Mean lengths were 442 and 445 mm, respectively with a combined mean length of 444 mm. Hybrid trout totaled 526 fish and consisted of 65% males and 35% females with mean lengths of 537 mm and 582 mm, respectively.

We collected 1,750,695 green eggs from 740 Yellowstone cutthroat trout females for a mean fecundity of 2,366 eggs per female (Table 7). Eyed Yellowstone cutthroat trout eggs totaled 1,270,914 for an overall eye-up rate of 73%. We shipped all eyed Yellowstone cutthroat trout eggs to Mackay Hatchery where they were hatched, reared, and subsequently released back into Henrys Lake in the fall of 2005 as fingerlings (851,240 fingerlings). Green egg to fingerling survival was approximately 49%. We committed 11 days to Yellowstone cutthroat trout spawning.

We collected 628,800 green eggs from 262 female Yellowstone cutthroat trout for hybrid trout production (Table 8). Eyed hybrid trout eggs totaled 331,452 for an overall eye-up rate of 53%. We shipped 93% of all eyed hybrid trout eggs to the Mackay Hatchery for hatching, rearing, and subsequent release into Henrys Lake in the fall of 2005. The remaining 7% were shipped to the Ashton Hatchery for hatching, rearing and subsequent release into local waters. Mean sterilization rates for hybrid trout were 100% during 2005. Green egg to fingerling survival was approximately 32%. Sterile induction rates reached 100% for the first time during 2005. We stocked 201,300 sterile hybrids in Henrys Lake and devoted two days to production of hybrid eggs during 2005.

Disease sampling was completed on adult spawning fish during the spring and fall runs. Complete results and discussion will be included in the resident fisheries pathologist report. Thirteen trays of Yellowstone cutthroat trout and two trays of hybrid trout tested positive for bacterial disease and were subsequently destroyed.

Riparian Fencing, Fish Screening and Tributary Spawning Surveys

Electric fencing functioned well during the year. Voltages remained high throughout the season and riparian infringements by cattle were rare. Fish screens functioned well on Targhee and Howard Creeks but did not work on Duck Creek due to low water conditions.

A new conservation agreement that excludes grazing was adopted between landowners along Duck and Kelly creeks and the Nature Conservancy and the Bureau of Land Management. The new agreement provides for wetland enhancements, development restrictions, and voluntary grazing restrictions. As a result, fences on the west shoreline of Henrys Lake, Kelly Springs, and Lower Duck Creek were removed. Additionally, we initiated a new fence agreement with Fremont County along a section of the lake shoreline that had been previously unprotected and subject to grazing degradation. This new fence near the William Frome County Park was constructed entirely with the salvaged Kelly Springs fence for a significant cost savings. This new fence should protect vegetation on approximately 1/3 km of the west shoreline of Henrys Lake.

Spawning surveys documented 75 fish in Targhee Creek below the culvert blockage and no fish in Duck Creek. All fish were assumed to be Yellowstone cutthroat trout. We were able

to relocate 25 fish from Targhee Creek upstream above the road culvert. This data will be used as baseline spawning fish counts to be compared to future counts following the removal of fish barriers on two of the monitoring creeks.

DISCUSSION

Overall, our gill net catch rates (fish per net night) on trout from 2005 were similar to those found in 2004. Although catch rates decreased by 1.4 fish per net in 2005, this difference was statistically insignificant. Brook trout catch rates remain low, and have not improved since last year in spite of a reinstatement of the stocking program in 2003. However, we anticipate an improvement in catch rates as stocked fish recruit to our gill nets and the fishery. Yellowstone cutthroat trout were found in their highest abundance since 1997. Although gill net catch rates were slightly higher than in 2004, this increase was not statistically different from our 13-year average, or from last year's catch. Catch of Yellowstone cutthroat trout was dominated by age 1 and age 2 fish (37 and 55% respectively), which should equate to strong year classes of age 2 and 3 year old fish in the coming year. The dominance of the 2-year old fish likely contributed significantly to the increase in catch rates documented in our creel survey. These strong year classes should continue to be influential on angler catch rates in upcoming seasons.

Over the past seven years, the ratio of fin clipped cutthroat trout has exceeded 10% on five occasions, indicating that during drought years, natural reproduction does not contribute significantly to the fishery. Excluding fish collected in the spawning operation, we found 55 of 508 Yellowstone cutthroat trout were adipose-clipped fish. This 11% clipped fish again shows that during drought years, additions from natural reproduction are low and don't significantly contribute to the fishery.

Mean catch rates for Utah chub in our gill nets decreased for the first time since 2002. However, this decrease is not statistically significant. Although down slightly from last year, mean gill net catch rates are near their peak in abundance with the current year's sample (> 13 fish per net night). Compared to other local water bodies with high Utah chub abundance (Mud Lake, 225 fish / net night; Island Park Reservoir, 26 fish / net night), catch rates in Henrys Lake remain low. Results from 2004 data analysis on Utah chub suggest non-parametric methods of data analysis are a more appropriate way to look at gill net catch (Garren et al. 2006). Median gill net catch for Utah chub was higher than that found in 2004, but remains below the peak in abundance found in 2000. Although meaningful inferences on Utah chub densities are hampered by low gill net sample numbers in past years and high variability among nets, we are concerned that the population of Utah chub may be increasing and warrant close monitoring.

Age and growth information of Utah chub suggest a long-lived population with low annual mortality. The oldest Utah chub we encountered was from the 1989 year class, which is four years older than the first year we detected their presence, and two years older than the oldest chub aged in 2004. However, prior to 1991, Henrys Lake was sampled with trap nets, which may have been less efficient at catching Utah chub. In 1991, only six gill nets were set. Given the low density and non-uniform distribution of Utah chub, it is possible our 1991 gill net sample did not detect them even though they were likely present. Utah chub aged in 2004 combined with age information from the current year suggest Utah chub have been present in Henrys Lake longer than we realized.

Results from spawning fish surveys on Targhee, Duck and Howard Creeks will be a useful benchmark for evaluating the effects of ongoing and recent habitat improvements on these waterbodies. These data will be especially pertinent for measuring changes to spawning and natural recruitment as a result of the barrier removals on Targhee and Howard creeks.

RECOMMENDATIONS

1. Continue annual gill net samples at 50 net nights of effort.

2. Collect otolith samples from all trout species; use for cohort analysis and estimates of mortality/year class strength.

3. Continue winter dissolved oxygen monitoring, and implement aeration when necessary.

4. Monitor Utah chub densities, and continue work on determining population dynamics within the lake.

5. Continue spring tributary surveys to monitor adult spawning use.

6. Continue to maintain riparian fences and fish screens.

LITERATURE CITED

Anderson, R.O. and S.J. Gutreuter., 1983. Length, weight and associated structural indices. Pages 283-300 *in* L.A. Nielsen and D.L. Johnson, editors. Fisheries techniques. American Fisheries Society, Bethesda, MD.

Flickinger, S.A. and F. J. Bulow., 1993. Small impoundments. Pages 469-492 *in* C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society. Bethesda, MD.

Garren, D., W.C. Schrader, D. Keen and J. Fredericks, 2006. Regional fisheries management investigations. Federal Aid in Fish Restoration 2004 Job Performance Report. F-71-R-29. Idaho Department of Fish and Game, Boise, Idaho.

McArthur, T.J. 2005. Statewide angler opinion and harvest surveys: Creel census system. Idaho Department of Fish and Game, Job Completion Report, Boise, Idaho

Appendix A. Locations used in standard Henrys Lake gill net sets and standard dissolved oxygen monitoring stations. Coordinates are given as UTMs; Datum is NAD 27.

Gill Net Sites

Gill Net 1.	467,252 E	4,944,882 N	Z 12
Gill Net 2.	469,510 E	4,943,608 N	Z 12
Gill Net 3.	467,217 E	4,940,776 N	Z 12
Gill Net 4.	467,320 E	4,943,171 N	Z 12
Gill Net 5.	467,962 E	4,942,292 N	Z 12
Gill Net 6.	468,203 E	4,940,874 N	Z 12

Dissolved Oxygen Sites

County boat dock:	465,725 E	4,944,234 N	Z 12
Wild Rose:	467,751 E	4,945,816 N	Z 12
Outlet:	471,374 E	4,938,741 N	Z 12
Pittsburg Creek:	469,446 E	4,943,838 N	Z 12
Hatchery Ladder:	469,290 E	4,945,489 N	Z 12
Cliffs:	467,072 E	4,940,951 N	Z 12

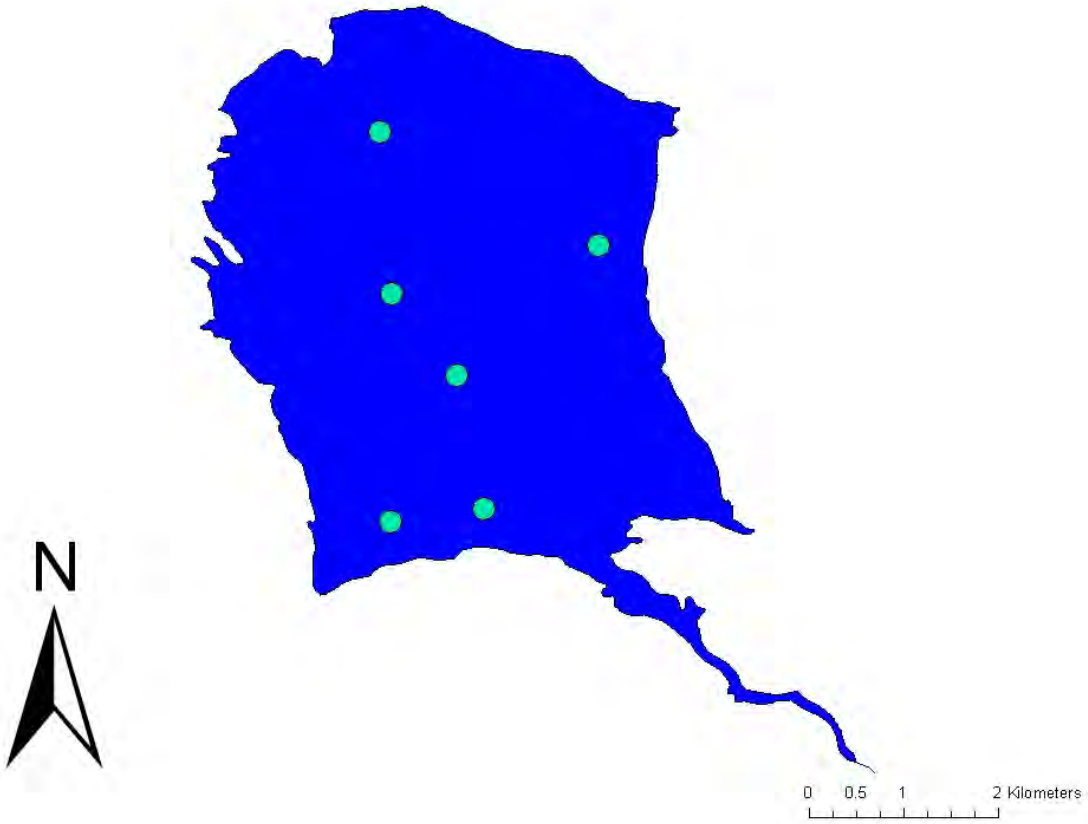

Figure 1. Spatial distribution of gill net locations used in population monitoring in Henrys Lake, Idaho.

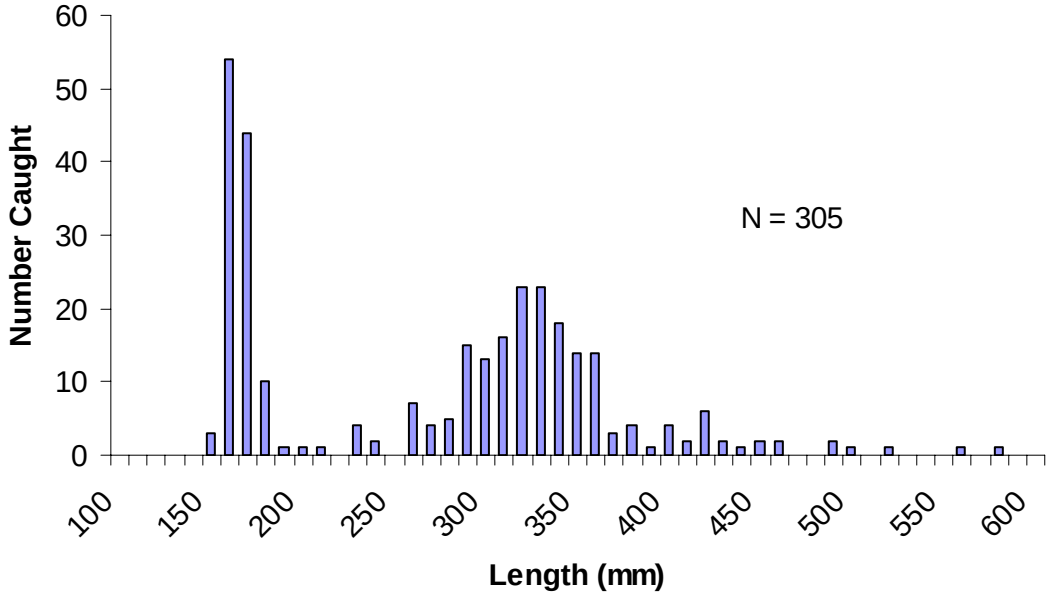

Figure 2. Yellowstone cutthroat trout length frequencies from gill nets set in Henrys Lake, Idaho, 2005.

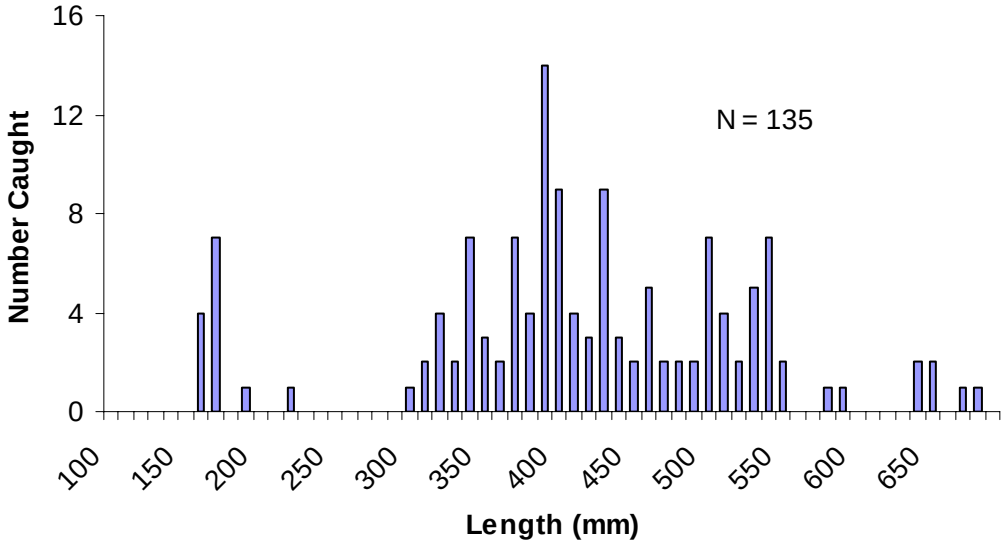

Figure 3. Hybrid trout length frequencies from gill nets set in Henrys Lake, Idaho, 2005.

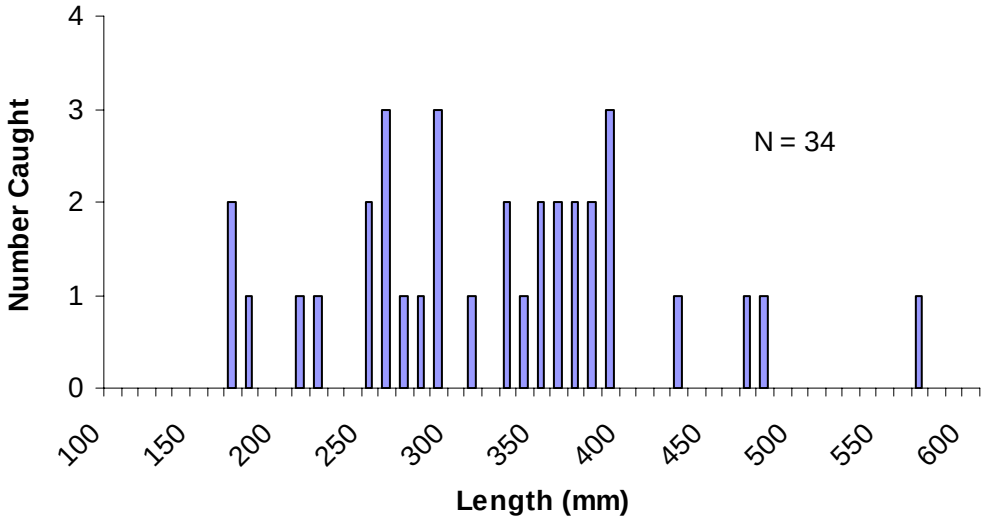

Figure 4. Brook trout length frequencies from gill nets set in Henrys Lake, Idaho, 2005.

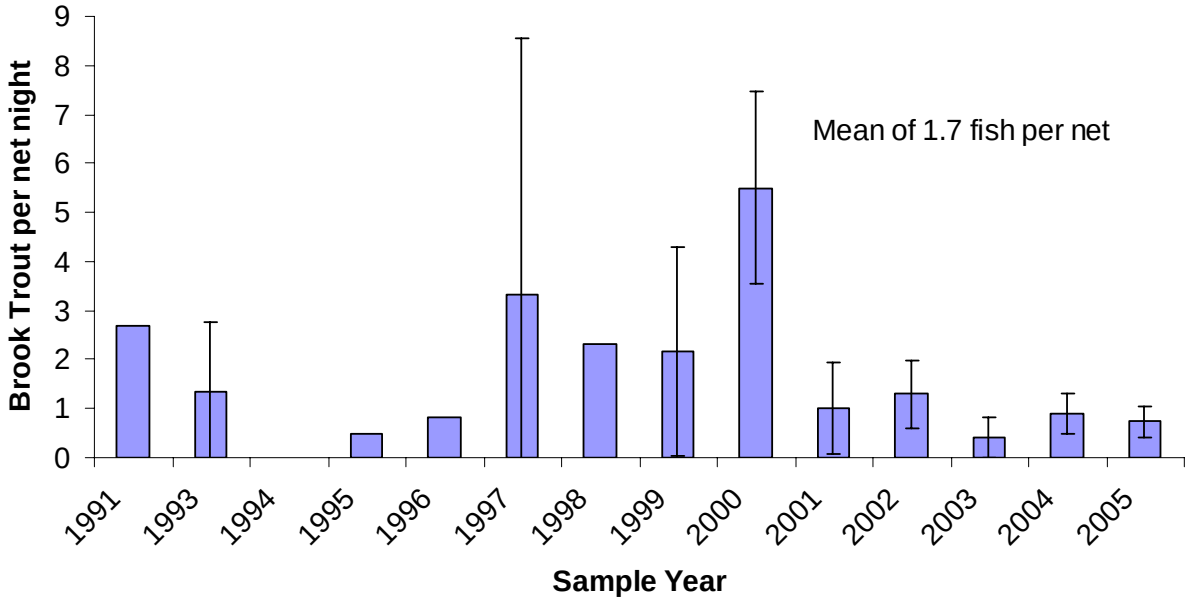

Figure 5. Brook trout catch rates in gill nets set in Henrys Lake, Idaho 1991 to present. Error bars represent 95% confidence intervals.

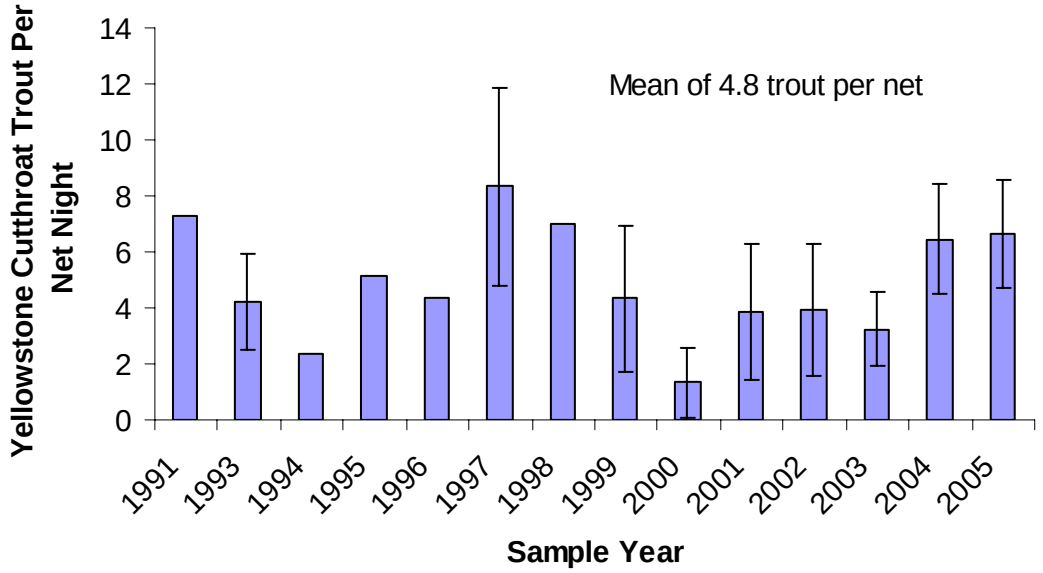

Figure 6. Yellowstone cutthroat trout catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present. Error bars represent 95% confidence intervals.

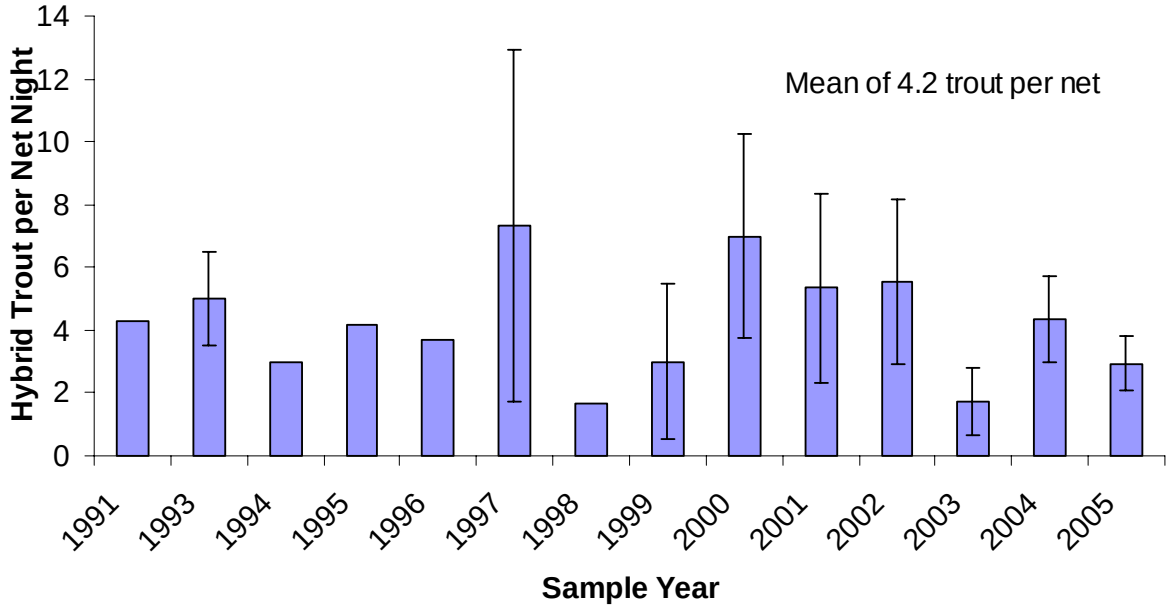

Figure 7. Hybrid trout catch rates in gill nets set in Henrys Lake, Idaho 1991 to present. Error bars represent 95% confidence intervals.

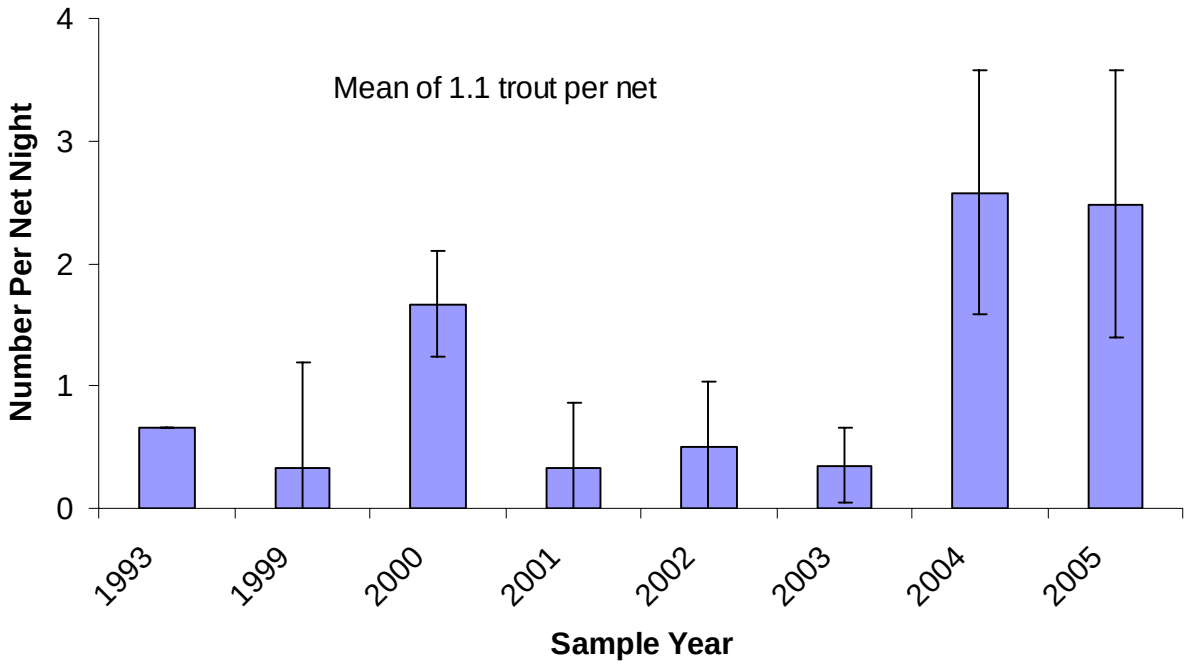

Figure 8. Catch per unit effort (number per net night) of age-1 Yellowstone cutthroat trout in Henrys Lake, Idaho. Error bars indicate 95% confidence intervals.

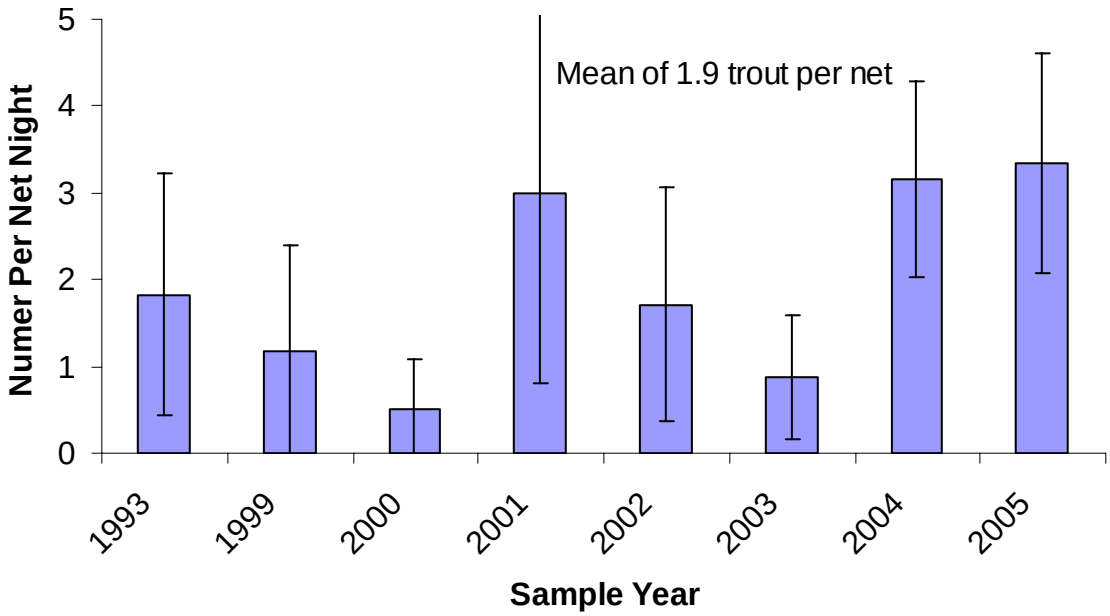

Figure 9. Catch per unit effort (number per net night) of age-2 Yellowstone cutthroat trout in Henrys Lake, Idaho. Error bars indicate 95% confidence intervals.

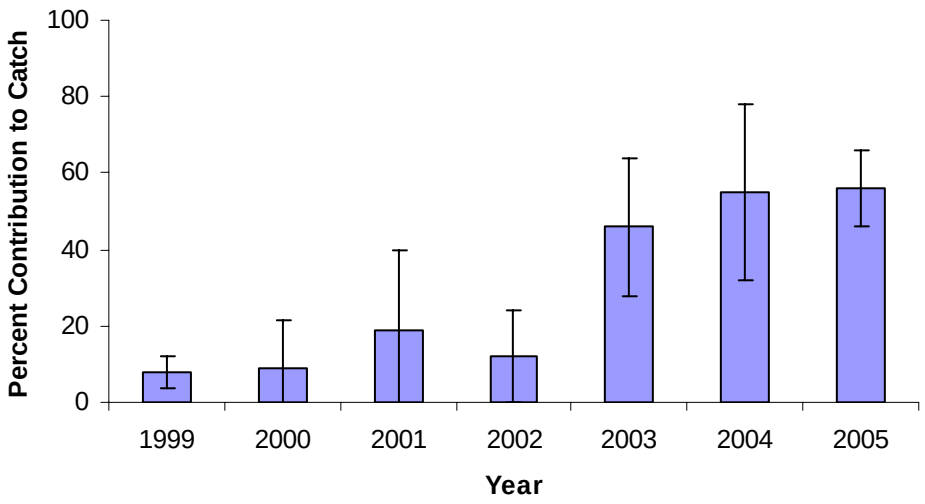

Figure 10. Relative abundance of Utah chub caught in gill nets in Henrys Lake, Idaho. Error bars represent 95% confidence intervals.

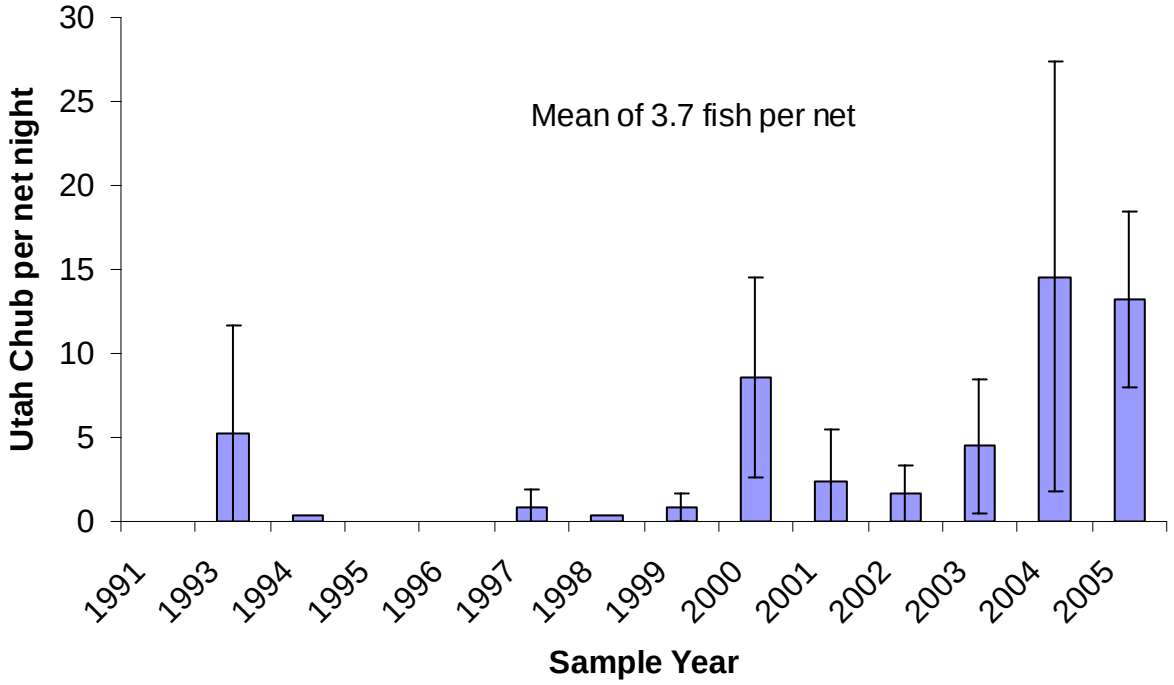

Figure 11. Mean Utah chub catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present. Error bars represent 95% confidence intervals.

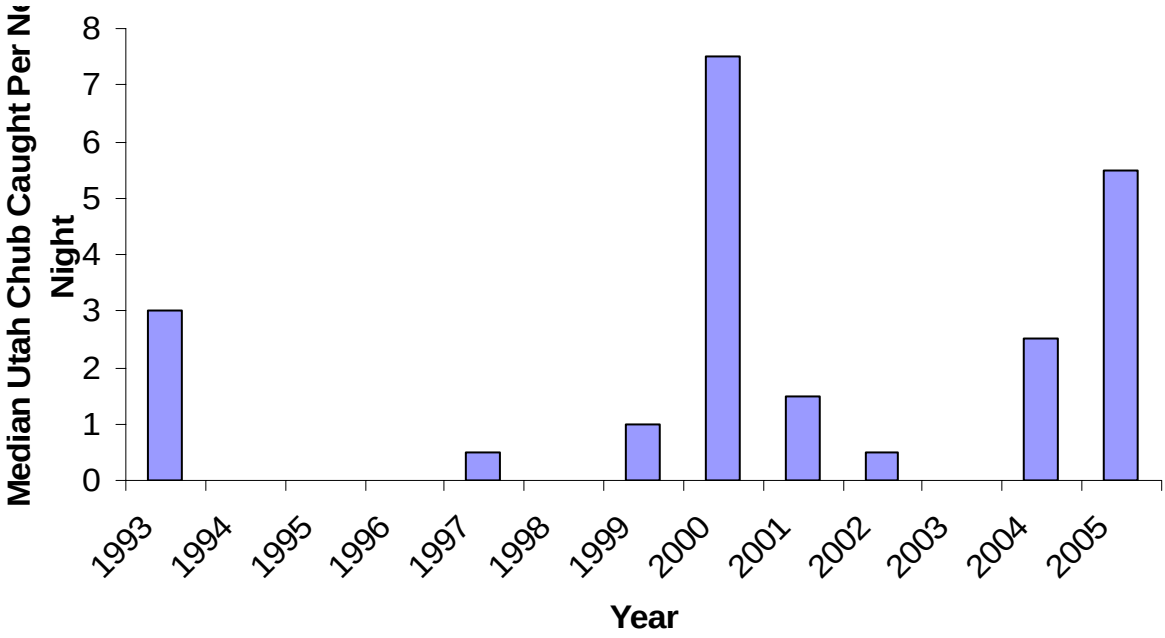

Figure 12. Median Utah chub catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present.

Table 1. Relative weights for all trout species collected with gill nets in Henrys Lake, Idaho 2005.

Species	Mean Relative Weight			
	< 200 mm	200-299 mm	300-399 mm	> 399 mm
Yellowstone cutthroat trout	94	110	115	109
Hybrid trout	--	--	124	127
Brook trout	102	111	115	114

Table 2. Mean length at age data from trout caught with gill nets in Henrys Lake, Idaho 2005. All fish were aged using otoliths.

Species	Mean Length at Age (mm)					
	1	2	3	4	5	6
Yellowstone cutthroat trout	167	319	433	531	--	--
(No. Caught)	(125)	(182)	(20)	(4)	--	--
Hybrid trout	178	381	499	569	649	632
(No. Caught)	(1)	(63)	(35)	(6)	(2)	(1)
Brook trout	204	324	473	316	523	--
(No. Caught)	(7)	(18)	(1)	(1)	(2)	--

Table 3. Mean length at age for Utah chub collected in gill net surveys on Henrys Lake, Idaho 2005. 160 Utah chubs were aged using otoliths, and total catch expanded with an age key.

	Mean length at age (mm)															
Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Length (mm)	152	144	171	182	211	241	247	268	258	305	295	--	--	338	--	331
No.	8	44	145	123	96	107	38	14	12	2	6	--	--	1	--	1

Table 4. Fin clipping data from trout stocked in Henrys Lake, Idaho. Ten percent of all stocked Yellowstone cutthroat trout and brook trout receive an adipose fin clip annually.

	Yellowstone cutthroat trout				Brook trout			
Year	No. Clipped	No. of fish checked for clips	No. of clips detected	Percent clipped	No. Clipped	No. of fish checked for clips	No. of clips detected	Percent clipped
2005[a]	85,124	508	55	11%	15,176	34	5	14
2005[b]		2,138	629	29%	--	--	--	--
2004[c]	92,100	323	28	8%	98,711	45	11	24%
2003[c]	163,389	273	47	17%	--	--	--	--
2003[b]		106	37	35%	--	--	--	--
2002	110,740	38	7	18%	--	6	2	33%
2001	99,110	116	22	19%	--	30	6	20%
2000	100,000	14	1	7%	--	3	0	0%
1999	124,920	160	20	13%	--	48	5	10%
1998	104,740	--	--	--	2,067	--	--	--
1997	123,690	178	5	3%	2,044	11	1	9%
1996	100,290	--	--	--	1,961	1	0	0%

[a]Obtained from gill net samples and creel survey.
[b]Fish observed in Hatchery Creek spawning run.
[c]Fish obtained from gill net samples.

Table 5. Annual estimates of angler effort, catch and harvest collected from creel surveys on Henrys Lake, Idaho.

							Catch Composition			% Exceeding Goals			Mean Size (mm)			Residency (%)	
Year	Effort (*1,000)	No. Caught (*1,000)	No. Harvested (*1,000)	Total CR[a]	Harvest CR[a]	% Released	YCT	HYB	BKT	YCT (500 mm)	HYB (500 mm)	BKT (450 mm)	YCT	HYB	BKT	Res	Non Res
2005	95	45.0	8.9	0.48	0.10	80	53	42	5	4	38	0	413	497	379	66	34
2003	108.5	16.9	5.4	0.17	0.05	68	45	51	4	18	65	82	476	543	464	68	32
2002	--	--	--	0.41	--	--	42	49	9	17	71	50	454	540	462	--	--
2001	165.8	93.3	17.7	0.56	0.11	81	35	58	7	12	57	43	447	503	452	--	--
1999	228.0	148.6	27.3	0.65	0.12	72	22	65	13	8	12	16	442	447	405	--	--
1997	228.9	127.7	32.4	0.54	0.25	74	51	46	3	5	15	9	423	434	389	--	--
1995	172.6	99.3	20.6	0.58	0.12	79	37	60	3	9	21	27	434	442	432	65	35
1994	177.8	116.6	21.0	0.66	0.12	82	52	43	5	5	15	29	418	437	425	71	29
1993	144.3	92.5	26.7	0.64	0.18	71	76	21	3	7	35	23	410	485	382	--	--
1992	115.5	53.0	12.2	0.45	0.11	72	38	52	10	27	42	22	452	474	417	--	--
1991	124.4	50.5	16.1	0.36	0.13	68	49	49	2	21	35	20	460	473	369	--	--
1990	344.2	174.5	63.1	0.51	0.18	64	53	41	5	2	24	0	427	461	433	--	--
1989	340.0	262.5	103.7	0.77	0.31	60	50	45	5	4	11	10	404	435	387	--	--
1988	100.5	81.6	19.5	0.82	0.20	76	49	39	12	8	17	21	430	432	383	--	--
1987	150.2	81.1	35.7	0.54	0.24	56	60	34	6	5	26	3	436	447	371	--	--
1986	172.8	154.7	67.7	0.90	0.39	55	85	14	1	0	12	0	407	441	364	--	--
1985	125.7	159.4	37.9	1.30	0.30	76	92	4	4	0	0	0	378	416	364	60	40
1984	162.9	271.0	47.0	1.70	0.29	83	92	5	3	1	5	30	388	427	393	64	36
1983	96.0	122.0	25.4	1.23	0.23	81	84	9	7	3	14	17	388	448	392	64	36
1982	63.3	28.7	7.1	0.45	0.11	75	62	25	13	7	17	25	416	451	405	--	--
1981	65.9	14.2	7.5	0.21	0.11	47	30	54	16	13	11	19	445	450	389	--	--
1980	68.5	14.6	9.2	0.21	0.14	37	31	59	10	11	16	5	429	459	391	67	33
1979	93.9	29.8	18.7	0.32	0.20	37	35	42	24	11	8	6	452	456	378	53	47
1978	85.3	40.5	25.5	0.48	0.30	32	48	20	33	9	--	9	429	389	381	51	49
1977	66.1	29.2	16.5	0.44	0.25	44	71	<1	29	4	--	4	420	339	362	50	50
1976	68.1	36.7	18.7	0.54	0.27	49	81	<1	19	2	--	2	426	--	371	50	50
1975	86.3	--	29.9	0.38	0.35	10	89	0	11	--	--	--	--	--	--	49	51
1972	83.8	--	27.0	0.32	0.32	0	69	19	12	--	--	--	--	--	--	50	50
1971	102.2	--	36.7	0.36	0.36	0	70	14	16	--	--	--	--	--	--	--	--
1951	27.9	--	12.3	0.49	0.44	12	80	0	20	--	--	--	--	--	--	--	--
1950	17.0	--	12.3	0.82	0.72	12	77	0	23	--	--	--	--	--	--	--	--

[a]CR = Catch Rate

Table 6. Dissolved oxygen (DO) readings (g/m^3) recorded in Henrys Lake, Idaho wintertime monitoring 2004-2005.

Location	Date	Snow depth (mm)	Ice depth (mm)	DO Ice bottom	DO 1 meter	DO 2 meters	DO 3 meters	Total g/m^3
Pittsburg Creek	Dec 23	3	9.5	13.8	13	11.3	7.8	32.5
	Jan 19	16	14.0	13.1	12.2	7.6	4.4	24.7
	Feb 2	1	18	13.4	12.3	7.2	2.6	22.7
County Boat Dock	Dec 23	3	9.5	14.5	13.7	10.1	1.7	25.9
	Jan 19	15	11.0	12.9	11.94	7.9	0.3	20.6
	Feb 2	2	18.0	11.8	9.9	6.2	1.3	18.4
Wild Rose	Dec 23	3	9.5	13.5	12.9	11.1	4.7	29.0
	Jan 19	15	14.5	13.5	12.3	7.2	0.4	20.5
	Feb 2	4	18	12.8	11.6	6.7	1.0	19.9
Cabin	Dec 23	2.8	9.5	13.4	12.4	9.0	--	21.9
	Jan 19	6	16.5	12.4	11.0	5.5	3.5	20.6
	Feb 2	2	17.0	7.7	6.9	4.9	1.9	14.1

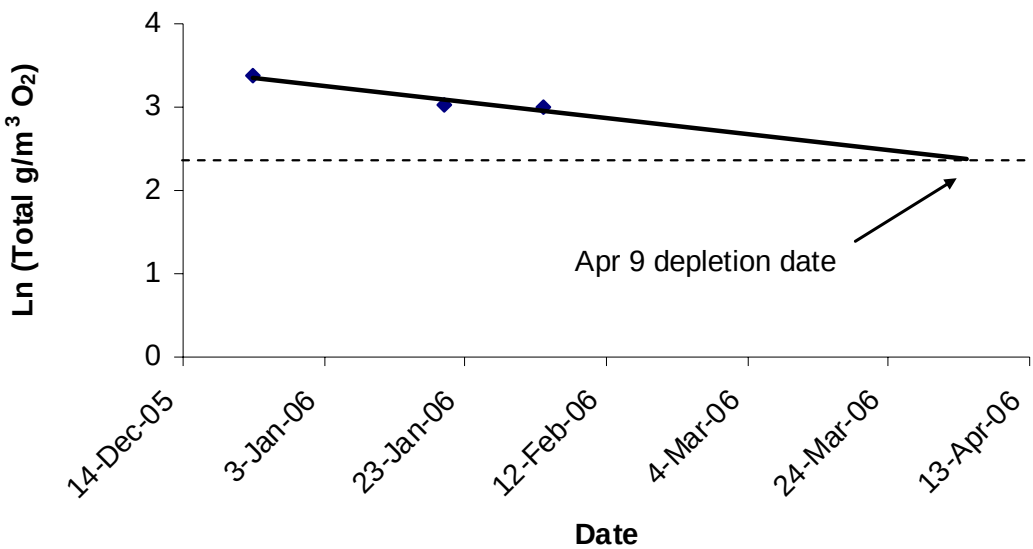

Figure 13. Oxygen depletion rate for the Wild Rose collection station, Henrys Lake, Idaho 2005. Threshold level of 10.0 g/m^3 estimated at April 9 based on the predicted rate of decline.

Table 7. 2005 Henrys Lake Yellowstone cutthroat trout spawning summary.

Spawn Date	Lot Number	Females Spawned	No. of Green Eggs	Mean Fecundity	No. of Eyed Eggs	Disease Status	Percent Eye-up
Feb 28	3	140	328,580	2,347	105,000	Pos.	32
Mar 1	4	70	164,290	2,347	155,000	Neg.	94
Mar 7	5	105	246,435	2,347	213,333	Neg.	87
Mar 10	6	105	246,435	2,347	182,258	Neg.	74
Mar 14	7	55	143,000	2,600	137,097	Neg.	96
Mar 21	8	57	133,779	2,347	103,226	Neg.	77
Mar 28	9	53	124,391	2,347	117,742	Neg.	95
Apr 4	10	35	82,145	2,347	82,258	Neg.	100
Apr11	11	67	157,249	2,347	150,000	Neg.	95
Apr 17	12	20	46,940	2,347	25,000	Neg.	53
May 9	13	33	77,451	2,347	0	Neg.	0
Total		**740**	**1,750,695**	**2,366**	**1,270,914**		**73**

Table 8. 2004 Henrys Lake hybrid trout spawning summary.

Spawn Date	Lot Number	No. of Females Spawned	No. of Green Eggs	Mean Fecundity	No. of Eyed Eggs	Disease Status	Percent Eye-up
Feb 14	1	147	352,800	2,400	167,742	5 & 10	48
Feb 17	2	115	276,000	2,400	163,710	Neg.	59
Total		**262**	**628,800**	**2,400**	**331,452**		**53**

RIRIE RESERVOIR

ABSTRACT

We conducted a creel survey on Ririe Reservoir to obtain angler effort, catch and harvest information. From January 15 through March 15, anglers fished 10,930 hours through the ice. Once the reservoir opened for the remainder of the fishing season (May 1 to November 30), anglers fished an additional 32,895 hours for a total season effort of 43,825 hours (95% CI 34,158 – 53,493). This represents a 70% increase in effort compared to our 2003 survey. The overall season catch rate was 0.89 fish per hour, while the harvest rate was 0.41 fish per hour. Catch rates have nearly tripled over 1993 levels. Species caught included kokanee salmon *O. nerka* (0.35 fish/hour), smallmouth bass *Micropterus dolomieu* (0.23 fish/hour), Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* (0.20 fish/hour), yellow perch *Perca flavescens* (0.11 fish/hour) and rainbow trout *O. mykiss* (0.01 fish/hour). Catch rates on Yellowstone cutthroat trout, kokanee salmon, and yellow perch have improved over rates recorded in 2003, while rainbow trout and smallmouth bass catch rates have declined. We estimated 18,406 fish were harvested from Ririe Reservoir during 2005.

We set seven experimental gill nets overnight and used shoreline electrofishing to assess population parameters and relative abundance of the fish populations in Ririe Reservoir. Average catch (fish per net night) were 36 for Utah chub *Gila atraria*, 16 for Utah sucker *Catostomus ardens,* 4 for Yellowstone cutthroat trout, 2 for yellow perch and 2 for kokanee salmon. Species composition was 61% Utah chub, 27% Utah sucker, 7% Yellowstone cutthroat trout, 3% kokanee salmon and 3% yellow perch. We collected 0.5 smallmouth bass per minute of electrofishing effort ranging in size from 105 to 292 mm.

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METHODS

We conducted a stratified random creel survey on Ririe Reservoir from the formation of ice coverage on January 15 through March 15, and again starting May 1 through the end of November 2005 to estimate angler use and success. We stratified sample days into weekdays and weekend and holidays to better represent angler use. One weekday and one weekend/holiday day were randomly selected each week to obtain effort estimates and interview anglers. Effort information was obtained by counting anglers from a fixed-wing aircraft that circled the reservoir two times daily, twice per week. Count times were randomly selected and started no earlier than ½ hour after sunrise, and were completed no later than ½ hour before sunset. We obtained catch and harvest information, residency information and gear type used with direct interviews. During the ice fishing season, clerks walked across the ice to interview all anglers possible. During the remainder of the fishing season, clerks traveled the entire reservoir in a motorboat and interviewed all anglers encountered. We analyzed our data using standard methodologies and the department creel census program (McArthur, 1993). We also estimated the number of fish caught by multiplying catch rate estimates for each species by the total effort estimate.

We used seven experimental gill nets to monitor species composition, relative abundance, and size structure of the fishery in Ririe Reservoir. On May 25, we set six sinking and one floating experimental gill nets at standardized locations (seven net nights, Appendix A). Gill nets measured 46 m by 2 m, with mesh sizes of 2 cm, 2.5 cm, 3 cm, 4 cm, 5 cm and 6 cm bar mesh. Nets were set at dusk and retrieved the following morning. We identified captured fish to species and recorded total lengths (TL). We calculated catch rates as fish per net night.

On June 15, we used a jet sled and boat-mounted electrofishing gear to sample smallmouth bass in Ririe Reservoir. Our survey started at dusk, and progressed for approximately three hours. The electrofishing boat was driven along the shoreline in representative areas throughout the reservoir. Two netters were used to collect all bass encountered. All fish were measured for total length before being released to the general location of capture.

RESULTS

We interviewed 1,168 anglers in 546 parties over the course of the creel survey. Average party size was 2.1 anglers, and average trip length was 3.0 hours. We estimated overall season effort at 43,825 hours (Table 1), which represents a 70% increase from 2003 estimates. Residents made up the bulk of anglers interviewed (96%), while gear type was split between bait (60%) and lures (40%). Few anglers fly fished on Ririe Reservoir (<1%). Thirty-four percent of parties fishing during 2005 caught no fish, while 34% caught between one and three fish, and 33% of anglers caught four or more fish. Catch rates (fish caught per hour) have increased by 37% over 2003 estimates to 0.89 fish per hour (Figure 1). Anglers caught an estimated 15,339 kokanee salmon *Oncorhynchus nerka*, 10,080 smallmouth bass *Micropterus dolomieu*, 8,765 Yellowstone cutthroat trout *O. clarkii bouvieri*, 4,821yellow perch *Perca*

flavescense, and 438 rainbow trout *O. mykiss*. Catch rates on rainbow trout and smallmouth bass have declined from 2003 rates, while catch rates for Yellowstone cutthroat trout, yellow perch and kokanee salmon have increased. Overall harvest rates have increased over rates from 2003, but have declined compared to 1993 data (Figure 2). The percentage of fish caught that are harvested remains high in Ririe Reservoir (Figure 3). Catch rates for the ice fishery were dominated by kokanee salmon, while Yellowstone cutthroat trout and smallmouth bass provided the bulk of angler catch during the open-water fishery (Figure 4).

We collected 410 fish with our gill net survey. Species composition was dominated by nongame fish, with sport fish comprising 13% of the total catch (Figure 5). We also collected 42 smallmouth bass with 88 minutes of electrofishing effort. Size ranged from 105 mm to 292 mm (Figure 6), with mean catch per unit effort of 0.5 bass per minute. Results from our electrofishing survey show a low-density bass population.

DISCUSSION

Overall effort and catch rates have increased over 2003 estimates, due in part to an ice fishery that occurred in 2005 that did not occur in 2003. Excluding the ice fishery, catch rates during the general fishing season (May 1 to Nov 30) were still above those documented in 2003, and are likely the result of shifts in the management program on Ririe. Over the past four years, we have tripled our stocking goals for kokanee, with a goal of 210,000 fish annually compared to 70,000 fish up to 2001. Kokanee catch rates have reflected this increase in stocking, jumping from 0.05 fish per hour in the 2003 creel to 0.21 fish per hour in the current survey. We also shifted our management emphasis away from rainbow trout, replacing those stockings with Yellowstone cutthroat trout beginning in 2003. Rainbow trout dominance in the creel began to decline in our 2003 survey, and has become an insignificant part of angler catch in the current survey. This year's catch rates on cutthroat trout (0.2 fish/hour) have surpassed our historical catch rates on rainbow trout prior to cutthroat trout introduction (0.19 fish per hour in 1993), effectively replacing rainbow trout in the fishery. Trout, kokanee and yellow perch are providing a harvest-oriented fishery on Ririe Reservoir. This year as in previous years, anglers harvested a large proportion of all fish caught. The one exception to this generalization is for smallmouth bass. Harvest rates for bass continue to be low, with approximately 4% of all bass caught being harvested. Anglers continue to release most bass caught either as a result of the 300 mm minimum length limit or the catch and release ethic prevalent in bass fisheries. Catch rates for bass were second only to kokanee in 2005, indicating smallmouth bass are a major component of the reservoir fishery.

RECOMMENDATIONS

1. Continue to stock Yellowstone cutthroat trout, and evaluate their contribution to the fishery over the next several years.

2. Continue stocking kokanee salmon at 210,000 fish and evaluate the effects of higher stocking on the size structure and catch rates in the coming years.

Table 1. Angler statistics recorded for Ririe Reservoir, Idaho during 2005 creel survey.

		2005	2003	1993
Total Effort		43,825	25,981	56,612
Residency (Percent)	Resident	96	96	98
	Nonresident	4	4	2
Angler Type (Percent)	Bank	3	16	55
	Boat	72	83	45
	Tube	--	<1	0
	Ice	25	None	--
Percent of Anglers Catching	0 fish	34	36	52
	1 to 3 fish	34	39	31
	4 or more fish	33	25	17
Gear Type Used (Percent)	Bait	60	45	100
	Lure	40	55	0
	Fly	<1	<1	0
Catch Rate (Fish Per Hour)	All Fish	0.89	0.65	0.33
	Cutthroat trout	0.20	0.06	0.00
	Rainbow trout	0.01	0.07	0.19
	Kokanee salmon	0.35	0.06	0.04
	Yellow perch	0.11	0.04	0.08
	Smallmouth bass	0.23	0.31	0.02
	Crayfish	0.00	0.06	0.00
Number Harvested	All Fish	17,968	5,020	17,600
	Cutthroat trout	6,574	875	17
	Rainbow trout	438	1,138	11,009
	Kokanee salmon	9,203	1,106	2,268
	Yellow perch	1,753	841	3,697
	Smallmouth bass	438	111	496
	Crayfish	0	949	0
Percent Harvested	All Fish	47	38	82
	Cutthroat trout	75	67	0
	Rainbow trout	100	57	95
	Kokanee salmon	60	83	100
	Yellow perch	36	75	62
	Smallmouth bass	4	3	50
	Crayfish	0	100	0

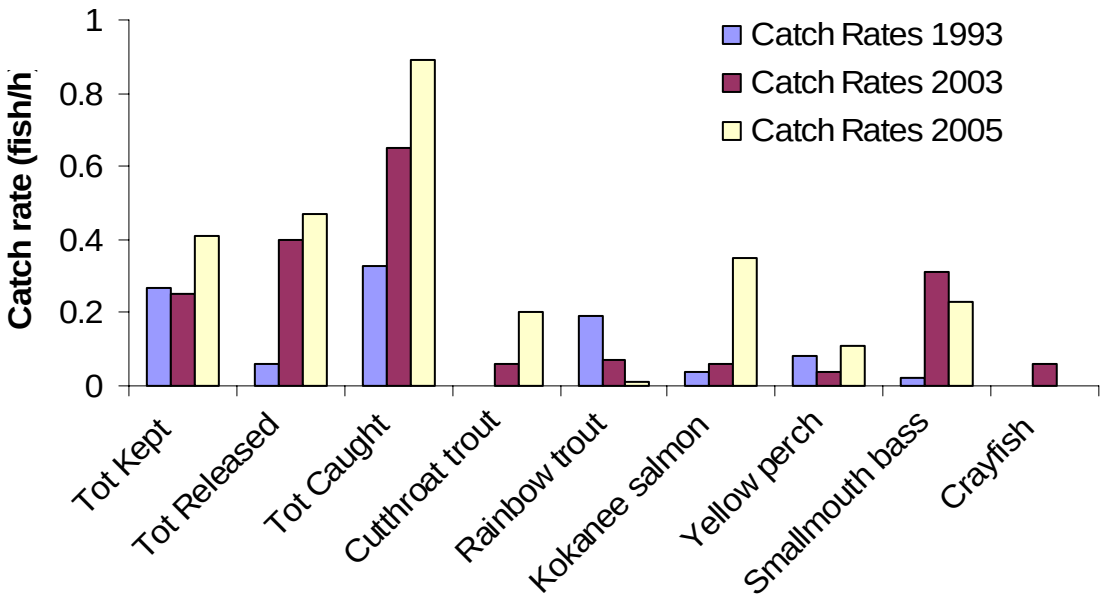

Figure 1. Catch rates (fish per hour) obtained from creel surveys on Ririe Reservoir, Idaho 1993-2005.

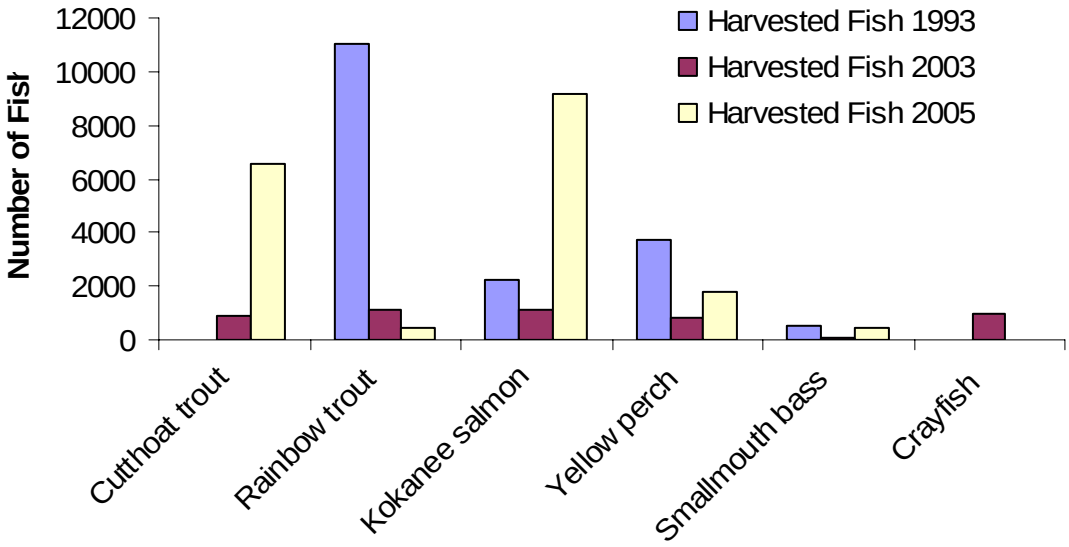

Figure 2. Harvest estimates obtained from creel surveys on Ririe Reservoir, Idaho from 1993-2005.

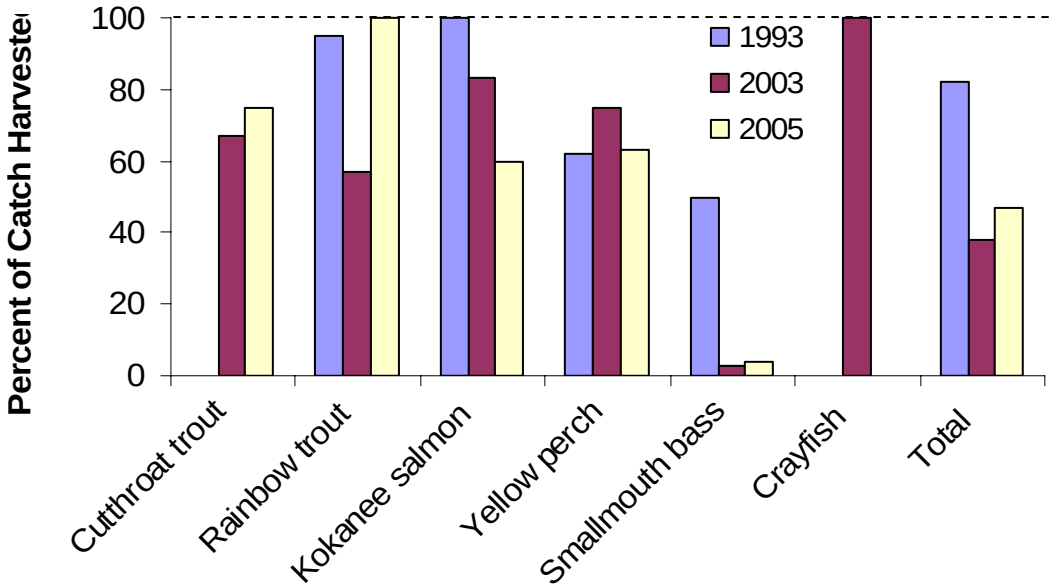

Figure 3. Percentage of angler catch by species that is harvested in Ririe Reservoir, Idaho 1993-2005.

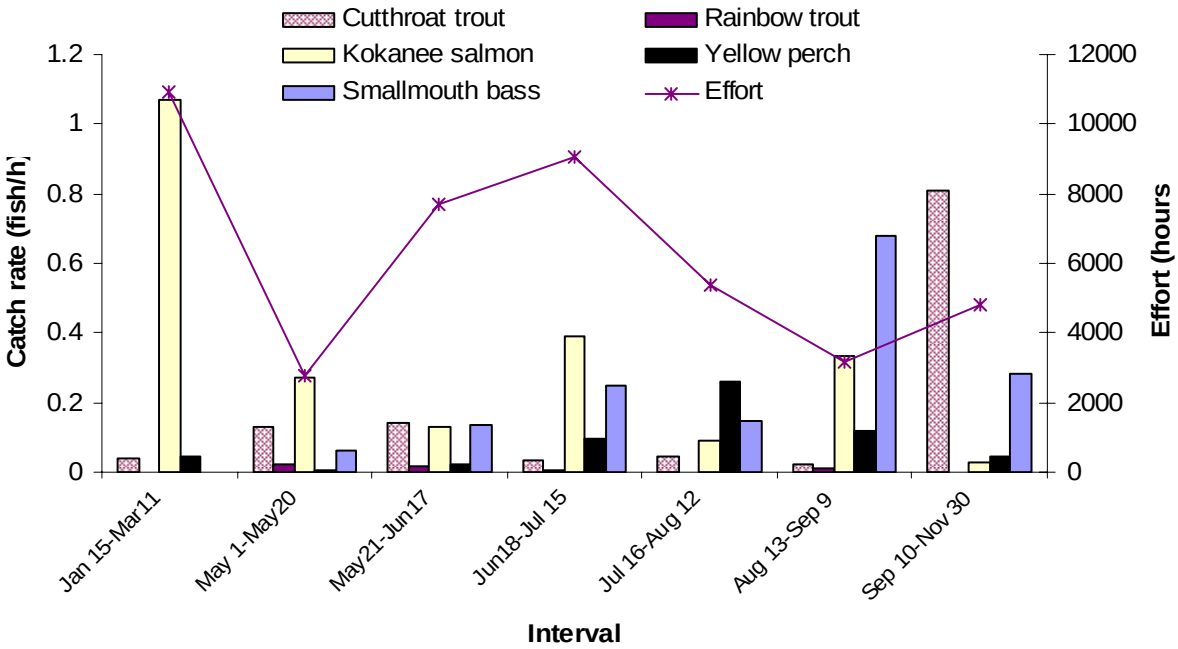

Figure 4. Catch rate (fish per hour) from the 2005 creel survey on Ririe Reservoir. The period from January 15 to March 11 was an ice fishery.

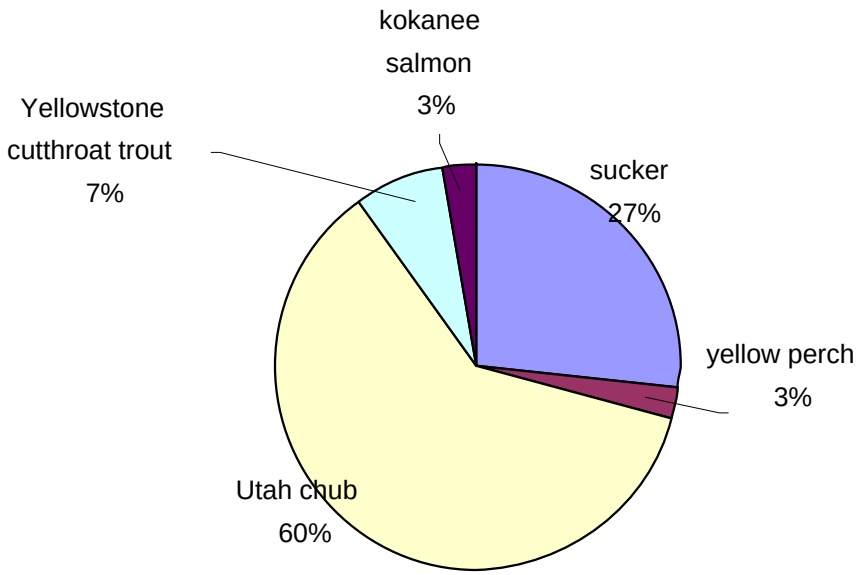

Figure 5. Relative abundance of fish caught with gill nets in Ririe Reservoir, 2005.

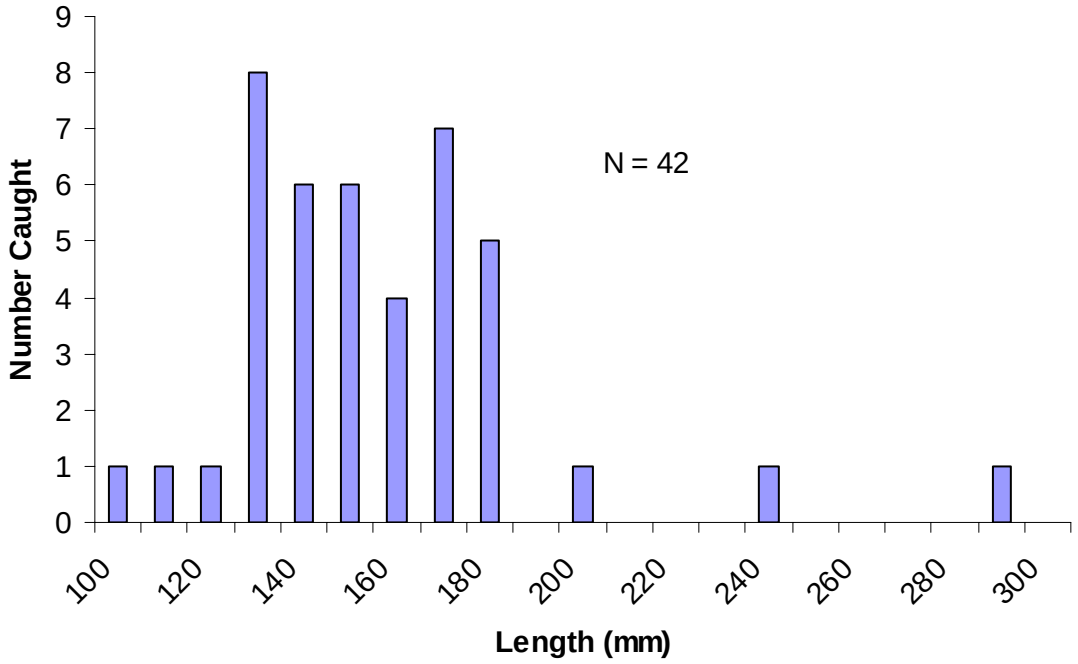

Figure 6. Length frequency of smallmouth bass collected while electrofishing in Ririe Reservoir, Idaho 2005.

Appendix A. Gill net locations for Ririe Reservoir, 2005. GPS locations are all Zone 12, North American Datum 27.

	Easting	Northing
Net 1	439, 479 E	4, 815, 450 N
Net 2	439, 497 E	4, 816, 665 N
Net 3	441, 409 E	4, 818, 290 N
Net 4	441, 911 E	4, 820, 220 N
Net 5	440, 367 E	4, 820, 798 N
Net 6	440, 992 E	4, 822, 665 N
Net 7	440, 284 E	4, 825, 378 N

ISLAND PARK RESERVOIR

ABSTRACT

We set seven experimental gill nets to assess population parameters and relative abundance of the fishery in Island Park Reservoir. Nets were set in standard locations used each May. Mean catch (fish per net) was 36 Utah sucker *Catostomus ardens*, 14 Utah chub *Gila atraria*, 7 rainbow trout *Oncorhynchus mykiss*, 0.6 mountain whitefish *Prosopium williamsoni*, 0.1 Yellowstone cutthroat trout *O. clarkii bouvieri* and 0.1 brook trout *Salvelinus fontinalis*. Gill net catch rates reflect a similar trend to our 2002 samples, with an overall decline in abundance of all fish which began in 1998. Catch rates on salmonids with the exception of rainbow trout and nongame fish with the exception of Utah sucker follow this trend. Species composition based on gill nets was 62% Utah sucker, 24% Utah chub, 13% rainbow trout, and less than 1% kokanee salmon, Yellowstone cutthroat trout and mountain whitefish. We found a negative relation between reservoir storage and trout abundance the following year using linear regression.

METHODS

Since the 1992 drawdown and renovation of Island Park Reservoir, we have used standardized gillnetting to monitor species composition, relative abundance, and size structure of the fishery in Island Park Reservoir. On May 24, we set six sinking and one floating experimental gill nets at standardized locations (seven net nights). Gill nets measured 46 m by 2 m, with mesh sizes of 2 cm, 2.5 cm, 3 cm, 4 cm, 5 cm and 6 cm bar mesh. Nets were set at dusk and retrieved the following morning. We identified captured fish to species and recorded total lengths (TL). We calculated catch rates as fish per net night. Catch rate data and relative abundance information were compiled and compared to data from 1993 to present. We used linear regression to compare minimum fall drawdown to gill net catch rates of rainbow trout to explore the relation between reservoir storage and trout densities. We also compared gill net catch rates to our fingerling and catchable trout stocking rates using linear regression. We added catchable trout stocked during the year of sampling to fingerling trout stocked two years prior as our independent variable, and used gill net catch rates as our dependent variable to explore the relation between these factors.

RESULTS

We captured a total of 408 fish with a combined gillnetting effort of seven net-nights in standard locations (Figure 1; Appendix A). Relative abundances were dominated by nongame fish, which comprised 86% of our catch (Figure 2). Salmonids (rainbow trout *Oncorhynchus mykiss* and brook trout *Salvelinus fontinalis*) comprised 13% of the total catch, compared to 10% in 2002, 11% in 2001 and 26% in May 2000 samples. Rainbow trout length frequency was dominated by fish < 150 mm (Figure 3). Utah chub *Gila atraria* and Utah sucker *Catostomus ardens* comprised 86% of the catch,

compared to 90%, 89% and 74% in 2002, 2001 and 2000, respectively. Catch rates on all species with the exception of rainbow trout and Utah suckers showed a continued decline that began in 1998 (Figure 4, 5 and 6).

We found a significant relation between rainbow trout catch rates in our gill net samples and the minimum pool level in Island Park (Figure 7). Catch of rainbow trout following major drawdowns was low compared to gill net samples following high water years with little reservoir drawdown (r^2=0.73, p = 0.0017). Reservoir storage over the past 14 years has varied substantially, with six of the eight lowest drawdowns occurring in the past six years (Figure 8). We also found a weak relation between the number of trout stocked and our gill net catch rates two years later (r^2 = 0.29, p = 0.13, Figure 9).

DISCUSSION

Catch per net night in Island Park Reservoir is similar to catch rates from 2002, and reflects a continued downward trend in abundance of all species with the exception of rainbow trout and Utah sucker. The only sport fish species that showed a marked increase from 2002 catch rates were rainbow trout. However, the increase in abundance found in 2005 samples is more likely the result of one net set in the Bill's Island area on May 24, which captured a large number of young (< 150 mm) rainbow trout. Because we stocked the reservoir on May 20 with rainbow trout in the 75 – 150 mm range near where this net was set, the high catch rates of small rainbow trout in this particular net were likely a result of the additional 187,000 fish planted four days earlier as opposed to an increase in trout abundance in the reservoir.

Our regression of minimum annual pool and gill net catch rates the following year showed a negative relation between fall drawdowns and gill net catch. It is likely that trout densities in Island Park Reservoir are heavily impacted by the consistent and severe drawdowns that have plagued the reservoir since 2001. Of the six lowest reservoir drawdowns in the past 14 years, five have occurred consecutively since 2001. Based on our regression, these drawdowns are likely having a significant impact on the sport fishery in the reservoir. Additionally, stocking rates may be contributing to the decline in the sport fish population. Fingerling trout stockings have declined over the past ten years from a high of 1.3 million in 1994 to the 280,000 fish stocked in 2005. Additionally, we shifted management emphasis from fertile rainbow trout to triploid rainbow trout starting in 1998. By 2003, all stocked rainbow trout were triploid. It's possible that fertile fish recruit to the fishery better than triploid fish. Relations based on gill net data may improve with more intensive surveys.

RECOMMENDATIONS

1. Analyze potential factors related to the decline in gill net catch rates of rainbow trout.

2. Increase gill net survey intensity to better sample trout densities in the reservoir.

3. Evaluate performance of diploid versus triploid trout fingerling stocking.

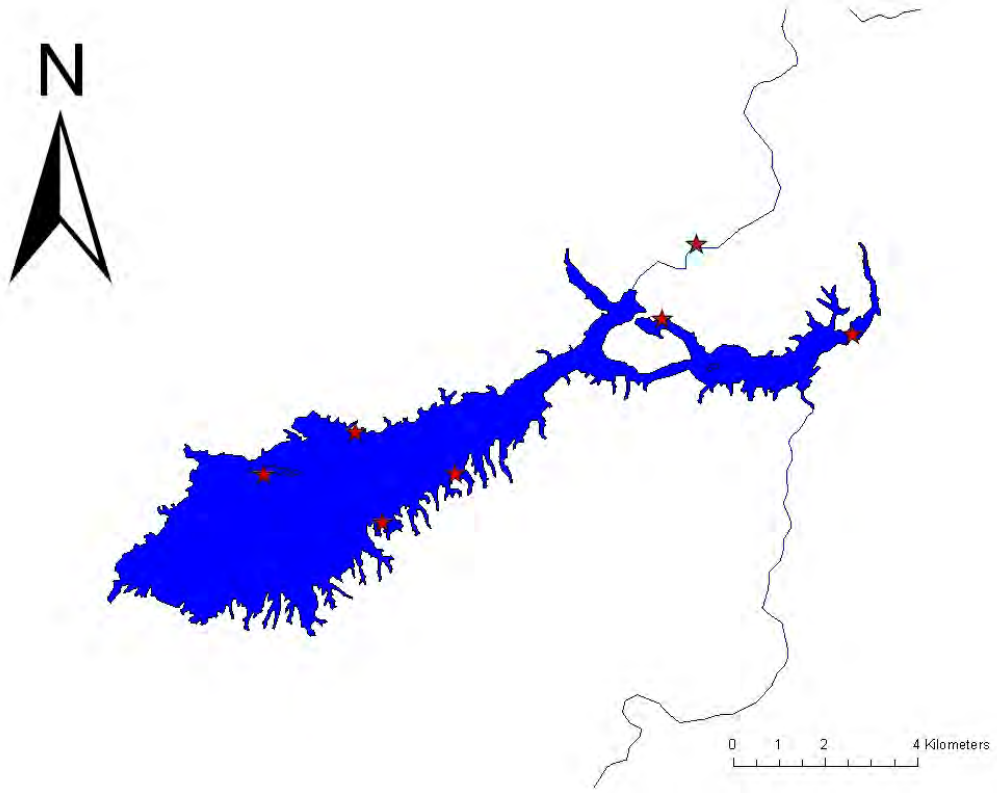

Figure 1. Gill net locations used for population assessments in Island Park Reservoir, Idaho.

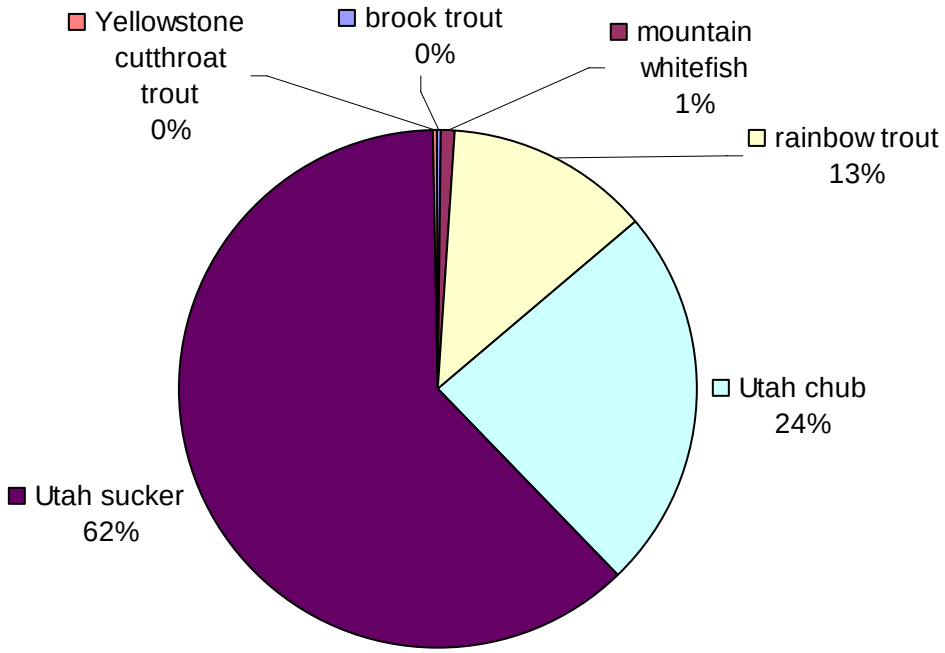

Figure 2. Relative abundance of all species collected with experimental gill nets in Island Park Reservoir, 2005.

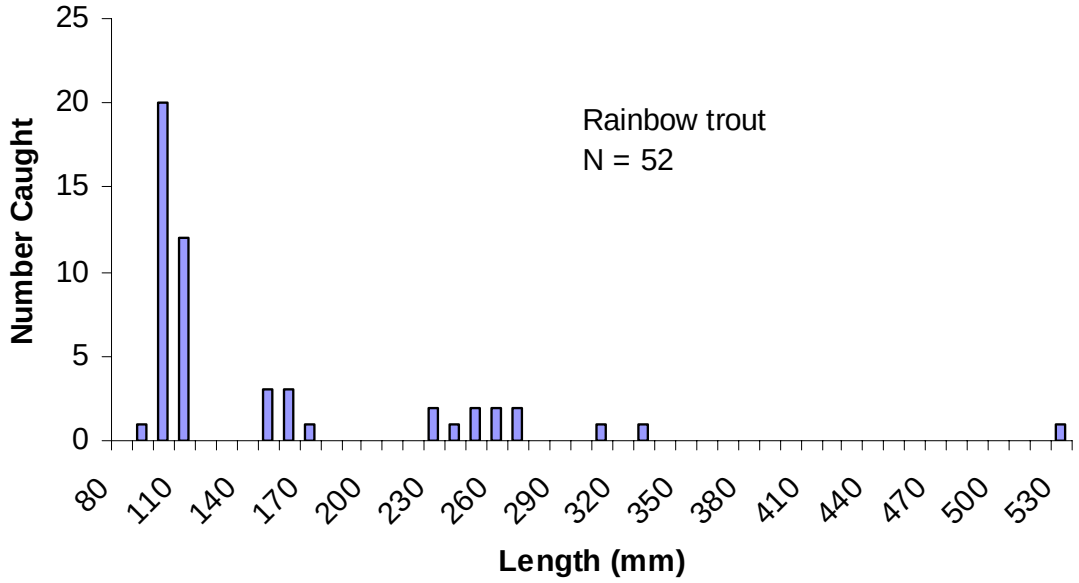

Figure 3. Length frequency distribution for rainbow trout collected in gill net samples from Island Park Reservoir, Idaho 2005

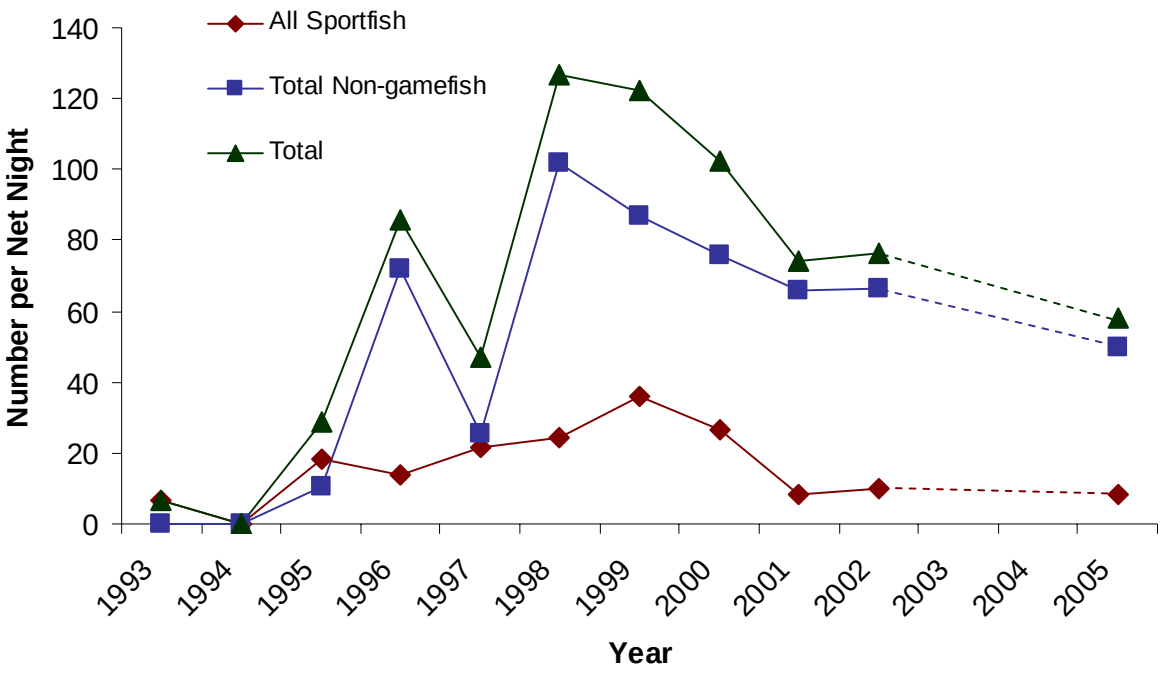

Figure 4. Gill net catch rates (fish/net night) for all fish captured in Island Park Reservoir, Idaho,1993 to present.

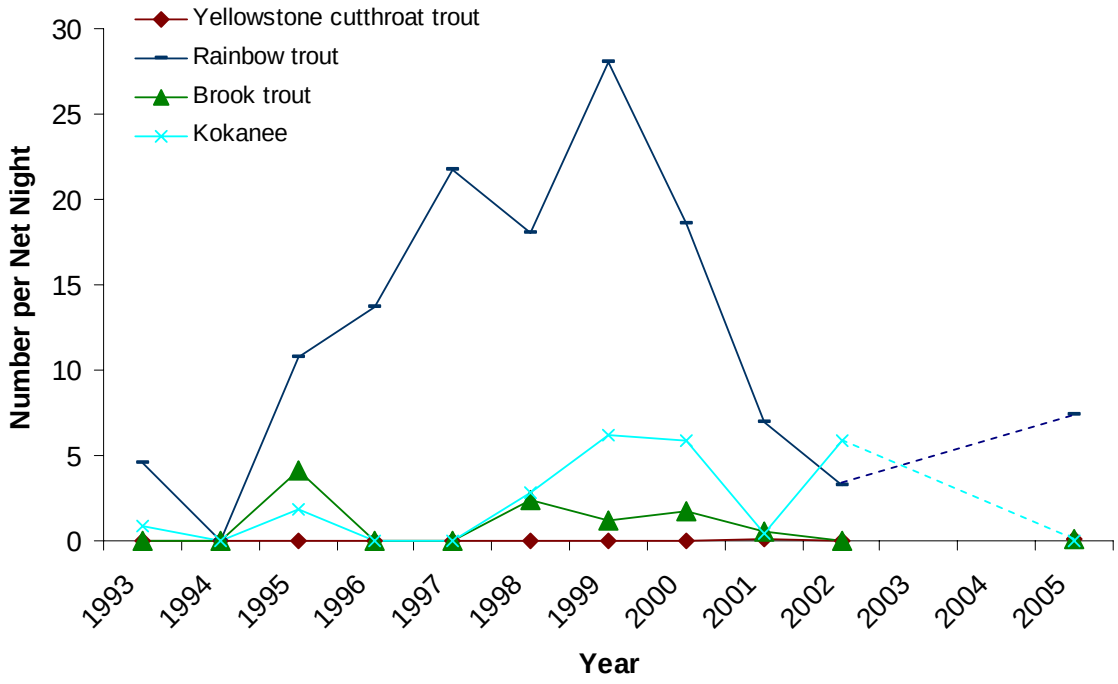

Figure 5. Gill net catch rates (fish/net night) for sport fish (rainbow trout, brook trout, kokanee and mountain whitefish) captured in Island Park Reservoir, 1993 to present.

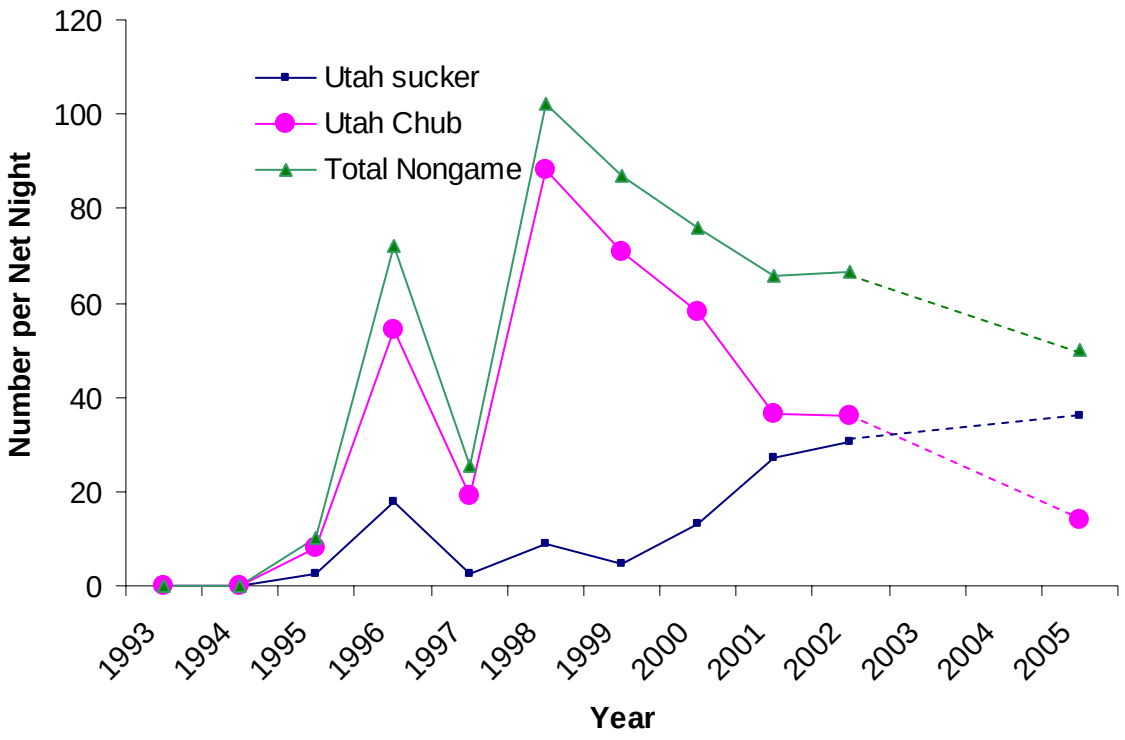

Figure 6. Gill net catch rates (fish/net night) for nongame fish (Utah sucker and Utah chub) captured in Island Park Reservoir, Idaho, 1993 to present.

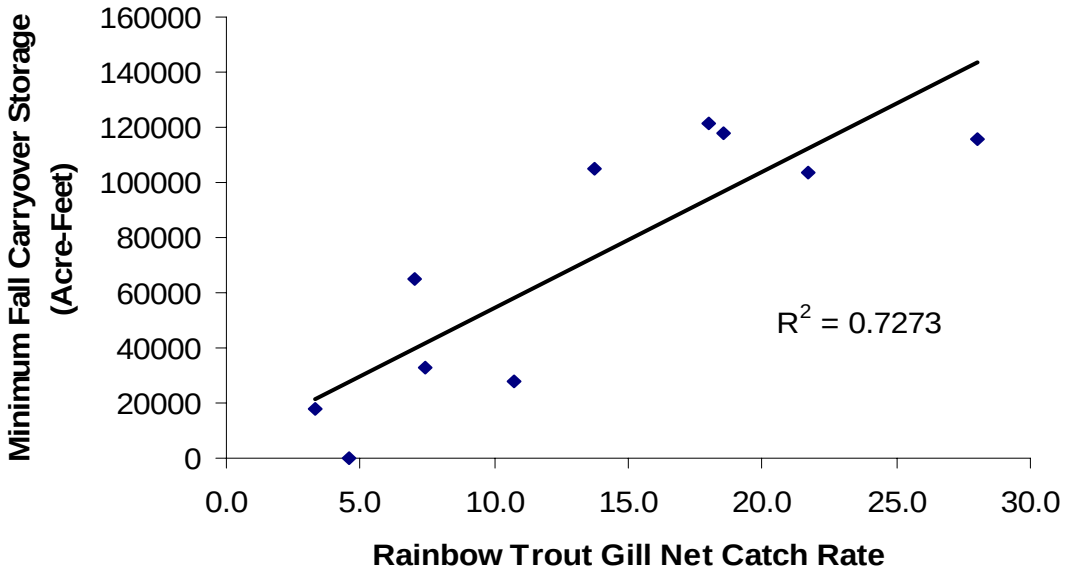

Figure 7. Fall carryover storage for Island Park Reservoir, Idaho regressed against rainbow trout catch rates in gill nets the following spring.

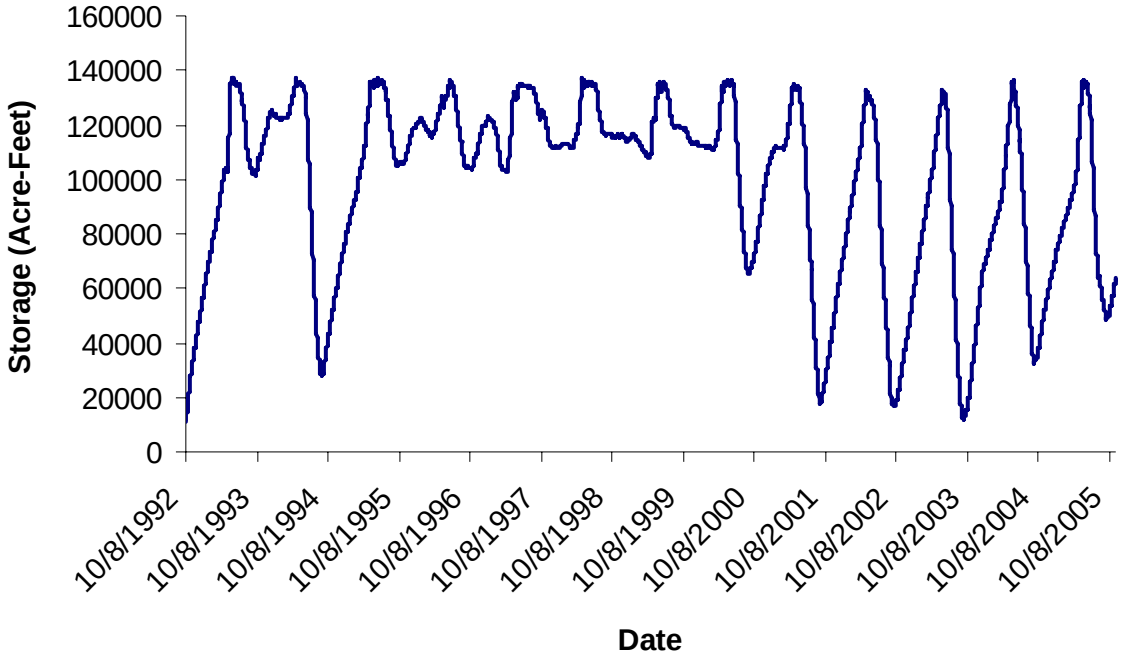

Figure 8. Reservoir storage (acre-feet) for Island Park Reservoir, 1992 to 2005.

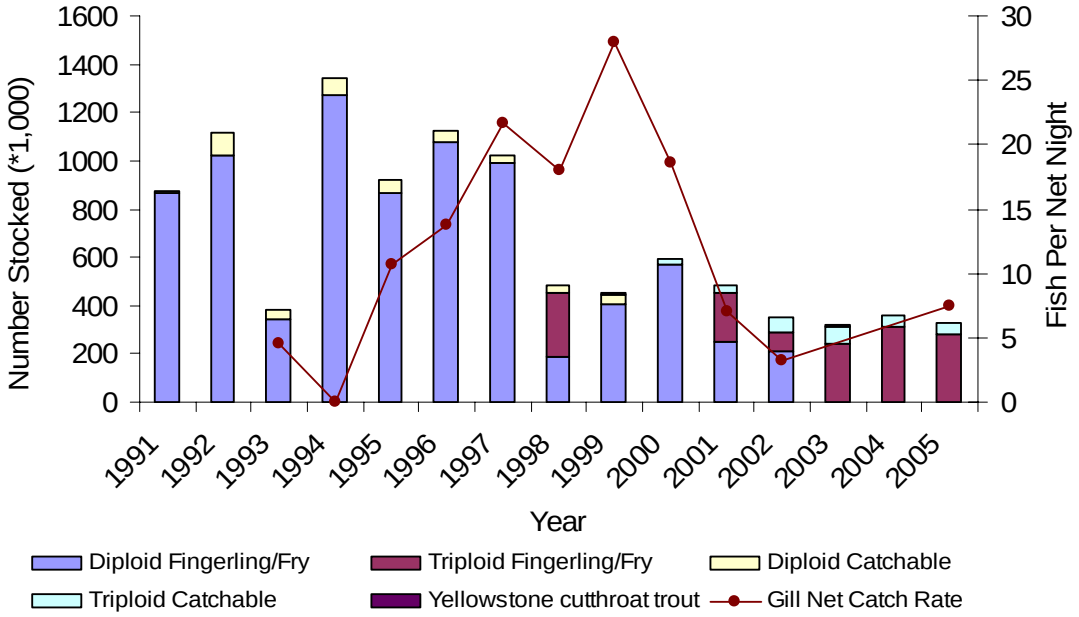

Figure 9. Stocking history for Island Park Reservoir, 1991 to 2005, and gill net catch rate (fish per net night) for trout.

Appendix A

Standard gill net locations in Island Park Reservoir.

Goose Island	456 712 E	49 16 812 N	Z 12
MP 25	459 241 E	49 15 685 N	Z 12
Trudes Bay	458 721 E	49 17 667 N	Z 12
MP 56	460 864 E	49 16 686 N	Z 12
Bills Island	465 499 E	49 19 897 N	Z 12
Mill Creek	466 325 E	49 21 491 N	Z 12
Brush	469 648 E	49 19 391 N	Z 12

GEM LAKE

ABSTRACT

We used a jet-boat mounted electrofisher to assess the smallmouth bass *Micropterus dolomieu* population in Gem Lake during the summer of 2005. We electrofished at night on seven trips between June 14 and July 21. Electrofishing efforts were concentrated in and around the Gem Lake Harbor although we also attempted to collect bass in representative sections throughout the reservoir. All bass collected were measured for total length, and those over 300 mm were tagged with an individually numbered Floy T-bar anchor tag as part of an exploitation study conducted by Nampa Research personnel. We collected a total of 282 smallmouth bass ranging in size from 74 mm to 410 mm. Mean and median size was 246 and 250 mm, respectively. We analyzed our data using Schnabel multiple-census mark recapture methods and estimated 231 (95% CI 128-1,156) smallmouth bass > 300 mm in the 314-acre impounded area of Gem Lake. Anglers directly reported catching three of 54 tagged fish, one of which was released. Indirectly, one angler reported catching two other tagged bass, but did not make an effort to report the tags. Exploitation was low based on unadjusted angler returns of tagged fish.

METHODS

We used jet boat-mounted electrofishing gear to sample smallmouth bass *Micropterus dolomieu* in Gem Lake. Electrofishing surveys were conducted on seven evenings from June 14 through July 21. All surveys started at dusk, and progressed from one to three hours in duration. The electrofishing boat was driven along the shoreline in representative areas throughout the reservoir. One to two netters were used to collect all bass encountered. All bass were measured for total length, and those fish > 300 mm received an individually-numbered Floy T-bar anchor tag. Tags were placed in the muscular tissue and through the dorsal rays to maximize tag retention. All fish were released to the general location of capture. We used a multiple-census mark recapture estimator to obtain abundance estimates of smallmouth bass in the reservoir (Schnabel 1938). We estimated population size and 95% confidence intervals with the formulas supplied by Van Den Avyle (1993). We also estimated preliminary exploitation rates by using tag return information supplied by anglers who had captured tagged smallmouth bass. Unadjusted exploitation estimates were obtained by dividing the number of tags returned by anglers by the total number of tags assumed to be in the population.

RESULTS

We captured a total of 282 smallmouth bass with a combined electrofishing effort of 6.7 hours. Mean catch per unit of effort (fish per hour) was 42 for all bass, and 11 for bass > 300 mm (Table 1). Size ranged from 74 to 410 mm total length, with mean and median lengths of 246 and 250 mm, respectively (Figure 1). Based on catch per hour of electrofishing effort, catch did not appear to vary by sample time (Table 1). Electrofishing was most effective in the Gem Lake Harbor, where the majority of all captured bass were caught. We estimated 231

smallmouth bass > 300 mm, with 95% confidence intervals of 128 – 1,126 bass (Table 2). Anglers reported catching three of 54 Floy tagged bass, one of which was harvested (2% exploitation). While conversing with an angler about a reported tag, the angler mentioned that he had caught and released two other tagged fish and never reported the information. Based on the low return of tagged fish, we believe smallmouth bass exploitation in Gem Lake is low.

DISCUSSION

Electrofishing for smallmouth bass indicated highest densities were in the Gem Lake Harbor. Littoral habitat within the harbor consists of rip-rap banks and gravel beds in shallow (< 3 m) water which is consistent with the preferred spawning habitat of smallmouth bass. Similar habitat is limited in other areas of the reservoir. Our surveys were conducted when smallmouth bass should have been spawning, and our efficiency in the harbor may be the result of congregated spawning bass or other factors. Temperature differences between the harbor and main lake may also be attracting bass to this area. Our population estimate combined with electrofishing catch per hour suggests Gem Lake supports a low-density population of smallmouth bass. The coefficient of variation (CV) from our estimate is higher than desirable, and the results should be regarded as a first-order estimate. The information obtained from tag returns was not adjusted for tag loss, angler noncompliance, or reporting bias, but suggests harvest is minimal.

RECOMMENDATIONS

1. Periodically assess the smallmouth bass fishery in Gem Lake with electrofishing surveys and reward tags.

2. Evaluate temperature regime in the main body of Gem Lake and in the Harbor.

LITERATURE CITED

Schnabel, Z. E. 1938. The estimation of the total fish population of a lake. American Mathematical Monographs 45: 348-368.

Van Den Avyle, M. J. 1993. Dynamics of exploited fish populations. Pages 105-135 *in* C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda Maryland.

Table 1. Electrofishing catch per hour (CPUE) in Gem Lake, Idaho, 2005.

Date	Jun 14	Jun 21	Jul 9	Jul 11	Jul 13	Jul 18	Jul 21	Total
Effort (s)	3,875	2,069	1,264	2,779	4,638	6,057	3,465	24,147
SMB Caught	38	25	11	58	55	43	52	282
SMB > 300mm	14	11	3	13	13	9	11	74
CPUE (all bass)	35	43	31	75	43	26	54	42
CPUE (> 300mm)	13	19	9	17	10	5	11	11

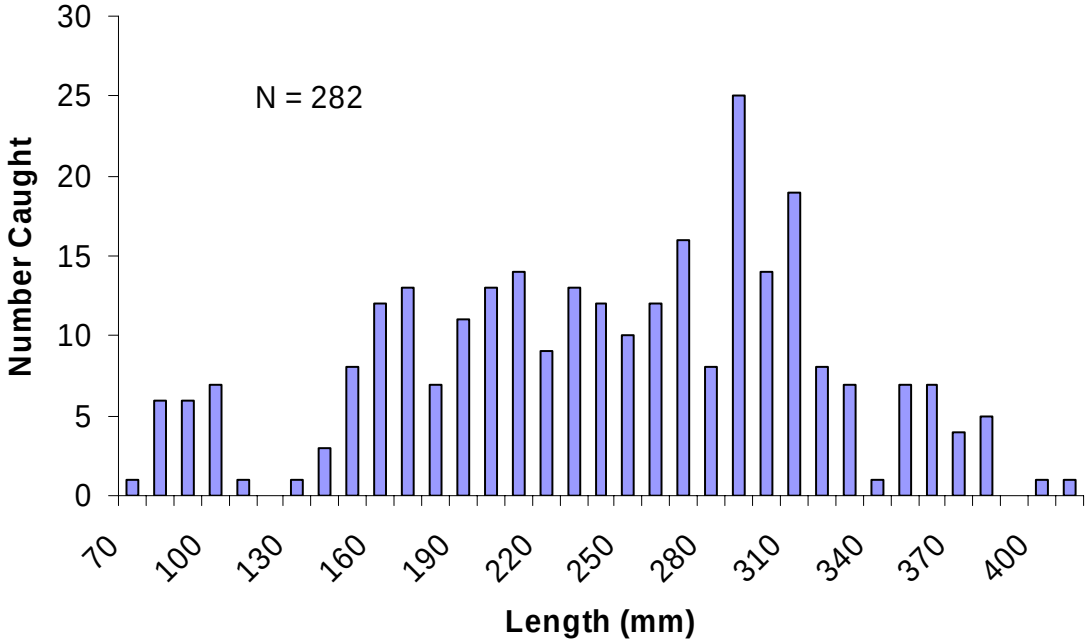

Figure 1. Length frequency distribution for smallmouth bass collected in Gem Lake, Idaho 2005.

Table 2. Data used in Schnabel multiple-census mark recapture estimate of smallmouth bass abundance, Gem Lake, Idaho, 2005.

Date	Marked (R)	Unmarked	Total (C)	Total Marked Fish Released Prior to Sample Period (M)	C x M
June 14[a]	0	14	14	0	0
June 21	0	10	10	0	0
July 9	0	3	3	10	30
July 11	1	12	13	13	169
July 13	1	13	14	25	350
July 18	2	7	9	38	342
July 21	2	9	11	45	495
Total	6				1,386
N = 231		95% CI = 128 - 1,156		CV = 0.44	

[a] – Data collected on June 14 was not used in the population estimate as tags were not available for use.

HENRYS FORK

ABSTRACT

We used boat mounted electrofishing equipment to estimate trout densities and population parameters on the Box Canyon, Vernon and Warm Slough sections of the Henrys Fork in May, 2005. We estimated rainbow trout *Oncorhynchus mykiss* densities (fish per km) at 1,174 in the Box Canyon, which is an 18% increase over our 2003 estimate. Mean and median length for all trout caught was 347 mm and 340 mm respectively. We used otoliths to age fish and found maximum age to be seven years, and estimated mean length at age four at 432 mm. Mortality was estimated at 38% annually from age two to seven based on our catch curve. Relative stock density (RSD-400) was considered good at 45, while relative weights for rainbow trout greater than 300 mm were 92. Species composition was 100% rainbow trout.

Estimated trout densities in the Vernon reach were 660 fish per km, which is a 29% decrease from 2002. Mean and median length for rainbow trout was 397 mm and 442 mm, respectively, and 388 mm and 408 mm for brown trout *Salmo trutta*. Maximum age for rainbow trout was eight years, and mean length at age four was estimated at 413 mm. Mortality estimates based on our catch curve were inaccurate due to low catch of young fish, resulting in a positive slope to our catch curve. Relative stock density (RSD-400) was high at 84, suggesting limited recruitment over the past several years. Relative weight for rainbow trout greater than 300 mm was low at 82. Species composition was 96% rainbow trout and 4% brown trout.

We did not capture enough trout to make density estimates in the Warm Slough section. We collected seven rainbow trout and two brown trout with 1.6 hours of electrofishing effort for a mean catch rate of 5.6 fish per hour. Species composition of captured fish was 78% rainbow trout and 22% brown trout. Rainbow trout ranged in size from 120 to 346 mm, whereas brown trout ranged in size from 280 to 333 mm.

Authors:

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Regional Fishery Biologist

Jim Fredericks
Regional Fishery Manager

METHODS

We used two drift boat mounted electrofishers to assess fish populations in two sections of the Henrys Fork in 2005. We collected fish over two days for marking (May 9 and 10) followed by a seven-day rest, and a single-day recapture event (May 16) in the Box Canyon. The Box Canyon section started below Island Park Dam at the confluence with the Buffalo River and extended downstream 3.7 km to the bottom of a large pool (GPS locations in Appendix A). We used a single collection day (May 11) followed by a week's rest and a single day recapture (May 18) in the Vernon section. The Vernon section started immediately below the Vernon Bridge and extended downstream 4.4 km to the lowest house on river left at the start of the impounded water above Chester Dam (Appendix A). Two passes per boat were used on all sample days in the Box Canyon and Vernon sections. We used a jet-boat electrofishing sled to sample fish in the Warm Slough section of the Henrys Fork. The Warm Slough section started at the confluence with the North Fork Teton River, and progressed downstream to the Warm Slough boat ramp (Appendix A). We only used a single-day capture as low fish densities precluded mark-recapture estimates.

Rainbow trout *Oncorhynchus mykiss*, brown trout *Salmo trutta*, Yellowstone cutthroat trout *O. clarkii bouvieri* and brook trout *Salvelinus fontinalis* collected during initial runs were marked with a caudal fin hole punch, measured for total length (TL) and released to the area of capture. We estimated densities for all trout > 150 mm using the Partial Log-Likelihood method and Montana's MR5 data analysis program (MR5; Montana Department of Fish, Wildlife, and Parks 1994). Relative stock densities (RSD-400) were calculated as the number of each species ≥ 400 mm / by the number of each species ≥ 200 mm (Ney 1993). Likewise, RSD-500 used the same formula, and the number of each species ≥ 500 mm as the numerator. Relative weights were calculated using the formulas provided by Anderson and Gutreuter (1983). We randomly selected 100 trout in both the Box Canyon and Vernon sections for age and growth analysis. Otoliths were removed, cleaned, dried and read in whole view under a dissecting microscope and 40 x magnification. Fish over three years old were sectioned using a Dremel tool and read in cross-section with the aid of a fiber-optics light source. We calculated mean length at age from our otoliths, and estimated mortality and survival using a catch curve (Van Den Avyle 1993).

RESULTS

Box Canyon

We collected 1,064 trout over three days of electrofishing in the Box Canyon. Species composition of trout handled was 100% rainbow trout. We only targeted trout, and did not collect whitefish although they were abundant. Our efficiency rate (R/C unadjusted for size selectivity) was 0.22 (Appendix B-1). Size distribution of rainbow trout showed a bimodal distribution (Figure 1) and a desirable relative stock density (RSD-400) of 45 (Appendix B-2) which is an increase over past years. Rainbow trout have a mean size of 347 mm and median size of 340 mm (Table 1). We captured 22 fish greater than 500 mm. We estimated 4,324 trout

> 150 mm (95% CI = 4,027 – 4,657, cv = 0.05, Figure 2, Appendix B-3) in the section, which equates to 1,174 fish per km (Table 2). Mean length at age four was 432 mm (Table 3). Rainbow trout mortality was estimated at 38% annually from age two to seven (Figure 3).

Vernon to Chester Backwaters

We collected 803 trout in the Vernon section of the Henrys Fork during the two-day population estimate. Species composition was 96% rainbow trout and 4% brown trout. We only targeted trout, and did not collect whitefish. Our efficiency rate (R/C unadjusted for size selectivity) for all trout was 0.22. Rainbow trout and brown trout stock density indices were high, with RSD-400 of 84 for rainbow trout and 69 for brown trout (Table 1). Mean and median size of rainbow trout was 397 mm and 442 mm respectively, with an RSD-500 of eight. Mean and median size of brown trout was 388 mm and 408 mm respectively, with an RSD-500 of 38. Rainbow trout length frequencies were skewed towards larger fish (Figure 4). Mean length at age four for rainbow trout was 413 mm (Table 3). We estimated 2,903 trout > 150 mm for the section (95% CI = 2,323 – 3,127; cv = 0.15), which equates to 660 fish per km (Table 2). Rainbow trout density estimates were 2,725 for the three km section (619 fish per km), while brown trout were estimated at 178 fish (41 fish per km). Estimated trout densities were approximately 29% lower than those estimates from the survey done in 2002.

Mortality estimates based on our catch curve were affected by a lack of young fish in our sample (Figure 5). We were unable to calculate mortality from the age data collected in the Vernon section due to a disproportionate catch of large, older fish in our sample. Seventy-two percent of our aged fish were five years old or older, resulting in a positive slope to the catch curve and a survival rate exceeding 100% demonstrating a violation of the assumptions necessary for the use of a catch curve. The lack of younger fish is also evident in our length-frequency distribution (Figure 4), with 78% of all captured rainbow trout exceeding 350 mm.

Teton River Confluence to Warm Slough

We collected nine trout during our one-day electrofishing survey in the Warm Slough section of the Henrys Fork. Species composition was 78% rainbow trout and 22% brown trout. Five of seven rainbow trout collected were less than 200 mm, suggesting some recruitment occurs in this section. Overall catch rates (fish per hour) were low, at 4.4 for rainbow trout and 1.3 for brown trout. We did not do a recapture run due to the low number of fish marked on the first sample day.

DISCUSSION

Our Box Canyon population estimate shows an increase in trout densities compared to our 2003 survey. The relation between winter flows and trout abundance is well-understood in this reach of the Henrys Fork (Mitro 1999, Garren et. al. 2004), with higher winter flows producing stronger year classes. Recent winter (December, January and February) flows from Island Park Dam (215 cfs) have increased slightly when compared to flows from 2002 (107 cfs)

and 2003 (145 cfs), and likely increased the number of juvenile trout recruiting in the upper Henrys Fork. Continued precipitation and resulting higher winter flow releases from Island Park Dam should further improve trout densities in the river.

Electrofishing estimates in the Vernon section show a slightly reduced rainbow trout population dominated by larger fish. Few juvenile trout were caught, which suggests poor recruitment from the 2002 and 2003 year classes, or that recruitment is dependent on migrations of juvenile fish from other areas. The RSD-400 of 84 in the Vernon reach corroborates this and is indicative of a population dominated by large fish, but lacking juveniles. Information from our aged fish further supports this observation, with the majority of fish being five years old or older. The result of a lack of juvenile trout may be lower adult densities in upcoming years. However, we have never sampled this reach of river and have little historic size structure information. It is possible that our 2005 collections may be typical of the Vernon section of the Henrys Fork and that most recruitment comes from outside the sampling section. Future research should address the disproportionate age structure found in this section.

RECOMMENDATIONS

1. Continue annual population surveys in the Box Canyon to quantify population response to changes in the flow regime over time.

2. Investigate potential for immigration of juvenile trout from areas outside of the Henrys Fork into the Vernon and Chester sections.

LITERATURE CITED

Anderson, R.O. and S. J. Gutreuter. 1983. Length, weight and associated structural indices. Pages 283-300 *in* L. A. Nielson and D. L. Johnson, editors. Fisheries techiques. American Fisheries Society, Bethesda, Maryland.

Garren, D., W. C. Schrader, D. Keen and J. Fredericks. 2004. Regional fisheries management investigations. Idaho Department of Fish and Game, 2003 Job Performance Report, Project F-71-R-28, Boise.

Mitro, Matthew G. 1999. Sampling and analysis techniques and their application for estimating recruitment of juvenile rainbow trout in the Henrys Fork of the Snake River, Idaho. PhD Thesis, Montana State University – Bozeman, MT.

Montana Department of Fish, Wildlife, and Parks. 1994. MARKRECAPTURE Version 4.0: A software package for fishery population estimates. Montana Department of Fish, Wildlife, and Parks, Helena.

Ney, J. J. 1993. Practical use of biological statistics. Pages 137-158 *in* C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda, Maryland.

Van Den Avyl, 1993. Dynamics of exploited fish populations. Pages 105-134 in C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda, Maryland.

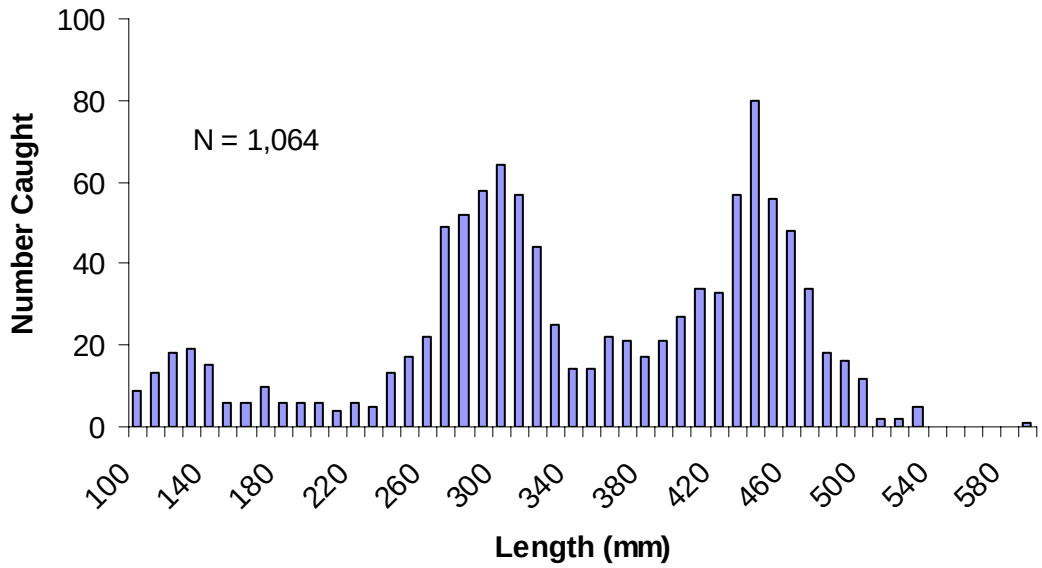

Figure 1. Length frequency distribution for rainbow trout collected electrofishing in the Box Canyon section of the Henrys Fork, Idaho, 2005.

Table 1. Trout population index summaries for the Henrys Fork, Idaho, 2005.

River Reach	Mean Length (mm)	Median Length (mm)	RSD-400	RSD-500	Fish per km	Percent Contribution to Catch
Box Canyon						
Rainbow trout	347	340	45	2	1,197	100
Vernon						
Rainbow trout	397	442	84	8	736	96
Brown Trout	388	408	69	38	78	4
Warm Slough						
Rainbow trout	190	167	--	--	--	78
Brown trout	307	305	--	--	--	22

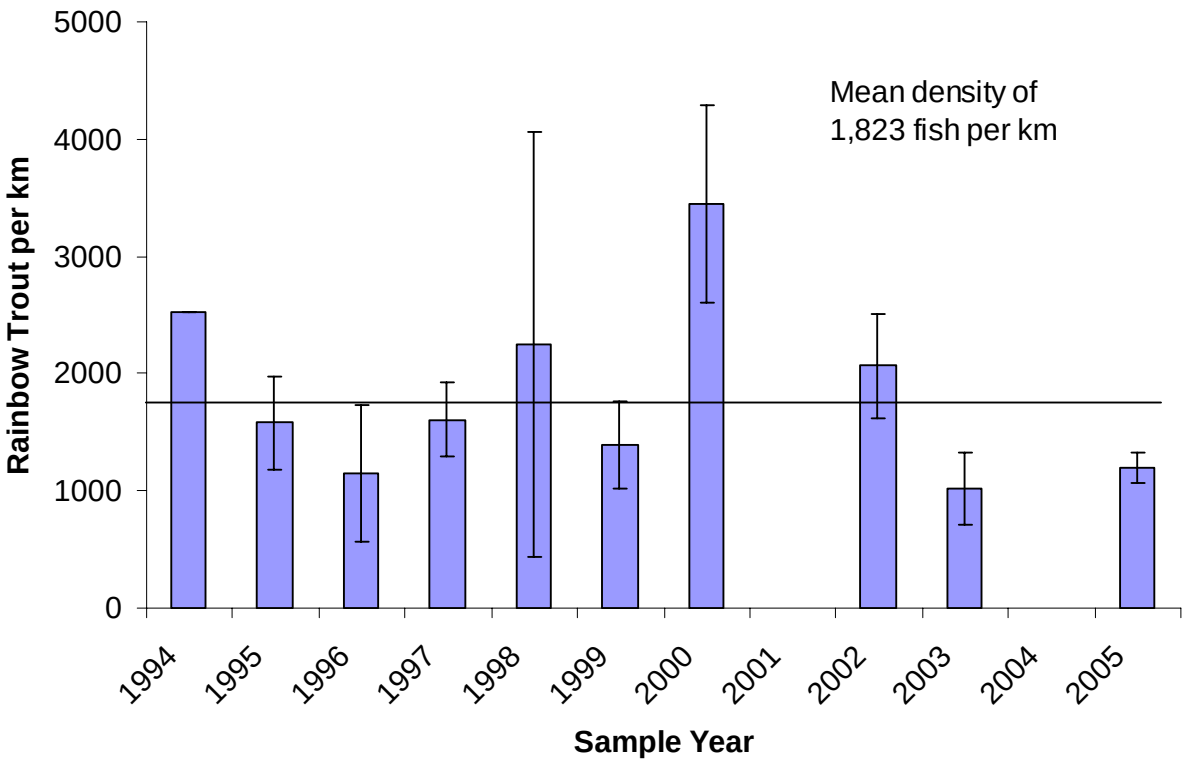

Figure 2. Population estimates for the Box Canyon section of the Henrys Fork, Idaho 1994 to present.

Table 2. Data used in population estimates from the Henrys Fork, Idaho during 2005 and flow levels during sampling.

River reach	Number Marked	Number Captured	Number Recaptured	Population Estimate	Confidence Interva (+/- 95%)l	Density (No./ km)	Discharge (Q)
Box Canyon							
Rainbow trout	735	401	90	4,342	4,027 - 4,657	1,174	14m^3/s [a]
Vernon							
Rainbow trout	386	385	84	2,725	2,323 - 3,127	619	57m^3/s [b]
Brown trout	14	15	4	178	0 - 500	41	
Warm Slough							
All trout	9	--	--	--	--	--	111m^3/s [c]

[a]Data obtained from USGS gauge near Island Park Dam (13042500)
[b]Data obtained from USGS gauge near Ashton Reservoir (13046000)
[c]Data obtained from USGS gauge near Rexburg (13056500)

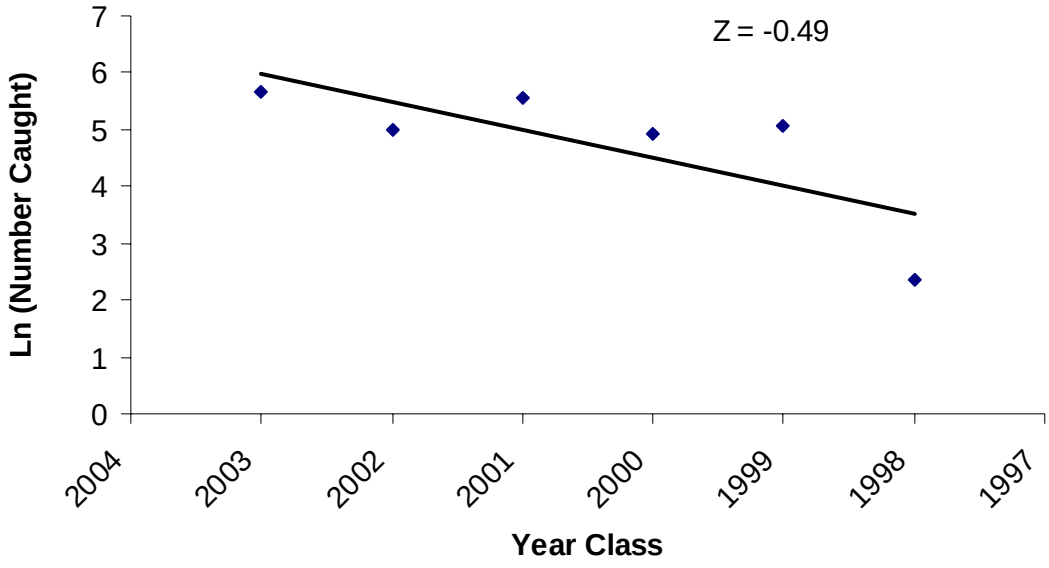

Figure 3. Catch curve for rainbow trout collected in the Box Canyon section of the Henrys Fork, Idaho 2005.

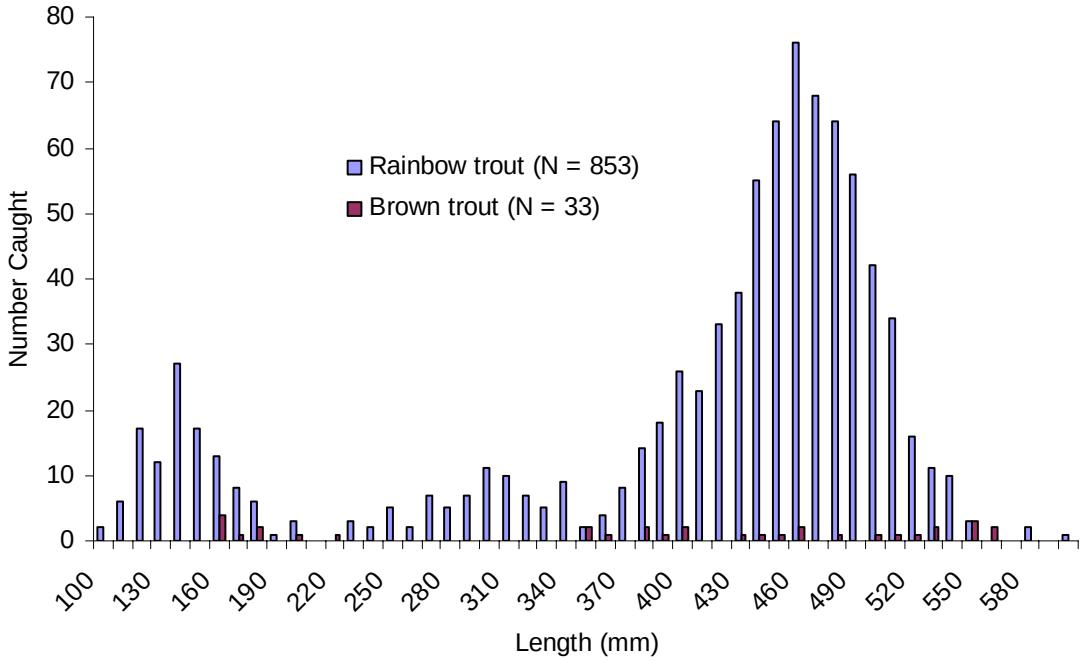

Figure 4. Length frequency distribution for brown trout and rainbow trout collected electrofishing in the Vernon section of the Henrys Fork, Idaho, 2005.

Table 3. Mean length at age of rainbow trout collected electrofishing in the Box Canyon and Vernon sections of the Henrys Fork, Idaho 2005 based on otoliths.

Species	Mean Length at Age (mm)							
	1	2	3	4	5	6	7	8
Box Canyon								
Rainbow trout							494	--
	122	296	348	432	422	458		
(No. Collected)	(6)	(28)	(14)	(25)	(13)	(15)	(1)	
Vernon								
Rainbow trout	139	297	384	413	446	458	468	473
(No. Collected)	(10)	(8)	(2)	(5)	(11)	(23)	(21)	(9)

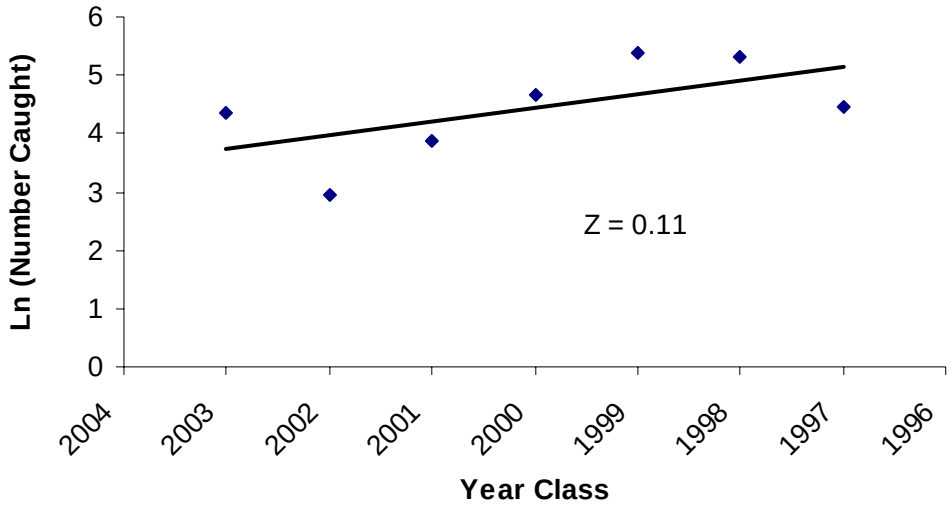

Figure 5. Catch curve for rainbow trout in the Vernon section of the Henrys Fork, Idaho 2005 showing the strong year classes in the 1990's compared to the early 2000s. Estimates of mortality were precluded by this unequal recruitment.

Appendix A Locations used in population surveys on the Henrys Fork Snake River, Idaho 2005. All locations used NAD-27 and are in Zone 12.

	Start		Stop	
Section	Easting	Northing	Easting	Northing
Box Canyon	04 68 677	49 17 703	04 67 701	49 14 352
Vernon	04 57 138	48 77 930	04 54 246	48 74 836
Warm Slough	04 32 651	48 60 810	04 30 266	48 57 637

Appendix B1. Electrofishing mark-recapture statistics for the Box Canyon section, Henrys Fork Snake River, Idaho, 1995-2005.

Year	Brook trout[a]				Rainbow trout				All trout			
	M[a]	C[a]	R[a]	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)
1995	--	--	--	--	982	644	104	16	982	644	104	16
1996	--	--	--	--	626	384	69	18	626	384	69	18
1997	--	--	--	--	859	424	68	16	859	424	68	16
1998	--	--	--	--	683	425	42	10	683	425	42	10
1999	--	--	--	--	595	315	38	12	595	315	38	12
2000	--	--	--	--	1,269	692	74	11	1,269	692	74	11
2002	2	0	0	0	1,050	511	81	16	1,052	511	81	16
2003	2	2	0	0	427	167	20	12	429	169	20	12
2005	0	0	0	0	735	401	90	22	735	401	90	22

[a] M = number of fish marked on marking run; C = total number of fish captured on recapture run; R = number of recaptured fish on recapture run.

Appendix B-2. Mean total length and relative stock density (RSD-400) of trout captured at the Box Canyon electrofishing section, Henrys Fork Snake River, Idaho, 1995-2005. Total individual fish captured during mark (M) and recapture (C - R) runs equals n. RSD-400 = (number ≥400 mm / number ≥200 mm) x 100.

Year	Brook trout			Rainbow trout			All trout		
	n	Mean (mm)	RSD-400 (%)	n	Mean (mm)	RSD-400 (%)	n	Mean (mm)	RSD-400 (%)
1995	0	--	--	1,626	318	28	1,626	318	28
1996	0	--	--	1,010	304	20	1,010	304	20
1997	0	--	--	1,283	308	13	1,283	308	13
1998	0	--	--	1,108	272	12	1,108	272	12
1999	0	--	--	910	330	15	910	330	15
2000	0	--	--	1,961	294	10	1,961	294	10
2002	2	--	--	1,561	350	40	1,563	350	40
2003	4	194	0	594	366	45	594	366	45
2005	0	--	--	1,136	354	45	1,136	354	45

Appendix B-3. Estimated abundance (N) of age-1 and older rainbow trout (≥150 mm) at the Box Canyon electrofishing section, Henrys Fork Snake River, Idaho, 1995-2005. Confidence intervals (±95%) are in parentheses.

First marking date	Rainbow trout		
	N/section MPM[a]	N/section LLM[b]	N/km LLM
5-16-1995	6,160 (5,045-7,275)	5,843 (5,542-6,144)	1,579 (1,498-1,661)
5-17-1996	5,055 (3,053-7,058)	4,253 (3,971-4,535)	1,150 (1,073-1,226)
5-8-1997	5,324 (4,188-6,460)	5,944 (5,504-6,384)	1,607 (1,488-1,725)
5-12-1998	8,086 (5,190-10,982)	8,312 (7,589-9,035)	2,247 (2,051-2,442)
5-27-1999	4,728 (3,388-6,068)	5,135 (4,700-5,570)	1,388 (1,270-1,505)
5-11-2000	12,089 (9,418-14,760)	12,746 (12,001-13,491)	3,445 (3,244-3,646)
5-5-2002	7,089 (5,412-8,766)	7,657 (7,205-8,108)	2,069 (1,948-2,192)
5-8-2003	3,318 (2,082-4,554)	3,757 (3,202-4,312)	1,015 (865-1,165)
5-16-2005	3,922 (2,989-4,855)	4,342 (4,027-4,657)	1,174 (1,069-1,279)

[a] Modified Peterson Estimate
[b] Log-Likelihood Method

TETON RIVER

ABSTRACT

We electrofished two sections of the upper Teton River in September 2005. A total of 314 trout were captured during two days of sampling at Breckenridge. Species composition and relative abundance were cutthroat trout *Oncorhynchus clarkii bouvieri* (10%), rainbow trout and hybrid rainbow x cutthroat trout (83%), and brook trout *Salvelinus confluentus* (7%). Estimated densities, in fish/km, were 11 cutthroat trout, 485 rainbow trout *O. mykiss*, and 483 for all species combined. Mean total length was 291 mm for cutthroat trout, 290 mm for rainbow trout, 251 mm for brook trout, and 291 mm for all species combined. Quality stock density (QSD) was 25.0% for cutthroat trout, 18.4% for rainbow trout, 0.0% for brook trout, and 18.5% for all species combined. A total of 621 trout were captured during two days of sampling at Nickerson. Species composition and relative abundance were cutthroat trout (13%), rainbow trout (37%), and brook trout (50%). Estimated densities, in fish/km, were 44 cutthroat trout, 161 rainbow trout, 152 brook trout, and 338 for all species combined. Mean total length was 248 mm for cutthroat trout, 298 mm for rainbow trout, 248 mm for brook trout, and 267 mm for all species combined. QSD was 9.4% for cutthroat trout, 14.8% for rainbow trout, 1.1% for brook trout, and 7.4% for all species combined.

STUDY AREA AND METHODS

We surveyed trout populations at the Breckenridge section on September 8 and 15 and at the Nickerson section on September 7 and 14, 2005 (Table 1). Breckenridge and Nickerson have been the standard IDFG monitoring sections in the upper Teton River, or Teton Valley, since 1987 (Figure 1). They represent two different types of main river habitat in the Teton Valley – each responding differently to drought conditions – and they have different levels of fishing pressure. Fish population information from these two sections represents the most comprehensive and longest-running data set for the Teton River (Schrader and Brenden 2004; Garren et al. in press). The Breckenridge section is 4.9 km long, averages 26 m wide, and is about 12.74 ha in surface area. The Nickerson section is 5.8 km long, averages 42 m wide, and is about 24.36 ha in surface area.

Fish were captured using direct-current (DC) electrofishing gear (Coffelt VVP-15 powered by a Honda 5000 W generator) mounted in two drift boats. We used pulsed DC current through two boom-and-dangler anodes fixed to the bow while floating downstream. The boat hull was the cathode. VVP settings and conductivity readings were similar to past years (Garren et al., in press).

We attempted to capture all species and sizes of trout. After capture, fish were anesthetized, identified, and measured to the nearest millimeter (TL). Brook trout *S. confluentus* less than 150 mm and all other species less than 100 mm (generally age-0) were not marked as they are not efficiently recruited to the gear. Age-1 and older fish were marked with a caudal fin punch and released. Hereafter, “rainbow trout” *O. mykiss* refers to wild rainbow and hybrid trout combined – but not hatchery rainbow trout. Hatchery rainbow trout were stocked as catchables through 1994 (Schrader and Brenden 2004). Hatchery cutthroat trout *O. clarkii bouvieri* from Henrys Lake were stocked as fingerlings through 1991.

Electrofishing data were entered and analyzed using the computer program Mark Recapture 5.0 (MR5; Montana Department of Fish, Wildlife, and Parks 1997). Additional analyses were made using Microsoft Excel. General statistical procedures were conducted according to Zar (1984).

We assumed capture probabilities did not vary with species, and relative abundance was estimated using proportions of all individual trout captured (excluding recaptures). Although capture probabilities vary with fish length (Schill 1992; Reynolds 1996), population size structures (length frequency distributions) and average fish lengths were estimated using all sizes of individual fish captured. Quality stock density (QSD; Anderson 1980) was estimated using the number of individual fish captured greater than or equal to 400 mm divided by the number greater than or equal to 200 mm, times 100. Density was estimated using two methods in the MR5 computer program. The log-likelihood method was preferred over the modified Peterson method if modeled efficiency curves were acceptable (termcode=1 and at least one of two chi-square p-values>0.05).

RESULTS

Breckenridge

During 2005, a total of 314 trout were captured during two days of electrofishing at the Breckenridge section. Species composition and relative abundance were cutthroat trout (10%), rainbow trout (83%), and brook trout (7%; Figure 2, Table 2). No rainbow trout were of hatchery origin.

We combined the Breckenridge and Nickerson length frequency distributions due to small sample sizes. For cutthroat trout, relatively strong groups of age-1 (about 100-250 mm) and age-2 (about 200-300 mm) juvenile fish were observed (Figure 3). This is in contrast to 2003 when few juvenile cutthroat trout were captured. Strong groups of juvenile rainbow trout <300 mm were observed in both 2003 and 2005, although the mode shifted from 200 to 230 mm Figure 4). The 2003 and 2005 brook trout length frequency distributions were also similar Figure 5). Ages were approximated from the overall 1987-2005 frequency distributions and were not validated.

Mean total length (TL) was 291 mm for cutthroat trout, 290 mm for rainbow trout, 251 mm for brook trout, and 291 mm for all species combined (Table 3). Quality stock density was 25.0% for cutthroat trout, 18.4% for rainbow trout, 0.0% for brook trout, and 18.5% for all species combined.

Electrofishing sampling efficiencies (R/C) ranged from 9% for rainbow trout to 42% for cutthroat trout Table 4). Estimated densities, in fish per kilometer, were 11 cutthroat trout, 485 rainbow trout, and 483 for all species combined (Figure 6, Table 5). Too few brook trout were captured for a valid estimate.

Nickerson

A total of 621 trout were captured during two days of electrofishing at the Nickerson section. Species composition and relative abundance were cutthroat trout (13%), rainbow trout (37%), brook trout (50%), and brown trout (<1%; Table 2, Figure 2). No rainbow trout were of hatchery origin. A single brown trout was caught and was probably illegally introduced.

Nickerson length frequency distributions were combined with those from Breckenridge due to small sample sizes. Results are above.

Mean total length (TL) was 248 mm for cutthroat trout, 298 mm for rainbow trout, 248 mm for brook trout, and 267 mm for all species combined (Table 3). Quality stock density was 9.4% for cutthroat trout, 14.8% for rainbow trout, 1.1% for brook trout, and 7.4% for all species combined.

Electrofishing sampling efficiencies (R/C) ranged from 8% for cutthroat trout to 17% for brook trout (Table 4). Estimated densities, in fish per kilometer, were 44 cutthroat trout, 161 rainbow trout, 152 brook trout, and 338 for all species combined Figure 7, Table 5).

DISCUSSION

Since 2003, Teton Valley cutthroat trout have increased slightly, and rainbow trout have increased significantly, over all sections combined Figure 8). Average cutthroat trout density increased from 2 to 7 fish/ha and was accompanied by improved recruitment (Figure 3). Strong age-1 and possibly age-2 year classes were observed in 2005, and mean lengths and QSDs have returned to average. This is welcome news following the collapse observed in 2003 (Garren et al., in press). It is likely that improved flows in spawning and rearing tributaries have improved the cutthroat trout population. However, cutthroat trout density remains well below the long-term average of 33 fish/ha observed prior to 2003.

Rainbow trout density increased from 65 to 112 fish/ha and recruitment has remained strong (Figures 4 and 8). Rainbow trout density remains well above the long-term average of 35 fish/ha observed prior to 2003. This supports Van Kirk and Jenkins (2005) proposition that hydrologic alteration in the Teton Valley, particularly low maximum/minimum discharge ratios during the recent groundwater-dominated drought years, favors rainbow over cutthroat trout recruitment.

The 2003 density estimate for all trout combined (133 fish/ha) was the second highest recorded – surpassed only by 1987 when electrofishing began (198 fish/ha; Figure 8). The increase since the late 1990s can be directly attributed to increasing numbers of rainbow trout but not brook trout. Brook trout density has remained stable at about 20 fish/ha – after accounting for the unusable 2005 Breckenridge estimate.

RECOMMENDATIONS

We recommend modifying regulations to curtail any cutthroat trout harvest until the population can rebuild.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Anderson, R.O. 1980. Proportional stock density (PSD) and relative weight (W_r): Interpretive indices for fish populations and communities. Pages 27-33 in S. Gloss and B. Shupp, editors. Proceedings of the 1st annual workshop of the New York chapter American Fisheries Society. Cazenovia, New York.

Garren, D., W. C. Schrader, D. Keen, and J. Fredericks. In press. Regional fisheries management investigations. Idaho Department of Fish and Game, 2003 Job Performance Report, Project F-71-R-28, Boise, Idaho.

Montana Department of Fish, Wildlife, and Parks. 1997. Mark recapture for Windows, version 5.0. Montana Department of Fish, Wildlife, and Parks, Helena.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada, Bulletin 191, Ottawa.

Reynolds, J.B. 1996. Electrofishing. Pages 221-254 in B. Murphy and D. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Schill, D.J. 1992. Statewide data summary. Idaho Department of Fish and Game, Wild Trout Investigations Job Performance Report, Project F-73-R-13, Boise.

Schrader, W.C., and K.R. Brenden. 2004. Teton River investigations – Part II: Fish population surveys. Idaho Department of Fish and Game, Boise.

Van Kirk, R., and A. Jenkins. 2005. Hydrologic alteration in the upper Teton watershed and its implications for cutthroat trout restoration. Project Completion Report, Friends of the Teton River, Driggs, Idaho.

Zar, J.H. 1984. Biostatistical analysis, 2nd edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Table 1. Survey dates and number of runs conducted at the Breckenridge and Nickerson electrofishing sections, Teton River, Idaho, 1987-2005.

Section and year	First marking run date	Last recapture run date	Lapsed days	Total number of runs	Number of recapture runs
Breckenridge:					
1987	Oct 1	Oct 26	25	3	1
1991	Oct 3	---[a]	---	1	---
1994	Aug 30	Sept 14	15	3	1
1995	Sept 14	Sept 21	7	3	1
1997	Sept 23	Oct 1	8	3	1
1999	Sept 28	Oct 8	10	4	2
2003	Aug 29	Sept 4	6	4	2
2005	Sept 8	Sept 15	7	4	2
Nickerson:					
1987	Sept 11	Sept 25	14	3	1
1991	Sept 12	Sept 20	8	2	1
1994	Sept 9	Sept 21	12	3	1
1995	Sept 27	Oct 3	6	3	1
1997	Sept 2	Sept 11	9	4	2
1999	Aug 31	Sept 9	9	3[b]	1
2003	Sept 3	Sept 9	6	4	2
2005	Sept 7	Sept 14	7	4	2

[a] No recapture runs due to equipment failure.
[b] Took two days to complete one run due to equipment failure.

Table 2. Trout species composition and relative abundance (%) at the Breckenridge and Nickerson electrofishing sections, Teton River, Idaho, 1987-2005. Total individual fish captured during mark and recapture runs equals n.

Year	Cutthroat trout[a]		Rainbow trout[b]		Brook trout		Brown trout		Total	
	%	n	%	n	%	n	%	n	%	n
Breckenridge										
1987	15.3	66	69.9	302	14.8	64	0.0	0	100.0	432
1991	27.8	5	66.7	12	5.6	1	0.0	0	100.0	18
1994	18.3	94	76.4	392	5.3	27	0.0	0	100.0	513
1995	39.9	103	43.0	111	17.1	44	0.0	0	100.0	258
1997	29.8	77	24.8	64	45.3	117	0.0	0	100.0	258
1999	44.4	107	37.3	90	18.3	44	0.0	0	100.0	241
2003	3.4	13	90.1	344	6.5	25	0.0	0	100.0	382
2005	10.2	32	82.8	260	7.0	22	0.0	0	100.0	314
Nickerson										
1987	52.5	307	6.7	39	40.9	239	0.0	0	100.0	585
1991	46.6	178	20.9	80	32.5	124	0.0	0	100.0	382
1994	55.6	440	19.1	151	25.3	200	0.1	1	100.0	792
1995	78.2	352	5.8	26	16.0	72	0.0	0	100.0	450
1997	63.8	166	8.1	21	28.1	73	0.0	0	100.0	260
1999	55.8	188	11.3	38	32.9	111	0.0	0	100.0	337
2003	6.4	35	33.9	185	59.6	325	0.0	0	100.0	545
2005	12.9	80	37.2	231	49.8	309	0.2	1	100.0	621

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.

Table 3. Mean total length and quality stock density (QSD) of trout captured at the Breckenridge and Nickerson electrofishing sections, Teton River, Idaho, 1987-2005. Total individual fish captured during mark and recapture runs equals n. QSD = (number ≥400 mm / number ≥200 mm) x 100.

Year	Cutthroat trout[a]			Rainbow trout[b]			Brook trout			All trout[c]		
	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n
Breckenridge												
1987	223	8.3	66	207	4.7	302	216	2.3	64	211	4.8	432
1991	134	0.0	5	297	9.1	12	220	0.0	1	247	8.3	18
1994	268	14.7	94	247	5.1	392	208	0.0	27	249	6.8	513
1995	296	17.2	103	286	14.7	111	227	0.0	44	280	13.5	258
1997	341	50.7	77	239	27.0	64	252	0.0	117	275	21.6	258
1999	325	19.0	107	291	11.6	90	270	0.0	44	302	12.8	241
2003	400	66.7	13	265	9.8	344	247	0.0	25	269	11.6	382
2005	291	25.0	32	290	18.4	260	251	0.0	22	291	18.5	332
Nickerson												
1987	208	1.4	307	246	0.0	39	193	0.0	239	204	0.6	585
1991	233	3.0	178	282	11.1	80	213	0.0	124	236	4.1	382
1994	241	7.4	440	237	11.9	151	207	0.0	200	232	6.5	792
1995	277	14.1	352	316	43.5	26	230	0.0	72	271	13.6	450
1997	304	50.4	166	311	71.4	21	256	0.0	73	291	35.7	260
1999	284	13.4	188	361	34.2	38	248	0.0	111	281	11.4	337
2003	339	32.3	35	305	21.0	185	240	0.0	325	268	9.1	545
2005	248	9.4	80	298	14.8	231	248	1.1	309	267	7.4	621

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.

Table 4. Mark recapture statistics for the Breckenridge and Nickerson electrofishing sections, Teton River, Idaho, 1987-2005. Cases where R≤3 and unbiased density estimates are not possible (Ricker 1975) are highlighted.

Year	Cutthroat trout[a]				Rainbow trout[b]				Brook trout				All trout[c]			
	M[d]	C[d]	R[d]	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)
Breckenridge																
1987	41	29	4	14	214	94	6	6	51	13	0	0	306	136	10	7
1991	5	ND[e]	ND	ND	12	ND	ND	ND	1	ND	ND	ND	18	ND	ND	ND
1994	63	56	25	45	268	181	57	31	20	9	2	22	351	246	84	34
1995	78	37	12	32	77	41	7	17	32	15	3	20	187	93	22	24
1997	50	36	9	25	30	38	4	11	76	48	7	15	156	122	20	16
1999	66	58	17	29	55	41	6	15	29	17	2	12	150	116	25	22
2003	11	7	5	71	234	149	39	26	9	22	6	27	254	178	50	28
2005	25	12	5	42	136	137	13	9	15	8	1	13	176	157	19	12
Nickerson																
1987	145	177	15	8	25	15	1	7	140	102	3	3	310	294	19	6
1991	90	96	8	8	47	39	6	15	63	65	4	6	200	200	18	9
1994	276	196	32	16	104	59	12	20	120	93	13	14	501	348	57	16
1995	241	165	54	33	23	4	1	25	58	15	1	7	322	184	56	30
1997	70	122	26	21	12	12	3	25	48	29	4	14	130	163	33	20
1999	121	98	31	32	24	19	5	26	75	43	7	16	220	160	43	27
2003	25	18	8	44	104	110	29	26	193	169	37	22	322	297	74	25
2005	24	61	5	8	107	145	21	14	150	191	32	17	282	397	58	15

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.
[d] M = number of fish marked on marking run; C = total number of fish captured on recapture run; R = number of recaptured fish on recapture run.
[e] ND = no data; no recapture runs due to equipment failure.

Table 5. Estimated abundance (N) of age-1 and older cutthroat trout (≥100 mm), rainbow trout (≥100 mm), brook trout (≥150 mm), and all trout (≥100 mm) at the Breckenridge and Nickerson electrofishing sections, Teton River, Idaho, 1987-2005. Ninety-five percent confidence intervals (1.96 x SD) are in parentheses.

First marking date	Cutthroat trout[a]		Rainbow trout[b]		Brook trout		All trout[c]	
	N/section	N/km	N/section	N/km	N/section	N/km	N/section	N/km
Breckenridge								
10/1/87	245[d] (168)	50[d] (34)	2,124[d] (1,382)	433[d] (282)	NUE[e]	NUE	3,520 (1,354)	718 (276)
10/3/91	NE[f]	NE	NE	NE	NE	NE	NE	NE
8/30/94	213 (66)	43 (14)	1,023 (126)	209 (26)	NUE	NUE	1,340 (135)	273 (28)
9/14/95	235 (84)	48 (17)	349 (180)	71 (37)	NUE	NUE	744 (169)	152 (34)
9/23/97	199 (72)	41 (15)	204[d] (138)	42[d] (28)	604 (299)	123 (61)	1,357 (266)	277 (54)
9/28/99	316 (84)	64 (17)	485 (245)	99 (50)	NUE	NUE	937 (187)	191 (38)
8/29/03	15[d] (4)	3[d] (1)	1,405 (266)	287 (54)	32[d] (10)	7[d] (2)	1,364 (213)	278 (43)
9/8/05	55[d] (27)	11[d] (5)	2,375 (895)	485 (183)	NUE	NUE	2,369 (672)	483 (137)
Nickerson								
9/11/87	1,851 (563)	319 (97)	NUE	NUE	NUE	NUE	4,985 (1,200)	859 (207)
9/12/91	1,628 (788)	281 (136)	317 (161)	55 (28)	695[d] (510)	120[d] (88)	2,879 (635)	496 (110)
9/9/94	2,200 (484)	379 (83)	533 (189)	92 (33)	849 (312)	146 (54)	3,647 (420)	629 (72)
9/27/95	814 (99)	140 (17)	NUE	NUE	NUE	NUE	1,217 (139)	210 (24)
9/2/97	479 (108)	83 (19)	NUE	NUE	253[d] (173)	44[d] (30)	996 (187)	172 (32)
8/31/99	645 (134)	111 (23)	82[d] (45)	14[d] (8)	499 (292)	86 (50)	1,133 (141)	195 (24)
9/3/03	52[d] (19)	9[d] (3)	504 (80)	87 (14)	956 (189)	165 (33)	1,569 (166)	271 (29)
9/7/05	257[d] (159)	44[d] (27)	933 (169)	161 (29)	879 (173)	152 (30)	1,960 (211)	338 (36)

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.
[d] Modified Peterson rather than log-likelihood estimate.
[e] NUE = no unbiased estimate possible as R≤3 (Ricker 1975).
[f] NE = no estimate; no recapture runs due to equipment failure.

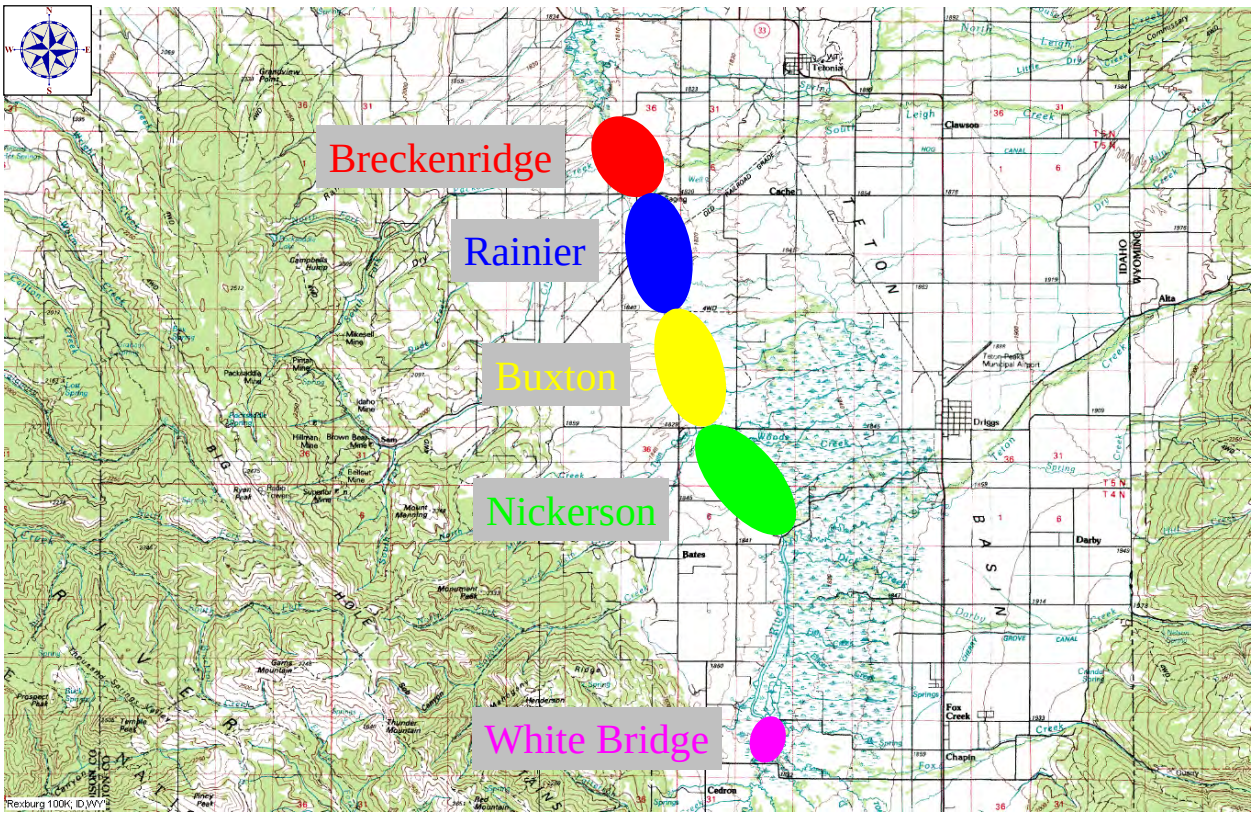
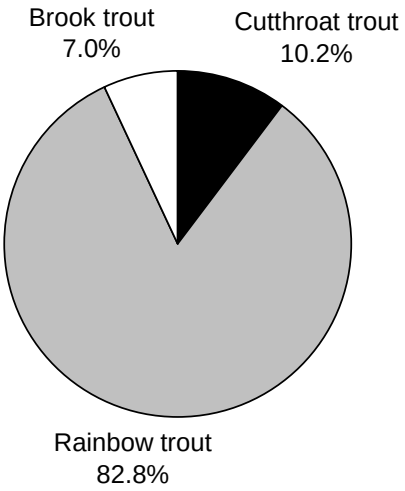


Figure 1. Map of Teton Valley showing IDFG electrofishing sections in the Teton River, Idaho.

Breckenridge Section



Nickerson Section

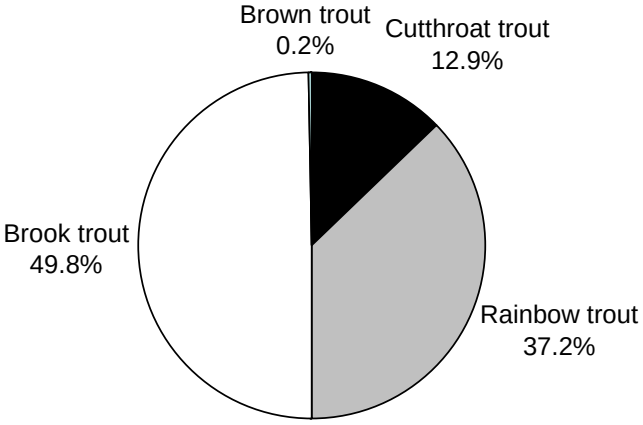


Figure 2. Trout species composition and relative abundance at the Breckenridge (top, n = 314) and Nickerson (bottom, n = 621) electrofishing sections, Teton River, Idaho, 2005.

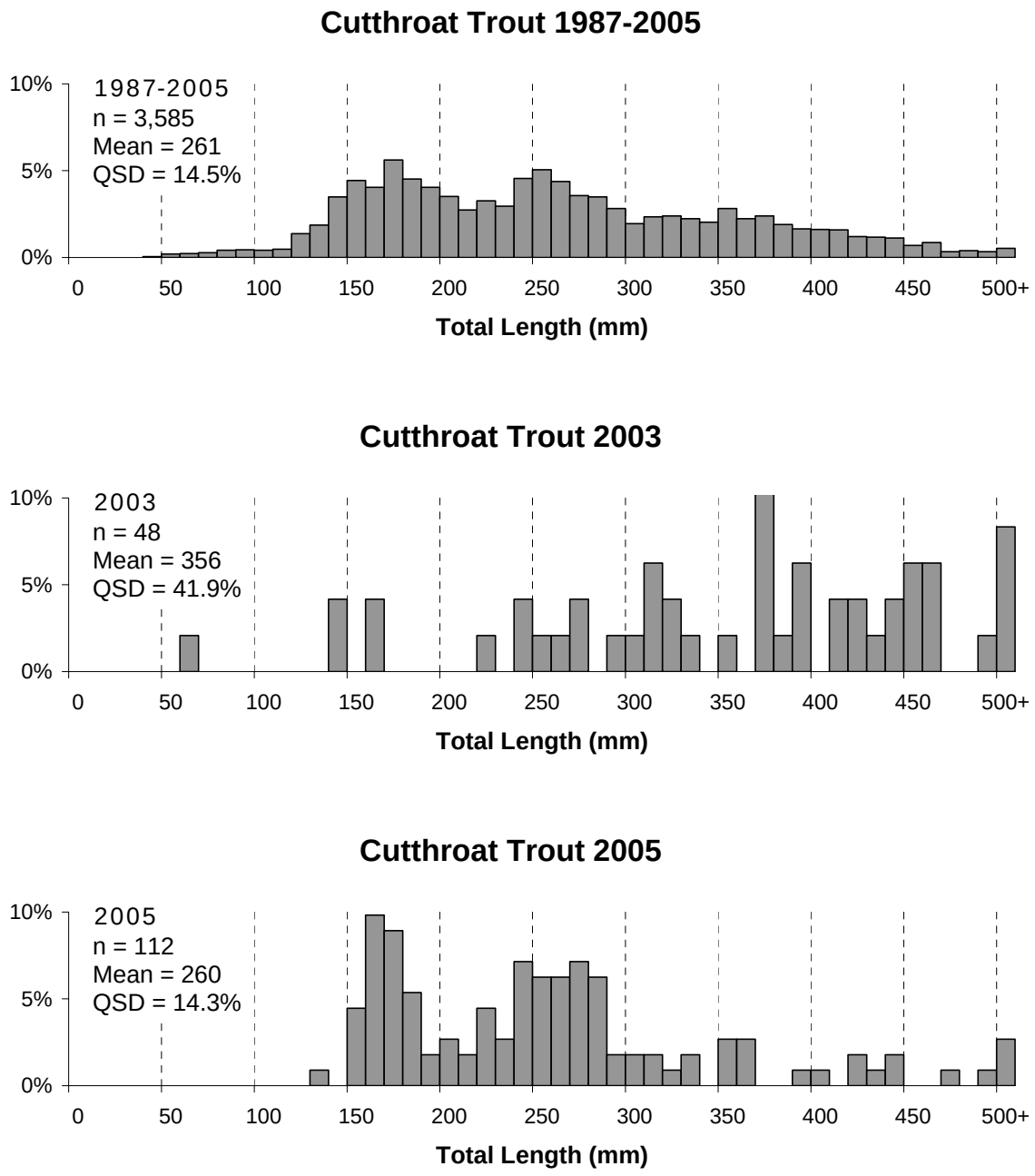


Figure 3. Length frequency distributions of cutthroat trout captured at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2005. Total individual fish captured during mark and recapture runs = n.

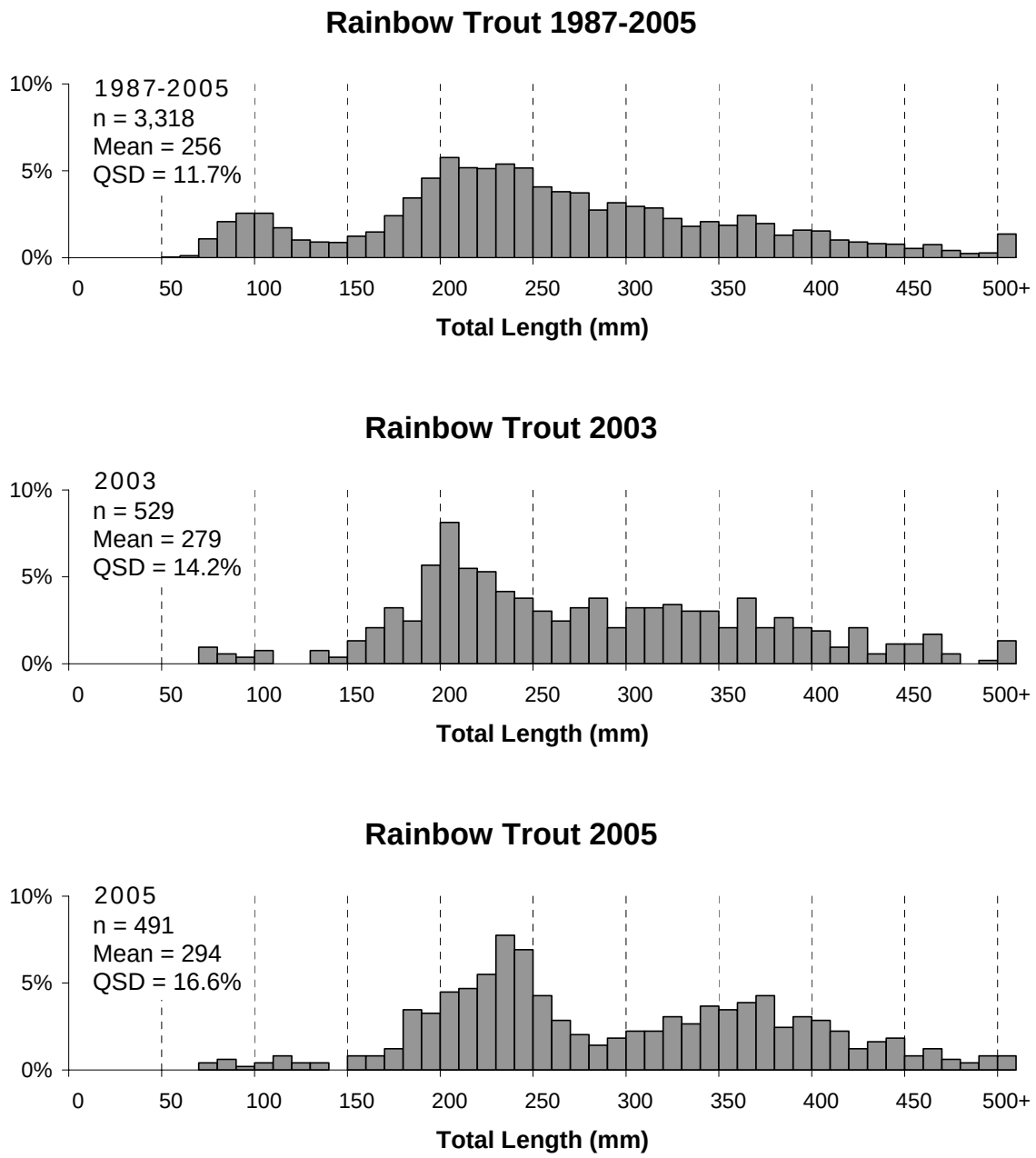


Figure 4. Length frequency distributions of rainbow trout captured at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2005. Total individual fish captured during mark and recapture runs = n.

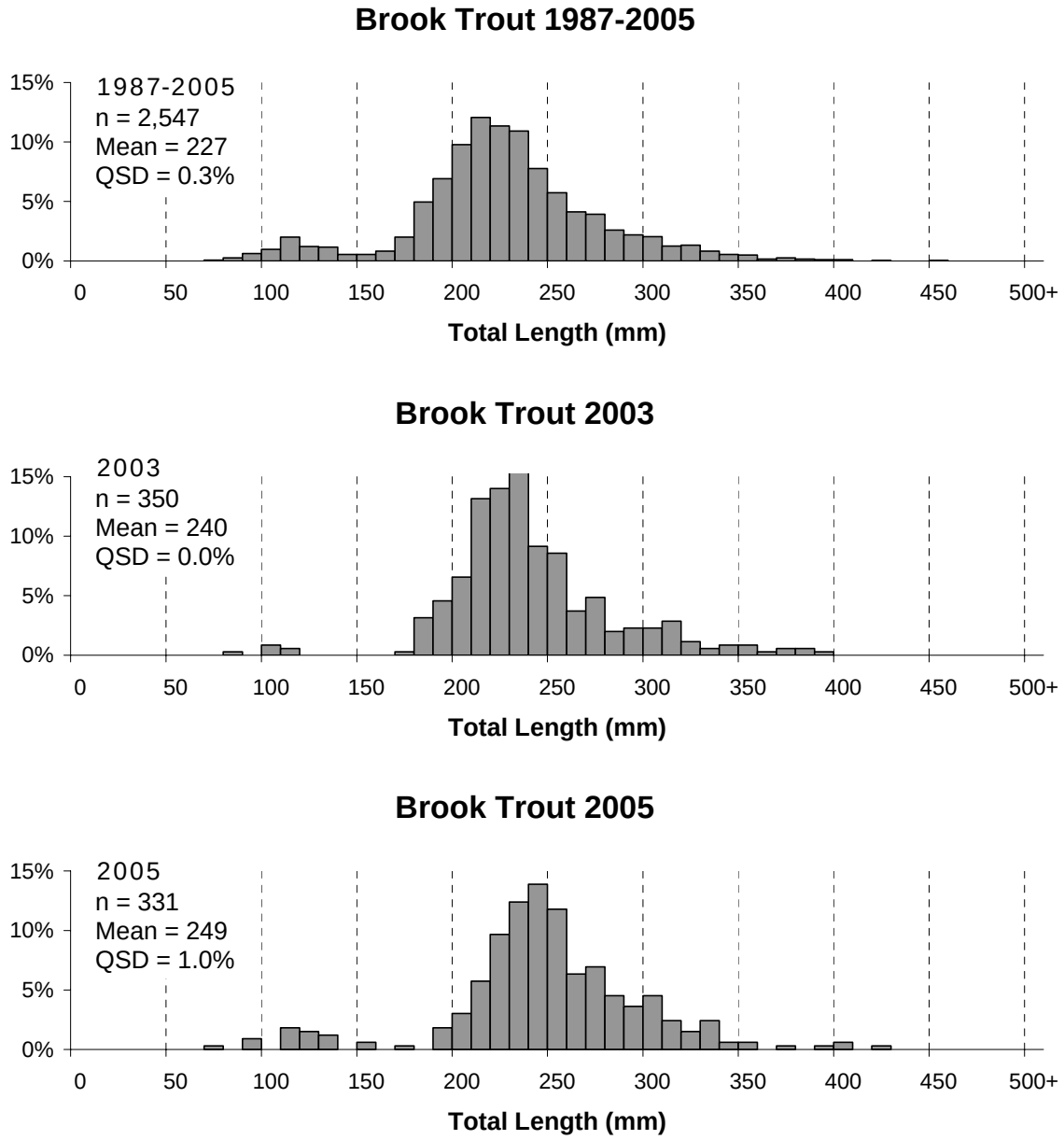


Figure 5. Length frequency distributions of brook trout captured at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2005. Total individual fish captured during mark and recapture runs = n.

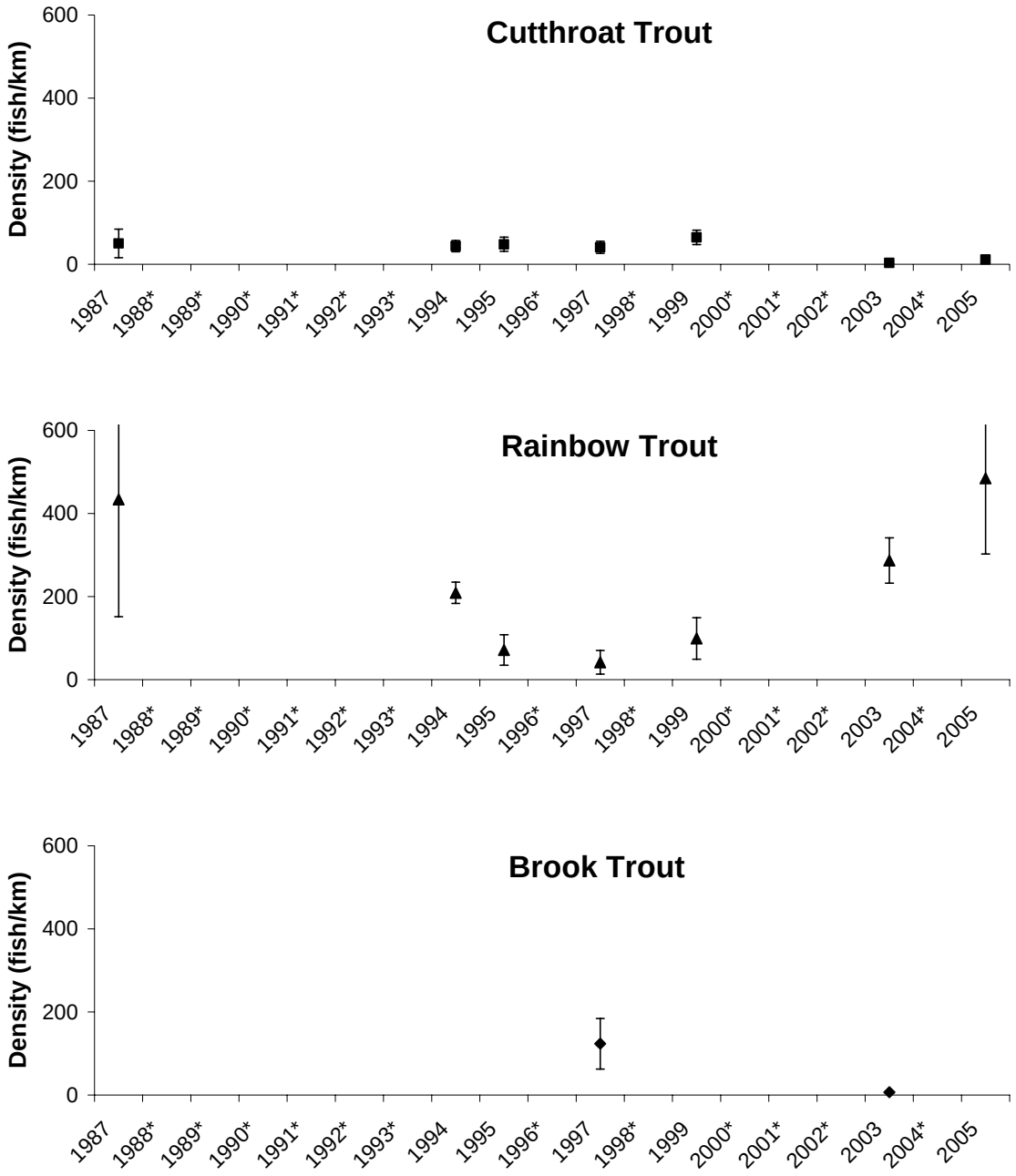


Figure 6. Estimated densities of age-1 and older cutthroat, rainbow, and brook trout at the Breckenridge electrofishing section, Teton River, Idaho, 1987-2005. Asterisks denote years when no estimates were possible.

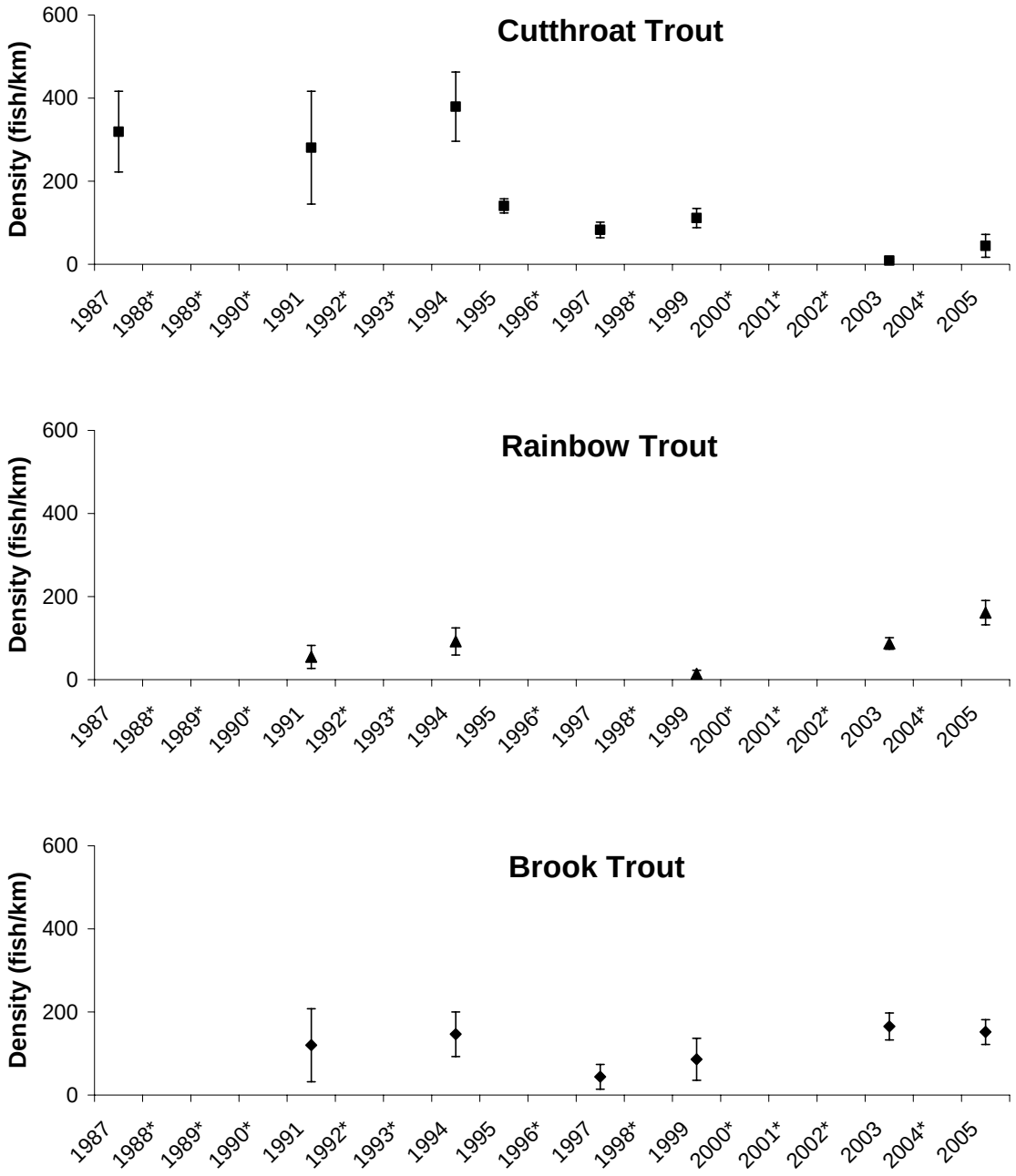


Figure 7. Estimated densities of age-1 and older cutthroat, rainbow, and brook trout at the Nickerson electrofishing section, Teton River, Idaho, 1987-2005. Asterisks denote years when no estimates were possible.

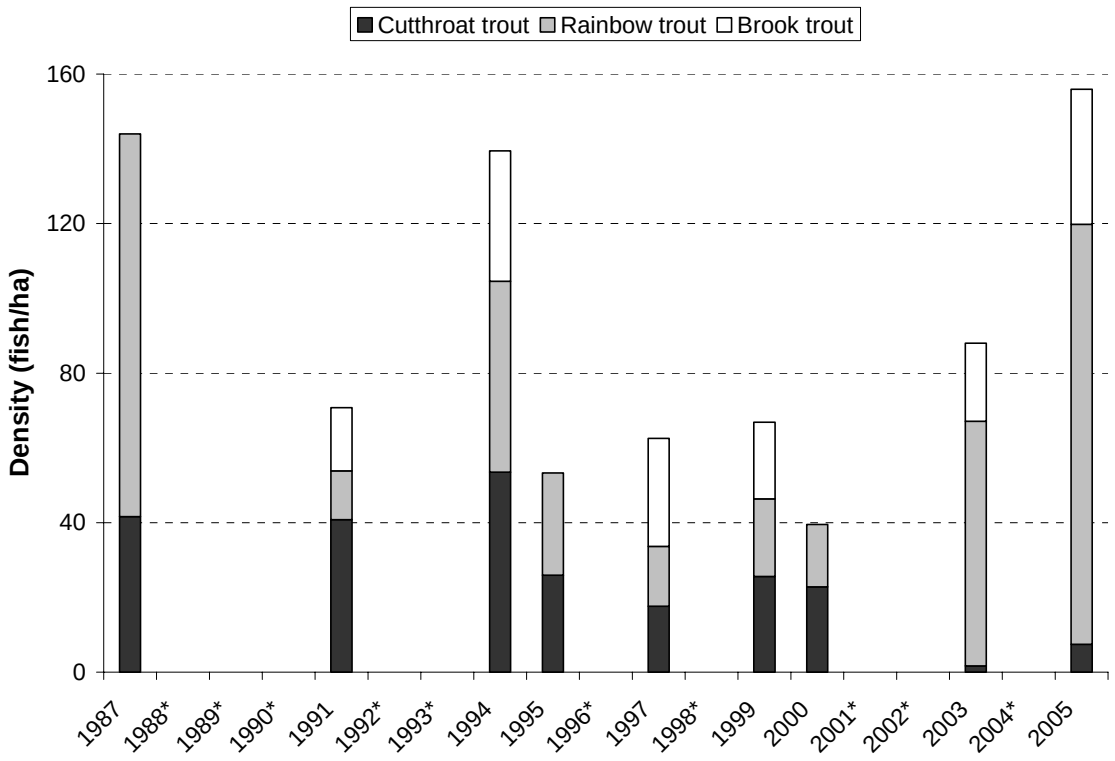


Figure 8. Age-1 and older cutthroat, rainbow, and brook trout density (fish/ha) averaged over all Teton Valley electrofishing sections except White Bridge, Teton River, Idaho, 1987-2005. Unbiased brook trout density estimates were not possible in 1987, 1995, and 2000.

SMALL STREAM SURVEYS

ABSTRACT

We measured species composition and estimated trout densities in the Medicine Lodge, Beaver Creek and Camas Creek drainages in June, 2005. Of the 81 randomly-selected sites through these drainages, 25 sites (31%) were dry. We found no fish in 19% of our sites while 41 sites (51%) had fish present. Trout were found in 47% of all sample locations. We found Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* in 13 of our sample sites, five of which had Yellowstone cutthroat trout in combination with brook trout *Salvelinus fontinalis*, rainbow trout *O. mykiss* or rainbow trout x cutthroat trout hybrids. Trout densities ranged from 0.3-29 fish per 100 m^2. Streams in the Medicine Lodge drainage with allopatric populations of Yellowstone cutthroat trout were Fritz Creek, Indian Creek and Webber Creek. Sites in the Beaver Creek drainage with allopatric populations of Yellowstone cutthroat trout were Dry Creek and Rattlesnake Creek. However, past surveys have documented nonnative species in all these streams. We found no allopatric populations of cutthroat trout in the Camas Creek Drainage.

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METHODS

Stream samples in the Sinks Drainages conducted in 2005 were a cooperative effort between the Upper Snake Region, Nampa Fisheries Research, the Henry's Fork Foundation and the United States Forest Service. Sample locations were selected by Nampa Research personnel, who identified perennial streams on a 1:100,000 land status map, then randomly selected stream reaches in each of the three drainages for sampling. Sample locations were distributed randomly across public and private land.

Fish inventories were performed with backpack electrofishers from June 27 to June 29. Sampling occurred during low to moderate flow conditions (after spring runoff and before the onset of winter) to facilitate effective fish capture and standardization of sampling conditions. Seven sample crews consisting of two to four people used backpack electrofishers and multiple-pass depletion methods to estimate trout abundance. All trout collected were identified, measured for total length and released outside the survey area. Sample reaches were standardized at 100 meters in length in most instances. Population estimates and 95% confidence intervals were estimated with MicroFish (2005) where appropriate. Capture efforts were focused on trout species, but at each site where they occurred, nongame fish were captured and identified to species. Fin clips were taken from all trout except brook trout for genetic analysis. Results from genetic analysis will be covered in a future Fisheries Research report.

RESULTS

A total of 81 stream surveys were completed in the three study drainages, including 35 sites in the Medicine Lodge drainage, 25 sites in the Beaver Creek drainage, and 21 sites in the Camas Creek drainage (Figure 1). Of the sites sampled in 2005, Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* were present at six (17%) of the sites in the Medicine Lodge drainage, five (20%) of the sites in the Beaver Creek drainage and 2 (10%) of the sites in the Camas Creek drainage (Table 1). Allopatric populations of Yellowstone cutthroat trout were found in 9% and 20% of the samples in the Medicine Lodge and Beaver Creek drainages, respectively (Figure 2). No allopatric populations were found in the Camas Creek drainage. Sites with only cutthroat trout were found in Fritz Creek, Indian Creek and Webber Creek in the Medicine Lodge drainage, and Dry Creek and Rattlesnake Creek in the Beaver Creek drainage. Overall, 31% of sample locations were dry, 19% were fishless, and 51% had fish present. We found trout in 47% of our sample reaches, with Yellowstone cutthroat trout found in 16% of sample locations. Overall trout densities (fish per $100m^2$) ranged from 0.3 – 29 (Table 2).

DISCUSSION

Although we identified several stream reaches with allopatric populations of Yellowstone cutthroat trout, the possibility exists that other species were present but not detected in the samples. Because our samples were short (about 100 m in length), it is possible our results do not reflect the overall species composition in each stream. Our surveys have identified several streams where native salmonids have been replaced by nonnative fish. Some of these streams

may provide opportunities to increase the distribution of native salmonids through their historic range by chemical renovation of existing populations and replacement with native trout. Streams where native trout are absent that also are disconnected from other streams or have migration barriers such as a dam or natural blockage preventing immigration of nonnative trout may provide the most effective avenue for restoration efforts.

RECOMMENDATIONS

1. Re-survey Fritz Creek, Indian Creek and Webber Creek in the Medicine Lodge drainage to evaluate species composition.

2. Re-survey Dry Creek and Rattlesnake Creek in the Beaver Creek drainage to evaluate species composition.

3. Evaluate renovation potential on streams containing only nonnative species that also have fish passage barriers. Consider renovating and restocking with native species as time and public support warrant.

Figure 1. Sample locations for stream surveys conducted in 2005 in the Medicine Lodge, Beaver and Camas Creek drainages, Idaho.

Table 1. Summary statistics for streams sampled in the Upper Snake Region, 2005.

Drainage	No. Sampled	Dry Channel	No Fish	Fish Present	Trout Present	Native and Nonnative Trout	Native Trout Only	Density (trout/100m^2)
Medicine Lodge	35	15	7	13	11	3	3	0.3-19
Beaver Creek	25	8	5	12	11	0	5	0.5-27
Camas Creek	21	2	3	16	16	2	0	0.5-29

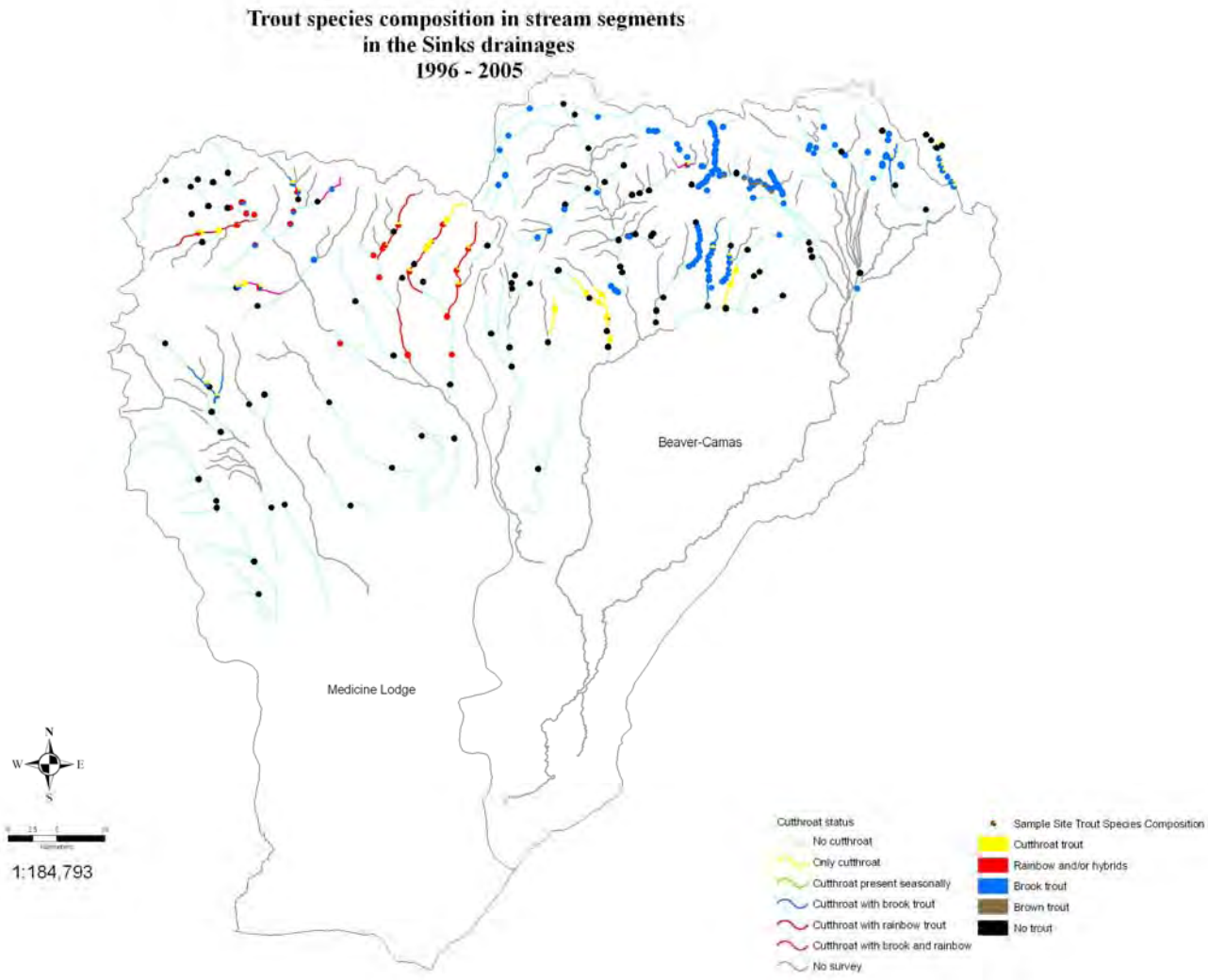

Figure 2. Historic stream sampling locations (1995-2005) and species present in the Beaver-Camas and Medicine Lodge drainages, Idaho.

Table 2. Stream locations sampled in the Upper Snake River Region during 2005.

Location	Major Drainage	Minor Drainage	Water Present	Species Present[a] (Relative Abundance of Trout)			Abundance Estimate (Trout >100mm)	Abundance Estimate (All Trout)	Density (trout per 100m^2)
Snakey Canyon	Medicine Lodge	Warm Springs	No	None			0	0	0
Chandler Canyon	Medicine Lodge	Warm Springs	No	None			0	0	0
Gallagher Canyon	Medicine Lodge	Chandler Canyon	No	None			0	0	0
Chandler Canyon 2	Medicine Lodge	Chandler Canyon	No	None			0	0	0
Campbell Gulch	Medicine Lodge	Campbell Gulch	No	None			0	0	0
Unnamed 6	Medicine Lodge	Warm Springs	No	None			0	0	0
Grouse Canyon	Medicine Lodge	Warm Springs	No	None			0	0	0
Blue Creek	Medicine Lodge	Blue Creek	Yes	None			0	0	0
Deep Creek	Medicine Lodge	Deep Creek	Yes	None			0	0	0
Unnamed Cr 13	Medicine Lodge	Unnamed 13	No	None			0	0	0
Unnamed Cr 14	Medicine Lodge	Unnamed	No	None			0	0	0
Corral Cr	Medicine Lodge	Indian Creek	Yes	None			0	0	0
E. Fork Indian Cr	Medicine Lodge	Indian Creek	Yes	HYB (56)	YCT (38)	RBT (6)	--	--	No estimate
Cabin Creek	Medicine Lodge	Indian Creek	Yes	None			0	0	0
Middle Creek	Medicine Lodge	Middle Creek	Yes	RBT (100)	SCL		3	4	1
Dry Creek	Medicine Lodge	Middle Creek	Yes	HYB (100)			1	1	0.5
Middle Cr Upper	Medicine Lodge	Middle Creek	Yes	SCL			0	0	0
Rocky Creek	Medicine Lodge	Middle Creek	No	None			0	0	0

Table 2. Continued.

Location	Major Drainage	Minor Drainage	Water Present	Species Present[a] (Relative Abundance of Trout)		Abundance Estimate (Trout >100mm)	Abundance Estimate (All Trout)	Density (trout per 100m^2)
Robertson Gulch	Medicine Lodge	Webber Creek	No	None		0	0	0
Edie Creek	Medicine Lodge	Edie Creek	Yes	BKT (100)	SCL	1	1	0.3
E. Fork Irving Cr	Medicine Lodge	Irving Creek	Yes	None		0	0	0
N. Fork Fritz Cr	Medicine Lodge	Fritz Creek	Yes	YCT (100)		9 (8-10)	20 (6-34)	6.7
S. Fork Fritz Cr	Medicine Lodge	Fritz Creek	Yes	None		0	0	0
Thunder Gulch	Medicine Lodge	Thunder Gulch	No	None		0	0	0
Cottonwood Creek	Medicine Lodge	Cottonwood Cr	Yes	None		0	0	0
Lower Cottonwood Cr	Medicine Lodge	Cottonwood Cr	Yes	None		0	0	0
Unnamed 30	Medicine Lodge	Cottonwood Cr	No	None		0	0	0
Patelzick Creek	Medicine Lodge	Patelzick Creek	No	None		0	0	0
Dry Creek 32	Beaver Creek	Dry Creek	Yes	None		0	0	0
Dry Creek 33	Beaver Creek	Dry Creek	No	None		0	0	0
Dry Creek Lower	Beaver Creek	Dry Creek	Yes	YCT (100)		2	2	0.5
Dry Creek Upper	Beaver Creek	Dry Creek	Yes	YCT (100)	SCL	20 (16-24)	33 (24-42)	12.6 (9-16)
East Dry Creek	Beaver Creek	Dry Creek	Yes	YCT (100)		9 (8-10)	24 (19-29)	16 (13-19)
Telephone Creek	Beaver Creek	Dairy Creek	No	None		0	0	0
Left Fork Cr	Beaver Creek	Dairy Creek	No	None		0	0	0
Sheep Creek	Beaver Creek	Sheep Creek	No	None		0	0	0

Table 2. Continued.

Location	Major Drainage	Minor Drainage	Water Present	Species Present[a] (Relative Abundance of Trout)		Abundance Estimate (Trout >100mm)	Abundance Estimate (All Trout)	Density (trout per 100m^2)
Sheep Creek Upper	Beaver Creek	Sheep Creek	No	None		0	0	0
Beaver Creek	Beaver Creek	Beaver Creek	Yes	None		0	0	0
Long Creek	Beaver Creek	Long Creek	Yes	BKT (100)	SCL	15 (10-20)	16 (13-19)	10 (8-12)
Long Creek 2	Beaver Creek	Long Creek	Yes	SCL		0	0	0
Beaver Creek 2	Beaver Creek	Beaver Creek	No	None		0	0	0
Beaver Creek 3	Beaver Creek	Beaver Creek	Yes	BKT (100)	SCL	18 (16-20)	18 (16-20)	21 (19-23)
Modoc Creek	Beaver Creek	Modoc Creek	Yes	BKT (100)	SCL	2	2	0.5
Modoc Creek 2	Beaver Creek	Modoc Creek	Yes	BKT (100)	SCL	7 (6-8)	8 (6-10)	7 (5-9)
West Modoc Cr	Beaver Creek	Modoc Creek	Yes	BKT (100)		15 (14-16)	16 (15-17)	9 (8-10)
West Camas Cr	Camas Creek	Camas Creek	Yes	None		0	0	0
Pete Creek	Camas Creek	Pete Creek	Yes	BKT (100)		11	11	3
Bear Gulch Upper	Camas Creek	Bear Gulch	Yes	BKT (100)		12 (11-13)	21 (11-31)	14 (7-21)
Bear Gulch Lower	Camas Creek	Bear Gulch	Yes	BKT (100)		3 (3-11)	27 (25-29)	22 (20-24)
Corral Creek Lower	Beaver Creek	Rattlesnake Cr	Yes	YCT (100)		17	32 (30-34)	10 (10-11)
Corral Creek Middle	Beaver Creek	Rattlesnake Cr	Yes	YCT (100)		22 (16-28)	53 (41-65)	27 (20-33)
Corral Creek Upper	Beaver Creek	Rattlesnake Cr	Yes	None		0	0	0
Rattlesnake Creek	Beaver Creek	Rattlesnake Cr	No	None		0	0	0
Rattlesnake Creek 2	Beaver Creek	Rattlesnake Cr	No	None		0	0	0

Table 2. Continued.

Location	Major Drainage	Minor Drainage	Water Present	Species Present[a] (Relative Abundance of Trout)				Abundance Estimate (Trout >100mm)	Abundance Estimate (All Trout)	Density (trout per 100m^2)
East Camas	Camas Creek	Camas Creek	Yes	BKT (100)				21 (12-30)	25 (11-39)	6 (3-10)
East Camas Lower	Camas Creek	Camas Creek	Yes	BKT (100)				17 (15-19)	31 (27-35)	8 (7-9)
Pasture Creek	Camas Creek	Camas Creek	Yes	BKT (100)				20 (19-21)	21 (20-22)	11 (10-11)
Little Creek	Medicine Lodge	Cottonwood Cr	Yes	BKT (100)				22 (20-24)	23 (21-25)	19 (17-21)
Ching Creek	Medicine Lodge	Cottonwood Cr	Yes	BKT (100)				1	1	1
Lower Moose Cr	Camas Creek	Dry Creek	No	None				0	0	0
Middle Moose	Camas Creek	Dry Creek	Yes	BKT (100)				2	6 (5-7)	6 (5-7)
Scalp Creek	Camas Creek	Dry Creek	Yes	BKT (79)	YCT (21)	SCL		21 (14-28)	55 (39-71)	13 (9-17)
West Dry Cr Low	Camas Creek	Dry Creek	Yes	BKT (97)	YCT (3)	SCL	RSS	30 (28-32)	35 (31-39)	9 (8-10)
West Dry Cr 2	Camas Creek	Dry Creek	Yes	None				0	0	0
Allan Creek	Camas Creek	Allan Creek	Yes	BKT (100)				14 (12-16)	21 (17-25)	14 (11-17)
Castle Creek	Camas Creek	West Camas	Yes	None				0	0	0
Divide Creek	Medicine Lodge	Divide Creek	No	None				0	0	0
Fritz Creek	Medicine Lodge	Fritz Creek	Yes	YCT (33)	HYB (67)			3	3	3
Indian Creek	Medicine Lodge	Indian Creek	Yes	YCT (100)				4	5	4
Indian Creek Lower	Medicine Lodge	Indian Creek	Yes	YCT (69)	HYB (31)	SCL				No estimate
Irving Creek	Medicine Lodge	Irving Creek	Yes	SCL				0	0	0
Kay Creek	Camas Creek	Cottonwood Cr	Yes	BKT (100)				4	15	14

Table 2. Continued.

Location	Major Drainage	Minor Drainage	Water Present	Species Present[a] (Relative Abundance of Trout)		Abundance Estimate (Trout >100mm)	Abundance Estimate (All Trout)	Density (trout per 100m^2)
McGarry Creek	Camas Creek	McGarry Creek	Yes	BKT (100)		16 (15-17)	21	21
Pleasant Valley Cr	Beaver Creek	Pleasant Val. Cr	Yes	BKT (100)	SCL	20 (15-25)	30 (20-40)	12 (8-16)
Ramshorn Cr	Beaver Creek	Pleasant Val. Cr	Yes	None		0	0	0
Saw Creek	Camas Creek	East Camas	Yes	BKT (100)		1	1	0.5
School Sect. Cr	Beaver Creek	Pleasant Val. Cr	Yes	None		0	0	
Spruce Gulch	Camas Creek	East Camas	Yes	BKT (100)		35 (24-46)	57 (50-64)	22 (19-25)
Steel Creek	Camas Creek	West Camas	Yes	BKT (100)		11 (9-13)	26 (22-30)	29 (24-33)
Unnamed Kay Cr	Camas Creek	Cottonwood Cr	No	None		0	0	0
Unnamed Pete Cr	Camas Creek	West Camas	Yes	BKT (100)		0	6 (3-9)	4 (2-6)
Webber Creek 2	Medicine Lodge	Webber Creek	Yes	YCT (100)		1	1	0.3

[a] – Species definitions: YCT = Yellowstone cutthroat trout; BKT = brook trout; RBT = rainbow trout; HYB = hybrid (rainbow x cutthroat) trout; RSS = rosy side dace; SCL = sculpin

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