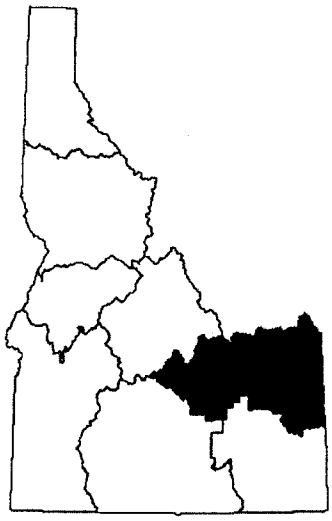
FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME

FISHERY MANAGEMENT ANNUAL REPORT

Cal Groen, Director



UPPER SNAKE REGION

2008

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2008 Upper Snake Region Annual Fisheries Management Report

HENRYS LAKE

ABSTRACT

We used 12 standard experimental gill nets (6 sinking, 6 floating) set at standard locations to assess fish populations and relative abundance in Henrys Lake during May 2008. We captured brook trout (BKT) *Salvelinus fontinalis*, Yellowstone cutthroat trout (YCT) *Oncorhynchus clarkii bouvieri*, hybrid trout (rainbow trout (RBT) *O. mykiss* x Yellowstone cutthroat trout) and Utah chub *Gila atraria*. Relative weight (W_r) for all trout species exceeded 100. Median catch rate for Utah chub decreased from 13.0 fish per net in 2007 to 0.5 fish per net in 2008, while mean catch rate increased from 20.3 to 50.5 chub per net between 2007 and 2008.

We monitored dissolved oxygen (D.O.) levels to assess the possibility of a winterkill event from December 17 through February 21. Based on depletion estimates, we predicted D.O. levels would diminish to the area of concern (10.0 g/m^3) by late winter; therefore, we operated the aeration system between March 26 and April 22, 2008.

The 2008 spawning operations at Henrys Lake produced 1,788,710 eyed YCT eggs and 470,161 eyed hybrid trout eggs. YCT in the Hatchery Creek run averaged 453 mm total length (TL), whereas hybrid trout averaged 526 mm. During the 2008 spawning run, 13% of the YCT returning to the ladder were adipose fin-clipped, indicating low levels of natural reproduction. Sterility tests from Henrys Lake hybrid trout production indicate a 98% induction rate. Pathology tests for viral or bacterial presence identified one positive result from a family of hybrid eggs, which was subsequently destroyed.

Riparian fencing was installed and maintained on Duck Creek and Kelly Springs Creek, as well as around the south and north side of the county boat dock. Fish screens were maintained on eleven irrigation diversions on Howard, Targhee, and Duck Creeks, and two new fish screens were installed on previously unscreened diversions on Howard and Targhee Creeks.

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METHODS

Population Monitoring

As part of routine population monitoring, we set gill nets at six standardized locations (Figure 1) in Henrys Lake from May 20 to May 23, 2008 for a total of 12 net nights. 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 used a one-way analysis of variance (ANOVA) to detect differences in gill net catch rates among data collected from 1993 to present. We also used a Kruskal-Wallis one-way analysis of variance to analyze gill net catch rates of Utah chub *Gila atraria,* as this species demonstrates schooling behavior, and are likely not randomly distributed.

To estimate contributions to the lake wide cutthroat trout population from natural reproduction, we examined all captured YCT for adipose fin clips and calculated the ratio of marked to unmarked fish collected in annual gill net surveys and in the spring spawning operation. Ten percent of all stocked YCT are marked with an adipose fin clip prior to stocking, therefore, a ratio of 10% or greater indicates low levels of natural reproduction.

We removed the saggital otoliths of all trout caught in our gill nets for age and growth analysis. After removal, all otoliths were cleaned on a paper towel and stored in individually-labeled envelopes. Ages were estimated by counting annuli under a dissecting microscope at 40x power. Otoliths were submerged in water and read in whole view when clear, distinct growth rings were present. We sectioned, polished and read otoliths in cross-section view with transmitted light when the annuli were not distinct in whole view. Aged fish were then plotted against length using a scatter plot, and any outliers were selected, re-read, and the ages corroborated by two readers.

W_r were calculated by dividing the actual weight of each fish (in grams) by a standard weight (W_s) for the same length for that species multiplied by 100 (Anderson and Neumann 1996). W_r were then averaged for each length class (< 200 mm, 200-299 mm, 300-399 mm and fish > 399 mm). We used the formula $\log W_s = -5.194 + 3.098 \log L$ (Anderson 1980) to calculate W_r of hybrid trout (rainbow trout *O. mykiss* x YCT), $W_s = -5.189 + 3.099 \log TL$ for cutthroat trout (Kruse and Hubert 1997) and $W_s = -5.186 + 3.103 \log TL$ for BKT (Hyatt and Hubert 2001).

We calculated proportional stock density (PSD) and relative stock density (RSD) to describe the size structure of game fish populations in Henrys Lake. We calculated PSD for YCT, hybrid trout, and BKT using the following equation:

$$PSD = \frac{\text{number} \geq 300 \text{ mm}}{\text{number} \geq 200 \text{ mm}} * 100$$

We calculated RSD-400 for YCT, hybrid trout, and BKT using the following equation:

$$\text{RSD-400} = \frac{\text{number} \geq 400\text{ mm}}{\text{number} \geq 200\text{ mm}} * 100$$

The criteria used for PSD and RSD-400 values for YCT, hybrid trout, and BKT (BKT) populations was based on past calculations and kept consistent for comparison purposes. This methodology is used on other regional waters to provide comparison between lakes and reservoirs throughout the Upper Snake Region.

Zooplankton samples were collected at three standard locations distributed through the lake (Targhee Creek, Outlet, and Wild Rose) (Figure 1) with three separate nets fitted with small (153 :), medium (500:) and large (750:) mesh on July 29 and again on August 26. We preserved zooplankton in denatured ethyl alcohol at a concentration of 1:1 (sample volume: alcohol). After ten days in alcohol, phytoplankton were removed from the samples by re-filtering through a 153: mesh sieve. The remaining zooplankton were blotted dry with a paper towel and weighed to the nearest 0.1 g. Biomass estimates were corrected for tow depth and reported in g/m. We measured competition for food (or cropping impacts by fish) using the zooplankton productivity ratio (ZPR) which is the ratio of preferred (750:) to usable (500:) zooplankton. We also calculated the zooplankton quality index (ZQI) to account for overall abundance of zooplankton using the formula ZQI = (500: + 750:) * ZPR (Teuscher 1999).

Water Quality

We measured winter D.O. concentrations, snow depth, ice thickness and water temperatures at established sampling sites on Henrys Lake between December 2007 and March 2008 (Figure 1). 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 D.O. samples and estimated total g/m^3 of oxygen by averaging D.O. readings at ice bottom and one meter below ice bottom, and summing readings at subsequent one-meter intervals to the bottom. Once measurements were collected on at least three separate dates, we used linear regression to estimate when oxygen levels would deplete to the critical threshold for fish survival (10.0 g/m^3). Once the approximate date when D.O. levels will reach the critical threshold is determined, we can initiate aeration as needed.

Spawning Operation

We operated the Hatchery Creek fish ladder for the spring spawning run from February 18 through April 28. Fish ascending the ladder were identified to species and counted. We measured total length for a sub-sample (10%) of each group. YCT were produced using ripe females spawned into seven-fish pools and fertilized with pooled milt from seven males. Hybrid trout were produced with YCT 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. A random sample of 60 hybrid fry produced with this method were taken from the Mackay Hatchery and sent to the Eagle Fish Health Lab to test induction rates of sterilization. Hybrid trout eggs were shipped to Mackay and Ashton hatcheries for hatching,

rearing and subsequent release back into Henrys Lake and other Idaho waters. Cutthroat trout eggs were shipped to Mackay for hatching, rearing and release back into Henrys Lake.

We took disease samples from the spring spawning run. Ovarian fluids were collected from all female egg pools of YCT to detect bacterial disease presence. Random viral samples were taken from 25 seven-female egg pools in the spring run. A mixed-sex group of 60 adult YCT during the spring run were sacrificed for disease testing. All samples were sent to the Eagle Fish Health Laboratory for analysis.

Riparian Fencing and Fish Screening

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 2008 at ten sites on the tributaries of Henrys Lake. Two new riparian fences were installed along Duck Creek and Kelly Springs Creek. The fences were installed along previously unfenced riparian buffer areas. We routinely checked fencing during the summer and fall for proper voltage and function. Fences were let down and prepared for winter in November 2008.

Fish screens are located on eleven irrigation diversions on tributaries streams to Henrys Lake. Two new modular screens were installed during 2008; one on Howard Creek and one on Targhee Creek. Both new screens were installed on previously unscreened irrigation diversions. Screens were routinely maintained, cleaned and checked for proper operation during the summer and fall months of 2008. During the fall of 2008, all screens (aside from the two new screens and the screen on lower Duck Creek, which is scheduled for replacement in 2009) received major maintenance (replaced worn seals, bearings, and shafts).

RESULTS

Population Monitoring

We collected 763 fish in 12 net nights of gill net effort. Catch composition was 13% YCT, 6% hybrid trout, 2% BKT, and 79% Utah chub (Figure 2). YCT ranged from 230 to 570 mm TL (Figure 3), hybrid trout ranged from 260 to 590 mm (Figure 4), and BKT 300 to 390 mm (Figure 5). Mean length at age-3 was 418 mm, 466 mm and 375 mm for YCT, hybrid trout and BKT, respectively (Table 1). Gill net catch rate (fish per net night) for YCT during 2008 was 8.3 fish per net night (Figure 6). Hybrid trout (Figure 7) and BKT (Figure 8) catch rates were 3.6 and 1.2 fish per net night, respectively. Results from our gill net surveys showed 10 of 100 (10%) YCT were adipose-clipped (Table 2). The median catch rate for Utah chub was 0.5 fish per net night, lower than the median of 13 Utah chub per net night in 2007 (Figure 9). However, the mean number of Utah chub per net increased from 20.3 in 2007 to 50.5 in 2008 (Figure 10). Mean W_r for all trout species >200 mm exceeded 100 (Table 3). Between 2004 and 2008, W_r of all YCT larger than 200 mm has been greater than 100 (Figure 11). Zooplankton monitoring showed that preferred size zooplankton is not being cropped by fish (ZPR = 0.56) (Table 4) and that abundance of quality zooplankton is relatively high in Henrys Lake (ZQI = 1.23) (Figure 12).

Water Quality

Total D.O. diminished from 40.2 g/m^3 to 10.3 g/m^3 at the Pittsburgh Creek site, 29.9 g/m^3 to 8.0 g/m^3 at the County dock, 37.1 g/m^3 to 9.3 g/m^3 at the Wild Rose site, 12.4 g/m^3 to 11.0 g/m^3 at the Outlet, and 31.0 g/m^3 to 5.4 g/m^3 at the Hatchery (Table 5). Linear regressions based on the depletion rates recorded on these sampling events predicted D.O. levels would decline below 10.0 g/m^3 (our level of concern) before ice-out (Figure 13); therefore, we operated the Helixor aeration system between March 26 and April 22, 2008.

Spawning Operation

We collected 5,159 YCT that ascended the hatchery spawning ladder between February 18 and April 28, 2008. Of these, 62% were males and 38% were females; mean lengths were 446 and 462 mm respectively, with a combined mean length of 453 mm. Hybrid trout totaled 349 fish and consisted of 85% males and 15% females with mean lengths of 512 mm and 565 mm, respectively.

We collected 3,445,800 green eggs from 1,243 YCT females for a mean fecundity of 2,772 eggs per female. Eyed YCT eggs totaled 1,788,710 for an overall eye-up rate of 61%. We shipped all eyed YCT eggs to Mackay Hatchery where they were hatched, reared, and subsequently released back into Henrys Lake in the fall of 2008 as fingerlings. We committed 11 days to YCT spawning.

We collected 849,700 green eggs from 293 female YCT for hybrid trout production. Eyed hybrid trout eggs totaled 470,161 for an overall eye-up rate of 55%. We shipped 346,774 (74%) eyed hybrid trout eggs to Mackay Hatchery for hatching, rearing, and subsequent release into Henrys Lake in the fall of 2008, while 52,419 eggs (11%) were shipped to the Ashton Hatchery for hatching, rearing, and subsequent release into local waters. The remaining 70,968 surplus eggs were destroyed. Mean sterilization rates for hybrid trout were 98% during 2007. We devoted two days to production of hybrid eggs during 2008.

Disease sampling was completed on adult spawning fish during the spring run. Bacterial disease samples were taken during spawning from ovarian fluids of all families of eggs. Tray 1 of Lot 1 of the hybrid take was identified as positive for bacterial presence and was destroyed. All other lots tested were negative. Additional analysis and results are available in the Idaho Dept. of Fish and Game (IDFG) Resident Fish Hatcheries 2008 Annual Report (Frew 2008).

Riparian Fencing and Fish Screening

Electric fencing functioned well during the year. Voltages remained high throughout the season and riparian infringements by cattle were rare.

The fish screens functioned well during the summer of 2008 on Targhee and Howard Creeks, but were in need of routine maintenance. The Stockton fish screen on Targhee Creek was determined to be too small and plans were initiated to replace that screen. The Duck Creek rotary drum screens did not function as well. Seals and bearings were in need of replacement on several screens. Additionally, the lower Duck Creek screen was inoperable and plans were made to replace that screen in 2009.

During the fall of 2008, a major maintenance project was initiated on all of the screens in operation on the Henrys Lake tributaries. Seals, bearings, and drive shafts were replaced where needed. Additional seals were installed along the lower edge of screens to prevent fish escapement under the screens. Maintenance was completed by the IDFG Screen Shop located in Salmon.

Two new modular screens were installed on previously unscreened diversions. One was installed on Howard Creek on the Cole property and the other on Targhee Creek on the Clements property. Both screens were funded via a U.S. Fish and Wildlife Service (USFWS) FRIMA grant and Henrys Lake Foundation funds. The screens were fabricated and installed by the IDFG Screen Shop in Salmon.

DISCUSSION

Gill net catch rates for trout during 2008 were similar to the long-term average for all species, but significant differences between years were not identified. The low gill net effort in 2008 contributed to the high amount of sample variance observed in data collected in 2008. Weather conditions, specifically late ice cover, prohibited increased sampling effort prior to the opening of fishing season. Past research has identified increased gill net effort with decreased sample variation and an increase in sample accuracy. Future gill net sampling should include at least 50 net nights to reduce variation and allow for observable (statistical) changes in catch rates.

Median catch rates for Utah chub in our gill nets declined, but chub abundance contributed a larger portion of the total species composition of Henrys Lake this year compared to past years. However, meaningful inferences on Utah chub densities in 2008 are hampered by low gill net sample numbers and high variability among nets. Our data indicate that the Utah chub population in Henrys Lake may be increasing, but impacts to the fishery are unknown. Garren et al. (2008) documented some dietary overlap (scuds and daphnia) between Utah chub and trout in Henrys Lake, but competition for these food sources seems limited, as both occur in relatively high abundance. W_r for all trout species (>200 mm) were above 100 indicating sufficient food is present, and is not limiting growth (Flickinger and Bulow 1993). Further, monitoring during 2008 documented a high abundance of zooplankton, indicating that this food source is not being cropped by fish and suggesting competition is low. During 2008, nearly 1.65 million juvenile trout (1.23 million fingerling and 411,000 fry) were stocked into Henrys Lake. This equals 254 fish per acre, which is an appropriate stocking rate based on Teuscher's (1999) stocking guidelines using the zooplankton quality index (ZQI).

MANAGEMENT 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 and compare to previous years.
3. Continue winter D.O. monitoring, and implement aeration when necessary.
4. Continue to monitor Utah chub densities.
5. Examine stomach contents of BKT captured in gill nets to determine diet.
6. Conduct creel survey to evaluate angler use and harvest.

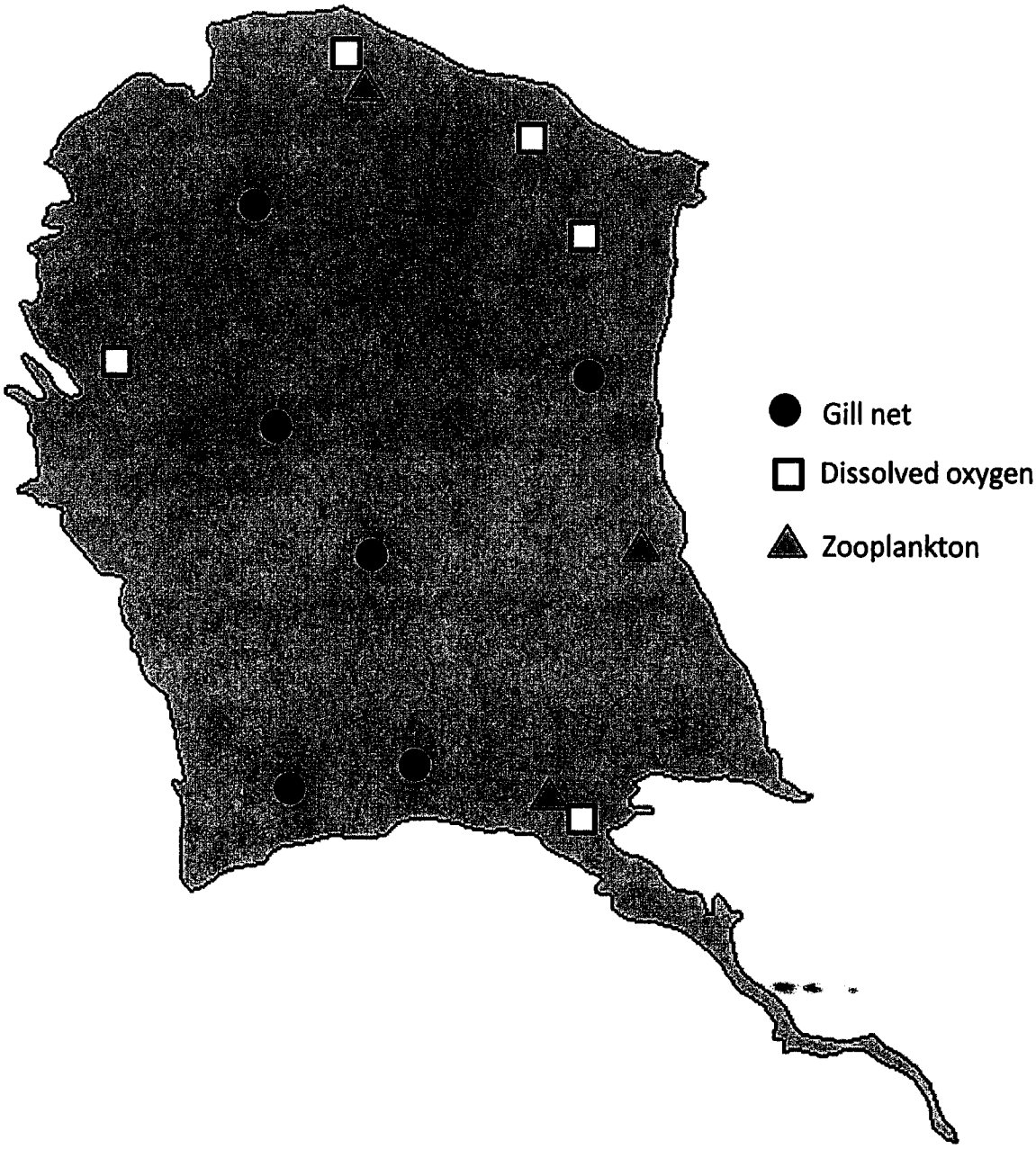

Figure 1. Spatial distribution of gill net, D.O., and zooplankton monitoring sites in Henrys Lake, Idaho, 2008.

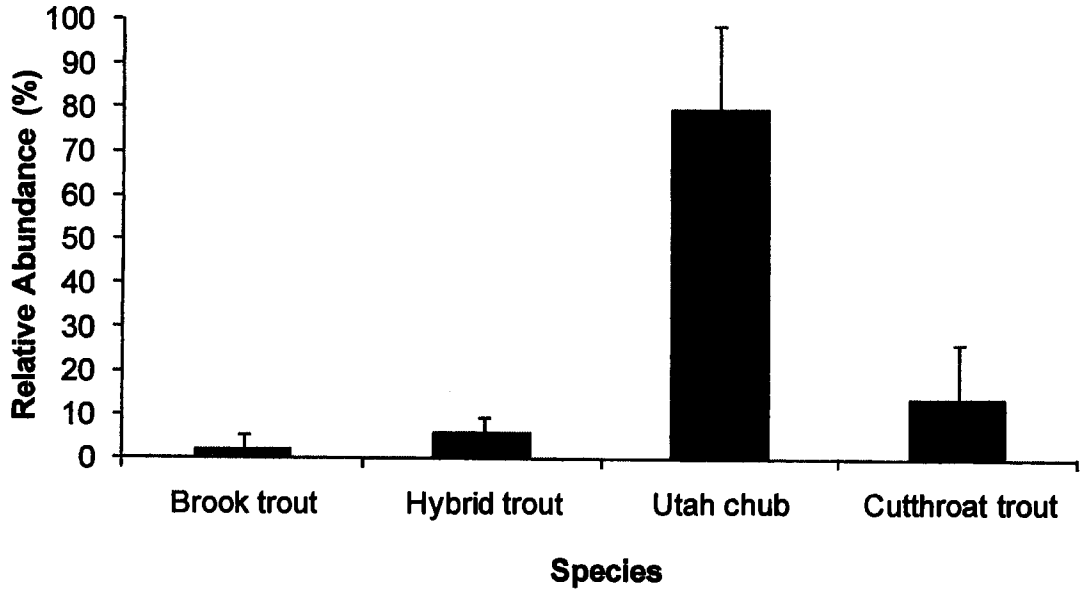

Figure 2. Relative abundance of fish caught in gill nets in Henrys Lake, 2008. Error bars represent 90% confidence intervals.

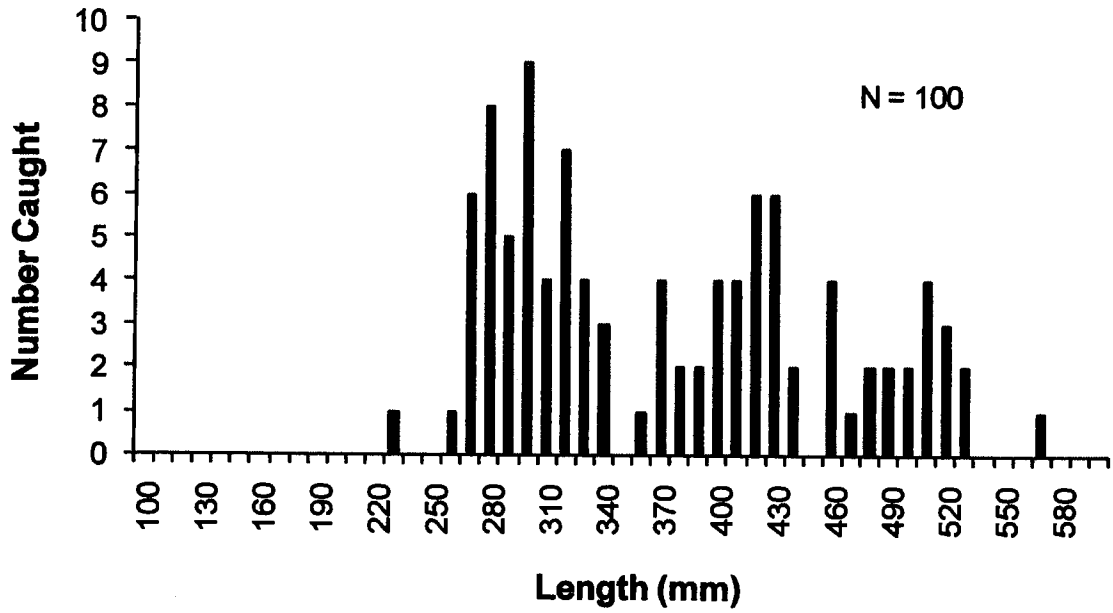

Figure 3. Yellowstone cutthroat trout length frequencies from gill nets set in Henrys Lake, Idaho, 2008.

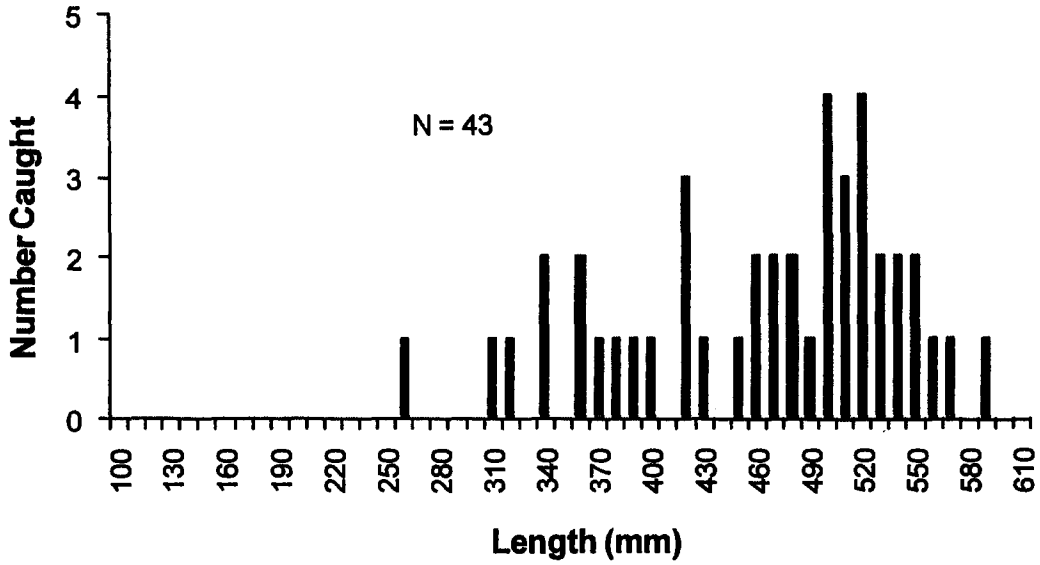

Figure 4. Hybrid trout length frequencies from gill nets set in Henrys Lake, Idaho, 2008.

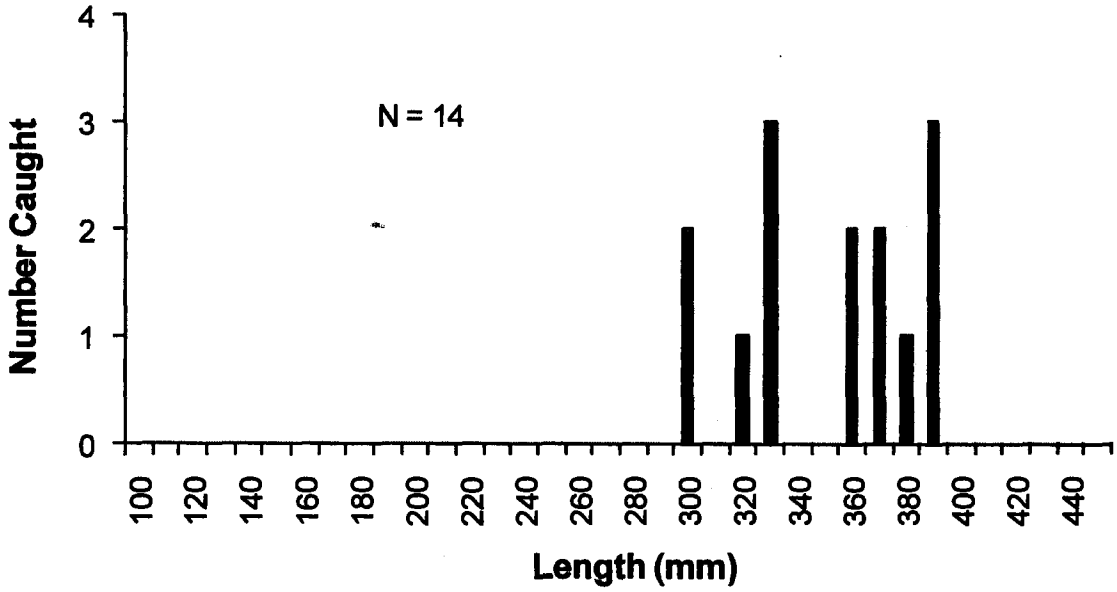

Figure 5. Brook trout length frequencies from gill nets set in Henrys Lake, Idaho, 2008.

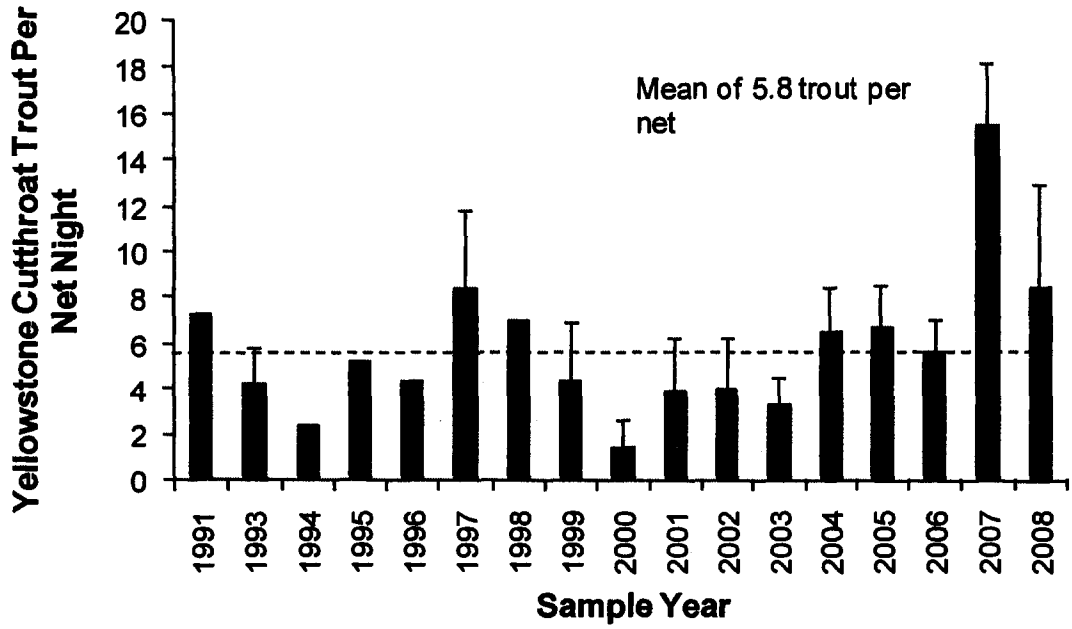

Figure 6. Yellowstone cutthroat trout catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present. Error bars represent 95% confidence intervals. The dashed line represents the mean catch rate (5.8 fish per net night) of Yellowstone cutthroat trout from 1991 to 2008.

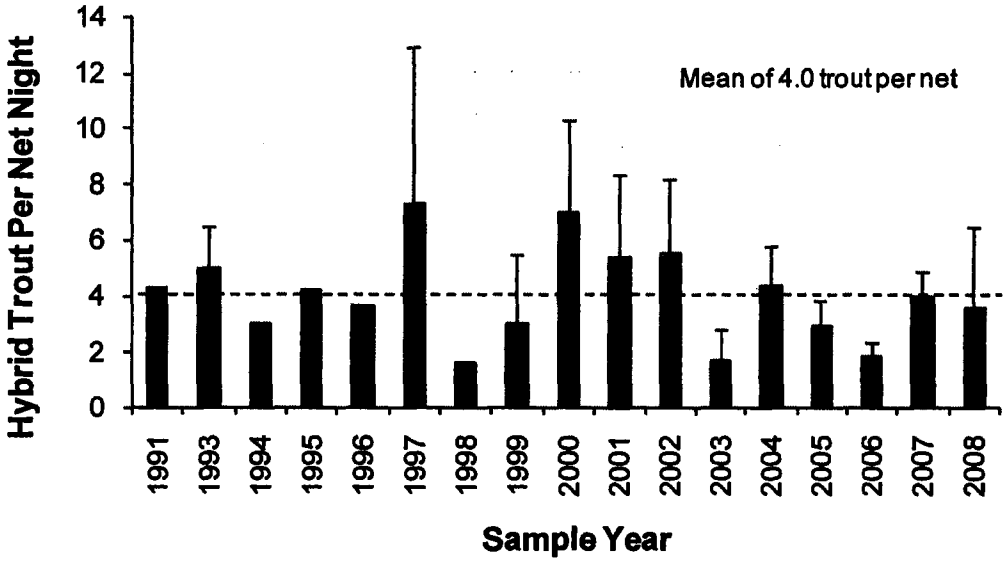

Figure 7. Hybrid trout catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present. Error bars represent 95% confidence intervals. The dashed line represents the mean catch rate (4.0 fish per net night) of hybrid trout (rainbow x cutthroat) from 1991 to 2008.

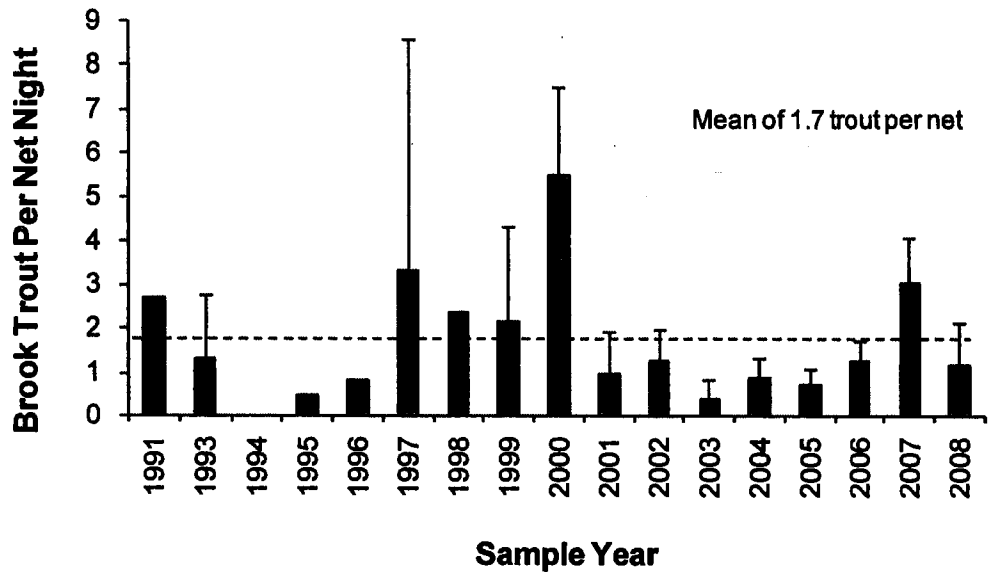

Figure 8. Brook trout catch rates in gill nets set in Henrys Lake, Idaho, 1991 to present. Error bars represent 95% confidence intervals. The dashed line represents the mean catch rate (1.7 fish per net night) of brook trout from 1991 to 2008.

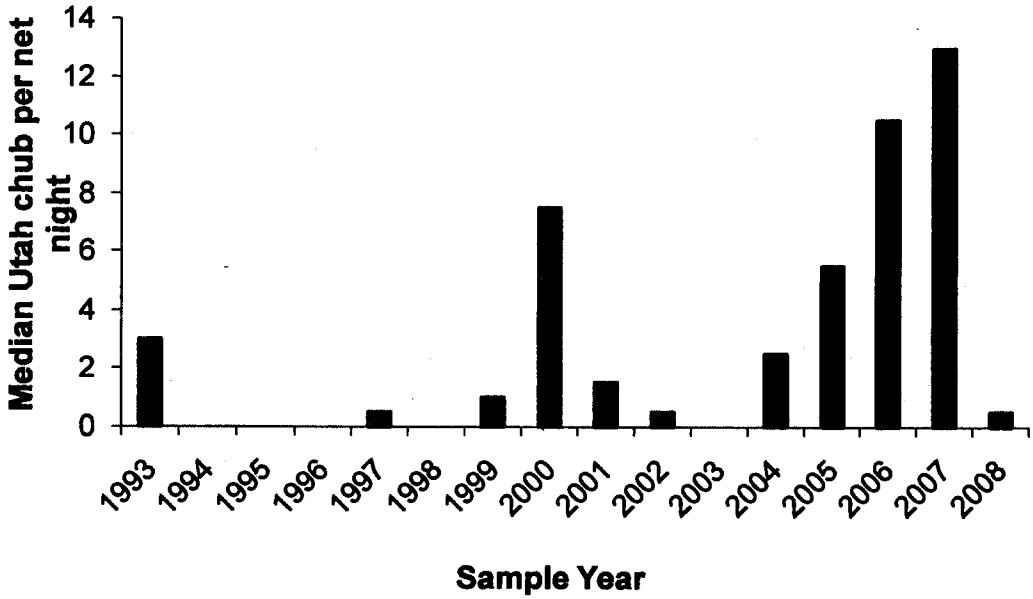

Figure 9. Median Utah chub catch rates in gill nets in Henrys Lake, Idaho 1993 to present.

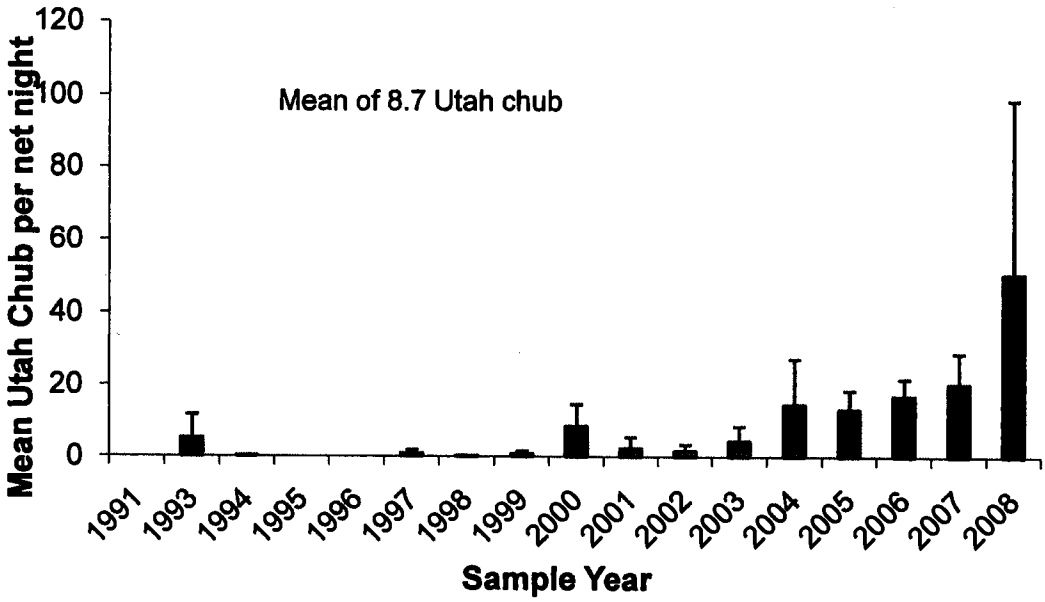

Figure 10. Mean Utah chub catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present. Error bars represent 95% confidence intervals.

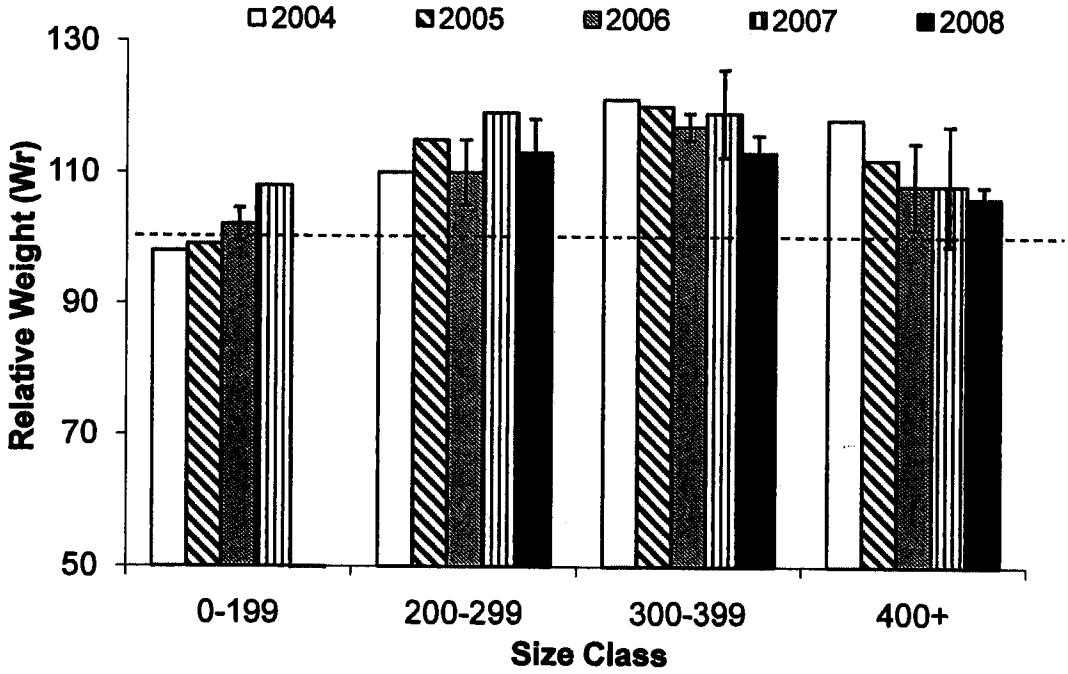

Figure 11. Relative weights (W_r) for Yellowstone cutthroat trout in Henrys Lake, Idaho 2004-2008. Error bars represent 95% confidence intervals.

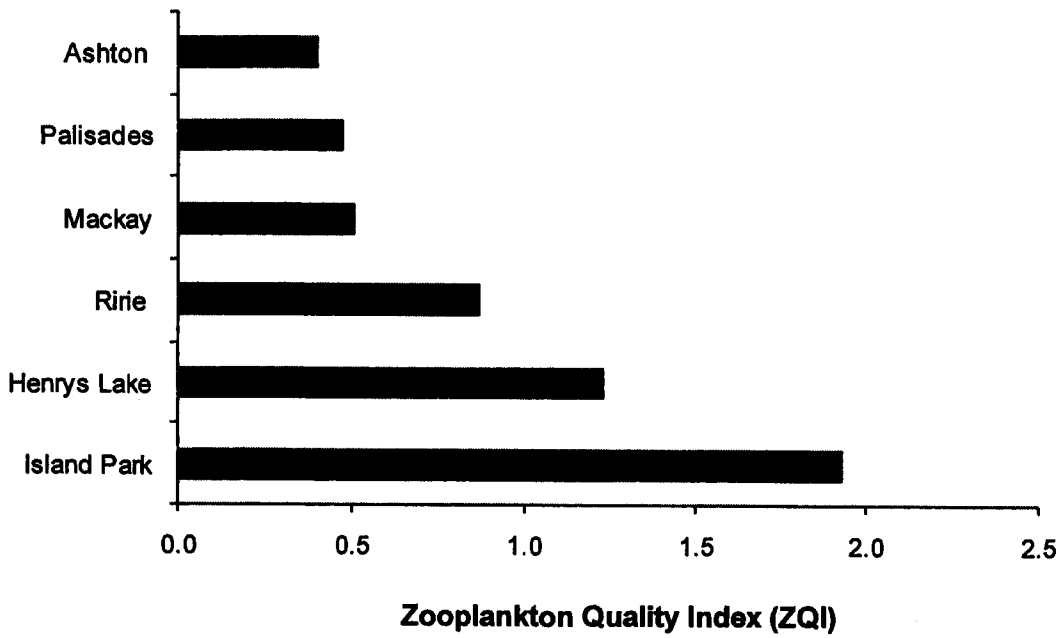

Figure 12. Zooplankton quality index (ZQI) for lakes and reservoirs in the Upper Snake Region, 2008.

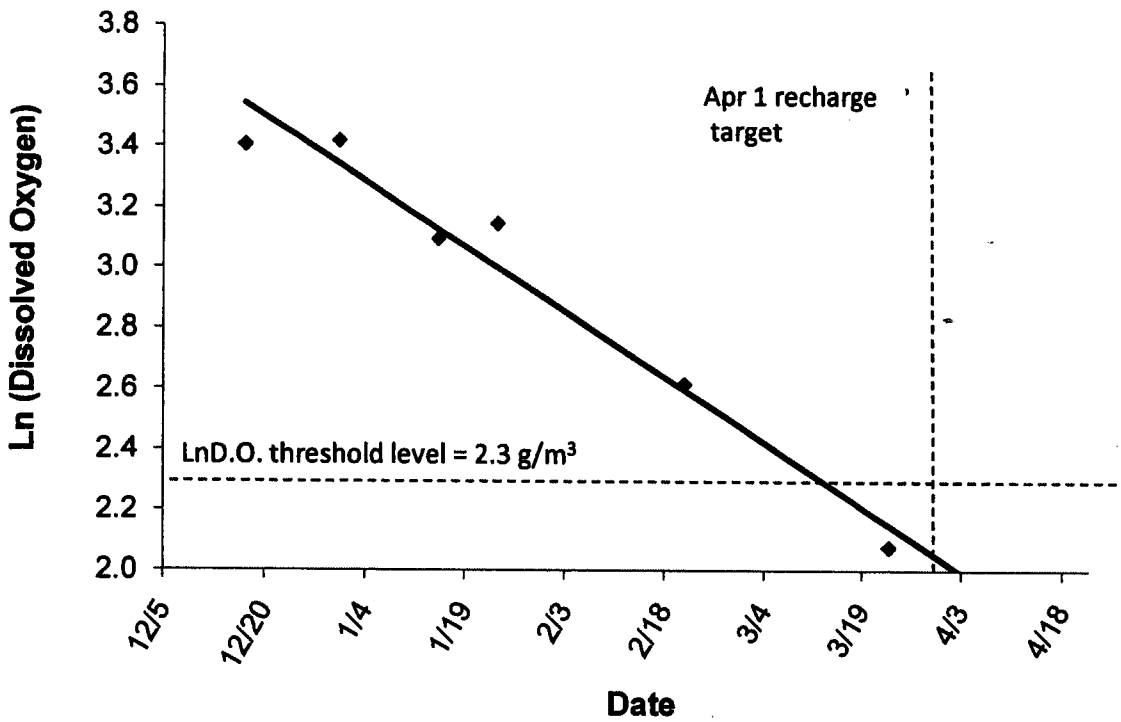

Figure 13. Summary of D.O. measurements from all sample locations and estimated lakewide oxygen depletion rate Henrys Lake, Idaho, 2007-2008.

Table 1. Mean length at age data from trout caught with gill nets in Henrys Lake, Idaho 2008. Ages were estimated using otoliths.

Species	Mean Length at Age (mm)			
	1	2	3	4
Yellowstone cutthroat trout	307	292	421	492
(No. Analyzed)	(1)	(54)	(24)	(10)
Hybrid trout	--	338	466	520
(No. Analyzed)	--	(9)	(38)	(5)
Brook trout	286	349	375	--
(No. Analyzed)	(2)	(10)	(2)	--

Table 2. 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 (Brook trout have not been clipped since 2005).

	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
1996	100,290	--	--	--	1,961	1	0	0%
1997	123,690	178	5	3%	2,044	11	1	9%
1998	104,740	--	--	--	2,067	--	--	--
1999	124,920	160	20	13%	--	48	5	10%
2000	100,000	14	1	7%	--	3	0	0%
2001	99,110	116	22	19%	--	30	6	20%
2002	110,740	38	7	18%	--	6	2	33%
2003[a]	163,389	106	37	35%	--	--	--	--
2003[b]		273	47	17%	--	--	--	--
2004[b]	92,100	323	28	8%	98,711	45	11	24%
2005[a]	85,124	2,138	629	29%	--	--	--	--
2005[c]		508	55	11%	15,176	34	5	14
2006[a]	100,000	2,455	944	39%	--	--	--	--
2006[c]		269	20	8%	--	60	4	7%
2007[b]	139,400	770	70	9.1%	--	--	--	--
2008[a]	125,451	4,890	629	12.9%	--	--	--	--
2008[b]		100	10	10.0%	--	14	0	0%

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

Table 3. Relative weights for all trout species collected with gill nets in Henrys Lake, Idaho 2008.

	Mean Relative Weight		
Species	200-299 mm	300-399 mm	> 399 mm
Yellowstone cutthroat trout	113	113	106
Hybrid trout	112	123	115
Brook trout	110	114	na

Table 4. Mean zooplankton biomass (g/m) by mesh size, preferred to usable (750:500) zooplankton ratio (ZPR), and zooplankton quality index (ZQI = [500+750]*ZPR) for reservoirs in the Upper Snake Region of Idaho, 2008.

	Net mesh (microns)				
Waterbody	153	500	750	ZPR	ZQI
Henrys Lake	3.63	1.40	0.79	0.56	1.23
Island Park Reservoir	0.99	0.68	0.85	1.26	1.93
Ashton Reservoir	0.45	0.26	0.22	0.84	0.40
Mackay Reservoir	2.09	0.48	0.31	0.64	0.51
Palisades Reservoir	0.50	0.25	0.24	0.95	0.47
Ririe Reservoir	1.20	0.61	0.48	0.79	0.87

Table 5. D.O. (DO) readings (mg/l) recorded in Henrys Lake, Idaho winter monitoring 2007-2008.

Location	Date	Snow depth (in)	Ice depth (in)	DO Ice bottom	DO 1 meter	DO 2 meters	DO 3 meters	Total g/m^3
Pittsburg Creek	Dec 17	7	9.5	12.3	11.5	11.2	10.1	40.2
	Dec 31	8	11	13.8	12.8	11.2	9.0	41.0
	Jan 15	2	--	14.4	12.0	9.8	7.2	34.5
	Jan 24	--	--	--	--	--	--	--
	Feb 21	14	21	11.0	9.0	4.9	2.1	17.3
County Boat Ramp	Dec 17	8.5	8.5	12.4	11.1	10.8	7.3	29.9
	Dec 31	5	13	13.9	13.2	11.1	7.3	32.0
	Jan 15	10	12	11.5	8.0	6.0	1.5	17.3
	Jan 24	6	15	11.7	6.4	6.4	3.9	19.4
	Feb 21	2	25	6.3	6.2	4.4	0.5	11.2
Wild Rose	Dec 17	10	9	12.9	12.4	12.3	9.6	37.1
	Dec 31	4	14	13.2	12.8	11.3	8.3	37.0
	Jan 15	6	12	11.2	9.9	6.3	5.0	24.4
	Jan 24	12	16	12.8	11.0	7.7	5.9	28.0
	Feb 21	17	22	10.4	7.7	4.9	3.8	18.1
Outlet Bay	Dec 17	3.5	11.5	7.5	8.1	4.6	--	12.4
	Dec 31	6	14	11.8	9.8	7.6	--	18.4
	Jan 15	16	12	6.2	5.9	3.1	1.8	11.0
	Jan 24	--	--	--	--	--	--	--
	Feb 21	--	--	--	--	--	--	--
Hatchery	Dec 17	8	7.5	11.3	10.8	10.5	9.4	31.0
	Dec 31	9	10	11.1	10.5	8.8	4.5	24.1
	Jan 15	13	14	11.7	9.2	7.9	4.9	23.3
	Jan 24	4	20	12.2	9.2	6.8	4.9	22.4
	Feb 21	7	25	5.9	4.6	2.5	0.2	8.0

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ASHTON RESERVOIR

ABSTRACT

We used six experimental gill nets (three floating, three sinking) to assess fish populations and relative abundance in Ashton Reservoir during July 2008. Mean catch (fish per net) was 7 RBT, 3 brown trout (BNT) *Salmo trutta*, 18 Utah sucker *Catostomus ardens*, 87 Utah chub, and 2 yellow perch *Perca flavescens*. Similar to previous surveys, Ashton Reservoir continues to be dominated by Utah chub and Utah sucker (91% of the total species composition combined). Zooplankton sampling indicates that suitable forage is limited in Ashton Reservoir.

Authors

Greg Schoby
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Dan Garren
Regional Fishery Manager

METHODS

We set six experimental gill nets (three floating, three sinking) to assess fish populations and relative abundance in Ashton Reservoir on July 18, 2008 (Figure 14). 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 and also calculated 95% confidence intervals. To assess the production potential of Ashton Reservoir, we collected zooplankton samples on July 29 and August 27, 2008 (for detailed description of zooplankton collection methods, see *Methods* in *Henrys Lake* above).

We calculated proportional stock density (PSD) and relative stock density (RSD-400) to describe the size structure of the RBT population in Ashton Reservoir. We calculated PSD for RBT using the following equation:

$$PSD = \frac{\text{number} \geq 300 \text{ mm}}{\text{number} \geq 200 \text{ mm}} * 100$$

RSD for RBT was calculated as the number of individual fish captured greater than or equal to 400 mm divided by the number greater than or equal to 200 mm, multiplied by 100, and reported as RSD-400. PSD and RSD-400 values reported for BNT were calculated using the same equations. To assess yellow perch PSD and RSD, we used stock (130 mm), quality (200 mm), and preferred (250 mm) values described in Anderson and Neumann (1996) to calculate PSD and RSD-250 values.

We evaluated the level of precision of our standard gill net surveys using the equation of Cyr et al. (1992):

$$N = \left(\frac{CV_s}{CV_x}\right)^2$$

Where CV_s is the coefficient of variance of the sample, CV_x is the desired level of precision, and N is the number of gill net nights. We defined two levels of precision – one level for preliminary studies (ability to detect a 50% change in the catch rate), and one level suitable for management studies (ability to detect a 25% change in the catch rate).

RESULTS

We collected 580 fish in five net-nights of gill net surveys. Catch data from one gill net was excluded as this net washed to shore and did not function properly. Gill net catch rate was highest for Utah chub and Utah sucker at 86.6 and 18.2 fish per net night, respectively (Figure 15). RBT and BNT catch rates were 6.8 and 2.6 fish per net night, respectively. Species composition was dominated by Utah chub (75% of the catch) and Utah sucker (16% of the catch) in Ashton Reservoir, while RBT (6%), BNT (2%), and yellow perch (1%) comprised the remaining 9% of the total catch (Figure 16). RBT ranged from 245 – 588 mm in total length (mean: 331 mm) and BNT ranged from 331 – 680 mm in total length (mean: 446 mm; Figure 17). Yellow perch ranged from 181 – 318 mm (mean: 281 mm). RBT PSD was 57 and RSD-

400 was 23, BNT PSD = 100 and RSD-400 = 62, and yellow perch PSD =88 and RSD-250 = 88. Data collected during zooplankton monitoring did not show cropping impacts from fish (ZPR = 0.84) and the abundance of zooplankton (ZQI = 0.40) is able to support fingerling trout stocking at the rate of 75 -150 per acre (Teuscher 1999).

We calculated the number of gill net nights needed to obtain an estimate capable of detecting a 50% change in catch rates (preliminary study) and found that 3 nights of gill net effort would be capable of detecting that level of change in RBT. To obtain the precision necessary to detect a 25% change in RBT catch rates would require 10 net nights of effort. Based on the 5 net nights of effort, our sampling in 2008 would allow us to detect a 36% change in the RBT population.

DISCUSSION

Species composition of the gill net catch in Ashton Reservoir in 2008 was similar to that observed in prior surveys. Utah chub and Utah sucker continue to dominate the fishery; in 2008, the two species combined accounted for 91% of the overall species composition, which was similar to prior surveys (1985 and 1986 - 98% and 94% chubs and suckers combined, respectively (Maiolie 1987); 1980: 44% chubs, 7% suckers (Ball and Jeppson 1980); and 1969: 58% suckers, 33% chubs (IDFG records). While overall species composition appears similar to historic conditions in Ashton reservoir, gill net surveys during 2008 documented the presence of yellow perch – a species that had not been documented as present in the reservoir prior to the current survey. Yellow perch abundance was low (n=8), but the size range observed (181 – 318 mm) indicates that several age classes are present. It is unknown how long yellow perch have been present in Ashton Reservoir or how they were introduced. During 2008, anglers reported catching yellow perch in a small, unnamed gravel pond connected to the Henrys Fork River, approximately 1.8 km upstream of Ashton Reservoir. IDFG confirmed the presence of perch in this pond during a gill net survey in 2008; it is unclear if perch were introduced into Ashton Reservoir or the unnamed pond first, but transfer between the two seems likely.

Results from zooplankton monitoring in Ashton Reservoir indicate a sufficient prey base to support the stocking of 75-150 fingerling trout per acre. Currently, Ashton Reservoir is stocked with approximately 35,000 catchable RBT. Previous fingerling stocking attempts have led to low return to creel rates, therefore, fingerling stocking is not recommended at this time.

Results from analysis of gill net precision suggest that increased effort with future samples should result in more precise monitoring of trends in sportfish populations in Ashton Reservoir. Based on this information, we recommend using 16 net nights of effort to monitor sportfish populations during intensive surveys. This level of precision will allow us to observe a 20% change in RBT catch rates.

MANAGEMENT RECOMMENDATIONS

1. Periodically use gill net surveys to evaluate the fishery in Ashton Reservoir.
2. Increase gill net effort to 16 net nights to adequately monitor changes in the fish community.

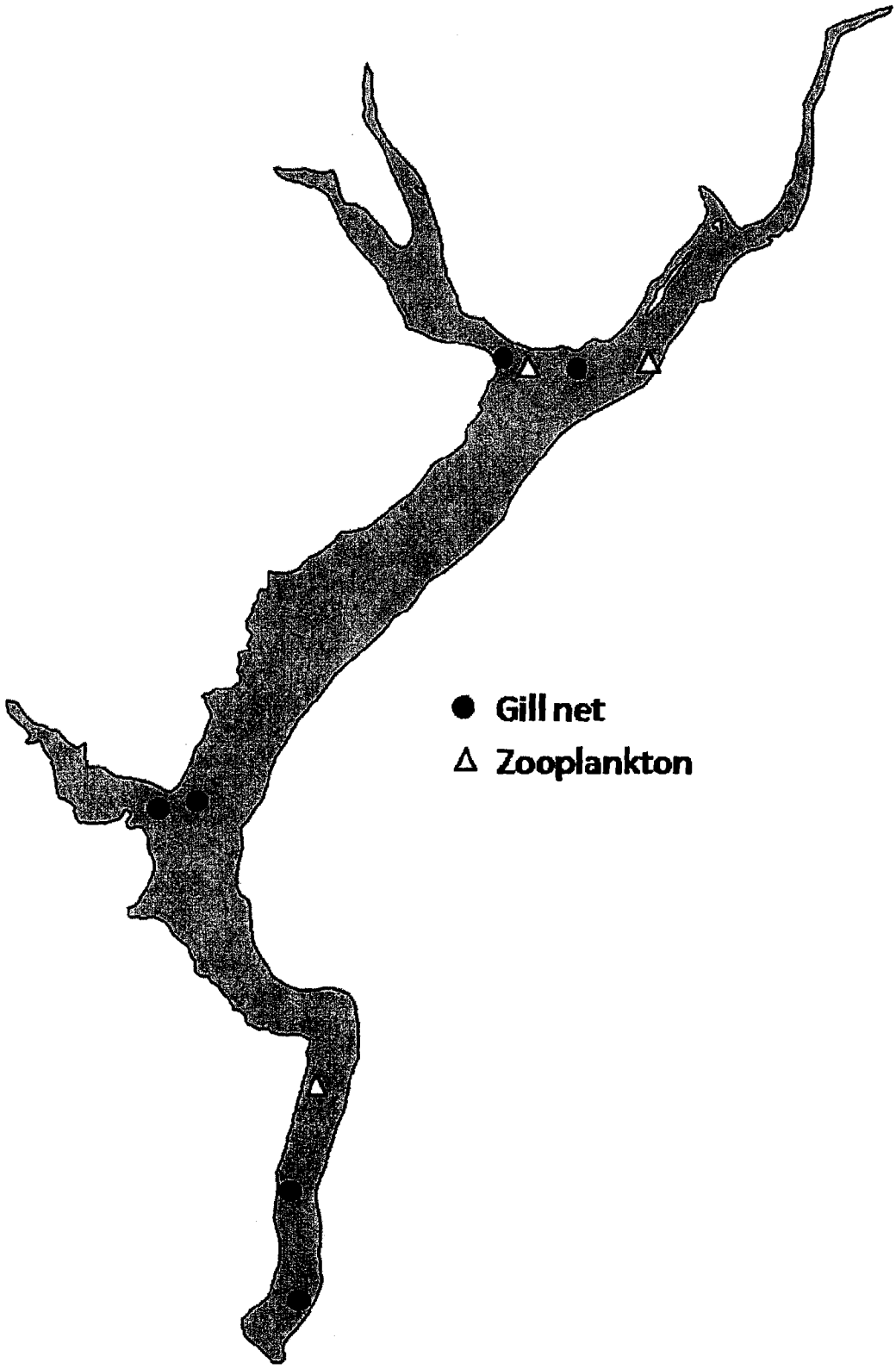

Figure 14. Gill net and zooplankton sample sites in Ashton Reservoir, Idaho, 2008.

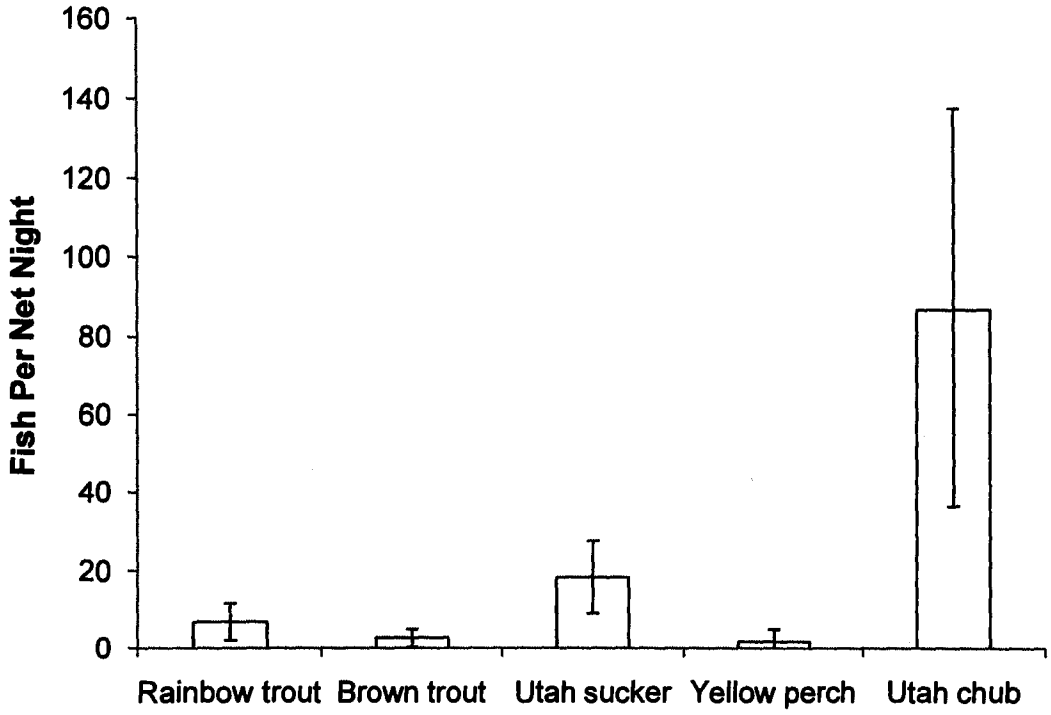

Figure 15. Gill net catch rates (fish per net night) in Ashton Reservoir, 2008. Error bars represent 95% confidence intervals.

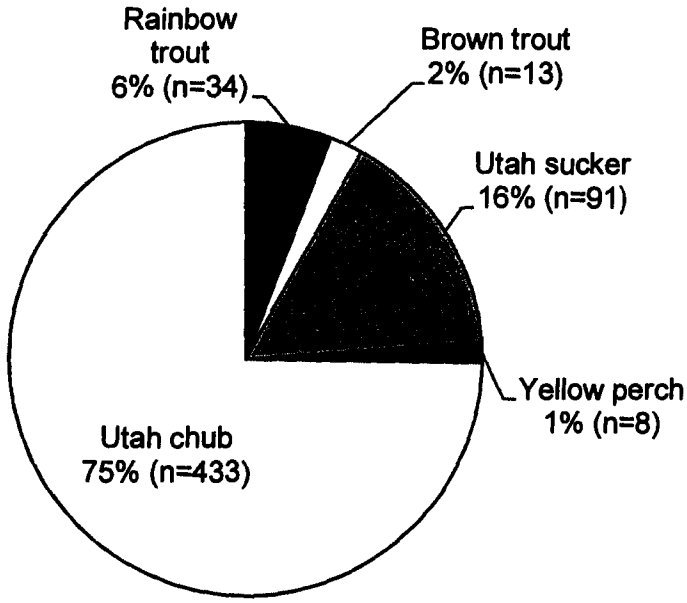

Figure 16. Species composition from gill nets set in Ashton Reservoir during 2008.

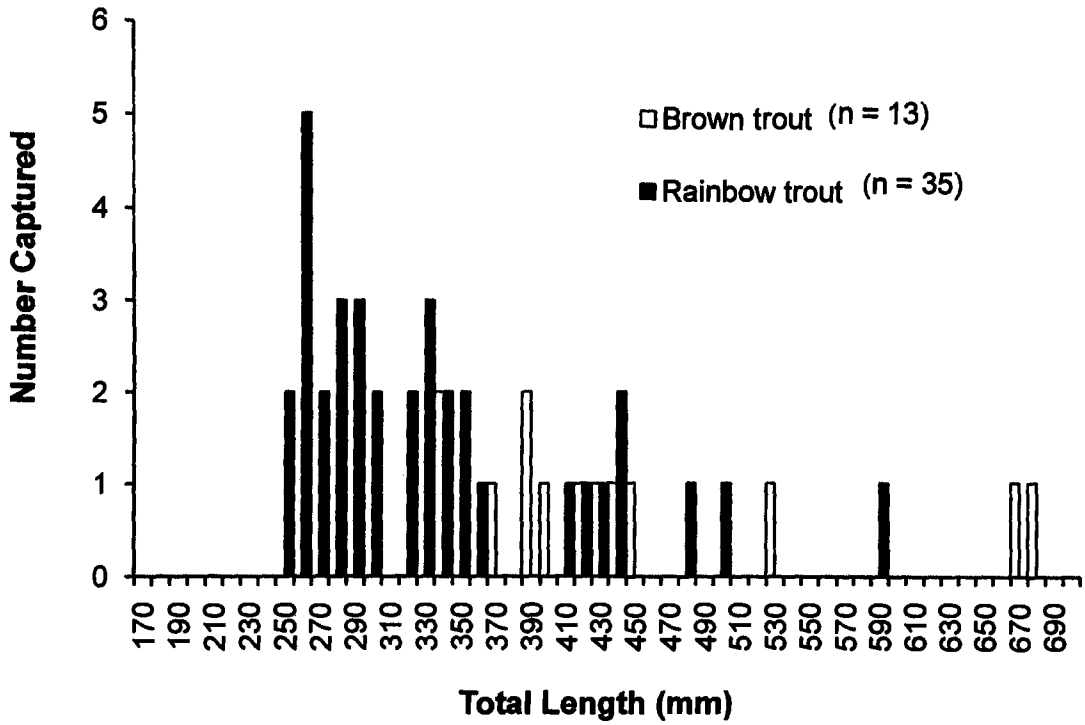

Figure 17. Length frequency of all rainbow trout and brown trout captured in gill nets in Ashton Reservoir during 2008.

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ISLAND PARK RESERVOIR

ABSTRACT

We used 22 standard experimental gill nets (21 floating, 1 sinking) to assess fish populations and relative abundance in Island Park Reservoir during September 2008. Mean catch (fish per net) was 9 RBT, 8 Utah sucker, 5 Utah chub, 0.5 kokanee salmon *O. nerka*, 0.1 mountain whitefish *Prosopium williamsoni*, and 0.1 YCT. W_r for RBT did not exceed 90 for any size class and ranged between 93 and 116 for kokanee larger than 200 mm total length. Zooplankton sampling indicates that suitable forage is abundant (ZQI = 1.93) in Island Park Reservoir.

Authors

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METHODS

We set experimental gill nets in Island Park Reservoir on September 24 -26, 2008 for a total of 22 net nights to assess trends in fish populations and to monitor relative abundance (Figure 18). Gill nets consisted primarily of floating types with one sinking net – all 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 and also calculated 95% confidence intervals, and compared data to past surveys.

W_r 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 Neumann 1996). W_r were then averaged for each length class (<200 mm, 200-299 mm, 300-399 mm and fish >399 mm). We used the formula $\log W_s = -4.898 + 2.990 \log TL$ to calculate W_r of RBT (Simpkins and Hubert 1996), and $\log W_s = -5.062 + 3.033 \log TL$ for kokanee (Hyatt and Hubert 2000).

We calculated PSD and RSD (RSD-400) to describe the size structure of RBT and kokanee populations in Island Park Reservoir. We calculated PSD for RBT using the following equation:

$$PSD = \frac{\text{number} \geq 300 \text{ mm}}{\text{number} \geq 200 \text{ mm}} * 100$$

RSD for RBT was calculated as the number of individual fish captured greater than or equal to 400 mm divided by the number greater than or equal to 200 mm, multiplied by 100, and reported as RSD-400. Kokanee PSD and RSD values were calculated using the same formula but used the number of fish greater than or equal to 250 mm divided by the number greater than or equal to 200 mm, multiplied by 100 for PSD, and the number of fish greater than or equal to 300 mm divided by the number greater than or equal to 200 mm, multiplied by 100 for RSD-300.

We collected zooplankton samples on July 29 and August 27 2008 to evaluate our stocking densities and assess fingerling trout forage availability (for detailed description of zooplankton collection methods, see *Methods* in *Henrys Lake* above).

We evaluated the level of precision of our standard gill net surveys using the equation of Cyr et al. (1992):

$$N = \left(\frac{CV_s}{CV_x}\right)^2$$

where CV_s is the coefficient of variance of the sample, CV_x is the desired level of precision, and N is the number of gill net nights. We defined two levels of precision – one level for preliminary studies (ability to detect a 50% change in the catch rate), and one level suitable for management studies (ability to detect a 25% change in the catch rate).

RESULTS

We collected 489 fish in 22 net nights of gill net effort. Species composition was 41% RBT, 33% Utah sucker, 22% Utah chub, 2% kokanee, 1% YCT and 1% mountain whitefish (Figure 19). Gill net catch rate (fish per net-night) was highest for RBT (9.2), followed by Utah sucker (7.5) and Utah chub (4.9) (Figure 20). RBT ranged from 165 to 573 mm TL (Figure 21), with a mean length of 389 mm. PSD was 96 and RSD-400 was 41. Mean W_r for all size classes of RBT ranged between 86 and 90 (Table 6). Kokanee lengths ranged from 195 to 545 mm, with a mean length of 320 mm. Kokanee PSD was 100 and RSD-300 was 56. Mean W_r for all size classes of kokanee ranged between 93 and 116 (Table 6).

Zooplankton monitoring showed total production as measured by the 153 micron net to be adequate at 0.99 g/m. We measured the ratio of preferred to usable zooplankton (ZPR) at 1.26 g/m, indicating that preferred zooplankton is not being cropped by fish. We used ZQI to adjust for overall abundance of desirable zooplankton, and estimated zooplankton abundance (ZQI = 1.93) sufficient to support 150-300 fingerling trout per acre (Teuscher 1999).

We calculated the number of gill net nights needed to obtain an estimate capable of detecting a 50% change in catch rates (preliminary study) and found that 8 nights of effort with floating gill nets would be capable of detecting that level of change in RBT, and 10 net nights would be capable of doing the same for kokanee. To obtain precision necessary to detect a 25% change in catch rates would require 32 and 41 net nights of effort for RBT and kokanee, respectively. Based on the 22 net nights of effort, our sampling in 2008 should be adequate to detect a 30% change in the RBT population and a 34% change in the kokanee population.

DISCUSSION

In previous surveys of Island Park Reservoir, gill net catch was dominated by nongame fish, specifically Utah sucker and Utah chub. During 2008, species composition of the gill net catch was dominated by RBT and abundance of Utah sucker and chub appears to have declined, but these numbers should be viewed cautiously, as sample gear was predominantly floating gill nets. Following the 2006 gill net survey of Island Park Reservoir, Garren et al. (2008) recommended using floating nets for future samples, as high catch of suckers prevented sinking nets from functioning properly. Floating gill nets were used during 2008 to catch RBT for triploid hatchery trout evaluations by IDFG personnel from Nampa Research. Gill net catch rate of RBT during 2008 was higher than 2006, while catch rates for suckers and chubs appears to be lower but the use of floating gill nets may have skewed catch rate data to indicate an increase in RBT densities and decrease in Utah sucker and chub densities. Data obtained from the current study should not be directly compared to previous gill net catch rate data from Island Park Reservoir, but will be useful as baseline data for future studies using the same methods implemented in 2008.

Stocking guidelines for our ZQI estimate of 1.93 g/m are 150-300 fingerling trout per acre. During 2008, 199,619 RBT fingerling, 792,000 RBT fry, and 223,000 kokanee fry were stocked (174 fish per acre), which is an appropriate stocking rate based on the results from our zooplankton monitoring. Although the zooplankton community appears adequate to support the current stocking rate, the W_r observed during 2008, particularly for fish less than 300 mm, indicate that food may be limited.

Results from analysis of gill net precision suggest that increased effort with future samples should result in more precise monitoring of trends in sportfish populations in Island Park Reservoir. Based on this information, we recommend using 32 net nights of effort to monitor sportfish populations during intensive surveys.

MANAGEMENT RECOMMENDATIONS

1. Continue fall gill net monitoring with floating nets to develop juvenile abundance and recruitment indexes.
2. Increase gill net effort to 32 net nights to adequately monitor changes in the trout community.
3. Work with irrigation community and Bureau of Reclamation (BOR) to manage water to benefit fish in Island Park Reservoir as possible.

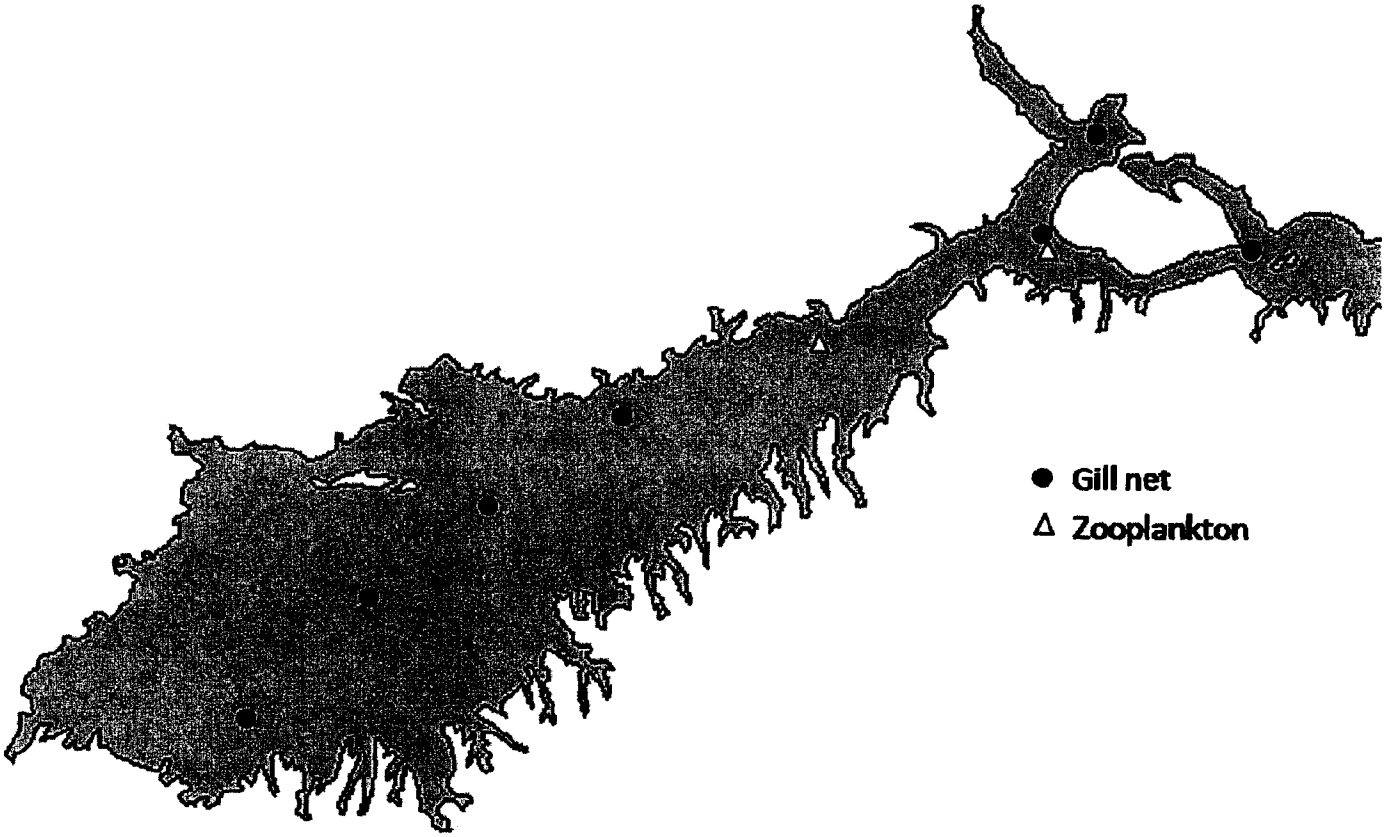

Figure 18. Spatial distribution of gill net and zooplankton sample site locations in Island Park Reservoir, Idaho, 2008.

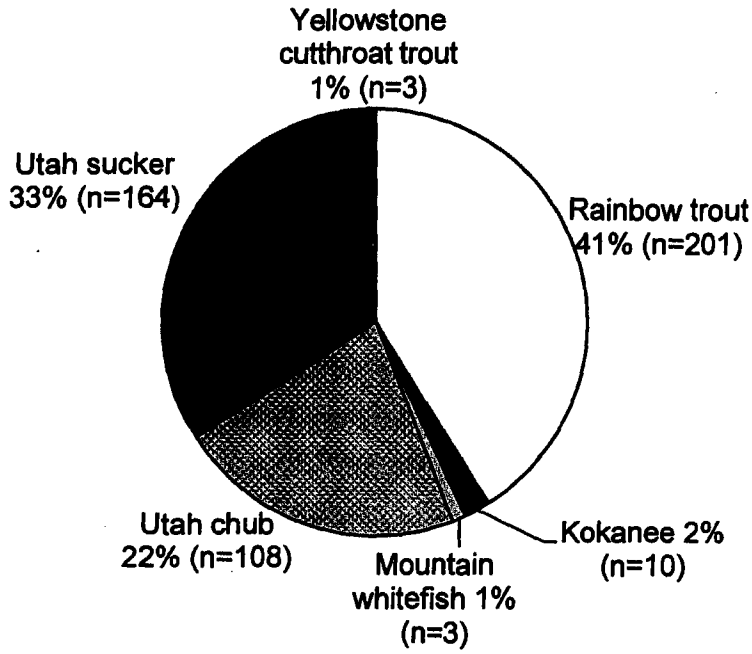

Figure 19. Species composition from gill nets set in Island Park Reservoir Idaho, 2008.

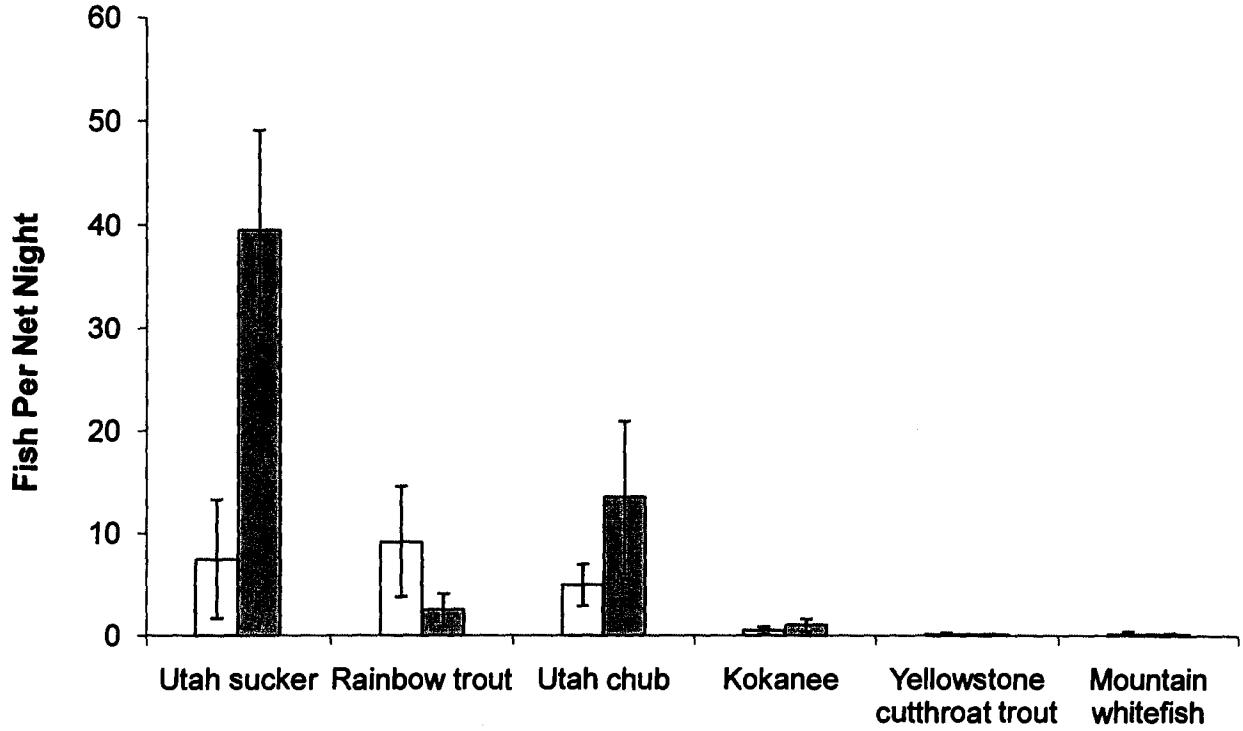

Figure 20. Gill net catch rates (fish per net night) in Island Park Reservoir from 2008 (open bars) and 2006 (shaded bars).

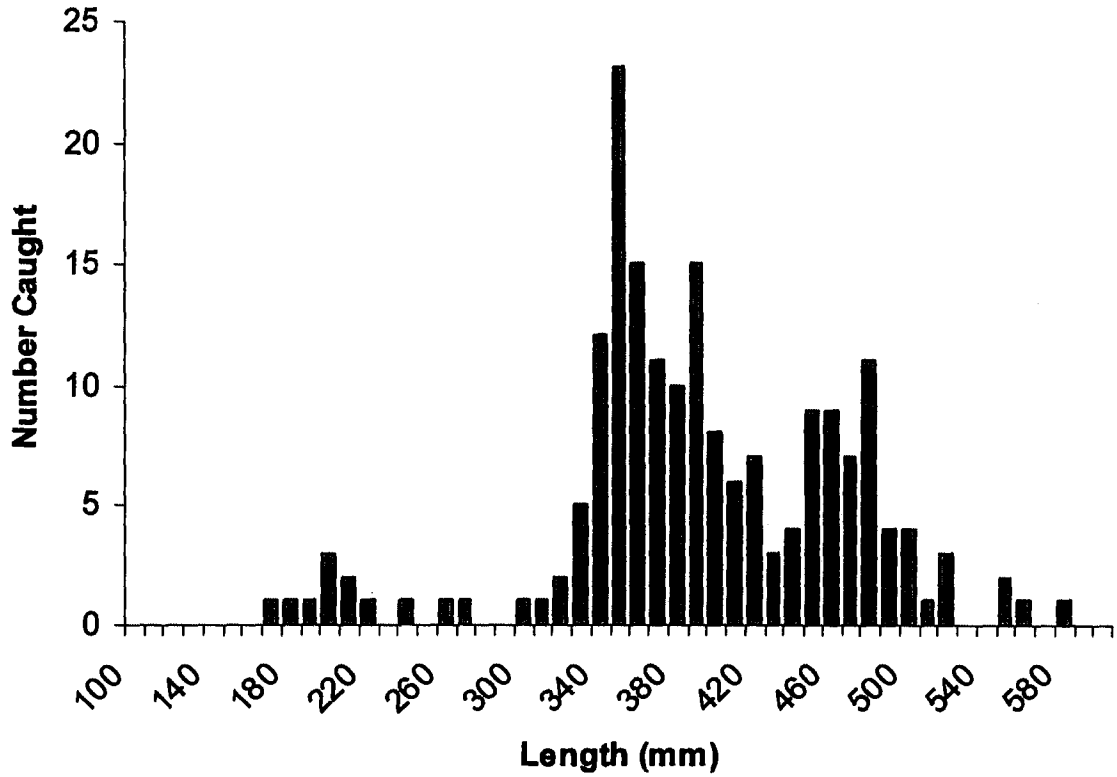

Figure 21. Length frequency of rainbow trout caught with gill nets in Island Park Reservoir, Idaho 2008.

Table 6. Relative weights for all trout species collected with gill nets in Island Park Reservoir, Idaho 2008.

	Mean Relative Weight (W_r)			
Species	< 200 mm	200-299 mm	300-399 mm	> 399 mm
Rainbow trout	86	89	90	87
Kokanee salmon	--	93	99	116

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MACKAY RESERVOIR

ABSTRACT

We used six standard experimental gill nets (three floating, three sinking) to assess fish populations and relative abundance in Mackay Reservoir during August 2008. Mean catch (fish per net night) was 17 RBT, seven kokanee salmon, and 0.2 mountain whitefish. Gill net catch rates for trout and kokanee in Mackay Reservoir were among the highest in all reservoirs sampled in the Upper Snake Region during 2008, but PSD and RSD values for RBT were among the lowest in the region. Zooplankton sampling indicates that forage is available to support stocking between 75 and 150 fingerling trout per acre in Mackay Reservoir. Although there is limited historic data to compare our recent surveys to, the fishery in Mackay Reservoir is likely limited by frequent draw downs.

Authors

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Dan Garren
Regional Fishery Manager

METHODS

We set six experimental gill nets (three floating, three sinking) to assess trends in fish populations and to monitor relative abundance in Mackay Reservoir on August 15, 2008 (Figure 22). 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 TL. We calculated gill net catch rates as fish per net night and also calculated 95% confidence intervals.

We calculated PSD and RSD to describe the size structure of the RBT population in Mackay Reservoir, using the methods and values described above in the *Henrys Lake* chapter. Kokanee PSD was calculated as the number of fish greater than or equal to 250 mm divided by the number greater than or equal to 200 mm, multiplied by 100. Kokanee relative stock density was calculated as the number of fish greater than or equal to 300 mm divided by the number greater than or equal to 200 mm, multiplied by 100, and reported as RSD-300.

We collected zooplankton samples on August 6, 2008 to evaluate our stocking program and assess fingerling trout forage availability (for detailed description of zooplankton collection methods, see *Methods* in *Henrys Lake* above).

We evaluated the level of precision of our standard gill net surveys using the equation of Cyr et al. (1992):

$$N = \left(\frac{CV_s}{CV_x}\right)^2$$

where CV_s is the coefficient of variance of the sample, CV_x is the desired level of precision, and N is the number of gill net nights. We defined two levels of precision – one level for preliminary studies (ability to detect a 50% change in the catch rate), and one level suitable for management studies (ability to detect a 25% change in the catch rate).

RESULTS

We collected 142 fish with six nights of gill net effort in Mackay Reservoir. Relative abundance was dominated by RBT (72%) and kokanee (27%); but we also captured one mountain whitefish (<1%, Figure 23). Gill net catch rates were 17.0 RBT and 6.5 kokanee per net night (Figure 24). RBT ranged between 153 and 471 mm (mean: 297 mm); kokanee ranged between 225 and 340mm (mean: 306 mm) (Figure 25). RBT PSD = 73 and RSD-400 = 2, and kokanee PSD = 90 and RSD-300 = 87 (Table 7). Zooplankton monitoring in Mackay Reservoir showed ZPR and ZQI values of 0.64 and 0.51, respectively, which is adequate to support stocking between 75 and 150 fingerling RBT per acre, according to Teuscher's 1999 guidelines.

We calculated the number of gill net nights needed to obtain an estimate capable of detecting a 50% change in catch rates (preliminary study) and found that one night of gill net effort would be adequate for detecting that level of change in RBT, and 11 net nights would be capable of doing the same for kokanee. To obtain precision necessary to detect a 25% change in catch rates would require 4 and 46 net nights of effort for RBT and kokanee, respectively.

Based on the six net nights of effort, our sampling in 2008 should be adequate to detect a 21% change in the RBT population and a 69% change in the kokanee population.

DISCUSSION

There is little historic gill net data from Mackay Reservoir. Gebhards sampled Mackay Reservoir with two gill nets in May 1962 (IDFG files) which yielded eight RBT and two mountain whitefish. Mackay Reservoir was sampled with two gill nets on two occasions during May 1973 (Jeppson 1975). The first survey (May 15) was a short net set (3 hours and 15 minutes) which yielded one RBT in each net. The second survey (May 20) was an overnight set which yielded 36.5 RBT, 6 BKT, 7.5 mountain whitefish, and 0.5 kokanee per net. Jeppson (1975) also surveyed Mackay Reservoir during April 1974, and collected 22 RBT, 11 BKT, and 4 mountain whitefish per net night. The majority of the work conducted on Mackay Reservoir since Jeppson's gill netting has been angler surveys. In comparison to the limited amount of historic gill net data, during 2008 the RBT gill net catch appears to be down slightly, kokanee catch rates have increased, mountain whitefish have declined, and BKT were not observed. Mountain whitefish densities have declined substantially throughout the Big Lost River drainage (Garren et al. 2007); whitefish numbers in Mackay Reservoir would be expected to follow this trend. BKT were absent from our survey, while Jeppson (1975) observed BKT comprising 30% of the total gill net catch and 6% of the angler catch in 1974. Jeppson cites recruitment from tributaries upstream of the Reservoir as the source of BKT observed in his surveys, as no BKT stocking into Mackay Reservoir had occurred. This is likely the cause, as BKT fingerlings were stocked within the Big Lost River upstream of the reservoir between 1970 and 1973. BKT are still present in the Big Lost River above Mackay Reservoir, but stocking stopped in 1978, which may explain the lack of BKT observed during our sampling.

In comparison to other regional reservoirs surveyed during 2008, Mackay Reservoir had the highest trout catch rate (17.0 RBT per net night) but the lowest RSD-400 value. The kokanee population in Mackay Reservoir was also high in relation to other regional reservoirs, with gill net catch rates and PSD and RSD-300 values similar to Ririe Reservoir. The fishery in Mackay Reservoir is likely limited in scope by the constant and drastic draw downs that occur each summer and fall. These drawdowns may be limiting the potential for long-term persistence of trout, which may be limiting the ultimate size trout may attain.

Results from analysis of gill net precision suggest that the current effort applied to future samples should be adequate to monitor RBT populations in Mackay Reservoir. Monitoring the kokanee population would require more intensive surveys. Based on this information, we recommend using six net nights of effort to monitor RBT populations unless detailed, specific data were required. Gill net effort of approximately 20 net nights will provide statistically valid data on kokanee populations.

MANAGEMENT RECOMMENDATIONS

1. Periodically use gill net surveys that incorporate at least six net nights of effort to evaluate the trout fishery in Mackay Reservoir.
2. Collect statistically valid baseline kokanee data using at least 20 net nights of effort.

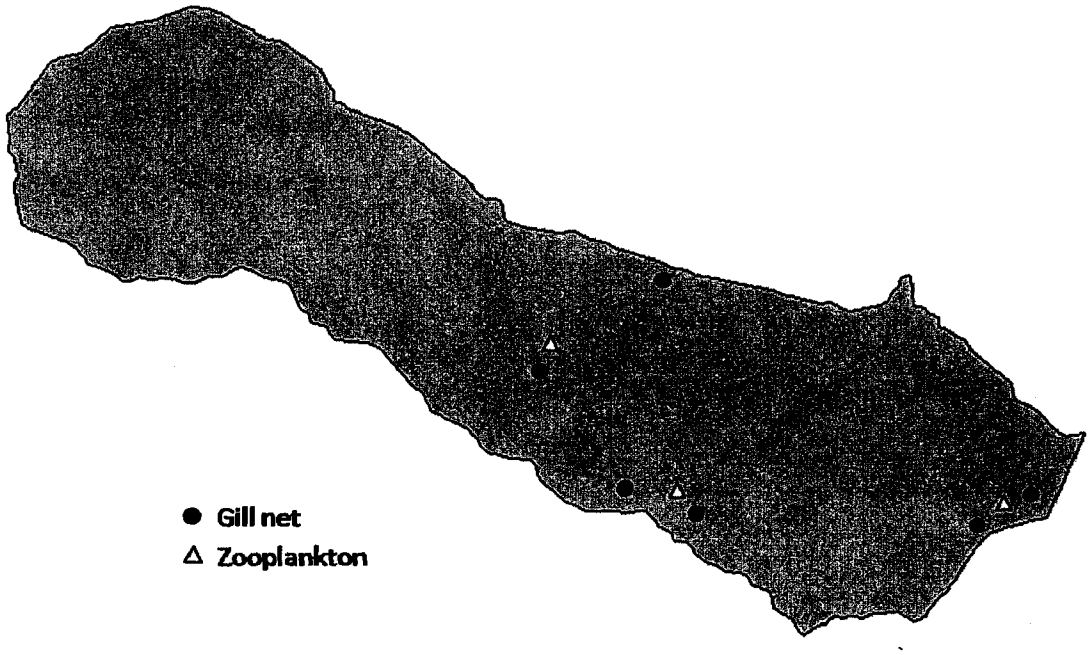

Figure 22. Gill net and zooplankton sample site locations in Mackay Reservoir, Idaho, 2008.

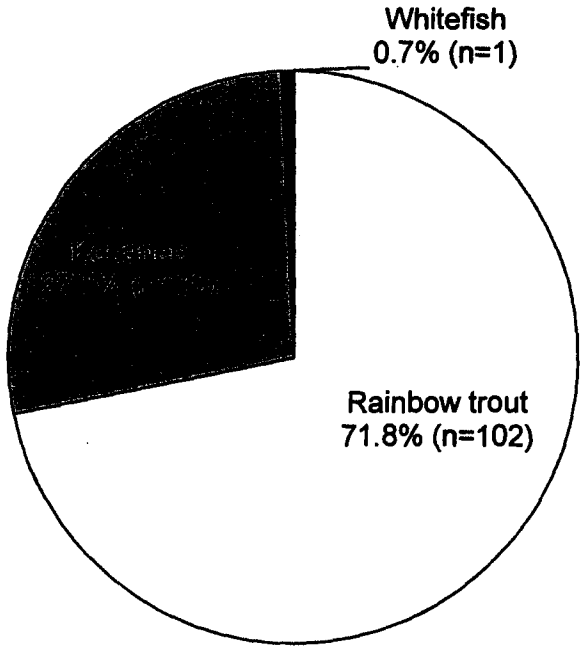

Figure 23. Species composition from gill nets set in Mackay Reservoir during 2008.

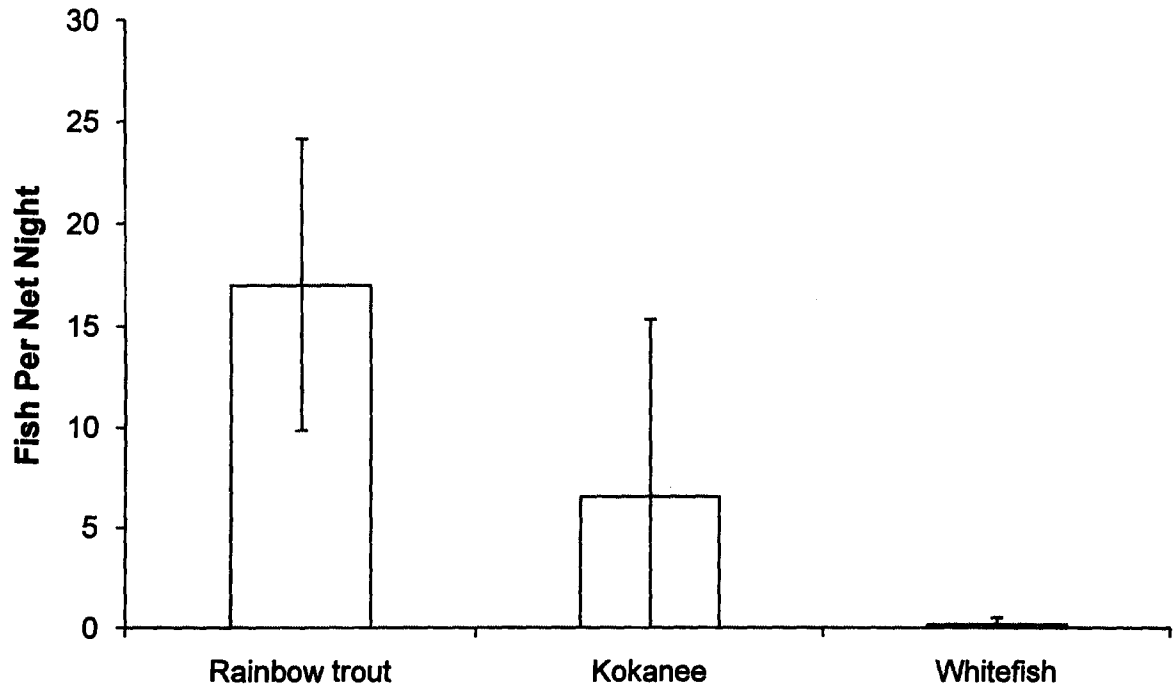

Figure 24. Gill net catch rates (fish per net night) in Mackay Reservoir, 2008.

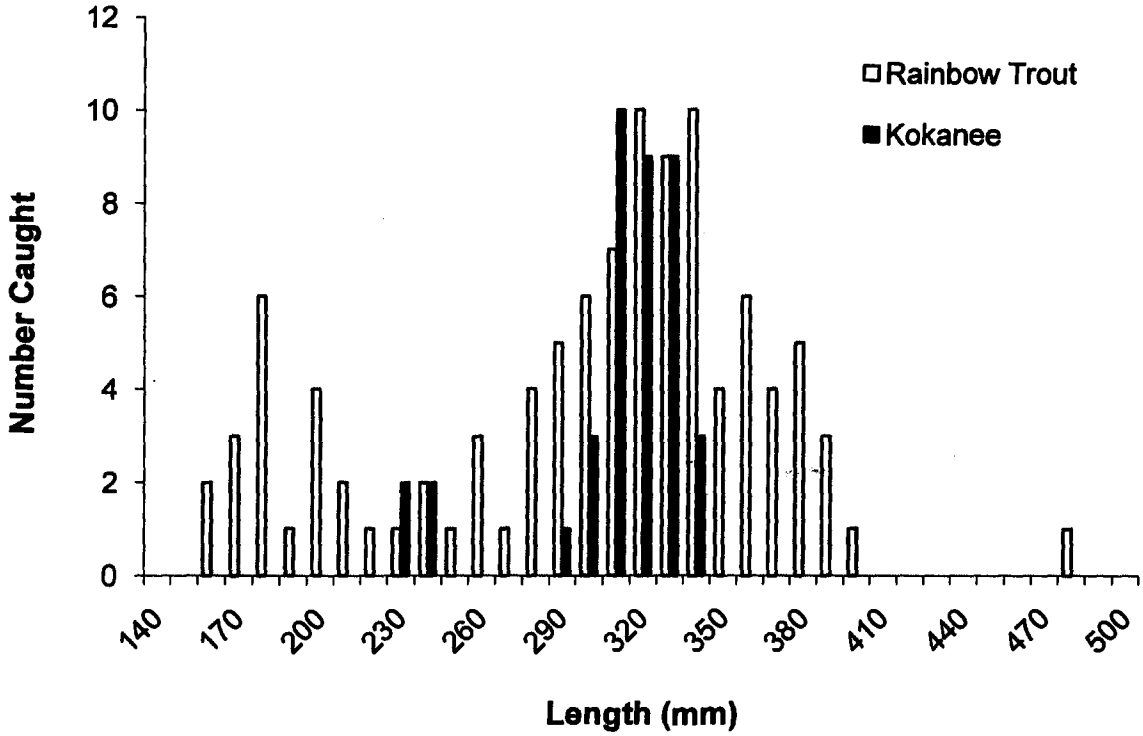

Figure 25. Length-frequency of rainbow trout and kokanee captured with gill nets in Mackay Reservoir during 2008.

Table 7. Fish per net night (CPUE), proportional stock density (PSD), and relative stock density (RSD) of trout and kokanee from waters in the Upper Snake Region during 2008.

	Rainbow Trout			Kokanee		
	CPUE	PSD	RSD-400	CPUE	PSD	RSD-300
Mackay Reservoir	17.0	73	2	6.5	90	87
Island Park Reservoir	9.2	96	41	0.5	100	56
Ashton Reservoir	6.8	57	23	--	--	--
Ririe Reservoir	--	--	--	6.9	99	78
Yellowstone cutthroat trout	6.3	50	2			
Henrys Lake						
Yellowstone cutthroat trout	8.3	79	43	--	--	--
Hybrid trout	3.6	98	77	--	--	--
Brook trout	1.2	79	0	--	--	--

2008 Upper Snake Region Annual Fisheries Management Report

RIRIE RESERVOIR

ABSTRACT

We set 21 experimental gill nets and used shoreline electrofishing to assess fish populations and W_r in Ririe Reservoir. The discovery of walleye, an unauthorized addition to Ririe Reservoir, prompted increased sampling efforts throughout the year. Gill netting efforts confirmed the presence of walleye in Ririe Reservoir, but the population appears to be low, with only 5 individuals captured. Species composition from gill nets was 39% Utah sucker, 29% yellow perch, 17% Utah chub, 7% kokanee salmon, 7% YCT, and 1% smallmouth bass *Micropterus dolomieu*. Species composition of yellow perch increased from 3% of the total composition in 2005 to 28% in the current survey. Our electrofishing effort yielded 9.9 smallmouth bass and 4.5 yellow perch per hour, ranging in size from 91 to 320 mm and 128 to 235 mm, respectively. The discovery of walleye in Ririe Reservoir, as well as the increase in yellow perch, warrants further investigations.

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METHODS

We set 21 experimental gill nets throughout the summer and fall to monitor species composition and size structure of the fishery in Ririe Reservoir. 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. On July 17 and 18, we set five nets (three floating and two sinking) each night for a total of 10 net nights. On July 25, we set three sinking and three floating gill nets (six net nights). On October 21, we set three floating and two sinking gill nets (five net nights) (Figure 26). We identified captured fish to species and recorded total lengths (TL) of all sport fish collected. We calculated gill net catch rates as fish per net night. Length and weight data were collected from a subsample of YCT. W_r was calculated by dividing the actual weight of each fish (in grams) by a standard weight (W_s) for the same length for that species multiplied by 100 (Anderson and Neumann 1996). We used the formula $\log W_s = -5.189 + 3.099 \log TL$ for cutthroat trout (lentic) (Kruse and Hubert 1997).

We calculated PSD and RSD to describe the size structure of game fish populations in Ririe Reservoir (for detailed description of PSD and RSD calculations, see *Methods* in *Henrys Lake* above). Kokanee PSD was calculated as the number of fish greater than or equal to 250 mm divided by the number greater than or equal to 200 mm, multiplied by 100. Kokanee RSD was calculated as the number of fish greater than or equal to 300 mm divided by the number greater than or equal to 200 mm, multiplied by 100, as reported as RSD-300. To assess yellow perch PSD and RSD, we used stock (130 mm), quality (200 mm), and preferred (250 mm) values described in Anderson and Neumann (1996) to calculate PSD and RSD-250 values. For smallmouth bass, we used the stock (180 mm), quality (280 mm), and preferred (350 mm) length values from Anderson and Neumann (1996) to calculate PSD and RSD-350 values.

We used boat-mounted electrofishing gear to sample the littoral fish community in Ririe Reservoir on July 17 and 18. Surveys started at dusk, and progressed for approximately two hours each night. Electrofishing surveys were conducted at 20 different shoreline locations in representative areas spaced throughout the reservoir (Figure 26); 10 minutes of electrofishing was conducted at each site. Two netters were used to collect all sport fish encountered. All fish were identified to species and measured for total length before being released to the general location of capture. We calculated catch per unit effort (CPUE) of all sport fish as fish per hour. We monitored zooplankton abundance with plankton tows on July 28 and again on August 25, 2008 (for detailed description of zooplankton collection methods, see *Methods* in *Henrys Lake* above).

We evaluated the level of precision of our standard gill net surveys using the equation of Cyr et al. (1992):

$$N = \left(\frac{CV_s}{CV_x}\right)^2$$

Where CV_s is the coefficient of variance of the sample, CV_x is the desired level of precision, and N is the number of gill net nights. We defined two levels of precision – one level for preliminary studies (ability to detect a 50% change in the catch rate), and one level suitable for management studies (ability to detect a 25% change in the catch rate).

RESULTS

We collected 1,979 fish in 21 net nights of effort, including five walleye, which were previously not found in Ririe Reservoir. Species composition was dominated by nongame fish (Utah sucker [39%] and Utah chub [17%]); while yellow perch (29%), kokanee salmon (7%), YCT (7%), and smallmouth bass *Micropterus dolomieu* (1%) comprised the remaining gill net catch (Figure 27). Gill net catch rates (fish per net night) were highest for Utah sucker (37.0) and yellow perch (26.7) (Figure 28; Table 8). The yellow perch population showed the biggest change from 2005 based on gill net catch rates (Figure 28) and percent of overall species composition. Yellow perch ranged from 75 to 365 mm total length (Figure 29; Table 9); kokanee salmon ranged from 170 to 394 mm (Figure 30); YCT ranged from 188 to 539 mm (Figure 31); smallmouth bass ranged from 142 to 412 mm (Figure 32); walleye ranged from 348 to 555 mm (Table 9). Weights were collected from 47 YCT ranging from 190 to 400 mm. Mean W_r for YCT was 87. YCT PSD was 50 and RSD-400 was 2. Kokanee PSD = 99 and RSD-300 = 78, smallmouth bass PSD = 42 and RSD-350 = 16, and yellow perch PSD =43 and RSD-250 = 3.

Although no age and growth work was conducted, there appears to be two strong year classes of yellow perch in Ririe Reservoir based on length frequency analysis (Figure 29). Yellow perch year class strength in Ririe Reservoir may be related to reservoir storage levels and spring refill, as has been seen in other studies (Martin et al. 1981). During 2006 and 2007, spring reservoir levels (March 1 – June 1) averaged 59,311 acre-feet compared to 40,208 acre-feet (mean) between 2001 and 2004 (Figure 33). During 2006, refill occurred earlier and the reservoir peaked at over 80,000 acre-feet. Increased spring reservoir levels during 2006 and 2007 may have provided more spawning habitat available to adult perch and produced the two strong year classes of perch observed during 2008.

We collected 33 smallmouth bass, 15 yellow perch, and two YCT in 3.3 hours of electrofishing effort. Smallmouth bass lengths ranged from 91 mm to 320 mm, with a mean CPUE of 9.9 bass per hour (Figure 34). Yellow perch lengths ranged from 128 mm to 235 mm, with a mean CPUE of 4.5 perch per hour (Figure 33). We estimated a zooplankton quality index (ZQI) of 0.87, which suggests a stocking rate of 75 – 150 fingerling trout per acre. Currently, approximately 210,000 kokanee fingerling (139 fingerling/acre) and 18,000 catchable cutthroat trout are stocked in Ririe Reservoir annually, which is appropriate based on zooplankton abundance estimates (Teuscher 1999).

We calculated the number of gill net nights needed to obtain an estimate capable of detecting a 50% change in catch rates (preliminary study) and found that four net nights of effort would be adequate for detecting that level of change in YCT and 10 net nights would be capable of doing the same for kokanee. To obtain precision necessary to detect a 25% change in catch rates would require 18 and 42 net nights of effort for YCT and kokanee, respectively. Based on the 21 net nights of effort, our sampling in 2008 should be adequate to detect a 23% change in the YCT population and a 35% change in the kokanee population.

DISCUSSION

Walleye presence was first documented in Ririe Reservoir during the early summer of 2008. One walleye was captured in a gill net by an IDFG research crew (Nampa Research) examining kokanee age and growth. This prompted further investigations by Upper Snake Region fisheries personnel. Initial gill net efforts did not yield any additional walleye. Angler

reports (including capture location) of additional walleye led to additional monitoring by fisheries personnel. On July 25, 2008, four walleye were captured in gill nets near Deer Creek in the Willow Creek arm of Ririe Reservoir. Press releases were issued, encouraging anglers to harvest all walleye captured in Ririe Reservoir. Fall gill netting efforts resulted in one additional walleye captured. Although the size of the current walleye population in Ririe Reservoir appears to be low based on gill net captures, there is potential for expansion. The source, timing, and number of walleye introduced into Ririe Reservoir is unknown, but two age classes (age 2 and 4) have been identified and both are assumed to be sexually mature. The oldest age class of walleye may have already spawned in Ririe Reservoir. The impact it may have on the existing fishery is unclear, but in Lake Roosevelt, Washington predation by introduced walleye accounted for a 31 - 39% loss of stocked kokanee (Baldwin and Polacek 2002). Not only do walleye have the potential to impact Ririe Reservoir, but also may have the ability to spread to other waters, including the Snake River. Washington Department of Fish and Wildlife personnel have documented the spread of walleye from Banks Lake to a series of other reservoirs through irrigation canals. Sampling efforts planned for 2009 include spring trap netting to capture walleye and implant combined acoustic and radio transmitters to identify spawning locations and habitat use throughout the following year.

Gill net catch rates in Ririe Reservoir varied between 2008 and 2005, but statistical differences were not observed due to the high amount of variation in both sample years. A low number of gill net nights increased the variability in catch rates, particularly in 2005. For example, of the seven gill nets set in 2005, one net captured 244 Utah chub while the other six nets captured between zero and three Utah chub. Future gill net surveys should include at least 20 nights of gill net effort to reduce sampling variability and increase precision. The observed increase in the gill net catch rate of yellow perch, combined with its overall increase in relative abundance (from 3 to 29% from 2005 to 2008) warrants further investigation to determine what impact this may have on the Ririe Reservoir fishery. Additional analysis of reservoir storage and its effects on fish populations is warranted.

MANAGEMENT RECOMMENDATIONS

1. Monitor walleye habitat use and identify spawning locations using telemetry.
2. Implement walleye monitoring (Ontario protocol: end of spring trap netting [ESTN]; fall walleye index netting [FWIN]) to gather information on abundance, growth, mortality, reproduction and diet.
3. Begin annual gill net monitoring using at least 20 nights of gill net effort to document changes in the fish community.
4. Continue to stock YCT and evaluate their contribution to the fishery over the next several years.
5. Continue stocking kokanee salmon at 210,000 fish and evaluate the effects of higher stocking on the size structure and catch rates.
6. Collect otolith samples from yellow perch; use for cohort analysis and estimates of mortality and year class strength.

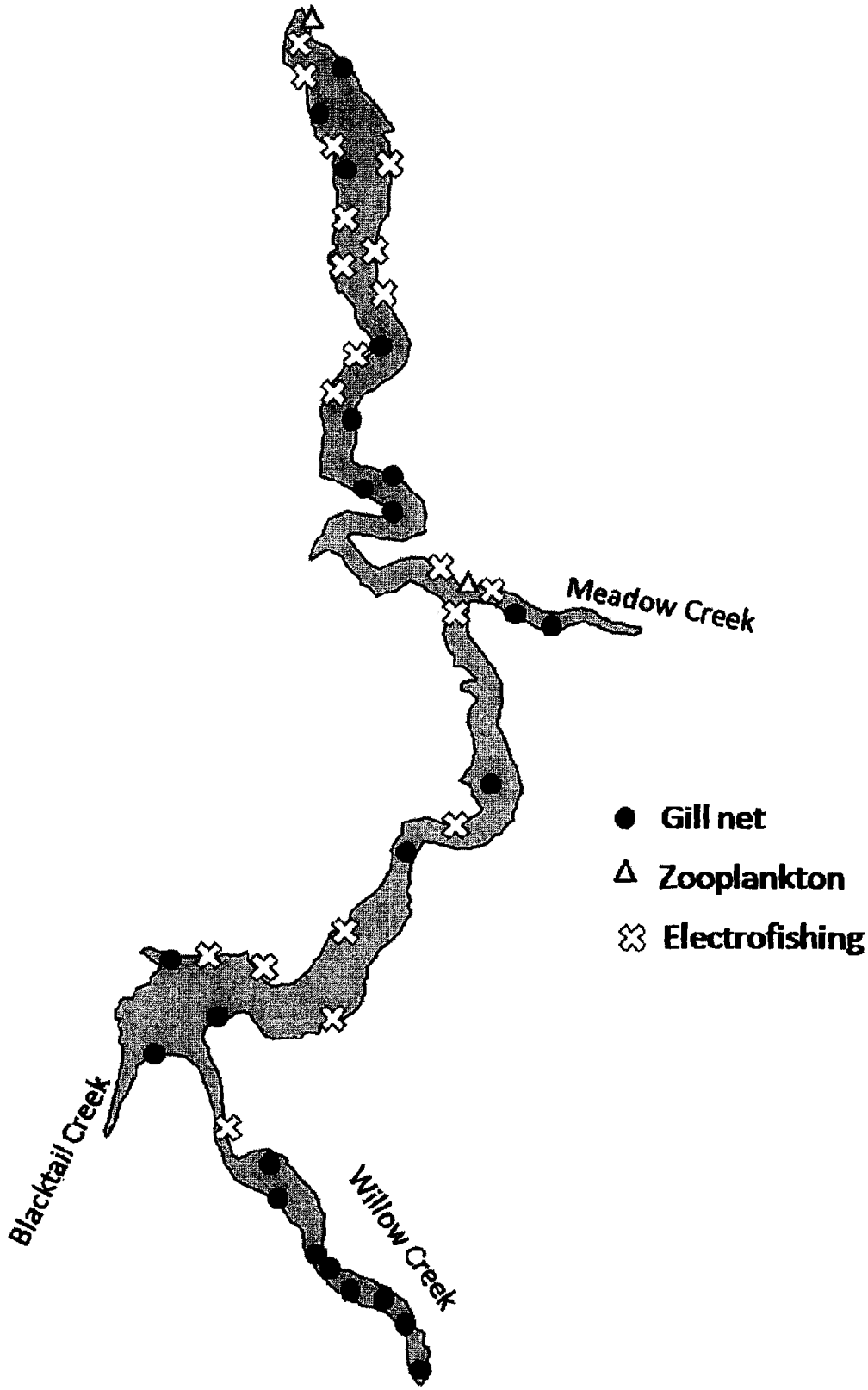

Figure 26. Locations of gill net, electrofishing, and zooplankton sample sites in Ririe Reservoir during 2008.

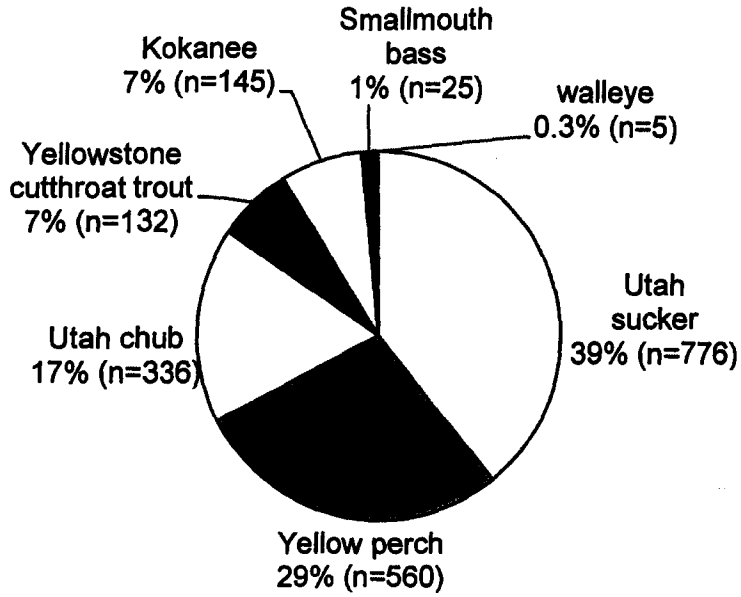

Figure 27. Relative abundance of fish caught with gill nets in Ririe Reservoir during 2008.

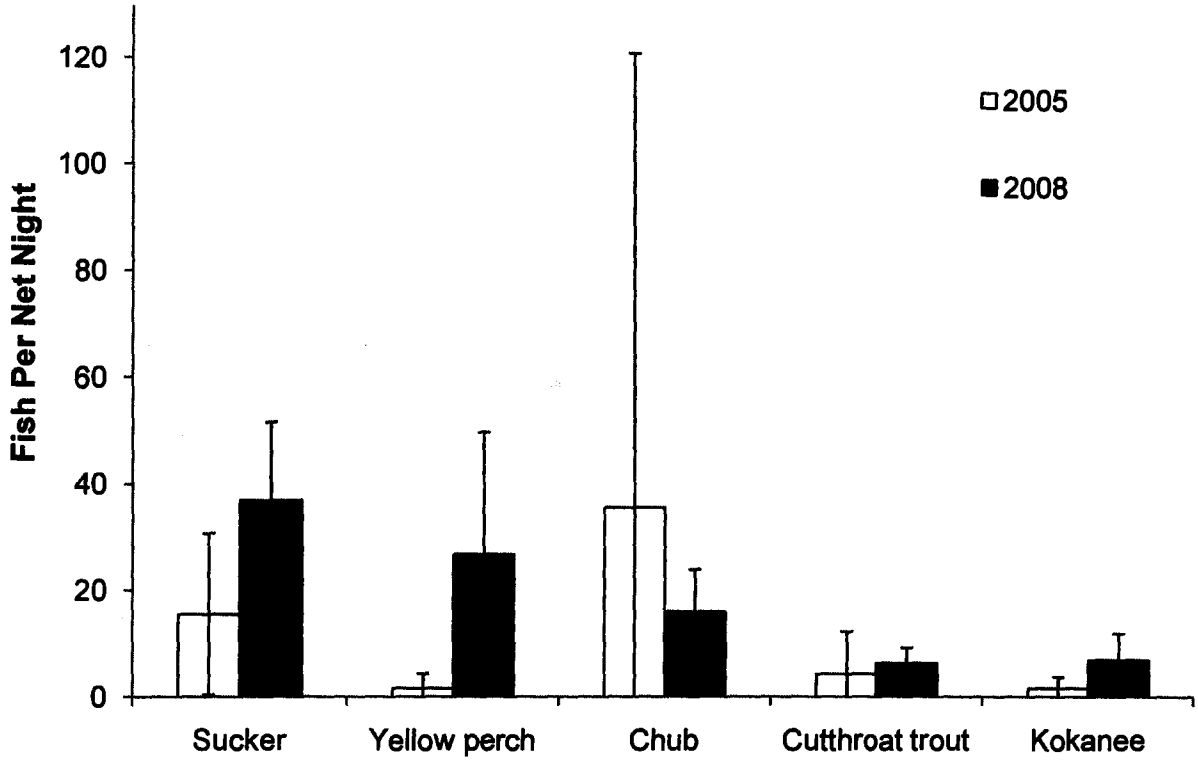

Figure 28. Gill net catch rates for Utah sucker, yellow perch, Utah chub, Yellowstone cutthroat trout, and kokanee salmon in Ririe Reservoir, 2005 and 2008. Error bars represent 95% confidence intervals.

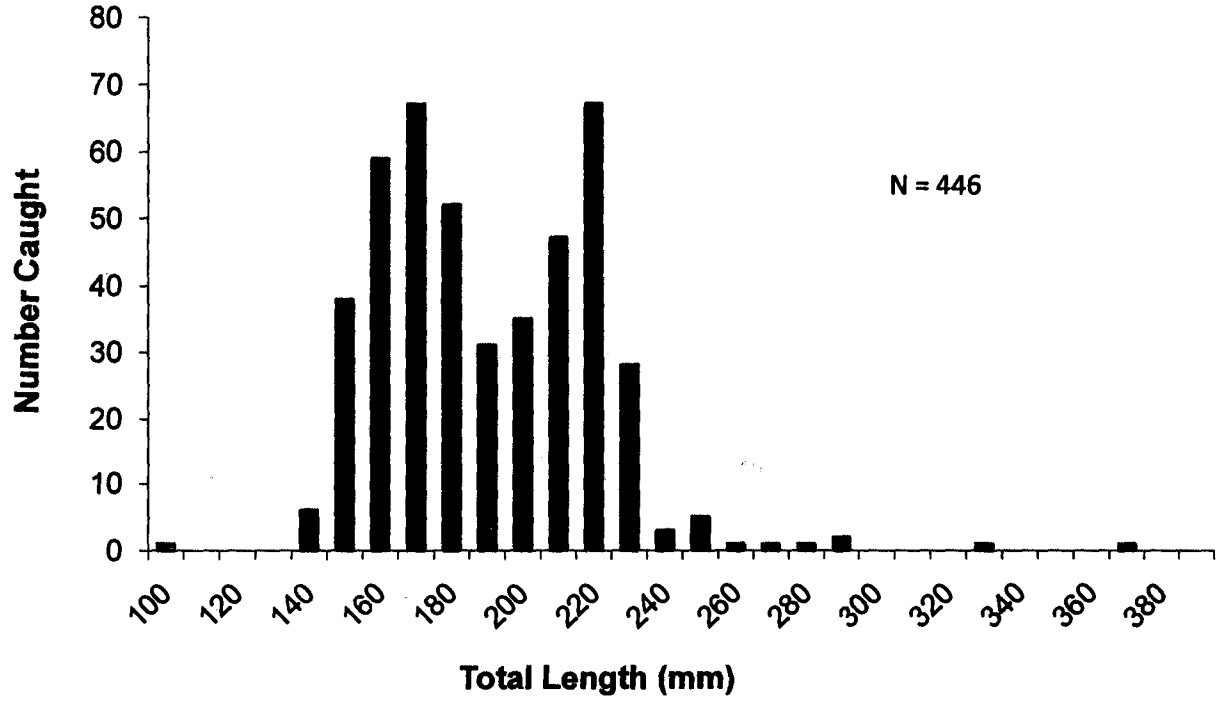

Figure 29. Length frequency of yellow perch collected in gill nets in Ririe Reservoir during 2008.

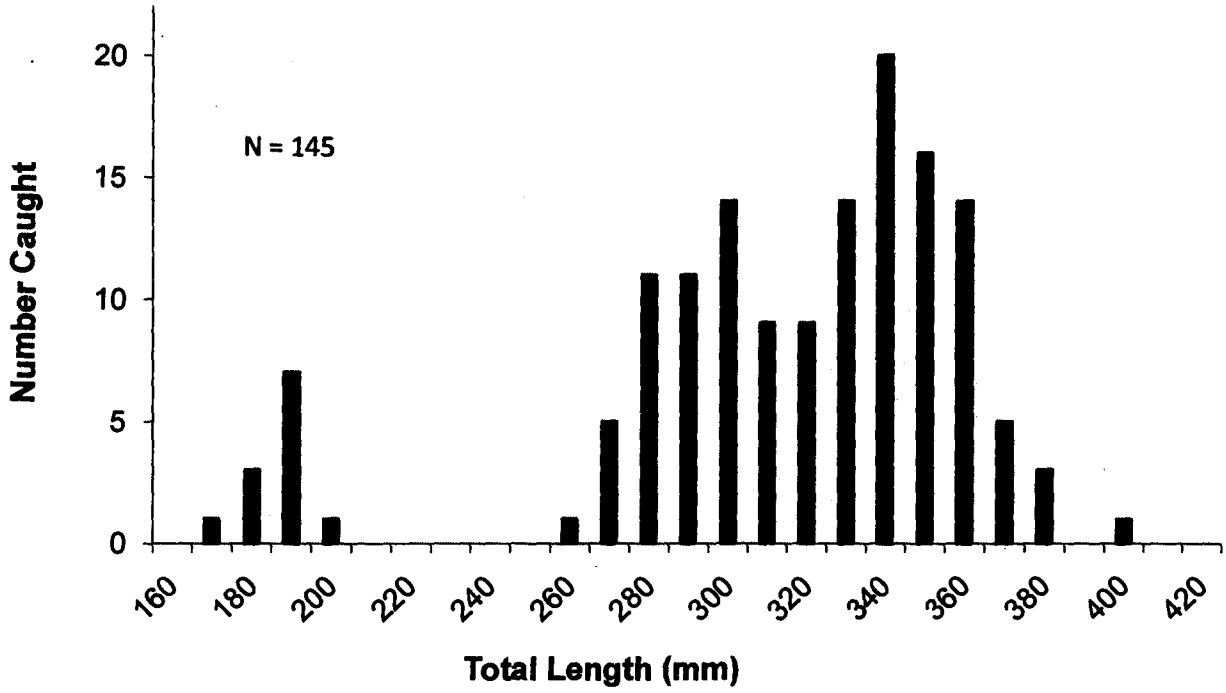

Figure 30. Length frequency of kokanee salmon collected in gill nets in Ririe Reservoir during 2008.

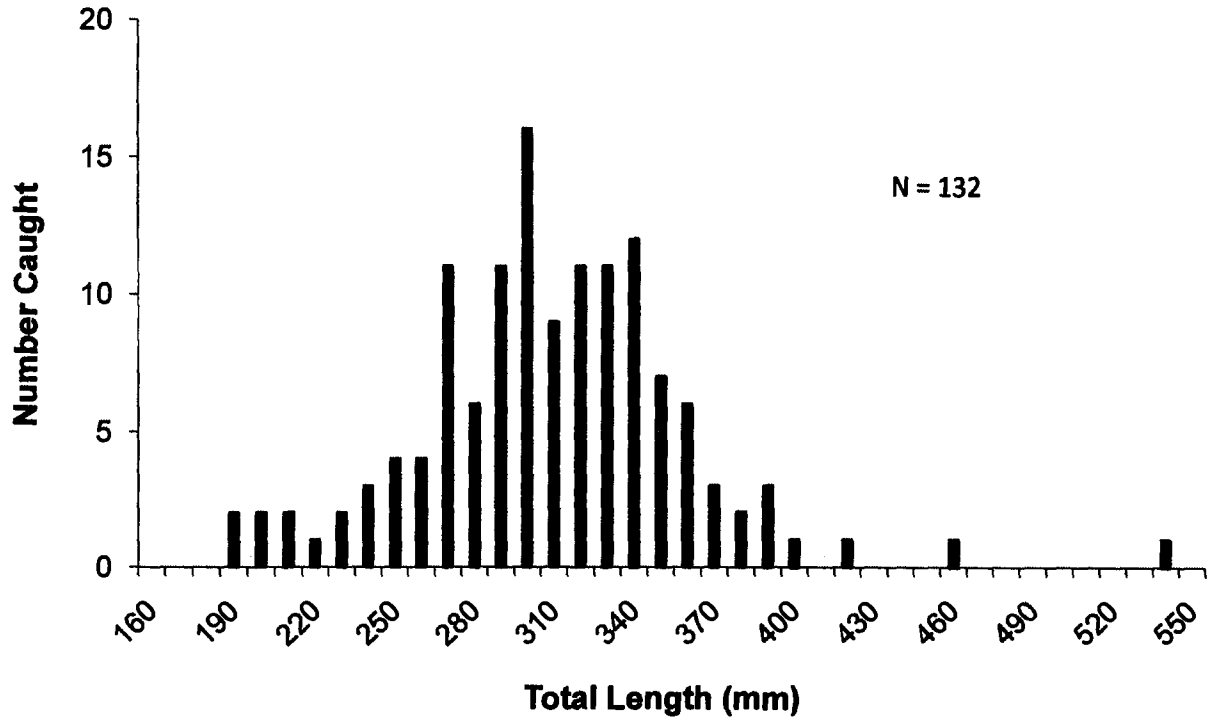

Figure 31. Length frequency of Yellowstone cutthroat trout collected in gill nets in Ririe Reservoir during 2008.

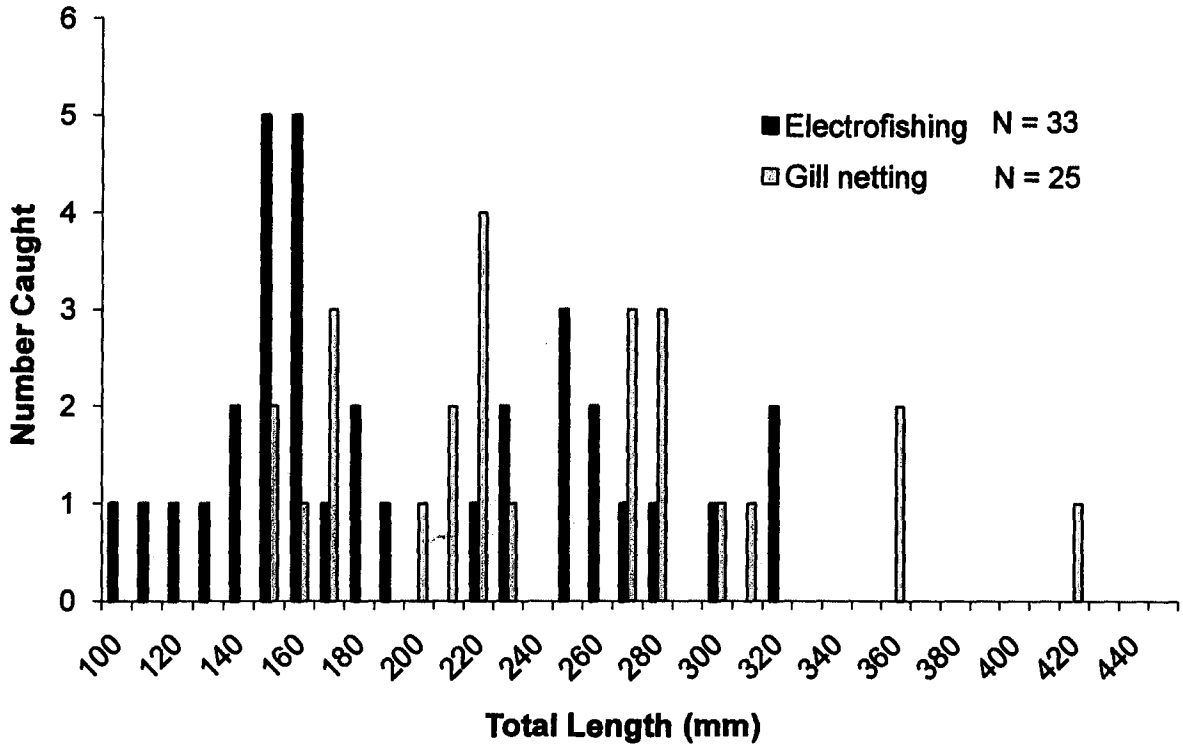

Figure 32. Length frequency of smallmouth bass collected while electrofishing and gill netting in Ririe Reservoir during 2008.

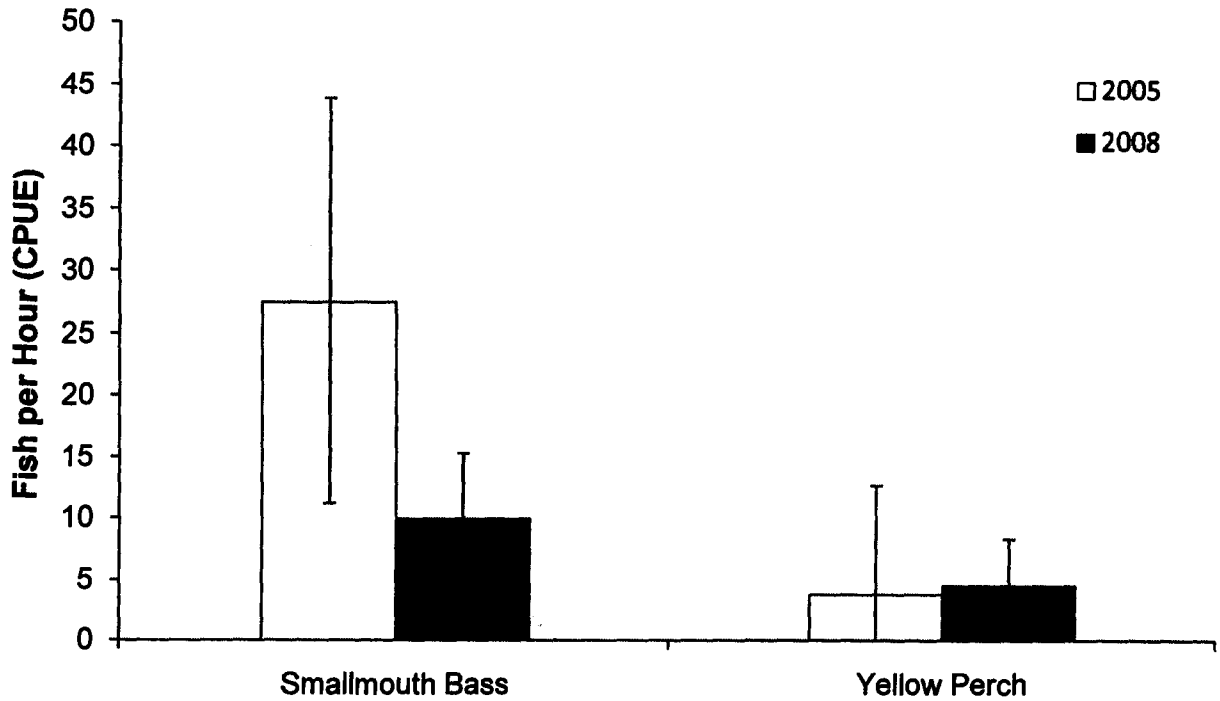

Figure 33. Electrofishing catch per unit effort (CPUE [fish per hour]) of smallmouth bass and yellow perch in Ririe Reservoir in 2005 and 2008. Error bars represent 95% confidence intervals.

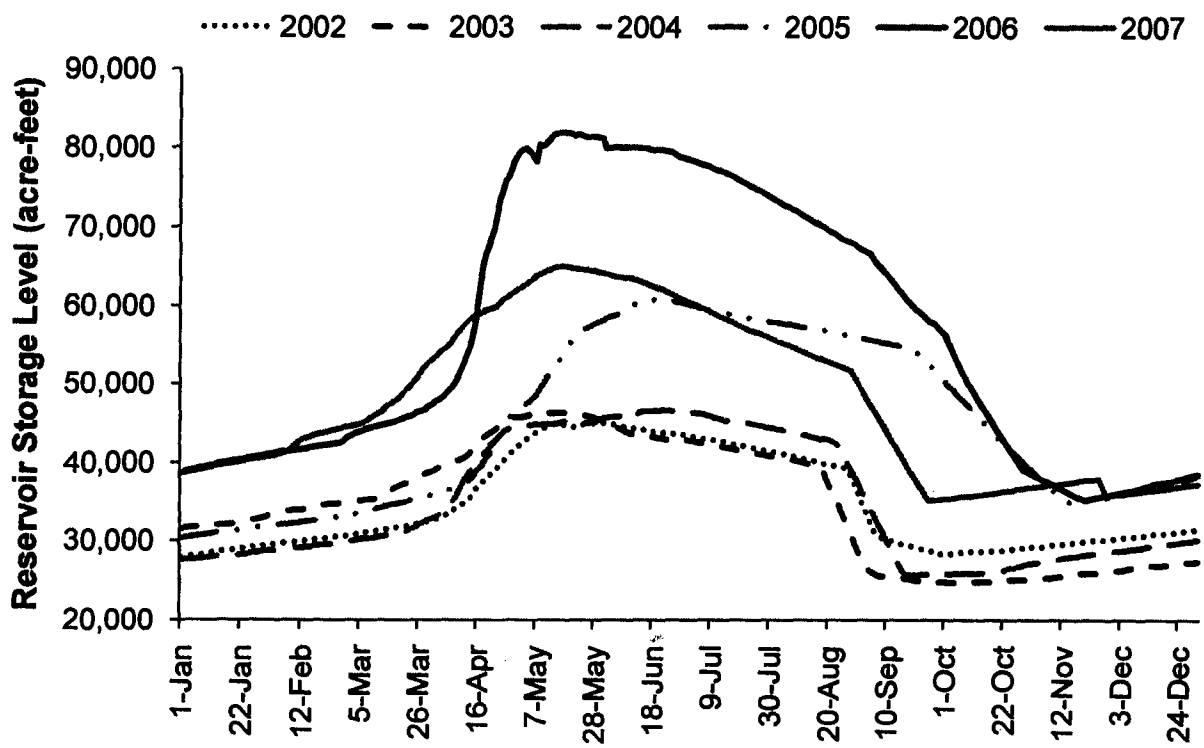

Figure 34. Annual water levels (acre-feet) in Ririe Reservoir between 2002 and 2007.

Table 8. Catch rates (catch per unit effort [CPUE]) and total number caught for all species collected from Ririe Reservoir in 21 gill net nights during 2008.

	Utah sucker	Yellow perch	Utah chub	Kokanee salmon	Cutthroat trout	Smallmouth bass	Walleye
CPUE	37.0	26.7	16.0	6.9	6.3	1.2	0.2
n	776	560	336	145	132	25	5

Table 9. Total length (mm) summary statistics for all gill net caught game fish in Ririe Reservoir during 2008.

	Cutthroat trout	Kokanee salmon	Smallmouth bass	Walleye	Yellow perch
Mean	305	309	241	408	187
Median	304	321	220	373	181
Range	188 - 539	170 - 394	142 - 412	348 - 555	75 - 365
n	132	145	25	5	446

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SOUTH FORK SNAKE RIVER

ABSTRACT

Picket weirs were used to trap adult trout migrating into Pine and Rainey creeks. High flows rendered trapping efforts ineffective. We sampled four sites in Pine Creek to compare Yellowstone cutthroat trout abundance with estimates from 2000 and found a significant increase in abundance.

Fall electrofishing surveys at the Lorenzo and Conant monitoring reaches were used to assess trout abundance, trend, and the influence of flow management on YCT and RBT recruitment. Density estimates for age I and older trout from 2008 were lower than in 2007 at both locations. We estimated there were 774 (±132) BNT (BNT) per kilometer at Lorenzo. We could not estimate cutthroat trout abundance at Lorenzo due to too few recaptures. At the Conant monitoring reach, we estimated there were 1,065 (±156) YCT/km, 574 (±108) RBT and rainbow x cutthroat trout hybrids (RBT)/km, and 380 (±57) BNT/km. No significant trend in size structure was detected for YCT at Conant or for BNT at Conant or Lorenzo. Stock indices for RBT have increased at Conant. Flow management from Palisades Reservoir resulted in a peak flow of 18,200 cfs (422 cms) on June 1, 2008. The max:min flow ratio for the spring of 2008 was 22.6:1 which exceeded our minimum goal of 15:1.

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INTRODUCTION

The South Fork Snake River a part of a unique and important ecosystem in eastern Idaho. The United State Bureau of Land Management (BLM) recognizes the cottonwood gallery forests growing in the riparian areas of the South Fork Snake River as the largest in the west (BLM 2009). The Audubon society has designated the habitat along the South Fork Snake River as a "National Important Bird Area" because it sustains numerous bird species, including Idaho's largest Bald Eagle population. The native trout of the South Fork Snake River is the YCT. This population is one of the few remaining healthy fluvial populations within their historical range in Idaho (Thurow et al. 1988; Van Kirk and Benjamin 2001; Meyer et al. 2006). Across the majority of the species range, YCT have experienced dramatic reductions in abundance and distribution (Behnke 1992). In August 1998, conservation groups petitioned the USFWS to list YCT under the Endangered Species Act (ESA). In February 2001, the listing petition was denied, and the conservation groups filed a lawsuit in January 2004 which led to a 12-month review of the current status of YCT. Based on the 12-month review, the USFWS determined that YCT did not warrant listing under the ESA in February 2006 (USFWS 2006). However, additional future litigation is possible.

The South Fork Snake River YCT population is both ecologically and economically important. YCT are widely known among anglers as a trout that are easy to catch (Griffith 1993; Thurow et al. 1988) and have a strong tendency to take dry flies. A substantial fishery has been established on YCT in the South Fork Snake River. The South Fork fishery generated approximately $12 million in local income and supported an estimated 341 jobs in 2004 (Loomis 2005). This important trout fishery in the South Fork has been managed under various regulations over the past 30 years (Table 10).

While the YCT population in the South Fork Snake River is considered healthy (Meyer 2006) recent abundance estimates have declined from previously documented abundances (Moore and Schill 1984) due to many factors including hybridization with non-native trout, connectivity with tributaries, and altered flows resulting from upstream dam operations. Hybridization with non-native RBT has increasingly impacted YCT populations relative to the early 1980s (Moore and Schill 1984). Hybridization has been blamed for YCT declines across their native range (Krueger and May 1991; Leary et al. 1995). When YCT successfully spawn, connectivity between tributary spawning areas and the mainstem South Fork can hinder YCT survival and recruitment. Most tributaries have irrigation diversions that can entrain out-migrating juvenile YCT and post-spawn adult YCT. Altered flows resulting from upstream dam operations have also been identified as impacting YCT populations in the South Fork (Moller and Van Kirk 2003). Natural flows and connectivity have been permanently altered by the completion of Palisades Dam in 1957. More recently, drought has affected water management in the South Fork and its tributaries and is likely impacting YCT.

Just as altered flows have negatively impacted YCT, a hydrograph reflective of an unregulated river has been shown to benefit YCT while adversely affecting RBT (Moller and Van Kirk 2003). The impacts of this natural-shaped hydrograph are more pronounced after low winter flows. Palisades Reservoir, as a flood control/irrigation storage reservoir, alters flows downstream by increasing late winter flows to make room for spring runoff, diminishing the spring run-off peak downstream and increasing the summer flows. In other words, the altered hydrograph tends to be smoothed relative to the natural snow-melt hydrograph. The hydrologic regime is a primary factor affecting ecological processes governing populations associated with river systems (Sparks et al. 1990). Springtime maximum flows of 36,000 cfs have been

recommended for optimal geomorphologic processes in the South Fork required for cottonwood recruitment (Merigliano 1997). Maximum daily spring flows out of Palisades Reservoir from 1999 to 2003 averaged 12,540 cfs. Moller and Van Kirk (2003) recommend a natural-shaped spring peak hydrograph that is at least 15 times higher than the prior winter's minimum flow to improve YCT recruitment relative to RBT in the South Fork.

YCT and RBT are closely related taxonomically and have similar life-histories. The spawn timing of RBT occurs slightly before YCT, which typically spawn during the descending limb of the spring hydrograph peak. However, spatial and temporal overlap of RBT and YCT spawning has been documented in the main river and spawning tributaries of the South Fork (Henderson et al. 2000). Currently, YCT and RBT select for similar spawning habitat in the main river (side channels), and in tributaries RBT tend to spawn in the lower reaches while YCT migrate further upstream (Henderson et al. 2000; Meyer et al. 2006). Another difference between these similar species is the communities they evolved in. YCT have evolved in fish communities depauperate of other closely-related salmonids while RBT have evolved sympatrically with other salmonids. YCT are considered the original native trout of the Snake River drainage, but was later replaced by RBT up to Shoshone Falls (Behnke 1992). Stable, sympatric populations of RBT and YCT are non-existent across their range. Non-native RBT were stocked in the South Fork Snake River from the 1880s through 1981, but comprised only a small portion of the species composition (Moore and Schill 1984). Through 1981, catchable-sized fertile RBT were stocked at various locations including Palisades Creek, Rainey Creek, and a wild run of RBT had become established in Palisades Creek by 1982 (Moore and Schill 1984). Densities of RBT remained low through the early 1990s (Schrader et al. 2002), but increased in abundance with a concurrent decline in YCT from the mid-1990s through 2003 (Garren et al. 2006). Rainbow x cutthroat hybrid trout (hereafter included with RBT) abundances have also increased. The threat of hybridization to YCT populations is substantial (Thurow et al. 1988; Clancy 1988) because females from both YCT and RBT hybridize and their offspring are fertile (Henderson et al. 2000).

A change in the South Fork fishery management program was implemented in 2004 to address the increasing RBT population and decreasing YCT population. The current management goal is to ensure YCT are the dominant trout in the South Fork Snake River, and the approach is three-pronged. The first component deals with reducing RBT abundance through harvest, the second component involves maintaining tributaries as YCT spawning strongholds, and the third component deals with shaping flows to benefit YCT.

The current management strategy differs from typical regulations in that IDFG actively encourages angler harvest of RBT instead of limiting harvest. This required a shift in angler attitude and behavior. The upper South Fork, where the majority of RBT resides, was recently dominated by anglers with a catch-and release mentality (Moller and Van Kirk 2003). For example, in 2003, 93% of the fish caught were released and RBT were 20% of the catch (Schrader and Fredericks 2006). In contrast, during 1979 anglers released 35% of their catch, and RBT constituted only 2% of the catch (Moore 1980). Moore (1980) reports that 8% of the RBT caught in 1979 were released, and most of the RBT caught were hatchery catchables. Through substantial outreach and education efforts, release of RBT has decreased since limits were removed in 2004. A creel survey from 2005 estimated 74% of RBT caught were released whereas 82% were released in 2003 (Schrader and Fredericks 2006b). Tag return studies have estimated RBT exploitation at 21% in 2005 (Schrader and Fredericks 2006b), 24% in 2006 (Schrader and Fredericks 2008), and 13% for a partial year not including the spawning season fishery in 2007 (High et al. 2008).

Permanent fish weirs have been used to sample adult migrants in four main tributaries of the South Fork since 1997. Since 2001, IDFG has removed RBT from spring runs to protect the genetic integrity of YCT spawning in these tributaries. Various weir configurations have been used to try to effectively catch trout including floating panel, Mitsubishi, hard picket, and electric weirs. Floating panel weirs were used at Burns, Pine Rainey, and Palisades creeks with limited effectiveness (Schrader and Fredericks 2008). A Mitsubishi style weir was first used at Palisades Creek in 2005 with an estimated efficiency of 91%, and was subsequently used at the other tributary weirs except Rainey Creek in 2006 (Schrader and Fredericks 2008). Trapping efficiencies of the Mitsubishi weirs were later deemed lower than necessary to protect YCT spawning areas (Schrader and Fredericks 2008). Hard picket weirs have been used at Pine Creek and Rainey Creek (Schrader and Fredericks 2008). Hard weir pickets have worked well during low snowpack years, but, during average or above-average years, pickets and/or frames had to be removed. In 2007, a temporary electric weir was installed at the Palisades Creek weir site, and trapping efficiency was estimated at 98% (High et al. 2008). Modifications of the tributary weirs are ongoing to increase trapping efficiency in order to better protect the genetic integrity of the South Fork YCT population.

High spring flows to benefit cutthroat in the South Fork have been the goal of flow management since 2004. IDFG, BOR, and irrigators have work collaboratively to try to obtain a natural-shaped hydrograph, but efforts are hampered by the competing demands of irrigation, flood control, and storage levels of other reservoirs in the upper Snake River system. Moller and Van Kirk (2003) reported more natural spring peaks in the hydrograph benefit YCT recruitment while discouraging RBT recruitment. Thus, the effectiveness of the spring freshets or natural-shaped peak flows experienced to date are assessed by analyzing data collected during electrofishing surveys during the fall. Conservation of the South Fork YCT is the focus of our South Fork management program, and our efforts during 2008 are summarized in this report.

OBJECTIVES

1. Operate weirs in Pine and Rainey creeks to maintain YCT stronghold areas
2. Operate screens at the Palisades Canal and Burns Creek ditch to reduce loss of YCT to irrigation diversions
3. Monitor trout abundance and species composition in Pine Creek relative to previous surveys
4. Monitor relative abundance, density, and size and stock structures of South Fork trout populations
5. Work with IDFG engineering and Smith-Root, Inc. to modify weir structures at Burns Creek and at Palisades Creek to increase trapping efficiency of adult trout
6. Evaluated effectiveness of flows benefiting YCT

STUDY AREA

The Snake River originates in Yellowstone National Park and flows south through Grand Teton National Park and the Jackson Hole valley before turning west and flowing into Palisades Reservoir at the Idaho – Wyoming state line. The 106 km portion of the Snake River that runs from Palisades Dam to the confluence with the Henrys Fork is commonly referred to as the

South Fork Snake River (South Fork). Anglers and biologists divide the South Fork into three segments. The first segment, called the upper river, runs from Palisades Dam to Pine Creek through a relatively unconfined valley. The first 13 km of the upper river downstream of the dam is a simple channel. From this point, the river braids around numerous islands. All but one of the four main YCT spawning tributaries enters the South Fork in this upper river, including Palisades Creek, Rainey Creek, and Pine Creek (Figure 35). The second segment of the South Fork runs from Pine Creek downstream to Heise, and is commonly referred to as the Canyon. Burns Creek, the fourth major YCT spawning tributary enters the South Fork in the Canyon. The last segment of the South Fork runs from Heise to the confluence with the Henrys Fork, and is commonly referred to as the lower river. There are no major YCT spawning tributaries in the lower river, and while constant water temperatures from Palisades Dam moderate winter conditions in the upper and canyon sections, winter conditions in the lower river are usually more severe than upstream (Moller and Van Kirk 2003). The Conant and Lorenzo monitoring reaches of the South Fork are in the upper river and lower river sections, respectively.

METHODS

Weirs and Screens

A picket weir was operated in Pine Creek from April 21, 2008 to July 8, 2008. Pickets were removed for part of this time period due to high water and debris. A picket weir was operated at Rainey Creek from June 19, 2008 to July 11, 2008. Late snowpack on the access road to Rainey Creek precluded early weir installation. Fish captured at the weirs were identified to species, sexed, and were released upstream of the weir if they were identified as YCT. RBT captured at the weirs were transported to a nearby fishing pond.

We operated fish screens on Palisades Canal and the Burns Creek ditch from April 26 to November 10, 2008 to prevent the entrainment of YCT. In addition to the regular maintenance (lubricating and cleaning of the screens and bypass pipes) a hot-water pressure washer was used on the four large screens at the Palisades Canal to reduce hard-water and algae build-up in effort to reduce the frequency of required trips to the Salmon screen shop for sand-blasting.

Tributary Surveys

We estimated densities of trout at four locations in Pine Creek during base flows in August 2008 (Figure 36). Two of these locations were new sites (sites 1 and 1A), while two locations (sites 2A and 3A) were sampled previously (Meyer and Lamansky 2003). We conducted multiple-pass depletions using gas-powered backpack electrofishing units and pulsed direct current (DC). We calculated population estimates with 95% confidence intervals for trout larger than 100 mm using the demo version of Microfish 3.0 (Van Deventer and Platts 1985). We calculated densities by dividing the population estimate by the surface area of the section sampled and then standardized densities to fish per 100 m^2. Densities and corresponding 95% confidence intervals were compared to prior estimates where possible.

Population Monitoring and River Flows

We sampled the Lorenzo and Conant monitoring reaches of the South Fork during the fall of 2008 to estimate abundance of trout. Estimates were calculated for each species and only included age-1 and older trout (based on lengths - Schrader and Fredericks 2006a). We used a jet boat outfitted with electrofishing gear and pulsed DC electrical current to capture fish. We collected trout over two days (September 18 and 19, 2008) for marking followed by a six day rest and a two day recapture event at Lorenzo. We collected trout over two days (October 1 and 2, 2008) for marking followed by a six day rest and a three day recapture event at Conant. All trout captured were identified to species and measured to the nearest mm. Fish captured during the marking runs that were large enough to be included in population estimates were marked with a hole punch in the caudal fin for identification during recapture runs. Additionally, all YCT captured were marked with a passive integrated transponder (PIT) tag and a corresponding adipose clip as a secondary mark to evaluate tag loss. This is the first year of a multi-year study where PIT-tagged YCT will be individually identified at weirs and during electrofishing surveys to assess spawning site fidelity, mortality rates, recruitment rates, repeat spawning periodicity, and general movement of YCT in the South Fork and its tributaries. Abundance estimates and 95% confidence intervals were calculated using the log-likelihood method in Montana Department of Fish Wildlife and Park's software Mark/Recapture for windows or MR 5.0 (MFWP 1997). The log-likelihood method adjusts estimates based on modeled capture efficiencies, which differ by fish size (Schill 1992). Abundance estimates were standardized to fish per kilometer for comparison with estimates collected since 1986. As with most mark - recapture surveys, we assumed the population was closed, the probability of capture was the same for individual fish for each run, fish did not lose their marks, marked fish mixed randomly with unmarked fish, and the marks were recognized properly (Ricker 1975). Stock structure was compared among sample years using relative stock density focusing on trout larger than 406mm (RSD_{406}) values and simple linear regression with α=0.05. RSD_{460} values were calculated separately for each species by dividing the number of trout >406 mm captured by the number of trout captured that were >203 mm and multiplying by 100. We monitor YCT and RBT recruitment to gauge the effectiveness of managed spring flows aimed to benefit YCT. We cannot effectively sample age-0 fish; therefore, we use the abundance of age-I YCT and RBT to evaluate the effects of spring flows during the year spawning occurred on that year class.

RESULTS

Weirs and Screens

The Pine Creek weir was installed on April 21 and was removed July 8, 2008. Although the Pine Creek weir was installed and continuously operated from April 21 through May 6, 2008, no trout were captured. We were unable to operate the picket weir at Pine Creek for 48 days from early May to late June due to high flows and debris. One section of pickets was removed on May 5 to alleviate flooding and concern for washing out the weir structure and backing up water onto state highway 31. On May 6, all of the remaining pickets were pulled, and on May 17, the picket frames were removed from the weir as the water level was above the walls of the trap (Figure 37). After peak flows in Pine Creek began to subside, the weir was reinstalled on June 23. From June 25 through July 1, some of the weir pickets were pulled for several hours on a daily basis to allow downstream migrants to pass downstream past the weir. All of the

pickets at Pine Creek were pulled on July 2 to facilitated downstream migration. The remaining weir components were removed July 8. We captured a total of 115 adult trout at Pine Creek. All 115 trout were YCT, including 41 males and 74 females. No RBT were captured at the Pine Creek weir in 2008.

We captured 14 adult trout at the Rainey Creek weir during 2008. Again, all captured trout were YCT, including 4 males and 10 females. Lingering snow on the access road to Rainey Creek during the spring of 2008 precluded early weir installation, which should have occurred in March. The Rainey Creek weir was installed June 19. The pickets were removed on July 3 to allow passage of downstream migrants, and the remaining weir components were removed July 11.

We started modifications that should increase trapping efficiency at Burns Creek and Palisades Creek in 2008. We worked with engineers from IDFG and Smith-Root, Inc. to design and implement a combination fall/velocity barrier for Burns Creek and an electrical barrier for Palisades Creek. The Burns Creek design incorporates a two foot (0.6 m) waterfall which lands directly on a concrete slope designed to prevent fish from swimming up because of swift stream velocity on the 12 foot (3.7 m) slab (Figure 38). We also worked with the U. S. Forest Service to complete an environmental analysis for the project and acquired necessary stream alteration permits from the Idaho Department of Water Resources and the U.S. Army Corps of Engineers. Construction on the Burns Creek weir began August 20, and was completed November 18, 2008. We began construction of the permanent electrical barrier electrodes at Palisades Creek on November 17, 2008, and it was completed May 8, 2009. We operated a temporary electric weir at Palisades Creek in 2007 and calculated trapping efficiencies in excess of 98% (High et al. 2008).

Tributary Surveys

Densities of YCT sampled at four locations in Pine Creek varied from 0.2 to 17 fish >100 mm/100m^2. RBT were captured at one of the lower sites (site 1A), but not at the upper two. BNT and RBT comprised 83% and 33% of the population at sample sites 1 and 1A, respectively (Figure 39). Density estimates of YCT at sites 2A and 3A in 2008 were 460% and 130% higher than in 2000. YCT estimates for 2000 and 2008 did not have overlapping 95% confidence intervals, so the increases in YCT abundances from 2000 to 2008 were statistically significant (Figure 40).

Population Monitoring and River Flows

We captured 64 YCT, 4 RBT, and 733 BNT during four days of electrofishing in the Lorenzo monitoring reach. We did not recapture marked RBT or YCT during the recapture runs, and were therefore unable to calculate abundance estimates for these species. The BNT estimate for age-1 and older fish was 778 BNT >178 mm/km (±132) which was 347 trout per km less than the 2007 estimate (Figure 41). Our capture efficiency was 11% for BNT. The RSD_{406} for BNT at Lorenzo was 16% (Figure 42) and individuals from all length groups were present in the length frequency distribution suggesting recruitment each year (Figure 43). The RSD_{406} values from 1989 to 2008 show no statistically significant trend ($F=2.304$, Num. df = 14, Den. df = 12, $P = 0.082$; Figure 42).

We captured 882 YCT, 486 RBT, and 435 BNT during five days of electrofishing the Conant monitoring reach. We also captured one lake trout *Salvelinus namaycush* that likely passed through Palisades Dam. We estimated there were 1,065 age-1 and older YCT per km (±156). This was a statistically significant 23% decrease from the 2007 YCT estimate (Table 11; Figure 44). The 2008 estimate for RBT was 574 RBT per kilometer (±108). The 2008 RBT estimate was significantly lower than the 2007 estimate (30%). We estimated there were 380 (±57) BNT per kilometer at Conant, which was not significantly different than the 2007 estimate but was 28% lower. Our capture efficiencies at Conant were 9%, 8%, and 12% for YCT, RBT, and BNT, respectively. The RSD_{406} value for YCT (11%) was similar to past estimates. Over the last 16 years, the RSD_{406} for YCT at Conant has not changed significantly (F=0.008, Num. df = 16, Den. df = 14, P = 0.63; Figure 45). The RSD_{406} value for RBT was 21% and has significantly increased over the last 16 years (F=9.37, Num. df = 16, Den. df = 14, P<0.001). The RSD_{406} value for BNT in 2008 was 34%. There has been no significant change in RSD_{406} values for BNT at Conant over the last 16 years (F=1.65, Num. df = 16, Den. df = 14, P=0.19).

Spring flows in the South Fork Snake River were controlled by BOR at Palisades Dam. Discharge from Palisades Dam peaked on June 1, 2008 at 18,200 cfs (422 cms). With winter flows near 800 cfs (19 cms), the max:min flow ratio for 2008 was 22.6:1 which was above the target of 15:1 set by Moller and Van Kirk (2003). The shape and timing of the peak flow in 2008 was similar to those from 2004 and 2007 (Figure 46). The effectiveness of the 2008 spring freshet will be assessed in the fall of 2009 when YCT and RBT recruits from the 2008 spawning season will be vulnerable to electrofishing gear. Recruitment responses for YCT and RBT after the 2004 spring freshet displayed a favorable response for YCT conservation in that RBT recruitment was low relative to YCT (Schrader and Fredericks 2006b). Unfortunately, our low capture efficiencies during fall monitoring surveys in 2008 did not allow us to assess effects of the spring 2007 freshet on YCT and RBT recruitment.

DISCUSSION

Weirs and Screens

Picket weirs were ineffective in 2008 due to prolonged runoff resulting from above normal snowpack and cool spring temperatures. The ineffectiveness of our trapping efforts in 2008 demonstrates the need to modify trapping structures so they remain functional in a range of flows. A hard picket weir had been used with greater than 95% efficiency in the past at Pine Creek (Schrader and Fredericks 2008), but the potential for flood water to erode the weir structure or parts of Idaho State Highway 31 necessitated the complete removal of the weir for over six weeks. The majority of the YCT spring spawning run and the entire RBT spawning run likely occurred while the weir was inoperable. Trapping efforts were equally unsuccessful in Rainey Creek, but for different reasons. In order to access and install the fish weir in Rainey Creek, the road would have had to be plowed for over 0.8 km during the US Forest Service human entry closure period. We opted to wait until the snow melted, which put installation of the Rainey Creek weir later than the 2008 peak migration time for YCT and RBT.

Tributary Surveys

The significant increase in YCT abundance in Pine Creek between 2000 and 2008 indicates Pine Creek continues to be a stronghold for YCT. Furthermore, no RBT were

observed during 2008 while they were found in low abundances at both sites in 2000 (Meyer and Lamansky 2003). The tributary surveys also provided an opportunity to review available options for moving the location of the Pine Creek weir. Although the Pine Creek weir is approximately 8 km from the mouth of Pine Creek the limited spawning habitat downstream of the current weir location precludes the necessity of abandoning the current location. Not only does the Pine Creek canyon located between the mouth and weir limit spawning opportunity for trout, but it also limits human accessibility such that moving a weir closer to the mouth would be logistically unfeasible. We recommend improvements occur at the current site.

Population Monitoring and River Flows

Although abundance estimates for all trout species at the Lorenzo and Conant reaches were lower than estimates from 2007, fall electrofishing surveys yielded encouraging results. The abundance estimates for all trout species at these reaches were lower than estimates from 2008. Because our estimates include age I and older trout, and the poor water year of 2007 likely negatively impacted trout recruitment in the South Fork Snake River, lower population estimates were not surprising. Further, based on the timing and magnitude of the managed flows in 2008, we anticipate a favorable response (strong YCT recruitment) in the South Fork next year. Although estimates for YCT, RBT, and BNT at Conant were lower in 2008 than 2007, the RBT estimate was significantly lower for the first time since management actions changed in 2004. This suggests management efforts including adult management in tributaries, spring freshets to mimic natural hydrographs, and angler harvest of RBT are making an impact at reducing abundance. Our analysis of RBT size structure also provides evidence that the three-pronged management approach in the South Fork is affecting the RBT population. Over the last 16 years the RSD_{406} for RBT at Conant has significantly increased. This suggests that each year there are increasingly more RBT >406 mm relative to recent recruits to the population or those RBT >203 mm but less than 406 mm. We feel this indicates reduced RBT recruitment.

Overall results from our efforts to keep YCT as the dominant salmonid in the South Fork are encouraging. Trapping success of RBT at tributary weirs must be improved if we are to protect tributary-spawning YCT from introgression with RBT and maintain YCT recruitment to the main river from the tributaries. The decrease in RBT abundance as shown in our mainstem monitoring reaches suggests RBT are responding to our three-pronged management approach. It appears our efforts may have affected the RBT population in the South Fork, but long-term success will require continued efforts and collaboration to secure spring freshets to produce natural-shaped hydrographs, continued education and outreach to inform anglers of their impacts on YCT conservation efforts in the South Fork, and continued efforts to limit RBT range expansion into important YCT spawning tributaries. YCT in the South Fork are proving to be a conservation reliant species that will require continued vigilance and intervention to preserve, protect, and perpetuate into the future.

MANAGEMENT RECOMMENDATIONS

1. Continue weir modifications by finishing the permanent electrode installation at the Palisades Creek weir in 2009 and installing electrodes at the Pine Creek weir in 2009.

2. Continue to implement flow management objectives recommended by EBSM (Hauer et al. 2004) and by Moller and Van Kirk (2003). Recommend that BOR time the spring freshet near the end of May to provide the maximum benefit for YCT (Van Kirk et al. 2010).
3. Continue to monitor South Fork trout populations by electrofishing in 2009.
4. Continue to estimate RBT exploitation using FLOY tags in 2009.
5. Continue to inform and educate anglers regarding benefits to cutthroat trout by harvesting RBT.
6. Continue to operate tributary weirs and canal screens.
7. Evaluate the efficiency of the newly modified Burns Creek weir in 2009.
8. Continue marking YCT with PIT tags as part of our ongoing study which will assess spawning site fidelity, mortality rates, recruitment rates, repeat spawning periodicity, and general movement of YCT in the South Fork and its tributaries.

ACKNOWLEDGMENTS

Greg Schoby, Bart Gamett, Matt Woodard, Russ Knight, Mike Bean, and Greg High helped with fall electrofishing. Chuck Traughber tended the weirs and screens. Volunteers from the Snake River Cutthroats assisted with weir installation at Pine Creek. Funding was provided by U.S. Department of Interior, BOR, under cooperative agreement #1425-05-FG-10-1188 (Ecologically Based System Management).

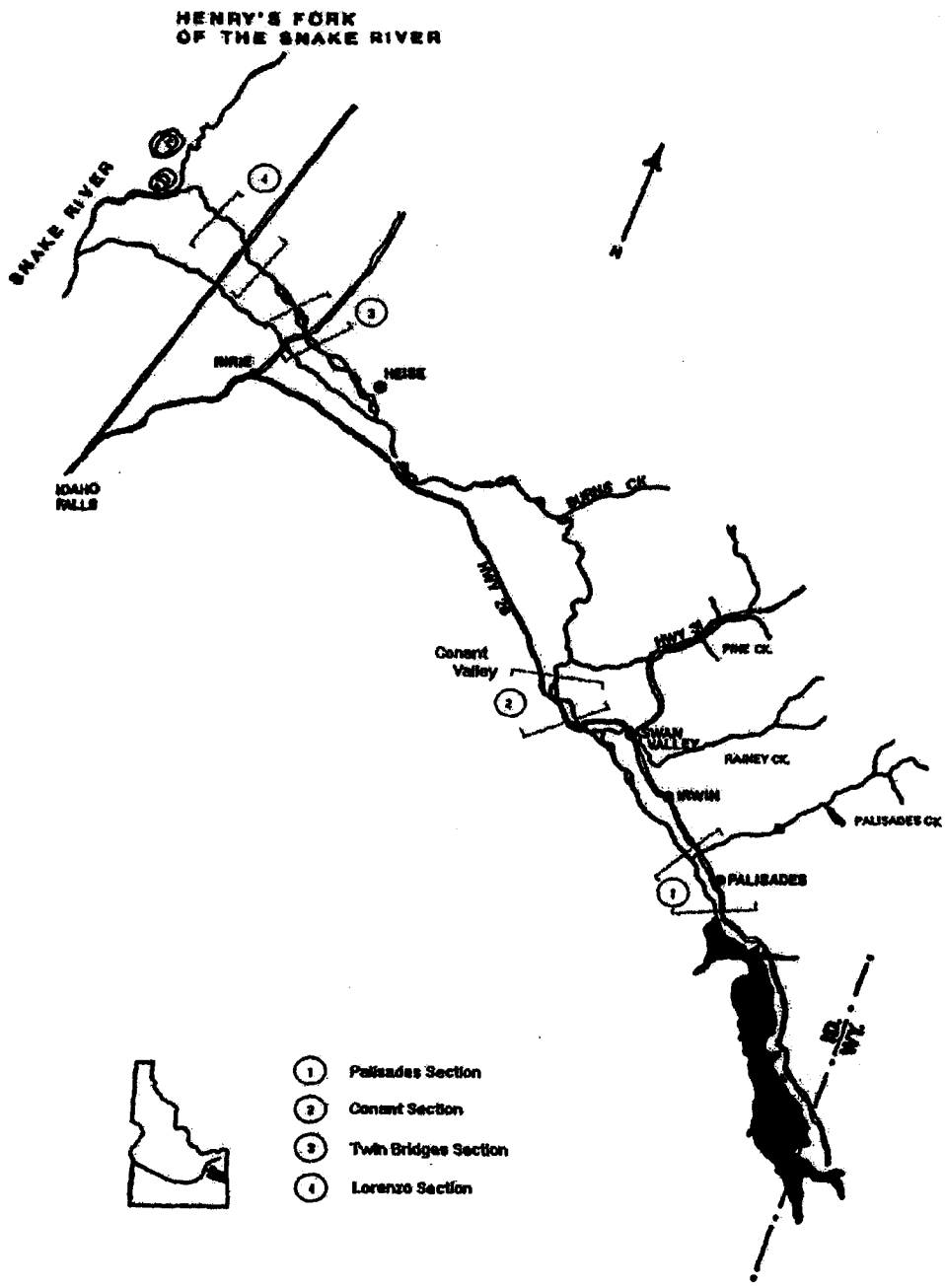

Figure 35. Map of the South Fork Snake River study area with standard monitoring reach location.

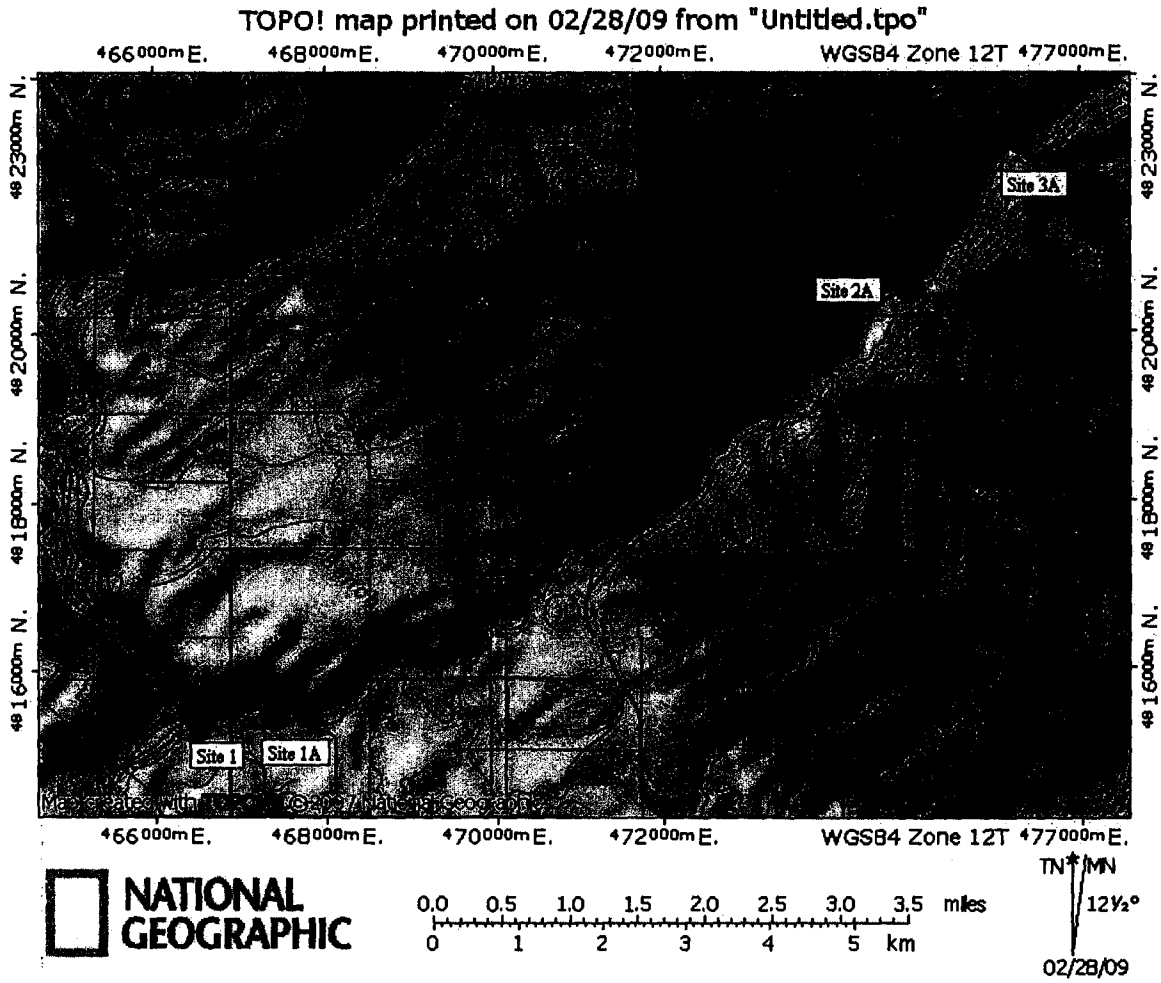

Figure 36. Sample sites from Pine Creek in 2008.

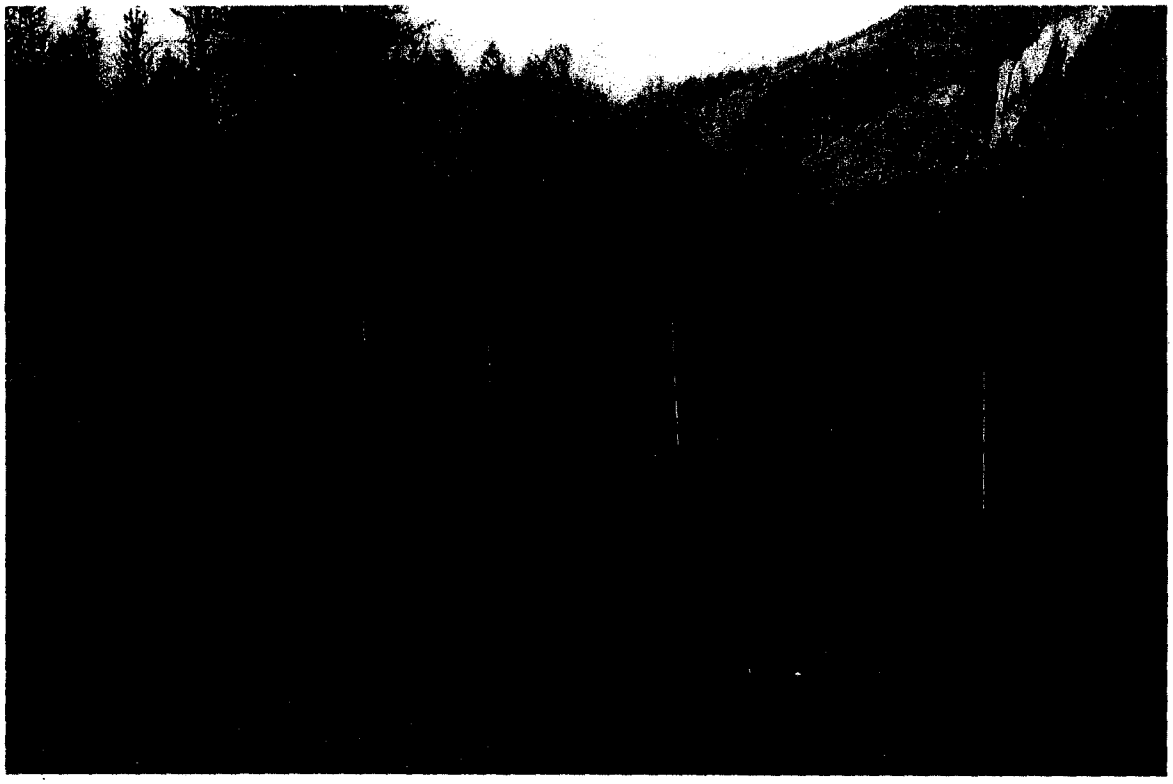

Figure 37. Flooding at the Pine Creek weir caused by woody debris build-up on picket frames and high flows on May 17, 2008.

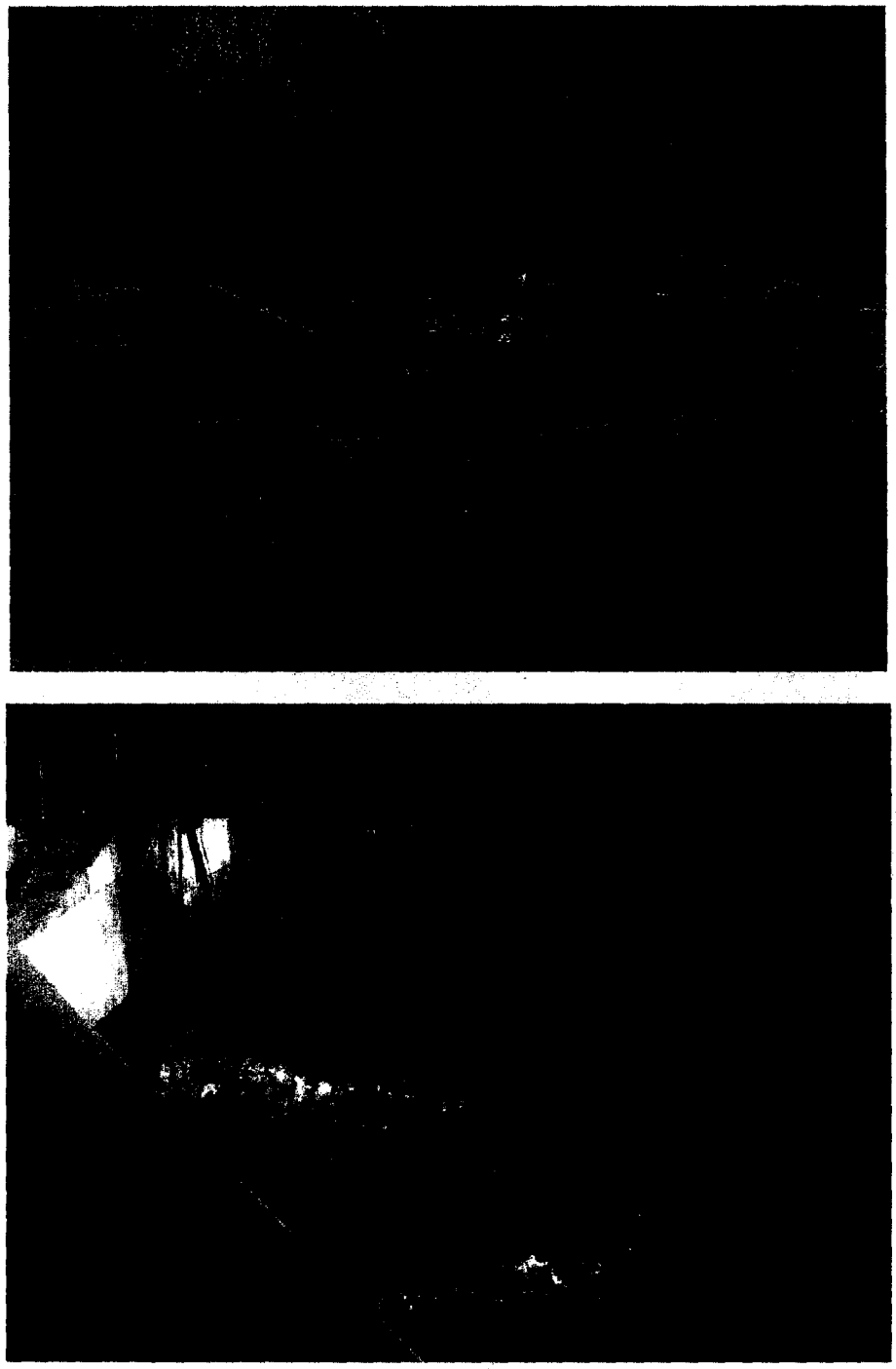

Figure 38. Burns Creek weir before and after the weir was modified in 2008 to incorporated a combination fall/velocity barrier to increase trapping efficiencies of spring migrating adult trout.

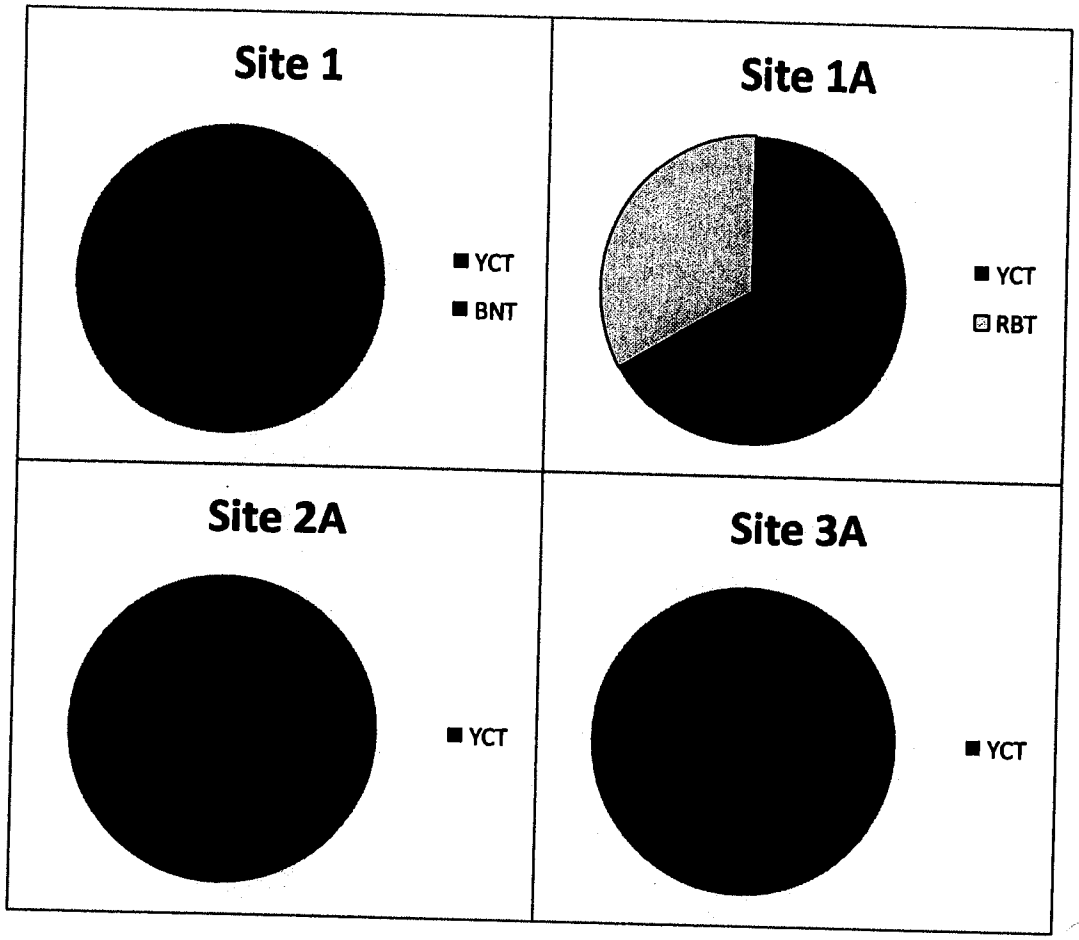

Figure 39. Species composition of trout in four sample sites in Pine Creek from 2008.

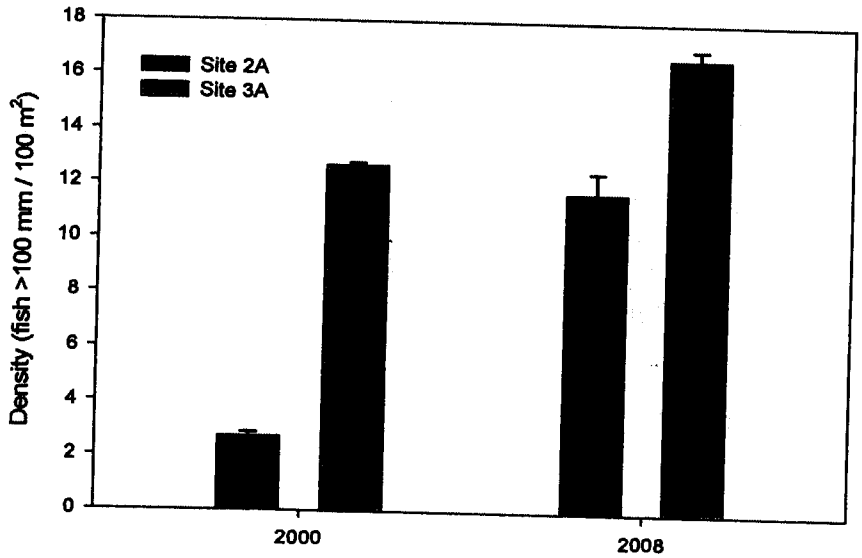

Figure 40. Densities of Yellowstone cutthroat trout at two sample sites in Pine Creek in 2000 and 2008.

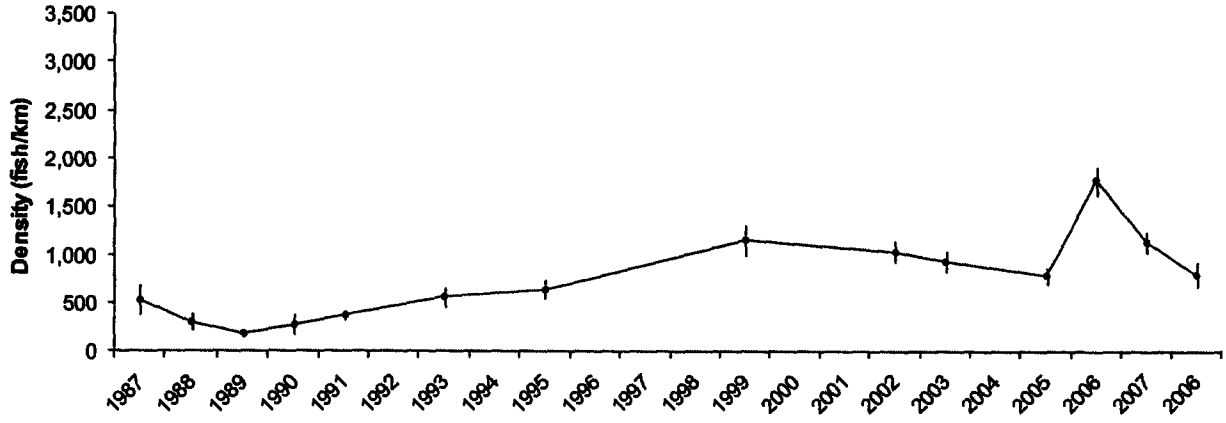

Figure 41. Estimated density of brown trout per kilometer at the Lorenzo monitoring reach from 1987 through 2008 with 95% confidence intervals.

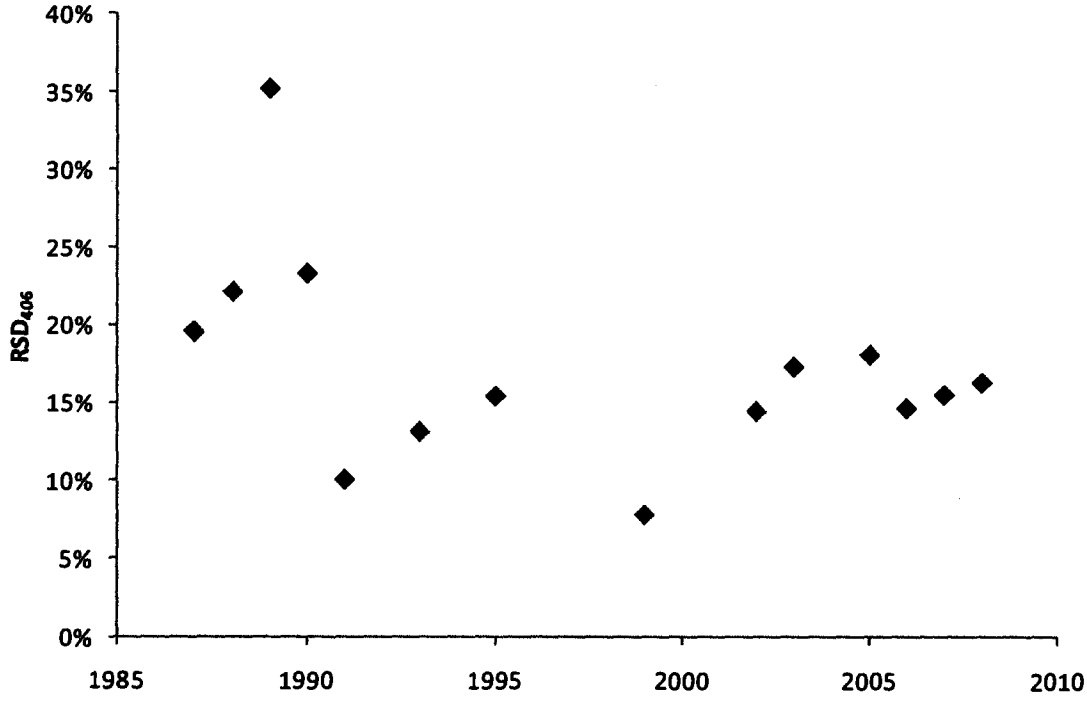

Figure 42. Brown trout RSD_{406} values from the Lorenzo monitoring reach since 1987.

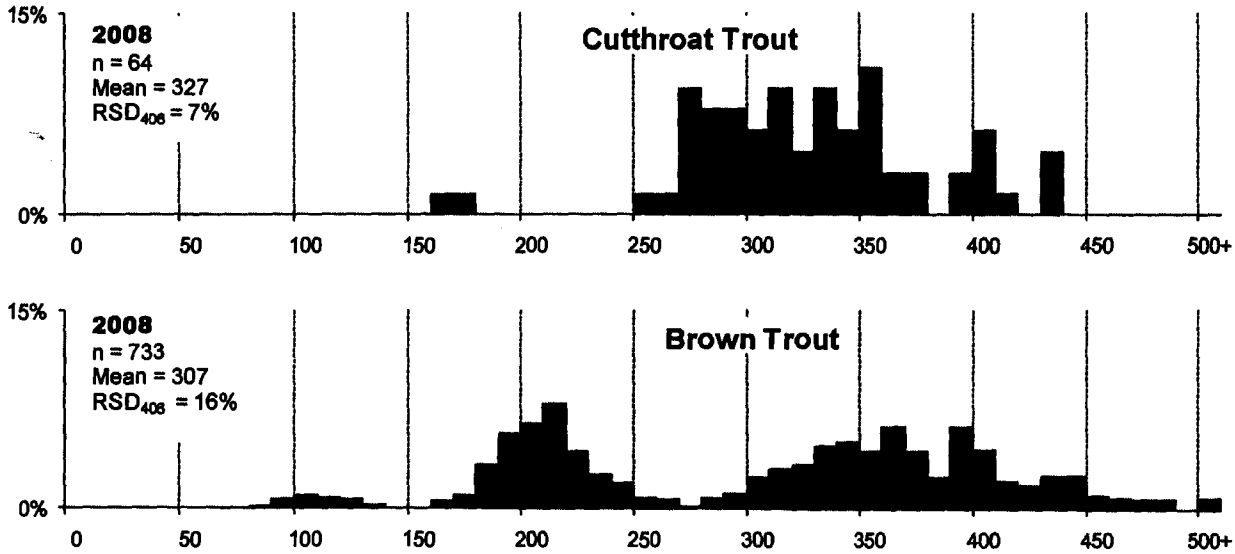

Figure 43. Length frequency distributions and summary statistics for Yellowstone cutthroat trout and brown trout captured in the Lorenzo monitoring reach in 2008.

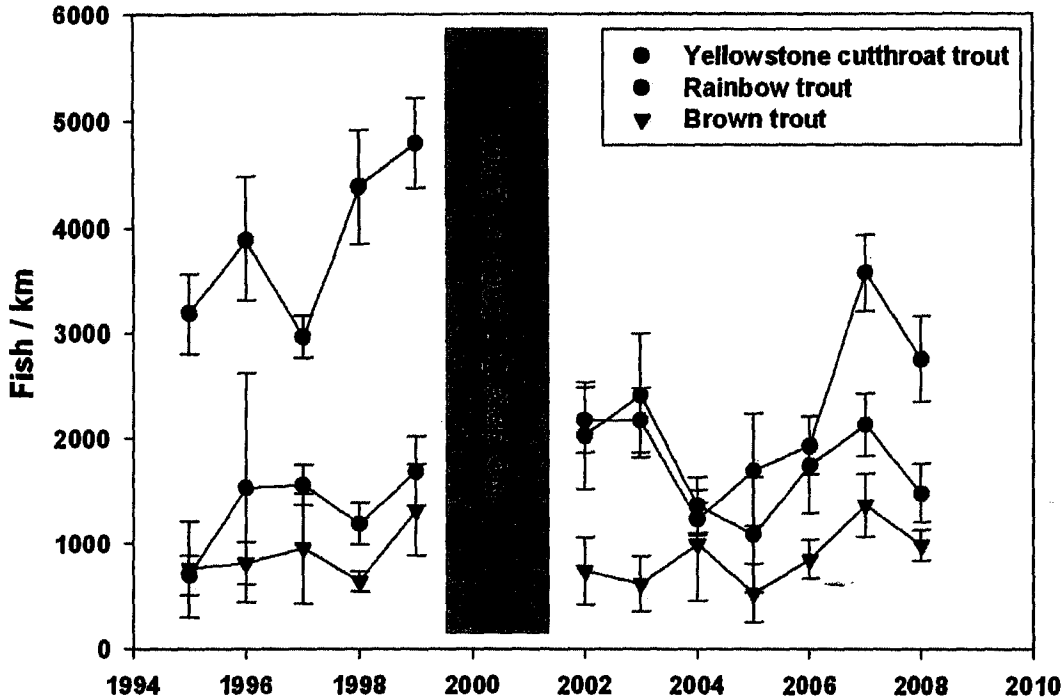

Figure 44. Estimated densities of Yellowstone cutthroat trout, rainbow trout (including hybrids), and brown trout from 1987 through 2008 at the Conant monitoring reach of the South Fork Snake River.

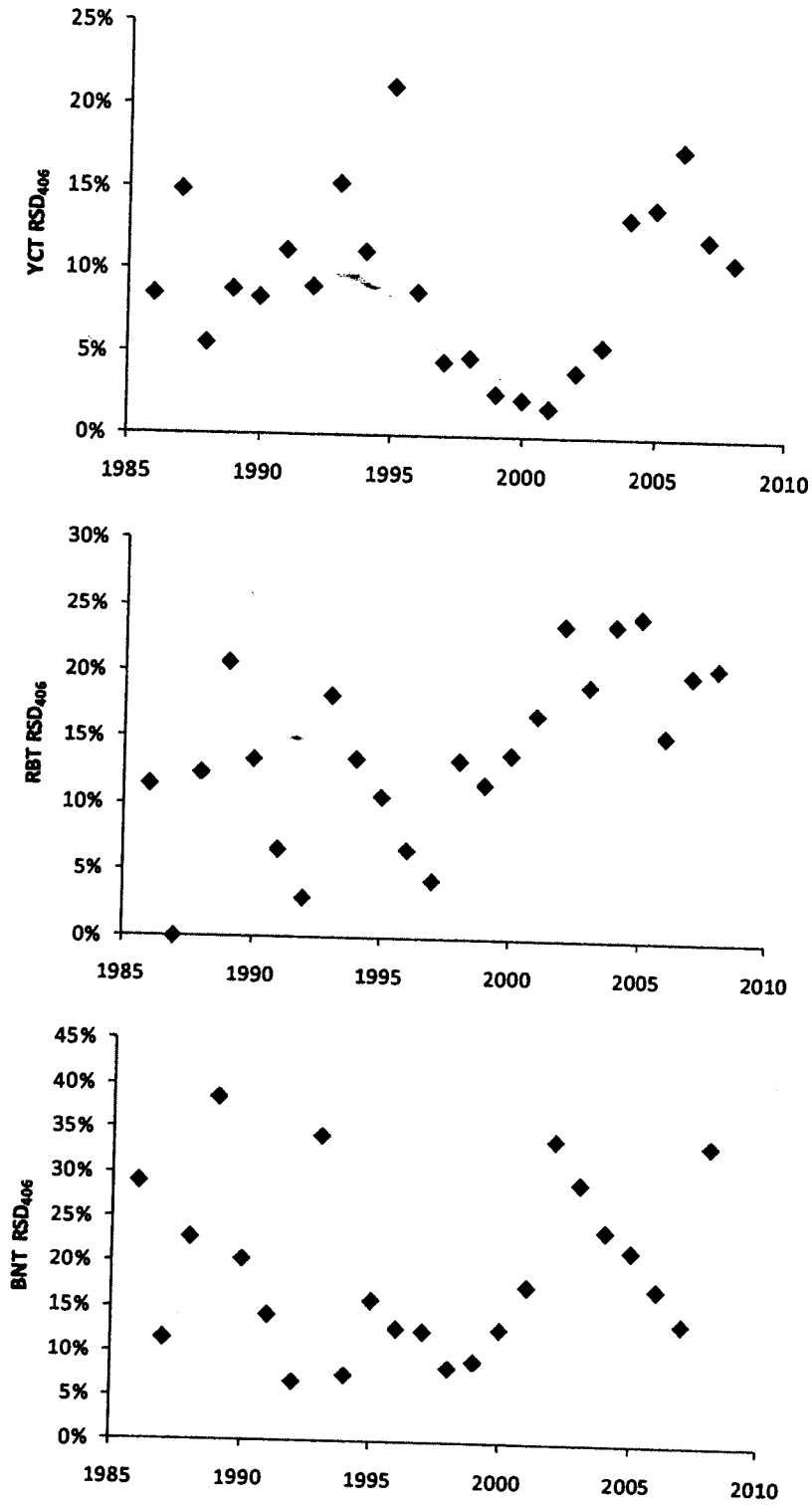

Figure 45. RSD_{406} values for Yellowstone cutthroat trout (YCT), rainbow trout (RBT; including cutthroat x rainbow hybrid trout), and brown trout (BNT) at the Conant monitoring reach from 1986 through 2008.

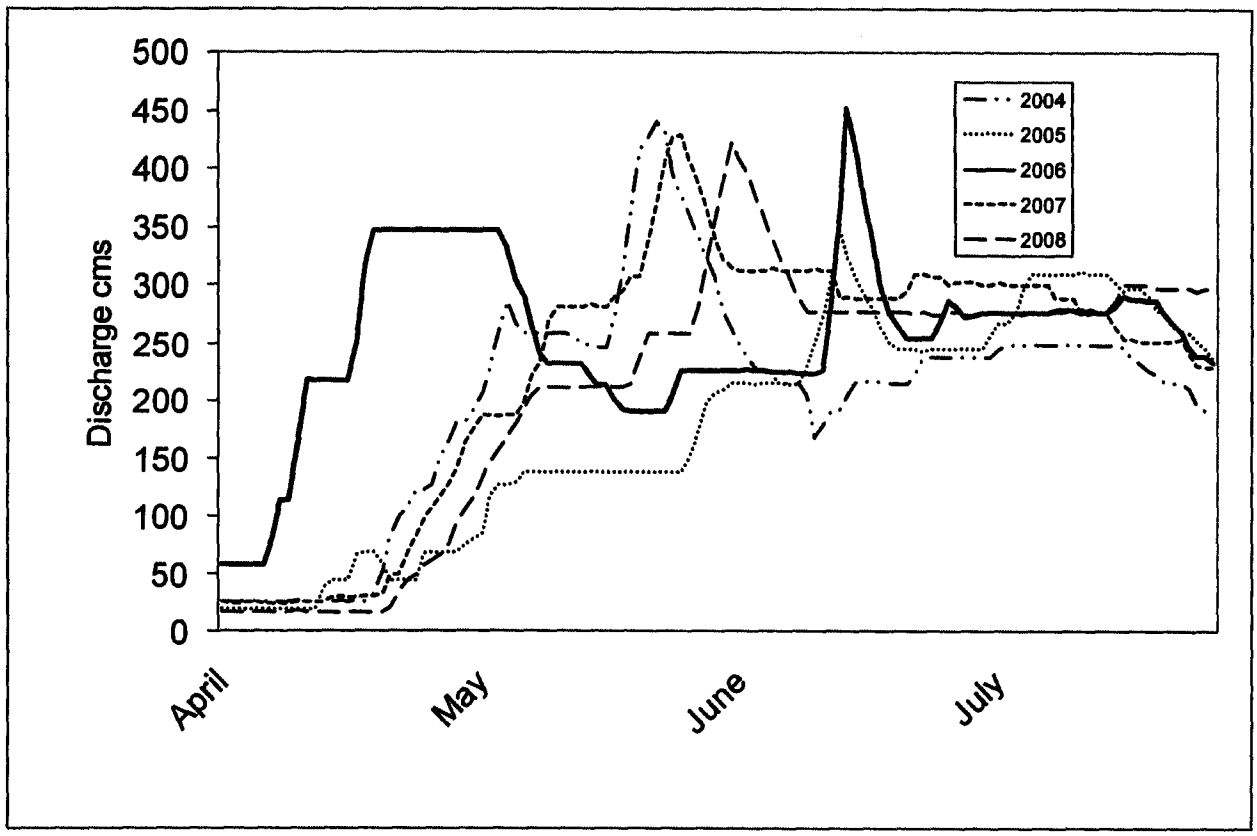

Figure 46. Discharges from Palisades Dam from 2004 through 2008 as measured at the Irwin USGS gauge station in cubic meters per second (cms).

Table 10. Summary of South Fork Snake River, Idaho, fishing regulations 1970-2008.

Year	Season	Trout bag & size limit	Special
1970	May 30 - Nov 30	7 lb. + 1 fish, not to exceed 15 fish	Whitefish open 3/1 to 4/30 Irwin to Dam; Mouth to Heise cable open all year
1971	May 29 - Nov 30	Same	Same
1972	May 27 - Nov 30	7 lb. + 1 fish, not to exceed 10 fish	Same
1973	May 26 - Nov 30	Same	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1974	May 25 - Nov 30	10 fish, not more than 2 exceeding 14"	Same
1975	May 24 - Nov 30	Same	Same
1976	May 29 - Nov 30	10 fish, not more than 5 exceeding 12", and not more than 2 exceeding 18"	Same
1977	May 28 - Nov 30	6 fish, only 2 over 16"	Same, except dam tailrace closed
1978	May 27 - Nov 30	Same	Dam tailrace closed; all species open 5/27 to 9/30 Irwin to Dam; Mouth to Heise cable open 5/27 to 12/31
1979	May 26 - Nov 30	Same	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1980	May 24 - Nov 30	Same	Same
1981	May 23 - Nov 30	Same	Same
1982	May 29 - Nov 30	Same	Same, except open 9/1 to 11/30 within 100 yards of Burns Creek
1983	May 28 - Nov 30	Same	Same
1984	May 26 - Nov 30	Same, except Heise cable to Irwin only 2 CT, none between 10-16"	Same
1985	May 25 - Nov 30	Same, except added hybrids	Same
1986-1987	May 24/23-Nov 30	Same	Same
1988-1989	May 28/27-Nov 30	6 fish, only 2 over 16"; except Heise cable to Dam only 2 CT or HYB, none between 10-16"	Mouth to Heise cable open all year; open 9/1 - 11/30 within 100 yards of Burns Creek
1990-1991	May 26/25-Nov 30	6 fish (except only 2 CT or HYB, none between 8-16", on all rivers and streams)	Mouth to Heise cable open all year
1992-1993	May 23/29-Nov 30	2 fish, none between 8-16"	Same

Table 10. continued

Year	Season	Trout bag & size limit	Special
1994-1995	May 28/27-Nov 30	Same	Same
1996-1997	May 25/24-Nov 30	Same	Same
1998	May 23 - Nov 30	Same	Same
1999	May 29 - Nov 30	6 fish (except only 2 CT, HYB, or BRN, none between 8-16")	Same
2000-2001	May 27/26-Nov 30	6 fish (except only 2 CT or BRN, none under 16")	Same
2002-2003	May 25/24-Nov 30	Same	Same
2004-2005	Jan 1-Dec 31	No harvest CT; no limits RB or HYB; 2 BRN, none under 16"	Entire river open all year
2006-2008	Jan 1-Dec 31	Same	Same

Table 11. Summary of electrofishing results from the Lorenzo and Conant monitoring reaches on the South Fork Snake River, 2008.

Reach	length	Species	Marked	Captured	Recaptured	% Efficiency	Abundance estimate	95% CI	Fish/km
		YCT	34	30	0	NA	NA	NA	NA
Lorenzo	4.8 km	RBT	2	2	0	NA	NA	NA	NA
		BNT	373	365	40	10.9	3,736	632	778
		YCT	377	554	51	9.2	5,218	764	1,065
Conant	4.9 km	RBT	187	318	25	7.9	2,811	528	574
		BNT	205	253	29	11.5	1,860	281	380

2008 Upper Snake Region Annual Fisheries Management Report

HENRYS FORK

ABSTRACT

We used boat mounted electrofishing equipment to assess fish populations in the Box Canyon and Harriman Ranch reaches of the Henrys Fork Snake River in May, 2008. In the Box Canyon reach, we estimated RBT densities of 1,570 fish/km, which was a 32% decrease from the 2007 estimate. Trout species composition was 99% RBT and 1% BKT. Mean and median length for RBT caught was 341 mm and 350 mm respectively. PSD was 73, while RSD-400 was 20. We estimated RBT densities in the Harriman Ranch reach at 301 fish per km, which was a 24% decrease from the last survey conducted in 1994. Species composition was 98% RBT, 1% BKT, and 1% kokanee salmon. RBT PSD was 74, while RSD-400 was 41. Mean and median length for RBT caught was 324 mm and 325 mm respectively. A creel survey was also conducted on the Henrys Fork during 2008, although analysis difficulties prohibited inclusion in this report. Results from the creel survey will be presented in the 2009 report.

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METHODS

Creel Survey

We conducted a stratified random creel survey on the Henrys Fork from April 18 through the end of October 2008, to estimate angler use and success. We stratified sample days into weekdays and weekend and holidays to better represent angler use. Two weekdays and two weekend/holiday days were randomly selected for each two week period to obtain effort estimates and interview anglers. Effort information was obtained by counting anglers from a fixed-wing aircraft that traveled the river corridor 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. The river was partitioned into the following survey sections: Box Canyon (Island Park Dam to Last Chance boat ramp), Harriman Ranch (Last Chance boat ramp to Riverside camp ground), Warm River (Riverside camp ground to the Hwy 20 bridge), Ashton (Ashton Dam to Chester Dam), and St. Anthony (Chester Dam to St. Anthony railroad bridge). Clerks traveled river sections in pontoon boats and interviewed all anglers encountered.

Population Monitoring

We used two drift boat mounted electrofishers to assess fish populations in the Box Canyon and the Harriman Ranch reaches of the Henrys Fork in 2008 (Figure 47). In the Box Canyon, we marked fish on May 15 and 16 followed by a seven day rest and a single day recapture event on May 22. Two passes per boat per day were used on all marking and recapture efforts in the Box Canyon. The Box Canyon reach 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). In the Harriman Ranch reach, we marked fish on May 20 and 21, followed by two days of recapture effort on May 28 and 29. One pass per boat per day was used on all marking and recapture efforts on the Harriman Ranch. The Harriman Ranch reach started at the log jam at the upper boundary of Harriman State Park and extended downstream 8.7 km to the Osborne (Hwy 20) bridge. All trout encountered were collected, identified, measured for total length, and those exceeding 150 mm were marked with a hole punch in the caudal fin prior to release. Fish were not marked on the recapture date, but all fish previously marked were recorded as such.

We estimated densities for all trout > 150 mm using the Partial Log-Likelihood method in MR5 software (MR5; Montana Department of Fish, Wildlife, and Parks 1994). PSD were calculated as the number of each species ≥ 300 mm divided by the number of each species ≥ 200 mm. Similarly, RSD-400 used the same formula, with the numerator replaced by the number of fish > 400 mm (Anderson and Neumann 1996).

We estimated age-2 abundance in our current population estimate based on lengths at age of RBT collected in prior years. Age-2 RBT were determined to be the first year class fully recruited to the electrofishing gear and were defined as fish between 230 and 329 mm. We then predicted expected abundance based on prior models using regression analysis between mean winter stream flows and observed estimates of age-2 fish. Using the equation:

$$y = 1606.5e^{0.0015x}$$

where x = mean winter flows (cfs), we were able to estimate age-2 RBT abundance and compare to our observed estimates to evaluate the effect of winter flow releases from Island Park Dam.

RESULTS

Creel Survey

Creel clerks interviewed 819 anglers in 607 parties between 18 April and 22 October 2008. Over half (56%) of the anglers interviewed were non-residents; the majority of which came from Utah (32%), California (13%), and Montana (7%). Anglers from 40 different states (including Idaho) fished the Henrys Fork in 2008. Difficulties with various creel software prohibited analysis of the creel survey data. Further analysis will be completed and reported in the 2009 Upper Snake Region Fishery Management Report.

Population Monitoring

We collected 1,425 trout over three days of electrofishing in the Box Canyon. Species composition of trout captured was 99% RBT and 1% BKT. RBT ranged in size from 92 mm to 536 mm, with a mean and median total length of 341 mm and 350 mm, respectively (Figure 48), which is similar to mean lengths observed in previous surveys (Appendix B). RBT PSD and RSD-400 were 73 and 20, respectively. We used the Log Likelihood Method (LLM) and estimated 5,812 RBT >150 mm (95% CI = 5,312 – 6,312, cv = 0.09) in the reach, which equates to 1,571 fish per km. This represents a 32% decrease in the RBT abundance compared to the 2007 estimate (Figure 49). Our efficiency rate (unadjusted for size selectivity) was 15% (Appendix C). Our estimate of age-2 RBT abundance for the Box Canyon was 2,490. Based on winter flows in 2006 (401 cfs), regression models predict age-2 abundance at 2,932. Our observations are consistent with the model predictions (Figure 50).

We collected 381 salmonids in the Harriman Ranch reach of the Henrys Fork during the two-day population estimate. Species composition was 98% RBT, 1% BKT, and 1% kokanee salmon. Our efficiency rate (unadjusted for size selectivity) for all trout was poor, at 6%. RBT stock density indices were high, with PSD and RSD-400 values of 74 and 41, respectively (Table 12). RBT ranged between 85 mm and 620 mm, with a mean and median size of 324 and 325 mm, respectively. The size range of RBT observed in 2008 was similar to that seen in 1994, although mean and median size was larger in 2008 compared to 1994 (Figure 51). We estimated 2,620 RBT >150 mm for the reach (LLM; 95% CI = 2,047 – 3,193; cv = 0.25), which equates to 301 RBT per km (Table 13), which is less than was observed in 1994, when RBT density was estimated at 397 per km (Figure 52).

DISCUSSION

The Box Canyon RBT population estimate for 2008 declined by 32% from 2007 but was only slightly below the long-term average. Although it appears the population has declined substantially, it may be more accurate to assess the 2007 data closely. Garren et al. (2004) and Mitro (1999) have documented a positive relationship between winter flows and year class strength of RBT within this reach of the Henrys Fork Snake River. Winter flows during water year 2006 (330 cfs), which influenced the 2007 estimate of age-2 abundance, were similar to recent years but the abundance of age-2 RBT was exceptionally high at 4,839 for the Box Canyon reach. The observed estimate of age-2 RBT abundance in 2007 was well above the model predictions of age-2 abundance, suggesting the abundance of age-2 RBT in 2007 was an anomaly as opposed to the 2008 estimate which showed a large decline in abundance. Average winter flows during 2007 which shape the abundance of age-2 RBT in 2008 resulted in model predictions and observed densities that were appropriate for the observed flows. It is unknown why the abundance of age-2 RBT was so high during 2007, but it appears to be more likely that estimates from 2007 were excessive as opposed to 2008 estimates being reflective of a larger decline. Length frequency data from RBT collected during 2008, combined with the observed relationship between year class strength and winter flows, indicates that the Henrys Fork will likely incur another weak year class of age-2 RBT in 2009 resulting from low winter flows during 2008. Winter flows during 2008 were low at 175 cfs and the abundance of age-1 RBT was limited compared to previous years. This may result in lower densities of catchable sized fish in 2009 and 2010.

The RBT population estimate in the Harriman Ranch reach of the Henrys Fork Snake River was down from 397 fish per km in 1994, to 301 fish per km in 2008. Although these estimates differed by 24%, there was no statistical difference due to the high variability in the 1994 estimate. Historic population estimates for the Harriman Ranch reach are limited, likely due to sampling difficulties within this river section. The wide, shallow channel and relatively slow-moving current in the Harriman Ranch reach makes accurate mark-recapture electrofishing population estimates difficult to obtain. Although comparisons between population estimates were difficult, some differences in stock density indices were observed between the past two surveys of the Harriman Ranch. PSD and RSD-400 values, 74 and 41, respectively, in 2008 indicate that the population is more balanced than in 1994 when PSD and RSD-400 values were 62 and 56, respectively. The mean and median size of RBT observed in 2008 was considerably larger than in 1994, mainly due to the lack fish between 250 and 400 mm observed during the 1994 survey. Similar to the Box Canyon, abundance of age-2 fish in the Harriman Ranch section is likely correlated with winter stream flows. Winter stream flows during 1993 averaged 129 cfs, and are likely limiting the age-2 segment of the population observed during the 1994 survey.

MANAGEMENT RECOMMENDATIONS

1. Continue annual population surveys in the Box Canyon to quantify population response to changes in the flow regime over time.
2. Complete analysis of creel data and report findings in the 2009 annual report.
3. Use harvest information from 2008 creel survey in correlation with population estimate data to estimate exploitation and evaluate current regulations.
4. Work with the irrigation community and other agencies to obtain increased winter flows to benefit trout recruitment.

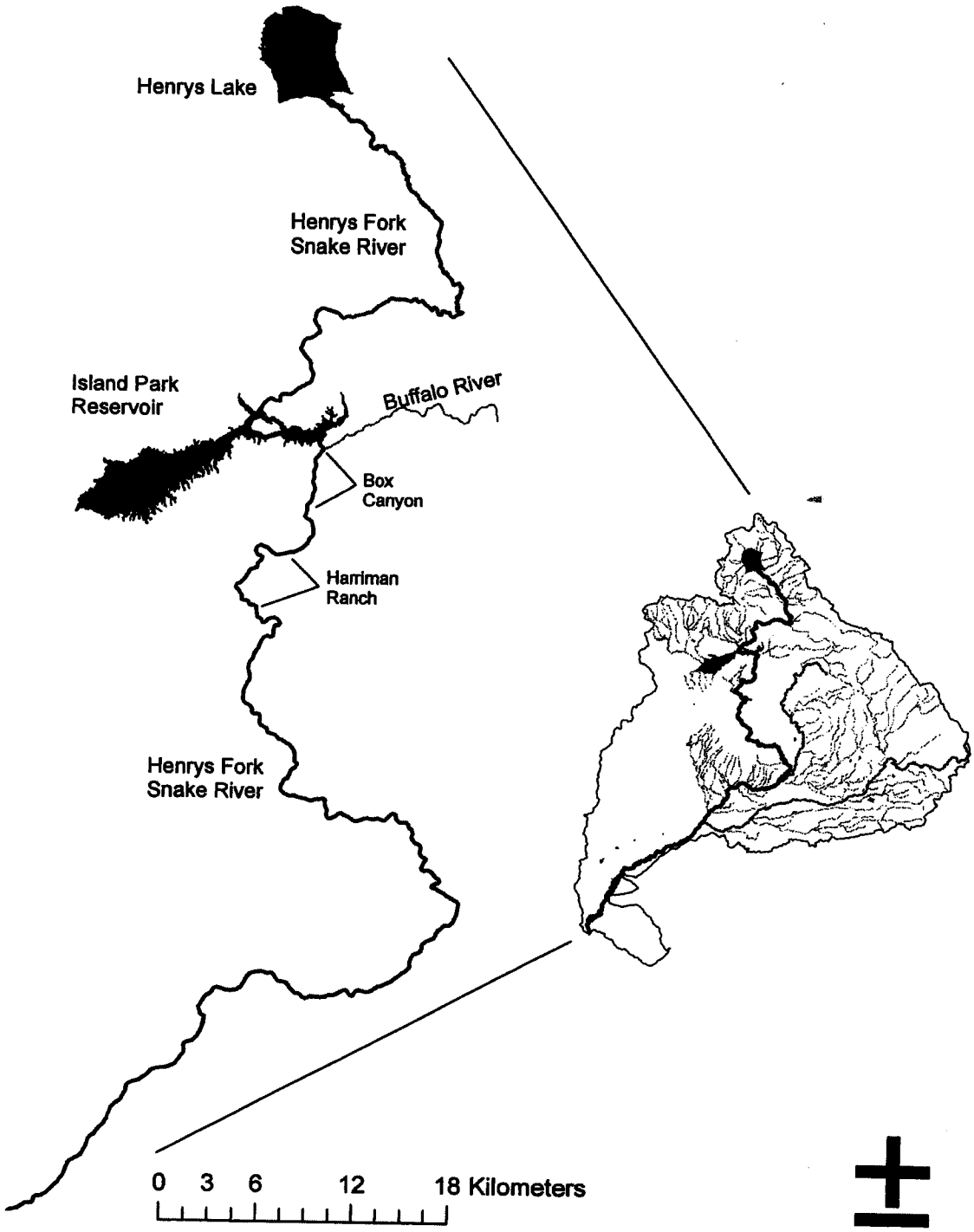

Figure 47. Map of the Henrys Fork Snake River watershed and electrofishing sample sites (Box Canyon and Harriman Ranch) during 2008.

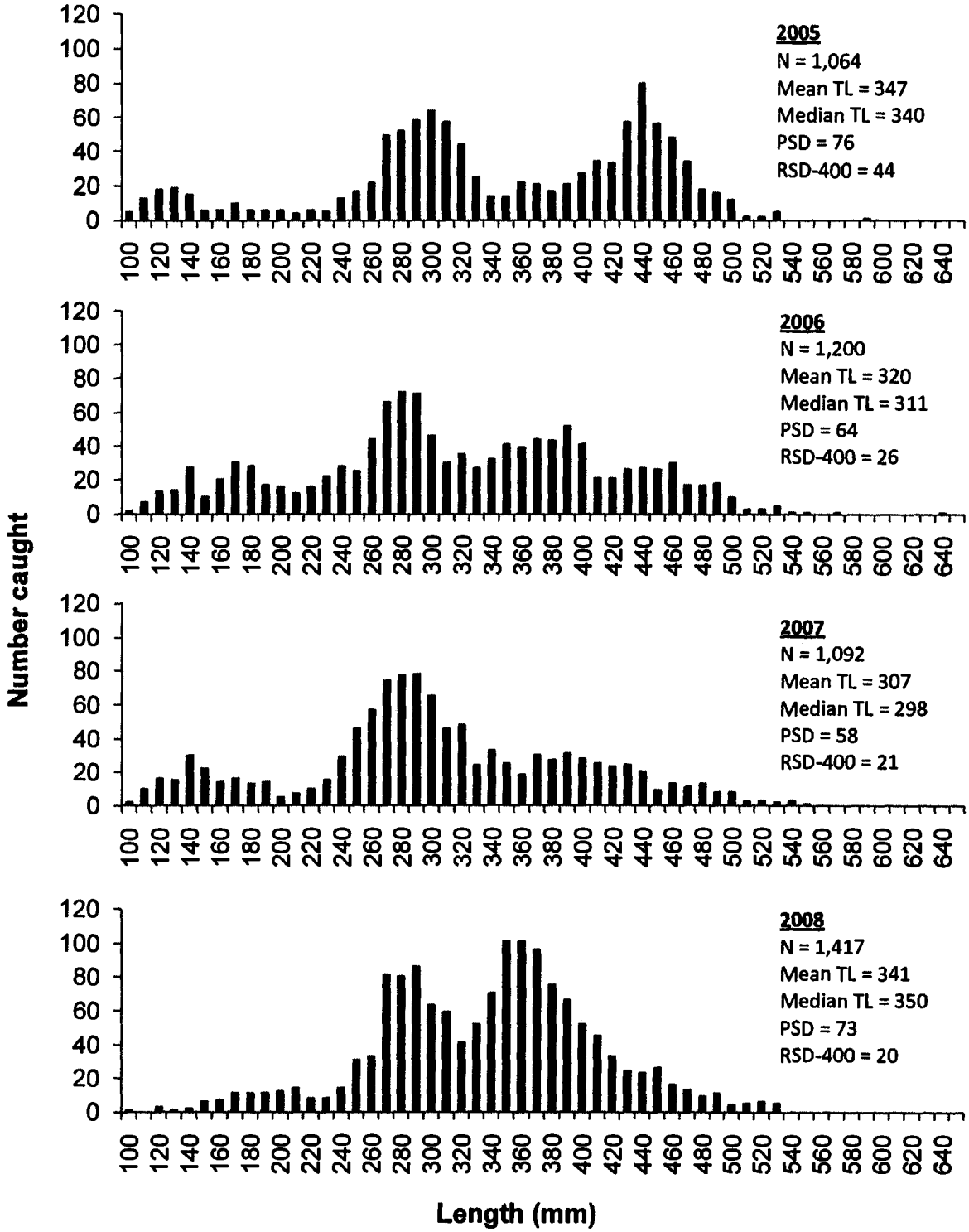

Figure 48. Length frequency distribution of rainbow trout (RBT) collected by electrofishing in the Box Canyon reach of the Henrys Fork Snake River, Idaho, 2005 - 2008.

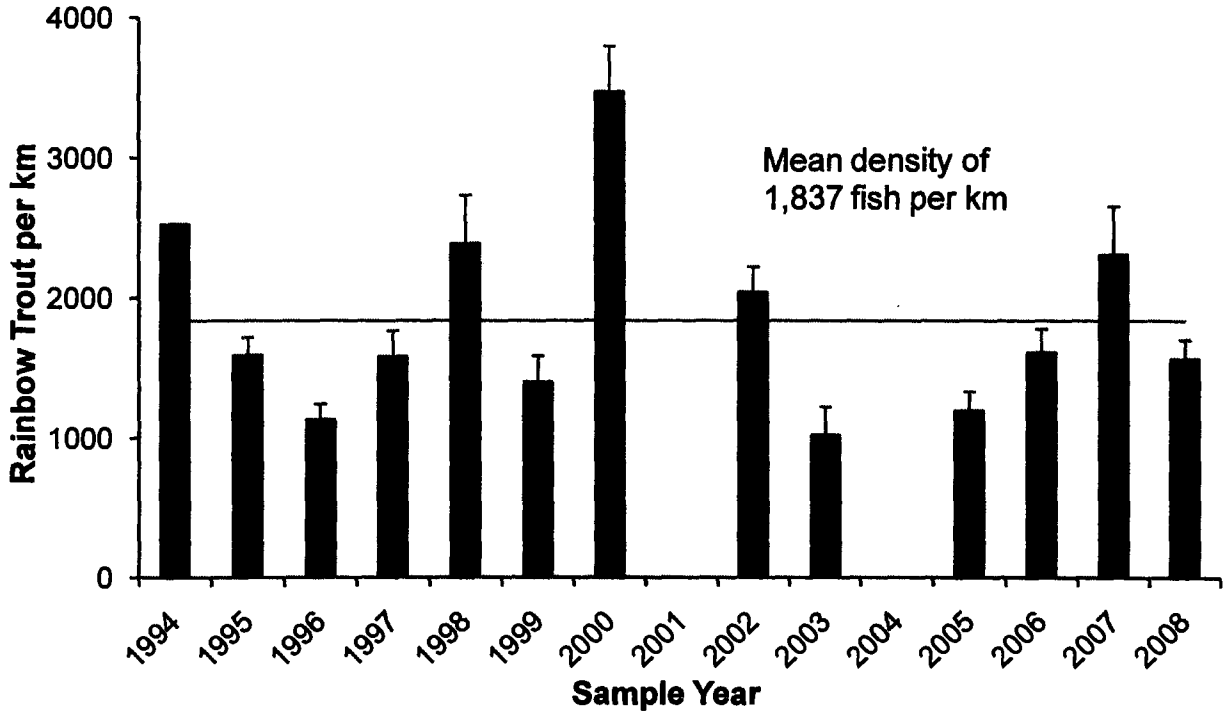

Figure 49. Rainbow trout population estimates for the Box Canyon reach of the Henrys Fork Snake River, Idaho, from 1994 to 2008. Error bars represent 95% confidence intervals.

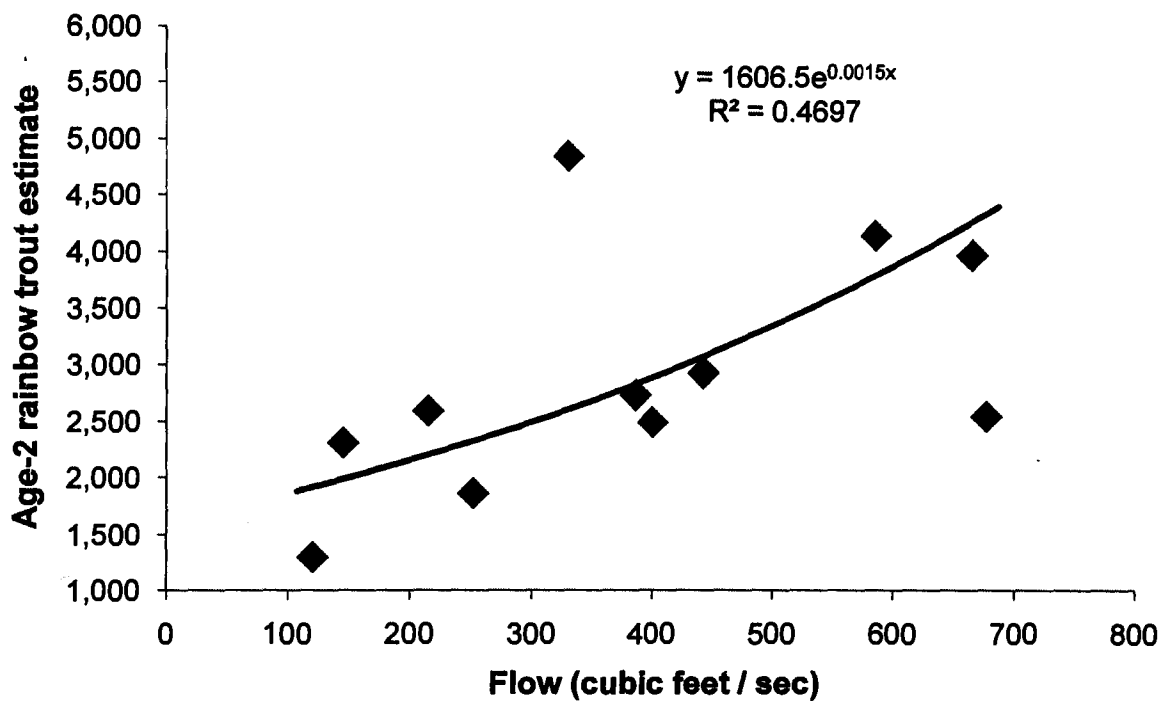

Figure 50. Age-2 rainbow trout population estimates compared to the previous years' mean winter flow (cfs) in the Box Canyon of the Henrys Fork Snake River, from 1995 to 2008. Estimated age-2 rainbow trout abundance at 401 cfs = 2,932; observed estimate was 2,490.

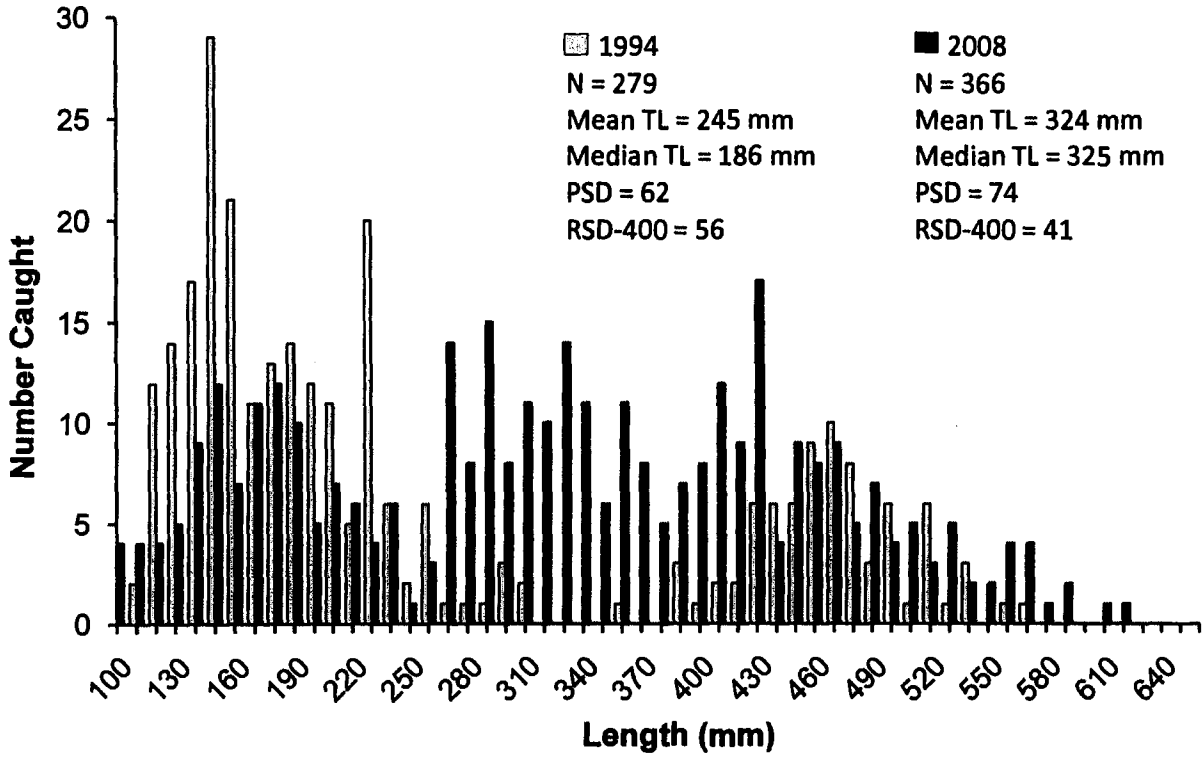

Figure 51. Length frequency distribution of rainbow trout in the Harriman Ranch reach of the Henrys Fork Snake River, Idaho, during 1994 and 2008.

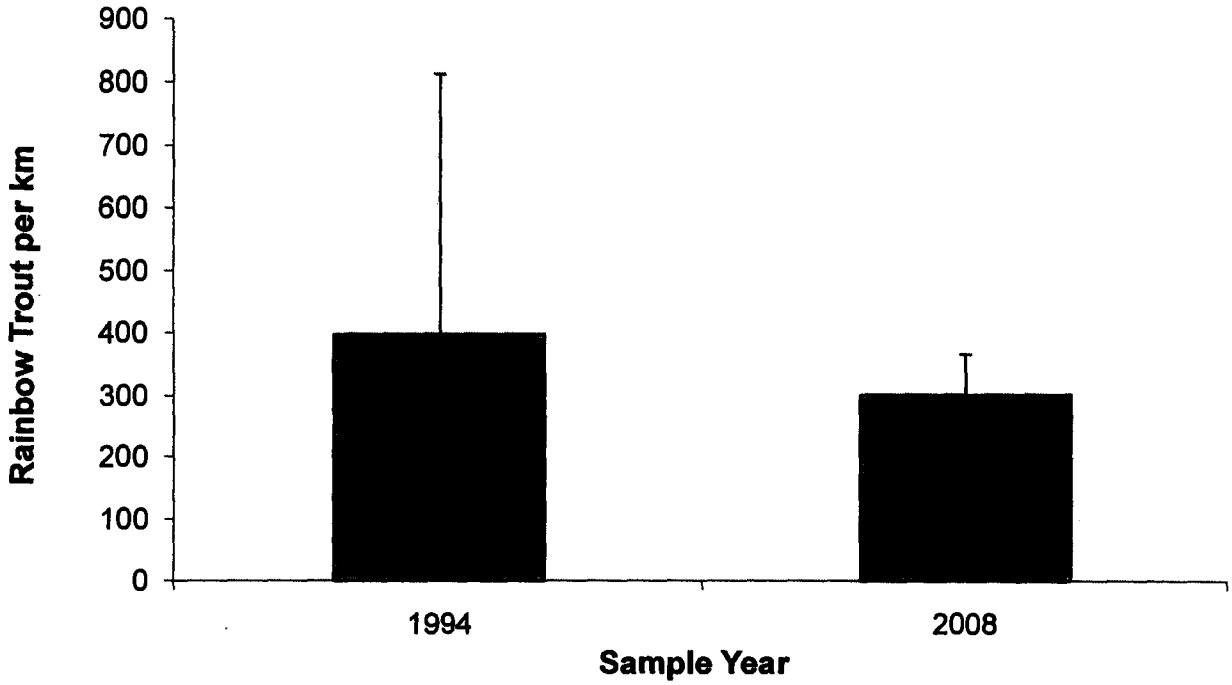

Figure 52. Rainbow trout population estimates conducted during 1994 and 2008 on the Harriman Ranch reach of the Henrys Fork Snake River, Idaho. Error bars represent 95% confidence intervals.

Table 12. Rainbow trout population index summaries for the Henrys Fork Snake River, Idaho 2008.

River Reach	Mean Length (mm)	Median Length (mm)	PSD	RSD-400	RSD-500	Fish per km	Percent of Overall Species Composition
Box Canyon	341	350	73	19	1	1,570	99
Harriman Ranch	324	325	74	41	11	301	98

Table 13. Rainbow trout population estimate summary from the Box Canyon and Harriman Ranch reaches of the Henrys Fork Snake River, Idaho during 2008.

River reach	Number Marked	Number Captured	Number Recaptured	Population Estimate	Confidence Interval (+/- 95%)	Density (No./ km)	Discharge (cfs)[a]
Box Canyon	887	615	93	5,812	5,312 – 6,312	1,571	1,300
Harriman	132	198	12	2,620	2,047 – 3,193	301	1,260

[a] Data obtained from USGS gauge near Island Park Dam (13042500)

APPENDICES

Appendix A. Locations used in population surveys on the Henrys Fork Snake River, Idaho 2008. All locations used NAD-27 and are in Zone 12.

	Start		Stop	
Reach	Easting	Northing	Easting	Northing
Box Canyon	468,677	4,917,703	467,701	4,914,352
Harriman Ranch	466,911	4,911,500	464,226	4,908,046

Appendix B. Number, mean total length, length range, proportional stock density (PSD), and relative stock density (RSD-400 and RSD-500) of rainbow trout captured in the Box Canyon reach electrofishing reach, Henrys Fork Snake River, Idaho, 1991-2008. RSD-400 = (number ≥400 mm/ number ≥200 mm) x 100. RSD-500 = (number ≥500 mm/ number ≥200 mm) x 100.

Year	Number	Mean TL (mm)	Length Range (mm)	PSD	RSD-400	RSD-500
1991	711	293	71 – 675	65	46	9
1994	1,226	313	46 - 555	90	46	3
1995	1,590	316	35 – 630	61	30	1
1996	1,049	300	31 – 574	66	20	1
1997	1,272	307	72 – 630	47	14	1
1998	1,187	269	92 – 532	45	13	0
1999	874	330	80 – 573	63	16	1
2000	1,887	293	150 – 593	45	11	1
2002	1,111	352	100 – 600	75	28	0
2003	599	365	100 – 520	86	42	1
2005	1,064	347	93 – 595	76	44	2
2006	1,200	320	95 – 648	64	26	2
2007	1,092	307	91 – 555	58	21	2
2008	1,417	341	92 – 536	73	20	1

Appendix C. Electrofishing mark-recapture statistics, population estimates (N) of age 1 and older rainbow trout (≥150 mm) (MPM = Modified Peterson Method; LLM = Log-Likelihood Method), and stream discharge (cfs) during the sample period for the Box Canyon reach, Henrys Fork Snake River, Idaho, 1995-2008. Confidence intervals (±95%) for population estimates are in parentheses.

Year	M[a]	C[a]	R[a]	R/C (%)	N/reach MPM	N/reach LLM	N/km LLM	Discharge (cfs)
1995	982	644	104	16	6,037 (5,043-7,031)	5,922 (5,473-6,371)	1,601 (1,479-1,722)	2,330
1996	626	384	69	18	3,456 (2,770-4,142)	4,206 (3,789-4,623)	1,137 (1,024-1,250)	1,930
1997	859	424	68	16	5,296 (4,202-6,390)	5,881 (5,217-6,545)	1,589 (1,410-1,769)	1,810
1998	683	425	42	10	6,775 (4,937-8,613)	8,846 (7,580-10,112)	2,391 (2,049-2,733)	1,880
1999	595	315	38	12	4,844 (3,484-6,204)	5,215 (4,529-5,901)	1,409 (1,224-1,595)	1,920
2000	1,269	692	74	11	11,734 (9,317-14,151)	12,841 (11,665-14,017)	3,471 (3,153-3,788)	1,210
2002	1,050	511	81	16	6,574 (5,329-7,819)	7,556 (6,882-8,230)	2,042 (1,860-2,224	763
2003	427	167	20	12	3,472 (2,147-4,797)	3,767 (3,005-4,529)	1,018 (812-1,224)	348
2005	735	401	90	22	3,250 (2,703-3,797)	4,430 (3,922-4,938)	1,197 (1,060-1,334)	496
2006	887	356	61	17	5,112 (4,005-6,219)	5,986 (5,387-6,585)	1,618 (1,456-1,779)	1,690
2007	737	332	51	15	4,725 (3,598-5,852)	8,549 (7,288-9,810)	2,311 (1,970-2,652)	1,695
2008	887	615	93	15	5,818 (4,842 – 7,089)	5,812 (5,312-6,312)	1,571 (1,436 –1,706)	1,300

[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; R/C (%) = electrofishing efficiency rate.

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. Practical fisheries management: more with less in the 1980's. American Fisheries Society, New York Chapter, Ithaca, New York. (Available from New York Cooperative Fishery and Wildlife Research Unit, Cornell University, Ithaca.)

Anderson, R.O. and R.M. Neumann. 1996. Length, weight and associated structural indices. Pages 447-482 *in* B.R. Murphy and D.W. Willis, ed. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Baldwin, C. and M. Polacek. 2002. Evaluation of limiting factors of stocked kokanee and rainbow trout in Lake Roosevelt, Washington. Inland Fish Investigations, Washington Department of Fish and Wildlife.

Ball, K. and P. Jeppson. 1980. Regional fisheries management investigations. Job Performance Report. F-71-R-5. Idaho Department of Fish and Game, Boise

Behnke, R.J. 1992. Native trout of western North America. American Fisheries Society Monograph No. 6, Bethesda Maryland.

Clancy, C.G. 1988. Effects of dewatering on spawning by Yellowstone cutthroat trout in tributaries to the Yellowstone River, Montana. Pages 37-43 *in* R.E. Gresswell, editor. Status and management of interior stocks of cutthroat trout. American Fisheries Society, Symposium 4, Bethesda Maryland.

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, Maryland.

Frew, T.S. 2008. Resident Fish Hatcheries 2008 Annual Report. Idaho Department of Fish and Game, Boise.

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.

Garren, D., W. C. Schrader, D. Keen and J. Fredericks. 2006. Regional fisheries management investigations. 2004 Job Performance Report. Project F – 71- R 29. IDFG 05-15. Idaho Department of Fish and Game. Boise, Idaho

Garren, D., W. C. Schrader, D. Keen, and J. Fredericks. 2008. Fishery management annual report, Upper Snake Region, 2006. Report No. 08-102. Idaho Department of Fish and Game, Boise

Garren, D., J. Fredericks, and D. Keen. 2009. Fishery Management Annual Report, Upper Snake Region 2007. Idaho Department of Fish and Game, Boise.

Griffith, J.S. 1993. Coldwater streams. Pages 405-425 in C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda, Maryland.

Hauer, F.R., M.S. Lorang, D. Whited, and P. Matson. 2004. Ecologically Based Systems Management: the Snake River – Palisades Dam to Henrys Fork. Final Report to U.S. Bureau of Reclamation. Flathead Lake Biological Station, Division of Biological Sciences, University of Montana, Polson.

Henderson, R., J.L. Kershner and C.A. Toline. 2000. Timing and location of spawning by nonnative wild rainbow trout and native cutthroat trout in the South Fork Snake River, Idaho, with implications for hybridization. North American Journal of Fisheries Management 20:584-596.

High, B., W. C. Schrader, D. Garren, and J. Fredericks. 2008. South Fork Snake River investigations. 2007 Annual Job Performance Report # 08-134. F-71-R-30. Idaho Department of Fish and Game. Boise.

Hyatt, M. W. and W. A. Hubert, 2000. Standard weight (Ws) equations and standard length categories for arctic grayling, brook trout, brown trout, bull trout, golden trout, kokanee and splake. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie.

Hyatt, M.W., and W.A. Hubert. 2000. Proposed standard weight (W_s) equations for kokanee, golden trout, and bull trout. Journal of Freshwater Ecology 15: 559-564.

Hyatt, M.W., and W.A. Hubert. 2001. Proposed standard-weight equations for brook trout. North American Journal of Fisheries Management 21:253-254.

Jeppson, P. 1975. Mackay Reservoir Fisheries Investigations. Idaho Department of Fish and Game, Boise.

Krueger, C. C., and B. May. 1991. Ecological and genetic effects of salmonid introductions in North America. Canadian Journal of Fisheries and Aquatic Sciences 48 (supplement):66-77.

Kruse, C.G. and W. A. Hubert, 1997. Proposed standard weight (Ws) equations for interior cutthroat trout. North American Journal of Fisheries Management 17:784-790.

Leary, R.F., F.W. Allendorf, and G.K. Sage. 1995. Hybridization and introgression between introduced and native fish. Pages 91-101 in H.L. Schramm, Jr., and R.G. Piper, editors. Uses and effects of cultured fishes in aquatic ecosystems. American Fisheries Society, Symposium 15, Bethesda, Maryland.

Loomis, J. 2005. The economic values of recreational fishing and boating to visitors and communities along the upper Snake River. Final Report to Trout Unlimited and Henrys Fork Foundation, Colorado State University, Fort Collins.

Maiolie, M. 1987. Ashton Reservoir fishery enhancement evaluation. Job Completion Report. Idaho Department of Fish and Game, Boise.

Martin, D.B., L.J. Mengel, J.F. Novotny, and C.H. Walburg. 1981. Spring and summer water levels in a Missouri River reservoir: effects on age-0 fish and zooplankton. Transactions of the American Fisheries Society 110:370-381.

Merigliano, M. 1997. Ecology and management of the South Fork of the Snake River cottonwood forest. Technical Bulletin 96-9. U.S. Bureau of Land Management .

Meyer, K.A., D.J. Schill, J.A. Lamansky, M.R. Campbell, and C.M. Cegelski. 2006. Status of Yellowstone cutthroat trout in Idaho. Transactions of the American Fisheries Society 135:1329-1347.

Meyer, K. A., and J. A. Lamansky. 2003. Assessment of native salmonids above Hells Canyon Dam, Idaho. Annual Progress Report 03-59. Idaho Department of Fish and Game. 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.

Moller, S., and R. Van Kirk. 2003. Hydrologic alteration and its effect on trout recruitment in the South Fork Snake River. Project Completion Report for Idaho Department of Fish and Game, Idaho State University, Pocatello.

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.

Moore, V. 1980. South Fork Snake River fisheries investigations. Job Performance Report, Project F-73-R-3, Idaho Department of Fish and Game. Boise.

Moore, V., and D. Schill. 1984. South Fork Snake River fisheries investigations. Job Completion Report, Project F-73-R-5. Idaho Department of Fish and Game. Boise.

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

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., M. Gamblin, T. J. Herron, and B.A. Rich. 2002. Regional fisheries management investigations. Idaho Department of Fish and Game. 1995 Job Performance Report, Project F-71-R-20. Boise.

Schrader, W.C., and J. Fredericks. 2006a. South Fork Snake River investigations. 2003 Annual Job Performance Report 06-20. Project F-71-R-28. Idaho Department of Fish and Game. Boise.

Schrader, W.C., and J. Fredericks. 2006b. South Fork Snake River investigations. 2005 Annual Job Performance Report 06-50, Project F-71-R-30. Idaho Department of Fish and Game. Boise.

Schrader, W. C., and J. Fredericks. 2008. South Fork Snake River Investigations. 2006 Annual Report 08-117. Idaho Department of Fish and Game. Boise.

Simpkins, D.G., and W.A. Hubert. 1996. Proposed revision of the standard-weight equation for rainbow trout. Journal of Freshwater Ecology 11:319-326.

Sparks, R. E., P. B. Bayley, S. L. Kohler, and L. L. Osborne. 1990. Disturbance and recovery of large floodplain rivers. Environmental management 14:699-709.

Teuscher, D. 1999. A simple method for monitoring zooplankton forage and evaluating flatwater stocking programs. Fisheries Research Brief, Idaho Department of Fish and Game, No 99-02. Boise

Thurow, R.F., C.E. Corsi, and V.K. Moore. 1988. Status, ecology and management of Yellowstone cutthroat trout in the upper Snake River drainage, Idaho. Pages 25-36 in R.E. Greswell, editor. Status and management of interior stocks of cutthroat trout. American Fisheries Society, Symposium 4, Bethesda, Maryland.

USFWS 2006. http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=2187144897+1+2+0&WAISaction=retrieve

Van Deventer, J.S. and W.S. Platts. 1985. A computer software system for entering, managing, and analyzing fish capture data from streams. Research Note INT-352, Intermountain Forestry and Range Research Station. U.S.D.A. Forest Service. Ogden, UT.

Van Kirk, R.W., and L. Benjamin. 2001. Status and conservation of salmonids in relation to hydrologic integrity in the Greater Yellowstone Ecosystem. Western North American Naturalist 61:359-374.

Van Kirk, R. W, L. Battle, and W. C. Schrader. 2010. Modeling competition and hybridization between native cutthroat trout and nonnative rainbow and hybrid trout. Journal of Biological Dynamics 4:158-175.

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