

Native Salmonid Research and Monitoring Progress Update – 2008

Idaho Tributary Habitat Acquisition and
Fishery Enhancement Program,
Appendix A

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Native Salmonid Research and Monitoring – 2008 Update

This is an annual update of work completed within the Native Salmonid Research and Monitoring project of the Idaho Tributary Habitat Acquisition and Fishery Enhancement Program, Appendix A of the Clark Fork Settlement Agreement. Completed project components in 2008 included tributary salmonid abundance monitoring in the Lightning Creek drainage, bull trout redd monitoring on Lake Pend Oreille/Lower Clark Fork River tributaries, lower Clark Fork River fishery assessment, and Trestle Creek bull trout outmigration and Lake Pend Oreille survival study.

Tributary Salmonid Abundance Monitoring

METHODS

We used the removal (depletion) method (Zippin 1958) to estimate abundance and size structure of tributary fish populations in the Lightning Creek drainage in 2008. Fish were collected using a SmithRoot backpack electrofishing unit and pulsed DC settings at 50Hz, 2ms, and 800 to 900 volts). Fish were anesthetized with MS-222, identified, measured (total length; mm) and weighed (g). The computer program Capture (White et al. 1982) was used to derive estimates from the depletion data when three or more passes were conducted and Microfish (Van Deventer and Platts 1986) was used to derive estimates from the depletion data when only two-passes were completed. Population and density estimates were conducted for fish ≥ 75 mm only (total length; TL), due to sampling efficiency considerations. We reported the total catch on the first pass as the population estimate when all the individuals of a particular species were captured on the first pass. Density estimates were reported as the number per 100m². Previously established sample sites were surveyed in the East Fork Lightning and Rattle Creeks. New survey locations were established in Savage, Porcupine, Char, and Lightning creeks (Table 1). Tributary monitoring will be used to follow general trends in fish abundance, species composition, and distribution.

Table 1. Locations (UTM) of survey sections sampled during 2008 tributary abundance monitoring efforts. Waypoints represent the approximate lowermost point of each survey section.

Stream	Site	Datum	Zone	E	N
Char Creek	Lower	WGS84	11	569120	5345907
Lightning Creek	Upper	WGS84	11	561184	5353295
East Fork Lightning	Lower	WGS84	11	566275	5343385
East Fork Lightning	Upper	WGS84	11	571415	5345862
East Fork Lightning	Middle	WGS84	11	569150	5345528
Rattle Creek	Lower	WGS84	11	562178	5353025
Rattle Creek	Upper	WGS84	11	564799	5352500
Porcupine Creek	Lower	WGS84	11	564206	5345914
Porcupine Creek	Upper	WGS84	11	562044	5344780
Savage Creek	Lower	WGS84	11	567203	5344131
Savage Creek	Upper	WGS84	11	567815	5343906

RESULTS

Savage Creek

Two sites were surveyed on Savage Creek in 2008. Surveys were completed at the lower and upper Savage Creek sites on 4 and 12 August 2008, respectively. Two species were collected at the lower survey location including five bull trout *Salvelinus confluentus* and two rainbow trout *Oncorhynchus mykiss*. Associated density estimates were 0.99 and 0.40 fish/100m², respectively. Three species were collected at the upper Savage Creek survey site including one bull trout x brook trout hybrid, one westslope cutthroat trout *Oncorhynchus clarkii lewisi*, and six westslope cutthroat x rainbow trout hybrids. Associated density estimates were 0.22, 0.22, and 1.30 fish/100m², respectively.

Rattle Creek

Two sites were surveyed on Rattle Creek in 2008. Lower and upper Rattle Creek sites were surveyed on 28 and 29 July 2008, respectively. Two species were sampled at the lower Rattle Creek survey site including two bull trout and 70 rainbow trout. Associated density estimates were 0.50 and 11.67 fish/100m², respectively. Three species were collected at the upper Rattle Creek survey site including 15 bull trout, 33 rainbow trout, and seven westslope cutthroat trout. Associated density estimates were 3.90, 5.71, and 1.56 fish/100m², respectively. Estimated mean densities among sample sites demonstrated a decline in bull trout abundance from previous sample years (Table 2). In contrast, both rainbow trout and westslope cutthroat trout demonstrated stable to increasing trends in estimated density over the same time period. Although changes in fish density may be present, sample frequency and distribution within the stream should be evaluated to determine if current sampling protocols accurately describe population changes.

Table 2. Mean estimated density (N/100m²) by year for bull trout (BLT), rainbow trout (RBT), westslope cutthroat trout (WCT), and westslope cutthroat trout x rainbow trout hybrids (WRHY) in Rattle Creek.

Year	BLT	RBT	WCT	WRHY
2004	9.30	2.08	0.55	--
2005	7.08	3.05	2.63	--
2006	10.70	2.18	NA	0.38
2008	2.20	8.69	1.56	--

Porcupine Creek

Two sites were surveyed on Porcupine Creek in 2008. Lower and upper Porcupine Creek sites were surveyed on 6 and 11 August 2008, respectively. Five species were sampled at the lower Porcupine survey site including eight bull trout, one brook trout *Salvelinus fontinalis* (47 mm; TL), 54 rainbow trout, 19 westslope cutthroat trout, and 48 westslope cutthroat trout x rainbow trout hybrids. Associated density estimates for bull, rainbow, westslope cutthroat, and westslope cutthroat trout x rainbow trout hybrids were 1.54, 11.91, 4.19, and 10.15 fish/100m², respectively. Two species were collected at the upper Porcupine Creek survey site including 44 brook trout and 20 westslope cutthroat trout. Associated density estimates were 12.17 and 4.81 fish/100m², respectively.

Char Creek

One site was surveyed on Char Creek in 2008. The lower Char Creek site was sampled on 30 July 2008. Species sampled included three bull trout, two westslope cutthroat trout, and one westslope cutthroat trout x rainbow trout hybrid. Associated density estimates were 0.74, 0.50, and 0.25 fish/100m², respectively. Notably, the survey site was located above a significant log/bedload blockage thought to be a recent development and a passage barrier. The absence of bull trout under 150 mm provided some evidence the blockage was in fact a barrier that has influenced migration in the last two years. Bull trout redd counts in Char Creek also potentially reflect the impacts of this barrier. Limited spawning habitat is available below the barrier, which is approximately 150 m upstream from the confluence with the East Fork Lightning Creek.

East Fork Lightning Creek

Three sites were surveyed on the East Fork of Lightning Creek in 2008. Sampling was conducted on 21, 22, and 24 July. Three species were sampled at the lower site including 15 bull trout, two brook trout, and 192 rainbow trout. Associated density estimates were 0.12, 0.24, and 20.81 fish/100m², respectively. Three species were sampled at the middle site including four bull trout, 147 rainbow trout, and three westslope cutthroat trout. Associated density estimates were 0.41, 16.83, and 0.41 fish/100m², respectively. Two species were sampled at the upper site including two bull trout, and 64 westslope cutthroat trout. Associated density estimates were 0.49 and 11.27 fish/100m², respectively. Estimated mean densities among sample sites demonstrated a decline in bull trout abundance from previous sample years (Table 3). In contrast, both rainbow trout and westslope cutthroat trout demonstrated stable to increasing densities over the same time period. Although changes may be present, sample frequency and distribution within the stream should be evaluated to determine if current sampling protocols accurately describe population changes.

Table 3. Mean estimated density (N/100m²) by year for bull trout (BLT), brook trout (BRK), rainbow trout (RBT), westslope cutthroat trout (WCT), and westslope cutthroat trout x rainbow trout hybrids (WRHY) in East Fork Lightning Creek.

Year	BLT	BRK	RBT	WCT	WRHY
2004	3.79	NA	11.25	4.90	--
2005	1.94	0.32	6.74	10.04	--
2006	1.79	0.11	10.10	4.01	0.85
2008	0.34	0.24	18.82	5.84	--

Lightning Creek

One site was surveyed on Lightning Creek in 2008. The upper Lightning Creek site was sampled on 5 August 2008. Four species were sampled at the upper Lightning Creek survey site including four bull trout, 45 rainbow trout, 16 westslope cutthroat trout, and six westslope cutthroat trout x rainbow trout hybrids. Associated density estimates were 0.36, 3.89, 1.09, and 0.54 fish/100m², respectively.

A summary of all 2008 tributary monitoring results by stream and sample location was listed in Table 4.

Table 4. Tributary monitoring 2008 results by stream, sampled reach, and species. Number caught includes all lengths, while only fish ≥ 75 mm were included in abundance estimates. In cases of non-declining catch, abundance estimates were minimum estimates defined as the total catch, and no confidence intervals were calculated.

Stream	Reach	Species	Caught	Min TL	Max TL	Estimate	95% CI	Density/100m ²
Char Creek	lower	BLT	3	158	165	3	3.0-3.0	0.74
		WCT	2	186	193	2	2.0-2.0	0.50
		WRHY	1	137	137	1	1.0-1.0	0.25
EF Lightning Creek	lower	BLT	15	36	101	1	1.0-1.0	0.12
		BRK	2	117	228	2	2.0-2.0	0.24
		RBT	192	64	190	173	173.0-181.0	20.81
	upper	BLT	2	156	158	2	2.0-2.0	0.49
		WCT	64	52	254	46	46.0-48.0	11.27
	middle	BLT	4	34	175	3	3.0-3.0	0.41
		RBT	147	58	299	123	120.0-128.0	16.83
WCT		3	200	208	3	3.0-3.0	0.41	
Lightning Creek	upper	BLT	4	42	179	4	--	0.36
		RBT	45	72	156	43	43.0-46.0	3.89
		WCT	16	72	167	12	12.0-14.0	1.09
Porcupine Creek	lower	WRHY	6	123	160	6	6.0-6.0	0.54
		BLT	8	48	168	7	7.0-7.0	1.54
		BRK	1	47	47	1	--	0.22
		RBT	54	78	126	54	54.0-54.0	11.91
	upper	WCT	19	80	175	19	19.0-19.0	4.19
		WRHY	48	66	228	46	46.0-46.0	10.15
		BRK	44	68	221	43	43.0-45.0	12.17
Rattle Creek	lower	WCT	20	65	218	17	17.0-18.0	4.81
		BLT	2	132	147	3	--	0.50
		RBT	70	67	211	70	70.0-83.0	11.67
	upper	BLT	15	116	160	15	15.0-16.0	3.90
		RBT	33	62	177	22	22.0-24.0	5.71
		WCT	7	71	182	6	6.0-7.0	1.56

Table 4. Continued

Stream	Reach	Species	Caught	Min TL	Max TL	Estimate	95% CI	Density/100m ²
Savage Creek	LOWER	BLT	5	157	175	5	5.0-5.0	0.99
		RBT	2	118	164	2	2.0-2.0	0.40
	UPPER	BBHY	1	227	227	1	1.0-1.0	0.22
		WCT	1	245	245	1	1.0-1.0	0.22
		WRHY	6	108	127	6	6.0-6.0	1.30

BLT = bull trout

BRK = brook trout

BBHY = brook trout x bull trout hybrid

RBT = rainbow trout

WCT = westslope cutthroat trout

WRHY = westslope cutthroat trout x rainbow trout hybrid

Bull Trout Redd Monitoring

METHODS

Idaho Department of Fish and Game, with assistance from Avista fishery staff, conducted redd counts on 19 tributaries to Lake Pend Oreille (LPO), as well as the Clark Fork River. In addition, surveys were completed on the Middle Fork East River and Uleda Creek (tributaries to the lower Priest River). Redds were located visually by walking along annually monitored sections within each tributary (Table 1). Redds were defined as areas of clean gravels at least 0.3 x 0.6 m in size with gravels of at least 76.2 mm in diameter having been moved by the fish, and with a mound of loose gravel downstream from a depression (Pratt 1984). In areas where one redd was superimposed over another redd, each distinct depression was counted as one redd.

We used a nonparametric rank-correlation procedure, Kendall's tau b ($\alpha = 0.05$) (Daniel 1990), to test for trends in the long-term LPO redd count data set (Rieman and Myers 1997), as recommended in the Lake Pend Oreille Bull Trout Conservation Plan. Data for the year 1995 were not used for any streams except the mainstem Clark Fork River, Sullivan Springs, North Gold and Gold creeks in this analysis because poor water visibility due to high water conditions likely affected the accuracy of the counts in that year. In addition, we did not use the 1983 data point for Grouse Creek or the 1986 data points for Rattle and the East Fork Lightning creeks because some segments of these streams that may have contained relatively substantial numbers of redds were not counted. Long-term trends were evaluated using the full data set (1983-present). Short-term trends were evaluated using data collected since 1999.

RESULTS

Bull trout redd counts were completed between 9 and 17 October, 2008. Redd counts ranged from a low of zero redds in the Clark Fork River to a high of 183 redds in Trestle Creek (Table 2). A total of 584 bull trout redds were observed across all sample locations. Index streams surveyed since 1983, accounted for 382 of the total observed redds in 2008. Based on 2008 LPO drainage redd counts the expanded (3.2 fish per redd) adult bull trout spawning population consisted of at least an estimated 1,872 individuals. Six local populations were estimated to have more than 100 adult spawning fish.

Significant trends in redd counts were only observed over the long-term evaluation (1983 to 2008) with the exception of the Middle Fork East River (Table 3). Long-term significant trends were observed on the Clark Fork River (negative); and Granite Creek, Gold Creek, Middle Fork East River, and collectively among all streams (all positive). Middle Fork East River, exhibited a positive trend over the last ten years.

Table 1. Survey streams for annual bull trout redd counts in tributaries to Lake Pend Oreille, Idaho.

Stream name	Section description (approximate length (km))
Char Cr	Mouth to falls (1.2)
Clark Fork River	Spawning channel (N/A)
E. Fk. Lightning Cr ^a	Savage to Thunder Creek (5.0)
Gold Cr ^a	Mouth to 0.2 km upstream of W. Gold confluence (2.4)
Granite Cr	Mouth to road 278 crossing (6.4)
Grouse Cr ^a	Flume Creek to end of road 280 (2.4 km beyond gate) (6.5)
Johnson Cr ^a	Mouth to falls (1.5)
Lightning Cr	Rattle to Quartz (3.2)
Morris Cr	Mouth to trail 132 crossing (N/A)
N. Gold Cr ^a	Mouth to falls (1.2)
Pack R	Road 231 bridge near McCormick Cr to Falls located 0.4 km downstream of W. Branch (2.8)
Porcupine Cr	Mouth to S.Fk. (3.2)
Rattle Cr	Mouth to falls by upper bridge (5.7)
Savage Cr	Mouth to trail 61 crossing (2.0)
Strong Cr	Mouth to diversion barrier (N/A)
Sullivan Springs	Mouth upstream 0.4 km (0.4)
Trestle Cr ^a	1.6 km upstream of mouth to 0.5 km upstream of the road 275 switchback (10.4 km); 0.5 km upstream of road 275 switchback upstream to confluence with first southeast bank un-named tributary (0.5 km)
Twin Cr	Mouth to River Road (1.5)
Wellington Cr	Mouth to falls (0.5)

^a Denotes "index" stream

Table 2. Pend Oreille drainage Bull trout redd counts by stream and year.

Stream	1983-1998 Avg.	1999	2000 ^e	2001 ^d	2002 ^d	2003 ^d	2004 ^{d,k}	2005 ^d	2006 ^L	2007 ^{M,N}	2008 ^L
Clark Fork R.	9	5	5	6	7	8	1	0	3	2	0
Lightning Cr.	11	16	4	7	8	8	9	22	9	3	10
EF Lightning Cr. ^c	51	44	54	36	58	38	77	50	51	34	38
Savage Cr.	8	4	2	4	15	7	15	7	25	0	8
Char Cr.	11	17	11	2	8	7	14	15	20	1	5
Porcupine Cr.	12	4	4	0	0	5	10	14	8	8	8
Wellington Cr.	8	22	8	7	7	8	7	6	29	9	10
Rattle Cr.	16	13	12	67	33	37	34	34	21	2	24
Johnson Cr. ^c	18	31	4	34	31	0	32	45	28	32	40
Twin Cr.	9	19	10	1	8	3	6	7	11	0	4
Morris Cr.	--	1	1	0	7	1	1	3	16	0	6
Strong Cr.	2	--	--	--	0	--	0	--	--	--	7
Trestle Cr. ^c	240	253	301	335	333	361	102	174	395	145	183
Pack River	25	0	8	28	22	24	31	53	44	16	11
Grouse Cr. ^c	34	50	77	18	42	45	28	77	55	38	31
Granite Cr.	33	41	25	7	57	101	149	132	166	104	52
Sullivan Springs	15	22	19	8	15	12	14	15	28	17	7
North Gold Cr. ^c	31	16	19	16	24	21	56	34	30	28	17
Gold Cr. ^c	106	147	168	127	203	126	167	200	235	179	73
W. Gold Cr.	--	--	--	--	--	--	--	--	4	0	7
M.F. East R.	--	--	--	4	8	21	20	48	71	34	36
Uleda Cr.	--	--	--	3	4	3	7	4	7	2	7
N.F. East R.	--	--	--	--	--	--	1	0	0	--	0
Total 6 index streams ^c	480	541	623	566	691	591	462	580	794	456	382
Total of all streams	640	705	732	710	890	836	781	940	1256	654	584

^d Includes an additional apprx. 0.5 km reach immediately upstream of index reach on Trestle Creek, which accounted for 4 additional redds in 2001 and 2002, 2 in 2003, 5 in 2004, and 3 in 2005.

^e A headcut barrier prevented access to most of spawning area on Johnson creek in 2000, and also potentially on Granite Creek in 2001.

^j Incomplete surveys on Porcupine and Grouse creeks in 1983, and on Grouse, Rattle, and E.Fk. Lightning creeks in 1986, and on Granite in 1987, See Pratt (1984) and Hoelscher and Bjornn (1989).

^k Observation conditions impaired by high water in Trestle Creek.

^L Large early spawning kokanee made it difficult to distinguish bull trout redds from kokanee redds in Sullivan Springs.

^M Flows were up and counting conditions were difficult in Savage and Uleda creeks.

^N Severe flooding in the Lightning Creek drainage in Nov. 2006 had significant adverse impacts on some stream channels.

Table 3. Correlations between year and redd count (trends) for bull trout populations monitored from 1983 to 2008 in tributaries to Lake Pend Oreille, Idaho. The total number of years actually included for each evaluation is described by valid years. Tau b represents the direction and magnitude of observed trend.

Stream	Period from 1999 to 2008		Period from 1983 to 2008	
	Valid Years	Tau-b	Valid Years	Tau-b
Clark Fork	10	-0.39	17	-0.41 ^a
Lightning Creek	10	0.20	21	-0.04
East Fork Lighting Creek	10	-0.13	22	-0.04
Savage Creek	10	0.28	20	0.05
Char Creek	10	-0.11	21	-0.01
Porcupine Creek	10	0.47	21	-0.08
Wellington Creek	10	0.07	21	-0.01
Rattle Creek	10	-0.13	20	0.03
Johnson Creek	9	0.23	23	0.23
Twin Creek	10	-0.29	21	-0.11
Morris Creek	10	0.24	10	0.24
Strong Creek	3	0.82	4	0.18
Trestle Creek	10	-0.07	25	0.08
Pack River	10	0.29	21	-0.10
Grouse Creek	10	-0.13	24	-0.04
Granite Creek	10	0.42	21	0.45 ^a
Sullivan Springs	10	-0.13	21	0.15
North Gold Creek	10	0.31	26	-0.17
Gold Creek	10	0.07	26	0.34 ^a
West Gold Creek	3	0.33	3	0.33
Middle Fork East River	8	0.64 ^a	8	0.64 ^a
Uleda Creek	8	0.28	8	0.28
North Fork East River	4	-0.71	4	-0.71
Index Streams	10	-0.24	26	0.09
All Streams	10	0.07	26	0.27 ^a

^a Denotes significance at $\alpha \leq 0.05$

Lower Clark Fork River Fishery Assessment

METHODS

Mark-recapture population estimates were conducted in the spring of 2008 for brown trout *Salmo trutta* and mountain whitefish *Prosopium williamsoni* (target species) greater than 200 mm total length (TL) in the approximately 6.6 km long study reach of the Clark Fork River below Cabinet George Dam. Complete methodologies were described in Ryan et al. 2009.

Marking runs were completed between March 31 and April 2 and recapture runs were completed on April 8 and 9, 2008. We continued with recapture runs until we captured at least three previously marked fish of each target species to reduce probability of statistical bias in our estimates (Ricker 1975). Population estimates were calculated using the modified Petersen method for sampling without replacement (Krebs 1989). All salmonid species were netted on one complete pass down each bank of the river during the first night of the marking run to estimate catch per unit effort (CPUE). Netting effort was focused on targeted species during the remainder of sampling.

Confidence intervals were estimated using a Poisson distribution to account for small recapture sample size (Chapman 1948, Seber 1982). Confidence intervals (95%) were calculated using tabled values provided in Hayes et al. (2007). Confidence intervals (95%) around population estimates were examined between years to determine significant differences.

Relative weight (W_r) (Anderson and Neumann 1996) was calculated to assess salmonid condition. Proportional stock density (PSD) (Anderson and Neumann 1996) was calculated to examine population size structure. PSD for salmonids was separated into two classes; proportion > 305 mm and the proportion > 406 mm (Quality Stock Density, QSD) using 200 mm (TL) as stock length (Schill 1991). All collected salmonids were measured, but not measured fish were weighed.

RESULTS

We estimated 282 brown trout and 6,404 mountain whitefish greater than 200 mm total length occupied the study reach during the spring sampling period in 2008 (Table 1). The population estimate for brown trout in 2008 was higher than the 2006 estimate, while the 2008 mountain whitefish estimate was lower than the 2006 estimate. However, overlap of 95% confidence intervals between spring samples in all years suggested there was no statistically significant difference in abundance (Figures 1 and 2).

Table 1. Population estimate statistics for brown trout and mountain whitefish >200 mm captured in the 6.6 km study reach of the Clark Fork River, Idaho, below Cabinet Gorge Dam, between March 31 and April 9, 2008.

Species	M	C	R	Estimate	Lower 95% CI	Upper 95% CI
Brown trout	133	60	28	282	187	412
Mountain whitefish	261	219	8	6404	3007	14633

M = Number of individuals marked in the first sample

C = Total number of individuals captured in the second sample

R = Number of individuals in second sample that are previously marked

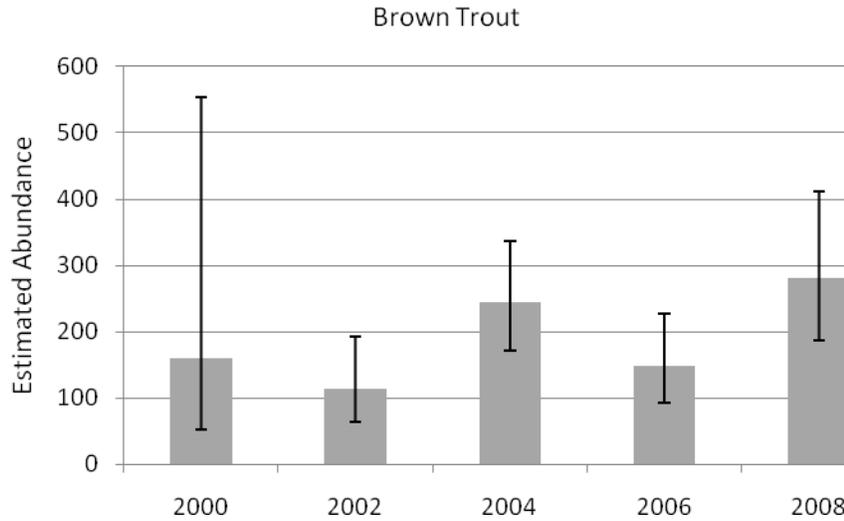


Figure 1. Estimated abundance of brown trout >200 mm by study year captured in the 6.6 km study reach of the Clark Fork River, Idaho, below Cabinet Gorge Dam. Error bars represent 95% confidence intervals.

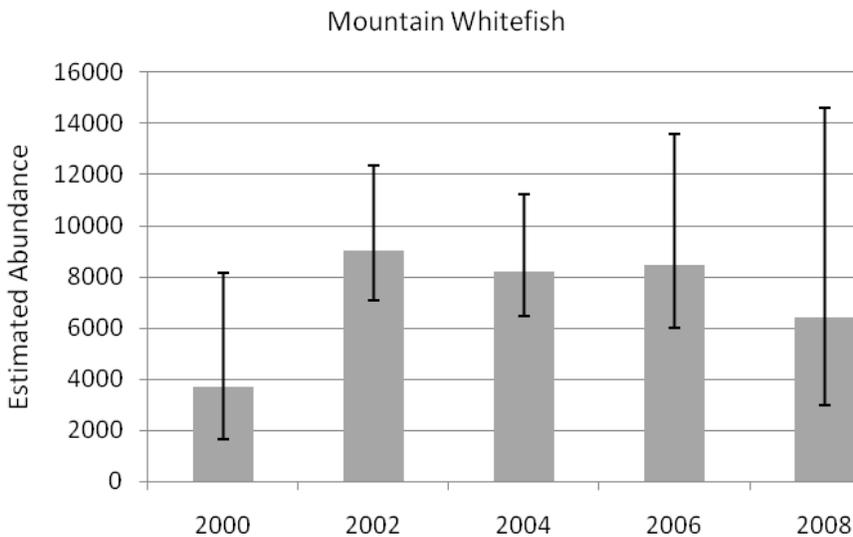


Figure 2. Estimated abundance of mountain whitefish >200 mm by study year captured in the 6.6 km study reach of the Clark Fork River, Idaho, below Cabinet Gorge Dam. Error bars represent 95% confidence intervals.

We captured eight species of salmonids during the spring 2008 sampling period, including bull trout *Salvelinus confluentus* and kokanee *Oncorhynchus nerka* (Table 2). We also captured a total of 10 fish visually identified as westslope cutthroat x rainbow trout hybrids (mean TL; mm = 364.8; range = 275-536; S.D. = 72.3) over the entire study period. CPUE of salmonids reflected dominance of mountain whitefish and brown trout in the survey reach (Table 3). Lake whitefish *Coregonus clupeaformis*, and brook trout *Salvelinus fontinalis* were the rarest salmonids in our catch based on CPUE. A single

northern pike *Esox lucius*, 647 mm total length, was also captured.

Table 2. Mean lengths (TL; mm), mean weights (g), standard deviation (SD), sample size (n), and length range (mm) for salmonid species collected in the 6.6 km long study reach on the Clark Fork River, Idaho, during the marking and recapture runs, combined, in spring, 2008.

Species	Mean length (SD) (n)	Length range	Mean weight (SD) (n)
Bull trout	553 (N/A) (1)	N/A	1,520 (N/A) (1)
Brook trout	198 (N/A) (1)	N/A	55 (N/A) (1)
Brown trout	356(58) (170)	150-560	409 (199) (170)
Kokanee	370 (N/A) (1)	N/A	410 (N/A) (1)
Lake whitefish	426 (57) (12)	378-600	546 (71) (8)
Mountain whitefish	347 (34) (477)	141-436	380 (91) (446)
Rainbow trout	379 (77) (111)	235-626	559 (365) (111)
Westslope cutthroat trout	334 (36) (38)	278-433	366 (126) (38)
Cutthroat x rainbow trout hybrid	365 (72) (10)	275-536	498 (331) (10)

Table 3. Catch Per Unit Effort (CPUE) for salmonid species captured over 290.7 minutes of electrofishing along both banks of the 6.6 km study reach in the Clark Fork River, Idaho, during the first night of marking in March 2008 only.

Species	Scientific name	Number captured	CPUE (fish/minute)
Brook trout	<i>Salvelinus fontinalis</i>	1	<0.01
Brown trout	<i>Salmo trutta</i>	59	0.2
Lake whitefish	<i>Coregonus clupeaformis</i>	1	<0.01
Mountain whitefish	<i>Prosopium williamsoni</i>	75	0.26
Rainbow trout	<i>Oncorhynchus mykiss</i>	32	0.11
Westslope cutthroat trout	<i>Oncorhynchus clarkii lewisi</i>	5	0.02
Cutthroat x rainbow trout hybrid	<i>O. clarkii lewisi</i> x <i>O. mykiss</i>	2	0.01

During the report period, mean length-at-capture across all salmonid species ranged from 198.0 mm for brook trout to 553.0 mm for bull trout (Table 3). PSD's of sampled brown trout and mountain whitefish were 80.6 and 89.7, respectively. QSD's of brown trout and mountain whitefish were 19.4 and 1.7, respectively. Mean W_r for brown trout and mountain whitefish were 79.1(95% CI \pm 1.96) and 86.4 (95% CI \pm 1.38), respectively.

A project completion report incorporating multiple years of data is in preparation and completion is expected in January 2010.

Trestle Creek Bull Trout Outmigration and Lake Pend Oreille Survival Study

METHODS

In 2008, we continued the Trestle Creek outmigration and Lake Pend Oreille bull trout survival study. Adult bull trout returning to spawn in Trestle Creek were monitored using a remote PIT tag detection weir (Downs and Jakubowski 2003). The remote weir was used to identify returning adults PIT tagged as outmigrating juveniles from 2000 through 2002 and as adults migrating in 2000 and 2005. From 2000 through 2002, 921 juvenile bull trout were captured migrating out of Trestle Creek in a rotary-screw trap and/or downstream weir, and marked for lake survival estimation using PIT tags (Downs and Jakubowski 2003). Juveniles were double marked in 2001 and 2002 with an adipose clip to estimate tag retention. A total of 572 adult bull trout were tagged with PIT tags in Trestle Creek in 2000 (428) and 2005 (144). Return results were used to estimate bull trout lake survival of juvenile migrants, minimum annual adult survival rates, and lake residency as described in Downs and Jakubowski (2003). No investigation was conducted on Twin Creek in 2008 due to limited recaptures in previous years.

RESULTS

The Trestle Creek remote weir was fished from August 20 to November 4 in 2008. Sixty-five unique adult bull trout were detected at the weir. Only five bull trout tagged as juveniles were detected, two from 2001 and three from 2002. All bull trout tagged as juveniles had been recaptured in a previous year and therefore did not affect estimates of juvenile survival. The remaining 60 detected bull trout were tagged as adults in 2000, 2002, 2005, 2006, and 2007. Of the 60 recaptures of previously tagged adults only two were new recaptures from 2005. Survival from juvenile to adult based on the detected returns from the 2000, 2001, and 2002 tagging years were 10.7%, 15.5%, and 8.9%, respectively. Minimum survival of adult bull trout tagged as adults in 2000 and 2005 was 61.6% and 55.2%, respectively.

A project completion report incorporating multiple years of data is in preparation and completion is expected in January 2010.

REFERENCES

- Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 *in* Fisheries Techniques, 2nd Edition, American Fisheries Society, Bethesda, Maryland.
- Chapman, D.G. 1948. A mathematical study of confidence limits of salmon populations calculated from sample tag ratios. International Pacific Salmon Fisheries Commission Bulletin 2:69-85.
- Downs C., and R. Jakubowski. 2003. Lake Pend Oreille/Clark Fork River Fishery Research and Monitoring 2002 Progress Report. Project 2, 2002 bull trout redd counts; Project 3, 2002 Clark Fork River fishery assessment progress report; Project 5, 2000-2002 Trestle and Twin creeks bull trout outmigration and Lake Pend Oreille survival study; Project 6, 2002 Johnson and Granite creeks bull trout trapping; Project 7, 2002 Twin Creek restoration monitoring progress report. Avista Corporation. Spokane, Washington.
- Hayes, D. B., J. R. Bence, T. J. Kwak, and B. E. Thompson. 2007. Abundance, biomass, and production *in* Analysis and interpretation of freshwater fisheries data, C. S. Guy and M. L. Brown, editors. American Fisheries Society, Bethesda, Maryland.

- Krebs, C.J. 1989. *Ecological Methodology*. Harper-Collins Publishers, Inc. New York, New York.
- Pratt, K. 1984. Pend Oreille trout and char life history study. Report to the Idaho Department of Fish and Game and the Lake Pend Oreille Idaho Club. Boise, Idaho.
- Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research board of Canada Bulletin 171.
- Rieman, B.E. and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. *Conservation Biology* 11:1015-1018.
- Seber, G.A.F. 1982. *The estimation of animal abundance and related parameters*, 2nd edition. Griffin, London.
- Schill, D.J. 1991. River and stream investigations. Sub project 2. Study 4: Wild trout investigations. Job 1: Statewide data summary. Job 2: Bull trout ageing and enumeration. Job 3: Bait hooking mortality. Job 4: Electrophoresis sampling. Job Performance Report. Project F-73-R-13. Idaho Department of Fish and Game. Boise.
- Van Deventer, J.S. and W.S. Platts. 1986. Documentation for MICROFISH 2.2: A software package for processing electrofishing data obtained by the removal method. Intermountain Research Station, Boise, Idaho.
- White, G.C., D.R. Anderson, K.P. Burnham, and D.L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory, LA-87-87-NERP, Los Alamos, New Mexico.
- Zippin, C. 1958. The removal method of population estimation. *Journal of Wildlife Management*. 22(1):82-90.