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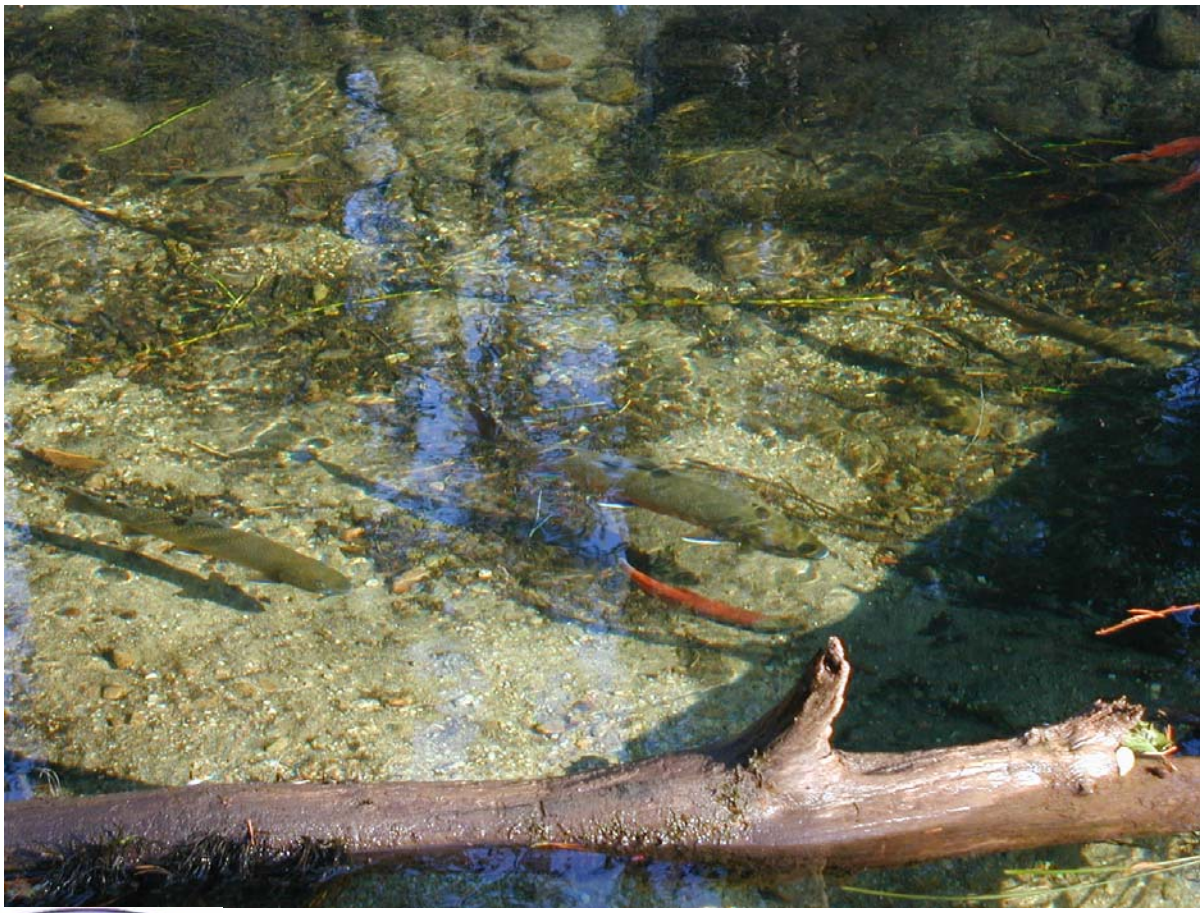
Technical Report for Idaho Department of Fish and Game Permit No. F-10-99

Boise River and Deadwood River Bull Trout Monitoring and Mitigation Activities



Annual Report
December 2006

Boise River and Deadwood River Bull Trout Monitoring and Mitigation Activities

Submitted to the Idaho Department of Fish and Game, Boise, Idaho

by

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TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

Chapter One

BOISE AND DEADWOOD RIVER BULL TROUT POPULATION MONITORING AND MITIGATION ACTIVITIES 2006

Introduction

The purpose of this report is to summarize the annual monitoring and mitigation activities carried out by the U. S Bureau of Reclamation (Reclamation) which occurred under Idaho Department of Fish and Game (IDFG) Scientific Collection Permit No. F-10-99 in the Boise and Deadwood River Basins.

Since the listing of the Columbia River and Klamath River distinct population segment of bull trout (*Salvelinus confluentus*) as threatened under the Endangered Species Act in 1998, serious consideration has been given to range-wide population size and recovery efforts. Section 7 of the Endangered Species Act (ESA) requires that any actions that may be implemented by the federal government entity that could affect federally listed species must be consulted upon through the federal regulatory agencies: the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS).

Bureau of Reclamation (Reclamation) consulted under section 7 of the ESA with the FWS and NMFS on Operations and Routine Maintenance of twelve Reclamation projects in the Snake River Basin above Brownlee Reservoir. The FWS completed a non-jeopardy Biological Opinion (BiOp) in March 2005. The biological opinion contains a 30 year incidental take statement and corresponding reasonable and prudent measures (RPM) that outline non discretionary actions to minimize take of bull trout (*Salvelinus confluentus)* in the Boise project area. Facilities in the Boise Projects with adfluvial forms of bull trout present include Arrowrock and Anderson Ranch Dams on the Boise River system, as well as Deadwood Dam on the Payette River system. Reclamation developed a monitoring and implementation plan that outlines the field activities and data collection necessary to addresses the RPMs, associated terms and conditions, monitoring, and reporting requirement for the BiOp. The monitoring and implementation plan was submitted to the FWS in March, 2006 (USBR 2006).

Reclamation's field and data collection activities are covered by IDFG Scientific Collection Permit No. F-10-99. This technical report describes the results of Reclamation's 2006 field activities and data collection work. This report is formatted in six chapters: a general introduction and study area chapter and five chapters that provide data corresponding to different monitoring and mitigation activities Chapter two provides data from the trap and transport activities at Lucky Peak Reservoir for 2006. Chapters Three and Four summarize the population size and distribution monitoring work conducted in the Boise River basin under cooperative agreement between Boise National Forest (BNF) and Reclamation. Chapter five summarizes the capture and tagging methods for bull trout in Deadwood Reservoir. Chapter six describes the electroshocking activities conducted on the Deadwood River below the dam.

Study Area

The Boise and Deadwood River basins are located in southwestern Idaho and are major tributaries to the Snake River. The Deadwood River is a major tributary to the South Fork of the Payette river.

Three dams are constructed on the upper Boise River system: Arrowrock, Anderson Ranch, and Lucky Peak dams (Figure 1). Lucky Peak Dam, a U.S. Army Corps of Engineers project, is located at the lowest elevation in the Boise River at river kilometer (rkm) 103 with a full pool elevation of 931 meters above sea level. Arrowrock Dam, a Reclamation project, is 19 rkm upstream from Lucky Peak Dam on the mainstem Boise River. Arrowrock Dam has a full pool elevation of 980 meters above sea level. Anderson Ranch Dam, also a Reclamation project, is the most upstream of the three projects, located at rkm 81 of the South Fork of the Boise River with a full pool elevation of 1,272 meters above sea level. These reservoirs are operated collectively as one system for irrigation, flood control, and recreation.

The Boise River basin upstream from Arrowrock Dam covers 5,700 km² (2,200 mile^2) of the granite rock dominated landscape with elevations ranging from 931 m (3057 ft.) to 3,231 m (10,600 ft.) above sea level. The upper Boise River includes three sub-basins: the North, Middle, and South Forks. The Boise River system is fed primarily by snowmelt run-off with highest flows occurring in April-May and lowest in September-October. Flows range from 4.25 m³/s (150 ft^3/s) to over 339.8 m³/s (12,000 ft^3/s) in the mainstem Boise River below the North and Middle Fork confluence. Land uses in the Boise River watershed include grazing, recreation, and both commercial and individual timber harvest. The majority of the Boise River basin lies within Forest Service or Wilderness area boundaries.

The Deadwood River is a major tributary to the South Fork Payette (Figure 2). The river is approximately 70 km long from headwaters (2124 meters above seas level) to mouth (1135 meters above sea level). Deadwood dam, located at river kilometer 36 was constructed in 1929 and is the only dam on the Deadwood River. Deadwood reservoir has a capacity of 162,000 acre feet with a maximum pool elevation of 1,628 meters and drains 282 km^2 while the river below the dam drains an additional 332 km^2.

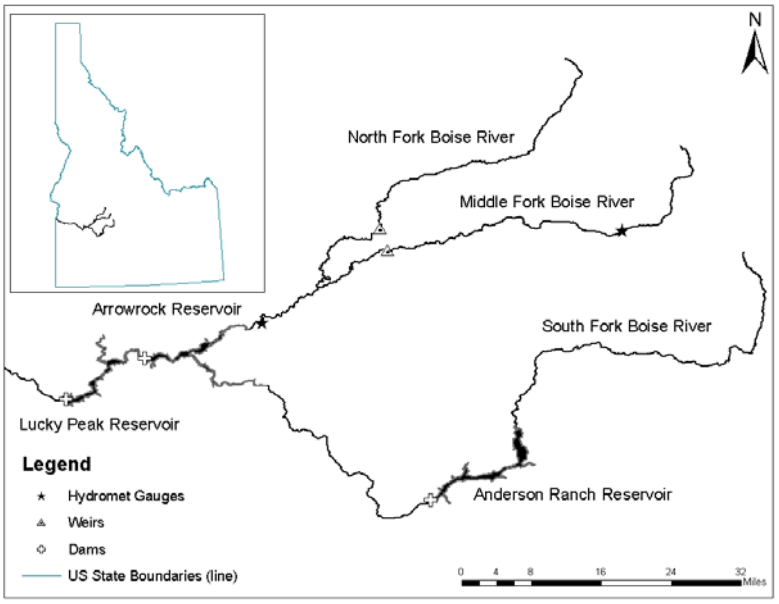

Figure 1. Boise River watershed with Arrowrock, Anderson Ranch and Lucky Peak reservoirs. Arrowrock, Anderson Ranch and Lucky Peak Dams

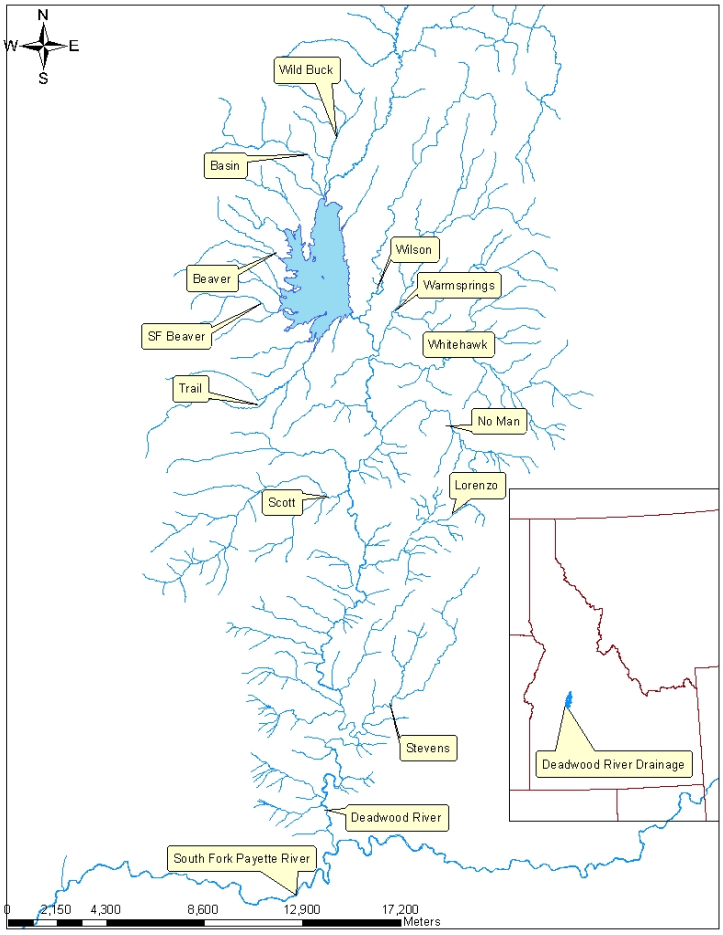

Figure 2: Deadwood Reservoir with Deadwood Dam

Chapter Two

TRAP AND TRANSPORT OF BULL TROUT (*Salvelinus confluentus*) FROM LUCKY PEAK RESERVOIR TO ARROWROCK RESERVOIR, IDAHO

Abstract

The FWS 2005 Upper Snake BiOp identified operation of Arrowrock dam to cause take of bull trout by entrainment over the spillway and through the outlet works of the Arrowrock dam. Reclamation was issued a term and condition with a RPM to implement a trap and transport program below Arrowrock dam to minimize permanent dislocation of bull trout from the Boise river system above Arrowrock reservoir. In 2006 Bull trout (*Salvelinus confluentus)* were captured in Lucky Peak Reservoir using weighted monofilament gill nets and transported above Arrowrock Dam for release into Arrowrock Reservoir. Trapping occurred between the months of May and June. A total of two bull trout were captured ranging from 379 mm to 402 mm in total length and 504 g to 580 g in weight. Bull trout that were captured and released into Arrowrock reservoir were PIT tagged and neither were recaptured during fall weir trap operations.

Study Area

The majority of the work discussed in this chapter occurred in Lucky Peak Reservoir on the mainstem Boise River (Figure 3). Lucky Peak Reservoir primarily stores water from the mainstem Boise River and from one small watershed, Mores Creek. In 2006 water was sent over the spillway at Arrowrock dam for just over one week at the end of May. 2006 was a higher than normal water year. The Middle Fork Boise River peaked at about 10,000 cfs and releases from Anderson Ranch reservoir peaked at about 6,500 cfs.

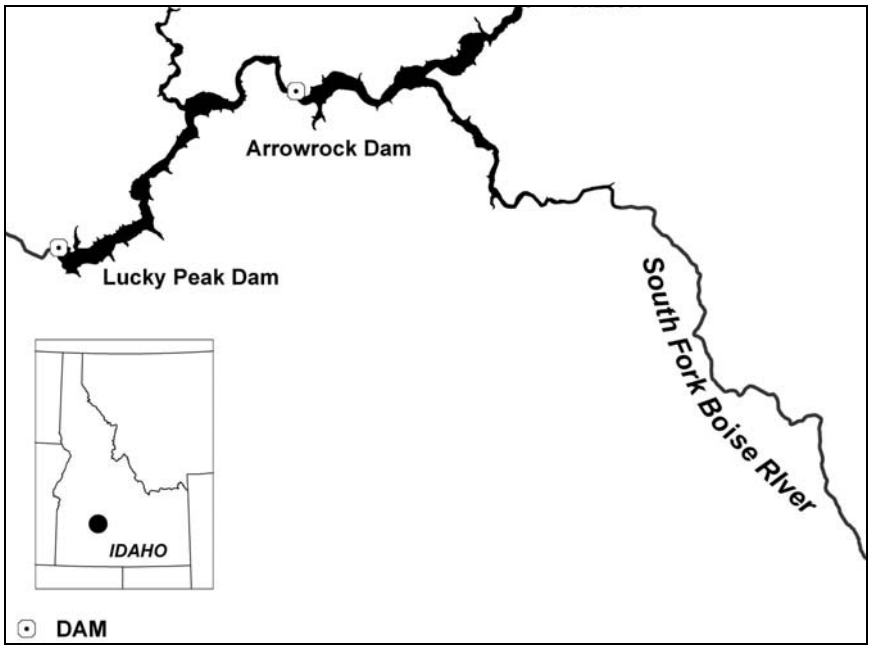

Figure 3. Lucky Peak and Arrowrock Reservoirs on the Boise River in Southwestern Idaho.

Methods

Fish were collected using experimental mesh, monofilament gillnets between early May and early June. Gillnets were set for 20 minute intervals during the daylight period from 8:00 to 18:00 hours four days per week. Nets were 30.5 m long x 1.25 m deep with four equal-length panels. Each panel had one of four mesh sizes: 3.18 cm, 5.04 cm, 6.35 cm, and 7.62 cm. The nets had lead core bottom lines that followed the bottom of the reservoir and foam core top lines to maintain the vertical orientation in the water. Each net had 8 kg weights to anchor the bottom line and 20 cm diameter buoys on the top line for marking location and retrieval. Catch rates for each species were calculated for hours that the nets were fished.

All captured bull trout were held in a 227 liter live well of the boat with periodic water exchange until the end of each sampling day. The fish were then transported to Arrowrock reservoir, measured, tagged with PIT tags, and released. The seasonal period of trapping was chosen to increase efficiency of capture as bull trout were anticipated to be staging below Arrowrock dam in preparation for the upstream spawning migration each spring (Flatter 2000).

All fish captured were identified to species and enumerated. Total length (TL) was recorded for all game species. Bull trout were anesthetized using diluted tricaine methanesulfonate (MS-222) (approximately 100 mg/L). When a bull trout was considered anesthetized (could not right itself) it was measured and weighed. Scale samples and fin clips were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout captured that were > 100 mm were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from IDFG personnel (Russ Kiefer, IDFG, pers. comm.). Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then released into Arrowrock Reservoir. If surface water temperatures in Arrowrock Reservoir exceeded 18°C (65°F), bull trout were driven by boat to the areas of cooler water near river transition zones in the reservoir. Visible infirmity or injuries such as descaling, frayed fins, or dermal lacerations were noted for all bull trout captured.

Results

A total of 357 fish, representing ten species, were captured (Table 1). Gillnetting was used as the primary method of capture based on previous work in the Boise River system (Flatter 2000). Two bull trout were captured, which represented less than 0.01 percent of the total fish captured. Bull trout were the least abundant fish captured. The most abundant fish captured was the largescale sucker (*C. macrocheilus*), comprising 31 percent of all fish captured. Also noteworthy were hatchery rainbow trout (*Oncorhynchus mykiss)*, comprising 22 percent of the total fish captured.

Table 1. Catch data listed for gill net captures for all species in Lucky Peak Reservoir

Species	CPUE (mean)	2.32
	Total Fish	357
	Total Hours	153.8
	Number Caught	*CPUE*
Bull trout (*Salvelinus confluentus*)	2	0.01
Cutthroat trout (*Oncorhynchus clarki lewisi*)	6	0.04
Largescale sucker (*Catostomus macrocheilus*)	110	0.72
Rainbow trout (*Oncorhynchus mykiss*)	78	0.51
Northern Pikeminnow (*Ptychocheilus oregonensis*)	40	0.26
Mountain whitefish (*Prosopium williamsoni*)	45	0.29
Chiselmouth (*Acrocheilus alutaceus*)	14	0.09
Bridgelip sucker (*Catostomus columbianus*)	7	0.05
Smallmouth bass (*Micropterus dolomieu*i)	22	0.14
Kokanee (*Oncorhynchus nerka kennerlyi*)	33	0.21

A total of two bull trout were captured ranging from 379 mm to 402 mm in total length and 504 g to 580 g in weight. Neither bull trout was recaptured at the Boise River weir traps during the fall operation in 2006.

Discussion

Catch per unit effort for bull trout was lower than in previous years (0. 01) which may reflect lower rates of entrainment. This was the first high flow year since the valve replacement was completed on Arrowrock Dam in 2003. In 2001 Reclamation changed policy to try not to spill and 2006 was the first year that spill has occurred since the valve replacement project was completed. With the new valves and policies Reclamation plans on spilling less often and later in the year. This will allow for more fish to start their upstream migration before the threat of entrainment over the spillway.

Chapter Three

DISTRIBUTION OF BULL TROUT (*Salvelinus confluentus)* IN THE NORTH FORK AND MIDDLE FORK BOISE RIVER BASINS, IDAHO

Abstract

A Boise National Forest (BNF) and Reclamation survey team collected 925 individual fish representing 5 species in the 2006 Boise River surveys. Three bull trout were captured, and tagged with 125 kHz PIT tags. Habitat surveys were conducted on each of the 28 stream sites sampled. Bull trout were found in two of the twenty-seven sites sampled that did have fish. Fisheries and habitat data will be entered into the BNF fisheries data base used for stream assessments.

Introduction

In response to the federal listing of bull trout, the BNF and Reclamation initiated a long term cooperative program to investigate the factors affecting their distribution in the Boise River basin. The work began in July 1999 and has continued through the 2006 field season. The purpose of the work was to assess habitat, water temperature, and flow conditions as they relate to bull trout distribution, abundance, and movement on a large-watershed scale.

Study Area

The work discussed in this chapter occurred on tributaries to the North Fork and Middle Fork Boise River upstream from Arrowrock reservoir (Figure 1, Table 3). The North Fork Boise River extends to 2,542 m elevation, while the Middle Fork extends to 2,813 m elevation. The Boise River system is fed primarily by snowmelt run-off with highest flows occurring May-June and lowest flows in September-October.

Methods

Fish Data Collection

Stream reaches were sampled by electrofishing using multiple pass depletion methods. Density estimates were calculated from the depletions and a modified R1/R4 protocol (Overton et al. 1997) was used to collect habitat data at each stream site. In areas where riparian canopy or debris made stream access difficult single pass or select habitat units were sampled where access was possible. Smith-Root™ battery-operated electrofishers were used; batteries were changed every 3,500 to 4,000 operating seconds. Electrofishers were set between 500 and 900 volts and 30 to 40 Hz, depending on stream size and conductivity. Conductivity of Boise River streams range from 30 to 70 uS and stream temperature during survey work ranged from 8 to 18 $^{\circ}$ C.

All fish captured were identified to species and enumerated. Total length (TL) was recorded for all species. All amphibians were counted and released; though stage of development was not

noted. Bull trout were anesthetized using diluted tricaine methanesulfonate (MS-222) (approximately 100 mg/L). When a bull trout was considered anesthetized (could not right itself) it was measured and weighed. Scale samples and fin clips were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout captured that were > 100 mm were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from IDFG personnel (Russ Kiefer, IDFG, pers. comm.). Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then released back into the stream.

Habitat Data Collection

Habitat condition was measured following modified R1/R4 methods of the USFS as described in Burton (1999). Each stream site was located with a Garmin™ GPS 76, and Universal Transverse Mercater (UTM) coordinates were recorded in North American Datum (NAD) 83. Habitat was measured using the following methodology: waters were first categorized by the observer as slow or fast based on USFS training (Burton 1999) and different measurements are taken for either slow or fast water. A two-meter stadia rod marked in tenth meter units was used to measure all habitat variables. Field staff was trained for habitat measurement under guidance of the USFS.

Parameters collected for slow water habitats were: thalweg lengths, maximum depth, mean depth, crest depth, averaged wetted width, available cover area, and percent fines in pool tails. Parameters collected for fast water habitats were: thalweg length, mean depth, wetted width and available cover area.

Definition of Habitat Parameters Collected

Thalweg Length: the measured distance in the path of a stream that followed the deepest part of the channel from the crest of the slow water unit to the formative feature of the habitat unit (Armantrout 1998).

Crest depth: the downstream point of transition of slow water habitat types. It is the shallow downstream end of the depression in scour pools and the point of greatest flow over a dam.

Maximum Depth: the greatest depth measured in the slow water type.

Mean Depth: mean depth was taken at the area where average width was measured.

*Depths were measured at approximately ¼, ½, and ¾ of the channel width and the average was calculated by dividing

the sum by four (to account for zero depth at the banks).

Average Width: the wetted width measured at location of the pool that was the mean depth calculated from the depth at the crest and maximum depth of the pool.

Available Cover Area: cover was categorized as large wood debris, undercut banks. All cover types had to be at least 0.30 m in width to be measured and capable of providing refuge to fish.

Grid Fines: percent fines were estimated at each slow water pool tail. Fines were measured using a 100-intersection grid. Field staff measured the percent of the wetted substrate area of pool tail that is made up of fine particles, defined as sand/silt less that 6 mm, by randomly tossing the grid. The cross section of the pool tail was subdivided into 3 segments: right, middle, and left. The grid intersections were counted only where substrate was smaller than 6 mm.

Elevation: UTM coordinates collected with a Garmin GPS 76 unit at each site. Waypoint locations were mapped and elevation (m) was taken from coordinates.

Results

A total of 28 sites were sampled in the North Fork and Middle Fork Boise River basins in 2006. Twenty-seven sites had multiple-pass depletion estimates calculated for salmonids and habitat data collected. Five species of fish were captured. There were 925 individual fish captured including three bull trout ranging from 187 mm to 204 mm total length (Table 2). Two hundred and four tailed frogs of various life stages were also captured.

Table 2. Total fish captured during 2006 electrofishing sampling.

Species	**Number caught**
Bull trout *(Salvelinus confluentus)* (BT)	3
Cutthroat trout (CT) *(Oncorhynchus clarki lewisi)*	4
Mountain sucker (MTS) (*Catostomus platyrhynchus)*	0
Rainbow trout (RB) *(Oncorhynchus mykiss)*	450
Brook Trout (BR) (*Salvelinus fontinalis)*	241
Pike minnow (NPW) *(Ptychocheilus oregonensis)*	0
Mountain whitefish (MWF) *(Prosopium williamsoni)*	0
Sculpin spp. (SC) *(Cottus spp.)*	227
Long Nose Dace (LND) *Rhynichthys cataractae*	0
Speckled dace (SPD) *(Rhynichthys osculus)*	0
Red Sided Shiner (RSS) *Richardsonius balteatus hydrophlox*	0
Total Fish	**925**

Bull trout were found in 2 of the 28 sites sampled, rainbow trout were present in 25 of the 28 sites, and brook trout were captured in 11 of the 28 sites. Table 3 shows the sites sampled and number of each species captured in each site.

Table 3. Fish capture for 28 sites sampled with multiple-pass depletion methods in 2006.

Creek name	Species and number captured					
	BT	RB	SC	CT	BK	AMPH
Bear River 1	2	22	0	0	0	3
Bear River 2	0	4	0	0	0	2
Bear River 3	0	6	0	0	0	1
Bear River 4	0	1	0	0	0	3
Beaver A 1	0	16	0	0	34	2
Beaver A 2	0	0	0	0	14	2
Beaver A 3	0	8	0	0	23	9
Beaver A 4	0	4	0	0	0	6
Beaver B 2	0	10	0	0	0	5
Beaver B 3	0	28	0	0	0	4
Big Silver	0	15	1	0	0	6
Browns 1	0	47	0	0	0	22
Browns 2	0	34	0	0	0	20
Deadman 3	0	13	0	0	0	6
Deadman 4	0	9	0	0	0	9
E.F. Swanholm 1	0	27	0	0	0	7
E.F. Swanholm 3	0	23	0	0	0	1
E.F. Swanholm 4	0	14	0	0	0	10
Edna 1	0	1	8	0	6	12
Edna 2	0	8	14	0	29	1
Edna 3	0	0	0	0	18	20
Edna 4	0	0	0	0	35	20
Granite	1	41	77	0	0	5
Granite 1	0	49	40	0	0	0
Granite 2	0	71	15	0	0	10
Little Beaver 1	0	1	10	0	6	1
Little Beaver 2	0	2	42	0	32	2
Little Beaver 3	0	1	4	0	17	6
Little Beaver 4	0	1	16	0	27	3
Lodgepole	0	5	0	5	0	6

Discussion

2006 efforts focused on assisting the BNF with the Monitoring Indicator Species (MIS) program as part of the cooperative work with the BNF. Most of the sites surveyed this year did not have bull trout in the past so the low numbers of bull trout captured were expected. Bull trout had been found in high numbers in the Bear River, Lodgepole and Big Silver sites in past years. This is the second year in a row with very few or no bull trout at these sites. Habitat data for these sites will be compared to past years looking for any possible explanation for the decline in bull trout. Bull trout had never been found in Granite Creek in the past. It is suspected that it was a subadult and not a resident fish, because it was found below a barrier (culvert) and no bull trout were found above the barrier.

Chapter Four

INFERENCES FROM WEIR COUNTS OF POPULATION SIZE AND MIGRATION TIMING FOR ADFLUVIAL BULL TROUT (*Salvelinus confluentus)* IN THE NORTH AND MIDDLE FORKS OF THE BOISE RIVER, IDAHO

Abstract

Bull trout (*Salvelinus confluentus)* were captured using steel frame picket weir traps set across the North and Middle Forks of the Boise River in Southwestern Idaho. Trapping occurred between the months of August and October in the North Fork and Middle Fork Boise River. The combined fish capture for 2006 was 183 fish representing seven genera and ten species (Table 1). A total of 66 bull trout (36.1% of total fish captured) were captured and 56 were tagged with PIT tags. Two mortalities were associated with this project, both on the Middle Fork Boise River weir.

Introduction

The FWS developed a recovery plan which included guidelines for management agencies to facilitate bull trout recovery. The federal bull trout recovery team has outlined several important objectives for bull trout recovery. These are: 1) maintenance and restoration of the distribution of bull trout 2) maintenance and restoration of habitat for all life history forms 3) conservation of genetic diversity, and 4) implementation of recovery actions and assessment of their success (FWS 2002). Meeting recovery objectives requires that accurate estimates of population size, assessment of distribution, and trends in abundance are known for bull trout populations within each recovery unit. The Boise basin bull trout populations are located in the Southwest Basin Recovery Unit. In 1999, Reclamation and BNF developed a cooperative program to begin gathering baseline data to be used to meet the recovery objectives. Work began in July 1999 and is ongoing through the 2006 field season. The purpose of the work is to assess temperature, precipitation, and stream discharge conditions as they relate to bull trout movement, population size, and survival on a large-watershed scale. Work to address the study objectives was initially focused on the North Fork Boise River basin which contains the largest population of adfluvial bull trout and most stream miles of spawning and rearing habitats. Weir work was expanded to include the Middle Fork Boise River in 2002, 2003, 2005 and 2006. Flooding and poor conditions in the Middle Fork Boise River precluded weir installation in 2004. The following objectives were addressed through weir trap operation:

1. To quantify population size and trends of migratory bull trout within the Boise River drainage
2. To quantify fish length at age and growth rates of bull trout within the Boise River watershed
3. To examine survival of bull trout and environmental conditions that may affect survival.

Study Area

This work occurred on the mainstems of the North and Middle Forks of the Boise River. Crews were stationed at Barber Flats Guard station and monitored stationary traps located adjacent to the guard station on the North Fork Boise River and on the Middle Fork Boise River at Alexander Flat (Figure 1).

Methods

Steel frame picket weirs were operated across the major migratory corridor in both the North and Middle Forks of the Boise River below most known spawning and rearing habitat for bull trout. A 39.50 m (130 ft.) long x 1.53 m (5 ft.) tall steel picket style weir with upstream and downstream traps was constructed across the full width of the North Fork Boise (rkm 22.7 or rm 12.25) and the Middle Fork Boise River (rkm 15.6 or rm 8.42). Both traps were operated from the end of August through October. The weirs were constructed of 15, 3.05 m (10 ft.) angle iron frames with steel conduit pickets spaced 1.25 cm (0.5 in.) apart. The traps were built following design recommendations and guidance from Russ Thurow (1999). Operating time was planned during the post spawning migration of bull trout. Time and duration of the post-spawning run coincides with periods of lowest river discharge (Reclamation 2004, Flatter 2000). The trap acted as a migration barrier for all fish > 1.25 cm (0.5 in.) in width (approximately > 200 mm or 7.9 in. total length for bull trout), capturing fish in traps as they moved upstream or downstream. The North Fork trap was checked, and pickets cleaned three times per day, while the Middle Fork was checked only one time per day. Fish observed holding upstream of the weirs were netted at night using dip nets when possible.

All fish captured were identified to species and enumerated. Total length (TL) was recorded for all game species. Bull trout were anesthetized using tricaine methanesulfonate (MS-222) (80 mg/L dilution). When a fish was considered anesthetized (could not right itself) its total length and weight was recorded. A scale sample and fin clip was taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout > 100 mm TL which did not carry tags were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from IDFG personnel. Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then returned to the river. Bull trout captured moving downstream were released downstream of the weir and bull trout moving upstream were released upstream of the weir. Direction of migration as well as date and time of capture was noted. Groupings and pairs of fish were noted. All recaptured bull trout were measured and weighed so that data for growth over the time period from mark to recapture could be calculated.

Results

The combined fish capture was 183 fish representing seven genera and ten species (Table 5). A total of 66 bull trout (36.1 % of total fish captured) were captured and 56 were tagged with PIT tags. The majority of fish captured were bull trout. Mountain whitefish were the second most abundant species (29.0% of total), mostly in middle to late October during their spawning migration. Rainbow trout and kokane were very close for third and fourth most abundant species

captured (15.8 % and 15.3% respectively of total), but total capture was low in comparison to bull trout and whitefish. Most bull trout were captured during the night period from 21:00 to 06:00, and the majority of bull trout were captured moving downstream or netted from in front of the trap fence at night.

Table 4: Total number of fish captured from the Boise River weir traps in 2006.

Species	North Fork Boise Weir Fish Capture Data	Middle Fork Boise Weir Fish Capture Data
Bull trout (*Salvelinus confluentus***) (BT)**	47	19
Largescale sucker (LSS) (*Catostomus machrocheilus***)**	0	2
Rainbow trout (RB) (*Oncorhynchus mykiss***)**	24	5
Pike minnow (PM) (*Ptychocheilus oregonensis***)**	0	2
Mountain whitefish (WF) (*Prosopium williamsoni)*	35	18
Kokanee (KOK) (*Oncorhyncus nerka kennerlyi***)**	4	24
Long Nose Dace (LND) *Rhynichthys cataractae*	1	1
Red Sided Shiner (RSS) *Richardsonius balteatus hydrophlox*	1	0
Speckled Dace (SPDACE)	1	0
Cutthroat trout (*Oncorhynchus clarki lewisi)* **/ Rainbow Trout (***Oncorhyncus mykiss***) Hybrid (CT-RB)**	0	1
Total Fish	**112**	**71**

Table 5: Historic bull trout capture data on the Middle Fork Boise River weir. Population estimates have not been done on the Middle Fork bull trout population because only one PIT tagged bull trout has ever been recaptured.

Middle Fork Boise Weir			
Year	Total Bull Trout	Bull Trout >300mm	Population Estimate
2002	99	84	N/A
2003	14	6	N/A
2004	Flooding did not allow weir to be installed		
2005	3	2	N/A
2006	19	13	N/A

Table 6: Historic bull trout capture data on the North Fork Boise River weir.

North Fork Boise Weir			
Year	Total Bull Trout	Bull Trout >300mm	Population Estimate
1999	264	109	879
2000	434	161	432
2001	244	157	333
2002	138	109	159
2003	84	67	145
2004	103	32	33.35
2005	59	38	156
2006	47	27	N/A

A total of 56 of the 66 bull trout were PIT tagged at the weir traps. Eight bull trout were recaptures from previous years of trap operations or other work within the Boise River basin. Seven of these fish were recaptures at the North Fork Boise River weir and were used for the

population estimates. Of the 66 bull trout captured, 26 were juvenile sized bull trout (<300 mm TL) and were not used in the population estimates. The ratio of juvenile sized to adult sized bull trout captured in 2006 was 0.65 or 39.4 percent of the total bull trout captured.

The annual mark-recapture population estimate for adult bull trout (> 300 mm TL) from the North Fork weir trap was 156 bull trout (s = 51.06). The total number of bull trout over 300mm captured at the North Fork Boise River weir has decreased each year since 2000, but the population estimate increased for 2005. An estimate was not calculated for the Middle Fork weir trap due to the fact that no fish were recaptured. Even though none of the 19 bull trout captured at the Middle Fork weir in 2006 were recaptures the number captured is greater than the three that were captured in 2005 and 2003, but still much lower than the 99 captured in 2002 (Table 5).

Discussion

Very low numbers of bull trout were captured at the North and Middle Fork Boise River weir traps in comparison to earlier years of operation. Several factors may explain the low numbers. First, the Boise River basin has experienced five years of low winter snow pack and corresponding drought conditions. In 2005, record precipitation was received as rain in May and June, but this occurs after alevin emergence and egg incubation for bull trout. Low stream flows may impact rearing juveniles and incubating eggs by increasing formation of anchor and frazile ice, limiting invertebrate production, and causing fish to emigrate (Annear 1987). Second, the Arrowrock Reservoir construction project and corresponding reservoir drawdown incurred significant numbers of mortalities for bull trout as documented in Salow and Hostettler (2004). These combined factors will probably contribute to low numbers of adfluvial bull trout in the Boise Basin for several generations.

Even though the actual number of bull trout captured at the North Fork Boise Weir decreased from last year the population estimate increased for the first time. Even though no population estimates could be done on the Middle Fork Boise River there were higher capture rates this year than both 2005 and 2003, 19 fish in 2006 compared to only three in 2005 and 14 in 2003. The North and Middle Forks of the Boise River had very good water years in 2006; which may be the cause for the capture rates and population estimates increasing.

Hopefully the Middle Fork Boise River population is rebounding from the 2003 Hot Creek fire and the associated blowouts. Larger fish >600 mm did pass through the Middle Fork weir in 2006. Fish of this size are usually not on their first spawning run. The low recapture numbers may have reflected the fact that the Middle Fork weir was first installed in 2002 and was not operated in 2004. Alternate year spawning patterns that have been documented in the system may also attribute to the large fish passing through the weirs not being recaptures.

In recent years the majority of the bull trout captured at the North Fork Boise River weir have been netted infront of the weir at night and not actually captured in the downstream trap box. This may be a sign of weir avoidance. Bull trout at the North Fork Boise River weir have also been documented with claw marks and large gashes from predators. Predatory birds have been seen sitting on the weir and in nearby trees while otters have even been seen inside the downstream trap box. With these observations Reclamation is looking into different possibilities to minimize the effects of weir avoidance and the associated predation risk.

CHAPTER 5

SURGICAL IMPLANTATION OF RADIO TAGS FOR ENTRAINMENT MONITORING AT DEADWOOD RESERVOIR

Abstract

The FWS 2005 Upper Snake BiOp identified operation of Deadwood dam to cause take of bull trout by entrainment over the spillway. RPM 3, term and condition 3.e require Reclamation to minimize entrainment of bull trout due to operations. Understanding bull trout movement and use of the reservoir is the first step in meeting this RPM. Bull trout were captured in Deadwood Reservoir using fyke nets and tagged with radio transmitters as part of the entrainment monitoring project. One fish from the IDFG weir operations was also tagged migrating downstream. Trapping occurred during July. A total of eight fish were tagged and five fish are still being tracked as of November 20th 2006. These fish were tracked through the summer and fall to determine trends in migration patterns and habitat selection during staging, spawning, and after the return to the reservoir using both ground and aerial tracking methods. Two fish were confirmed mortalities and one fish was only found during the second week of tracking and not ever found again. No tagged bull trout were entrained in 2006.

Study Area

All of the work discussed in this chapter occurred in Deadwood reservoir located on the mainstem Deadwood River (Figure 2). Deadwood reservoir stores water from the mainstem Deadwood River as well as several smaller tributaries.

Methods

Experimental monofilament gill nets and fyke nets were used to try to capture bull trout from late June through early August. Bull trout were captured in fyke nets in the mouth of trail creek. Gillnets were set for 20 minute intervals during the daylight period from 8:00 to 18:00 hours four days per week. Gill nets were 30.5 m long x 1.25 m deep with four equal-length panels. Each panel had one of four mesh sizes: 3.18 cm, 5.04 cm, 6.35 cm, and 7.62 cm. Fyke nets were set for 24 hour intervals three days per week. Fyke nets were sinking 1.22 m x 1.22 m x 0.91 m nets with 30.48 m x 1.22 m lead lines (Figure 4). Sinking fyke nets were treated with an algicide to prevent decay and had 4 fykes per net. All of the nets had lead core bottom lines that followed the bottom of the reservoir and foam core top lines to maintain the vertical orientation in the water. Each net had 8 kg weights to anchor the bottom line and 20 cm diameter buoys on the top line for marking location and retrieval.

All fish captured were identified to species and enumerated. The first five fish of each species captured had muscle plugs taken from just below their dorsal fin for an associated isotope project. Total length (TL) was recorded for all game species. Bull trout were anesthetized using diluted tricaine methanesulfonate (MS-222) (approximately 100 mg/L). When a bull trout was considered anesthetized (could not right itself) it was measured and weighed. Scale samples and fin clips were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout accept

one with an angling injury were implanted with radio transmitters, five of which contained temperature and depth sensors. Fish were placed ventral side up in a V-shaped surgery cradle. The gills were bathed in anesthetic solution using a bilge pump and shower system throughout the surgery. The surgical methodology used was a modified shielded needle technique (Ross and Kleiner 1982). A small incision (1.0 cm to 2.0 cm) was made parallel to the linea alba and a sterilized transmitter was inserted into the peritoneal cavity. The antenna exit hole was created using a 12 or 14 gauge 7.6 cm (3.0 in.)-long surgical needle inserted through the body wall below the pelvic girdle onto a 1.0-cm X 7.6-cm (0.4-in. x 3.0-in) long steel spatula. The antenna exited the body approximately 1.5 cm to 2.0 cm (0.6 in. x 0.8 in) posterior to the pelvic girdle along the mid-ventral line. The incision was closed with Visistat™ 35 Regular or Wide disposable skin staples. Surgical glue was then applied to the incision after sutures or staples were in place.

Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then released into Deadwood Reservoir. Visible infirmity or injuries such as descaling, frayed fins, or dermal lacerations were noted for all bull trout captured.

Aerial tracking was done once a week; starting the week after the first fish were tagged in the middle of July. No flights were allowed between August 22 and September 20 due to flight restrictions because of the rattlesnake complex fire. Winter flights have been more infrequent due to bad weather and helicopter maintenance. Flights are planned to be ongoing through 2008.

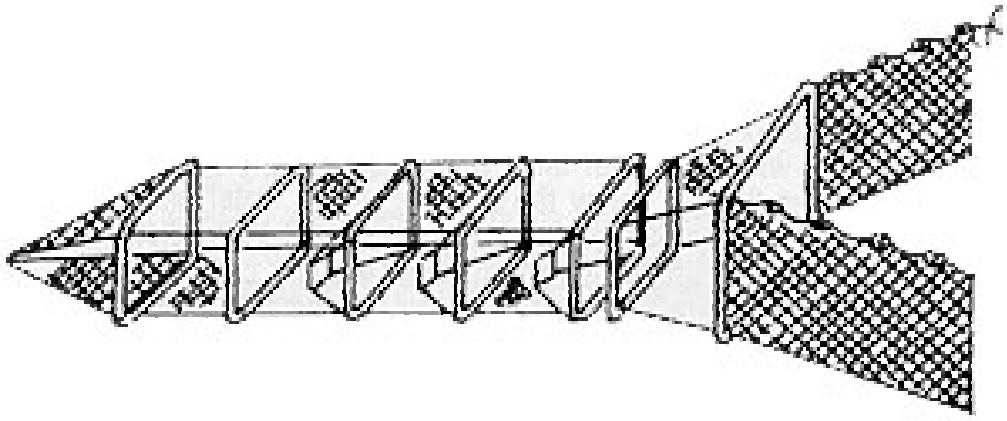

Figure 4: Fyke net used for capturing bull trout.

Results

A total of eight fish were captured in fyke nets at the mouth of trail creek in July of 2006 (Table 7). Seven of these fish were implanted with radio transmitters. Five of these transmitters had temperature and depth sensors in the radio tags. One additional fish was tagged as it passed downstream through the IDFG weir on Trail Creek. One transmitter was found on shore in the mud before the spawning run, one fish was only found once after being tagged, and one fish was eaten in Trail creek during the spawning run. Before migrating up to spawn most of the fish stayed close to the mouth of Trail creek. Some of the fish were tracked out in front of the dam and a couple traveled up to the mouth of Beaver creek and then back to Trail creek.

All of the tagged fish traveled up into Trail creek during their spawning migration. Because of the fire exact dates for upstream migration are unknown for some fish. One fish passed upstream through the IDFG weir on trail creek on September 4$^{th.}$ Individual fish also passed upstream on September 14th and 15th. Access restrictions due to fires and problems with

high flows damaging the weirs resulted in several upmigrating fish not being captured or tagged. Five bull trout without radio tags were seen while ground tracking the tagged bull trout and three fish were PIT tagged by IDFG personnel as they passed upstream through the weir. Fish appeared to migrate in groups and hold in habitats with large pools, undercut banks, or wood debris as a forming feature. Bull trout in trail creek do not travel far to get to spawning habitat. All of the radio tagged fish that were ground tracked were seen in spawning areas between a quarter mile and two miles upstream of the reservoir. One tagged male was seen with a tagged female and two untagged females holding in a large pool under a small log in a very sharp U in the creek (Cover Photo). One tagged female was seen sitting alone on the bottom near an undercut bank in a smaller pool. One tagged fish was seen holding with three other fish in a deep pool with overhanging woody debris. There was a large redd seen at this location (Figure 5). One fish was found during aerial flights in Trail creek but migrated back into the reservoir before ground validation could take place.

Two bull trout moved downstream through the IDFG weir on trail creek on September 20th. One of the bull trout was already tagged; the other fish was not tagged so a radio tag was surgically implanted. Both of these fish were females that looked spawned out. The remainder of the bull trout are believed to have migrated out during a high flow event the night of October 6th. This high flow event blew out the IDFG weirs so no additional fish were tagged after October 6th.Once back in the reservoir the fish dispersed and moved throughout the southern and western areas of the reservoir.

The five implanted radio tags equipped with temperature and depth sensors provided data showing the fish residing in temperatures ranging from 10 º-18º C in the reservoir during the summer; from 2º to 5º C in trail creek during spawning; and from 5º to 11º C in the reservoir in the fall after spawning. Fish were also shown to reside in depths ranging from zero to eleven meters in the reservoir and zero to three meters in the river.

Figure 5: Bull trout holding upstream of large redd in Trail creek.

Table 7: Bull trout captured in trap nets during July sampling in Deadwood Reservoir

Fork Length	Total length	Site	Date	Weight(gms)
337	351	Trail Creek Trap Net	7/12/2006	370
422	432	Trail Creek Trap Net	7/12/2006	840
465	485	Trail Creek Trap Net	7/12/2006	993
434	455	Trail Creek Trap Net	7/13/2006	878
533	555	Trail Creek Trap Net	7/13/2006	1178
388	405	Trail Creek Trap Net	7/17/2006	632
404	420	Trail Creek Trap Net	7/18/2006	744

Discussion

Bull trout in Deadwood reservoir were mainly found in and around Trail creek. All of the fish we captured in trap nets were caught within 30 meters of the mouth of Trail creek. The fish seem to be holding in the cold water coming out of trail creek. Reservoir surface water temperatures were over 21 º C by July 12th and mainstem Deadwood River temperatures were over 18 º C by August 8th. It is speculated that the mainstem Deadwood bull trout populations move out of the reservoir earlier in the season for temperature refuge. Efforts will be made

earlier next season to try to capture bull trout that may migrate into the mainstem Deadwood River.

The isotope project associated with this fish sampling was not planned until after the 2006 permit application was submitted and a permit was given to Reclamation. The permit was not modified to include the taking of muscle plugs and or entire fish for the isotope project. However staff from IDFG as well as the FWS were aware of Reclamation's plans to collect the isotope sampling. Associated sampling methods were discussed and input sought from IDFG, RMRS and FWS.

CHAPTER 6

Electroshocking for Bull Trout and Isotope Samples in the Deadwood River below Deadwood Dam

Abstract

Fish were collected from two river reaches during a construction project that allowed for reduced flows for three days in October, 2006. A total of eight kilometers were surveyed with no bull trout being found. Isotope samples were collected from up to ten fish of each species captured. Anecdotal information indicates anglers have caught bull trout in the river below the dam in the past during early September. The electroshocking occurred in October, later than originally planned, because of access restrictions due to the Rattlesnake Complex fire on the west side of the Deadwood Reservoir.

Study Area

All of the work discussed in this chapter occurred on the mainstem Deadwood River below Deadwood Dam. The river is approximately 70 km long from headwaters (2124 meters above seas level) to mouth (1135 meters above sea level). Deadwood dam, located at river kilometer 36. Two different crews worked on two different reaches of the river looking for bull trout to radio tag. Three kilometers of river were sampled in the upper reach, from the toe of Deadwood Dam to the confluence of Warmsprings Creek and Deadwood River, using backpack and boat electrofishing methods and gillnets. Five kilometers of river were sampled in the lower reach from just above Julie Creek Bridge to the confluence of the Deadwood River with Deadwood Jim creek.

Methods

Smith-Root backpack electroshockers were used to collect fish at the two separate locations on the Deadwood River below the dam. Isotope samples were collected from up to ten individuals of each species, using a biopsy plug, and then frozen following methods established by Claire McGrath from the Rocky Mountain Research Station. If fish were too small to collect biopsy plugs the entire fish was collected and frozen for processing. Isotope samples are being saved in a freezer for processing to determine carbon and nitrogen isotope ratios.

Results

Five isotope samples were collected from all species captured in the upper section. Five samples were collected from all species accept dace captured in the Julie creek section. Bull trout were not found at either location and only one dace was able to be saved for isotope analysis from the Julie creek section. Samples for fish collected below Deadwood Dam are shown in Table 8.

Table 8: Fish samples collected below Deadwood Reservoir 2006. Table 2 can be used as a species key.

Sample ID	Date	Location captured	Species	TL	FL	Comment
RB 1	10/2/06	DW River Downstream Dam	RB	272	287	
RB2	10/2/06	DW River Downstream Dam	RB	197	192	
RB-Z	10/2/06	DW River Downstream Dam	RB			Whole specimens in Ziploc, N = 3
Sculpin Z	10/2/06	DW River Downstream Dam	SC			Whole specimens in Ziploc, N = 5
LND Z	10/3/06	DW River Downstream Dam	LND			Whole specimens in Ziploc, N = 6
WF 1	10/3/06	DW River Downstream Dam	WF	340	318	
WF 2	10/3/06	DW River Downstream Dam	WF	345	322	
WF 3	10/3/06	DW River Downstream Dam	WF	329	307	
WF 4	10/4/06	DW River Downstream Dam	WF	403	384	
WF 5	10/4/06	DW River Downstream Dam	WF	345	324	
KOK 1	10/4/06	DW River Downstream Dam	KO	280	258	
Z1	10/3/06	DW River near Julie Creek Bridge	RB	43		Whole specimen in vial
Z2	10/3/06	DW River near Julie Creek Bridge	RB	198		
Z3	10/3/06	DW River near Julie Creek Bridge	RB	177		
Z4	10/3/06	DW River near Julie Creek Bridge	RB	222		
Z5	10/3/06	DW River near Julie Creek Bridge	RB	179		
Y1	10/3/06	DW River near Julie Creek Bridge	WF	200		
Y2	10/3/06	DW River near Julie Creek Bridge	WF	205		
Y3	10/3/06	DW River near Julie Creek Bridge	WF	315		
Y4	10/3/06	DW River near Julie Creek Bridge	WF	333		
Y5	10/3/06	DW River near Julie Creek Bridge	WF	196		
LND ZD	10/3/06	DW River near Julie Creek Bridge	LND			Whole specimens in Ziploc, N = 1
SC ZD	10/3/06	DW River near Julie Creek Bridge	SC			Whole specimens in Ziploc, N =5

Discussion

Bull trout were not found in the river below Deadwood Dam during this electroshocking exercise. Anecdotal information indicates anglers have captured bull trout downstream of Deadwood Dam in early September so it is unclear why they were not present. One possibility could be due to the late sampling time frame (October 4-6, 2006). Future approaches may include implementing an angling effort during the month of September to capture bull trout below Deadwood Dam, or another alternative could be to catch outmigrating bull trout using weirs on Clear, Warmsprings, or Scott Creeks during September.

The isotope project associated with this fish sampling was not planned until after the 2006 permit application was submitted and a permit was given to Reclamation. The permit was not modified to include the taking of muscle plugs and or entire fish for the isotope project. However staff from IDFG as well as the FWS were aware of Reclamation's plans to collect the isotope sampling. Associated sampling methods were discussed and input sought from IDFG, RMRS and FWS.

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