REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS
LOCHSA RIVER BULL TROUT

DISTRIBUTION, ABUNDANCE AND LIFE HISTORY CHARACTERISTICS OF BULL AND BROOK TROUT IN THE LOCHSA RIVER BASIN

Annual Report
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INTRODUCTION

In 1998 bull trout *Salvelinus confluentus* were listed in the Columbia River drainage as threatened under the Endangered Species Act. Reasons for their decline include: habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest, entrainment, and competition from non-native species.

In 2002, the draft recovery plan described processes to reduce threats to the long-term survival and reverse the decline of the species (US Fish and Wildlife Service 2002, Chapter 1). The Columbia River drainage was broken into 22 recovery units, areas where bull trout share genetic characteristics as well as management jurisdictions (US Fish and Wildlife Service 2002, Chapter 1). Recovery units contain one or more core areas (areas that contain local populations of bull trout and are partially isolated but have some degree of gene flow among them) (US Fish and Wildlife Service 2002, Chapter 1). Local populations are defined as groups of bull trout that spawn in various tributaries but are generally characterized by small amounts of genetic diversity within a tributary, but high levels of genetic divergence between tributaries (Leary et al. 1993). Local populations are considered to be the smallest group of bull trout known to represent an interacting reproductive unit (US Fish and Wildlife Service 2002, Chapter 1).

The draft recovery plan lists 7 core areas and 45 local populations in the Clearwater River drainage (US Fish and Wildlife Service 2002, Chapter 16). In addition to the local populations, 27 potential local populations were identified. Potential local populations are areas known or suspected to be unoccupied, but have the potential to provide spawning and rearing habitat for bull trout and support a local population in the future. Furthermore, the draft recovery plan considers 18 of the 27 potential populations as essential to recovery because they are considered to be central to recovery objectives. In order for bull trout in a core area to be considered at diminished risk of extinction, recovery plan criteria requires each of its core areas to contain at least 1,000 adult spawners, and a minimum of 10 local populations.

The Lochsa River Drainage is one of the seven core areas in the Clearwater River Recovery Unit. The recovery plan identifies 16 known local populations in the Lochsa core area. The local populations include: Fishing, Legendary Bear, Fox, Shotgun, Crooked Fork, Boulder, Haskell, Rock, Brushy Fork, Spruce, Twin, Colt Killed, Beaver, and Storm creeks. The recovery plan also categorizes nine potential populations essential to recovery in the Lochsa core area: Post Office, Weir, Indian Grave, Lake, Boulder, Old Man, Hungry, Fish, and Split creeks. The recovery criteria for the Lochsa River Drainage is 16 local and 9 potential populations, with 5,000 total adults, and a trend of stable to increasing for 15 years (US Fish and Wildlife Service 2002, Chapter 16).

To date, little information is known about adult bull trout numbers or trends in abundance in the Lochsa River Drainage except for redd counts conducted by the Clearwater National Forest (Pat Murphy, Personal Communication, USDA Forest Service, Clearwater National Forest). Additionally, little is known about the distribution or abundance of bull trout in streams listed as "potential essential" local populations.

Bull trout populations in the Lochsa River have been impacted by many of the reasons listed as contributing to bull trout declines including introduced non-native species.

Introduced Eastern brook trout *S. fontinalis* can have a negative impact on resident salmonids, particularly bull trout that share similar microhabitats and spawn at similar times of the year. These species have not evolved in sympatry and are found to use similar niches, competing strongly for limited resources (Nakano et al. 1998). In an Oregon stream non-native brook trout were clearly observed to be aggressive and dominant over bull trout of similar size, displacing them to other areas of the stream (Gunckel et al. 2002). The extent to which brook trout have impacted bull trout or limit their recovery is unknown.

The first goal of this project was to document bull trout distribution, migration patterns, and identify previously unknown spawning locations. The second goal of this project was to document the presence and distribution of bull trout and brook trout in Old Man Creek, a potential local population listed as essential to recovery.

OBJECTIVES

1. Obtain basic biological and life history information on bull trout in the Lochsa, Middle Fork Clearwater (MF), and Clearwater rivers (CWR).

2. Determine migration patterns of bull trout within the Lochsa, MF, and CWR rivers.

3. Document the presence, distribution, and abundance of salmonids, specifically, bull trout and non-native eastern brook trout in Chimney and Old Man creeks.

4. Evaluate the distribution and abundance of brook trout from a known mountain lake source population, Chimney Lake.

5. Determine migration patterns of bull trout present in the North Fork Clearwater River below Dworshak Dam (NFBD).

STUDY AREA

The CWR is a seventh order stream in north-central Idaho. The CWR extends from its confluence with the Snake River, at Lewiston, ID, east to its confluence with the South Fork Clearwater River (SF) at Kooskia, ID. Major tributaries to the CWR include the North Fork Clearwater River (NF) (rkm 64.8) and the SF (rkm 119.5). In this document, river kilometers are calculated from 0.0 rkm at the Snake and CWR rivers confluence. The NF extends east 3.1 km to the base of Dworshak Dam. The Dworshak Dam was constructed in 1971 without fish passage facilities, and is a permanent upstream migration barrier. Upstream of Dworshak Dam is Dworshak Reservoir and the remainder of the NF. Dworshak Reservoir and the NF is a fourth order stream with a total drainage area of 739,982 ha. The MF extends from the mouth of the SF near Kooskia, ID (rkm 119.5), east to the confluence of the Lochsa and Selway rivers (rkm 156.2) at Lowell, ID (Figure 1).

The Lochsa River is a fifth order stream with a total drainage area of 306,254 ha. The Lochsa River extends east to the Bitterroot Mountains on the Idaho - Montana border. The majority of the land in the watershed is under public ownership and more than 60% of the drainage is designated as wilderness or roadless. The primary private landowner in the drainage is Plum Creek Timber Company. Major tributaries include: Brushy Fork, Colt Killed Creek (CKC), Crooked Fork, Fishing, Warm Springs, Old Man, Fish creeks (Figure 1).

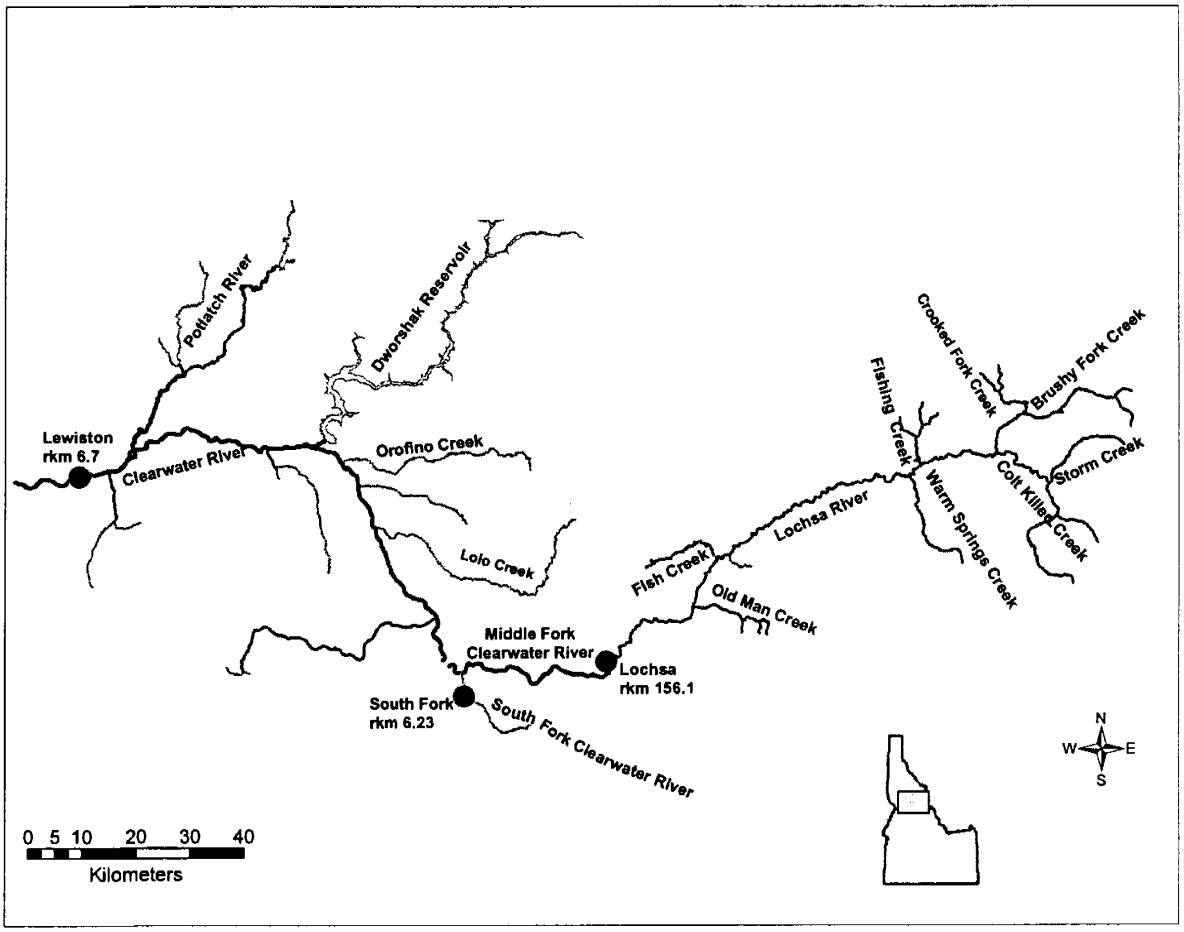

Figure 1. Overview map of the Clearwater, South Fork Clearwater, and Lochsa River drainages including major tributaries. Fixed telemetry site locations are indicated in red, they are located at the following rkm: Lewiston 6.7 (CWR), Kooskia 6.23 (SF) , and Lochsa 156.1 (MF).

Old Man Creek (rkm 183.5) is a third order tributary to the Lochsa River with a drainage area of 11,437 ha (Figure 2). Old Man Creek drains a portion of the north side of the Selway Bitterroot Wilderness. The Old Man Creek drainage contains 14 alpine lakes, 11 (79 %) contain fish populations. Brook trout are present in seven of the lakes. The lakes containing brook trout are: Chimney, Old Man, Hjort, Lloyd, Elizabeth, Dishpan, and Lottie lakes; all drain into Old Man Creek (Cochnauer et al 1996) (Figure 2). Little information is known on the species composition of Old Man Creek. Brook trout are suspected to have invaded downstream from the mountain lakes into Old Man Creek but at unknown distances or abundances.

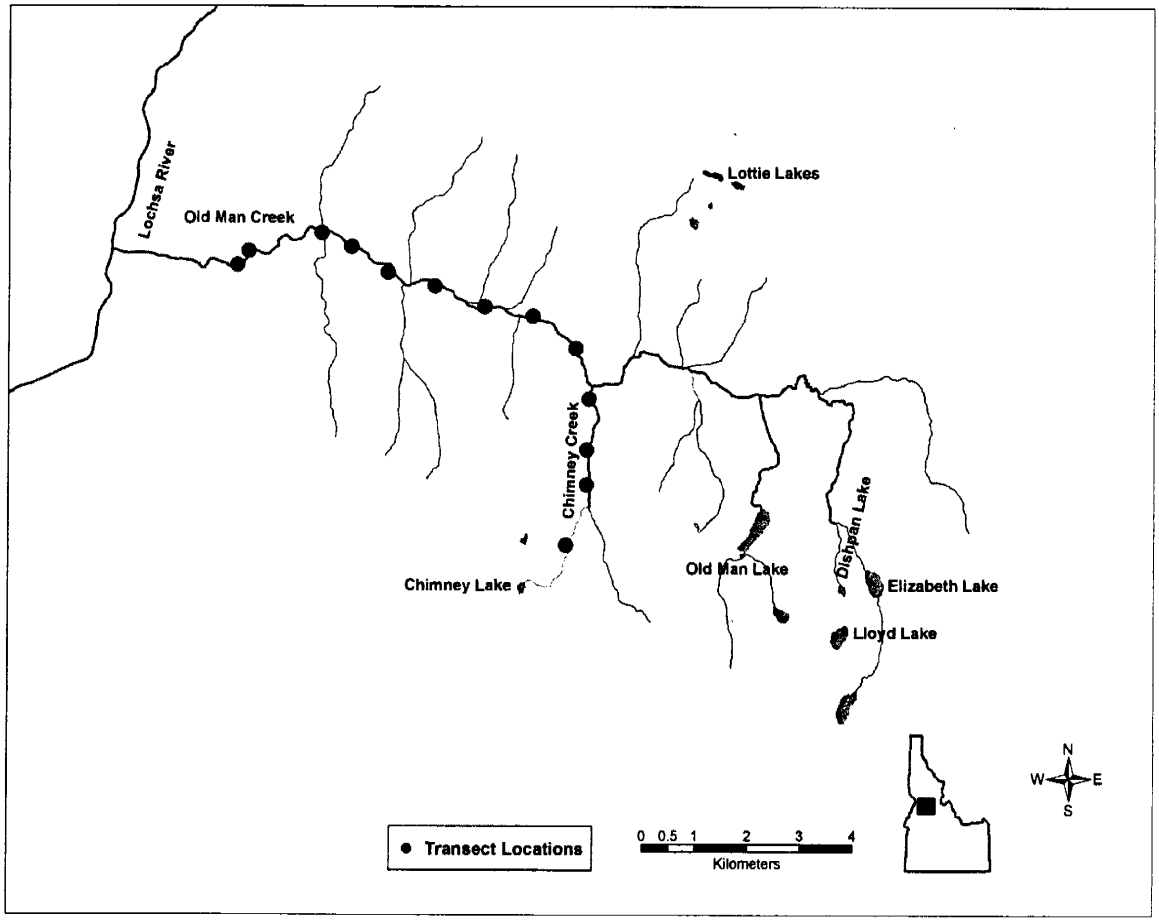

Figure 2. Overview map of the Old Man Creek Drainage including major tributaries and mountain lakes. Random snorkel transect locations are identified.

METHODS

Tagging

Bull trout were captured with hook-and-line in the NFBD, MF, and Lochsa rivers. Additional bull trout were captured in the NFBD using boat electrofishing techniques. Sampling was conducted in the NFBD between rkm 0.0 and rkm 3.1, MF between rkm 119.5 and rkm 156.2, and Lochsa between rkm 156.2 and rkm 268.3.

Individual bull trout were anesthetized in a 60-80 mg/l solution of MS222. Fish were initially weighed and measured. All fish were scanned for Passive Integrated Transponder (PIT) tags. If a fish was not previously PIT tagged, a 134 kHz PIT tag was inserted in the opercula muscle using a 14-gage hypodermic needle. The adipose fin was clipped for genetic sampling and future identification. If the fish was previously PIT tagged, the number was recorded.

Scales and the front pelvic ray were collected from all bull trout to determine age and verify a recaptured fish's age. Stomach contents were removed utilizing a gastric lavage technique.

Bull trout weighing greater than 385 g were candidates for surgical radio transmitter implantation. The surgical procedure is an adaptation of the shielded-needle technique as described by Schill et al. (1994). All individuals were allowed to recover in fresh water for a minimum of 15 minutes prior to release.

We utilized MCFT-3BM (MICRO) radio transmitters (Lotek Engineering). MICRO radio transmitters are relatively small in size, weighing 7.7 g and have a minimum transmitter life of 278 d. We used transmitters on two frequencies 148.480 MHz and 149.580 MHz. In addition to using two frequencies, each fish had an individual code associated with it ranging from 1 – 212. We will use a frequency-code combination to identify individual fish throughout this document. For example: a fish tagged with a transmitter in the 148.480 MHz frequency with a code 001 will be shown as 148.48.001.

Fish with radio transmitters implanted were also subject to maturity and sex determination. An otoscope was used to visually determine gender and maturity. An otoscope was inserted into the incision created for transmitter implantation. Once inserted into the body cavity, mature reproductive organs, if present, were readily observed. If no reproductive organs were observed, the otoscope followed the body wall down dorsally and anteriorly toward the head, following the kidney. Immature reproductive organs were generally found lying along the body wall posterior to the liver. If no reproductive organs were observed, it was recorded as unknown. A female was categorized to be mature if eggs greater than one mm diameter were observed and immature if eggs less than one mm diameter were observed. Males were identified as mature if large gonads were observed and immature if gonads were small and undeveloped.

Tracking and Distribution

IDFG and University of Idaho coordinated tracking efforts during the 2003-tracking year. Automobiles and fixed-wing aircraft were utilized on a monthly basis to monitor fish in the Lochsa, MF, NFBD, and CWR rivers. In addition to mobile tracking, we utilized three established stationary radio-receiving sites, maintained and operated by the University of Idaho. The Lochsa fixed site is located at the confluence of the Lochsa and Selway Rivers at rkm 156.2, at Lowell, ID. The South Fork fixed site is located on the South Fork Clearwater River at rkm 6.23 at Stites, ID. The Lewiston fixed is located on the Clearwater River at rkm 6.7, approximately 3.0 km upstream of Lewiston, ID (Figure 1).

Stream Survey

Snorkeling techniques were used to document fish distribution and abundance in Old Man and Chimney creeks. Transects to be sampled were selected using a stratified random sampling design. Transects were selected by delineating each km of the stream into ten, one hundred meter sections. One 100 meter transect per kilometer was randomly selected. The coordinates for each transect were obtained from MapTech (MAPTECH 2002). At each transect a minimum of 100 m was snorkeled, beginning and ending at natural habitat breaks.

Transects were snorkeled throughout the day. All fish observed were identified to species and their size estimated to the nearest inch. Physical stream characteristics including temperature, visibility, percent habitat type, three stream widths and transect length were recorded for each transect. Stream widths and the length were used to calculate the surface area for each transect (mean width [m]* length [m] = Area [m^2]). The density of each fish species per km was estimated using the following equation: # fish observed per species/stream area*100.

A population estimate was calculated for Old Man Creek for all salmonids. The same transects were used for this estimate as were used for the density calculation except for the addition of a transect 0.4. This transect was less than 100 meters and was completed as part of annual IDFG parr monitoring surveys (A. Byrne personal comm. 2004). Fish populations (by species) were estimated by multiplying the average density of fish observed in transects from each stream kilometer by the estimated surface area of stream in each kilometer. Individual kilometer population estimates were added together to estimate the total population. Stream surface area in each kilometer was estimated by multiplying the average stream width by 1,000 m. Average width for each kilometer of stream was calculated using actual measurements taken in the randomly chosen snorkel transects from each kilometer (Table 1). We assume the average fish density and average stream width for each respective stream kilometer is representative of the entire kilometer because they were chosen randomly.

Table 1. Formulas used to calculate the population estimate from stratified random snorkeling transects.

Equation 1: Average width per km = Σ (Km $X_{1(\text{widths})}/N_{x\ (\text{widths})}$ Where X_1 is the first transect in the *ith* km and X_2 is the second transect in the *ith* km
Equation 2: Area Surveyed per km = Equation 1/$\text{Length}_{(xi)}$
Equation 3: Area per km = Equation 1 * 1000 m
Equation 4: Density of Fish Species Y in Surveyed Area per km = Total number of Fish Species Y observed / Equation 1
Equation 5: Fish Species Y per km = Equation 3 * Equation 2
Equation 6: Total Number of Fish Species Y in stream = Σ Equation 5_{xi}

RESULTS

Tagging

From 21 May to 17 June 2003, 21 bull trout were collected and an additional 4 bull trout were collected from 15 - 17 November 2003 within the Lochsa and MF (Figure 3). Total length of all bull trout captured within the Lochsa and MFR in 2003 ranged from 319 mm to 583 mm (mean 430.4) mm and weight ranged from 300 g to 1820 g (mean 841 g) (Figures 4 and 5). Radio transmitters were implanted in 24 bull trout; 20 in the spring, and 4 in the fall.

On 29 and 30 June 2003, nine bull trout were collected the NFBD (Figure 6). One bull trout was a recapture, which had been radio-tagged in the Lochsa River thirteen days earlier. Total length of all bull trout captured within the NFBD, excluding the recapture, ranged from 310 mm to 508 mm (mean 443.8) and weight ranged from 300 g to 1600 g (mean 1072.5 g) (Figures 4 and 5). Radio transmitters were implanted in all eight-bull trout. No length or weight information was collected on the recapture, because of the short duration between capture events.

Life History Information

Length-Weight Relationship

The length-weight relationship for bull trout captured in the Lochsa River was described by the equation: log weight (g) 3.1195 log total length (mm) – 5.3164 (Figure 7). The NFBD has a value of log weight (g) 3.2094 log total length (mm) - 5.4915 (Figure 7). Schiff and Schriever (2003) obtained a value of log weight (g) 3.5551 log total length (mm) – 5.327. These values are not significantly different at the 95% confidence level.

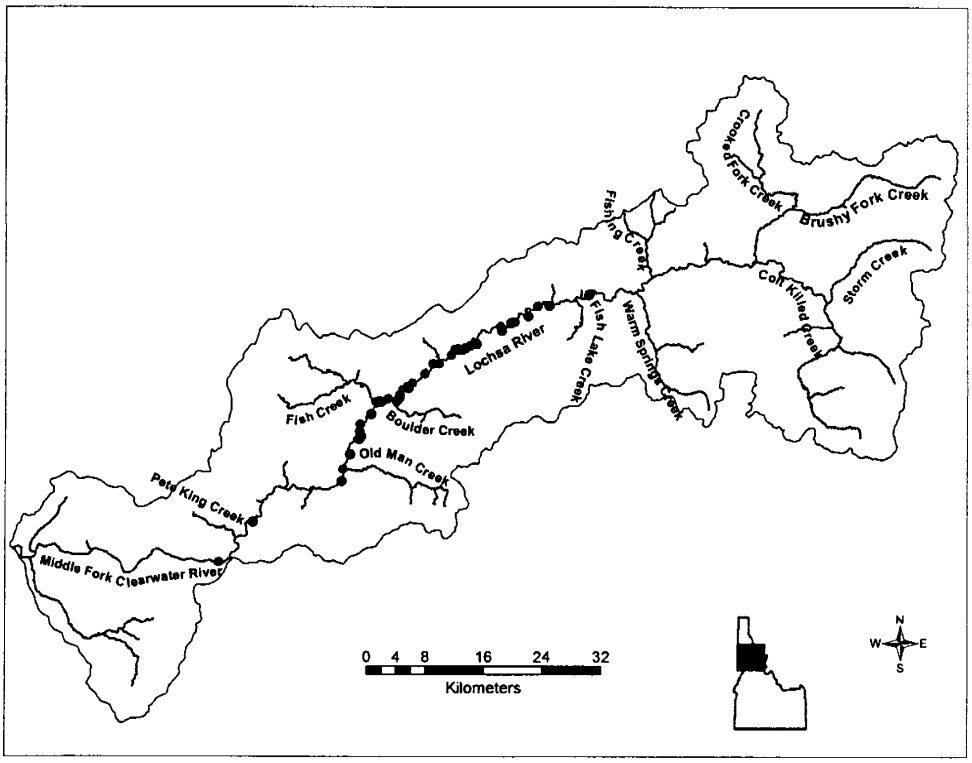

Figure 3. Bull trout capture locations in the Lochsa and Middle Fork Clearwater rivers, 2003.

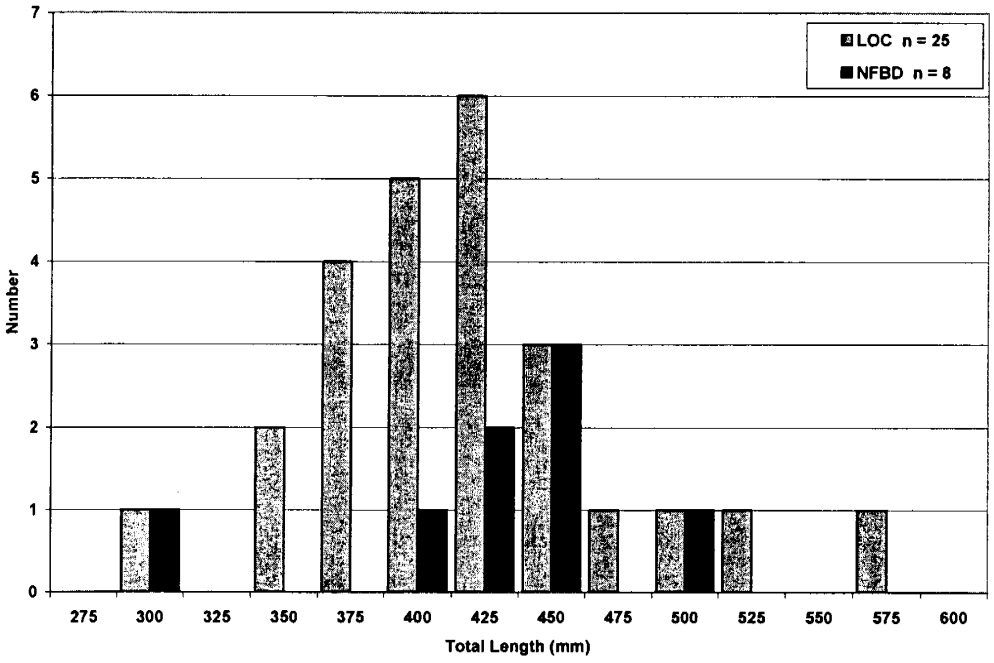

Figure 4. The total length of all bull trout captured in the Lochsa, Middle Fork Clearwater and North Fork Clearwater River below Dworshak Dam, 2003.

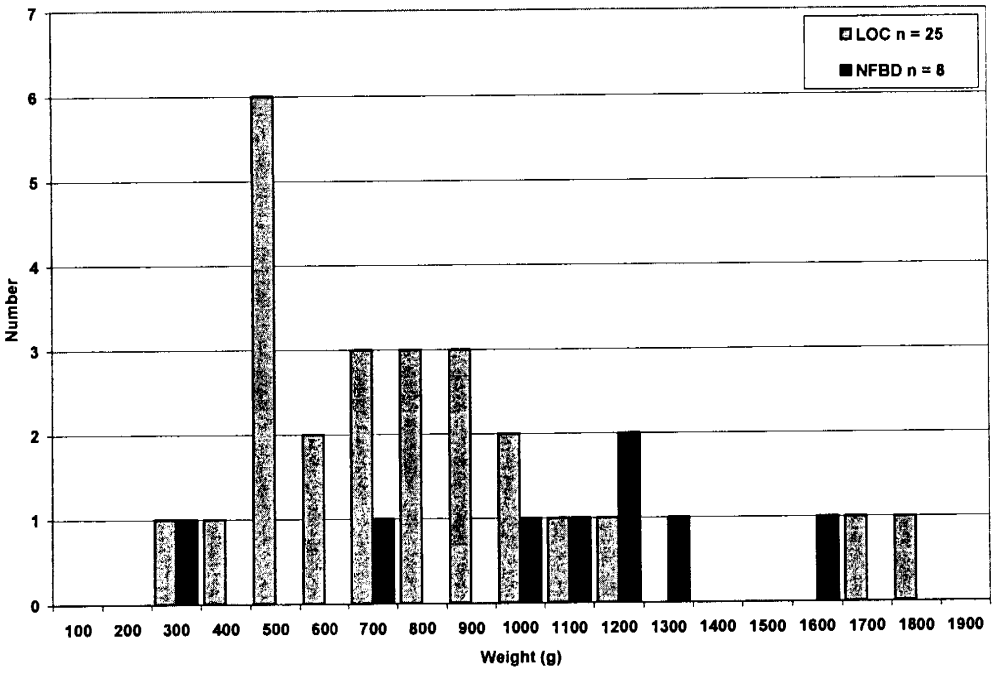

Figure 5. The weight range for all bull trout captured in the Lochsa and North Fork Clearwater rivers, 2003.

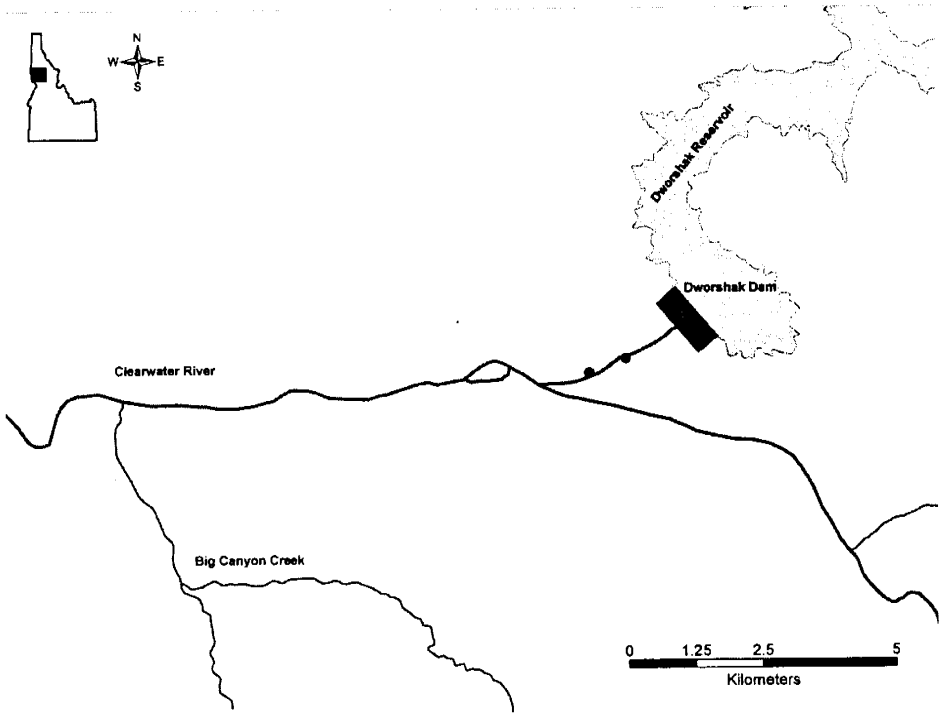

Figure 6. Bull trout capture locations in the North Fork Clearwater River, below Dworshak Dam, 2003.

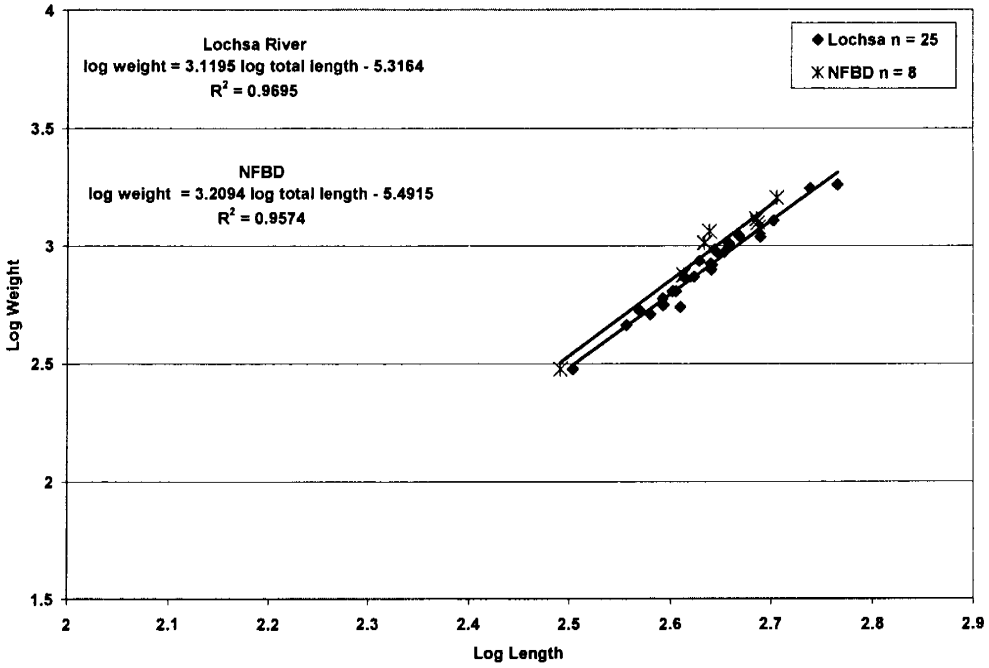

Figure 7. Log length-weight comparison for bull trout captured in the Lochsa River Drainage, 2003.

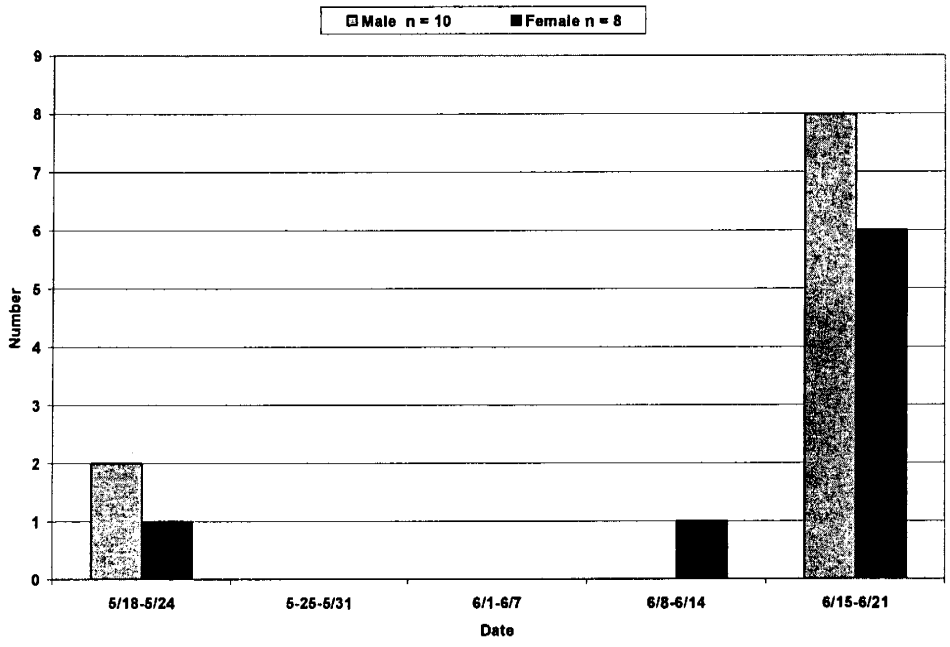

Figure 8. Weekly sex composition of bull trout captured in the Lochsa River, 2003

Sex Ratio and Maturity

Maturity and sex determination was obtained on 18 of the 20 fish collected in the Lochsa River. There were ten males and eight females (Figure 8). The sex ratio obtained was 1.25 males per female. One male was immature, the remainder were mature.

Maturity and sex determination was obtained on five of the eight fish collected in the NFBD. There was one male and four females. The sex ratio obtained was 0.25 males per female. There was one immature female; the remainder of the fish were found to be mature.

Spawning Mortality

Sixty-nine percent (11/16) of radio-tagged fish were detected returning to the mainstem Lochsa or MF, post-spawn. The remaining fish shed their transmitters, or were spawning mortalities. Fish survival/tag retention by spawning tributary was Storm Creek 25% percent (1/4), CKC 80% (4/5), and Brushy Fork Creek 50% (1/2) survival (Table 2). The sex ratio of suspected shed transmitters or mortalities was four males to one female.

Table 2. Number of radio-tagged fish in each watershed and the number of suspected shed transmitters or fish lost due to mortality in the associated drainage.

Drainage	Number of Fish in each Drainage	Percent of Total Radio-Tagged Fish in each Drainage	Number of Suspected Shed Transmitters or Fish Mortalities	Percent Survival of Radio-Tagged Fish by Drainage
Colt Killed Creek	5	31%	1	80%
Storm Creek	4	25%	3	25%
Fishing Creek	3	19%	0	0%
Warm Springs Creek	2	13%	0	100%
Brushy Fork Creek	2	13%	1	50%
Total	16		5	31%

Migration

In the spring, 16 of the 20 radio–tagged fish were detected migrating from their original tagging location into presumed spawning tributaries. These migrants were distributed in the following drainages: Five (31 %) to Colt Killed Creek, four (25%) to Storm Creek, three (19 %) to Fishing Creek, two (13 %) to Warm Spring Creek, and two (13 %) to Brushy Fork Creek (Figure 9, Tables 2 & 3).

Table 3. Tagging location, furthest upstream river kilometer, and overall upstream migration distance for radio-tagged bull trout in the Lochsa River drainage, 2003. Those fish tagged in the North Fork, below Dworshak Dam, and detected on the Lochsa fixed site, are listed as in the Lochsa River in an unknown spawning watershed.

Frequency Code	Tagging Date	Spawning Watershed	Tagging Location (rkm)#	Furthest Location (rkm)#	Migration Distance From Tagging Location (km)
149.58.211	5/20/2003	Brushy Forks Creek	181.8	288.2	106.4
149.58.197	6/16/2003	Brushy Forks Creek	212.9	269.5	56.6
149.58.193	6/14/2003	Colt Killed Creek	195.8	274.0	78.2
149.58.196	6/16/2003	Colt Killed Creek	201.6	285.4	83.8
149.58.198	6/16/2003	Colt Killed Creek	213.6	292.2	78.6
149.58.202	6/17/2003	Colt Killed Creek	201.6	292.2	90.6
149.58.204	6/17/2003	Colt Killed Creek	239.0	278.2	39.3
149.58.194	6/14/2003	Fishing Creek	195.8	259.3	63.5
149.58.205	6/17/2003	Fishing Creek	224.3	259.3	35.0
149.58.210	6/18/2003	Fishing Creek	198.8	253.9	55.1
149.58.206	6/17/2003	Lower Clearwater River	220.9	6.7	-214.2
149.58.201	6/17/2003	Mortality	239.0	182.3	-56.7
149.58.195	6/16/2003	Mortality	212.6	194.1	-18.5
149.58.212	5/20/2003	Mainstem Post Office Creek	192.9	205.2	12.2
149.58.200	6/16/2003	Storm Creek	215.6	297.1	81.5
149.58.203	3/17/2003	Storm Creek	232.6	299.4	66.8
149.58.208	5/20/2003	Storm Creek	188.6	292.5	104.0
149.58.209	6/17/2003	Storm Creek	198.4	299.0	100.6
149.58.199	6/16/2003	Warm Springs Creek	213.9	249.6	35.7
149.58.207	6/17/2003	Warm Springs Creek	218.9	252.5	33.6
148.48.001	6/29/2003	Lochsa, unknown	64.8	156.2	91.4
148.48.002	6/30/2003	Lochsa, unknown	64.8	156.2	91.4
148.48.004	6/30/2003	Clearwater, mainstem	64.8	60.6	-4.2
148.48.005	6/29/2003	Clearwater, mainstem	64.8	61.0	-3.8
148.48.006	6/30/2003	Clearwater, mainstem	64.8	59.9	-4.9
148.48.008	6/30/2003	Clearwater, mainstem	64.8	62.5	-2.3
148.48.009	6/29/2003	Clearwater, mainstem	64.8	60.9	-3.9
148.48.010	6/30/2003	Clearwater, mainstem	64.8	59.9	-4.9
149.46.164	11/15/2003	Tagged in Fall	185.8		
149.46.165	11/16/2003	Tagged in Fall	189.1		
149.46.166	11/17/2003	Tagged in Fall	164.0		
149.46.167	11/17/2003	Tagged in Fall	189.1		

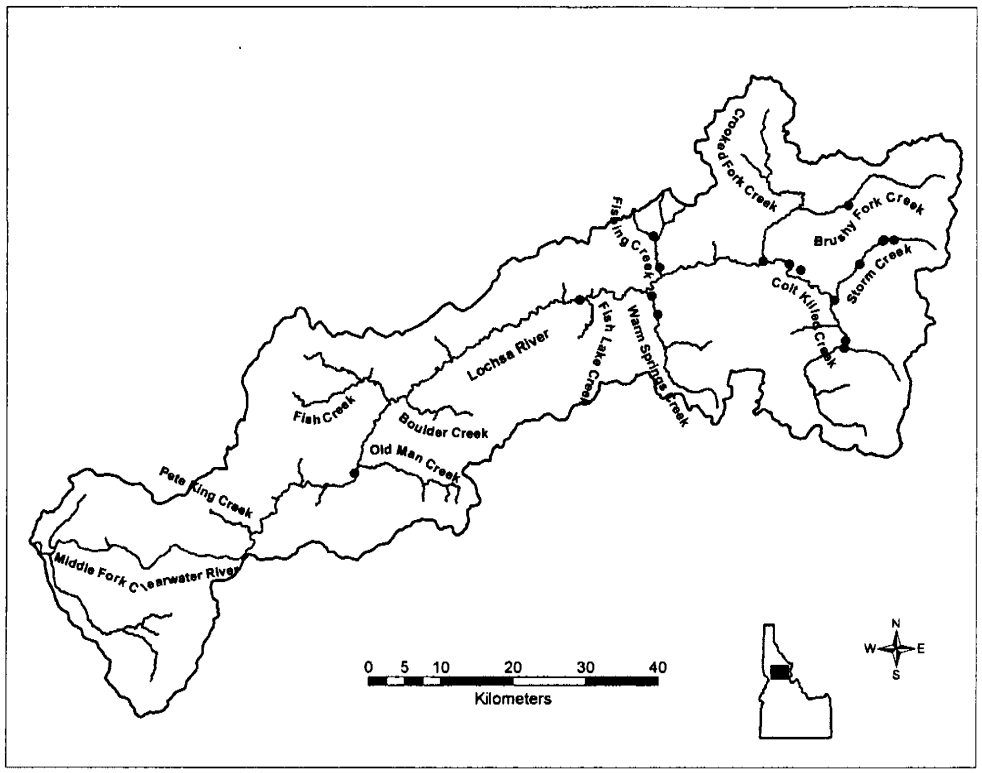

Figure 9. Radio-tagged bull trout distribution during the spawning time, 15 August – 1 October 2003. For simplification purposes each fish is displayed once during this time frame.

An additional four bull trout were detected moving from their original tagging locations, but were not detected in presumed spawning tributaries. Bull trout 149.58.201 moved downstream approximately 56.7 km and has not been detected moving since 16 July 2003. This fish is a presumed mortality but it is not known if it was a tagging related, angling, or predator mortality. Fish 149.58.195 migrated downstream approximately 18.5 km and has not been detected moving since 16 July 2003. This fish is a presumed mortality but it is not known if it was a tagging related, angler, or predator caused. Fish 149.58.212 moved upstream 12.2 km upstream to the mouth of Post Office Creek (rkm 205.2). It was later detected moving back downstream and was not detected leaving the mainstem. These three fish mentioned above were not included in the calculations for migration distance.

Fish 149.58.206 was tagged on 17 June 2003 and then migrated downstream approximately 369.1 km, near the NF/CWR confluence (rkm 64.8) where it was recaptured during night electrofishing below Dworshak Dam on 30 June 2003 (Figure 10). This fish then moved downstream approximately 36.3 km and was later detected on the Lewiston fixed site (rkm 6.7) on 17 & 19 July 2003 (Figure 10). Fish 149.58.206 then moved back upstream and was detected near the NF/CWR confluence on 26 November 2003 (Figure 11). Fish 149.58.206 remained near the NF/CWR confluence for the remainder of the tracking year. This fish was also not included in the calculations for migration distance.

Radio-tagged fish in the Lochsa Drainage migrated a mean upstream distance of 69.3 km, (range= 33.6 – 106.4 km) (Table 3). The first radio-tagged bull trout was detected in a known spawning tributary on 24 July 2003; and the last on 12 September 2003.

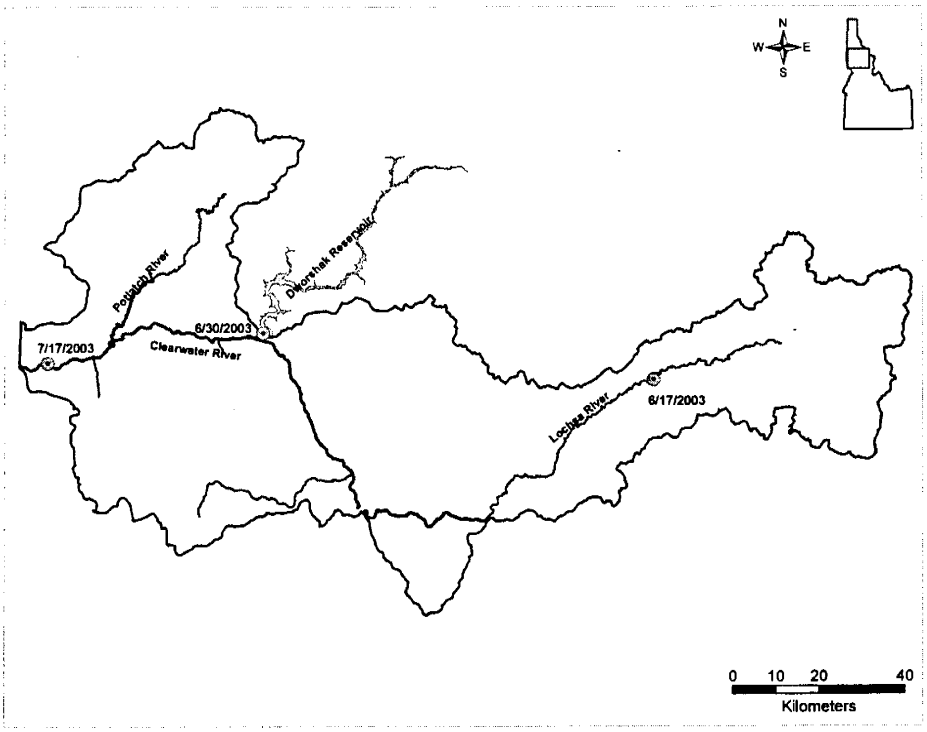

Figure 10. Distribution of fish 149.58.206 in the Clearwater and Lochsa river drainages from June – July 2003.

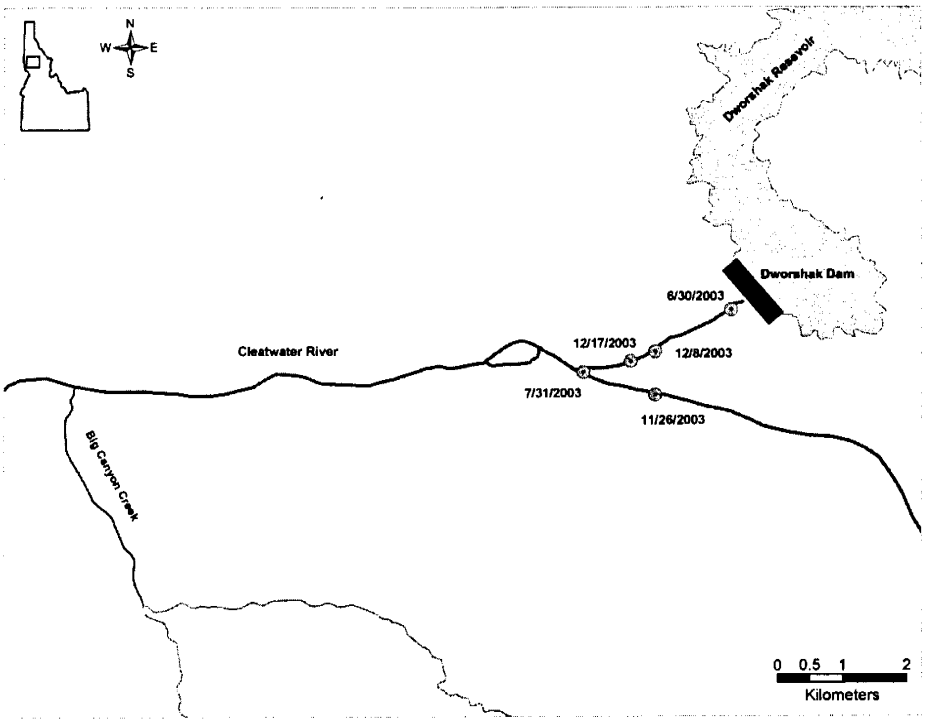

Figure 11. Distribution of fish 149.58.206 in the North Fork Clearwater River, below Dworshak Dam, and the Clearwater River, June – December 2003.

In the spring, eight bull trout were radio-tagged in the NFBD. All were detected after being released. Five remained in the vicinity, only migrating upstream/downstream a mean of 4.0 km from their release sites (range = 2.3 – 4.9 km) (Figures 12, 13). Due to the unique circumstances concerning the remaining three fish, their migration distances were calculated separately. Fish 148.48.008 was detected near the confluence of the NF and CWR (rkm 64.8) on 7 July 2003; 8 August 2003; 15 October 2003; and 12 December 2003. This fish was illegally harvested and the angler turned in the transmitter. It is unknown the exact date the fish was captured and the detections during the months of October and December occurred while the transmitter was at Dworshak National Fish Hatchery prior to being deactivated.

Fish 148.48.001 was not detected for more than 3 months after tagging. It was detected on 1, 4, 8, 11 October 2003 and 22 November 2003 on the Lochsa fixed site (rkm 156.1) (Figure 14). This fish was later detected on 12 December 2003 near Orofino (rkm 71.3) (Figure 14). Fish 148.48.001 had a total detected migration distance of 182.8 km in 2003.

Fish 148.48.002 was also not detected for more than three months after tagging, before being detected on 4 October 2003 at the Lochsa fixed site (rkm 156.1) (Figure 15). Fish 148.48.002 had a total detected migration distance of 91.4 km (Table 3). Fish 148.48.002 had no further detections in 2003.

Old Man Creek

Relative Abundance and Distribution

From 10 - 15 July 2003, thirteen transects were snorkeled in the Old Man Creek drainage; nine in the mainstem of Old Man Creek, and four in Chimney Creek. No bull trout were observed.

Rainbow trout (*Oncorhynchus mykiss*) were the most abundant species in Old Man Creek. A total of 1,012 rainbow trout were observed with a mean of density of 9.36 fish/100m^2 (5.71 – 15.67 fish/100m^2) (Table 4). Rainbow trout densities were higher in the lower 5 km of stream, with the highest in transect 5.2 (Table 4). The rainbow trout population is estimated at 9,956 fish (+/- 198, 95% CI) (Table 5). All rainbow trout observed were less than 305 mm.

A total of 114 cutthroat trout (*O. clarki*) were observed with a mean density of 1.04 fish/100m^2 (0.08 – 2.40 fish/100m^2) (Table 4). Cutthroat trout densities were higher in the upper reaches, with the highest in transect 8.2 (Table 4). The cutthroat trout population was estimated at 1,157 fish (+/- 55, 95% CI) (Table 5). All cutthroat trout observed were less than 305 mm.

A total of 24 brook trout were observed with a mean density of 0.22 fish/100m^2 (0.00 – 1.22 fish/100m^2) (Table 4). The brook trout population was estimated at 224 fish (+/- 27, 95 % CI) (Table 5). No brook trout were observed in the lower 3 km, and densities in the upper reaches were highest near the mouth of Chimney Creek (Table 4). The highest brook trout density was in transect 9.4.

Additionally, one age zero chinook (*O. tshawytscha*) was observed in transect 7.1 with a mean density of 0.08 fish/100m^2 (Table 4). The chinook zero population was estimated at 72 fish (+/- 14, 95% CI) (Table 5).

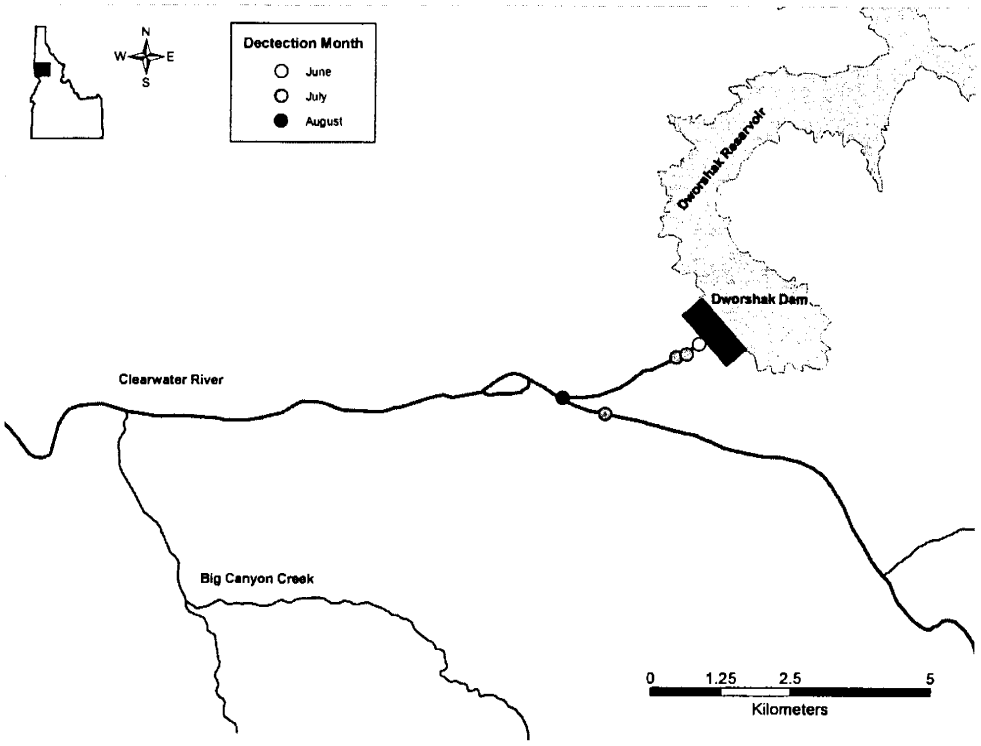

Figure 12. Distribution of radio-tagged bull trout below Dworshak Dam in the North Fork Clearwater and Clearwater rivers, June – August 2003.

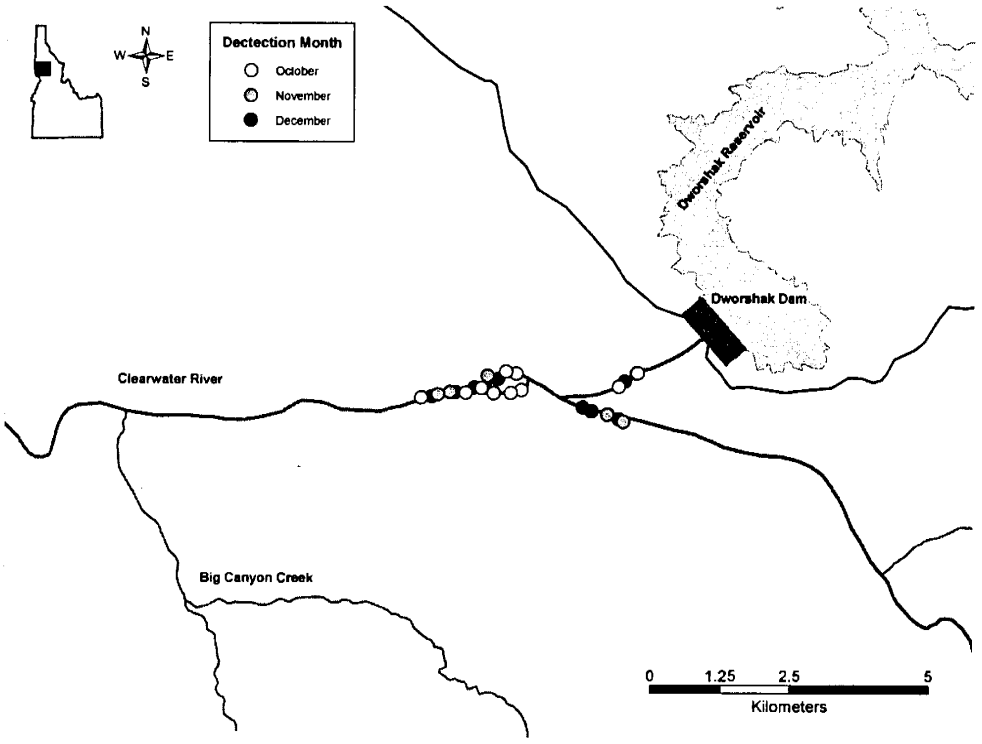

Figure 13. Distribution of radio-tagged bull trout below Dworshak Dam in the North Fork Clearwater and Clearwater rivers, October - December 2003.

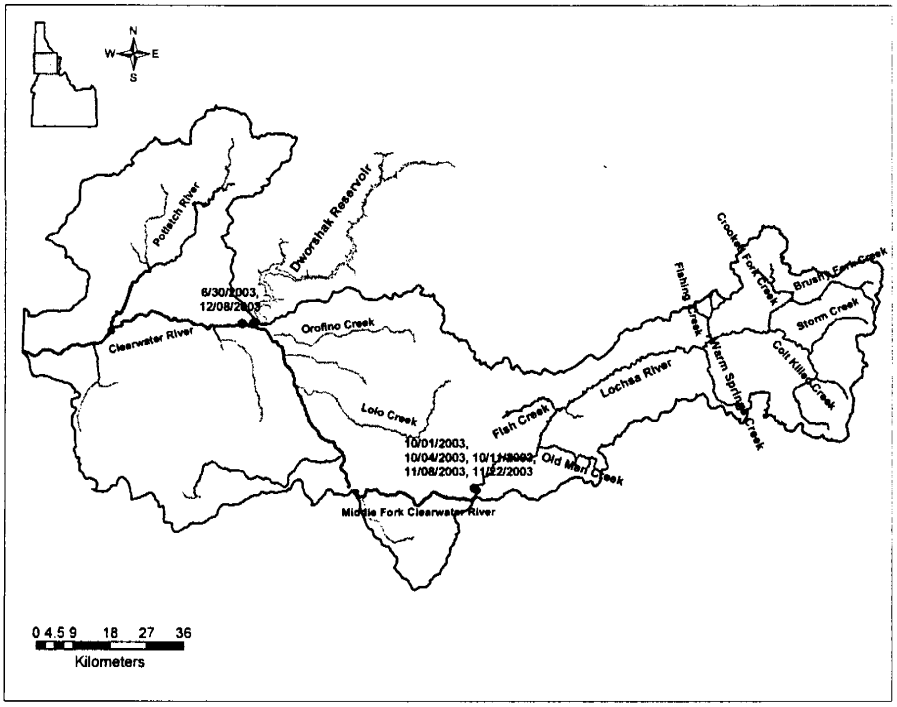

Figure 14. Migration distribution and relevant dates for fish 148.48.001 in the Clearwater, Lochsa, and Middle Fork Clearwater rivers, 2003.

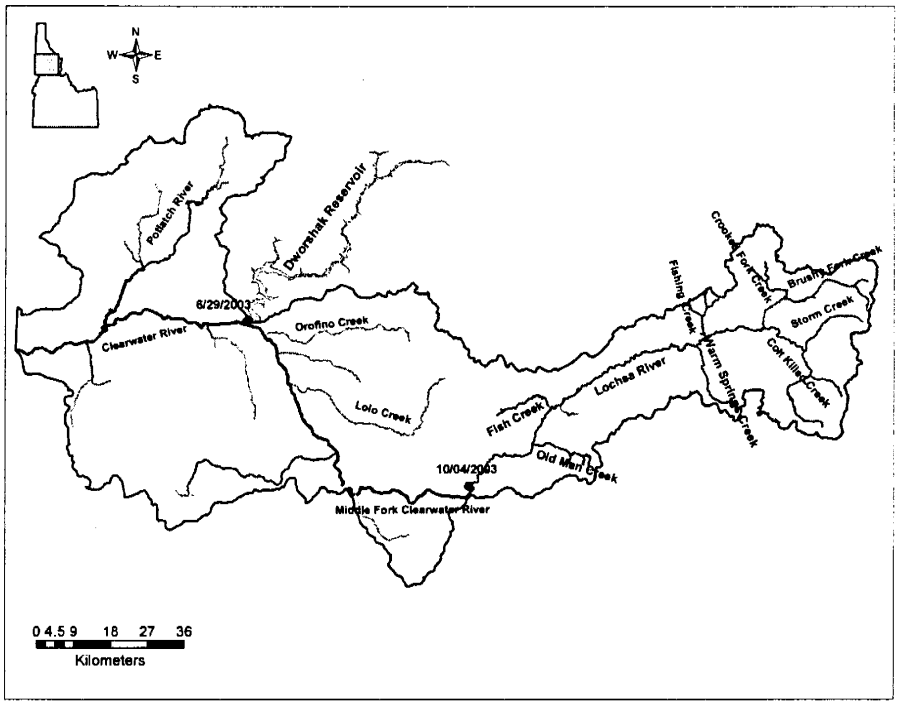

Figure 15. Migration distribution and relevant dates for fish 148.48.002 in the Clearwater, Lochsa, and Middle Fork Clearwater rivers, 2003.

Table 4. Density estimates for all salmonid species in Old Man and Chimney creeks, 2003.

Stream	Transect	Area (m^2)	Rainbow Trout < 305 mm /100m^2	Cutthroat Trout < 305 mm /100m^2	Brook Trout < 305 mm /100m^2	Chinook Zero /100m^2
Old Man Creek	2.7	1206.3	10.69	0.08		
Old Man Creek	3.0	1261.7	9.51	0.63		
Old Man Creek	4.7	1208.5	11.01	0.83		
Old Man Creek	5.2	880.6	15.67	1.02	0.11	
Old Man Creek	6.0	1727.9	6.54	0.46	0.06	
Old Man Creek	7.1	1302.6	8.21	1.77	0.31	0.08
Old Man Creek	8.2	1126.7	7.10	2.40		
Old Man Creek	9.4	1144.7	9.78	0.96	1.22	
Old Man Creek	10.3	1400.3	5.71	1.21	0.29	
Chimney Creek	0.5	820.0	0.98	0.12	2.93	
Chimney Creek	1.5	624.8			3.20	
Chimney Creek	2.0	817.7			2.57	
Chimney Creek	3.3	302.4			4.96	

Table 5. Population estimate for all salmonid species in Old Man Creek, 2003.

OLD MAN CREEK

Stream KM	Rainbow Trout Average Density (/100m²)	Rainbow Trout Estimated Fish/KM	Cutthroat Trout Average Density (/100m²)	Cutthroat Trout Estimated Fish/KM	Brook Trout Average Density (/100m²)	Brook Trout Estimated Fish/KM	Chinook Salmon Average Density (/100m²)	Chinook Salmon Estimated Fish/KM
1	6.14	373	1.02	62	0.00	0	1.02	62
2	10.69	1,173	0.08	9	0.00	0	0.00	0
3	9.51	1,157	0.63	77	0.00	0	0.00	0
4	11.01	1,258	0.83	95	0.00	0	0.00	0
5	15.67	1,353	1.02	88	0.11	10	0.00	0
6	6.54	1,018	0.46	72	0.06	9	0.00	0
7	8.21	1,054	1.77	227	0.31	39	0.08	10
8	7.10	769	2.40	260	0.00	0	0.00	0
9	9.78	1,004	0.96	99	1.22	126	0.00	0
10	5.71	796	1.21	169	0.29	40	0.00	0
Population Estimate		9,956		1157		224		72
	+/-	198	**+/-**	55	**+/-**	27	**+/-**	14
95% C.I.		9757-10154		1103-1212		196-251		58-86
		0.8726541		0.1014402		0.0195978		0.0063079

CHIMNEY CREEK

Stream KM	Rainbow Trout Average Density (/100m²)	Rainbow Trout Estimated Fish/KM	Cutthroat Trout Average Density (/100m²)	Cutthroat Trout Estimated Fish/KM	Brook Trout Average Density (/100m²	Brook Trout Estimated Fish/KM	Chinook Salmon Average Density (/100m²	Chinook Salmon Estimated Fish/KM
1	0.96	80	0.12	10	2.88	240	0.00	0
2	0	0	0	0	3.20	174	0	0
3	0	0	0	0	2.57	191	0	0
4	0	0	0	0	4.96	139	0	0
Population Estimate		81		10		744		0
	+/-	64	**+/-**	8	**+/-**	67	**+/-**	0
95% C.I.		16-144		2-18		677-811		0

Eight rainbow trout were observed in transect 0.5 of Chimney Creek, a mean density of 0.98 fish/100m^2 (Table 3). The rainbow trout population estimate for Chimney Creek was 81 fish(+/- 64, 95%CI) (Table 5). Additionally in transect 0.5 one cutthroat trout was observed with a mean density of 0.12 fish/100m^2 (Table 4). The cutthroat trout population estimate for Chimney Creek was 10 fish (+/-8, 95% CI) (Table 5). No rainbow and cutthroat trout were observed over 305 mm (Table 4). Brook trout were observed in all of the Chimney Creek transects with a total of 80 fish observed and a mean density of 3.41 fish/100m^2 (2.57 – 4.96 fish/100m^2) (Table 4). Transect 3.3 had the highest brook trout density. The brook trout population estimate for Chimney Creek was 744 fish (+/-67, 95% CI) (Table 5). No brook trout were observed over 305 mm (Table 4).

DISCUSSION

Migration

Many of the tracking flights from the middle of July to the end of August were either canceled or postponed due to wild fires that were actively burning during this period. In some cases mobile car tracking was substituted for the canceled flights, but car tracking is limited primarily to the mainstem Lochsa River. Maximum migration distances, migration timing, and date fish entered a spawning tributary may be biased due to timing of the tracking flights.

Fish 149.58.206 had a migration that was unique for bull trout tagged in the Lochsa. Sixteen of the 20 bull trout in the Lochsa moved into known spawning tributaries. However, 149.58.206 moved downstream into the lower CWR (rkm 6.7) and NFBD (rkm 64.8), an area of river where no known spawning occurs. One possible reason for this fish having an unusual migration could be that it was previously entrained through Dworshak Dam, and was attempting to return to its natal stream. Other studies (Schiff and Schriever 2004) confirmed that bull trout are entrained through Dworshak Dam. Another possibility is that this fish was an alternate year spawner that was returning to the lower reaches of the CWR for forage. Maturity and sex determination on this individual was inconclusive.

Six of the eight bull trout tagged in the NFBD remained in the area around the NF/CWR confluence. Three of these fish were mature individuals and were detected at spawning time in an area with no known spawning habitat. The remaining two fish 148.48.001 and 148.48.002 were not detected between their tagging dates 29 & 30 June 2003 and 1 & 4 October 2003. The location of these fish during this three-month period is not known. Possible reasons for not detecting these fish include the interruption of fall tracking due to wildfires creating gaps in our tracking. On some weeks, aerial tracking between Orofino rkm 71.3 to Kooskia rkm 119.5, was not completed and car tracking was not as efficient at detecting transmitters. Another possibility is that the fish migrated out of our tracking area. Our tracking was limited to the CWR, NF, MF, and Lochsa (including major tributaries). If the two bull trout moved into the Selway river, or any minor tributary of the MF or Lochsa rivers, they would have been outside our detection area. Regardless of the lack of upstream migration data, the time period 148.48.001,002 were detected moving past the Lochsa fixed site is consistent with the downstream migration timing of other fish that were tagged in the Lochsa. Fish 148.48.001 was a mature female and 148.48.002 was a mature male, therefore should be seeking spawning areas. These fish have three likely origins. The first possible origin is the NF. These fish would have been entrained through Dworshak Dam and were searching for suitable spawning habitat. The second possible origin is the Lochsa River. These fish may have spawned in the Lochsa and were simply not

detected upstream of the Lochsa fixed site. The migration of fish 149.58.206 shows that fish from the Lochsa do migrate to the lower CWR. The third possible origin is the Selway River. Little is known about the Selway River bull trout population or their migration patterns. Either way, the unusual migration of these individuals and the presence of mature fish below Dworshak Dam warrant continued investigation to determine their origins and potential detriment to the NF population.

Spawning Mortality

Lochsa post-spawning survival estimates of 69% were similar to estimates from the NF in 2002 and 2003 (76% and 82%) (Schiff and Schriever 2004, Schiff et al. 2005). This survival is different than NF estimates in 2000 and 2001 (40% and 31%) and Rapid River estimates (31%) (Cochnauer and Schiff 2001, Schiff and Schriever 2003, Schill et al. 1994). Trend data from the NF suggests that post-spawning survival may be highly variable by year, and multiple years of data are required before any conclusions may be drawn.

Old Man Creek

We did not document the presence of bull trout or a local bull trout population in Old Man Creek Drainage below the barrier at stream km 10.3. Additionally, a previous survey completed in 1997 did not document the presence of bull trout in any of its 30 transects in the Old Man Creek Drainage (Clearwater Biostudies Inc. 1997).

Clearwater Biostudies (1997) documented brook trout distributed from kilometer 5.5 to 23.6. The survey found brook trout were the only fish species present upstream of an immense bedrock waterfall (kilometer 10.6) immediately upstream of Chimney Creek (Clearwater Biostudies Inc. 1997). Historical salmonid distribution was likely limited to downstream of this barrier.

The average density of brook trout in the five sites upstream of the barrier was 12.36 fish/100m^2. In the 13 sites downstream of the barrier, the average brook trout density was 0.21 fish/100m^2 (Clearwater Biostudies Inc. 1997). Additionally they documented brook trout distributed from kilometer 5.5 to 23.6 (Clearwater Biostudies Inc. 1997). During this survey, we snorkeled 10 sites downstream of the barrier and observed brook trout distributed from kilometer 5.2 to 10.3. Additionally, we documented a similar average brook trout density of 0.19 fish/100m^2.

Chimney Creek is the largest tributary to Old Man Creek downstream of the barrier. Brook trout were distributed from mouth to kilometer 3.3. Rainbow and cutthroat trout distribution was limited to the first kilometer up from the mouth. Brook trout densities from four sites in Chimney Creek averaged 3.41 fish/100m^2. Brook trout represent 89 percent of the fish community in Chimney Creek.

Brook trout represent a threat to native salmonids though competition and a hybridization risk to char, specifically bull trout. In Old Man Creek, native salmonids did not access areas upstream of the barrier where the highest densities of brook trout were detected. Therefore, the high numbers of brook trout in this area do not pose a direct risk to native salmonids. However, this area is a source population that continually seeds Old Man Creek

below the barrier. Below the barrier in Old Man Creek brook trout represent 1.9 percent of the total fish community. This small occurrence of brook trout represents a minor risk to native fish through competition. Brook trout presence in Old Man Creek below the barrier would present a limited risk to bull trout through hybridization; if bull trout were present.

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