

**FLUVIAL BULL TROUT *SALVELINUS CONFLUENTUS* MIGRATORY
DYNAMICS AND LIFE HISTORY IN THE LEMHI RIVER SUB-BASIN, IDAHO**

**Final Report
2006**



By

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ABSTRACT

Fluvial bull trout *Salvelinus confluentus* distribution in the Lemhi River sub-basin has been affected by habitat fragmentation caused by irrigation withdrawals. Nearly all tributaries to the Lemhi River are disconnected during the irrigation season resulting in limited access to spawning habitat. To determine current fluvial bull trout distribution, migration patterns, and habitat use, we surgically implanted radio transmitters in 32 adult fish (mean TL 493 mm, range 352-696 mm) in the main-stem Lemhi River between April 14 and July 6, 2006. Tagged bull trout were monitored weekly from April 25 to November 1, 2006 via ground tracking and three fixed telemetry stations. Bull trout migrated upstream from the Lemhi River in the spring/summer exclusively into Hayden Creek, the largest remaining perennially connected tributary in the Lemhi River sub-basin. Bull trout entering Hayden Creek did so by July 20 (50% entrance by June 22). We documented a mean upstream migration distance of 39.0 km (range 6.5- 58.9 km) from main-stem tagging locations. All tagged bull trout returned to the Lemhi River by September 25 after the cessation of spawning activity in Hayden Creek. We observed a spawning mortality and/or spawning tag expulsion frequency of 7.4%. Redd surveys were conducted in six streams in the Hayden Creek watershed documenting 306 redds of which 52.3% were assumed to be fluvial bull trout redds based on the observed relationship between total length of spawning adults and redd size. These results suggest Hayden Creek supports the only fluvial population of bull trout in the Lemhi River sub-basin. As part of the ongoing Lemhi Conservation Program, measures are being implemented to reconnect tributary streams with the Lemhi River. Future monitoring efforts will evaluate whether fluvial bull trout expand their current distribution and utilize these newly connected tributary habitats.

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INTRODUCTION

Resident and fluvial life forms of bull trout *Salvelinus confluentus* inhabit the Lemhi River sub-basin, which has been designated as a Core Area within the larger Salmon River Recovery Unit (USFWS 2002). Current distribution of this species in the Lemhi River sub-basin is generally restricted to isolated resident populations in tributary headwaters where individuals obtain sizes no greater than 300 mm (P. Murphy, IDFG personal communication), however, larger bull trout have been documented in the watershed. Schoby (2006) observed fluvial bull trout wintering in the main-stem Lemhi River and spawning in the Hayden Creek watershed. Large bull trout have also been observed in Big Timber Creek (Murphy and Horsmon 2004), although the life histories of these populations are unclear.

Bull trout distribution and abundance in the Lemhi River sub-basin has been affected by irrigation withdrawals from tributary streams for ranching and farming practices. Water withdrawals dewater sections of tributaries during certain periods of the irrigation season, and irrigation ditch structures can create barriers to migrating fish. Currently, only two of 31 tributaries in the Lemhi sub-basin are functionally connected with the main-stem Lemhi River (IDEQ 1998). Most of the irrigation diversions on tributaries are not screened to prevent fish from being entrained into ditches. Bull trout entrainment has been documented in Hayden and Mill creeks (Resseguie 2004; Warren and Bliss 2005). Furthermore, flow that is diverted from tributaries affects the natural hydrograph of the system, decreases main-stem flow, and elevates stream temperatures in summer. Reduction and alterations in the timing of Lemhi River discharge reduces sediment transport, riparian habitat, and instream habitat complexity (e.g. loss of undercut banks) in both the main-stem Lemhi River and tributaries (IDEQ 1998). The combined effects of tributary water withdrawals, increased water temperatures, and decreased discharge has fragmented and isolated important spawning and rearing habitat from migratory bull trout and other salmonids in the Lemhi River sub-basin.

The developing Lemhi Conservation Program (Lemhi CP) prescribes conservation measures that will increase the quantity and improve the quality of habitat for salmonids in the Lemhi River sub-basin. The Lemhi CP places emphasis on reconnecting 10 tributary streams with the Lemhi River. Reconnecting these tributaries will provide access to currently unavailable, high quality spawning and rearing habitat for anadromous and resident/fluvial fish listed under the Endangered Species Act (ESA). Four tributary reconnects will be initiated in the first 5 years of the plan to provide immediate benefits to bull trout, Snake River spring/summer Chinook salmon *Oncorhynchus tshawytscha*, and Snake River summer steelhead *O. mykiss*. Pursuant to Section 6 of the ESA, effectiveness monitoring activities must be conducted and annual reports on these activities must be submitted to the National Marine Fisheries and U.S. Fish and Wildlife Services (referred to as the Services) so that the Services can determine whether the activities implemented under the Lemhi Conservation Plan meet Section 6 ESA standards.

Re-establishing connection between tributary streams and the Lemhi River is expected to provide several benefits for bull trout. First, adults and juveniles will have access to currently unavailable but historically important spawning and rearing habitat. Second, re-established migratory corridors will allow the fluvial form to act as a conduit for gene flow among existing resident populations. Third, increased flow to the Lemhi River, including high water events during spring runoff, will improve the quality of existing habitat for bull trout by mobilizing bed load, removing fine sediments, and improving base flow throughout the irrigation season.

Finally, reconnected tributary streams will moderate water temperatures in the Lemhi River during summer months while providing thermal refuge when necessary.

The goal of this study was to determine spatial and temporal distribution of bull trout in the Lemhi sub-basin. Information regarding their current status is lacking. Data collected during this study will be used as a baseline to determine the effectiveness of ongoing conservation actions designed to reconnect tributary habitats. Future monitoring efforts will be used for adaptive management purposes as necessary, and will prioritize future tributary reconnection efforts.

STUDY AREA

The Lemhi River is a relatively low-gradient largely spring-fed system located in east-central Idaho with a drainage basin encompassing approximately 3290 km² (Figure 1). The Lemhi River (fourth-order stream) flows in a northwesterly direction for 90 km from its source at the confluence of Eighteenmile and Texas creeks at Leadore, Idaho to the Salmon River near the city of Salmon, Idaho. To the north and east, the broad Lemhi River Valley is bounded by the Beaverhead Mountains that form the Continental Divide and to the south and west by the Lemhi Mountain Range. Approximately 1,028 km (71.2%) of the total 1,443 stream kilometers in the sub-basin flow through public land.

The Lemhi River is augmented downstream from its source by flow from numerous springs and several major tributaries including Big Eightmile, Little Eightmile, Hayden, Agency, and Kenney creeks. The largest of these tributaries is Hayden Creek, entering at river kilometer (rkm) 49.0 of the Lemhi River (measuring from its confluence with the Salmon River). The Hayden Creek watershed encompasses 392.67 km² and is the single largest streamflow contributor to the Lemhi River with a mean daily discharge of 88 cfs in 2006 (R. Seger, Water District 74 Watermaster personal communication). This watershed provides substantial spawning and rearing habitat for three fish species listed as threatened under the ESA: bull trout, Snake River spring/summer Chinook salmon, and Snake River summer steelhead trout.

OBJECTIVES

1. Obtain life history information on adult fluvial bull trout occurring in the Lemhi River sub-basin.
2. Determine migration patterns and tributary use of adult fluvial bull trout in the Lemhi River sub-basin.

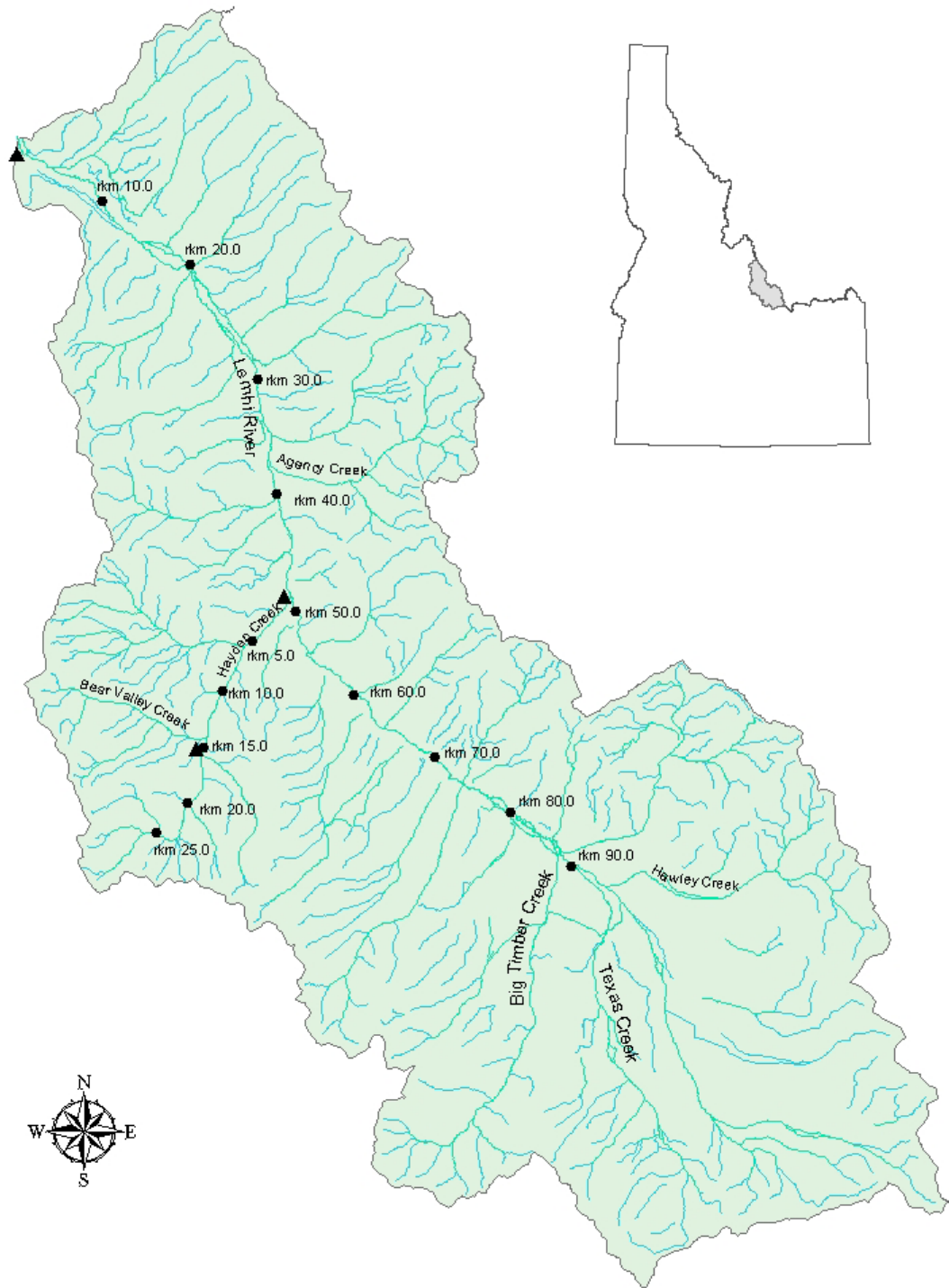


Figure 1. The Lemhi River sub-basin, Idaho. Locations of fixed telemetry sites to monitor radio-tagged bull trout movements in 2006 are marked with black triangles.

METHODS

Capture and Tagging

Radio transmitters were surgically implanted into the abdominal cavity of bull trout to determine migration patterns throughout the study area. Sampling and tagging were conducted in the Lemhi River from April 14 to August 1, 2006 between rkm 5.0 and rkm 89.0. Each fish was captured via angling, anesthetized in a 70-mg/L solution of tricaine methanesulphate (Finquel MS-222), measured for total length (mm), fork length (mm), and total weight (g). A small (<1 cm²) piece of tissue was clipped from the upper lobe of the caudal fin from some fish and preserved in 95% denatured ethyl alcohol for genetic analysis. To maintain anesthesia and implant radio transmitters, anesthetized fish were placed in a V-shaped operating tray and their gills irrigated with a solution of MS-222 using a battery operated pump. Once under anesthesia, radio transmitters were implanted using a surgical procedure similar to that described by Ross and Kleiner (1982). A 10% solution of povidone iodine was applied to the incision and exit hole just prior to recovery to prevent infection. Surgery time (from incision to placement into freshwater recovery) typically took 4-5 minutes. As a second means of identification, Passive Integrated Transponder (PIT) tags were inserted into the opercula muscle of most fish using a 12-gauge hypodermic needle. Initial recovery took place in a 49-liter cooler filled with fresh river water. Once equilibrium was realized (typically 10-15 minutes), fish were transferred to a tube livewell (25 cm diameter and 70 cm in length PVC pipe with 2.5 cm diameter water exchange holes) and placed in the river for a minimum of 30 minutes or until the fish completely recovered. After recovery, fish were released within 250 m of their capture location. Stream water temperature, time anesthetized, surgery start and end times, bleeding resulting from the incision or antenna exit hole, and release time were recorded for each fish. Additionally, overall body condition and scarring was documented.

Model MCFT-3EM coded microprocessor transmitters manufactured by Lotek Wireless (New Market, Ontario) were implanted in bull trout captured that met the project tagging weight criteria. MCFT-3EM transmitters are 11 mm in diameter, 49 mm long and weigh 8.9 g (in air). Winter (1996) suggests not exceeding a 2% transmitter to body weight ratio (in air). To conform to this accepted guideline, bull trout had to weigh at least 445 g to be considered for radio transmitter implantation. Radio transmitters were not implanted in fish weighing less than the target weight, however, these individuals were marked with PIT tags inserted into the body cavity or left opercula muscle. The transmitters operated at factory preset frequency of 151.340 MHz and emitted digitally encoded signals every 5 seconds. Codes 128 through 158 and code 161 were used for this study. The minimum battery life for these transmitters is 399 days.

Radio-Tracking

Lotek model SRX_400 radio telemetry receivers were used to relocate radio-tagged fish on a weekly basis. Fish were tracked by vehicle and by foot between April 25 and November 1, 2006. Generally, fish were relocated to within 0.25 km of their location, the location was documented utilizing a hand held Global Positioning System (GPS) unit, and comments made relating to their location were recorded on datasheets. Tracking by vehicle was completed using a truck-mounted three-element Yagi antenna while a collapsible three-element antenna was employed when tracking on foot. For the greater part of the seasonal migration, bull trout could be relocated from the road. When radio-tagged fish remained in unlikely holding locations or showed a lack of movement for extended periods, tracking on foot was used to determine if fish were alive and/or to recover transmitters. When this situation arose, the tag in question was

tracked to the exact location to verify the status of the fish. This method was also used to relocate individual fish on their spawning grounds.

Three fixed site radio telemetry stations were used to record bull trout movements in addition to ground tracking. Fixed stations were set up at the mouths of the Lemhi River and Hayden Creek, and on Hayden Creek 0.8 km above the Bear Valley Creek confluence with Hayden Creek (Figure 1). Data logging telemetry fixed stations consisted of a Lotek model SRX_400 radio telemetry receiver, two 50-watt solar panels connected in series, two 12-volt deep cycle batteries, an ASC photovoltaic battery charge regulator, and either two or three 3-element Yagi antennas. Receivers, batteries, and battery charge regulators were contained in a locked steel box. Three antennas were used at the Lemhi Mouth and Hayden Creek Mouth stations while only two antennas were set up at the Hayden Creek location above Bear Valley Creek. The antennas of each fixed site station were positioned to allow for the detection of directional movement of bull trout. Data from fixed site locations were downloaded as needed to augment mobile ground tracking methods.

Redd Counts

Redd counts were conducted on main-stem Hayden, Bear Valley, Wright, East Fork Hayden, West Fork Hayden, and Bray creeks, all within the Hayden Creek watershed, between August 22 and October 5, 2006. These streams were surveyed because radio-tagged bull trout were detected at these locations with the exception of East Fork Hayden Creek which was surveyed as part of an annual trend redd count. While conducting surveys the number of fish present and the approximate length of bull trout observed were recorded. Most redds were delineated between resident and fluvial life history forms based on redd size and total length of bull trout associated with redds. Bull trout greater than 350 mm total length and redds exceeding 0.6 m in length and 0.4 m in width were considered fluvial (parameters derived from 2006 field observations). Streams were generally surveyed between 1000 and 1700 hours.

RESULTS

Capture and Tagging

Angling for bull trout in the Lemhi River occurred on 24 days from April 14 to August 1, 2006. During this time period 177.5 fishing hours yielded 44 captured bull trout (catch per unit effort (CPUE) = 0.25 bull trout/hour). No bull trout were captured after July 6. Bull trout were almost exclusively caught below Hayden Creek where 43 bull trout were captured after 106.5 fishing hours (CPUE = 0.40 bull trout/hour) compared to only one bull trout captured after 71.0 hours of effort (CPUE = 0.01 bull trout/hour) above Hayden Creek. Thirty-two of the 44 bull trout exceeded the minimum target weight (445 g) to be considered for radio tag implantation. Radio transmitters were surgically implanted in these fish. Of these 32 bull trout, 27 (84.4%) were radio-tagged from April 14 to May 11. All radio-tagged bull trout were captured in the Lemhi River below Hayden Creek (Figure 2). PIT tags were placed in 24 of the radio-tagged bull trout and caudal fin clips were taken from seven fish for future genetic analysis. Radio-tagged bull trout averaged 493 mm in total length (range 352 to 696 mm) and averaged 1326 g (range 480 to 3,542 g) in total weight (Figures 3, 4; Table 1). Actual weights for two radio-tagged bull trout were not obtained because their weights exceeded the upper limit (2,500 g) of the scale used in the field. Weights for these bull trout were calculated using the log length–weight regression equation (Figure 5) created from 30 radio-tagged bull trout from which both weights and total lengths were collected. The calculated weights are included in the average weight and weight range for all radio-tagged bull trout. In addition, 4 of the 12 bull trout that did not receive radio transmitters were PIT-tagged. Bull trout that only received PIT tags averaged 307 mm (range 250 to 356 mm) in total length and 271.3 g (range 100 to 420 g) in weight. No data was collected from the remaining eight bull trout that did not receive a radio tag. Individual lengths and weights for all radio-tagged bull trout can be found in Appendix A.

Radio-Tracking

In addition to the 32 bull trout radio-tagged in 2006, one bull trout radio-tagged on October 30, 2004 (code 120) in the Lemhi River was monitored through July 4, 2006, the last relocation date before the radio transmitter battery presumably expired. Movement data obtained from code 120 is used in migration timing analysis but not for total migration distance or post-spawn survival analysis because the transmitter became inoperable before these data could be collected.

Radio-tagged bull trout were monitored from April 25 through November 1, 2006 resulting in 708 total relocations averaging 21.5 relocations per bull trout (range 10 to 29 relocations). The vast majority of relocations were obtained by vehicle or fixed site stations. Foot tracking occurred on 10 days between August 17 and September 13 when bull trout were on their spawning grounds accounting for 60 of the 708 relocations. A complete list of relocations for all radio-tagged bull trout can be found in Appendix B.

Pre-Spawn Mortalities/Tag Expulsions

During the pre-spawn migration period five radio-tagged bull trout died or expelled their tags. Movement timing was only retained for one of these fish (code 141) as it entered Hayden Creek before the transmitter was recovered. The movements of these 5 fish are summarized in Appendix C.

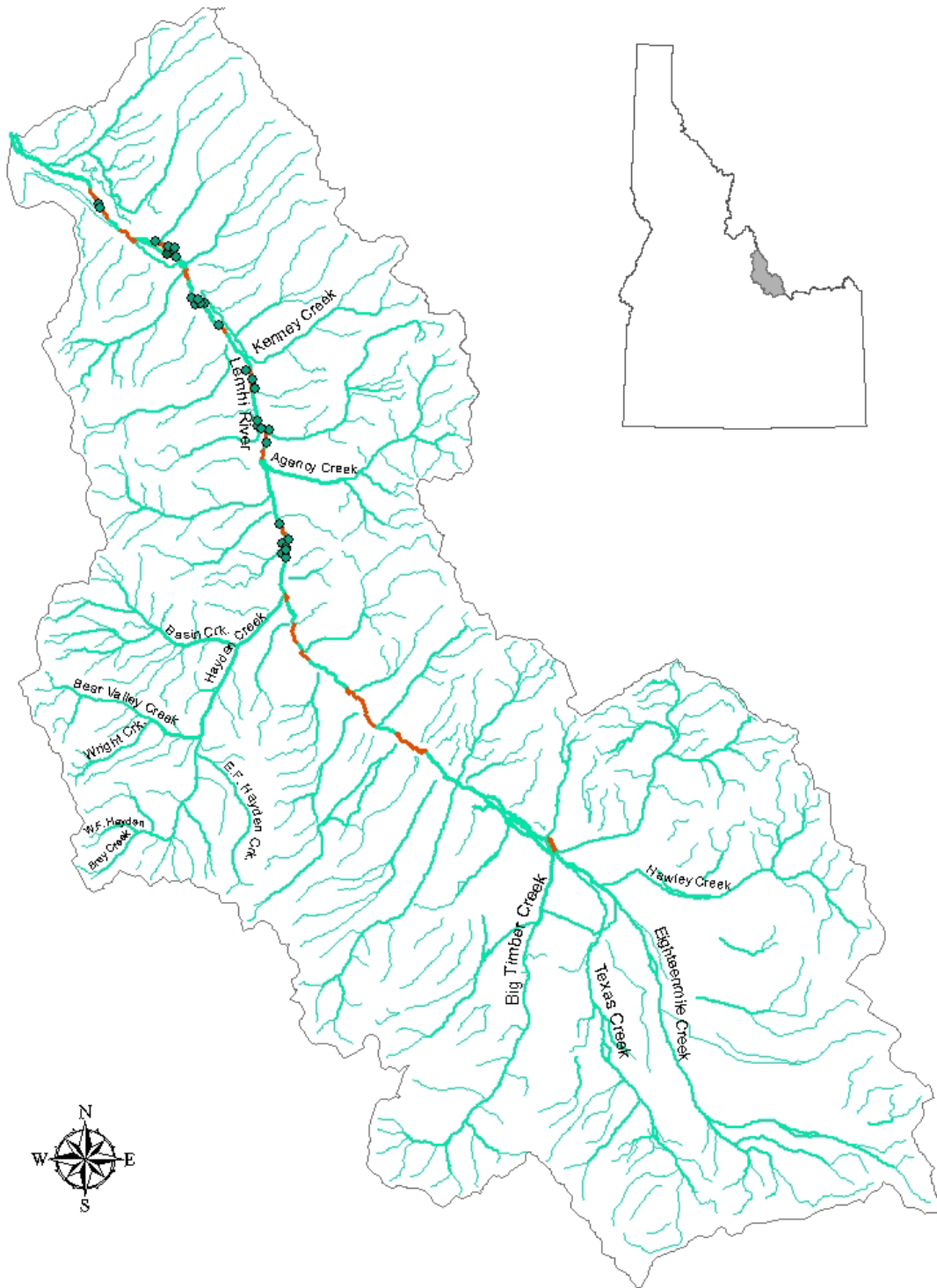


Figure 2. Capture and tagging locations of radio-tagged bull trout in the Lemhi River, Idaho 2006. Angled reaches of the Lemhi River are shown in bold.

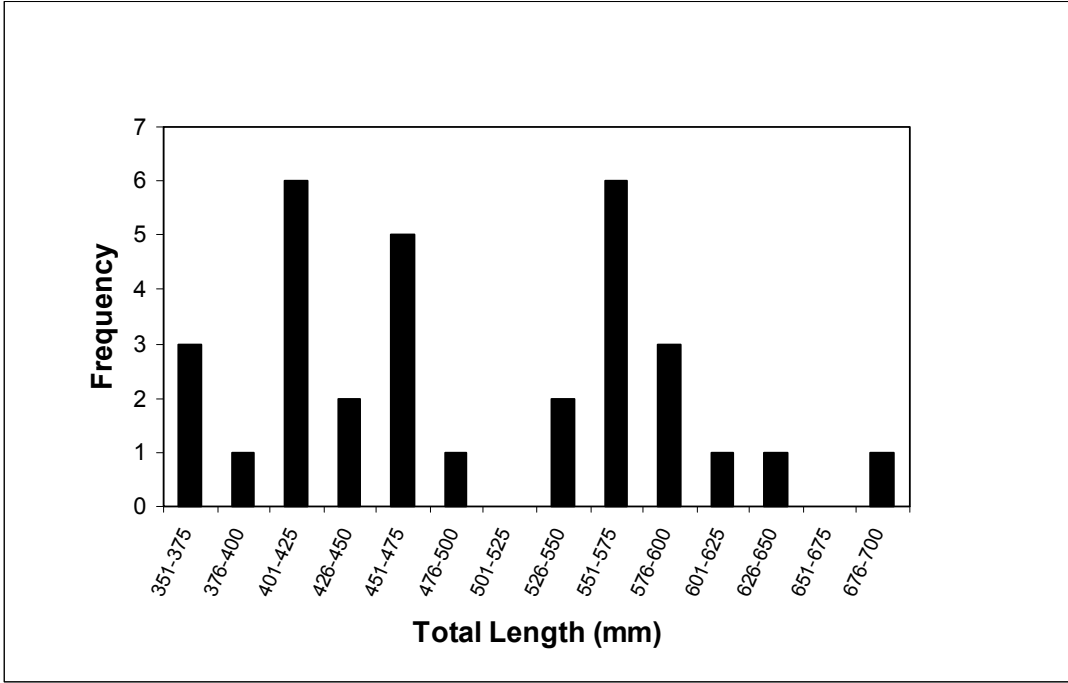


Figure 3. Radio-tagged bull trout length frequency (n = 32), Lemhi River, Idaho, 2006.

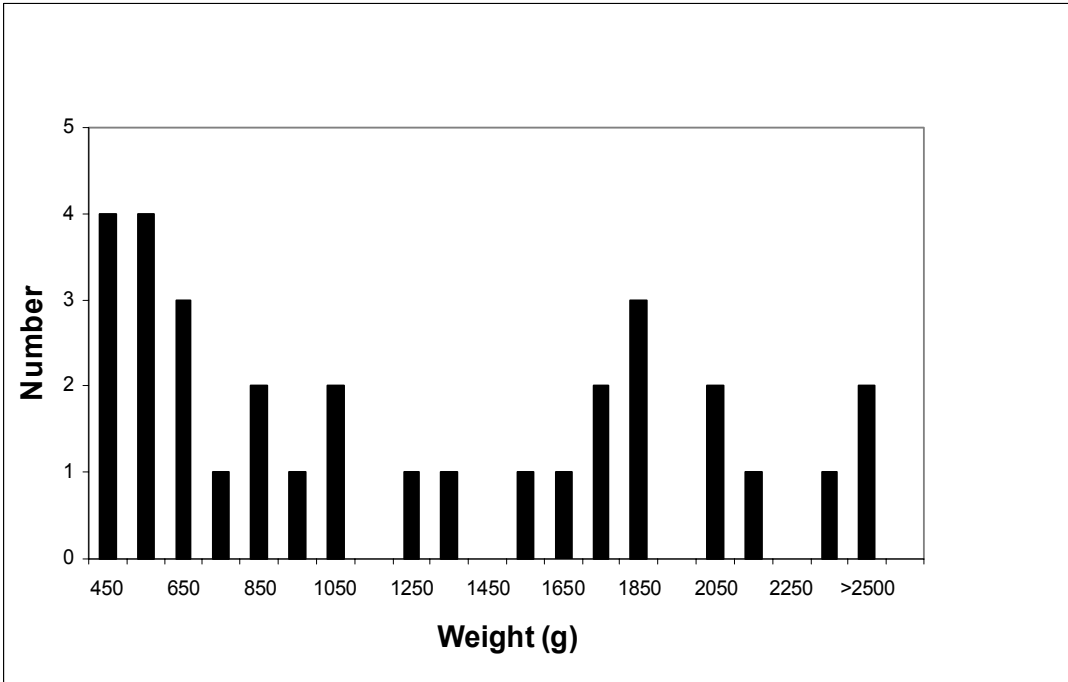


Figure 4. Radio-tagged bull trout weight distribution (n = 32), Lemhi River, Idaho, 2006.

Table 1. Summary statistics for bull trout radio-tagged in the Lemhi River, Idaho, 2006.

	Total Length (mm)	Total Weight (g)
Mean	493.3	1325.9
Median	473.0	1100.0
Mode	473.0	700.0
Standard Deviation	89.2	762.4
Sample Variance	7953.6	581320.5
Minimum	352.0	480.0
Maximum	696.0	3542.0
Sample Size	32	32

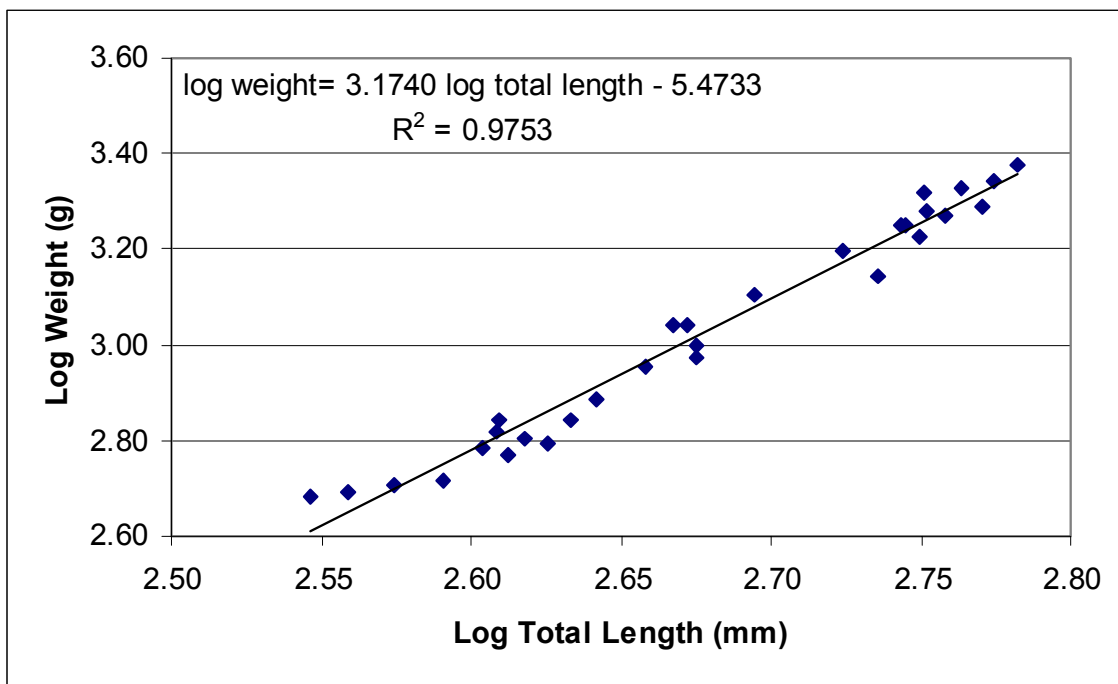


Figure 5. Radio-tagged bull trout log length-weight regression (n = 30), Lemhi River, Idaho, 2006.

Pre-Spawn Migration Period

Bull trout migrated upstream from tagging locations in the Lemhi River exclusively to spawning grounds in the Hayden Creek watershed between May 2 and August 17. Mean migration distance from main-stem tagging location to their uppermost relocation was 39.0 km (n = 27; range 6.5 – 58.9 km; Table 3). The greatest mean monthly movements during the pre-spawn migration period occurred in June (18.8 km, n = 27) (Figure 6; Table 2).

To determine upstream migration start date, all relocations for each radio-tagged bull trout were analyzed and the first date in which continuous upstream movement began was applied. Bull trout commenced upstream movement from release sites across a wide temporal range from May 2 to July 26 with 11 bull trout beginning movement in May, 14 in June, and 4 in July (Table 4). After tag implantation, 75.6% (22 of 29) of bull trout remained near their release sites for an average of 31.5 days (range 4 – 65 days; Table 4). The remaining seven bull trout (Codes 128, 129, 135, 149, 153, 155, and 156) were relocated in different areas than the release site following the first tracking event after tag implantation with 6 moving upstream and 1 moving downstream. Five of the six fish observed upstream from the tagging location following the first relocation most likely were collected after their upstream migration already commenced and therefore their first movement dates are considered a minimum. Code 129 was the only fish to move downstream following the first relocation after tagging. This fish began continuous upstream movement on May 18.

Twenty-eight bull trout migrated into Hayden Creek during the pre-spawn migration. Entrance into Hayden Creek occurred between June 1 and July 20 corresponding with the descending slope of the Lemhi River hydrograph (Figure 7). Fifty percent of radio-tagged bull trout entered Hayden Creek by June 22. Four bull trout (codes 131, 135, 141, and 142) migrated into Hayden Creek prior to establishing the data logging fixed station at the mouth of Hayden Creek on June 7, therefore their entrance dates were estimated based on relocations obtained just prior to and just after the establishment of the fixed station. Data collected from the radio telemetry fixed site at the mouth of Hayden Creek indicated 23 of 24 radio-tagged bull trout entered the drainage between 2110 and 0639 hrs, with the vast majority (81.8%) entering between 2110 and 0310 hrs (Figure 8).

Twenty-seven bull trout survived through August and the extent of their upstream migrations were concentrated in the upper portion of the Hayden Creek watershed and the Bear Valley Creek drainage (Figure 9). Fourteen of the 27 radio-tagged bull trout (51.9%) were detected in the Hayden Creek watershed above East Fork Hayden Creek with 7 residing in Hayden Creek (25.9%), 3 in West Fork Hayden Creek (11.1%), and 3 in Bray Creek (11.1%). Eleven fish (40.7%) occupied the Bear Valley Creek drainage at their uppermost relocations with 7 (25.9%) residing in Bear Valley Creek and 4 (14.8%) in Wright Creek. The remaining two bull trout did not occupy either of these two areas. One bull trout (code 137) occupied habitat 2.7 km from the mouth of Hayden creek when it was detected at its uppermost location. Another bull trout (code 161) was identified at its uppermost location in the Lemhi River 1.7 km below the mouth of Hayden Creek.

Fourteen of the 27 radio-tagged bull trout that survived to spawning were tracked frequently enough to determine the date at which they reached the extent of their migrations. These bull trout arrived within 3.5 km of their uppermost relocations between June 30 and August 17 with the majority (85.7%) arriving at their uppermost locations by July 31 (Table 4).

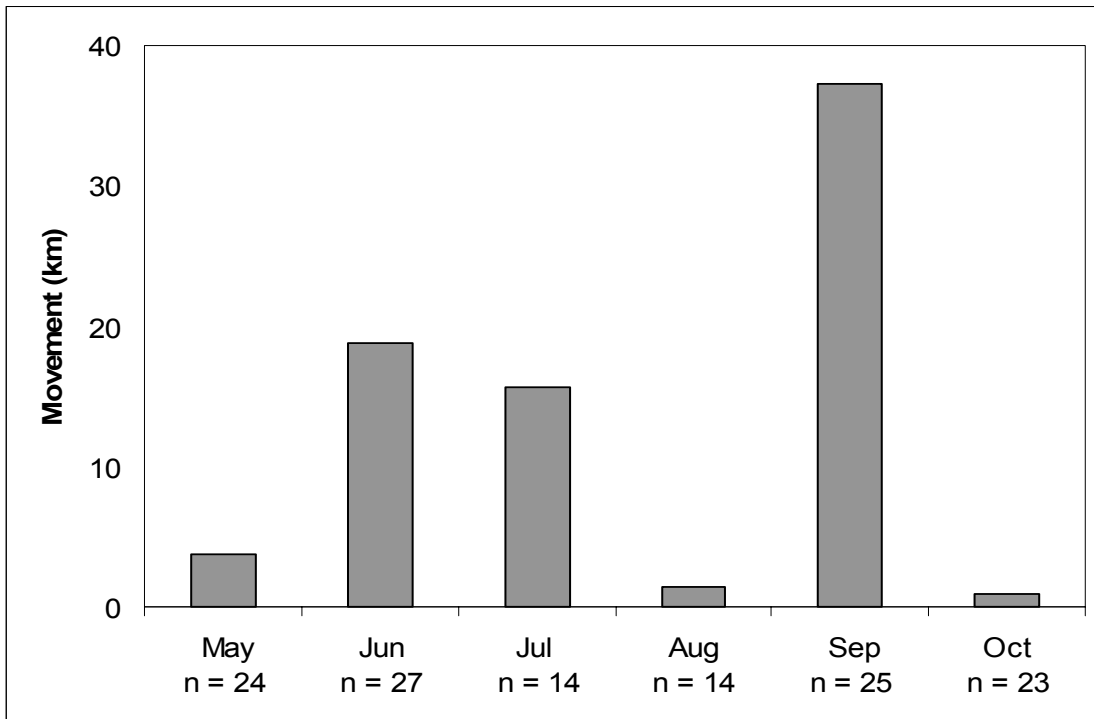


Figure 6. Mean monthly movement rates of radio-tagged bull trout in the Lemhi River sub-basin, Idaho, 2006.

Table 2. Mean monthly movement rates of radio-tagged bull trout in the Lemhi River sub-basin, Idaho, 2006.

	Month					
	May	Jun	Jul	Aug	Sep	Oct
Mean (km)	3.8	18.8	15.6	1.4	37.3	0.9
Range (km)	0.0-14.5	0.1-39.7	1.9-37.6	0.2-5.7	13.2-57.2	0.0-12.4
n	24	27	14	14	25	23

Table 3. Transmitter frequency and code, date tagged, uppermost location, tagging location (rkm), furthest upstream (rkm), migration distance from tagging location (km), and furthest upstream detection date for bull trout radio-tagged in the Lemhi River, Idaho, 2006.

Frequency Code	Tagging Date	Uppermost Location	Tagging Location	Furthest Upstream Detection (rkm)	Migration Distance From Tagging Location (km)	Furthest Upstream Detection Date
151.34.137	04/28/06	Hayden Creek	45.1	51.6	6.5	07/31/06
151.34.161	07/06/06	Lemhi River	34.3	47.1	12.8	08/28/06
151.34.142	05/01/06	Wright Creek	45.2	68.3	23.1	08/30/06
151.34.158	06/01/06	Hayden Creek	42.6	67.5	24.9	09/06/06
151.34.156	06/01/06	Bear Valley Creek	42.6	68.6	26.0	08/30/06
151.34.138	04/28/06	Hayden Creek	45.1	72.3	27.2	08/22/06
151.34.140	04/29/06	Hayden Creek	45.2	73.4	28.2	09/06/06
151.34.139	04/29/06	West Fork Hayden	45.1	74.1	29.0	08/22/06
151.34.155	06/01/06	Hayden Creek	42.6	73.0	30.4	08/22/06
151.34.157	06/01/06	Hayden Creek	42.6	73.7	31.1	08/22/06
151.34.133	04/21/06	Bear Valley Creek	34.3	67.8	33.5	08/31/06
151.34.131	04/21/06	Bear Valley Creek	34.3	68.6	34.3	08/30/06
151.34.134	04/21/06	Bear Valley Creek	34.3	68.7	34.4	09/05/06
151.34.135	04/26/06	Hayden Creek	30.0	71.0	41.0	08/22/06
151.34.144	05/04/06	Wright Creek	23.3	68.3	45.0	08/30/06
151.34.136	04/26/06	Bray Creek	29.7	75.2	45.5	08/23/06
151.34.148	05/04/06	Bear Valley Creek	23.0	68.6	45.6	09/05/06
151.34.153	05/11/06	Wright Creek	18.5	68.3	49.8	08/30/06
151.34.151	05/10/06	Bear Valley Creek	18.5	68.6	50.1	09/05/06
151.34.146	05/04/06	West Fork Hayden	23.3	74.1	50.8	08/22/06
151.34.143	05/03/06	West Fork Hayden	24.9	75.8	50.9	08/23/06
151.34.145	05/04/06	Bray Creek	23.3	76.4	53.1	08/23/06
151.34.149	05/10/06	Hayden Creek	18.5	72.8	54.3	08/22/06
151.34.154	05/11/06	Hayden Creek	18.5	73.8	55.3	08/22/06
151.34.129	04/18/06	Bear Valley Creek	10.9	66.9	56.0	08/31/06
151.34.152	05/10/06	Bray Creek	18.5	74.9	56.4	08/23/06
151.34.128	04/18/06	Wright Creek	10.6	69.5	58.9	08/28/06
				Mean (km)	39.0	
				Range (km)	6.5 – 58.9	

Table 4. Transmitter frequency and code, date tagged, minimum number of days remained near release location before commencing upstream migration, date arrived within 3.5 km of uppermost location, and date discontinue downstream migration for radio-tagged bull trout in the Lemhi River sub-basin, Idaho, 2006.

Frequency Code	Tagging Date	Minimum # Days Remained Near Tag Location Before Commencing Upstream Migration	Commence Upstream Migration Date	Arrive Within 3.5km of Uppermost Location	Discontinue Downstream Migration Date
151.34.120	04/25/06 ^a	56	06/26/06	TE	TE
151.34.128	04/18/06	0	05/18/06	07/12/06	10/04/06
151.34.129	04/18/06	0	05/18/06	07/31/06	10/26/06
151.34.131	04/21/06	17	05/18/06	07/12/06	09/12/06
151.34.133	04/21/06	17	05/18/06	07/12/06	09/11/06
151.34.134	04/21/06	65	07/16/06	08/17/06	09/20/06
151.34.135	04/26/06	0	05/02/06	ND	09/20/06
151.34.136	04/26/06	64	07/11/06	ND	10/04/06
151.34.137	04/28/06	62	07/16/06	07/16/06	09/26/06
151.34.138	04/28/06	38	06/12/06	ND	10/16/06
151.34.139	04/29/06	34	06/15/06	ND	09/20/06
151.34.140	04/29/06	47	06/20/06	ND	09/12/06
151.34.141	04/29/06	32	06/05/06	UNKM	UNKM
151.34.142	05/01/06	18	05/26/06	06/30/06	PM
151.34.143	05/03/06	15	05/26/06	ND	09/20/06
151.34.144	05/04/06	26	06/05/06	07/12/06	09/20/06
151.34.145	05/04/06	4	05/18/06	ND	09/20/06
151.34.146	05/04/06	47	06/28/06	ND	09/26/06
151.34.148	05/04/06	42	06/29/06	07/31/06	09/20/06
151.34.149	05/10/06	0	05/18/06	ND	>11/01/06
151.34.151	05/10/06	8	05/30/06	08/09/06	PM
151.34.152	05/10/06	35	06/20/06	ND	09/20/06
151.34.153	05/11/06	0	05/18/06	07/12/06	09/11/06
151.34.154	05/11/06	24	06/12/06	ND	09/20/06
151.34.155	06/01/06	0	06/05/06	ND	09/20/06
151.34.156	06/01/06	0	06/05/06	07/12/06	09/26/06
151.34.157	06/01/06	14	06/18/06	ND	09/26/06
151.34.158	06/01/06	19	06/27/06	07/31/06	09/26/06
151.34.161	07/06/06	10	07/26/06	07/31/06	09/20/06

^a This is the first relocation date. This fish was tagged on October 30, 2004.

TE = transmitter battery expired.

ND = no data.

UNKM = mortality; unknown causes.

PM = post-spawning mortality/tag expulsion.

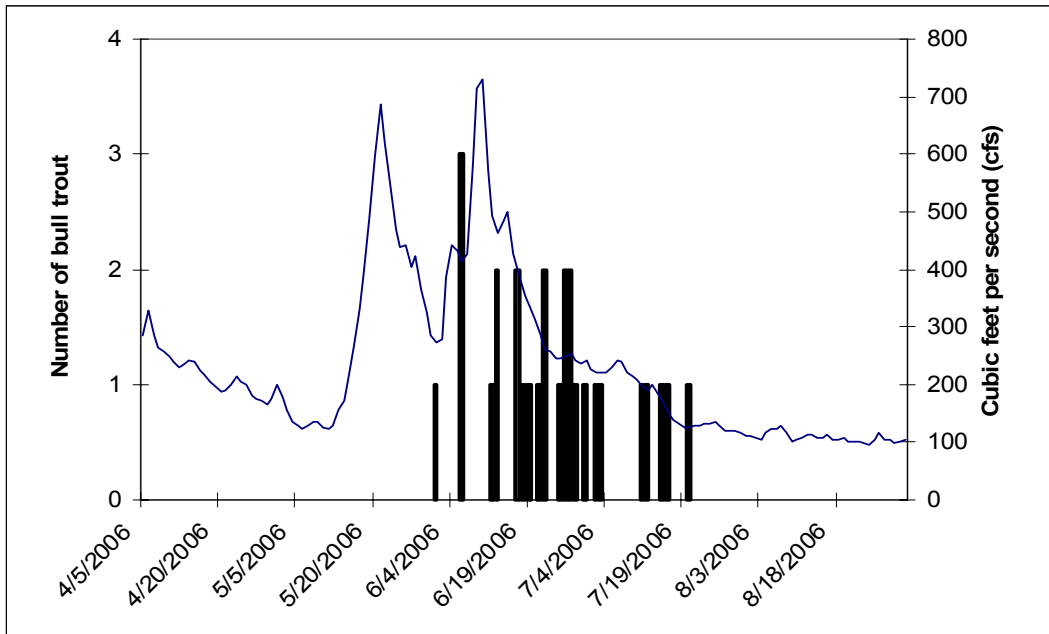


Figure 7. Number of bull trout migrating into Hayden Creek, Idaho in relation to the Lemhi River Hydrograph, 2006. Hydrograph data was obtained from USGS gage #13305000 located on the Lemhi River 10.0 km below Lemhi, Idaho.

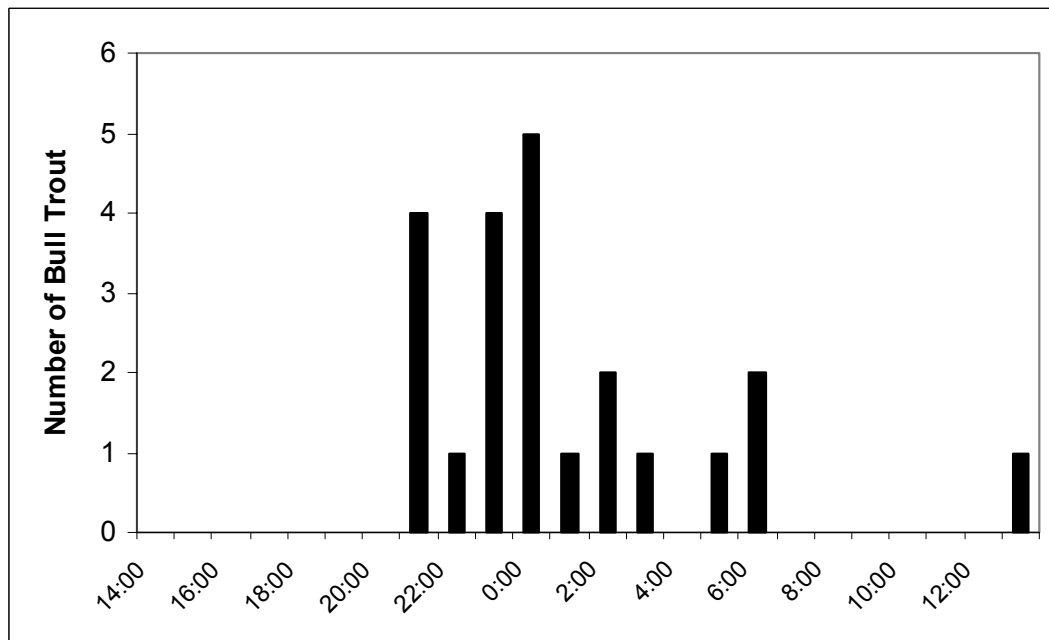


Figure 8. Time of day (24 hr clock) radio-tagged bull trout migrated into Hayden Creek, Idaho (n = 24), 2006.

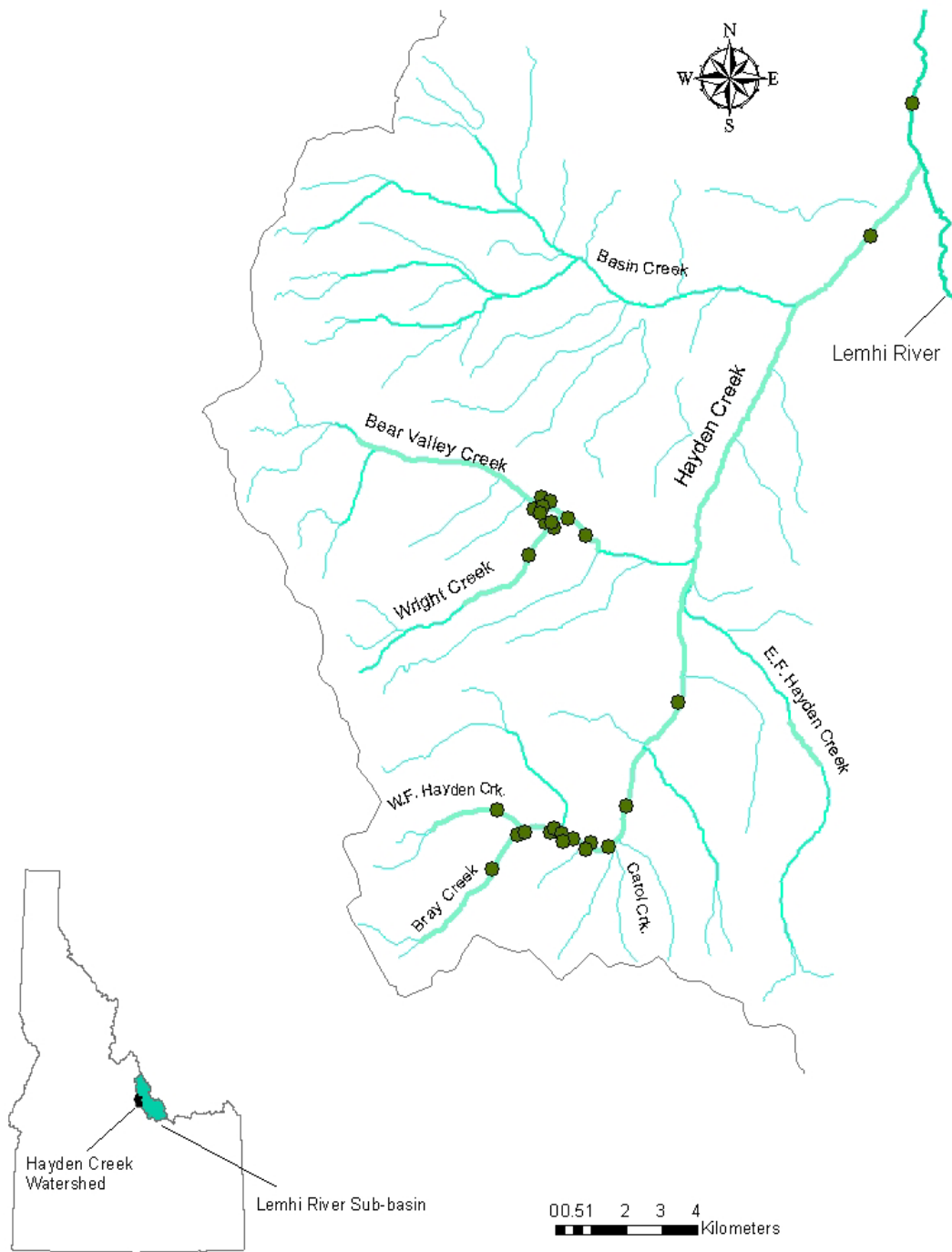


Figure 9. Uppermost locations of radio-tagged bull trout in the Hayden Creek watershed, Idaho, 2006.

Post-Spawn Migration Period

Twenty-four radio-tagged bull trout exited the Hayden Creek watershed between September 4 and September 25 shortly after the cessation of spawning, and 54.2% (13 of 24) entered the Lemhi River by September 12. Once in the Lemhi River, the majority of bull trout (83.3%) halted downstream migration by September 26. September migration distances ranged between 13.2 km and 57.2 km (mean 37.3 km), the greatest monthly movement documented in this study. Of the fish that remained in the Lemhi River, mean October movements were 0.9 km (Figure 6; Table 2). Two bull trout (8.3%) migrated downstream into the Salmon River in October. One bull trout (code 138) was last relocated in the Salmon River 200 m below the North Fork Salmon River after moving 80.2 km in October. The other bull trout (code 129) that entered the Salmon River moved 16.1 km in October. Only one radio-tagged bull trout (code 149) had not ceased downstream migration by November 1.

Post-Spawn Mortalities/Tag Expulsions

Two radio-tagged bull trout either expelled their transmitters or died from unknown causes during spawning resulting in a post-spawn mortality and/or tag expulsion frequency of 7.4% (2 of 27 radio-tagged bull trout). These two transmitters were recovered on October 11. One radio transmitter was recovered in the riparian area along Wright Creek (code 142) and the other was recovered in pool habitat in Bear Valley Creek (code 151). No carcasses were recovered.

Redd Counts

Bull trout redd surveys were conducted along six streams covering 45.4 km in the Hayden Creek watershed between August 22 and October 5 documenting 306 bull trout redds (Figure 10; Table 5). Spawning activity was first observed on August 22 and data collected from Hayden Creek surveys suggest peak spawning activity occurred during the first week of September (Table 6). All spawning activity ceased by September 27. We were able to classify 160 of 306 (52.3%) as fluvial bull trout redds based on redd size.

Hayden Creek

Three surveys were conducted on Hayden Creek from the mouth to the confluence with Carol Creek on August 29, September 6-7 and September 13 excluding a 2.2 km reach below the Hayden Creek ponds in which we were unable to obtain landowner permission to access. Two additional Hayden Creek surveys occurred on August 22 and September 27 from the confluence of Carol Creek upstream to the confluence with West Fork Hayden Creek for a total surveyed reach of 23.3 km. We observed 63 redds in the upper 8.1 km of Hayden Creek with the majority (55 redds, 87.3 %) being recorded in the upper 4.0 km of the surveyed reach. Forty-four redds (69.8%) were designated fluvial bull trout redds.



Figure 10. Bull trout redd locations in the Hayden Creek watershed, Idaho, 2006. Stream reaches surveyed for redds are shown in bold.

Table 5. Summary of bull trout redd surveys in the Hayden Creek watershed, Idaho, 2006.

Stream	Survey Dates	Transect Length (km)	Total Transect Redds	Designated Fluvial Bull Trout Redds	Percent Fluvial Bull Trout Redds	Density (redds /km)
Hayden Creek (main-stem)	Aug 22, 29. Sept 6, 7, 13, 27.	23.3	63	44	69.8	2.7
West Fork Hayden Creek	Sept 27, 28.	5.0	31	8	25.8	6.2
Bray Creek	Sept 28.	4.0	56	43	76.8	14.0
East Fork Hayden Creek	Sept 8.	0.9	49	0	0.0	54.4
Bear Valley Creek	Aug 30-31. Sept 5, 8, 18.	8.2	86	50	58.1	10.5
Wright Creek	Oct 5.	4.0	21	15	71.4	5.3
TOTAL		45.4	306	160	52.3	6.7

Table 6. Summary of bull trout redd surveys in Hayden Creek, Idaho from the mouth upstream to the confluence of Carol Creek (21.6 km).

Survey Date	Completed Redds	Redds In Progress	Trout (>350mm) Observed
8/29/2006	3	3	16
9/6-7/2006	28	1	19
9/13/2006	39	0	2

West Fork Hayden Creek

West Fork Hayden Creek was surveyed for bull trout redds from its mouth to a distance 5.0 km upstream on September 27 and 28. The upper 1.3 km of the surveyed reach is characterized by a high gradient channel with cascading waterfalls and no bull trout redds were observed in this reach. Thirty-one redds were observed along the lower 3.7 km of the surveyed reach. Of these 31 redds, 8 (25.8%) were designated fluvial bull trout redds.

Bray Creek

A 4.0 km survey was conducted on September 28 along Bray Creek from its mouth to a fish passage barrier created by a glacial moraine. Fifty-six bull trout redds were observed of which 43 (76.8%) were designated fluvial bull trout redds. All redds were located in the lower 2.4 km of the creek. The greatest density of redds occurred in the lowest 0.9 km where 36 redds were documented (40 redds/km).

East Fork Hayden Creek

East Fork Hayden Creek was surveyed for bull trout redds on September 8. In this 0.9 km transect we documented 49 bull trout redds, all of which were resident sized redds. This transect begins 0.1 km above the East Fork Hayden Creek bridge.

Bear Valley Creek

Three subreaches totaling 8.2 km were surveyed along Bear Valley Creek. Ascending the drainage, the boundaries of each were as follows: 1) 240 m above the confluence of Kadletz Creek to Wright Creek, 2) Wright Creek to the Forest Service campground at the end of the Bear Valley Creek Road, and 3) The Forest Service campground to a trail crossing 0.6 km above the confluence of Buck Creek. The two lower transects were surveyed three times and the upper transect was surveyed twice. Surveys were conducted on August 30 and 31, and September 5, 8, and 18 documenting 86 bull trout redds of which 50 (58.1%) were designated to be of fluvial size. No redds were observed in the upper 1.6 km of the surveyed reach which is characterized by high channel gradient and cascading waterfalls.

Wright Creek

One bull trout redd survey was conducted on Wright Creek on October 5 from the mouth to a point 4.0 km above the mouth. A waterfall approximately 1.5 m in height was observed 3.7 km above the mouth presenting a potential fish passage barrier. No redds were observed above this barrier. Twenty-one redds were documented during this survey of which 15 (71.4%) were designated to be of fluvial size.

DISCUSSION

The results of this study indicate the temporal migration patterns of Lemhi River fluvial bull trout are similar to other fluvial populations located throughout its range (Bahr and Shrimpton 2004; Schiff et al. 2005; Schoby 2006). Bull trout generally began their upstream migration in the main-stem Lemhi River to spawning grounds in the Hayden Creek watershed between mid-May and mid-June, reaching their spawning locations by mid-August. After completing spawning activities, fish immediately returned to the Lemhi River. Upon returning to the Lemhi River, nearly all bull trout ceased downstream movement at presumed overwintering locations by October 26.

The mean migration distance we calculated should be considered a minimum estimate of the actual seasonal movements of Lemhi River bull trout. After transmitter implantation, five bull trout appeared to have commenced upstream migration immediately. Considering all other radio-tagged bull trout remained near their release sites, on average, for a month, it is plausible these five fish were captured after they had already commenced upstream movement from their overwintering areas and once released, they simply continued their upstream migration. Also, one fish moved downstream after tag implantation. Since, migration distance was calculated from tagging location, the additional movement by this fish is not reflected in the mean migration distance.

Main-stem habitat use by radio-tagged bull trout was generally restricted to reaches in the Lemhi River downstream of Hayden Creek. While attempting to capture bull trout in the Lemhi River for this study, 60.0% of angling effort was conducted below and 40.0% was conducted above Hayden Creek. However, angling success was 40 times greater in river reaches below Hayden Creek than above. This suggests bull trout distribution is concentrated in the Lemhi River downstream of Hayden Creek. In addition, once bull trout ceased downstream migration from their spawning grounds, only 2 fish were detected in the Salmon River with the remainder residing in the Lemhi River. This is the first documented occurrence of Hayden Creek watershed spawners occupying the Salmon River. These data suggest the Lemhi River below Hayden Creek contains suitable overwintering habitat for bull trout. Future tracking events will determine whether these fish remain in the Lemhi River for the duration of winter.

Determining bull trout tributary use was an important component of this study to provide baseline data for tributary reconnection monitoring efforts as outlined in the Lemhi CP. During this study, Hayden Creek was the only Lemhi River tributary utilized by bull trout. Fluvial-sized bull trout have been documented in Big Timber Creek, the second largest Lemhi River tributary, however, no radio-tagged bull trout in this study migrated into or near the vicinity of Big Timber Creek. Consequently, it remains unclear whether these large bull trout are fluvial migrants or large resident forms.

Currently, Big Timber Creek is intermittently connected to the Lemhi River for a brief period during spring runoff providing only a short window of opportunity for bull trout to ascend this tributary stream. Efforts are under way at this time to connect Big Timber Creek perennially to the Lemhi River. Once the project is completed, it is expected that a minimum discharge of 4.5 cfs will continually enter the Lemhi River throughout the year.

Positive results from reconnection efforts have been documented in Fourth of July Creek, a Salmon River tributary near Stanley, Idaho. Prior to commencing reconnection efforts, fluvial-sized bull trout were documented in Fourth of July Creek even though fish passage into

this tributary was limited due to diversion structures and dewatering events in the lower end of the creek caused by irrigation withdrawals (Munther 1974). In 2002, Idaho Department of Fish and Game (IDFG) and Idaho Department of Water Resources (IDWR) worked with area landowners to improve fish passage at irrigation diversions in addition to constructing fish screens on irrigation canals. Furthermore, IDWR began leasing water to maintain a minimum discharge of 2-4 cfs at the mouth of Fourth of July Creek. Results from bull trout redd surveys conducted between 2003 and 2006 show increased spawning activity after these actions were completed (IDFG in preparation). We expect a similar response by bull trout and other migratory species, including Chinook salmon and steelhead, once Big Timber Creek is reconnected.

Redd survey results show fluvial bull trout redds comprised 52.3% of the total redds observed in the Hayden Creek watershed. This frequency should be considered a minimum because not all observed redds were classified. Fifty-three redds in the survey reaches were designated “unclassified” due to miscommunication between observers regarding survey protocols. A better representation of the composition between fluvial and resident bull trout in the Hayden Creek drainage could be obtained if the “unclassified” redds and the redds observed in the East Fork Hayden Creek transect, which is inaccessible to migratory bull trout due to a channel gradient passage barrier, were removed from the total count. Manipulating the data in this manner shows a fluvial bull trout redd frequency of 78.4% (160 out of 204) in the upper Hayden Creek and Bear Valley Creek drainages.

The temporal distribution of radio-tagged bull trout in the Lemhi River sub-basin provides guidelines for Lemhi River tributary reconnection efforts. During 2006, radio-tagged bull trout entered Hayden Creek between June 1 and July 20 and subsequently returned to the Lemhi River between September 4 and September 25 although in 2004, Schoby (2007) observed bull trout entering Hayden Creek as early as April 25 and returning to the Lemhi River as late as December 1. At a minimum, stream flow from tributaries to the Lemhi River should be maintained from mid-May through July and again throughout the month of September as these are two critical time periods in which bull trout move between the main-stem and tributary habitats.

In summary, life history characteristics of fluvial bull trout in the Lemhi River sub-basin suggest their distribution has been restricted by water withdrawals from tributary streams. Hayden Creek was the sole tributary utilized by radio-tagged bull trout implying this watershed provides the only available tributary/spawning habitat in the Lemhi River sub-basin. The exclusive use of the Hayden Creek watershed in conjunction with the absence of functionally connected tributaries to the Lemhi River upstream of Hayden Creek has effectively concentrated current bull trout distribution in the main-stem Lemhi River to habitat downstream of Hayden Creek. Additional habitat will become available once Big Timber Creek, located in the upper end of the sub-basin, is reconnected. Future studies should be designed to ascertain the response by bull trout, and other salmonids, to this re-established migratory corridor.

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APPENDICES

Appendix A.

Transmitter frequency and code, tagging date, PIT tag code, total length (mm), fork length (mm), and total weight (g) for bull trout radio-tagged in the Lemhi River, Idaho, 2006.

Frequency Code	Tagging Date	PIT Tag	Total Length (mm)	Fork Length (mm)	Total Weight (g)
151.34.128	04/18/06		455	445	900
151.34.129	04/18/06		406	392	660
151.34.130	04/14/06		410	394	590
151.34.131	04/21/06		565	555	1900
151.34.132	04/21/06		430	418	700
151.34.133	04/21/06		544	534	1390
151.34.134	04/21/06		390	376	520
151.34.135	04/26/06	3D9.1BF1B17A78	556		1780
151.34.136	04/26/06	3D9.1BF1BA726F	422	404	620
151.34.137	04/28/06	3D9.1BF1BA867D	375	358	510
151.34.138	04/28/06	3D9.1BF1BA721A	630	609	
151.34.139	04/29/06	3D9.1BF1B1A991	530	515	1580
151.34.140	04/29/06	3D9.1BF1B0B019	562	545	1680
151.34.141	04/29/06	3D9.1BF1B4B9F7	606	593	2380
151.34.142	05/01/06	3D9.1BF1B11975	473	462	995
151.34.143	05/03/06	3D9.1BF1B9A982	554	538	1780
151.34.144	05/04/06	3D9.1BF1B17CE0	564	545	2090
151.34.145	05/04/06	3D9.1BF1B10A96	415	401	640
151.34.146	05/04/06	3D9.1BF1B09D6D	438	420	770
151.34.147	05/04/06	3D9.1BF1BAC703	352	343	480
151.34.148	05/04/06	3D9.1BF1B0E12B	580	570	2120
151.34.149	05/10/06	3D9.1BF1B0A4CE	402	384	610
151.34.150	05/10/06		590	575	1940
151.34.151	05/10/06	3D9.1BF1B10810	407	388	700
151.34.152	05/10/06	3D9.1BF1B08C6A	470	462	1100
151.34.153	05/11/06	3D9.1BF1B49EA4	495	479	1270
151.34.154	05/11/06	3D9.1BF1B13880	573	553	1870
151.34.155	06/01/06	3D9.1BF1B09EF1	473	452	940
151.34.156	06/01/06	3D9.1BF1BADB99	696	688	
151.34.157	06/01/06	3D9.1BF1B0D092	595	578	2200
151.34.158	06/01/06	3D9.1BF1B98499	465	460	1100
151.34.161	07/06/06	3D9.1BF1B1129A	362	349	490
PIT tag only	05/01/06	3D9.1BF1B1101A	333	321	375
PIT tag only	05/04/06	3D9.1BF1B19675	356	343	420
PIT tag only	05/09/06	3D9.1BF1BA94FE	250	238	100
PIT tag only	05/10/06	3D9.1BF1B0DC5D	289	281	190

Appendix B.

Transmitter frequency and code, relocation date, and GPS location for bull trout radio-tagged in the Lemhi River, Idaho, 2006.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.120	04/25/06	12	291301	4982631
151.34.120	05/03/06	12	291301	4982631
151.34.120	05/08/06	12	291301	4982631
151.34.120	05/26/06	12	291301	4982631
151.34.120	06/05/06	12	291301	4982631
151.34.120	06/12/06	12	291301	4982631
151.34.120	06/15/06	12	291301	4982631
151.34.120	06/20/06	12	291309	4982550
151.34.120	06/30/06	12	287941	4966186
151.34.128	05/02/06	12	281612	4999562
151.34.128	05/08/06	12	281612	4999562
151.34.128	05/18/06	12	285933	4997168
151.34.128	05/30/06	12	285905	4996299
151.34.128	06/05/06	12	287174	4993864
151.34.128	06/12/06	12	287606	4993363
151.34.128	06/15/06	12	287564	4993528
151.34.128	06/20/06	12	288365	4992377
151.34.128	06/23/06	12	290581	4988482
151.34.128	06/29/06	12	292450	4972240
151.34.128	07/12/06	12	283157	4961346
151.34.128	08/28/06	12	281108	4961312
151.34.128	09/11/06	12	285881	4962166
151.34.128	09/20/06	12	291187	4981826
151.34.128	09/26/06	12	290561	4989353
151.34.128	10/04/06	12	289368	4990723
151.34.128	10/11/06	12	289345	4990761
151.34.128	10/17/06	12	289352	4990762
151.34.128	10/26/06	12	289334	4990842
151.34.128	11/01/06	12	289084	4991312
151.34.129	05/02/06	12	273452	5006316
151.34.129	05/03/06	12	272945	5007650
151.34.129	05/05/06	12	272699	5007440
151.34.129	05/08/06	12	272699	5007440
151.34.129	05/18/06	12	277347	5004447
151.34.129	05/30/06	12	278061	5004084
151.34.129	06/05/06	12	280828	5000134
151.34.129	06/15/06	12	284191	4998768
151.34.129	06/20/06	12	286145	4995948
151.34.129	06/29/06	12	290661	4987097
151.34.129	07/16/06	12	291630	4970259
151.34.129	07/31/06	12	282731	4961890
151.34.129	08/09/06	12	282928	4961668

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.129	08/17/06	12	282779	4961771
151.34.129	08/31/06	12	282721	4961771
151.34.129	09/11/06	12	286468	4963081
151.34.129	09/20/06	12	286320	4995275
151.34.129	09/26/06	12	279135	5002544
151.34.129	10/04/06	12	278230	5004113
151.34.129	10/11/06	12	278276	5004095
151.34.129	10/26/06	12	271487	5002291
151.34.129	11/01/06	12	271487	5002291
151.34.130	04/25/06	12	290689	4987892
151.34.130	05/02/06	12	290726	4988080
151.34.130	05/18/06	12	290736	4988216
151.34.130	05/26/06	12	290559	4989289
151.34.130	06/05/06	12	290221	4989804
151.34.130	06/12/06	12	285935	4997106
151.34.130	06/15/06	12	285950	4997041
151.34.130	06/20/06	12	285937	4997111
151.34.130	06/29/06	12	285939	4997178
151.34.130	07/12/06	12	285939	4997178
151.34.130	07/13/06	12	285939	4997178
151.34.131	05/02/06	12	291637	4983870
151.34.131	05/08/06	12	291485	4983920
151.34.131	05/18/06	12	292562	4974973
151.34.131	06/07/06	12	291203	4969868
151.34.131	06/12/06	12	290248	4968786
151.34.131	06/15/06	12	289250	4968070
151.34.131	06/20/06	12	287738	4965394
151.34.131	06/30/06	12	285073	4960951
151.34.131	07/12/06	12	283065	4961371
151.34.131	08/09/06	12	282381	4962214
151.34.131	08/17/06	12	281534	4962606
151.34.131	08/30/06	12	281520	4962598
151.34.131	09/05/06	12	281748	4962507
151.34.131	09/06/06	12	287624	4965239
151.34.131	09/12/06	12	293324	4970029
151.34.131	09/20/06	12	293247	4969320
151.34.131	09/26/06	12	293232	4969350
151.34.131	10/04/06	12	293120	4969394
151.34.131	10/11/06	12	293254	4969327
151.34.131	10/17/06	12	293131	4969397
151.34.131	10/26/06	12	293131	4969397

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.131	11/01/06	12	293158	4969738
151.34.131	04/25/06	12	291378	4984367
151.34.132	04/25/06	12	291378	4984367
151.34.132	05/02/06	12	291370	4984340
151.34.132	05/08/06	12	291321	4984333
151.34.132	05/18/06	12	291377	4984335
151.34.132	05/26/06	12	291370	4984348
151.34.132	06/5/06	12	291441	4984264
151.34.132	06/12/06	12	291440	4984266
151.34.132	06/15/06	12	291472	4984249
151.34.132	06/20/06	12	291377	4984366
151.34.132	06/29/06	12	291382	4984327
151.34.132	07/16/06	12	291376	4984352
151.34.132	07/26/06	12	291370	4984364
151.34.133	04/25/06	12	291378	4984367
151.34.133	05/02/06	12	291584	4983899
151.34.133	05/08/06	12	291495	4984090
151.34.133	05/18/06	12	291662	4980356
151.34.133	05/26/06	12	292275	4977233
151.34.133	05/30/06	12	292836	4975914
151.34.133	06/05/06	12	292604	4971729
151.34.133	06/07/06	12	292599	4971718
151.34.133	06/12/06	12	292743	4971306
151.34.133	06/15/06	12	292619	4971653
151.34.133	06/20/06	12	292754	4971333
151.34.133	06/23/06	12	292387	4971297
151.34.133	06/29/06	12	289396	4968184
151.34.133	07/12/06	12	284976	4960911
151.34.133	07/31/06	12	282172	4962354
151.34.133	08/09/06	12	282306	4962243
151.34.133	08/17/06	12	282269	4962293
151.34.133	08/31/06	12	282257	4962258
151.34.133	09/11/06	12	292726	4971259
151.34.133	09/20/06	12	292750	4971323
151.34.133	09/26/06	12	292738	4971304
151.34.133	10/04/06	12	292732	4971264
151.34.133	10/11/06	12	292745	4971314
151.34.133	10/17/06	12	292717	4971251
151.34.133	10/26/06	12	292717	4971251
151.34.133	11/01/06	12	292717	4971251
151.34.134	04/25/06	12	291378	4984367

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.134	05/02/06	12	291547	4983943
151.34.134	05/08/06	12	291469	4984156
151.34.134	05/18/06	12	291583	4984122
151.34.134	05/26/06	12	291627	4983884
151.34.134	06/05/06	12	291557	4984162
151.34.134	06/12/06	12	291602	4983897
151.34.134	06/15/06	12	291623	4983875
151.34.134	06/20/06	12	291572	4984028
151.34.134	06/29/06	12	291409	4984322
151.34.134	07/16/06	12	291648	4980526
151.34.134	07/31/06	12	285824	4961243
151.34.134	08/09/06	12	284539	4961022
151.34.134	08/17/06	12	282321	4962232
151.34.134	08/30/06	12	281767	4962513
151.34.134	09/05/06	12	281444	4962615
151.34.134	09/11/06	12	283765	4961200
151.34.134	9/20/2006	12	291542	4984209
151.34.134	9/26/2006	12	291542	4984201
151.34.134	10/04/06	12	291597	4984106
151.34.134	10/17/06	12	291600	4984081
151.34.134	10/26/06	12	291600	4984081
151.34.134	11/01/06	12	291600	4984081
151.34.135	05/02/06	12	290982	4985439
151.34.135	6/7/2006	12	291949	4970599
151.34.135	06/12/06	12	291811	4970446
151.34.135	06/15/06	12	291222	4969882
151.34.135	06/20/06	12	290792	4969453
151.34.135	06/23/06	12	289997	4968503
151.34.135	06/30/06	12	287759	4965697
151.34.135	07/12/06	12	285381	4958503
151.34.135	08/22/06	12	283618	4954326
151.34.135	09/06/06	12	283796	4955082
151.34.135	09/07/06	12	285200	4957120
151.34.135	09/12/06	12	293104	4969629
151.34.135	09/20/06	12	293143	4968292
151.34.135	09/26/06	12	293614	4967638
151.34.135	10/04/06	12	293589	4967674
151.34.135	10/11/06	12	293558	4967731
151.34.135	10/17/06	12	293490	4967833
151.34.135	10/26/06	12	293749	4967321
151.34.135	11/01/06	12	293749	4967321

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.136	05/02/06	12	290622	4988409
151.34.136	05/08/06	12	290536	4988382
151.34.136	05/18/06	12	290644	4988382
151.34.136	05/26/06	12	290665	4988357
151.34.136	05/30/06	12	290680	4988337
151.34.136	06/05/06	12	290563	4988658
151.34.136	06/12/06	12	290546	4988666
151.34.136	06/15/06	12	290646	4988387
151.34.136	07/12/06	12	291530	4970208
151.34.136	08/23/06	12	280480	4953653
151.34.136	09/26/06	12	292786	4976309
151.34.136	10/04/06	12	290610	4988428
151.34.136	10/11/06	12	290566	4988636
151.34.136	10/17/06	12	290711	4988312
151.34.136	10/26/06	12	290711	4988312
151.34.136	11/01/06	12	290711	4988312
151.34.137	05/02/06	12	292573	4975000
151.34.137	05/08/06	12	292487	4975047
151.34.137	05/20/06	12	292664	4973727
151.34.137	05/26/06	12	292624	4973714
151.34.137	05/30/06	12	292668	4973747
151.34.137	06/05/06	12	292659	4973742
151.34.137	06/12/06	12	292581	4973684
151.34.137	06/15/06	12	292576	4973674
151.34.137	06/20/06	12	292692	4973781
151.34.137	06/29/06	12	292695	4973668
151.34.137	07/16/06	12	292428	4971368
151.34.137	07/26/06	12	292529	4971441
151.34.137	07/31/06	12	290715	4969324
151.34.137	08/09/06	12	290715	4969324
151.34.137	08/17/06	12	290715	4969324
151.34.137	08/28/06	12	291125	4969657
151.34.137	09/7/06	12	291118	4969658
151.34.137	09/11/06	12	291110	4969650
151.34.137	09/20/06	12	292421	4976954
151.34.137	09/26/06	12	290978	4985452
151.34.137	10/04/06	12	290996	4985223
151.34.137	10/11/06	12	291579	4984134
151.34.137	10/17/06	12	290992	4985121
151.34.137	10/26/06	12	291590	4984113
151.34.137	11/01/06	12	291590	4984113

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.138	05/02/06	12	292573	4975000
151.34.138	05/08/06	12	292477	4975036
151.34.138	05/18/06	12	292613	4975020
151.34.138	05/26/06	12	292787	4975576
151.34.138	05/30/06	12	292573	4975021
151.34.138	06/05/06	12	292580	4975020
151.34.138	06/12/06	12	292415	4972951
151.34.138	06/15/06	12	290377	4968875
151.34.138	06/20/06	12	286034	4962518
151.34.138	06/23/06	12	286267	4962864
151.34.138	06/30/06	12	285817	4961928
151.34.138	08/22/06	12	283082	4953242
151.34.138	09/11/06	12	285368	4958540
151.34.138	09/20/06	12	292582	4975037
151.34.138	09/26/06	12	292574	4974991
151.34.138	10/04/06	12	290723	4986877
151.34.138	10/11/06	12	277083	5004316
151.34.138	10/16/06	12	265426	5032089
151.34.138	10/26/06	12	265426	5032089
151.34.138	11/01/06	12	265426	5032089
151.34.139	05/02/06	12	292573	4975000
151.34.139	05/08/06	12	292477	4975036
151.34.139	05/18/06	12	292579	4974994
151.34.139	05/26/06	12	292821	4976124
151.34.139	05/30/06	12	292820	4976093
151.34.139	06/05/06	12	292759	4976299
151.34.139	06/12/06	12	292570	4975026
151.34.139	06/15/06	12	292418	4972854
151.34.139	06/20/06	12	291194	4969727
151.34.139	06/23/06	12	289146	4968044
151.34.139	06/30/06	12	285817	4961928
151.34.139	08/22/06	12	281469	4953764
151.34.139	09/11/06	12	290860	4969479
151.34.139	09/12/06	12	292836	4974324
151.34.139	09/20/06	12	292779	4976297
151.34.139	09/26/06	12	292741	4976267
151.34.139	10/04/06	12	292797	4976311
151.34.139	10/11/06	12	292753	4976287
151.34.139	10/17/06	12	292784	4976297
151.34.139	10/26/06	12	292784	4976297
151.34.139	11/01/06	12	292784	4976297

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.140	05/08/06	12	292512	4974866
151.34.140	05/18/06	12	292800	4974748
151.34.140	05/26/06	12	292650	4974864
151.34.140	05/30/06	12	292661	4974861
151.34.140	06/05/06	12	292790	4974758
151.34.140	06/12/06	12	292784	4974764
151.34.140	06/15/06	12	292790	4974748
151.34.140	06/20/06	12	292419	4973052
151.34.140	06/23/06	12	292570	4971921
151.34.140	06/29/06	12	291630	4970016
151.34.140	07/12/06	12	285506	4960279
151.34.140	08/22/06	12	283132	4953279
151.34.140	09/06/06	12	282050	4953497
151.34.140	09/11/06	12	292580	4971945
151.34.140	09/12/06	12	292842	4974693
151.34.140	09/20/06	12	292836	4974638
151.34.140	09/26/06	12	292624	4974870
151.34.140	10/04/06	12	292625	4974872
151.34.140	10/11/06	12	292614	4974875
151.34.140	10/17/06	12	292734	4973971
151.34.140	10/26/06	12	292734	4973971
151.34.140	11/01/06	12	292574	4975028
151.34.141	05/02/06	12	292623	4974884
151.34.141	05/08/06	12	292617	4974809
151.34.141	05/18/06	12	292598	4974901
151.34.141	05/26/06	12	292735	4974791
151.34.141	05/30/06	12	292782	4974754
151.34.141	06/05/06	12	292324	4972330
151.34.141	06/07/06	12	292205	4970932
151.34.141	06/12/06	12	291596	4984071
151.34.141	06/15/06	12	290482	4989516
151.34.141	07/10/06	12	272830	5012627
151.34.142	05/02/06	12	292629	4974878
151.34.142	05/08/06	12	292619	4974809
151.34.142	05/18/06	12	292836	4974677
151.34.142	05/26/06	12	292319	4972382
151.34.142	05/30/06	12	292612	4971664
151.34.142	06/08/06	12	288414	4966685
151.34.142	06/12/06	12	288477	4966955
151.34.142	06/15/06	12	288495	4966808
151.34.142	06/20/06	12	286958	4964252

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.142	06/23/06	12	285888	4962128
151.34.142	06/30/06	12	283122	4961277
151.34.142	07/12/06	12	282165	4962341
151.34.142	07/31/06	12	281969	4962458
151.34.142	08/09/06	12	282040	4962426
151.34.142	08/17/06	12	281764	4962174
151.34.142	08/30/06	12	281734	4962170
151.34.142	09/05/06	12	281788	4962192
151.34.142	09/11/06	12	281788	4962192
151.34.142	10/11/06	12	281711	4962123
151.34.143	05/08/06	12	288254	4992422
151.34.143	05/18/06	12	289089	4991290
151.34.143	05/26/06	12	290400	4989576
151.34.143	05/30/06	12	290227	4989769
151.34.143	06/05/06	12	291693	4979472
151.34.143	06/12/06	12	292469	4973443
151.34.143	06/15/06	12	291900	4970465
151.34.143	06/20/06	12	287234	4964672
151.34.143	06/23/06	12	285742	4960846
151.34.143	08/23/06	12	279936	4954353
151.34.143	09/06/06	12	283469	4953763
151.34.143	09/11/06	12	288807	4967700
151.34.143	09/12/06	12	292647	4974867
151.34.143	09/20/06	12	288251	4992384
151.34.143	09/26/06	12	288319	4992383
151.34.143	10/04/06	12	288367	4992380
151.34.143	10/11/06	12	288283	4992387
151.34.143	10/17/06	12	288245	4992384
151.34.143	10/26/06	12	288245	4992384
151.34.143	11/01/06	12	288245	4992384
151.34.144	05/08/06	12	287048	4994165
151.34.144	05/18/06	12	287010	4994085
151.34.144	05/30/06	12	287021	4994100
151.34.144	06/05/06	12	291459	4982819
151.34.144	06/12/06	12	292119	4977913
151.34.144	06/15/06	12	292499	4973487
151.34.144	06/20/06	12	290913	4969492
151.34.144	06/23/06	12	288935	4967853
151.34.144	06/30/06	12	285798	4961212
151.34.144	07/12/06	12	282728	4961871
151.34.144	07/31/06	12	282050	4962434

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.144	08/09/06	12	282151	4962341
151.34.144	08/17/06	12	281731	4962148
151.34.144	08/30/06	12	281795	4962184
151.34.144	09/11/06	12	286854	4964203
151.34.144	09/20/06	12	287023	4994084
151.34.144	09/26/06	12	287016	4994097
151.34.144	10/04/06	12	287038	4994151
151.34.144	10/11/06	12	287077	4993937
151.34.144	10/17/06	12	287026	4994120
151.34.144	10/26/06	12	287026	4994120
151.34.144	11/01/06	12	287026	4994120
151.34.145	05/08/06	12	287048	4994165
151.34.145	05/18/06	12	289576	4990356
151.34.145	05/26/06	12	289967	4990101
151.34.145	06/05/06	12	291194	4984684
151.34.145	06/12/06	12	291557	4983540
151.34.145	06/20/06	12	292461	4976903
151.34.145	06/23/06	12	292136	4970773
151.34.145	06/30/06	12	289196	4968074
151.34.145	08/23/06	12	279740	4952753
151.34.145	09/20/06	12	291214	4981999
151.34.145	09/26/06	12	291174	4981769
151.34.145	10/04/06	12	291178	4981707
151.34.145	10/11/06	12	291187	4981638
151.34.145	10/17/06	12	291188	4981629
151.34.145	10/26/06	12	291188	4981629
151.34.145	11/01/06	12	291188	4981629
151.34.146	05/08/06	12	287048	4994165
151.34.146	05/18/06	12	286658	4994298
151.34.146	05/26/06	12	287588	4993490
151.34.146	05/30/06	12	286658	4994291
151.34.146	06/05/06	12	287027	4994178
151.34.146	06/12/06	12	286533	4994545
151.34.146	06/15/06	12	286257	4995016
151.34.146	06/20/06	12	286568	4994479
151.34.146	06/29/06	12	291899	4970384
151.34.146	08/22/06	12	281453	4953770
151.34.146	09/20/06	12	291933	4979017
151.34.146	09/26/06	12	287956	4992725
151.34.146	10/04/06	12	288021	4992641
151.34.146	10/11/06	12	288165	4992440

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.146	10/17/06	12	288039	4992576
151.34.146	10/26/06	12	288039	4992576
151.34.146	11/01/06	12	288039	4992576
151.34.147	05/08/06	12	286297	4995136
151.34.147	05/18/06	12	286835	4994227
151.34.147	05/30/06	12	286607	4994386
151.34.147	06/05/06	12	286688	4994255
151.34.147	06/12/06	12	286646	4994340
151.34.147	06/15/06	12	286650	4994350
151.34.147	06/20/06	12	286660	4994296
151.34.147	06/29/06	12	287851	4993184
151.34.147	07/16/06	12	292476	4976872
151.34.147	07/26/06	12	292146	4977730
151.34.147	07/31/06	12	291609	4980665
151.34.147	08/01/06	12	291609	4980665
151.34.147	08/03/06	12	290629	4987474
151.34.147	08/04/06	12	289525	4990426
151.34.147	08/05/06	12	289525	4990426
151.34.147	08/08/06	12	289389	4990676
151.34.147	08/09/06	12	289343	4990791
151.34.147	08/10/06	12	289343	4990791
151.34.148	05/08/06	12	286320	4995353
151.34.148	05/18/06	12	286557	4994518
151.34.148	05/30/06	12	286474	4994629
151.34.148	06/12/06	12	286584	4994445
151.34.148	06/15/06	12	286555	4994518
151.34.148	06/29/06	12	291146	4987967
151.34.148	07/31/06	12	282267	4962285
151.34.148	08/09/06	12	281750	4962550
151.34.148	08/17/06	12	281668	4962552
151.34.148	08/30/06	12	281623	4962548
151.34.148	09/05/06	12	281557	4962567
151.34.148	09/11/06	12	283044	4961496
151.34.148	09/20/06	12	286580	4994463
151.34.148	09/26/06	12	286653	4994289
151.34.148	10/04/06	12	286677	4994271
151.34.148	10/11/06	12	286562	4994476
151.34.148	10/17/06	12	286531	4994554
151.34.148	10/26/06	12	286531	4994554
151.34.148	11/01/06	12	286531	4994554
151.34.149	05/18/06	12	285941	4996440

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.149	05/30/06	12	286233	4995522
151.34.149	06/05/06	12	287195	4993842
151.34.149	06/12/06	12	288042	4992577
151.34.149	06/15/06	12	288248	4992387
151.34.149	06/20/06	12	289008	4991470
151.34.149	06/29/06	12	291899	4978985
151.34.149	08/22/06	12	282512	4953272
151.34.149	09/11/06	12	292625	4975031
151.34.149	09/20/06	12	292625	4975019
151.34.149	09/26/06	12	291540	4983962
151.34.149	10/04/06	12	290654	4987596
151.34.149	10/11/06	12	290535	4988691
151.34.149	10/17/06	12	289403	4990641
151.34.149	10/26/06	12	288967	4991571
151.34.149	11/01/06	12	286593	4994415
151.34.150	05/18/06	12	284794	4998080
151.34.150	05/30/06	12	284964	4998112
151.34.150	06/05/06	12	284935	4998110
151.34.150	06/12/06	12	278090	5004093
151.34.151	05/18/06	12	285202	4997762
151.34.151	05/30/06	12	286933	4994207
151.34.151	06/05/06	12	290572	4988582
151.34.151	06/12/06	12	291610	4983669
151.34.151	06/15/06	12	291295	4982159
151.34.151	06/20/06	12	292654	4976299
151.34.151	06/29/06	12	291899	4970384
151.34.151	07/12/06	12	285858	4962016
151.34.151	07/31/06	12	285731	4960746
151.34.151	08/09/06	12	283035	4961605
151.34.151	08/17/06	12	281448	4962636
151.34.151	08/30/06	12	281691	4962544
151.34.151	09/05/06	12	281528	4962586
151.34.151	09/11/06	12	281554	4962605
151.34.151	10/11/06	12	281481	4962619
151.34.152	05/18/06	12	284877	4998105
151.34.152	05/30/06	12	284910	4998108
151.34.152	06/05/06	12	284989	4998108
151.34.152	06/12/06	12	285067	4998048
151.34.152	06/15/06	12	285036	4998088
151.34.152	06/20/06	12	286890	4994207
151.34.152	06/29/06	12	292019	4978199

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.152	07/12/06	12	285367	4958579
151.34.152	08/23/06	12	280697	4953727
151.34.152	09/20/06	12	285036	4998093
151.34.152	09/26/06	12	285059	4998035
151.34.152	10/04/06	12	285021	4998107
151.34.152	10/11/06	12	285013	4998096
151.34.152	10/17006	12	285316	4997642
151.34.152	10/26/06	12	285316	4997642
151.34.152	11/01/06	12	285316	4997642
151.34.153	05/26/06	12	289334	4990833
151.34.153	05/30/06	12	290565	4989313
151.34.153	06/05/06	12	291711	4979705
151.34.153	06/12/06	12	291700	4979577
151.34.153	06/15/06	12	291959	4979151
151.34.153	06/20/06	12	292774	4974129
151.34.153	06/23/06	12	292223	4970955
151.34.153	06/30/06	12	289046	4967977
151.34.153	07/12/06	12	284463	4961069
151.34.153	07/31/06	12	281776	4962535
151.34.153	08/09/06	12	282116	4962424
151.34.153	08/17/06	12	281834	4962507
151.34.153	08/30/06	12	281790	4962177
151.34.153	09/05/06	12	282141	4962375
151.34.153	09/06/06	12	288925	4967895
151.34.153	09/11/06	12	291700	4979573
151.34.153	09/20/06	12	291703	4979475
151.34.153	09/26/06	12	291695	4979526
151.34.153	10/04/06	12	291697	4979572
151.34.153	10/11/06	12	291706	4979840
151.34.153	10/17/06	12	291732	4979966
151.34.153	10/26/06	12	291732	4979966
151.34.153	11/01/06	12	291732	4979966
151.34.154	05/18/06	12	284838	4998090
151.34.154	05/30/06	12	284855	4998094
151.34.154	06/05/06	12	284880	4998101
151.34.154	06/12/06	12	285939	4996253
151.34.154	06/15/06	12	287976	4992705
151.34.154	06/20/06	12	291321	4982647
151.34.154	06/30/06	12	287965	4966244
151.34.154	08/22/06	12	281729	4953565
151.34.154	09/06/06	12	282210	4953421

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.154	09/11/06	12	286797	4963939
151.34.154	09/20/06	12	284967	4998128
151.34.154	09/26/06	12	284965	4998125
151.34.154	10/04/06	12	284945	4998109
151.34.154	10/11/06	12	284894	4998105
151.34.154	10/17/06	12	284990	4998114
151.34.154	10/26/06	12	284990	4998114
151.34.154	11/01/06	12	284990	4998114
151.34.155	06/05/06	12	292648	4976558
151.34.155	06/12/06	12	292644	4976316
151.34.155	06/15/06	12	292817	4976093
151.34.155	06/20/06	12	291887	4970460
151.34.155	06/23/06	12	289647	4968315
151.34.155	06/30/06	12	285212	4959641
151.34.155	08/22/06	12	282470	4953306
151.34.155	09/06/06	12	282248	4953409
151.34.155	09/07/06	12	285336	4957773
151.34.155	09/11/06	12	287405	4993648
151.34.155	09/20/06	12	286258	4995071
151.34.155	09/26/06	12	286258	4995019
151.34.155	10/04/06	12	286264	4995100
151.34.155	10/11/06	12	285964	4994994
151.34.155	10/17/06	12	286263	4994987
151.34.155	10/26/06	12	286263	4994987
151.34.155	11/01/06	12	286263	4994987
151.34.156	06/05/06	12	292734	4974049
151.34.156	06/12/06	12	292581	4971838
151.34.156	06/15/06	12	292259	4971116
151.34.156	06/20/06	12	290946	4969508
151.34.156	06/23/06	12	289373	4968105
151.34.156	07/31/06	12	281669	4962566
151.34.156	08/09/06	12	281970	4962450
151.34.156	08/17/06	12	281604	4962593
151.34.156	08/30/06	12	281575	4962570
151.34.156	09/05/06	12	281557	4962567
151.34.156	09/11/06	12	292604	4974907
151.34.156	09/20/06	12	290543	4988716
151.34.156	09/26/06	12	286255	4995078
151.34.156	10/04/06	12	286319	4995283
151.34.156	10/11/06	12	286269	4994991
151.34.156	10/17/06	12	286237	4995487

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.156	10/26/06	12	286237	4995487
151.34.156	11/01/06	12	286237	4995487
151.34.157	06/05/06	12	292462	4976908
151.34.157	06/12/06	12	292600	4976806
151.34.157	06/15/06	12	292597	4976682
151.34.157	06/20/06	12	290870	4969494
151.34.157	06/23/06	12	288901	4967822
151.34.157	06/30/06	12	285212	4959641
151.34.157	08/22/06	12	281782	4953530
151.34.157	09/26/06	12	292408	4976962
151.34.157	10/04/06	12	292593	4976736
151.34.157	10/11/06	12	292615	4976764
151.34.157	10/17/06	12	292590	4976729
151.34.157	10/26/06	12	292590	4976729
151.34.157	11/01/06	12	292590	4976729
151.34.158	06/05/06	12	292431	4976953
151.34.158	06/12/06	12	292301	4977304
151.34.158	06/15/06	12	292605	4976763
151.34.158	06/20/06	12	292796	4976316
151.34.158	06/29/06	12	290930	4969361
151.34.158	07/12/06	12	285896	4962167
151.34.158	07/31/06	12	285387	4959715
151.34.158	08/09/06	12	285736	4960868
151.34.158	08/17/06	12	285826	4961137
151.34.158	09/06/06	12	285200	4957120
151.34.158	09/11/06	12	285342	4959562
151.34.158	09/20/06	12	292758	4974760
151.34.158	09/26/06	12	291665	4980555
151.34.158	10/04/06	12	291672	4980306
151.34.158	10/11/06	12	291645	4980466
151.34.158	10/17/06	12	291620	4980697
151.34.158	10/26/06	12	291620	4980697
151.34.158	11/01/06	12	291620	4980697
151.34.161	07/16/06	12	291371	4984379
151.34.161	07/26/06	12	292088	4978101
151.34.161	07/31/06	12	292456	4973400
151.34.161	08/08/06	12	292425	4973054
151.34.161	08/09/06	12	292566	4973678
151.34.161	08/15/06	12	292426	4973267
151.34.161	08/28/06	12	292426	4973267
151.34.161	09/07/06	12	292523	4973544

Appendix B. Continued.

Frequency/ Code	Relocation Date	Zone	GPS Location	
			Datum - NAD 27	
			UTM Easting	UTM Northing
151.34.161	09/11/06	12	292539	4973562
151.34.161	09/12/06	12	292649	4976610
151.34.161	09/20/06	12	290995	4985259
151.34.161	09/26/06	12	290998	4985397
151.34.161	10/04/06	12	290981	4985289
151.34.161	10/11/06	12	290999	4985391
151.34.161	10/17/06	12	290991	4985431
151.34.161	10/26/06	12	290991	4985431
151.34.161	11/01/06	12	290991	4985431

Appendix C. Detailed relocation descriptions of five radio-tagged bull trout not included in migration timing analysis.

1) Code 130 was the first fish tagged during this study on April 14, 2006 and remained near the tagging/release site at rkm 30.0 until at least May 18. On May 26, code 130 had moved down 1.5 km from the release site and remained in this area until June 5. From June 5 to June 12 the radio-tagged bull trout moved down the Lemhi River an additional 9.7 km to 100 m above Wimpey Creek and it was relocated here on four occasions from June 15 to July 12. On July 13, the transmitter was recovered in the riparian area just above the wetted stream bank 11.0 km downstream from the tagging location.

2) Code 132 was tagged on April 21, 2006 at rkm 34.3 and remained near this location until the transmitter was recovered on July 26. From April 21 to at least June 15 the radio-tagged bull trout was observed, via radio-tracking equipment, moving up and down within 200 m of the tagging/release site. On June 20, code 132 returned to the pool where it was originally released and here the tag was recovered via snorkeling.

3) Code 141 was tagged on April 29, 2006 at rkm 45.2 and remained within 0.3 km of the tagging/release site until at least May 30. On June 5, the radio-tagged bull trout was relocated 2.9 km upstream from the release site and then on June 7 code 141 was relocated in Hayden Creek 0.9 km above the confluence with the Lemhi River, 4.6 km upstream from the release site. Five days later this bull trout had moved 15.3 km downstream and then it move an additional 5.3 km downstream over the next three days. Code 141 was not relocated again until July 10 when the radio tag was recovered on the banks of the Salmon River 55.8 km downstream from the furthest upstream relocation in Hayden Creek. The data logging fixed station at the mouth of the Lemhi River was non operational from June 16 to June 22 due to receiver failure and code 141 was not detected at this fixed site before or after these dates, therefore the radio-tagged bull trout entered the Salmon River during the non operational time frame.

4) Code 147 was tagged May 4, 2006 at rkm 23.0 and remained within 1.2 km of the tag/release site until at least June 29. On July 16, code 147 was relocated 20.7 km upstream from the release site at which point the fish began a continuous downstream movement. The bull trout had traveled 4.3 km downstream by August 1 when snorkeling equipment was used to obtain a visual to confirm the status of the fish. During the snorkeling event, it was noted that the bull trout was alive yet it had a circular open wound 2 cm in diameter in the top left portion of its head and, consequently, was not swimming too strongly. By August 3, code 147 had traveled an additional 7.6 km downstream and a second visual confirmed code 147 was still alive. The radio transmitter was recovered on August 10 in mid-river at a depth of 75 cm after the fish had traveled an additional 3.9 km downstream. No carcass was located.

5) Code 150 was tagged on May 10, 2006 at rkm 18.5 and remained with 0.2 km of the tag/release site until at least June 5. On June 12, code 150 was relocated 11.1 km downstream from the tagging location and no other relocations have been obtained to date. The Lemhi mouth fixed telemetry station was not operational at this time and therefore no data exists to determine the date at which this fish entered the Salmon River. On June 30 an attempt was made to relocate code 150 in the Salmon River from the town of Salmon to Challis, Idaho without success. A second attempt took place on July 10. On this date, the Salmon River from the town of Salmon to the Middle Fork of the Salmon River was tracked as was the North Fork of the Salmon River, including the roaded sections of the North Fork tributaries. Code 150 was not detected in any of these areas. It is suspected the transmitter battery expired prematurely.

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