

RECLAMATION

Managing Water in the West

Technical Report for Arrowrock Dam Biological Opinion
#1009.0405 OALS #00-912 and Upper Snake Biological Opinion #
1009.2700

Arrowrock Dam Outlet Works Rehabilitation Endangered Species Monitoring and Mitigation Program

Compilation of 2003 monthly summary reports for radio telemetry
investigations for bull trout (*Salvelinus confluentus*)



ARROWROCK DAM OUTLET WORKS REHABILITATION ENDANGERED
SPECIES MONITORING AND MITIGATION PROJECT

Compilation of monthly summaries for radio telemetry investigations for listed bull trout
(*Salvelinus confluentus*), Boise, Idaho
2003

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Adult Bull Trout Movement and Habitat Use Upstream from Arrowrock Reservoir January 2003

Most of the adult fish have appeared to settle in for the last few months of winter. During the last telemetry flight (23 January), we located 31 adults. The majority of the adult fish appear to be overwintering in this section of the reservoir and lower South Fork. Seven adults had moved approximately 2.4 – 6.4 km. Most of these movements were upstream in the South Fork arm of Arrowrock Reservoir or the South Fork of the Boise River. The number of locations and the number of movements were similar to those recorded during the flight on 15 January. However, the majority of the six fish that moved between 8 January and 15 January moved downstream.

Table 1 shows the current distribution of adult bull trout in the Boise River watershed upstream from Arrowrock Dam. One fish was entrained below Arrowrock Dam in 2002 and has maintained a position approximately 1 km downstream from the dam since that time.

Table 1.

Location	Tag Code
Entrained	81
Arrowrock Reservoir	20, 60, 77, 79, 82, 83
South fork Arm, Arrowrock Reservoir	30, 61, 68, 70, 73, 87, 89
Boise River Mainstem	22, 62
North Fork Boise River	86
Middle Fork Boise River	37, 31
South Fork Boise River	23, 26, 27, 28, 29, 32, 33, 36, 39, 64, 65, 71, 72, 80, 83, 88, 29

Since 8 January, we have confirmed five adult mortalities (10.0% of total tagged, 2 with archival tags). Several tags have been collected on land, suggesting mammalian predators.

Accounting for the known mortalities, there are 45 active tags still in fish within the system. The number of tag codes not interrogated during the last two telemetry flights suggests that these fish are currently residing in the reservoir and are therefore, undetectable from the air.

Adult Bull Trout Movement in Anderson Ranch Reservoir

During the last flight over Anderson Ranch Reservoir, we collected location data on eight of the 12 radio-tagged fish. During flights over Anderson Ranch Reservoir we have routinely collected information five or six individuals, suggesting these fish are residing in deep water and are undetectable from the air. No entrainment below the dam has been documented at this time.

2002 Small Bull Trout Radio Tags in Arrowrock

Sixty eight bull trout < 400mm total length were tagged during the weir operation in 2002, all at the North Fork Boise River weir trap. Tags were distributed by size:

- 41 Large (4.5 g tags)
- 19 Medium (3.6 g tags)
- 8 Small (1.9 gram tags)

As of January 29th, 19 Bull trout <400 mm total length were located in Arrowrock Reservoir. The size of the radio tags in these fish are:

- 12 Large tags
- 6 Medium tags (3 of these fish could have received large tags by weight)
- 1 Small tag

In addition, 4 small bull trout have become entrained into Lucky Peak Reservoir from Arrowrock Dam. These are:

- 3 Large tags
- 1 Medium tag

2 radio tagged bull trout have not been located since they were tagged, suggesting tag malfunction or removal from the system.

2 bull trout have not been located since 10/29:

- 1 Medium tag last located on 9/24 at Rabbit creek station
- 1 Large tag last located downstream from Twin Springs on 10/29

There are 19 small bull trout documented mortalities (27.9% of total tagged):

- 2 bull trout with small tags (25.0% of total tagged).
- 6 bull trout with medium tags, 3 of these fish were large enough for large tags weighing 302g , 266g, and 164g (31.5 % of total tagged).
- 11 bull trout with large tags have died or shed their radios (26.8% of total tagged).

Juvenile Bull Trout Movement Summary –February 2003

Of the 68 < 400mm bull trout radio tagged:

There are 19 bull trout located in Arrowrock Reservoir (28%) and four bull trout entrained into Lucky Peak Reservoir (6 % of those tagged, these are not counted in Arrowrock reservoir fish). One of the fish in Lucky Peak has been holding in the Mores Creek arm, just upstream of the Highway 21 bridge. Six fish are in the mainstem Boise River, two fish are in the Middle Fork Boise River and 12 fish are in the North Fork Boise River canyon between Rabbit Creek and the confluence. Nine fish are near in the North Fork between Barber Flat and Rabbit Creek (43% currently within the river system). Two radio tagged bull trout not located since tagging (both large tags). There are 15 documented mortalities for juvenile bull trout with radio tags (22 %).

The medium sized tags are running out of batteries and the small radios have been expired since mid-December. This leaves 41 juvenile size bull trout to track. Of these:

- 8 are confirmed mortalities
- 5 are in the North Fork Boise River
- 6 in the North Fork Canyon between Rabbit Cr. and the confluence
- 1 upstream in the Middle Fork and still moving slowly upstream
- 4 in the Mainstem Boise River
- 13 in Arrowrock reservoir
- 2 in Lucky Peak (+ 1 Mortality included above)

We will continue our ground tracking to validate survival as weather and water levels allow throughout the spring. There are 2 fish (codes 174, 150) in the mainstem river that are suspiciously still. Survival validation will occur as soon as weather and river flow allow.

Warm weather and rain in late January seems to have confused the juvenile fish causing a bit of movement within the watershed:

Fish 136 (was near Alexander Flat on the Middle Fork) moved down to Arrowrock in < 3 days. Fish 193 and 197 (a suspiciously still fish that had not passed the rock check test) moved downstream about 4 kilometers. Survival was validated by ground tracking. Fish 154 reappeared in Arrowrock and was staging at the mouth of the river. He has since moved back into the depths of Arrowrock reservoir near Cottonwood Creek. Fish 170 and 177 also moved into the upper end of Arrowrock (Trail Cr), they have since dropped back to near Irish Creek in the reservoir.

Fish 162 resurrected herself from under the ice downstream of Black Rock Campground. She had been assumed a mortality in early December. She proved us wrong by moving 17.5 kilometers downstream to near Haga Creek in less than 48 hours (1/29-1/31). The batteries ran out on her radio tag a few days later.

Adult Bull Trout Movement Summary – February 2003

The majority of adult fish appear to be continuing to over-winter in the South Fork of the Boise River (SFBR) and the lower section of Arrowrock Reservoir. Fifteen individuals made no movements during the month of February. The remaining individuals have moved at least one time; however, these movements have been 1-5 km in length with no trend in directionality. Although these movements do not account for error due to aerial tracking and GPS location accuracy. If flight error is incorporated, it is possible that several of the mobile individuals have in fact remained sedentary. We did observe one individual make a substantial downstream movement within Arrowrock Reservoir. This individual moved from the confluence with Irish Creek to the confluence with Dutch Creek in 24 hours. Additionally, one large fish began upstream movement with the warmer temperatures and higher flows of late February and is currently in the mainstem Boise River above Twinsprings.

We have very little new data on the individual that was entrained below Arrowrock Dam. Recent telemetry flights have failed to detect the signal near Macks Creek, where this animal was residing. It is possible that this individual has moved down into Lucky Peak Reservoir; however, we have failed to detect its signal. We will continue tracking Lucky Peak for this fish and also check the Mores Creek area.

March Juvenile Movement Update

We have a total of 68 < 400mm (juvenile sized) bull trout radio that were tagged at the North Fork Boise River weir trap in 2002:

- 41 fish received large (4.5 g tags)
- 19 fish received medium (3.6 g tags)
- 8 fish received small (1.9 gram tags)

Table 1. Juvenile fish locations for March 2003

	Arrow-rock Reservoir	Lucky Peak Reservoir	Boise R.	MF Boise R.	N.F. Boise R. Canyon	NF upstream from Rabbit Creek	Mortalities	Unknown
Large tags (# fish)	12	3	5	1	6	5	8	2
Medium tags (# fish)	6	1	2	1	2	2	5	
Small tags (# fish)					4	2	2	

Warm weather, rain and rising water in Arrowrock Reservoir in March resulted in fish movement up and out of Arrowrock Reservoir. Stream flows peaked at 1200+ CFS (33.98 m³/s) on March 16th (precipitation on 3/12-3/16). Stream temperature increased from 0.56° C in early March to 6.1° C on 17 March. River temperatures and stream flows are continuing to vacillate with precipitation events and warmer weather, reaching over 2000 CFS (56.63 m³/s) and temperatures rising to 5.5° C during 23 March.

Increasing water levels in Arrowrock reservoir are making radio-tagged fish much more difficult to locate. Arrowrock forebay water elevation was 3,146 on January 20th, 3,178 on Feb 20th and 3,198 on 24 March. On 23 January, 8 of 12 radios were located in Arrowrock, compared to 5 of 12 radios on 19 March. These locations are a combination of ground and flight information. On each occasion some fish were located by one method and not the other. This information reinforces the need to do both ground and aerial tracking and also that all radio frequencies should be scanned whenever tracking occurs. Bull trout are moving up into the shallower sections of Arrowrock near the mouth of the river. These fish are easier to locate, however fish that remain in the main body of Arrowrock reservoir are much more difficult to locate and identify. Many times a signal is heard, but it is too weak for the receiver to decode.

Significant Juvenile Bull Trout Movements

Fish 193 moved upstream about 5 km from Twin Springs (20 Feb.) to Sheep Creek, 5 March) on the Boise River.

Fish 152 was located sheltered near an undercut bank close to Nienneyer Hot Springs on 5 March and 11 March. This fish moved downstream 2 km to near Breadwinner Creek on the Middle Fork (17 March)

Fish 170 moved into from near Irish creek (18 Feb) out of the reservoir and was located near Slide Gulch on the Boise River (17 March). Fish 170 was not located in the reservoir between these 2 dates.

Fish 175 was last located on 29 October moving downstream past the Twin Springs fixed station. On 17 March, fish 170 was located in Arrowrock (ARK) reservoir near Grouse Creek. On 19 March 175 was located staging near the river mouth 16.5 river km upstream from Grouse Creek.

Fish 154 reappeared in ARK on 31 January and was staging at the mouth of the river (last seen 4 December in ARK in the South Fork Arm). She moved back into the depths of ARK near Cottonwood Creek when the weather turned cold and river flow decreased. On 11 March she was located near Twin Creek which is 3 km upstream. On 17 March she was staging near the mouth of the Boise River again, 2.5 km upstream.

Fish 195 has exhibited a similar pattern of movement to fish 154 as stream flows and temperature increase then decrease. 195 is currently located near Lambing Creek in Arrowrock reservoir, 3.5 km upstream from its last location on 18 February.

Movements of approximately 2 km by fish 152, 154 and 195 were confirmed using separate ground locations for each fish. Movement was not detectable at that scale using data from aerial tracking from the same dates.

March Adult Bull Trout Movement Update

We have a total of 50 adult sized fish that were tagged with radios in 2002 at the North and Middle Fork Boise River weirs (Arrowrock group) and 12 tagged in Anderson Ranch reservoir. Radios have a battery life from 1-5 years. Twenty adult sized fish also were tagged with temperature/depth archival tags in the Arrowrock group and 11 in the Anderson Ranch (AND) group. We have 6 suspected mortalities for the 62 tagged fish.

Table 2. Adult fish locations for March 2003.

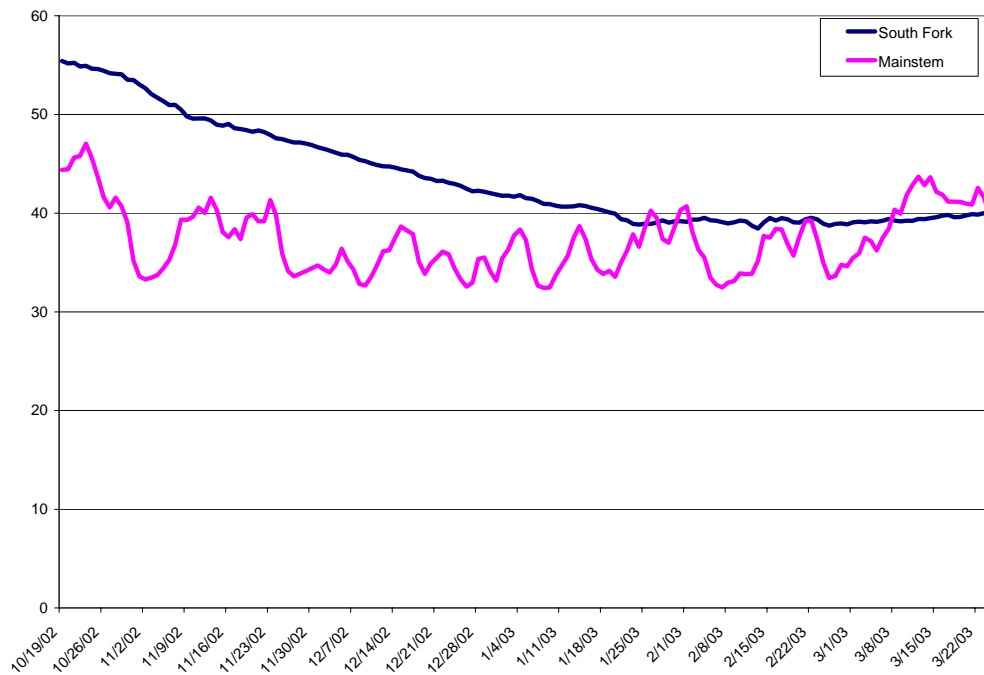
	Arrow-rock Reservoir	Lucky Peak Reservoir	Anderson Ranch Reservoir	South Fork Boise R.	Main Boise R.	Mortalities	Not Found in March
Arrowrock Bull Trout (# fish)	7	1		24 (below AND Dam)	4	5	9
AND Bull Trout (# fish)			4	3 (above Pine)		1	4

The majority of adult fish from the Arrowrock tag group appear to be continuing to over-winter in the South Fork of the Boise River (SFBR) below Anderson Ranch dam and the lower section of Arrowrock Reservoir. Recent analysis has suggested that our resolution of movement distance based on aerial locations may be as much as 3 km. There is little evidence to suggest that the adults in the SFBR are beginning their spring migration. The majority of movements recorded during flights on 5 March and 21 March were upstream movements. We recorded five upstream movements on during the 5 March flight. Two of the individuals that were determined

to have moved on 5 March also made upstream movements between 5 and 21 March. This conclusion is based on location data collected on 21 March. One individual had been residing at the base of Anderson Ranch Dam moved from that location downstream to another approximately half the distance between Anderson Ranch Dam and the confluence with Arrowrock Reservoir. Based on the data collected during a 24 March flight, four adults have moved from Arrowrock Reservoir into the mainstem Boise River; however, fish overwintering in the SFBR have remained relatively sedentary.

The SFBR overwintering group of fish raised some interesting questions for our work. We did not expect such a large component of the Arrowrock tag group to follow fluvial life history patterns. Several questions were raised about their behavior. One possible explanation for the differences in SFBR movement patterns may be low variation in temperature and flow that the South Fork Boise River has due to regulation at Anderson Ranch dam in comparison to the mainstem Boise River (Figure 1). This may provide milder habitat in addition to reducing movement as a result of temperature and flow fluctuations that we see in fish that remain in the mainstem Boise or Arrowrock. We will continue to investigate questions related to the overwintering behavior patterns for the Arrowrock tag group.

Figure 1. Winter temperatures (°F) at South Fork Boise River below Anderson Ranch dam and the mainstem Boise River below Twinsprings.



Entrainment

The adult that was entrained downstream from Arrowrock Dam has been quite active during the month of March. This individual had been located near the Mores Creek arm of Lucky Peak Reservoir during most of March, and was located there on the 19th of March. It was not located during the morning flight of 21 March, but was found on the dam logger monitoring the spilling basin early that morning. We have documented only one adult fish that has been entrained since the inception of our adult monitoring program last September. However, little water has been released from the dam since the large spilling event in November and December. Entrainment may become more likely with spring releases increasing from the upper valves in conjunction with increased fish movement corresponding to increased stream temperatures and flows. No entrainment was documented in March at Arrowrock dam.

Anderson Ranch Fish Movement

We located two adults while during flights from the upper end of Anderson Ranch Reservoir to one mile up Big Smoky Creek. One of these fish was located near Featherville and the other was located in Big Smoky Creek approximately one mile up from its confluence with the SFBR. We will continue exploratory flights throughout the South Fork watershed to attempt to locate the remaining three fish that have not been found. No entrainment has been documented Anderson Ranch dam.

April Juvenile Bull Trout Movement Update

We have a total of 68 < 400mm (juvenile sized) bull trout that were tagged with radios at the North Fork Boise River weir trap in 2002:

- 41 fish received large (4.5 g tags)
- 19 fish received medium (3.6 g tags)
- 8 fish received small (1.9 gram tags)

Only 41 juveniles sized fish still have active transmitters (large). All other transmitters have had the batteries expire. Currently, there are 10 juveniles remaining in Arrowrock reservoir, seven in the mainstem Boise River, two in the Middle Fork Boise River, 12 in the North Fork Boise River, six mortalities, and two fish that have not been found (Table 1 and Figure 1).

Table 1. Most Current Fish Locations as of 04/23/03

Location	Number of Fish
Arrowrock Reservoir	10
Boise River main stem	7
Middle Fork Boise River	2
North Fork Boise River-confluence to Rabbit Creek	6
North Fork Boise River upstream from Rabbit Creek	6
Mortalities	6
Unknown	2

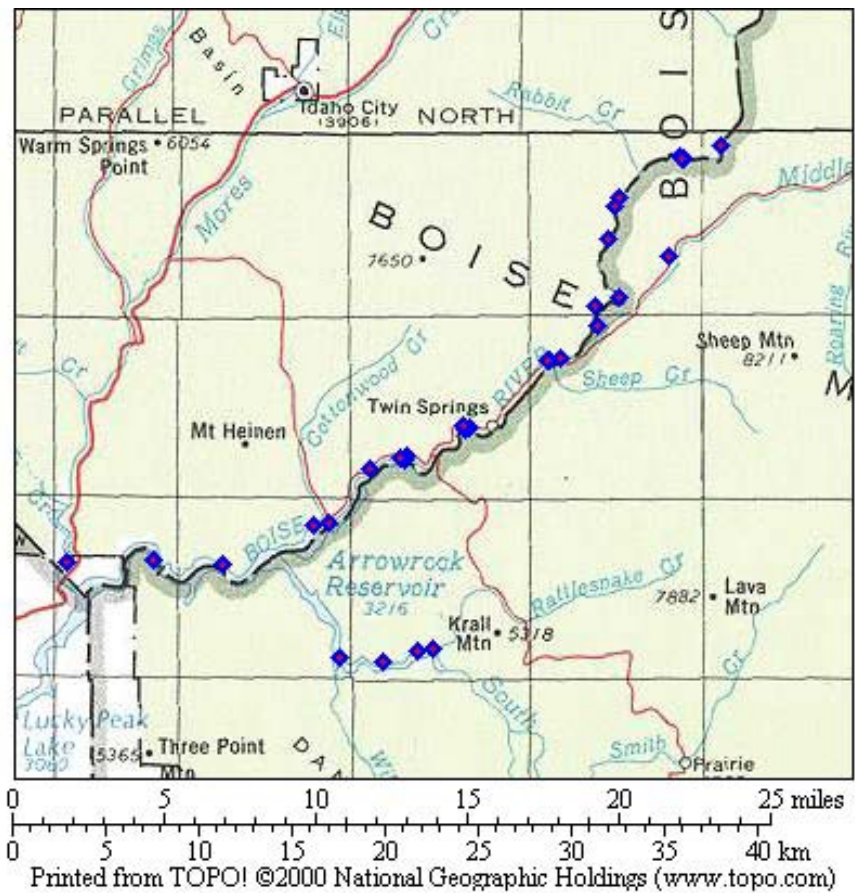


Figure 1. Most current locations of active radio transmitters not considered mortalities.

Juvenile movements found during ground and aerial telemetry tracking

Movement in juvenile bull trout has been quite variable, with some fish moving both up and downstream. Some movement has been quite localized, simply moving between pools less than a kilometer of distance. Direction of movement and cause for juvenile bull trout does not have a very clear pattern in juvenile bull trout.

Fish 132 had been located in Arrowrock reservoir upstream from Cottonwood Creek Arm from 1/8/03 through 4/4/03. On 4/15 he was located near Twin Creek in Arrowrock Reservoir. On 4/22 he had moved up into the river near Willow Creek. The radio tag has not been located with ground or aerial tracking since 4/22.

Fish 136 was located in Arrowrock reservoir near Grouse Creek on 3/24. On 4/2 and 4/10 he was located in the Boise River near Willow Creek. On 4/15 he was located 2.5 kilometers upstream near the Hydromet station. On 4/22 and 4/29 he was located 3.5 km upstream from the Hydromet gauging station.

Fish 152 made small movements that were verified using weekly ground tracking data. As river flow changed 152 moves upstream or downstream between Breadwinner and Repeat Creek on the Middle Fork Boise River. Fish 152 was not located during ground tracking on 4/22 or 4/29 or in the flight on 4/23.

Fish 170 moved upstream to the FS Road # 113 bridge over the Boise river on 3/24. On 4/10, this fish was located in the Arrowrock slack water/ river interface. This radio has not been located since 4/10.

Small-scale movements (<0.25km) have been made by fish 174 using ground telemetry data. This fish moves downstream to a larger pool as river flows increase, and then returns to a small pool when flows diminish.

Fish 193 moved upstream near the mouth of Sheep Creek about 0.25 km on both the 4/22 and 4/29 ground tracking expeditions.

Fish 197 has been in the same location since 1/31. On 4/15 he was found 0.5 km downstream while ground tracking. This radio tag has not been located during later ground or aerial tracking attempts.

Fish 207 is proving a mystery. This fish has been located in the same position since 11/26/02. In January snorkel validation was attempted resulting in no fish sighted and no movement detected. It was assumed that the fish died or shed its' radio tag. On 4/9 the radio tag was located using ground telemetry 0.25 km upstream around a river bend from its previous location. It was been located on all subsequent tracking attempts in the location where it was snorkeled for in January.

Figure 2 shows movement occurring with corresponding river temperature and discharge from the USBR Hydromet gauging station located near Twin Springs on the

Boise River. A sampling interval of 1 week makes it difficult to determine the nature of the relationship between river flow, temperature and fish movement as exact date of movement is unknown. In addition, although all frequencies are scanned during each tracking session, speed of travel and water depth cause individual radio tags to be missed from week to week. Figure 2 and Table 1 show movement and sampling interval.

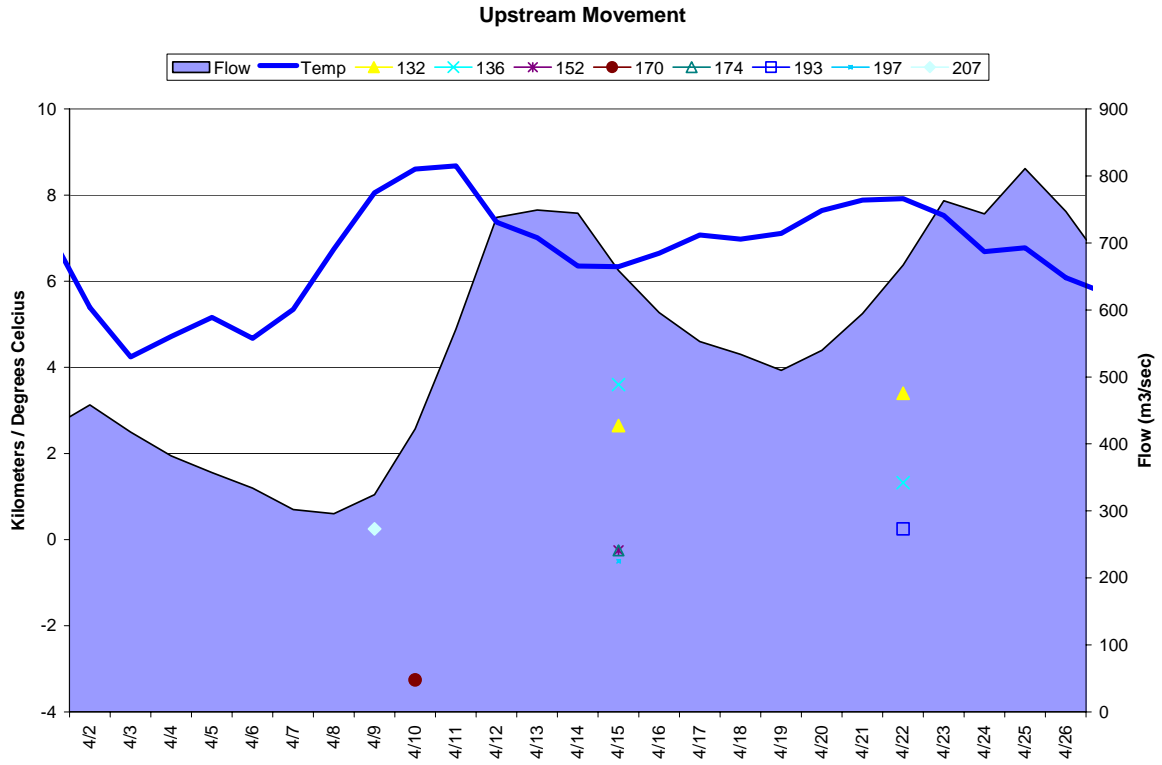
Table 1. Fish locations and net upstream movement. A value of zero indicates that the radio tag was located but that it has not changed location since the last observation.

Code	3/24	4/3	4/5	4/9	4/10	4/15	4/22	4/23
132		Ark Cottonwood		0		2.65	3.4	
136	Ark Dutch Creek	Willow Creek	0	0	0	3.6	1.32	
152	MF Repeat Creek	0	0	0	0	-0.25		
170	US Prairie Bridge				-3.26			
174	US Sheep Creek		0	0	0	-0.25	0	0
193	DS Sheep Creek	0		0	0	0	0.25	
197	Badger Creek		0		0	-0.5		
207	NF/MF Confluence	0	0	0.25	0	0	0	

Projected work for May

Ground tracking to validate movement and survival and will continue as weather and water levels allow. Radio transmitters implanted in juvenile bull trout are running out of battery life. Aerial tracking on 4/23 located 10 juvenile radio transmitters compared to 23 located on 4/9. This is not due to fish located in Arrowrock reservoir. Water levels have been holding steady then slowly declining in Arrowrock since mid April. Several transmitters that were located out of water have also been lost in the past few weeks. Ground tracking on 4/29 indicates that more radio transmitters are near battery life expiration. Unfortunately these radios seem to be running out weeks before their projected expiration date and the month of May could be our last chance to collect movement data from most of them.

Figure 2. Upstream Movement of Juvenile Bull Trout in the Middle Fork and Mainstem Boise River graphed with river temperature and flow.



April Adult Bull Trout Movement Update

This summary contains information about adult bull trout in the upper Boise River watershed, including the mainstem and Middle, North, and South Forks of the Boise River, Arrowrock Reservoir, and Anderson Ranch Reservoir. The migration behavior of adults that overwintered in Arrowrock Reservoir appears to differ from those that overwintered in the South Fork. Fish in the former group have begun to move upstream in the Boise River into the Middle Fork and the North Fork. However, only one individual that overwintered upstream from Rattlesnake Creek, in the South Fork watershed, has left the South Fork as of 30 April 2003. Some individuals have been observed moving upstream in the South Fork during the last month. The contrasting movement patterns between the groups may be due to the different flow and temperature regimes in the unregulated Middle and North Forks and the regulated South Fork (Figure 3).

Arrowrock, North, Middle, and South Forks Boise River below Anderson Ranch dam

As of 30 April, we have confirmed four mortalities and the status of 12 individuals is unknown. We are currently tracking a sample of 34 individuals. Twenty-two of these are currently in the South Fork. The remaining 12 are located in Arrowrock Reservoir or moving up into the tributary streams of the Middle Fork or North Fork (Table 2).

Lucky Peak Reservoir

One adult fish was entrained below Arrowrock Dam in October 2002. We had been tracking the individual downstream from the dam; however, we have lost contact with this fish and its current location and status is unknown. It was last located at in the spilling basin of Arrowrock dam on 3/21/03. We have been tracking the Mores Creek watershed in addition to Lucky Peak reservoir searching for this fish, but with no success.

Arrowrock Reservoir to Upper North and Middle Forks of the Boise River

Eight individuals were observed making consistent upstream movements during late March and early April. These individuals began their movements in late March or early April when they moved out of the reservoir and into the main stem of the Boise River. Most of these individuals overwintered at locations in the upstream portion of Arrowrock Reservoir (upstream from the South Fork Arm). As of 30 April, one individual has left the South Fork and moved upstream into the main stem of the Boise River. Most of the migrants are currently located in the Boise River near the confluence of the Middle Fork and North Fork; however, two have moved upstream of the confluence.

South Fork of the Boise River to Anderson Ranch Dam

The location of individuals in the South Fork has remained relatively consistent during April. Typical movements were of 1 to 5 km; however, few fish have demonstrated directionality in their movements. Five individuals have demonstrated

consistent upstream movements in the South Fork and only one individual has left the South Fork to begin a migration upstream of Arrowrock Reservoir.

South Fork of the Boise River upstream from Anderson Ranch Dam

The locations of radio-tagged bull trout in Anderson Ranch Reservoir have been consistent throughout the winter. We have routinely collected data on eight individuals: six in the reservoir and two upstream of the reservoir near the towns of Pine and Featherville. We are going to attempt to determine the locations of four individuals that have not been observed since tagging. It is possible these individuals are residing at water depths too great to be located using radio telemetry or they overwintered upstream of the reservoir.

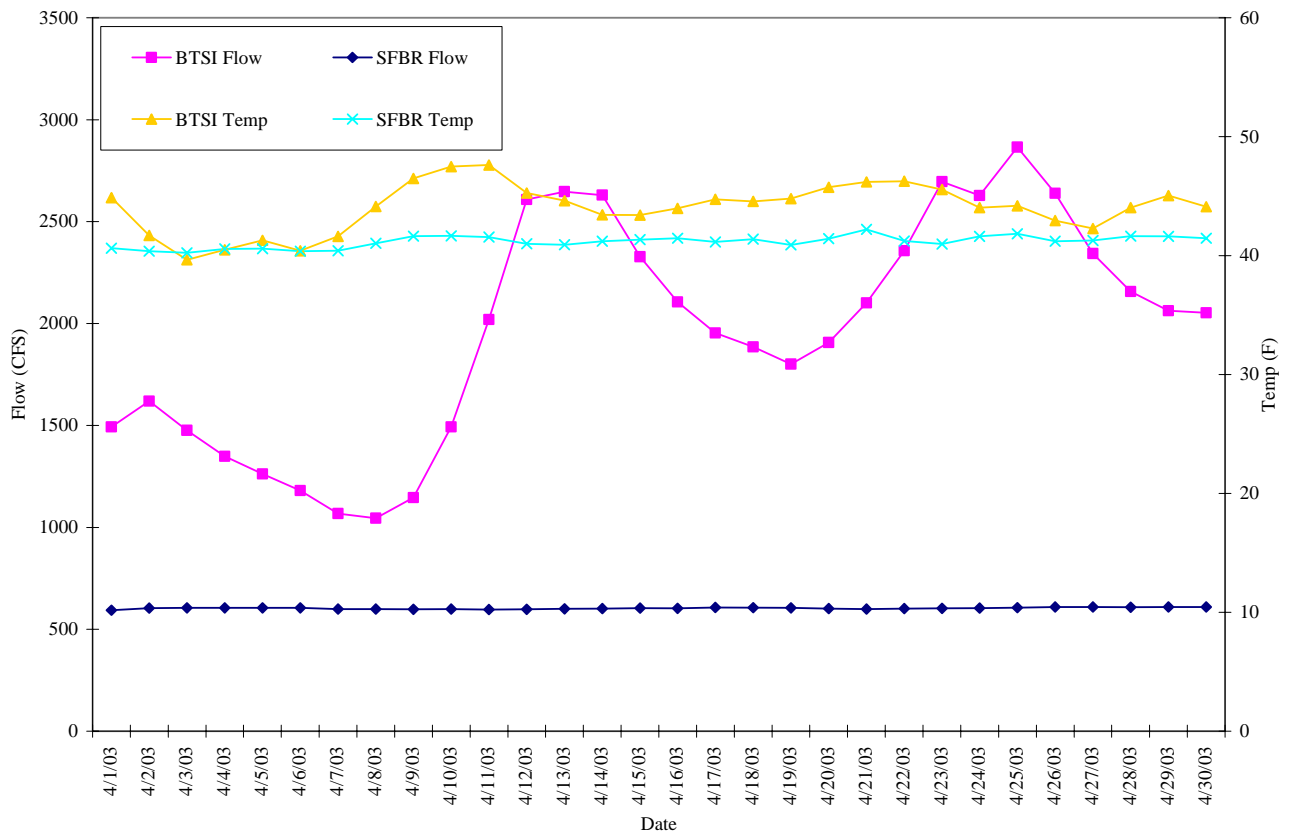


Figure 3. Mean daily temperature (F) and flow (CFS) for the Mainstem Boise River (BTSI) at Twinsprings and the South Fork Boise River downstream of Anderson Ranch dam (SFBR).

Table 2. – Current locations of radio-tagged adult (> 400 mm F. L.) in the Boise River watershed, upstream from Arrowrock Reservoir.

Location	Number of fish
Anderson Ranch Reservoir	6
Arrowrock Reservoir	2
Boise River main stem	8
Middle Fork Boise River	2
North Fork Boise River	1
South Fork Boise River, downstream*	21
South Fork Boise River, upstream*	2
Unknown	12

*Denotes locations downstream or upstream from Anderson Ranch Reservoir

Projected Adult fish work for May

We will continue our weekly flights and ground monitoring throughout May. Fish appear to be using the same stream areas to hold during the spring migration as the adult migration. These may be important refuge habitats during migration and we will continue to monitor these patterns.

May Juvenile Bull Trout Movement Update

We have a total of 68 < 400mm (juvenile sized) bull trout that were tagged with radios at the North Fork Boise River weir trap in 2002:

41 fish received large (4.5 g tags)

19 fish received medium (3.6 g tags)

8 fish received small (1.9 gram tags)

Only four juveniles sized fish still have active transmitters (large). All other transmitters have had the batteries expire. Currently, there are no juveniles remaining in Arrowrock reservoir, one in the mainstem Boise River, one in the Middle Fork Boise River, two suspected mortalities, and two fish that have never been found (Table 1)

Table 1. Most Current Fish Locations as of 04/23/03

Location	Number of Fish
Arrowrock Reservoir	0
Boise River main stem	1
Middle Fork Boise River	1
North Fork Boise River-confluence to Rabbit Creek	0
North Fork Boise River upstream from Rabbit Creek	0
Mortalities	2
Unknown	2

Juvenile movements found during ground and aerial telemetry tracking

Movement in juvenile bull trout has been generally upstream, with two fish moving upstream more than 3 kilometers. Some movement has been quite localized, simply moving between pools less than a kilometer of distance.

Fish 136 was located in the Boise River near Willow Creek on 4/10. On 4/15 he was located 2.5 kilometers upstream near the Hydromet station. On 5/5, he was located 5/15 at Twin Springs fixed station and was near Browns Creek on the 20th of May.

Fish 193 near the mouth of Sheep Creek in April and was located once in May in the North Fork Boise River 2 kilometers above the confluence.

Fish 207 continues to prove his ghostly qualities. This fish has been located in the same position since 11/26/02. In January snorkel validation was attempted resulting in no fish sighted and no movement detected. It was assumed that the fish died or shed its' radio tag. On 4/9 the radio tag was located using ground telemetry 0.25 km upstream around a river bend from its previous location. It was been located moving throughout the .25 km section of stream at the Middle Fork-North Fork confluence during May.

Projected work for June

Ground tracking to validate movement and survival and will continue as weather and water levels allow. Radio transmitters implanted in juvenile bull trout are running out of battery life. Aerial tracking on 4/23 located four juvenile radio transmitters compared to 10 located on 5/22. This is not due to fish located in Arrowrock reservoir. Water levels have been slowly declining in Arrowrock since mid April.

May Adult Bull Trout Movement Update

There continues to be a divergence in behavior patterns of adult bull trout which overwintered in Arrowrock reservoir and those which overwintered in the South Fork Boise River. Large-scale movements have occurred in the Arrowrock overwintering group into the North and Middle Forks of the Boise River. Five of these fish have moved over 10 km in the month of May. Generally, most fish that overwintered in the South Fork Boise River continue to show localized movement (within 1 km), however two individuals moved over 10 km downstream during the third week of May.

Arrowrock, North, Middle, and South Forks Boise River below Anderson Ranch dam

As of May 22nd, we have seven mortalities and the status of eight individuals is unknown. Twenty-two of these continue to remain in the South Fork Boise River. The remaining fish are located in Arrowrock Reservoir or moving up into the tributary streams of the Middle Fork or North Fork (Table 2).

Lucky Peak Reservoir

One adult fish was entrained below Arrowrock Dam in October 2002. We had been tracking the individual downstream from the dam; however, we have lost contact with this fish and its current location and status is unknown. It was last located at in the spilling basin of Arrowrock dam on 3/21/03. We have been tracking the Mores Creek watershed in addition to Lucky Peak reservoir searching for this fish, but with no success.

Arrowrock Reservoir to Upper North and Middle Forks of the Boise River

Eight individuals were observed making consistent upstream movements during early May within the North and Middle Forks of the Boise River. Two fish are currently holding as far upstream as Roaring River with three other between Roaring River and the Middle Fork confluence. Three fish are upstream of the confluence in the roadless area of the North Fork Boise River. All fish are showing affinity for similar holding areas that were used during the fall migration period.

South Fork of the Boise River to Anderson Ranch Dam

Movement in the South Fork below Anderson Ranch Reservoir has been relatively limited during the month of May. Most movement was in an area 1-2 km in length. No fish moved out of the South Fork Boise River during the first three weeks of May, but two fish moved downstream more than ten kilometers in third week of May. We anticipate more largescale movement out of the South Fork as the summer moves in with warmer temperatures.

Table 2. – Current locations of radio-tagged adult (> 400 mm F. L.) in the Boise River watershed, upstream from Arrowrock Dam.

Location	Number of fish
Arrowrock Reservoir	2
Boise River main stem	2
Middle Fork Boise River	5
North Fork Boise River	3
South Fork Boise River, downstream*	22
Unknown	8

Projected Adult fish work for June

We will continue our weekly flights and ground monitoring throughout June. Fish appear to be using the same stream areas to hold during the spring migration as the adult migration. These may be important refuge habitats during migration and we will continue to monitor these patterns. We have met with the Idaho Department of Fish and Game to discuss the important holding areas and additional enforcement. We will be working closely with IDFG to report any poaching we may encounter and also potential problem areas where many fish are holding.

June Juvenile Bull Trout Movement Update

We had a total of 68 < 400mm (juvenile sized) bull trout that were tagged with radios at the North Fork Boise River weir trap in 2002:

41 fish received large (4.5 g tags)

19 fish received medium (3.6 g tags)

8 fish received small (1.9 gram tags)

Currently there is 1 juvenile to track, fish code 207, which had a 50% duty cycle set on the tag so the tag life is extended approximately 2 months. This fish has moved downstream approximately one mile in the month of June. The juvenile bull trout work was funded as a graduate study between Boise State University and Reclamation. Lauri Hostettler is the student and Reclamation employee working on the study. Lauri has completed a draft report of the 2001 fall movement and is currently working on adding the 2002 data to the report. We hope to have the 2001 report finalized and available for distribution to our working group for the end of the month report for July. Lauri will be working on the full summary report and is presenting this work as part of her thesis.

June Adult Bull Trout Movement Update

The adult bull trout have started to really move with the warmer weather and increasing flows of June. We have had several fish exhibit movements of over 40 miles in less than a one week time period. The South Fork Boise River adult overwintering group has been of particular interest during the month of June due to the butterfly valve replacement project and increasing temperatures. We now have fish above Swanholm road 327 on the Middle Fork and near or possible entering the mouth of Bear River on the North Fork.

As of June 26th, we have ten suspected mortalities and the status of ten individuals is unknown, however they are presumed to be in Arrowrock reservoir from the last location information available.

We have been carefully monitoring the South Fork fishery and the tagged fish that are overwintering there due to the butterfly valve replacement at Anderson Ranch Dam. The construction work required the conversion of spill from turbines (low level intake) to surface causing an increase in temperature. We were concerned that the high temperatures may harm the fishery downstream (temperatures shown in Figure 1), and have been tracking fish and talking with anglers on the river frequently over the last two weeks of June. Only eleven fish continue to remain in the South Fork Boise River, with four of these likely mortalities. Seven of the fish in the South Fork have been moving relatively small scale movements (less than three miles) both up and down stream. We floated the roadless region of the river to confirm mortalities and check the condition of the South Fork fishery. We found several sucker in poor condition with ich infestations and several dead sucker. Condition in the whitefish captured varied from excellent to poor, some fish exhibited a minor dermal irritation. All of the rainbow trout captured were in very good to excellent condition. Two of the four mortalities of bull trout were in the roadless reach and have been in the same locations since February 11. The other two

mortalities were located at fishing access sites and could possibly be angling mortalities. They have been in these locations since December 24th.

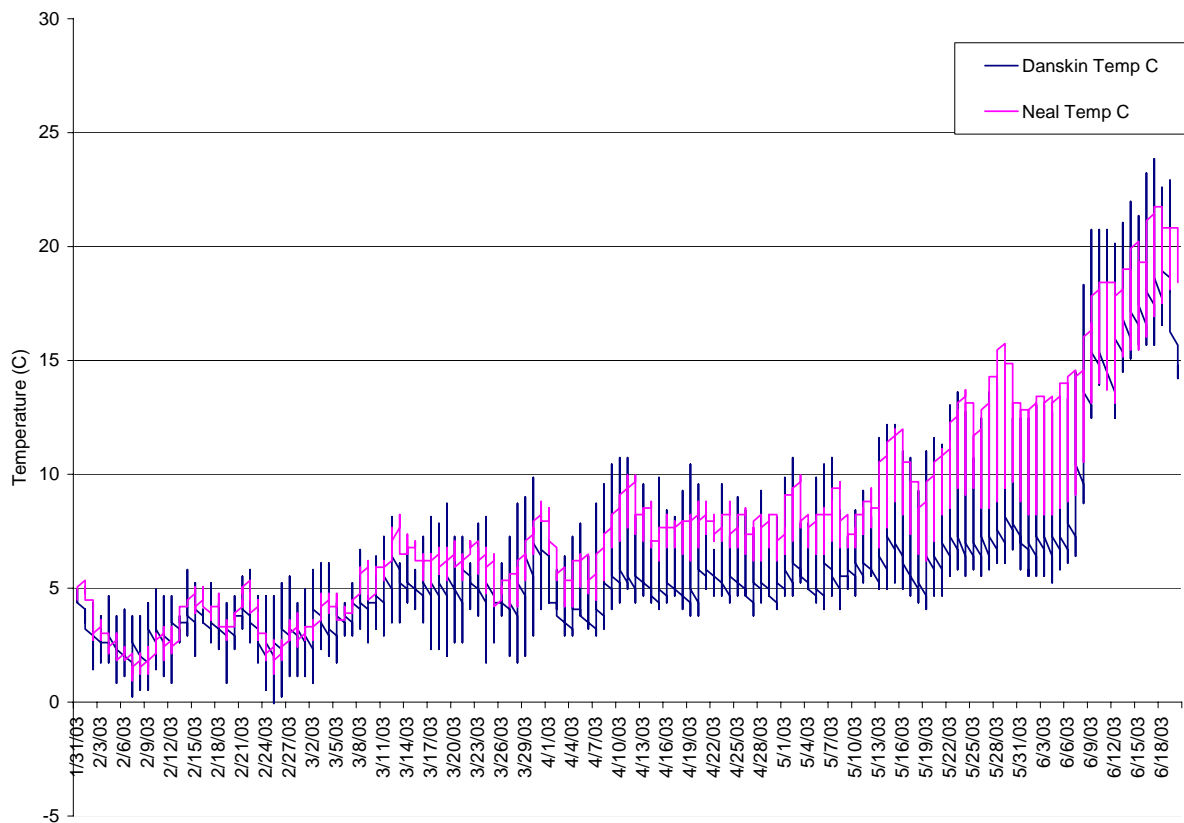


Figure 1. Hourly temperature recordings from Neal and Danskin bridges on the South Fork of the Boise River.

Lucky Peak Reservoir

One adult fish was entrained below Arrowrock Dam in October 2002. We have been tracking the individual downstream from the dam. He surfaced on June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking and was tracked on the dam remote station on June 6 through June 9 at various times of the day. We have not located the tag since June 10. We will continue tracking the Mores Creek watershed in addition to Lucky Peak reservoir searching for this fish.

Table 2. – Current locations of radio-tagged adult (> 400 mm F. L.) in the Boise River watershed, upstream from Arrowrock Reservoir.

Location	Number of fish
South Fork Boise R. above Anderson Ranch Reservoir	3
Arrowrock Reservoir	12
Middle Fork Boise River	15
North Fork Boise River	12
South Fork Boise River, downstream*	11

*Denotes locations downstream from Anderson Ranch Reservoir

Projected Adult fish work for July

We will continue our weekly flights and ground monitoring throughout July. Fish appear to be moving closer to spawning areas and may begin selecting spawning habitat in later July. We will start working on the preferred spawning habitat work when fish have moved into headwater streams.

July Juvenile Bull Trout Movement Update

Currently there is 1 juvenile to track, fish code 207, which had a 50% duty cycle set on the tag so the tag life is extended approximately 2 months. This fish had been considered a possible mortality due to lack of obvious movement for over seven months. On July 2nd this fish was found at Meadow Cr., 12 km up the North Fork Boise River from its overwintering location. This fish is currently just downstream of Lightening Creek on the North Fork Boise River, 50.8 km from its overwintering habitat. This demonstrates clearly that inactivity cannot be considered an indicator of mortality in bull trout radiotelemetry studies. The juvenile bull trout work was funded as a graduate study between Boise State University and Reclamation. Lauri Hostettler is the student and Reclamation employee working on the study. Lauri has completed a draft report of the 2001 fall movement and is currently working on adding the 2002 data to the report. We hope to have the full 2001-2002 report finalized and available for distribution to our working group for the end of the month report for December. Lauri will be working on the full summary report and is presenting this work as part of her thesis. We look forward to some of the exciting information Lauri will be presenting!!

July Adult Bull Trout Movement Update

The adult bull trout have started to access their spawning territories. We are very excited to have the first documented use of Bear River (North Fork Boise River) by two adult adfluvial bull trout. These fish entered Bear River in mid-July and we have had visual identification and collected habitat data for their locations. Both fish are at the mouth of Cub Creek, which has been the stronghold for bull trout in the Bear River electrofishing sites of the past. July movement has been quite substantial with most fish averaging over 7 km per week. We are seeing some interesting patterns in our fish, with fish that were tagged in the Middle Fork of the Boise during the fall spawning migration moving up into the North Fork Boise River spawning habitats.

The South Fork Boise River adult overwintering group continues to be quite interesting. We have five inactive fish with radios and four fish that have exhibited small scale movements from 3 km to 7 km within the South Fork. Angling reports confirm that bull trout continue to spend the summer in the South Fork Boise River and are biting on Panther Martins.

As of July 25, 2003th, we have 14 suspected mortalities and the status of six individuals is unknown, however they are presumed to be in Arrowrock reservoir from the last location information available. One radio tag was found by a camper near a fire pit at Willow Creek just after Memorial Day and returned to us. Of the 14 fish considered mortalities, seven could be attributed to angling injury or secondary infection from tagging (ceased movement more than one month after tagging), six to natural predation or age, and one to tagging. These conclusions are based on locations of tags and time of year they were found. With the lowering reservoir elevation, we are beginning to be able to locate more of the radios that have been missing since the fall.

Lucky Peak Reservoir

Fish code 81 was entrained below Arrowrock Dam in October 2002. On July 16th, fish code 83 also became entrained. Currently, we have entrained six of the 118 fish radio tagged in 2002, just over 5% of the total tagged. All of the entrainment occurred when the dam was spilling over 1000 CFS and the reservoir was < 50% of its full pool volume. We have been tracking these individuals downstream from the dam. Fish code 81 surfaced on June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking and was tracked on the dam remote station on June 6 through June 9 at various times of the day. We have not located the tag since June 10. We have been tracking the most recently entrained fish (code 83) and it has remained in the spilling basin near the dam. We will continue to track the Mores Creek watershed in addition to Lucky Peak reservoir searching for fish code 81.

Table 1. – Current locations of radio-tagged adult (> 400 mm F. L.) in the Boise River watershed, upstream from Arrowrock Reservoir.

Location	Number of fish
South Fork Boise R. above Anderson Ranch Reservoir	3
Arrowrock Reservoir/unknown	6
Middle Fork Boise River	10
North Fork Boise River	14
South Fork Boise River, downstream*	4
Lucky Peak reservoir	2
Mortalities	14

*Denotes locations downstream from Anderson Ranch Reservoir

Projected Adult fish work for August

We will continue our weekly flights and ground monitoring throughout August. Fish appear to be establishing spawning territories and we have started to get visual confirmation and habitat data collected with fish that are establishing their territories. We will continue working on the preferred spawning habitat work as fish move into and hold in headwater streams.

August Juvenile Bull Trout Movement Update

Currently there is 1 juvenile to track, fish code 207, which had a 50% duty cycle set on the tag so the tag life is extended approximately 2 months. This fish had been considered a possible mortality due to lack of obvious movement for over seven months. On July 2nd this fish was found at Meadow Cr., 12 km up the North Fork Boise River from its overwintering location. This fish was snorkeled on the North Fork Boise River and appeared to be in good condition.

August Adult Bull Trout Movement Update

The adult bull trout continue to move into their spawning territories. We have been able to get visual verification of ten of the bull trout within the spawning areas of the Middle and North Forks of the Boise River. We have not found any of the archival tagged bull trout which retained their tags and are working on a new attachment method for 2003. Fish have been verified at Johnson Creek, the North Fork Boise River at Deer Park, Bear River, and the Middle Fork Boise River.

As of August 26, 2003, we have 26 suspected mortalities and the status of four individuals is unknown, however they are presumed to have moved into someone's home in a cooler (last location on road upstream of a dam), buried under debris, or be in an atypical spawning stream from the last location information available. Of the 26 fish considered mortalities, twelve could be attributed to angling injury or secondary infection from tagging (ceased movement more than one month after tagging), eleven to natural predation or age, one to flooding, and two to tagging. These conclusions are based on locations of tags and time of year they were found. With the lowering reservoir elevation, we are beginning to be able to locate more of the radios that have been missing since the fall.

Lucky Peak Reservoir

Fish code 81 was entrained below Arrowrock Dam in October 2002. On July 16th, fish code 83 also became entrained. Currently, we have entrained six of the 118 fish radio tagged in 2002, just over 5% of the total tagged. All of the entrainment occurred when the dam was spilling over 1000 CFS and the reservoir was < 50% of its full pool volume. We have been tracking these individuals downstream from the dam. Fish code 81 surfaced on June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking and was tracked on the dam remote station on June 6 through June 9 at various times of the day. We have not located the tag since June 10. We have been tracking the most recently entrained fish (code 83) and though it had been missing for several weeks, it surface at road mile marker 3 in Lucky Peak on August 19th. We will continue to track the Mores Creek watershed in addition to Lucky Peak reservoir searching for movement from these fish..

Table 1. – Current locations of radio-tagged adult (> 400 mm F. L.) in the Boise River watershed

Location	Number of fish
Middle Fork Boise River	6
North Fork Boise River	10
South Fork Boise River, downstream*	2
Lucky Peak reservoir	2
Mortalities	26
Missing from river locations	4

*Denotes locations downstream from Anderson Ranch dam

Projected Adult fish work for September

We will continue our weekly flights and ground monitoring throughout September and will increase our ground surveys to twice weekly beginning September 15th. Fish appear to be establishing spawning territories and we will continue to get visual confirmation and habitat data collected with fish that are establishing their territories. We will continue working on the preferred spawning habitat work as fish move into and hold in headwater streams. We will also be installing the Middle and North Fork Boise River weirs and Mores Creek weir during the next week and will start our tagging project for 2003. We have been documenting the Arrowrock drawdown in conjunction with the fires and flooding by air and ground with our digital camera. We will continue taking photos throughout the project to maintain a ‘visual library’ of the conditions. Please let me know if you are interested in any photos.

Mid-September Bull Trout Movement Update

Currently, there are 51 radio tags from the 2002 fall tagging project that should be still active. We have started tagging the 2003 fish and have tagged a total of 14 bull trout in the North Fork Boise River and have just started catching bull trout at the Middle Fork Boise River.

The first two weeks of September have been a bit of a disappointment to us. Post spawning mortality appears to be quite high. Of the fish that entered spawning habitats, 45 percent were found killed. We no longer have any of the archival tagged bull trout which retained their tags and so we have begun tagging with a new attachment method for 2003. I will (hopefully) have pictures of the archival tagging attachment for the end of September update. Post spawning mortalities were verified at Johnson Creek, Black Warrior Creek, and Bear River. One fish (Code 66) was found in the mainstem Middle Fork Boise River upstream of Bald Mountain Creek. This animal had expired within a few hours from the time we found her. She had hooking injuries and scars from previous hooking, internal bruising, and the antenna of her radio tag had been trimmed flush to her body. The former exit hole of the antenna was healed. We are not sure if the cause of death was the antenna of the radio creating a new exit hole and causing internal bleeding (Figures 1 and 2), or from bruising and stress from handling (Figure 3). Most likely, the cause of death was a combination of all factors. The stomach of the animal was empty and she had large skeins of immature eggs.

As of September, 2003, we have 31 suspected mortalities and the status of two individuals is unknown, however they are presumed to have moved into someone's home in a cooler (last location on road upstream of a dam), or to be buried under debris (last location at the mouth of Lake Creek). Table 1 shows the These conclusions are based on locations of tags and time of year they were found.

Table 1. Mortalities and possible causes of 2002 radio tagged bull trout

Fish Identification Code	Possible Cause of Death	Reason
20, 22, 25	Angling or secondary infection from tagging	Tag was found less than two months post tagging in high use angling locations
28,29,76,82,65,70,84	Angling	Tag was found more than two months post tagging in high use angling locations.
66	Angling, tag injury due to handling	Fish was found just a few hours post-mortem in MFBR. See description in text.
77,62,63	Angling or predation	Tag found in high use areas within eagle nesting territories
31,37,39,67,68,69,73,21,78	Predation	Tag found in inaccessible areas within nesting territories
67	Flood	Found covered with sediment on rock
26,80,24,79,38	Post-spawning	Found after spawning in headwater tributaries.
86,75	Tagging	Found less than 2 weeks after tagging

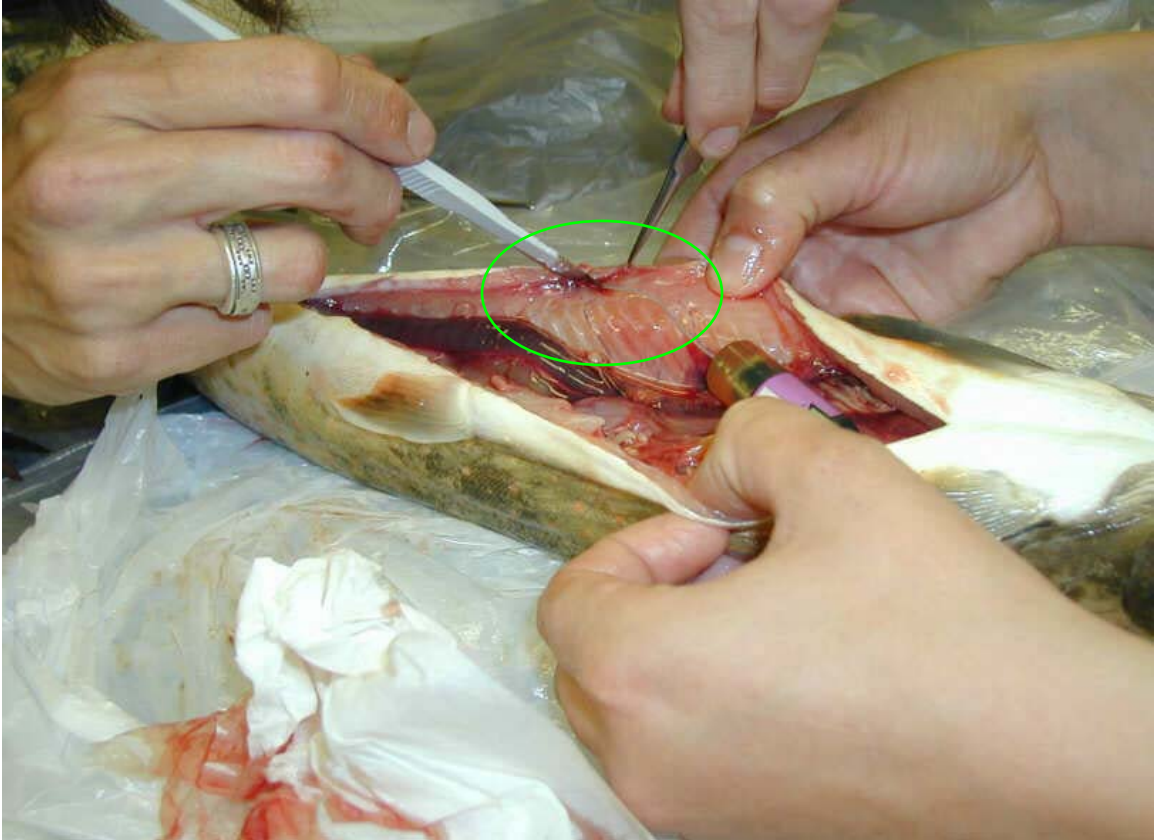


Figure 1. New exit hole formed by the sharp end of the trimmed antenna of the radio tag.

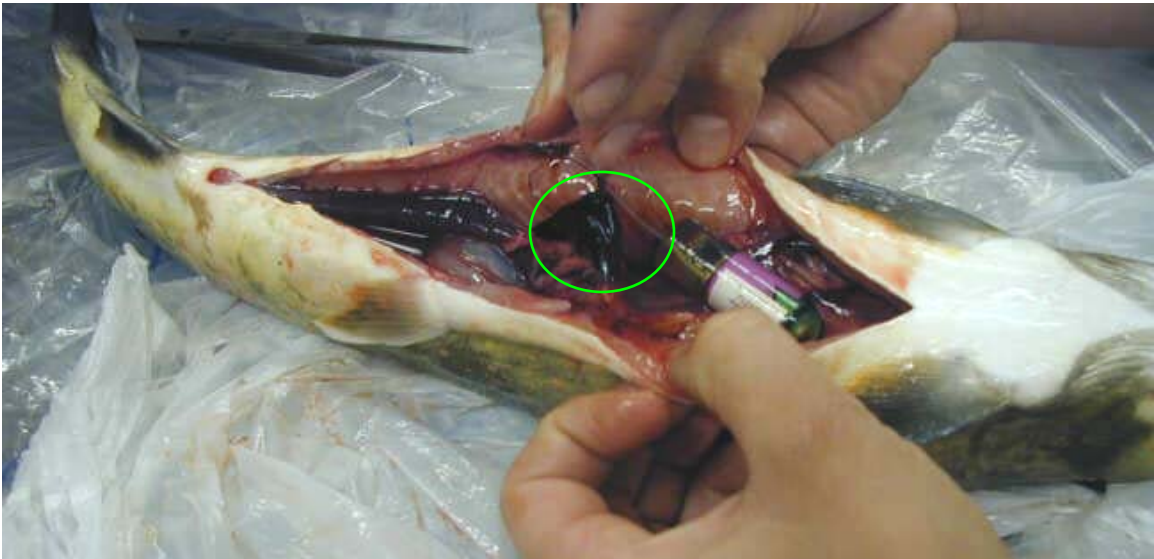


Figure 2. Bleeding caused by tag antenna creating new exit hole.



Figure 3. Internal bruising most likely caused by handling.

The remaining radio tagged bull trout have begun the downstream migration. We have been able to get visual verification of nine of the bull trout within the spawning areas of the Middle and North Forks of the Boise River. One bull trout, Code 88, was captured in a side channel willow grove and moved downstream. The fish had been forced into a newly created side channel with water 3.5 inches deep cutting through a willow grove (Figure 4) by a beaver dam on the main channel. The fish was alive and appeared to have spawned, though was in poor condition (Figure 5). Many of the post-spawning fish that are captured appear much like this animal...no wonder post-spawning mortality is so high!



Figure 4. Location of fish code 88 in newly created side channel.



Figure 5. Fish code 88 found in the willow grove on Bear River.

Lucky Peak Reservoir

Fish code 81 was entrained below Arrowrock Dam in October 2002. On July 16th, fish code 83 also became entrained. Currently, we have entrained six of the 118 fish radio tagged in 2002, just over 5% of the total tagged. All of the entrainment occurred when the dam was spilling over 1000 CFS and the reservoir was < 50% of its full pool volume. We have been tracking these individuals downstream from the dam. Fish code 81 surfaced on June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking and was tracked on the dam remote station on June 6 through June 9 at various times of the day. We have not located the tag since June 10. We have been tracking the most recently entrained fish (code 83) and though it had been missing for several weeks, it surface at road mile marker 3 in Lucky Peak on August 19th. Fish code 83 has remained near Macks Creek and the spilling basin of Arrowrock through the month of August and into September. We will continue to track the Mores Creek watershed in addition to Lucky Peak reservoir searching for movement from these fish.

Projected work for the end of September

We will continue our weekly flights and ground monitoring through the last couple of weeks of September and have increased our ground surveys to twice weekly beginning September 15th. Fish appear to be leaving spawning territories so we will begin assessing the spawning data collection program that we began this summer. We have installed the Middle and North Fork Boise River weirs and Mores Creek weir and have started our tagging project for 2003. We will continue to photograph the Arrowrock drawdown from the air and ground. Please let me know if you are interested in any photos.

End of September Bull Trout Movement Update

Currently, there are 18 radio tags from the 2002 fall tagging project that are still active in live fish. For the 2003 sample, in the North Fork, we have completed tagging of the large fish (N=20) sample, have captured 59 and tagged 44 bull trout with radios. Six of the 2003 radios were documented as mortalities, one post-tagging, and five from predation. We have just started catching fish at the Middle Fork (N=4) and have not captured any fish large enough to tag yet. Several of the 2002 radio tagged fish have been recaptured in the North Fork weir. Inactive tags from 2002 have been successfully removed and new tags were implanted. Fish with active tags were measured, weighed, and released.

We documented the loss of one tag (fish 88) due to antenna entanglement. The fish, though slightly battered and skinny, moved through the North Fork weir on September 22 (Figure 1).

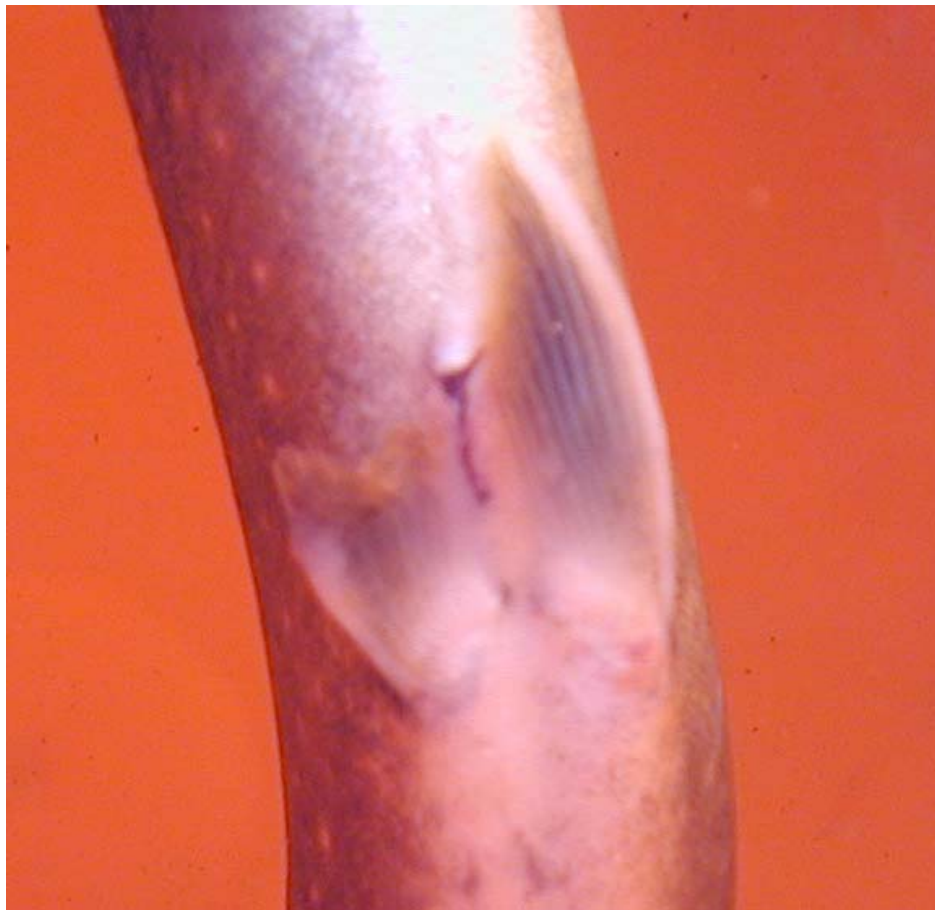


Figure 1. Hole left from fish code 88 tag expulsion

Due to the low river flows and reservoir draw-down, we have been collecting tags from 2002 that were considered mortalities. Many of the locations of the tags are verification of the suspected causes of death. As of October 3, 2003, we have 31 suspected mortalities from the 2002 tagged fish and the status of two individuals remains

unknown, however they are presumed to have moved into someone's home in a cooler (last location on road upstream of a dam), or to be buried under debris (last location at the mouth of Lake Creek). Table 1 shows the current mortalities and possible cause of death for the 2002 tags. These conclusions are based on locations of tags and time of year they were found.

Table 1. Mortalities and possible causes of 2002 radio tagged bull trout

Fish Identification Code	Possible Cause of Death	Reason
20, 22, 25	Angling or secondary infection from tagging	Tag was found less than two months post tagging in high use angling locations
28,29,76,82,65,70,84	Angling	Tag was found more than two months post tagging in high use angling locations.
66	Angling, tag injury due to handling	Fish was found just a few hours post-mortem in MFBR. See description in text.
77,62,63	Angling or predation	Tag found in high use areas within eagle nesting territories
31,37,39,67,68,69,73, 21,78, 86	Predation	Tag found in inaccessible areas within nesting territories
67	Flood	Found covered with sediment on rock
26,80,24,79,38	Post-spawning	Found after spawning in headwater tributaries.
75	Tagging	Found less than 2 weeks after tagging

The North Fork Boise River radio tagged bull trout have begun the downstream migration and several of them have entered the reservoir. We have a total of ten bull trout that have entered Arrowrock reservoir downstream of Willow Creek camp ground. Additionally, we have had one bull trout that spent most of the summer in the South Fork Boise River and moved into the residual reservoir pool in late August. The four fish that are within the reservoir pool are hanging around the mouth of Cinch Creek and are near an eddy where fish appear to be actively feeding (Figure 4).



Figure 4. Eddy near the mouth of Cinch Creek where fish were actively feeding

Three fish have moved past the confluence and into the South Fork Boise River arm. One fish just recently entered moved into the dewatered area near Irish Creek, and three fish have been documented as mortalities. One fish was prey to a raptor or shore bird (pieces found), and two were found downstream of the braided, dewatered area near the South Fork confluence (Figure 5). Since these tags were found in shallow water downstream of where numerous seagulls have been holding, we are guessing that they are predation mortalities.



Figure 5. Location of radio tags found in Arrowrock

Lucky Peak Reservoir

Fish code 81 was entrained below Arrowrock Dam in October 2002. On July 16th, fish code 83 also became entrained. Currently, we have entrained six of the 118 fish radio tagged in 2002, just over 5% of the total tagged. We have been tracking these individuals downstream from the dam. We have not located fish code 81 since June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking. Fish code 83 has remained near Macks Creek and the spilling basin of Arrowrock through the month of August and into September. We will continue to track the Mores Creek watershed in addition to Lucky Peak reservoir searching for movement from these fish.

Projected work for October

We will continue our weekly flights and twice weekly ground monitoring. Fish have begun entering Arrowrock reservoir and the South Fork Boise River. We will continue to operate the Middle and North Fork Boise River weirs and Mores Creek weir and finish our radio tagging project for 2003. We will continue to photograph the Arrowrock drawdown and our monitoring work from the air and ground. Please let me know if you are interested in any additional photos.

Mid-October Bull Trout Movement Update

Currently, there are 14 radio tags from the 2002 fall tagging project that are still active in live fish. Additionally, we have captured 72 and tagged 56 bull trout with radios for the 2003 project. Eleven of the 2003 radios were documented as mortalities, one post-tagging, four from shallow, braided river or sloughing bank conditions, and six from predation. We have just started catching fish at the Middle Fork (N= 7) and have tagged three of these fish. Several of the 2002 radio tagged fish have been recaptured in the North Fork weir. Inactive tags from 2002 have been successfully removed and new tags were implanted. Fish with active tags were measured, weighed, and released. We have been reusing tags recovered from the reservoir in order to obtain a larger sample of fish and have a larger sample of fish with mortality sensors in the tags. The mortality sensors appear to be working well, and we have verified operation of two tags in our mortalities.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

Currently we have 15 bull trout that appear alive and active in Arrowrock reservoir basin downstream of Willow Creek campground.

Willow Creek to Trail Creek – 2 radio tag (5-187, 5-188)

This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish.

Trail Creek to the South Fork Confluence- no radio tags. Eight radio tags were retrieved from this section during this period, three from fish that were buried in the substrate, five from the shore about 100-300 m distance from the water. This section of the reservoir basin is inundated in October of a normal water year. Currently the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. Many of these fish are suspected mortalities.

South Fork Confluence to the reservoir pool – 6 radio tags (5-165, 2-63, 5-200, 2-177, 5-184) This river section consists of shifting sand/clay substrate and fast moving, shallow water. However, turbidity in this section provides cover for fish. Radio tags were located on 10/15 and 10/16 and appeared to be moving short distances (500-1000 m).

Reservoir Pool – 2 radio tags (1-44, 1-49)

The reservoir pool is very turbid. Fish code 1-49 moved several times when during the week from near Arrowrock dam to the upper end of the reservoir pool near Cinch Creek. Both fish have tags equipped with mortality sensors which have not been triggered.

South Fork Boise River – 5 radio tags (1-48, 5-185, 7-122, 1-47, 2-5 and 1-175)

These fish are all actively moving upstream in the South Fork Boise River. Code 1-47 is farthest upstream near Dive Creek. All these fish are upstream from the lower section of the South Fork Boise that is characterized by a shifting sand channel through the reservoir bottom.

Mortalities/Tag Expulsions

We have been documenting higher levels of mortality in the reservoir area from Cottonwood Creek to the South Fork confluence this year compared with 2002. This area of the reservoir is relatively shallow and the stream channel is braided with a light colored sand substrate (Figure 1). Fish have been observed from the shoreline.



Figure 1. South Fork and Middle Fork Confluence in Arrowrock reservoir looking Upstream toward Irish Creek campground.

Since the beginning of the 2003 project, twenty-six of the radio tagged fish tagged in 2002 or 2003 have entered the reservoir area downstream of Willow Creek campground. Of these fish, ten radios have been retrieved and one additional radio could not be excavated. Fish (fish parts and tags) have been found substantial distances from the reservoir (Fig. 2), indicating avian predation. Numerous raptors have been observed in addition to active sea gull and shore bird feeding.



Figure 2. Carl Stiefel showing fish found 10/7/03. The fish also had puncture wounds and scratches.

Other fish parts have been observed (fins, skulls) near Irish Creek campground. Nine fish are within the Arrowrock residual pool and appear to be actively moving. Six fish have moved well into the South Fork Boise River downstream of Anderson Ranch. Mortality rates are near 42% for radio tagged fish entering the reservoir. This is approximately four times the level that was observed in 2002. Fish that have been killed appear to be larger (mean total length = 545 mm) than fish that moved into the reservoir (mean total length = 484 mm) or South Fork Boise River (mean total length = 452 mm).

Mortality during the first two weeks of October

We recovered eight tags from the section of river from Cottonwood Creek to the South Fork Boise River confluence during the first two weeks of October, four tags were found well outside (100-300 m) of the river bed on the shore:

Fish 1-170 was found on shore upstream from Irish Creek on the north side of the reservoir near Nibbler Creek. The tag was found far from the water, coiled on the sand with dried blood apparent on the tag and no fish remains present.

Fish 5-183 was found damaged surrounded by small canid tracks and one bear track. The tag had been severely chewed and the battery was dented, however the tag was still transmitting.

Fish 1-45 was found on shore upstream from Irish Creek on the south side of the reservoir near Nibbler Creek. The tag was found far from the water with no fish remains present.

Fish 1-46 was found in a draw on the north side of Arrowrock road near Cottonwood Creek. The fish carcass was found intact an hour after the mortality sensor was triggered. The carcass was covered in powdery sand most likely from being dropped near the river. The draw where the fish was recovered did not have a loose sand substrate. There were puncture wounds on the fish's back and side.

One tag left us no hint of what had killed the animal except that the location was similar to where several other fish have been killed by birds.

Fish 2-3 was found in the stream bed with no fish parts nearby or any indication of cause of death.

Three fish were found intact with clues that their deaths may have been caused by conditions in the new river section of Arrowrock:

Fish 1-171 was found in a draw on the north side the river directly adjacent to the Irish Creek campground boat launching area on 10/11. The tag was found with the intact fish buried so that its pelvic fins were just visible in the substrate (Fig. 3).

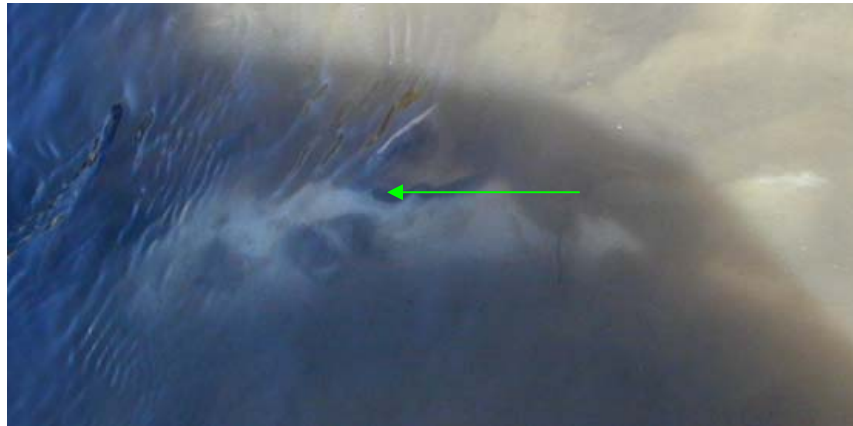


Figure 3. Fish 1-171 found buried in sediment. Some of the sediment has been moved away from the animal so that it could be photographed. Green arrow shows pelvic girdle

The fish had an archival tag and was located at the Twin Springs logging station on 10/7. Data from the archival tag indicate that the fish may have been stranded which may have caused it to become stressed (Fig. 4). Archival temperature data in conjunction with body condition may give us clues to the cause of death. Two days before the fish was found and one day after it passed the Twin Springs logging station, the temperatures recorded on its archival tag followed air temperatures which indicate the fish was either removed from the water for 48 hours (the condition of the fish did not reflect this), or that it was possible stranded in the narrow side channels where it was close to or at the surface of the river. The fish was found buried, though not deeply, within a side channel.

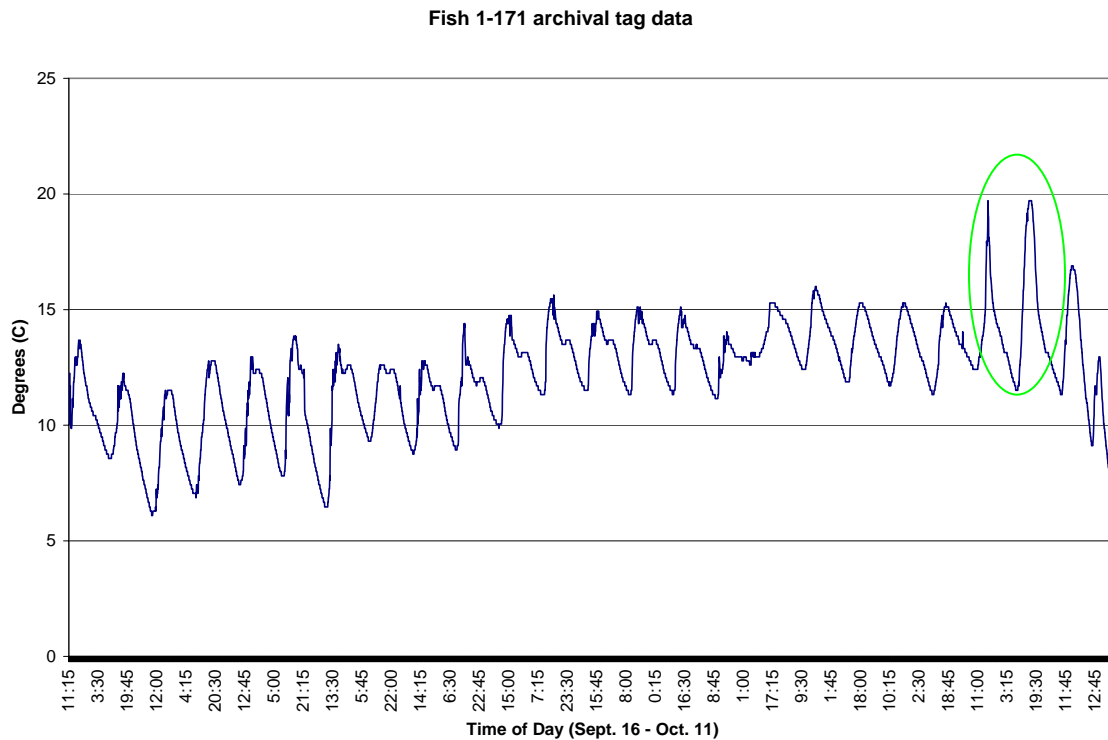


Figure 4. Temperature data from the archival tag taken from the dorsal region of the fish. The two temperature peaks circled in green are reflective of air temperatures.

The fish had large claw marks on its tail and the upper half of the caudal fin and all of one pectoral fin were missing so it may have been attacked and stressed while moving through the narrow side channels (Fig. 5)



Figure 5. Fish 1-171 found partially buried in a narrow side channel of the Middle Fork near Irish Creek campground.

Fish 1-42 was found relatively intact but its head to just past its dorsal fin was completely buried under what appears to be the old reservoir bottom (Fig. 6)



Figure 6. Fish 1-42 found partially buried. Green arrow shows pelvic girdle.

This fish also had an archival tag that when considered along with where the fish was found and its condition, may indicate it had been buried while seeking refuge in the undercut banks that are sloughing into the reservoir. For a period of two days the fish experienced very little temperature changes from either air or water influence that may more closely reflect a thermal regime found under substantial sediment (Fig. 7).

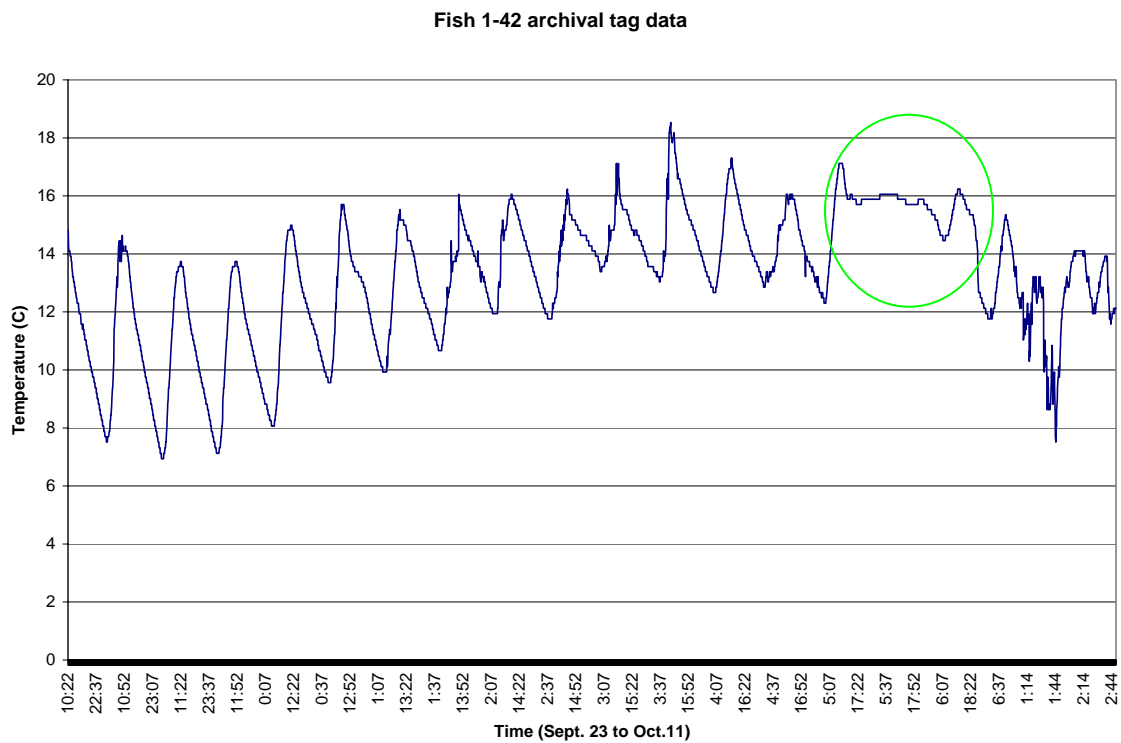


Figure 7. Archival tag data from fish 1-42. Green circle shows where fish was possibly buried.

Fish 1-27 was found intact and buried under more than 8" of sediment immediately next to the shoreline. This fish was tagged in 2002 and recaptured at the North Fork weir in 2003. It was noted to be in good condition, measured, weighed and released. It did not enter spawning tributaries this summer, and based on the condition of the animal, probably did not spawn. It had overwintered in the South Fork in 2002 and was found near the confluence.

Lucky Peak Reservoir

Fish code 81 was entrained below Arrowrock Dam in October 2002. On July 16th, fish code 83 also became entrained. Currently, we have entrained six of the 118 fish radio tagged in 2002, just over 5% of the total tagged. We have been tracking these individuals downstream from the dam. We have not located fish code 81 since June 10 near the North shore just below the point with the outhouse about 0.5 km below Arrowrock dam during our ground tracking. Fish code 83 has remained near spilling basin of Arrowrock through the month of later September and October. On October 15th we attempted to locate this fish. It appears to have been ceased movement and the tag is in an inaccessible area on the south shore of Lucky Peak near Arrowrock dam. We will attempt to retrieve the tag by boat next week. We will continue to track the Mores Creek watershed in addition to Lucky Peak reservoir searching for movement from fish 81 as we have not tracked this fish since June in either Lucky Peak or Mores Creek.

Projected work for October

We will modify our work plan slightly to attempt to reduce mortality in the river section above the residual pool in Arrowrock reservoir. Based on recommendations from the Arrowrock Fisheries Advisory Team, we will be operating the North and Middle Fork weirs through November 14, 2003. We also will undertake an experimental program to capture ten bull trout from the weirs and transport them to the residual reservoir pool and to the South Fork Boise River near Danskin bridge for release. Five fish will be moved to each site for release and will be taken randomly from the North and Middle Forks. All fish will be radio tagged and some will be archival tagged. Larger fish will be targeted from each weir as these fish appear more susceptible to predation. By moving the fish, we hope to reduce mortality from predation and river channel conditions. We will be reporting to the Advisory team on the progress of the trap and transport program to determine if more fish should be transported through the next two weeks.

October Bull Trout Movement Update

Currently, there are 12 radio tags from the 2002 fall tagging project that are still active in live fish. Additionally, we have captured 73 and tagged 57 bull trout with radios for the 2003 project. Since the beginning of the 2003 project, forty-one of the radio tagged fish tagged in 2002 or 2003 have entered the reservoir area downstream of Willow Creek campground. Of these fish, eleven radios have been retrieved and one additional radio could not be excavated.

Two of the 2002 fish were documented as mortalities during this period, both from predation while still in the mainstem North and Middle Fork Boise Rivers. One fish from the 2003 tagged sample was documented as a mortality in the area near Cottonwood Creek in the area normally inundated by the reservoir. We have caught only three bull trout at the North and Middle Forks weirs during this period and speculate that this is due to warm weather and no precipitation. Several of the 2002 radio tagged fish remain above the North Fork and Middle Fork weirs.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

Currently we have 29 bull trout that appear alive and active in Arrowrock reservoir basin (including the South Fork Boise River downstream of Anderson Ranch dam) downstream of Willow Creek campground.

Upper end of Arrowrock reservoir, from Willow Creek campground to Trail Creek – 5 radio tags (5-164, 5-165, 5-181, 2-72, 5-187)

This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish.

Irish Creek campground area, from Trail Creek to the South Fork Confluence- 1 radio tag (1-46). This section of the reservoir basin is inundated in October of a normal water year. Currently the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. This fish was retrieved on 10/29, an apparent raptor mortality.

South Fork Confluence to the reservoir pool – 4 radio tags (1-174, 5-188, 5-180, 5-200).

This river section consists of shifting sand/clay substrate and fast moving, variable depth water. Turbidity in this section provides cover for fish and material from Dutch Creek appears to be providing cover and food for several species of fish as active feeding was observed.

Reservoir Pool – 7 radio tags (2-177, 5-178, 1-49, 1-172, 6-148, 2-71, 1-41). Fish appear to be moving actively in the reservoir, alternating between the mouths of Cinch and Dutch Creek. One new fish was entrained (1-44) on 10/15 during the afternoon. One other fish has been holding close to the dam and could become entrained (6-148). The eleven fish within the Arrowrock residual pool and appear to be actively moving in the area between the mouths Deep and Cinch Creeks (Figure 1).



Figure 1. View of area where fish have been actively moving

South Fork Boise River – 12 radio tags (1-48, 5-185, 7-122, 1-47, 2-5, 6-146, 2-60, 5-184, 2-59, 2-63, 3-89 and 1-175). We relocated the first fish from the Middle Fork weir to the South Fork just downstream of Danskin bridge (fish code 6-146, Figs. 2 and 3).



Figure 2. First relocated bull trout taken from the Middle Fork weir to the South Fork Boise River



Figure 3. Pilot Jim Castillo with bull trout secured in cooler for trip to South Fork.

Fish in the South Fork are all actively moving within the river. Fish codes 3-89 and 1-175 are the farthest upstream below Anderson Ranch dam. All these fish are upstream from the lower section of the South Fork Boise that is characterized by a shifting sand channel through the reservoir bottom.

Mortalities/Tag Expulsions within Arrowrock Reservoir

Mortality rates for the reservoir area have improved for this period with seven fish entering the area downstream of Willow Creek campground and one mortality documented. Current rates of mortality are near 27% for radio tagged fish entering the reservoir area downstream of Willow Creek campground. One radio tag was retrieved from fish killed during this period within Arrowrock reservoir (1-46).

Fish code 1-46: The whole animal was recovered from a sandy bank across from the mouth of Cottonwood Creek (Figure 4) on 10/29/03.



Figure 4. Amber Fonner with fish (green circle) where on the sandy bank

The fish had been alive when pulled from the water as it was completely coated in the fine sand where it was found (Figure 5).



Figure 5. Fish coated with sand

The mortality sensor on its radio tag had not yet been triggered when it was recovered indicating the time of predation was no earlier than noon on 10/27. The animal was an apparent raptor predation. Numerous raptors were observed actively feeding in this area during the flight and ground tracking of this reporting period. Six bald eagles were seen within the area at the same time (Figure 6).



Figure 6. One of the bald eagles observed during the flight 10/28/03.

Mortalities documented within riverine habitat outside of Arrowrock reservoir
Two fish were documented as mortalities in riverine habitat outside of the reservoir area during this period (1-32, 1-34)

Fish Code 1-34: The tag with fin rays and part of an operculum from the fish was found on a hillside on 10/14 and is apparently a mortality from raptor predation.

Fish Code 1-32: The tag was found on 10/15 up on the hillside, no fish parts were found.

Tag retrieval from the 2002 tagging: Five radio tags from mortalities that occurred in the winter of 2002 or early spring of 2003 were retrieved from the South Fork arm of Arrowrock reservoir during this period (1-39, 1-21, 2-68, 2-73, and 1-29). These tags were apparent predation mortalities, with tags found high on ridges or on cliffs (Figs. 7 and 8).



Figure 7. Amber Fonner showing the location of the radio tag retrieved from the South Fork on 10/30.



Figure 8. Location of one radio tag retrieved from the South Fork Arm on 10/22.

Several fish passed this section of the South Fork so we surveyed the area by kayak on 10/22 to check on passage of fish and available holding habitat. One fish was observed holding under a small boulder near the side of the channel. Fish appear to be moving rather quickly through the area (within 1-2 days).

Projected work for November

We modified our work plan slightly to attempt to reduce mortality in the river section above the residual pool in Arrowrock reservoir. Based on recommendations from the Arrowrock Fisheries Advisory Team, we will be operating the North and Middle Fork weirs through November 14, 2003. We have also undertaken an experimental program to capture ten bull trout from the weirs and transport them to the residual reservoir pool and to the South Fork Boise River near Danskin bridge for release. Five fish will be moved to each site for release and will be taken randomly from the North and Middle Forks when we catch them. All fish will be radio tagged and some will be archival tagged. Larger fish will be targeted from each weir as these fish appear more susceptible to predation. By moving the fish, we hope to reduce mortality from predation and river channel conditions. We will be reporting to the Advisory team on the progress of the trap and transport program to determine if more fish should be transported through the remainder of the weir operation.

Mid-November Arrowrock Reservoir and Boise River Bull Trout Movement Update

The Mores Creek, North and Middle Fork Boise River weir traps were removed on 11/03/03 and 11/04/03 due to ice damage (Figures 1 and 2). Currently, there are five radio tags from the 2002 fall tagging project that are still active in live fish. During the 2003 weir trap operations we captured 86 and tagged 57 bull trout with radios. Since the beginning of the 2003 construction project, fifty of all fish tagged have entered the reservoir area downstream of Willow Creek campground. Of these fish, twelve radios have been retrieved, two additional radios could not be excavated, and we are retrieving two radios this week.



Figure 1. Middle Fork Boise River weir after snow and ice storm 11/01/03



Figure 2. North Fork Boise River weir after snow and ice storm, 11/01/03

A total of six fish were killed during this period. Three of the 2002 fish were documented as mortalities during this period, both from predation. Two fish were within Arrowrock reservoir and the other was near Trapper Creek on the North Fork Boise River. Three fish from the 2003 tagged sample were documented as mortalities during this period. Two fish were found within Arrowrock reservoir near the South Fork confluence and Irish Creek camp ground. The other fish was found near the Hydromet gauging station on a ridge, most likely killed by a raptor.

We have observed several unique movement patterns from our fish including documenting use of Arrowrock reservoir during the summer period as well as documenting fish that did not make a migration to upstream habitats. The movement patterns that we have observed are quite varied: one fish entered the reservoir pool then changed direction to move into the South Fork arm and has since left the South Fork and is moving back upstream toward Twin Springs on the Middle Fork Boise River. Another fish was tagged in the Middle Fork Boise River in 2002, overwintered in the South Fork Boise River, moved into the residual pool in July and just recently moved back into the South Fork. We also had one fish that was tagged in the Middle Fork Boise River in 2002, moved into the South Fork Boise River and has spent the last ten months within the same three mile reach of the South Fork.

2003 Radio tagging summary, North and Middle Fork Boise River weirs

We tagged 52 bull trout at the North Fork weir and five bull trout at the Middle Fork weir with digitally encoded radio transmitters with lives varying from 70 days to 1686 days. Of these fish, fifteen have been documented as mortalities, primarily from predation while moving through the upper section of Arrowrock reservoir from Trail Creek to the South Fork confluence. Two fish moved through the weirs upstream of the traps and remained upstream near Barber flat while the weirs were operated. One fish has since moved just downstream of the Rabbit Creek confluence on the North Fork Boise River. Two fish have become entrained through Arrowrock dam over the last few weeks. We moved one fish by helicopter from where it was captured (Middle Fork Boise River weir) to the South Fork Boise River near Danskin bridge. That fish has since moved downstream to the residual pool of Arrowrock reservoir.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

Currently we have 33 bull trout that appear alive and active in Arrowrock reservoir basin (including the South Fork Boise River downstream of Anderson Ranch dam) downstream of Willow Creek campground.

Upper end of Arrowrock reservoir, from Willow Creek campground to Trail Creek – 4 radio tags (5-164, 5-187, 2-4, 5-191)

This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish. Three of the fish in this area are holding in a large pool directly adjacent to the campground. We did confirm that the fish were alive and moving within the pool.

Irish Creek campground area, from Trail Creek to the South Fork Confluence- 2 radio tags (2-74, 2-2). This section of the reservoir basin is inundated in October of a normal water year. Currently the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. We have been unable to check on these fish due to equipment problems during the second week of this period. We are checking these fish 11/17/03 however based on the magnitude of raptors observed and the fate of other fish remaining more than one day in this area, these fish are likely mortalities.

South Fork Confluence to the reservoir pool – 1 radio tag (1-174). This river section consists of shifting sand/clay substrate and fast moving, variable depth water. Turbidity in this section provides cover for fish and material from Dutch Creek appears to be providing cover and food for several species of fish as active feeding was observed. Fish appear to be moving between the residual pool and this area.

Reservoir Pool – 14 radio tags (2-177, 5-178, 1-49, 6-146, 5-197, 5-181, 5-180, 6-148, 2-71, 5-189, 2-7, 1-41, 5-188, 5-200). Fish appear to be moving actively in the reservoir, alternating between the mouths of Cinch and Dutch Creek. One new fish was entrained (5-192) on 11/01 during the night. Several fish have been holding close to the dam and could become entrained. The fish within the

Arrowrock residual pool and appear to be actively moving in the area between the mouths Deep and Cinch Creeks.

South Fork Boise River – 11 radio tags (1-48, 5-185, 7-122, 1-47, 2-5, 2-60, 5-184, 2-59, 2-63, 3-89 and 1-175). Our relocated fish did not stay in the South Fork long. Currently it is residing just upstream of Arrowrock dam in the residual reservoir pool.

Fish in the South Fork are all actively moving within the river. Fish codes 2-5, 1-47, and 1-48 are the farthest upstream just below Anderson Ranch dam. One fish is downstream in the lower section of the South Fork Boise that is characterized by a shifting sand channel through the reservoir bottom (2-63). These fish were checked by kayak on 11/13 and appears to be holding in a large pool near a rock. We disturbed the animal and were able to view it from the boats.

Mortalities/Tag Expulsions within Arrowrock Reservoir

Mortality rates for the reservoir area have increased slightly for this period with nine fish entering the area downstream of Willow Creek campground and four mortalities documented within the reservoir. The current rate of mortality is 32.0% for radio tagged fish entering the reservoir area downstream of Willow Creek campground (increased from 29.8% for the previous period). One tag was retrieved (1-172) and one tag could not be excavated. Two tags could not be retrieved during the last day of the reporting period due to equipment problems, but we are working to retrieve both tags 11/17/03. These fish are presumed mortalities due to their location (adjacent to Irish Creek campgournd, Figure 3) and the duration occupied (>5 days).



Figure 31. Confluence of Cottonwood Creek (green arrow) in Arrowrock reservoir near Irish Creek campground.

Fish code 1-172: The tag was retrieved from the reservoir area at the South Fork confluence. This tag had teeth marks on it and no fish parts were found near the tag.

Fish code 2-61: This tag was buried in the active channel and could not be excavated. It was also found at the South Fork confluence.

Fish code 2-71: This fish was found during ground tracking on 11/10/03 near Irish Creek campground. The magnitude of raptors occupying the area and duration the fish has occupied the area leads us to believe it has been killed and we're working to retrieve the tag 11/17/03.

Fish code 2-2: This fish was found during ground tracking on 11/12/03 near Irish Creek campground. The magnitude of raptors occupying the area and duration the fish has occupied the area leads us to believe it has been killed and we're working to retrieve the tag 11/17/03.

Mortalities documented within riverine habitat outside of Arrowrock reservoir

Two fish were documented as mortalities in riverine habitat outside of the reservoir area during this period (1-30, 5-165)

Fish Code 1-30: The tag and fish were found buried near the stream. The fish was an apparent predation mortality and was buried by the animal that caught it. The whole fish was excavated.

Fish code 5-165: This tag was found on a ridge adjacent to the USBR Hydromet station downstream of Twin Springs. The tag was found underneath a large snag with no fish parts found.

Projected work for the rest of November

We will continue to ground track and check on fish that have not moved within the reservoir and river sections twice per week. We will also be flying the area once per week. We'll be working on the 2002 and 2003 radio tagging fish summaries and permit reports through the end November and into December.

November Arrowrock Reservoir and Boise River Bull Trout Movement Update (Period 11/15/03 through 11/26/03)

Currently, there are five radio tags from the 2002 fall tagging project that are still active in live fish. Since the beginning of the 2003 construction project, fifty-one of all fish tagged have entered the reservoir area downstream of Willow Creek campground. Of these fish, fifteen radios have been retrieved and two additional radios could not be excavated.

A total of three fish were confirmed mortalities during this period. Two fish were documented as killed, we presume from predation. Both of the tags were found buried in 1-2 inches of sediment near Cottonwood Creek where active raptor feeding has been observed for several weeks now. One fish was found within Arrowrock reservoir near the confluence of Dutch Creek. The animal had a fish hook embedded in its throat and approximately four feet of fishing line trailing from the lure. Two fish are possible mortalities, but we have been unable to confirm the status of these animals. Two of the mortality sensors have been triggered, one from the fish that was entrained through Arrowrock dam in September and one from a fish that has been holding in a large pool upstream of Twin Springs on the Middle Fork. We checked the fish in Lucky Peak and were unable to get a visual confirmation as this fish is located in the deep pool of the spilling basin of Arrowrock dam. We are checking the Twin Springs fish 11/26/03, this information will be included in the report for the next period.

The movement patterns observed this period have become much more localized. Most fish have moved < 3 km total distance this period. Another fish has become entrained through Arrowrock dam. This occurred 11/14/03 around 6 PM. This fish has since moved downstream of the dam toward Macks Creek boat ramp.

Bull Trout in Lucky Peak Reservoir (entrainment)

Three fish have become entrained from the 2003 tagged sample (1-44, 5-192, 6-148). Entrainment for 2003 currently is 5.3%, an increase from 2002. Entrainment for 2002 at the same time last year was 3.4%.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

Currently we have 30 bull trout that appear alive and active in Arrowrock reservoir basin (including the South Fork Boise River downstream of Anderson Ranch dam) downstream of Willow Creek campground. Three bull trout are located in Lucky Peak reservoir.

Upper end of Arrowrock reservoir, from Willow Creek campground to Trail Creek – 3 radio tags (5-164, 5-187, 2-72)

This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish. Both of the fish in this area are holding in large pools near rock cliffs. We did confirm that the fish were alive and moving.

Irish Creek campground area, from Trail Creek to the South Fork Confluence- No radio tags. This section of the reservoir basin is inundated in October of a normal water

year. Currently the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. Most of the fish that we have found killed have been located in this area. We have observed ten raptors feeding within the stream channel at one time.

South Fork Confluence to the reservoir pool – No radio tags. This river section consists of shifting sand/clay substrate and fast moving, variable depth water. Turbidity in this section continues to provide cover for fish.

Reservoir Pool – 15 radio tags (2-177, 5-178, 1-49, 6-146, 5-191, 5-181, 5-180, 5-168, 2-71, 5-189, 2-7, 1-41, 5-188, 5-200, 2-4). Fish appear to be moving actively in the reservoir, many are within the deepest area of the residual pool directly in front of the dam. One new fish was entrained (6-148) on 11/14 around 6 PM. Fish continue to hold very close to the dam and could become entrained.

South Fork Boise River – 12 radio tags (1-48, 5-185, 7-122, 1-47, 2-5, 2-60, 5-184, 2-59, 2-63, 3-89, 5-197 and 1-175). Fish in the South Fork are all actively moving within the river, most are moving upstream in small (<3 km) movements. Fish codes 2-5, 1-47, and 1-48 are the farthest upstream just below Anderson Ranch dam. We checked these fish for movement when pursued or disturbed, and all three appear to be moving away when disturbed. One new fish entered the South Fork during this period, moving down from Willow Creek campground on the Middle Fork.

Mortalities/Tag Expulsions within Arrowrock Reservoir

Mortality rates for the reservoir area have remained relatively constant for this period with one fish entering the area downstream of Willow Creek campground and three mortalities documented within the reservoir. The current rate of mortality is 33.3% for radio tagged fish entering the reservoir area downstream of Willow Creek campground (increased from 32.0% for the previous period). Three tags were retrieved (1-174, 2-2, 2-74). Two of these fish were presumed mortalities from the previous reporting period.

Fish code 1-174: The tag was retrieved from the reservoir area downstream of the South Fork confluence but upstream of Dutch Creek. This fish was found whole, partially buried, with a fish hook embedded in its throat with approximately four feet of fishing line attached (Figure 1).



Figure 1. Fish 1-174 after being removed from the channel

Fish code 2-71: This fish was found during ground tracking on 11/10/03 near Irish Creek campground. We retrieved the tag on 11/17/03.

Fish code 2-2: This fish was found during ground tracking on 11/12/03 near Irish Creek campground. We retrieved this tag on 11/17/03.

Projected work for December

We will continue to ground track and check on fish that have not moved within the reservoir and river sections twice per week. We will also be flying the area once per week and taking aerial reference photos. We'll also be working on the 2002 and 2003 radio tagging fish summaries and permit reports through December. We plan hold project coordination meetings for the 2004 field season in January.

Mid-December Arrowrock Reservoir and Boise River Bull Trout Movement Update (period 11/27/03 through 12/12/03)

Currently, there are five radio tags from the 2002 fall tagging project that are still active in live fish. Since the beginning of the 2003 construction project, fifty-three of all fish tagged have entered the reservoir area downstream of Willow Creek campground.

A total of three fish were confirmed mortalities during this period. Two of the fish were found in the mainstem Boise River upstream from Willow Creek campground and one was killed in the reservoir. One of these fish was documented as killed -we presume- from predation. The tag was found next to the chewed head of the fish. One radio tag was found upstream of Twin Springs and we speculate that the fish could have been killed or the tag expelled at least several weeks prior to finding it based on the periphyton growth it had obtained. The third documented mortality during this reporting period was found in the shallow river section near the confluence of the South Fork Boise River in Arrowrock reservoir. We presume this fish was killed by one of the many raptors in the area. Its mortality sensor was triggered on 12/10.

We did have substantial movement associated with the higher precipitation and warmer weather this period. Figure 3 shows the mean daily temperature and flow for the Twins Springs gauging station on the mainstem Boise River during the fall migration period. Several fish have moved > 10 km total distance. No new fish have become entrained through Arrowrock dam during this period.

Bull Trout in Lucky Peak Reservoir (entrainment)

No new fish were entrained during this period. Overall, three fish have become entrained from the 2003 tagged sample (1-44, 5-192, 6-148). Entrainment for 2003 currently is 5.3%, an increase from 2002. Entrainment for 2002 at the same time last year was 3.4%. Fish 1-44 began transmitting a mortality signal on 11/18. This fish has ceased movement and is continuously recorded on the dam logger. It had been documented as alive and moving in October, and we are unsure of the cause of death. We did not locate fish 5-192 during this period, but fish 6-148 was in the Mores Creek arm of Lucky Peak reservoir and both fish have been located periodically near Spring shores and downstream of Macks Creek.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

Currently we have thirty-one bull trout that appear alive and active in Arrowrock reservoir basin (including the South Fork Boise River downstream of Anderson Ranch dam) downstream of Willow Creek campground. Two bull trout are located in Lucky Peak reservoir.

Upper end of Arrowrock reservoir, from Willow Creek campground to Trail Creek – no radio tags. This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish. We had two fish residing in this area for the last six weeks. With the changing weather of this period, both fish moved and are now in the South Fork arm of Arrowrock reservoir.

Irish Creek campground area, from Trail Creek to the South Fork Confluence- No radio tags. This section of the reservoir basin is inundated in October of a normal water year. Currently the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. Most of the fish that we have found killed have been located in this area.

South Fork Confluence to the reservoir pool – no radio tags. This river section consists of shifting sand/clay substrate and fast moving, variable depth water. Turbidity in this section continues to

provide cover for fish. Fish 1-41 moved up to the South Fork confluence from the reservoir pool between 11/26 and 12/01, but when checked on 12/4, it was in a deep section of water and moved away from us when pursued. However, its mortality sensor was found triggered on 12/10 and numerous eagles were observed in the area (Figure 1). We retrieved the tag on 12/11. We did have one fish reside in the area for several days: fish 2-72 moved from near Trail Creek to the South Fork sometime between 12/5 and 12/10. It is now upstream of the confluence in the South Fork Boise River.



Figure 1. Two of the over 14 eagles observed during the flight on 12/10/03 (green circles).

Reservoir Pool – 15 radio tags (2-1, 3-9, 2-177, 5-178, 1-49, 6-146, 5-191, 5-180, 1-168, 2-71, 5-189, 2-7, 5-188, 5-200, 2-4). Fish appear to be moving actively in the reservoir, many are within the deepest area of the residual pool directly in front of the dam.

South Fork Boise River – 16 radio tags (5-181, 2-72, 5-164, 5-187, 1-48, 5-185, 7-122, 1-47, 2-5, 2-60, 5-184, 2-59, 2-63, 3-89, 5-197 and 1-175) Fish in the South Fork are all actively moving within the river. Fish code 5-187 moved 16.5 km downstream from Willow Creek Campground to South Fork Gulch between 11/26 and 12/03. Codes 1-47, 1-48, and 2-5 are the farthest upstream just below Anderson Ranch dam, but we have only been able to locate them periodically. Both fish are on the same channel, transmitting at the same burst rate, and the turbines at the dam generate a lot of interference so these fish must be located on foot. We have been ground tracking the roaded areas of the South Fork once per week to check on these fish.

Middle and North Fork Boise Rivers upstream of Arrowrock reservoir – 6 radio tags (5-166, 5-199, 5-195, 6-142, 5-190, 5-182) Five fish remain alive and moving in the Middle and North Fork Boise Rivers upstream of Willow Creek campground. These are some of the smaller fish that were radio tagged in 2003, with total lengths ranging from 258 mm to 364 mm (mean = 324.4, s = 42.6). One fish in the North Fork Boise River has not moved from Meadow Creek since three weeks post tagging. We presume this fish must have been killed as it is a large fish (TL = 498), but cannot access the site as it is neither trailed nor roaded. One fish has completely disappeared as was never tracked after it was tagged indicating tag failure or poaching (fish 5-179).

Mortalities/Tag Expulsions within Arrowrock Reservoir

We had three documented mortalities this period both in the mainstem Middle Fork Boise River upstream from Willow Creek campground.

Fish code 1-43 was found upstream from Twin Springs Resort. The radio tag was found in the river several meters from the bank. The radio was covered with a thick coat of algae, indicating the radio had been lying in the water for quite a while (Figure 2). The mortality signal was first heard on 11/24. This fish was first found in this area on 10/07/03.



Figure 2. Tag 1-43 where it was found in the water with periphyton

Fish code 1-40 was located downstream of the Hydromet Gauging station on 11/26. On 12/01 and 12/03 it was located 2.1 km downstream during ground and aerial near where the carcass was found. The mortality sensor had not yet been triggered. When the mortality signal was heard on 12/04 ground crews went to investigate and found the carcass near large woody debris on the far bank. The remains of fish code 1-40 were found on 12/04 in a slow area of the river channel upstream from Willow Creek Campground. The tag was found with the remains fish head and skin. The head had been chewed on and the flesh and entrails had been consumed or removed (Figure 3).



Figure 3. Remains of fish 1-40 found near log upstream of Willow Creek campground.

Fish code 1-41 was located at the confluence of the South Fork Boise River in Arrowrock reservoir on 12/11. Its mortality sensor was triggered on 12/10, though it had moved into the area on between 11/26 and 12/01, and when checked on 12/4, it was in a deep section of water and moved away from us when pursued. We presume it was killed when it moved into more shallow water perhaps into the South Fork arm and became more visible to the numerous bald eagles in the area. Eagles were observed perching on the cliffs adjacent to the river and diving for prey from these areas (see Figure 4).



Figure 4. Location of fish 1-41. Eagles were observed perching and hunting from the cliffs adjacent to the river (green arrow).

Summary of the fate of all radio tagged bull trout (radios with battery life extending at least one year)

In 2002 and 2003, we have tagged a total of 102 bull trout with radio tags having a battery life extending through at least one year. Of the fifty fish tagged in 2002, eleven were killed during the fall migration in 2002. Thirty fish survived through July, 2003 to begin the migration into river or headwater habitats. Of these fish, 22 actually made it to summer and spawning habitats, two fish never migrated, and two were entrained. Thirteen of the fish that migrated did not spawn and nine did (entered known spawning habitat during the spawning period). Only five fish tagged in 2002 are still alive with active radios and two radios have had their batteries expire in live fish. Of the 52 fish tagged in 2003, three have become entrained and twenty-two fish have been killed during the downstream migration to Arrowrock reservoir or the South Fork Boise River. We currently have 40 radio tags left in live fish, with one tag due to expire at any time and four tags due to expire in February.

Mortality rates generally are highest with increased movement with corresponds to changes in temperature and flow. Figure 5 shows mortalities documented each week with the corresponding daily temperature and flow. We documented the greatest number of mortalities on the week of October 6th.

Mortalities, temperature and flow

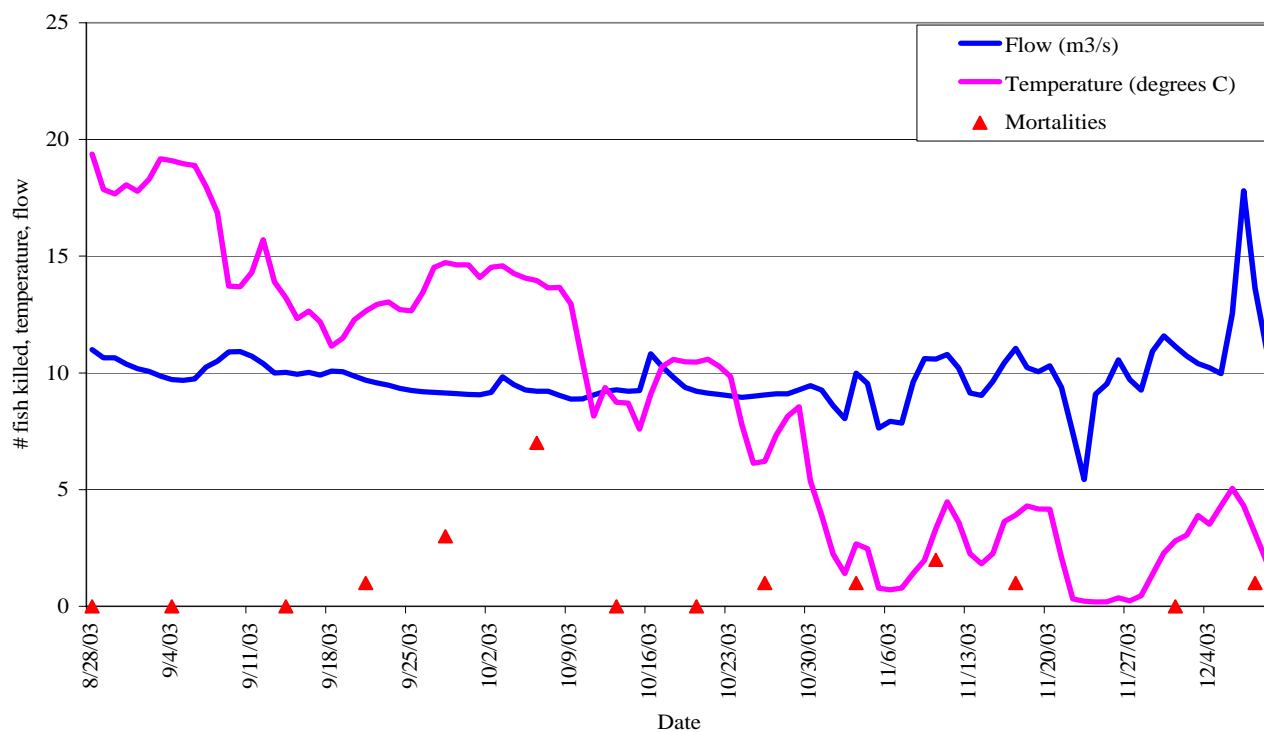


Figure 5. Weekly documented mortalities of radio tagged fish during the fall migration period with daily mean temperature and flow at the Twin Springs gauging station.

Projected work through December

We will continue to ground track and check on fish that have not moved within the reservoir and river sections twice per week. We will also continue flying the area once per week and taking aerial reference photos. We're continuing to work on the 2002 and 2003 radio tagging fish summaries and permit reports through December. We plan hold project coordination meetings for the 2004 field season in January.

December Arrowrock Reservoir and Boise River Bull Trout Movement Update (period 12/12/03 through 12/24/03)

Five radio tags from the 2002 fall tagging project remain in active, live fish. Since the beginning of the 2003 construction project, fifty-five of all fish tagged have entered the reservoir area downstream of Willow Creek campground.

No fish were confirmed mortalities during this reporting period (this is the first period without reported mortalities). One fish has completely disappeared from below Anderson Ranch dam, inferring either tag failure or poaching. This has occurred in previous years in the roaded South Fork area, an area highly used by anglers and osprey.

We continue to have substantial movement associated with the changing weather this period. Several fish have moved > 10 km total distance, with three fish moving into the residual pool of Arrowrock. Two of these fish moved from the South Fork below Neal Bridge and one fish moved from Willow Creek campground. No new fish have become entrained through Arrowrock dam during this period.

Bull Trout in Lucky Peak Reservoir (entrainment)

No new fish were entrained during this period. Overall, three fish have become entrained from the 2003 tagged sample (1-44, 5-192, 6-148). The entrainment rate for 2003 remains at 5.3 percent while entrainment for 2002 at the same time last year was 3 percent. We did locate both fish 5-192 and fish 6-148, both in Lucky Peak reservoir near the mouth of Mores Creek. Fish 6-148 was near the Forest Service tree farm downstream of the Mores Creek confluence in Lucky Peak reservoir and fish 5-192 was near Spring Shores Marina. All of the fish entrained during 2002 have had their batteries expire or have disappeared from the reservoir and Mores Creek indicating tag failure or poaching.

Bull Trout in Arrowrock Reservoir (area normally inundated at full pool)

We tracked thirty-two bull trout that appear alive and active in the Arrowrock reservoir basin (including the South Fork Boise River downstream of Anderson Ranch dam) downstream of Willow Creek campground during this reporting period. Two bull trout were tracked and are alive and active in Lucky Peak reservoir.

Upper end of Arrowrock reservoir, from Willow Creek campground to Trail Creek – one radio tag (fish 5-190). This area is normally not inundated at this time of year. There is a cobble bottom with pools riffles and runs providing habitat structure and cover for fish. We had two fish using this area during this period. One fish moved through the area, pausing for one week at the large pool near Willow Creek campground and then moving on to the residual pool of Arrowrock reservoir (fish 5-199). Fish 5-190 moved from upstream of Twin Springs Resort to an area just downstream of the Willow Creek campground pool between 12/17 and 12/22.

Irish Creek campground area, from Trail Creek to the South Fork Confluence- No radio tags. This section of the reservoir basin is inundated in October of a normal water year. This area of the river consists of a shifting sand channel with shallow water and minimal structure to provide fish cover. Most of the fish that we have found killed have been located in this area, and bald eagles are consistently observed hunting throughout this area during our surveys.

South Fork Confluence to the reservoir pool – no radio tags. This river section consists of shifting sand/clay substrate and fast moving, variable depth water. Three fish moved through this area to the residual pool. Bald eagles are consistently observed hunting in this area as well.

Reservoir Pool – 18 radio tags (3-9, 2-177, 5-178, 1-49, 6-146, 5-180, 2-1, 5-188, 5-189, 2-7, 5-200, 2-4, 1-168, 2-71, 2-63, 5-199, 5-187, 5-191). Fish have been moving actively in the reservoir, between the deep section of the residual pool immediately in front of Arrowrock dam to the mouth of Cinch Creek. The residual pool is covered with a thin sheet of ice from Grouse Creek to the dam (Figure 1).



Figure 1. Ice beginning to form at the edges of the residual pool on 12/17/03. The pool was covered with a thin sheet of ice from Grouse Creek to the dam on 12/22/03.

South Fork Boise River – 14 radio tags (5-181, 2-72, 5-164, 5-187, 5-185, 1-47, 2-5, 2-60, 5-184, 2-59, 2-63, 3-89, 5-197 and 1-175) Fish in the South Fork continue to be actively moving within the river. Fish codes 5-187 and 2-63 moved 15 km downstream from South Fork Gulch to the residual pool between 12/17 and 12/22, interesting to note that fish code 2-63 spent the entire summer moving through this same area. Fish 1-47, 2-5 are the farthest upstream just below Anderson Ranch dam. Fish 1-48 has disappeared from the boat ramp area just downstream of Anderson Ranch dam. The battery expired on fish code 7-122, this was expected based on the guaranteed life of the tag. We have been ground tracking the roaded areas of the South Fork once per week to check on the fish that are overwintering in this area.

Middle and North Fork Boise Rivers upstream of Arrowrock reservoir – 4 radio tags (5-166, 5-195, 6-142, 5-182) Three fish remain alive and moving in the Middle and North Fork Boise Rivers upstream of Willow Creek campground. These are some of the smaller fish that were radio tagged in 2003, with total lengths ranging from 258 mm to 364 mm (mean = 324.4, s = 42.6). One fish in the North Fork Boise River has not moved from Meadow Creek since three weeks post tagging (5-182). We presume this fish must have been killed as it is a large fish (TL =

498), but cannot access the site as it is neither trailed nor roaded. One fish has completely disappeared as was never tracked after it was tagged indicating tag failure or poaching (fish 5-179).

Mortalities/Tag Expulsions within Arrowrock Reservoir

We had no documented mortalities this period!!

Summary of the fate of all radio tagged bull trout (radios with battery life extending at least one year)

In 2002 and 2003, we have tagged a total of 102 bull trout with radios tags having a battery life extending through at least one year. Of the fifty fish tagged in 2002, eleven were killed during the fall migration in 2002. Thirty fish survived through July, 2003 to begin the migration into river or headwater habitats. Of these fish, 22 actually made it to summer and spawning habitats, two fish never migrated, and two were entrained. Thirteen of the fish that migrated did not spawn and nine did (entered know spawning habitat during the spawning period). Only five fish tagged in 2002 are still alive with active radios and two radios have had their batteries expire in live fish. Of the 52 fish tagged in 2003, two have become entrained (total of three fish entrained, but one fish that was entrained has a tag expected to expire in February) and twenty-two fish have been killed during the downstream migration to Arrowrock reservoir or the South Fork Boise River. We currently have 38 radio tags left in live fish, one tag expired this period, four tags are due to expire in February, two fish are missing, and two fish are entrained into Lucky Peak reservoir.

Projected work into January

We will continue to ground track and check on fish that have not moved within the reservoir and river sections twice per week. We will also continue flying the area once per week and taking aerial reference photos. We plan hold project coordination meetings for the 2004 field season in the third week of January.