An Evaluation of Trout Movements in the Upper Smith River Basin

2010 Progress Report

Submitted to

Canyon Ranch –White Sulphur Springs, Mt.
Pat Barnes Missouri River Chapter of Trout Unlimited – Helena, Mt.
Missouri River Flyfishers – Great Falls, Mt.

Prepared by

Grant Grisak
Montana Fish, Wildlife & Parks
4600 Giant Springs Road
Great Falls, MT 59405

Montana Fish, Wildlife & Parks

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Introduction

The interchange of game fish between the Missouri and Smith rivers has long been a subject of interest for Montana Fish, Wildlife & Parks (FWP). Empirical information from the late 1980's indicates rainbow trout tagged in the Missouri River near Craig were harvested by anglers in the Smith River near the mouth of Hound Creek. The amount of interchange remains uncertain. In 2009, two brown trout implanted with radio transmitters in the Sun and Missouri rivers entered the Smith River and traveled 21 miles upstream where they entered Hound Creek and ultimately spawned at stream mile 10.2 and 4.4, respectively. In 2009, FWP implanted 40 radio transmitters in rainbow trout, brown trout and walleye in the Missouri River between Ulm and Great Falls and two rainbow trout traveled 19 and 26 miles up the Smith River to spawn (Grisak 2009). A number of these trout and one walleye lingered in the lower reaches of the Smith River. Despite the low sample sizes over the past few years, a number of radio tagged fish from the Missouri and Sun rivers entered the Smith River to spawn, which raised further questions about the importance of the Smith River to the Missouri River trout life history. In the fall of 2009, Montana FWP expanded this study by partnering with three private entities (Canyon Ranch, Pat Barnes Missouri River Chapter of Trout Unlimited, Missouri River Flyfishers) to conduct a pilot study to investigate trout movements in the upper reaches of the Smith River. We used radio telemetry to 1) evaluate gross movements of trout during critical times of the year to describe spawning movements and locations to, 2) identify habitat refuge sites during critical times of the year (summer, winter) and to 3) determine if trout from the upper reaches of the Smith River basin move into the Missouri River.

In 2003 the Canyon Ranch conducted extensive habitat improvements in the Smith River that included upgrading irrigation head structures and constructing or enhancing 74 habitat features between river miles 106.2 and 109.2. Here we related fish movements to these habitat features to evaluate the relative importance of these structures to trout life history in the upper Smith River drainage.

Methods

Radios were supplied by the Canyon Ranch (10), Missouri River Flyfishers (2), Pat Barnes Missouri River Chapter of Trout Unlimited (1), PPL Montana (2) and FWP (6). We used Lotek model SR-11-25 (148 MHz) radios programmed to operate on 12h intervals beginning at 7:00 am MST. Radio burst rate was 1 cycle per 3 seconds (0.33 Hz) in order to differentiate Smith River radios with Missouri River radios (0.20 Hz). Radio service life was 769 days (guarantee 615 d). Radio surveillance in the remote sections of the Smith River was conducted using a Piper PA-18 Supercub airplane fitted with a four element Yagi antenna on the wing strut. We also used a truck instrumented with a four element Yagi antenna that could be set at 90^{o} positions to receive signals from the front, back, left and right side of the truck. In the truck and airplane we used a Lotek SRX 400 W5XG frequency/code scanning receiver. We stationed Lotek SRX 400

W7AS code logging receivers at Camp Baker, Eden Bridge and the mouth of the Smith River. We captured trout using mobile anode electrofishing (smooth DC, 200V, 2A) on five occasions between 23 September and 9 November 2009 near the Eagle Creek section and at the Canyon ranch section (Figure 1). Fish were randomly selected from the capture lots measuring between 14 and 21 inches long to ensure they were sexually mature, young enough to spawn in the following two seasons, and large enough to carry the radio transmitter without negatively affecting their behavior (Brown et al. 1999). We surgically implanted radio transmitters in the abdomen of trout in a manner similar to the external antennae procedure described by Cooke and Bunt (2001). In the Canyon Ranch section (rivermile [RM] 106.2-109.2) we implanted radios in 12 brown trout and 4 rainbow trout (Table 1). Mean length of brown trout was 18.8 (15.8-21.0) inches and mean weight was 2.3 (1.31-3.16) pounds. Mean length of rainbow trout was 18.7 (17.8-20.4) inches and mean weight was 2.21 (1.34-2.78) pounds.

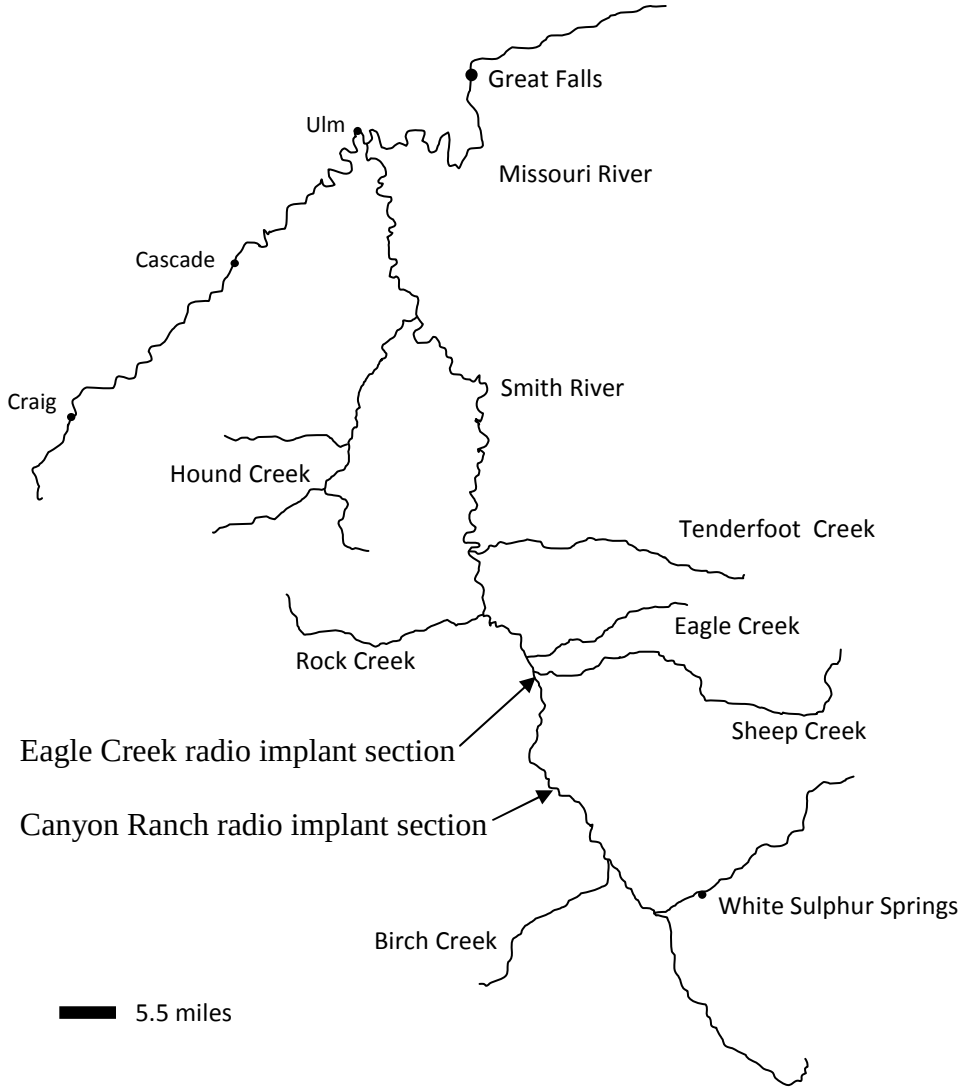


Figure 1. Map of the Smith River drainage with radio transmitter implant sections.

In the Eagle Creek section (RM 77.4-79.3) we implanted radios in 2 brown trout and 3 rainbow trout (Table 1). Mean length of brown trout was 16.9 (16.4-18.8) inches and mean weight was 1.87 (1.16-2.55) pounds. Mean length of rainbow trout was 14.6 (14.1-14.9) inches and mean weight was 1.06 (0.93-1.15) pounds. Mean surgery time for all fish was 2:01 (1:30-3:50). Mean body weight loading for all rainbow trout was 0.006 % and for all brown trout was 0.004%.

Fish locations were identified using GPS and transcribed to the nearest 0.1 river mile.

Table 1. Surgery statistics for rainbow trout and brown trout implanted with radio transmitters in the Smith River, 2009.

Species	Frequency	Code	Length (in)	Weight (lbs)	Sex	Implant date	Location	Surgery time
RB	148.720	110	14.9	1.11	Female	9/29/2009	Smith River - Eagle Creek	1:35
RB	148.720	111	14.1	0.93	Female	9/29/2009	Smith River - Eagle Creek	2:05
RB	148.720	113	14.7	1.15	Female	9/29/2009	Smith River - Eagle Creek	1:31
LL	148.720	112	16.4	1.63	Female	9/29/2009	Smith River - Eagle Creek	1:40
LL	148.720	75	14.9	1.16	Female	9/29/2009	Smith River - Eagle Creek	
LL	148.720	77	16.6	1.79	Female	10/19/2009	Smith River – Canyon Ranch	
LL	148.720	78	18.0	2.23	Female	10/19/2009	Smith River – Canyon Ranch	
LL	148.720	79	18.8	2.55	Female	10/19/2009	Smith River – Canyon Ranch	
LL	148.720	98	16.3	1.57	Female	9/23/2009	Smith River – Canyon Ranch	
LL	148.720	100	20.0	2.96	Female	9/23/2009	Smith River - Canyon Ranch	2:26
LL	148.720	101	19.8	2.51	Male	9/23/2009	Smith River - Canyon Ranch	3:50
LL	148.720	102	20.0	2.88	Male	9/23/2009	Smith River - Canyon Ranch	2:30
LL	148.720	103	21.0	3.08	Male	9/23/2009	Smith River - Canyon Ranch	1:37
LL	148.720	81	20.3	3.16	Female	10/19/2009	Smith River - Canyon Ranch	
LL	148.720	104	17.9	1.82	Female	11/9/2009	Smith River - Canyon Ranch	1:35
LL	148.720	108	19.4	2.42	Female	11/9/2009	Smith River - Canyon Ranch	2:30
LL	148.720	109	15.8	13.1	Female	11/9/2009	Smith River - Canyon Ranch	2:10
RB	148.720	88	15.4	1.34	Female	10/19/2009	Smith River - Canyon Ranch	
RB	148.720	105	20.4	2.78	Female	11/9/2009	Smith River - Canyon Ranch	1:30
RB	148.720	106	17.8	1.85	Female	11/9/2009	Smith River - Canyon Ranch	1:35
RB	148.720	107	18.0	2.01	Female	11/9/2009	Smith River - Canyon Ranch	1:50

Results

In 2010 we made 11 flights between 19 January and 29 November totaling 27.4 hours ($2,945.50). The mean flight time was 2.4 hours (1.5-4.6) per flight. There were 152 relocations

of radioed fish in 2010. The mean number of fish relocated per flight was 12 (2-16). Tracking by airplane accounted for 78% of the relocations, followed by 13% by truck, 7% by foot and 2% by remote ground stations.

There were 9 (43%) of the 21 fish that displayed notable movements;

Brown trout 720-75 was tagged in the Smith River on 29 September 2009 at river mile 78.3 in the Eagle Creek section. It stayed in the same general location over the next nine months. Starting in September 2010 it progressively moved upstream to river mile 95.0. This fish was located 3 times river from 17 October to 25 January (2011) in a 0.5 mile reach of between river mile 94.5 and 95.0. Based on positive movements observed during spawning season, we believed this fish spawned in the Smith River near confluence with the Soldier Lake outlet stream.

Rainbow trout 720-88 was tagged in the Smith River on 19 October 2009 at river mile 106.5 (pool 69) in the Canyon Ranch section. It stayed in the same general location over the next six months. On 12 April 2010 it was located at river mile 106. Within 5 days it moved 24.5 miles down the Smith River and was recorded at the Camp Baker remote ground station on 17 April. Twenty days later, during an airplane flight, it was discovered 10.5 miles up Sheep Creek, where we believed it spawned. It descended Sheep Creek and was located at the mouth on 22 June. It was not located again.

Brown trout 720-100 was tagged in the Smith River on 29 September 2009 at river mile 108.4 (pool 19) in the Canyon Ranch section. Over the next five months it progressively moved downstream 7.8 miles where it stayed at river mile 100.6 for a brief period in February 2010. In April it was discovered at river mile 105.5. In September it began moving upstream and traveled 3.0 miles and resided 0.1 mile upstream of where it was implanted. Based on positive upstream movements during the spawning season, we believed it spawned near river mile 108.5 (pool 16).

Brown trout 720-103 was tagged in the Smith River on 23 September 2009 at river mile 108.8 (pool 8). We lost contact with this over the next 6 months until it was discovered 10.4 miles upstream at river mile 119.2 on 12 April. It stayed in the same area over the next two days after which contact was lost. On several occasion over the next 6 months we expanded the surveillance area in an effort to locate this fish. The expanded search involved 3 flights up the North Fork Smith River as far as Sutherlin Reservoir Dam (24.8 miles) and two flights up the South Fork Smith River as far as the Highway 89/12 intersection bridge (20.9 miles). During return flights down the South Fork River, we scanned the numerous tributaries both east and west of the river and did not detect any radio signals. The location of this fish remains unknown.

Brown trout 720-108 was tagged in the Smith River on 9 November 2009 at river mile 107 (pool 55). Over the next 10 months it progressively moved upstream 1.7 miles (pool 11). Between 2 September and 15 November, it moved 8.8 miles upstream to river mile 117.5 where we believed it spawned. As of 25 January 2011 it remained in the same location.

Rainbow trout 720-111 was tagged in the Smith River on 29 September 2009 in the Eagle Creek section at river mile 78. It stayed in the same general vicinity (0.8 mile) over the next 6 months. On 9 June 2010 it was discovered 6.6 miles downstream of the Rock Creek confluence (river

mile 72.0). This fish stayed at this location through 2 September. W believed it spawned in that area based on positive movements during the rainbow trout spawning season. In October it moved upstream 0.5 mile near the mouth of Rock Creek and was located at that site four times over the next 3 months.

Rainbow trout 720-110 was tagged in the Smith River on 29 September 2009 in the Eagle Creek section at river mile 78.0. It displayed subtle upstream and downstream movements within a 0.6 mile reach over the next 8 months. During a flight on 9 June it was discovered 23.6 miles downstream at river mile 55.0 near the Meagher/Cascade county line. We believed it spawned in this area based on positive movements during the rainbow trout spawning season. From June 2010 through January 2011 it stayed in the same general area and we made 6 relocations of this fish within a 2.3 mile reach of river.

Rainbow trout 720-106 was tagged in the Smith River Canyon Ranch section on 9 November 2009 near river mile 108 (pool 29). It stayed in the same general vicinity through 12 May 2010 after which contact was lost. In 2010 FWP received numerous reports of pelicans in the upper Smith River basin. By September 2010, there were 4 radioed fish (including 720-106) that we had not collected relocation on for several months. We assumed the radios in these fish had malfunctioned, the fish had left the study area, or had been removed from the study area by anglers or predators. On 2 September, we conducted a flight over the waterfowl nesting area on Canyon Ferry Reservoir and detected a signal from radio 720-106 in the NW ¼ of pond #3. On 10 September we launched a boat on nesting pond #3 and tracked radio 720-106 to island # 83 (Figure 2). We were unable to recover the radio as it was in 3 feet of water. The distance from island # 83 to the last known location of this fish on the Smith River was 25.1 miles (Figure 3). This finding revealed that pelicans from the Canyon Ferry nesting colony travel over the Big Belt Mountains to the Smith River and are able to forage on rainbow trout as long as 17.8 inches and weighing 1.85 pounds.

Rainbow trout 720-113 was tagged in the Smith River on 29 September 2009 in the Eagle Creek section near river mile 78.3. It stayed in the same general area over the next 30d. Six months later, on 12 May 2010, it was discovered 1.2 miles upstream and stayed in that area over the next 28 days until contact was lost. In 2010 FWP received numerous reports of pelicans in the upper Smith River basin. By September 2010, there were 4 radioed fish (including 720-113) that we had not collected relocation on for several months. We assumed the radios had malfunctioned, had been removed from the study area by anglers or predators, or the fish had left the study area. On 2 September we conducted a flight over the waterfowl nesting area on Canyon Ferry Reservoir and detected a signal from radio 720-113 in the NW ¼ of pond #3. On 10 September we launched a boat on nesting pond #3 and tracked radio 720-113 to island # 75 (Figure 2). We were able to recover the radio from about 6 inches of water. The distance from island # 75 to the last known location of this fish on the Smith River was 32.8 miles (Figure 3). This finding revealed that pelicans from the Canyon Ferry nesting colony travel over the Big Belt Mountains to the Smith River and are able to forage on rainbow trout as long as 14.7 inches and weighing 1.15 pounds.

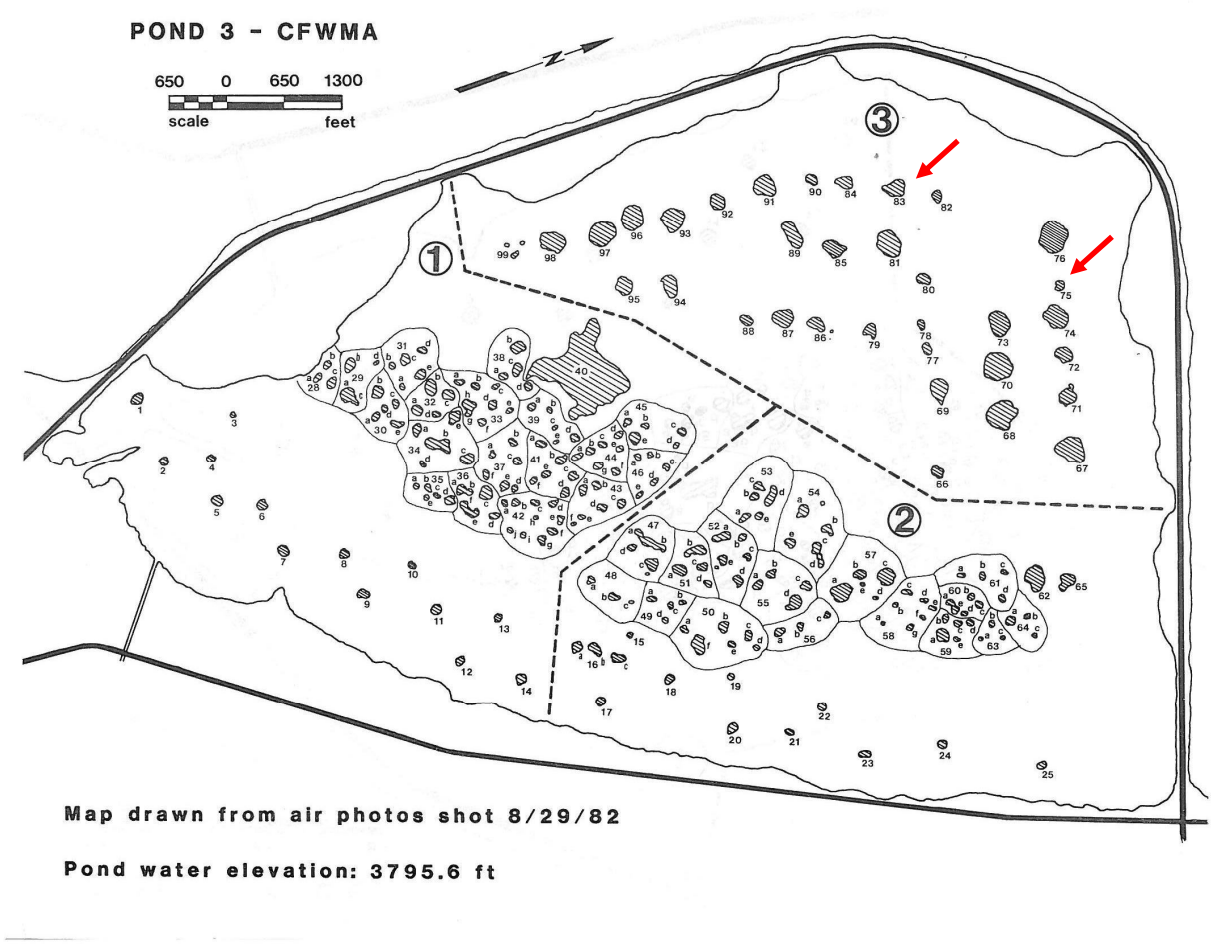


Figure 2. Map of waterfowl nesting pond #3 near Canyon Ferry Reservoir.

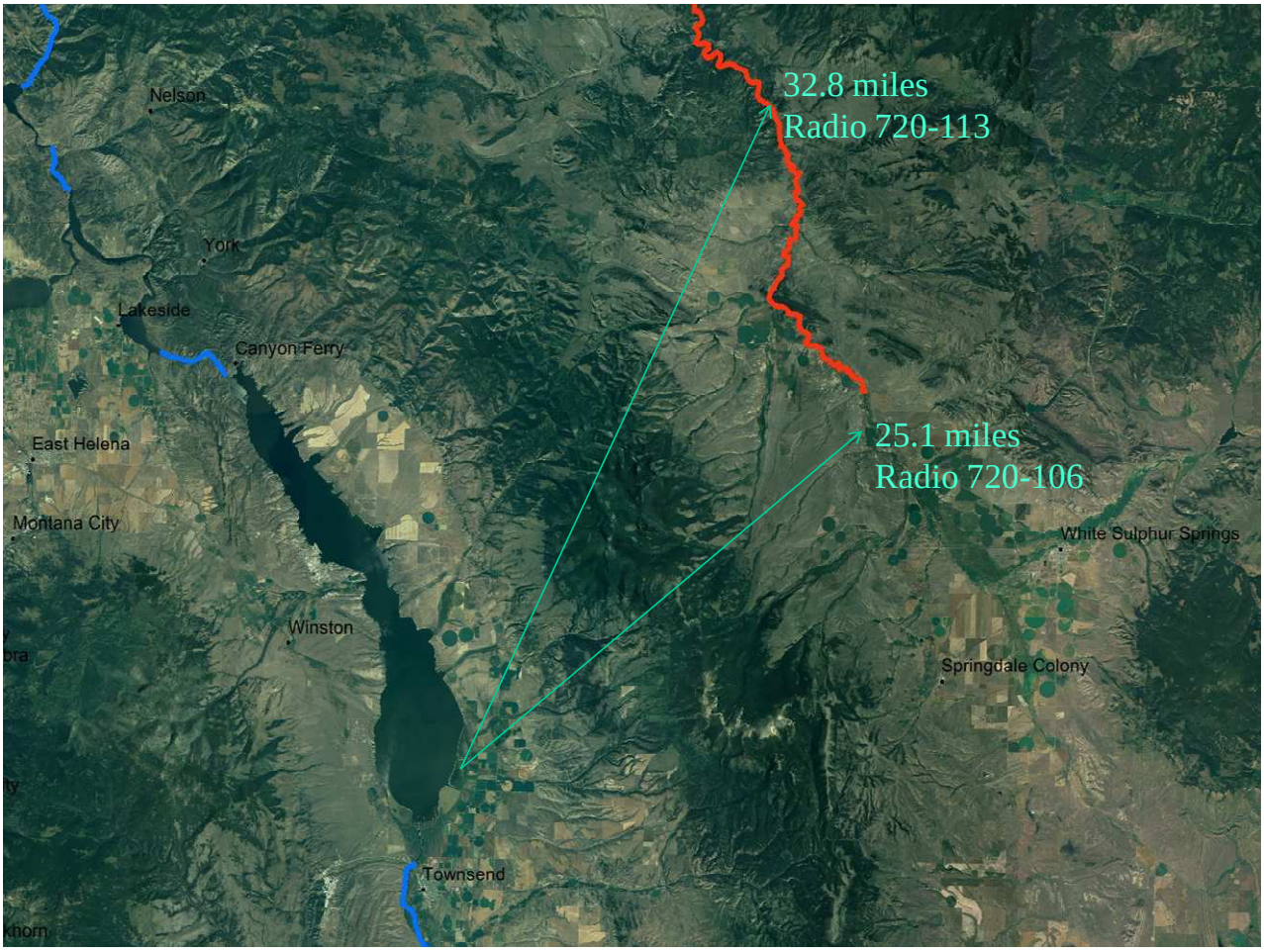
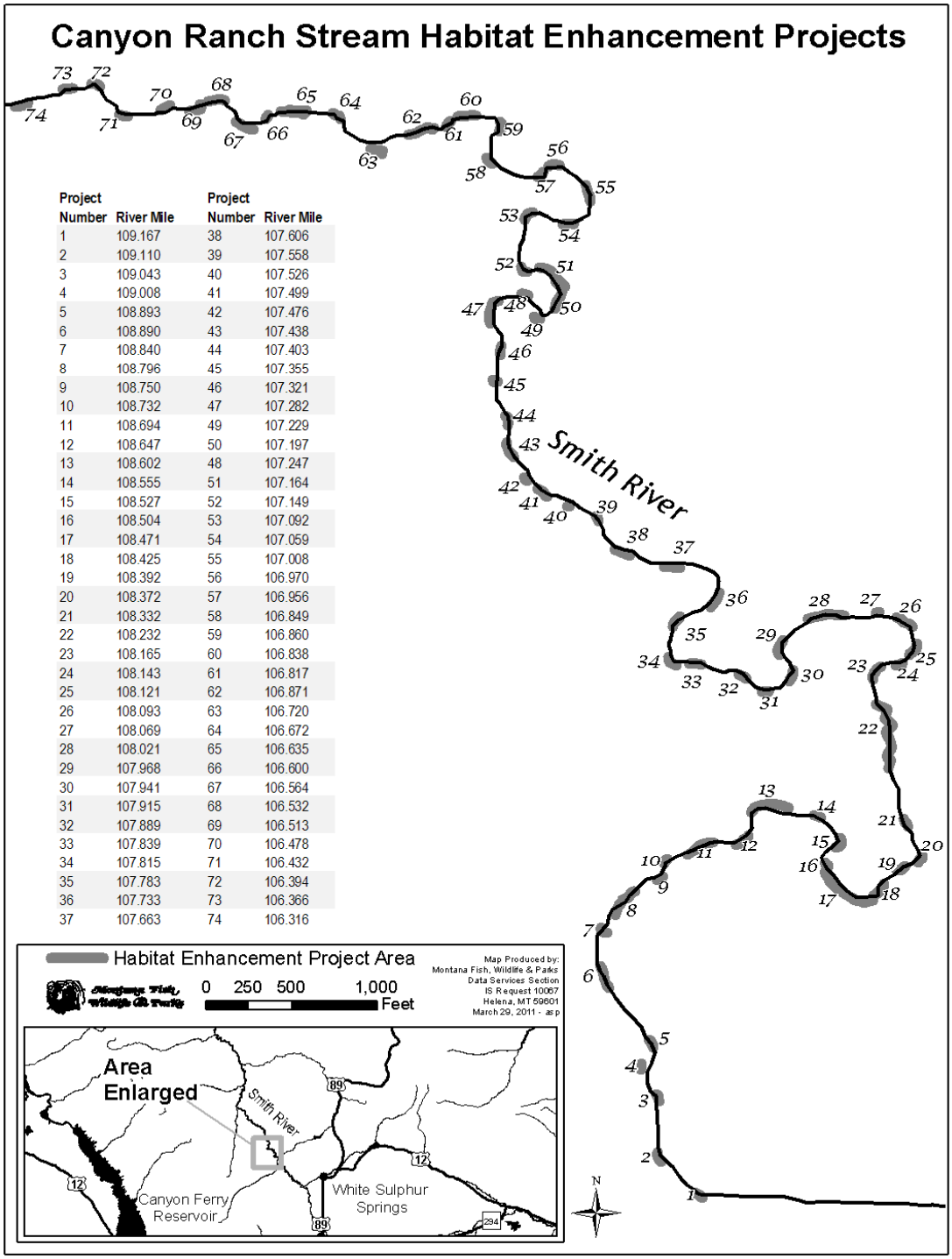


Figure 3. Aerial photo of upper Smith River drainage relative to Canyon Ferry waterfowl nesting pond #3 and distance birds traveled to forage on radioed trout.



Project Number	River Mile	Project Number	River Mile
1	109.167	38	107.606
2	109.110	39	107.558
3	109.043	40	107.526
4	109.008	41	107.499
5	108.893	42	107.476
6	108.890	43	107.438
7	108.840	44	107.403
8	108.796	45	107.355
9	108.750	46	107.321
10	108.732	47	107.282
11	108.694	49	107.229
12	108.647	50	107.197
13	108.602	48	107.247
14	108.555	51	107.164
15	108.527	52	107.149
16	108.504	53	107.092
17	108.471	54	107.059
18	108.425	55	107.008
19	108.392	56	106.970
20	108.372	57	106.956
21	108.332	58	106.849
22	108.232	59	106.860
23	108.165	60	106.838
24	108.143	61	106.817
25	108.121	62	106.871
26	108.093	63	106.720
27	108.069	64	106.672
28	108.021	65	106.635
29	107.968	66	106.600
30	107.941	67	106.564
31	107.915	68	106.532
32	107.889	69	106.513
33	107.839	70	106.478
34	107.815	71	106.432
35	107.783	72	106.394
36	107.733	73	106.366
37	107.663	74	106.316

Figure 4. Habitat enhancement sites (pool number) and relative river mile reference for Canyon Ranch section of the Smith River, Montana.

In 2010, all of the fish tagged in the Eagle Creek section moved out of this section and reestablished new home sites. Brown trout from this section traveled an average of 12.2 (7.7-16.7) miles and rainbow trout traveled an average of 15.7 (6.6-24.7) miles to reach new home sites. Nearly half (47%) of the fish from the Canyon Ranch moved away at some point during the study and reestablished in new home sites. The general behavior of fish that stayed (53%) in the 3 mile reach of the Canyon Ranch included subtle movements between the deep water habitat features present in this section (Appendix A). The mean distance these fish moved within this 3 mile reach in 2010 was 5.8 (0.6-11.9) miles for brown trout and 3.3 (2.5-4.1) miles for rainbow trout. Brown trout that moved away from the Canyon Ranch traveled an average of 11.1 (8.8-14.1) miles. One rainbow trout from the Canyon Ranch traveled the furthest distance of any fish in the study (46.2 miles). Only one of the radioed fish, a rainbow trout, showed clear use of a tributary (Sheep Creek) for spawning. In 2010, radioed fish in the Canyon Ranch section were relocated at 16 (22%) of the 74 "pool" sites developed during the 2003 habitat enhancement project. On average, 55% of the radioed fish were relocated at five different pools followed by 27% at 4 pools, 9% at 3 pools and 9% at 2 pools. The highest number of relocations (54%) came from pool 16 which was used by 11 of the radioed fish (Table 2). Pool 69 was used by 7 of the radioed fish and 15% of the relocations were from here. Pool 16 was used by 7 of the radioed fish and 7% of all relocation came from this site

(Table 2). Pools used by radioed trout in the Smith River Canyon Ranch section, 2010.

Species	Rb	Rb	Rb	LL	LL	LL	LL	LL	LL	LL	LL
Sex	F	F	F	F	M	F	F	F	F	F	F
Pool #	69	31	41	69	69	69	69	69	28	69	28
	69	28	19	55	63	69	69	69	25	69	16
	38	19	16	41	19	69	16	18	16	69	16
	28	16	16	19	16	36	16	16	16	66	16
	19	16	16	16	16	19	16	16	16	19	16
	16	16	11	16	16	16	16	16	16	16	16
	16	16	4	16	16	16		16	16	16	16
	16	11		16		16		16	11	16	16
	16					16		11		16	11
	16					4		8		16	
	16										
# of pools used	5	5	5	5	4	5	2	5	4	4	3

We expected more of the radioed fish to display long distance movements into the lower reaches of the Smith River in both winter and summer to avoid high water temperatures and

displacement due to low flows and ice. Despite low a sample size, we were able to make some general characterizations of trout behavior and risks during the first year of surveillance. All of the fish tagged in the Eagle Creek section moved away and reestablished new home sites. Most of these fish descended the river to spawn and established new home sites in the float section. It is likely that most of the fish in the Eagle Creek section are migratory. The sedentary behavior of over half of the fish (both rainbow and brown trout) tagged in the Canyon Ranch section suggests their life history is localized and most likely attributed to the habitat features present in this section of river. Twenty-one percent (n=3) of the trout that left the Canyon Ranch section during spawning seasons, returned after spawning. We lost contact with a relatively high percentage (24%) of the radioed fish in this study. Two (10%) were removed by fish eating birds. The other most common reason for losing radioed fish is by anglers. Only one of the radioed fish that we lost contact with was in the public floater section between Camp Baker and Eden Bridge. None of the radios implanted in the upper Smith River basin were recorded at the Eden Bridge receiver station, suggesting none were harvested by anglers.

References

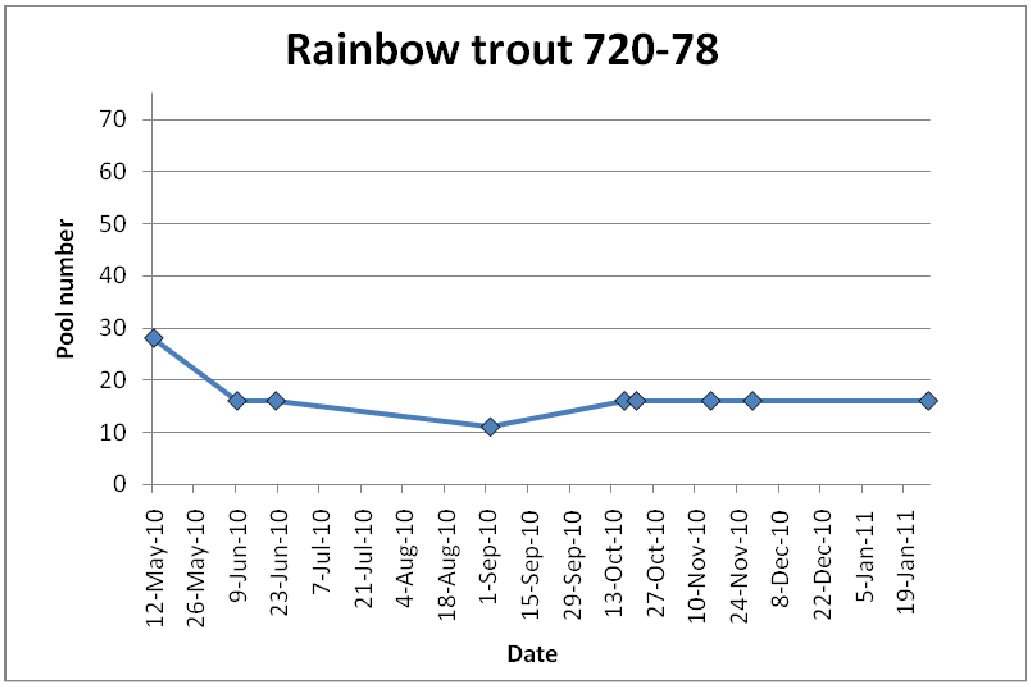
Brown, R.S., S.J. Cooke, W.G. Anderson and R.S. McKinley. 1999. Evidence to challenge the 2% rule for biotelemetry. North American Journal of Fisheries Management. 19:867-871.

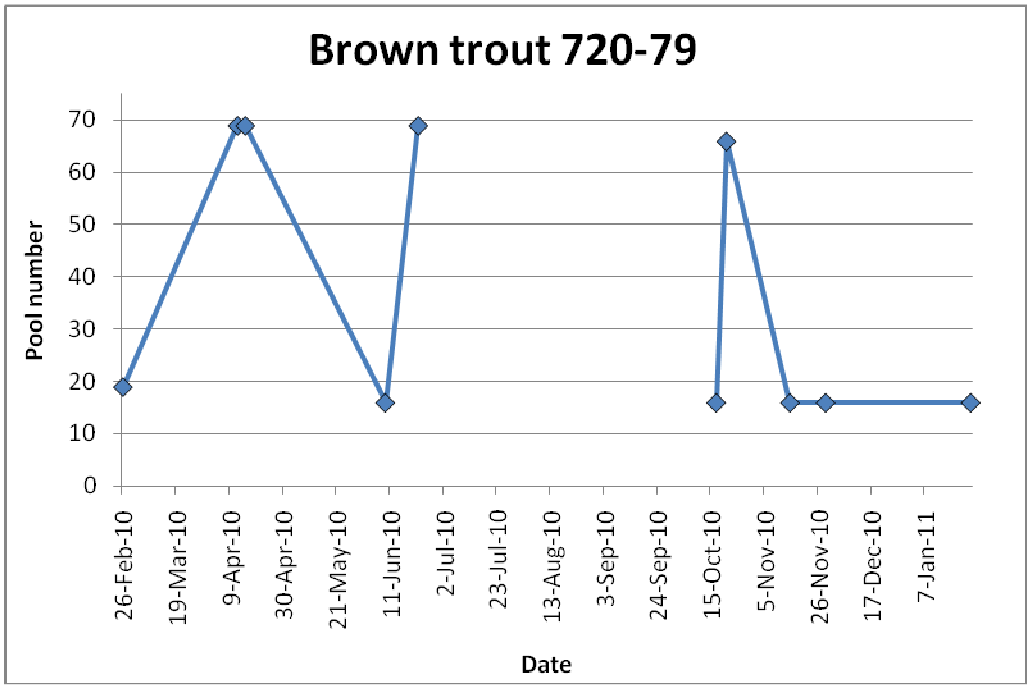
Cooke, S.J. and C.M. Bunt. 2001 Assessment of internal and external antenna configurations of radio transmitters implanted in smallmouth bass. North American Journal of Fisheries Management 21:236–241.

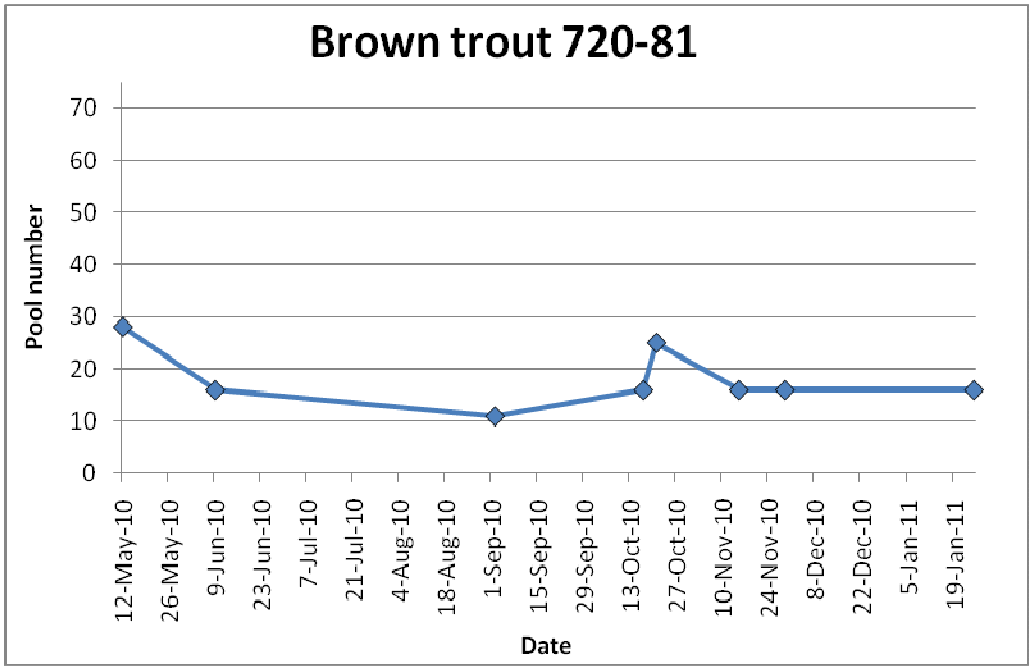
Grisak, G. 2009. Missouri-Smith-Sun Rivers fish movement study. PPL-Montana MOTAC project 771-09. Progress report. Montana Fish, Wildlife & Parks. Great Falls.

APPENDIX A

Fish movements in 2010 on the Canyon Ranch section of the Smith River with reference to "pools" developed during the 2003 habitat improvement program.






Brown trout 720-81
Pool number
70
60
50
40
30
20
10
0
12-May-10
26-May-10
9-Jun-10
23-Jun-10
7-Jul-10
21-Jul-10
4-Aug-10
18-Aug-10
1-Sep-10
15-Sep-10
29-Sep-10
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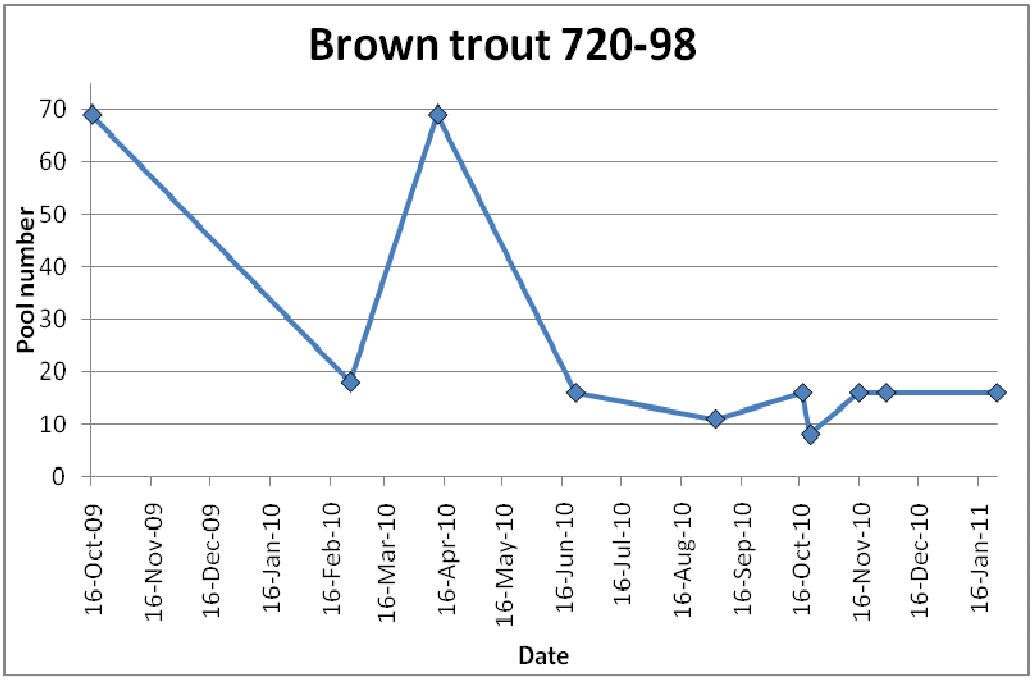
22-Dec-10
5-Jan-11
19-Jan-11
Date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Pool number
70
60
50
40
30
20
10
0
16-Oct-09
16-Nov-09
16-Dec-09
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16-Feb-10
16-Mar-10
16-Apr-10
16-May-10
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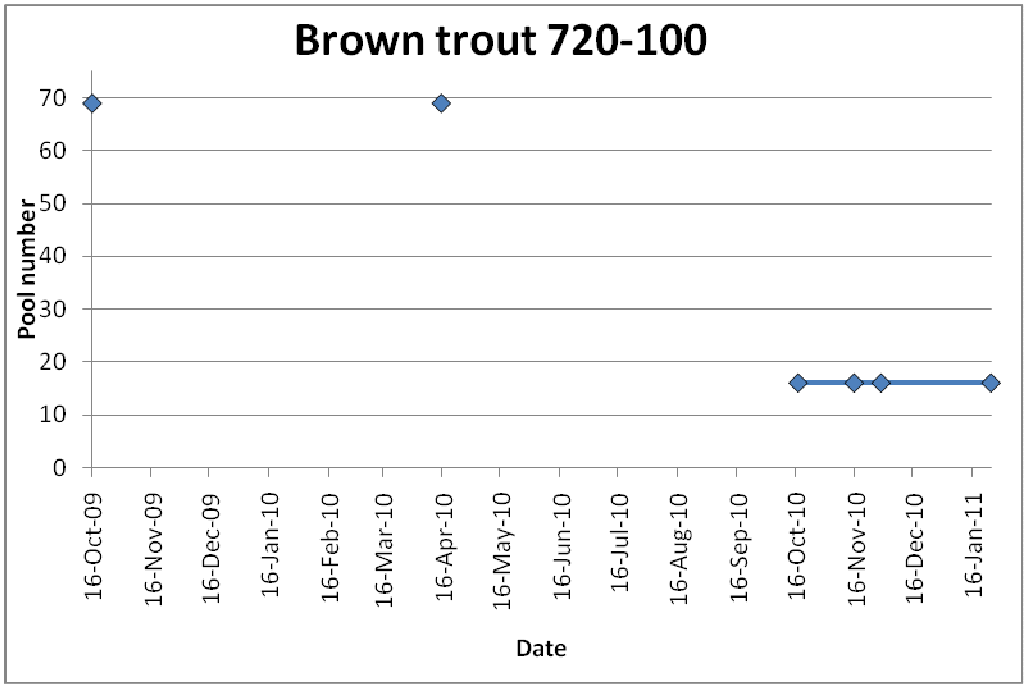
16-Nov-10
16-Dec-10
16-Jan-11
Date


Brown trout 720-100
Pool number
70
60
50
40
30
20
10
0
16-Oct-09
16-Nov-09
16-Dec-09
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16-Feb-10
16-Mar-10
16-Apr-10
16-May-10
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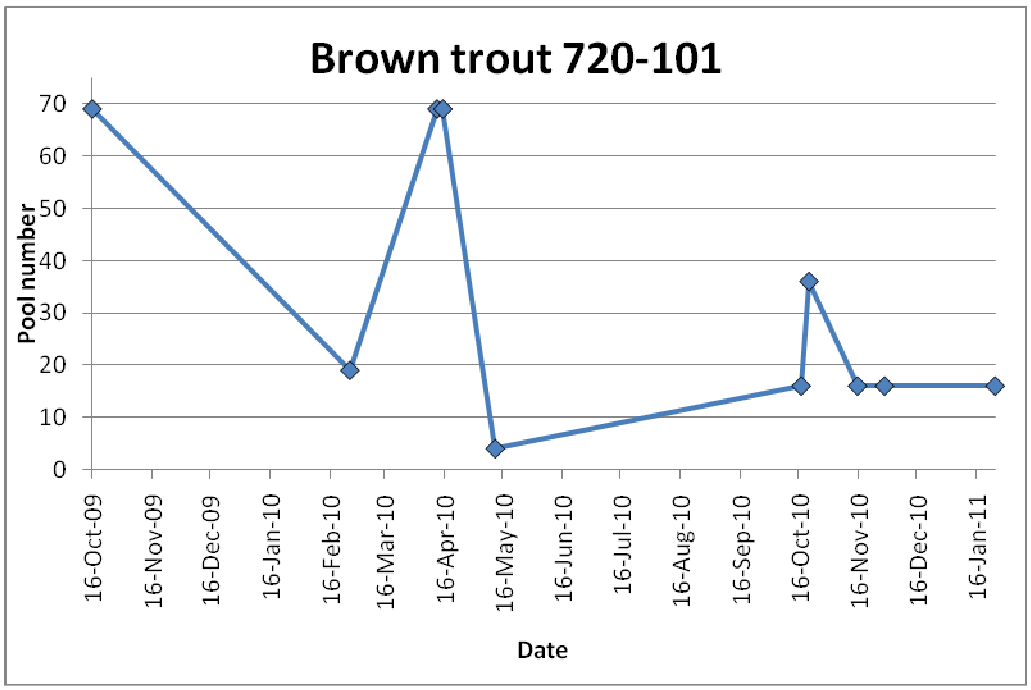
16-Dec-10
16-Jan-11
Date


Brown trout 720-101
Pool number
70
60
50
40
30
20
10
0
16-Oct-09
16-Nov-09
16-Dec-09
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16-Feb-10
16-Mar-10
16-Apr-10
16-May-10
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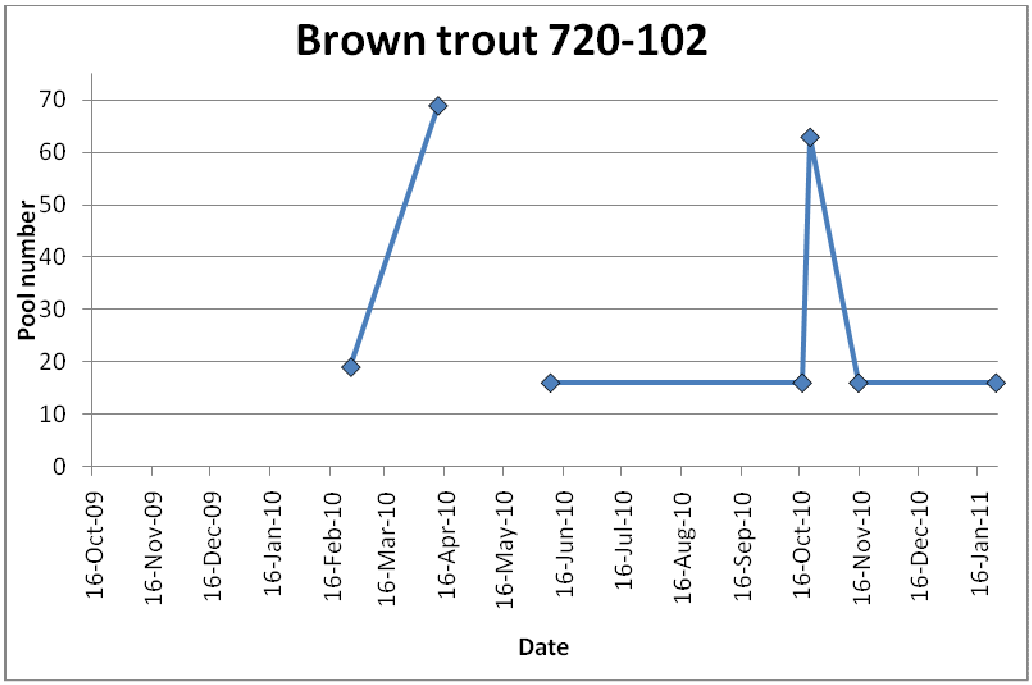
16-Nov-10
16-Dec-10
16-Jan-11
Date


Brown trout 720-102
Pool number
70
60
50
40
30
20
10
0
16-Oct-09
16-Nov-09
16-Dec-09
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16-Feb-10
16-Mar-10
16-Apr-10
16-May-10
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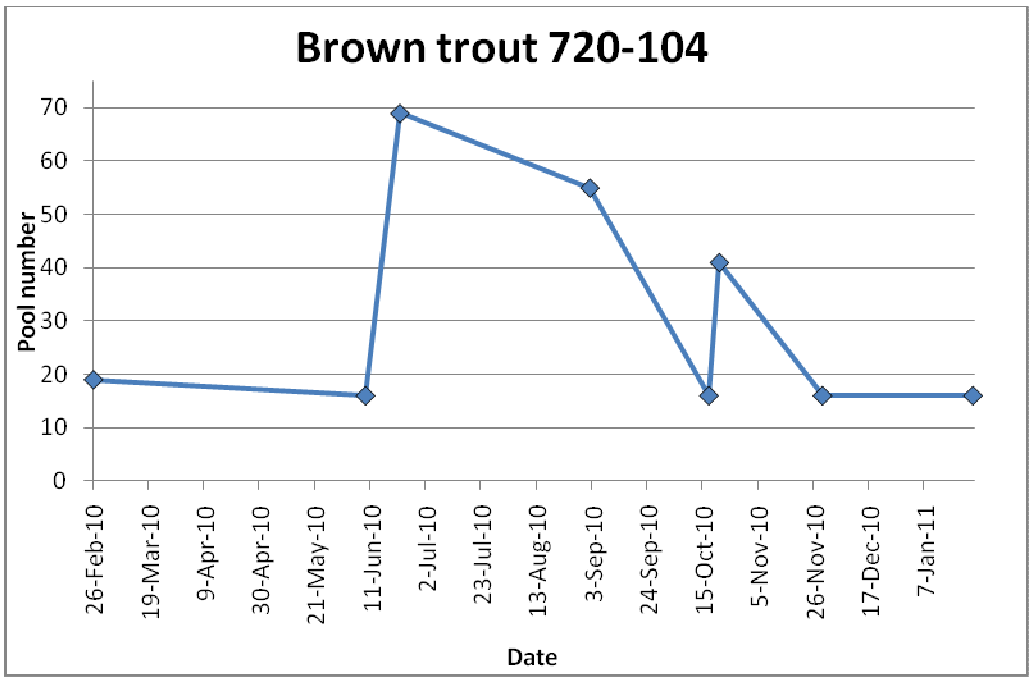
16-Oct-10
16-Nov-10
16-Dec-10
16-Jan-11
Date


Brown trout 720-104
Pool number
70
60
50
40
30
20
10
0
26-Feb-10
19-Mar-10
9-Apr-10
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21-May-10
11-Jun-10
2-Jul-10
23-Jul-10
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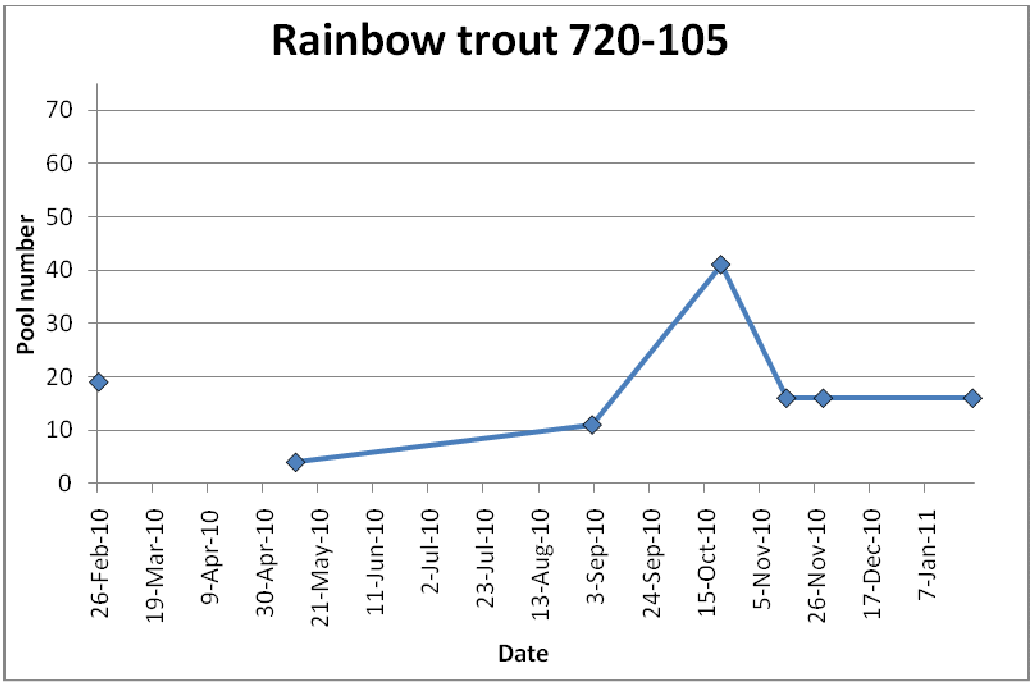
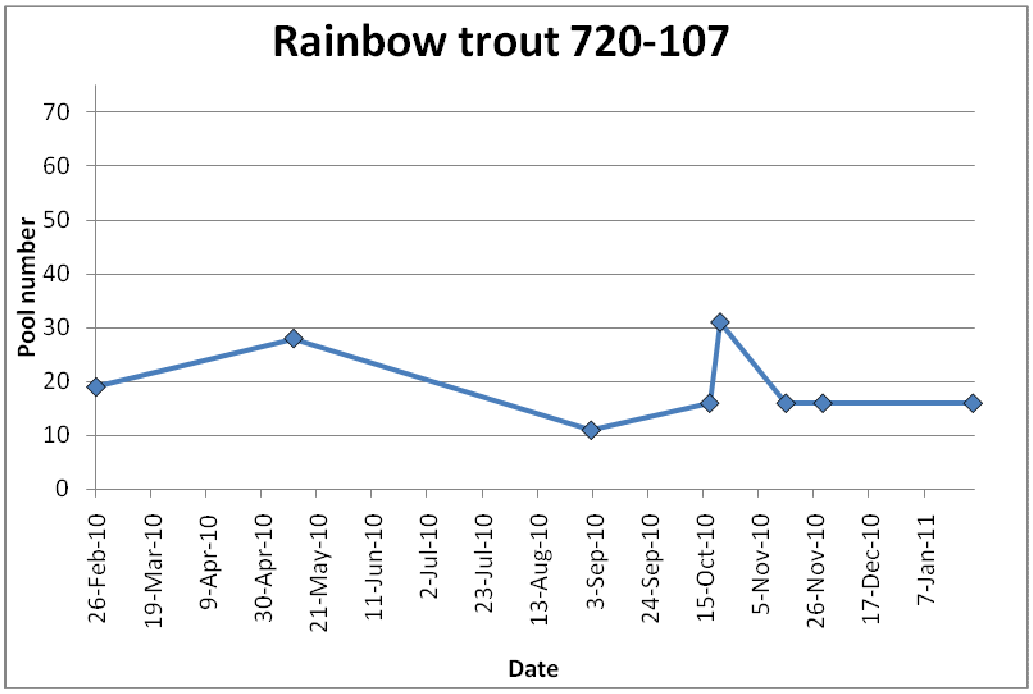
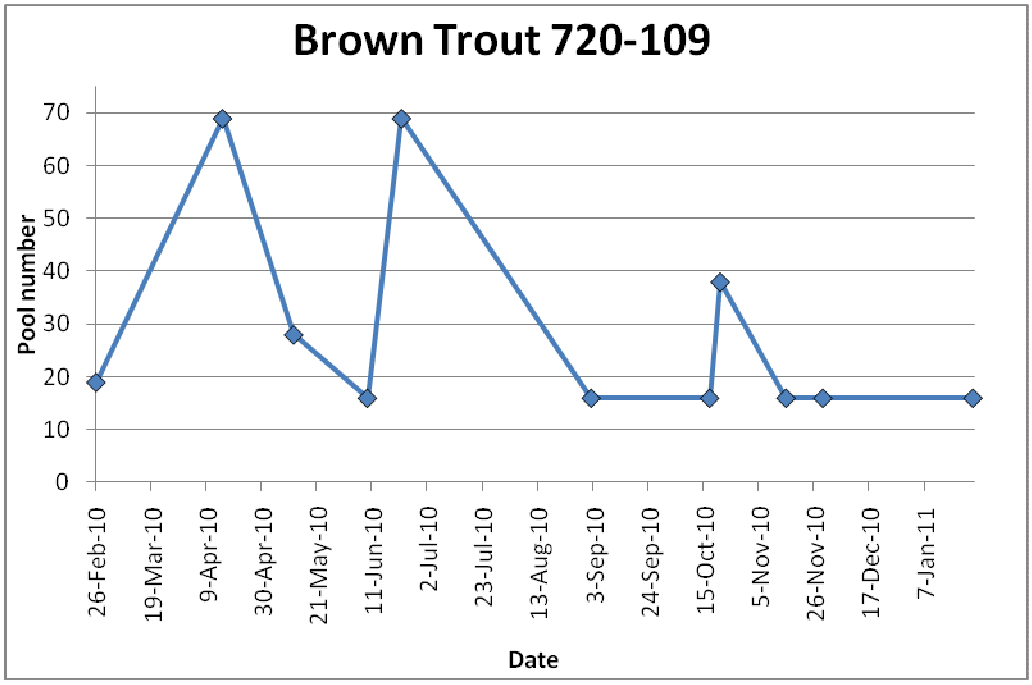
5-Nov-10
26-Nov-10
17-Dec-10
7-Jan-11
Date


Rainbow trout 720-105
Pool number
70
60
50
40
30
20
10
0
26-Feb-10
19-Mar-10
9-Apr-10
30-Apr-10
21-May-10
11-Jun-10
2-Jul-10
23-Jul-10
13-Aug-10
3-Sep-10
24-Sep-10
15-Oct-10
5-Nov-10
26-Nov-10
17-Dec-10
7-Jan-11
Date


Rainbow trout 720-107
Pool number
70
60
50
40
30
20
10
0
26-Feb-10
19-Mar-10
9-Apr-10
30-Apr-10
21-May-10
11-Jun-10
2-Jul-10
23-Jul-10
13-Aug-10
3-Sep-10
24-Sep-10
15-Oct-10
5-Nov-10
26-Nov-10
17-Dec-10
7-Jan-11
Date


Brown Trout 720-109
Pool number
70
60
50
40
30
20
10
0
26-Feb-10
19-Mar-10
9-Apr-10
30-Apr-10
21-May-10
11-Jun-10
2-Jul-10
23-Jul-10
13-Aug-10
3-Sep-10
24-Sep-10
15-Oct-10
5-Nov-10
26-Nov-10
17-Dec-10
7-Jan-11
Date