Fish Surveys on the Gros Ventre River, Grand Teton National Park
2007 Field Season Report

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Objective and Rationale:

The cutthroat trout *Oncorhynchus clarki* is the only native trout in Wyoming. The Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) is designated as a "species of special concern" or "sensitive species" by a number of agencies and conservation groups. Although the Yellowstone cutthroat trout has recently avoided federal listing because of robust headwater populations (USFWS 2006), they face continued threats across their range. The fine-spotted Snake River native trout is a morphologically divergent ecotype of the Yellowstone subspecies, although it is not genetically distinguishable (Novak et al. 2005). The Gros Ventre and Snake River in the Grand Teton National Park is the last remaining habitat for the fine-spotted Snake River cutthroat trout. Principal threats to the Gros Ventre native trout include both water diversions (loss of water and fish into irrigation ditches), as well as hybridization and competition with non-native rainbow trout (*Oncorhynchus mykiss*).

Water diversions can influence the quantity and quality of habitat, as well as, serve as an important source of mortality. Adult trout habitat in the lower Gros Ventre River is limited by the effects of at least 13 irrigation diversions between Kelly and its confluence with the Snake River. Such a large proportion of the river flow is diverted that fish habitat (and flow) is often completely eliminated near the Highway 191 bridge. This may reduce the quantity and quality of trout habitat in the Gros Ventre River and serve as a barrier to fish movement between the Gros Ventre River and the Snake River systems. In addition to reducing instream flow, water diversions can be a large source of mortality for trout. Irrigation diversions have been demonstrated to be a major source of mortality for a variety of native trout (e.g., Schrank and Rahel 2004, Gale 2005). Any period of movement can increase encounter with diversions and susceptibility to entrainment including, age-0 postemergence dispersal (Northcote 1992), downstream movements from headwater streams to overwintering habitats (Jakober et al. 1998), and movements to other habitats within a river. A previous study examining water diversions in the Gros Ventre River found mountain whitefish, cutthroat trout, as well as, speckled and longnose dace in several of the diversion ditches (Kiefling 1973). Thus, understanding the role of these diversions on the potential habitat availability and mortality of cutthroat trout in the Gros Ventre is crucial for the conservation of this population.

In the summer of 2007, we examined fish density and composition in irrigation ditches, evaluated whether ditches provided useful habitat, and was the first year of our study to examine rates of entrainment to understand the potential implications of this loss to the population.

Study Area

The Gros Ventre River is a major tributary to the Snake River approximately 5 miles north of Jackson, Wyoming. Gros Ventre River is a cobble-bed tributary to the Snake River which drains approximately a 600 square mile watershed. The Lower Gros Ventre River is the focus of our study, bounded on the east by the Grand Teton National Park and on the west at the confluence of the Gros Ventre with the Snake River. There are 13 diversion ditches along the Lower Gros Ventre River from Kelly to the confluence with the Snake River. At many of these ditches, diversions are greater than the allotted rights (Albright 1993) which have previously reduced instream flows along the lower 3 to 6 miles to a trickle of water (Campbell et al. 1990).

Although the original stocking records of rainbow trout in the river is unknown, previous studies identified Snake River cutthroat trout (*Oncorhynchus clarki*), rainbow trout

(*Oncorhynchus mykiss*), rainbow x cutthroat trout hybrids, mountain whitefish (*Prosopium williamsoni*), brook trout (*Salvelinus fontinalis*), Utah sucker (*Catostomus ardens*), mountain sucker (*Catostomus platyrhynchus*), bluehead sucker (*Catostomus discobolus*), mottled sculpin (*Cottus bairdii*), paiute sculpin (*Cottus beldingii*), longnose dace (*Rhinichthys cataractae*) and speckled dace (*Rhinichthys osculus*) present in the lower portions of the Gros Ventre River (Novak unpublished data). During the summer of 2007 lake trout (*Salvelinis namaycush)* were also recorded in a ditch off the lower Gros Ventre (Spring Gulch).

Objective 1: What is the fish composition (species and sizes) in the ditches? Which ditches have the highest abundances of fish?

Methods

During the month of July, we sampled eight irrigation ditches in order to determine species composition and abundance, including Enterprise/Hobo (ENT), Savage (SAV), Price-Lucas (PL), Glidden/Wild Cherry (GLD), White (WHIT) and those of the White complex near and on Jackson Hole Golf and Tennis Club (JHGT): Buckskin (BKS), May (MAY) & White Complex #1 (WC1). We systematically sampled multiple 200m reaches within each ditch. Some reaches were slightly greater or more less than 200m to complete a pool habitat unit (e.g. stop reach at the top versus the middle of a pool). The number of reaches sampled within a ditch depended on the length of the ditch and the connectedness to other ditch systems. Overall, we started near the headgate, randomly placed the beginning of the first reach, and then systematically sampled 200m reaches at 600-800 m intervals. MAY had only one reach sampled due to its relatively short length and its immediate connection to the White Complex. BKS ditch had 2 reaches spread 600m apart, though in reality it is a continuation of WHIT. WC1, PL and SAV each had 3 reaches sampled. ENT, GLD and WHIT were each long enough to allow 4 reaches to be sampled within each of them.

We used a Smith-Root Type-VII POW backpack electrofishing unit to sample the ditches. At each end of the sampling reach, temporary block nets were set up to secure a closed system. We conducted 2-pass depletions for trout and processed all non-game fish. Only 1 pass was conducted if there was 1 or less trout or no adult non-game fish. Snake River cutthroat (SCT), rainbow trout (RBT) and rainbow/cutthroat (RB/CT) hybrids were measured for weight (g), total length (mm) (TL), and had scale and genetic samples taken. Scale samples were taken for future age and growth analyses. Genetic samples were clipped from the tip of the anal fin and also served as a mark for recapture detection during additional surveys. All other fish were measured for total length (mm) and visually identified down to species level, except for sculpin and suckers which were classified at this more general level.

We also electrofished in the fall after the ditches closed for the season. All accessible lengths of the ditches were sampled estimate species abundance and composition. We conducted closure censuses on the following ditches: ENT, BKS, PL, SG & WHIT, South Park Supply (SPS) and GLD.

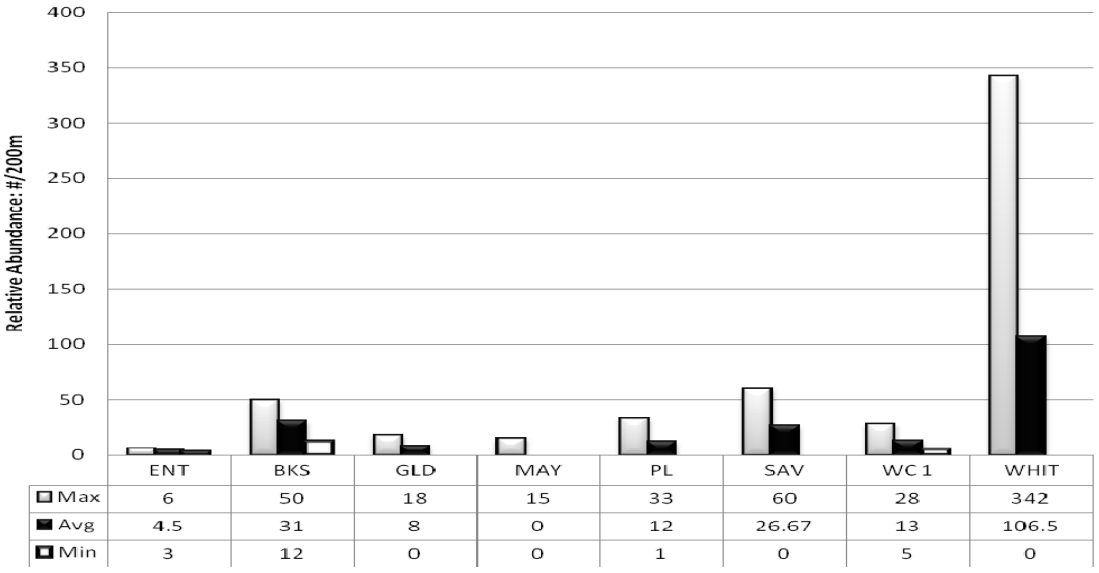
Results

Density of fish in ditches: July sampling

White Ditch had the highest abundance of both non-game species and trout in the July reach sampling (Figures 1 and 2). White had an average density of 106.5 non-game fishes per 200m reach. We collected four Snake River cutthroat trout from WHIT. Buckskin (a continuation of WHIT) had the second highest densities of fish with 31 nongame fishes per 200m reach and three SCT.

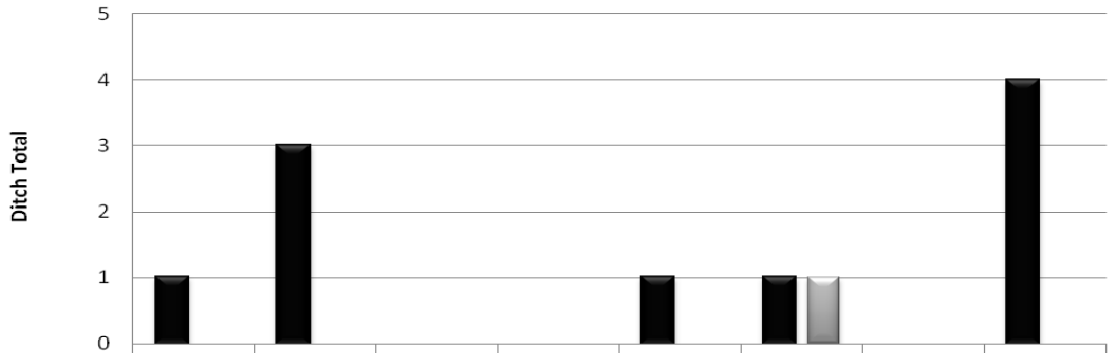
For all ditches, those reaches closest to the point of diversion off the Gros Ventre consistantly had the highest density of fish throughout the season. For example, the highest abundance of fish (342 nongame fish) within WHIT was in the top reach which was 200m downstream of the cobble diversion but there no fish collected at the reach furthest from the point

of diversion on WHIT (approximately 3.5-4 km from the cobble diversion). Similarly on Enterprise Ditch, in July a trap net was set at the border of the park service land and the airport. Over the period of three weeks in July, only 1 sucker was captured.



	ENT	BKS	GLD	MAY	PL	SAV	WC 1	WHIT
Max	6	50	18	15	33	60	28	342
Avg	4.5	31	8	0	12	26.67	13	106.5
Min	3	12	0	0	1	0	5	0

Figure 1. Relative abundance of nongame fish in the ditches during the July sampling. These numbers are from the first pass only to demonstrate their relative differences among the ditches.



	ENT	BKS	GLD	MAY	PL	SAV	WC1	WHIT
SCT	1	3	0	0	1	1	0	4
YOY TRT	0	0	0	0	0	1	0	0

Figure 2. The total number of trout captured in July sampling for each ditch. If trout were captured, then a second electrofishing pass was performed.

Density of fish in ditches: Fall closure sampling

Overall, during the fall closures we captured 2180 non-game fishes and a total of 274 trout comprised of SCT (n=175, 63.87%), YOY TRT (n= 47, 17.15%), RB/CT hybrids (n= 39, 14.23%), BRK TRT (n= 8, 2.92%) and RBT (n= 5, 1.82%). White Ditch had the highest abundance of nongame species and trout. There were 1,252 nongame and 88 trout collected when sampled on October 20th. The ditch was shut-off around October 7th; therefore the number of fish we observed was probably lower than the actual amount in the ditch due to loss from predation

and dropping water levels during this period. South Park Supply had the second highest abundance (305) of non-game fishes. SPS was closed the week before our sampling and much of the ditch was dry when sampled and therefore our sampling was biased low. Price-Lucas and Enterprise were closed (11/3) and sampled that day or the next day (11/3 and 11/4) and had 50 and 45 trout, respectively. May Ditch and White-Complex-1 were not sampled when shut-off on 11/3 due to their low numbers during our July reach sampling and logistical constraints. Savage Ditch did not shut-off and therefore could not be sampled for a closure census. It is worth noting that numbers of fish in the Spring Gulch closure census are lower as a result of a smaller amount of area sampled (headgate to park boundary) and some of the non-game fishes were killed when captured in trap nets reducing movement of non-game fishes further into the SG ditch system. Next, we plan to examine the relationship of abundance versus distance from diversion to project these ditch numbers to account for the different lengths of reach sampled.

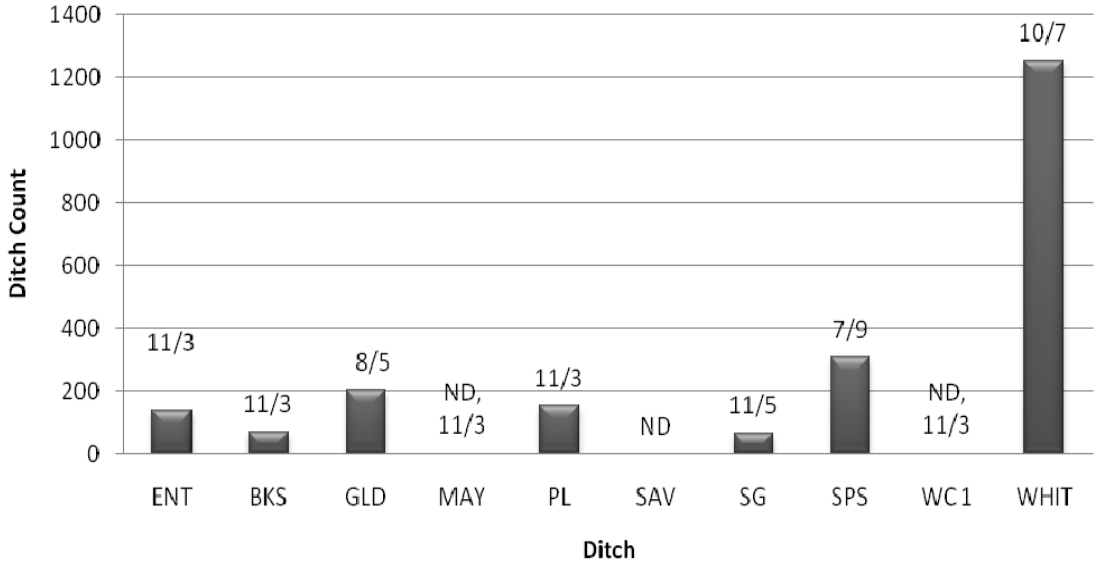


Figure 3. Abundance of nongame fish captured in the ditches after the headgates were closed. The dates above bars are our estimated date of closure. ND indicates that we have no data, because the ditch was not sampled.

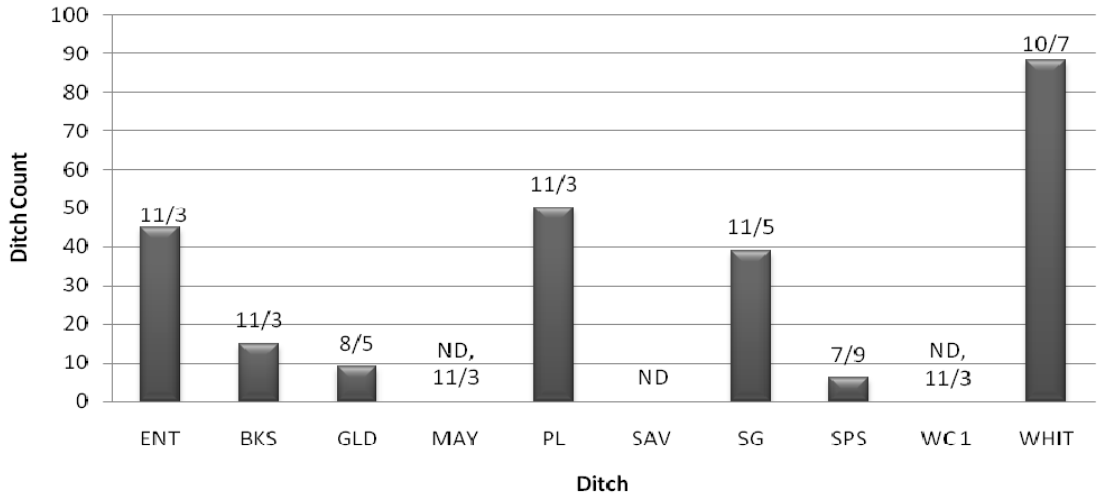


Figure 4: Numbers of trout captured in the ditch closure surveys.

Species composition: all gear types and ditches

We collected and processed a total of 4,593 nongame species during the summer season (July 7- August 31) and 4,994 during the fall season (September 1- November 17). We estimated composition from summer reach surveys, trap nets, and closure censuses. The most abundant nongame species was longnose dace during the summer and fall encompassing 32.6% and 50% of the species composition, respectively. The second most abundant group during the summer was suckers (34.5%) while the second most abundant group during the fall season was sculpin (16.7%; Figure 5).

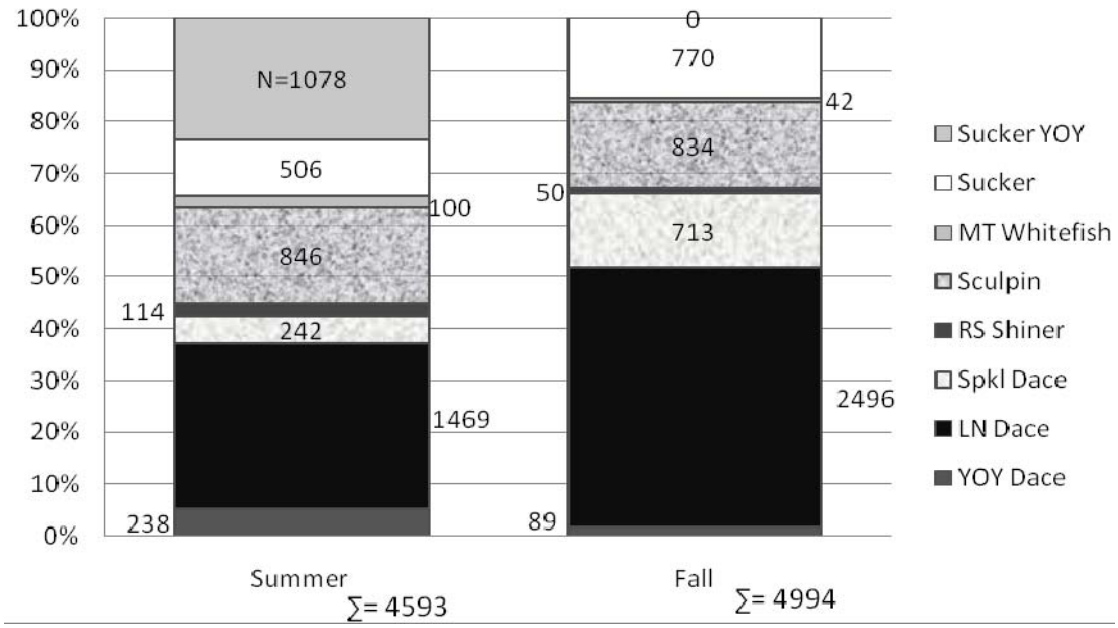


Figure 5. Nongame species composition in all gear types for the summer and fall of 2007.

There were a total of 94 trout collected in ditches during the summer and 274 during the fall season. Snake River cutthroat (SCT) was the most abundant trout species in the ditch systems. SCT comprised 83% and 62% of all trout in the summer and fall sampling, respectively. Small trout (YOY TRT in graph) included trout less than 100mm in the summer and less than 120 mm in the fall. Small trout capture rates increased substantially from 8 trout in the summer to 66 trout in the fall (Fig. 6).

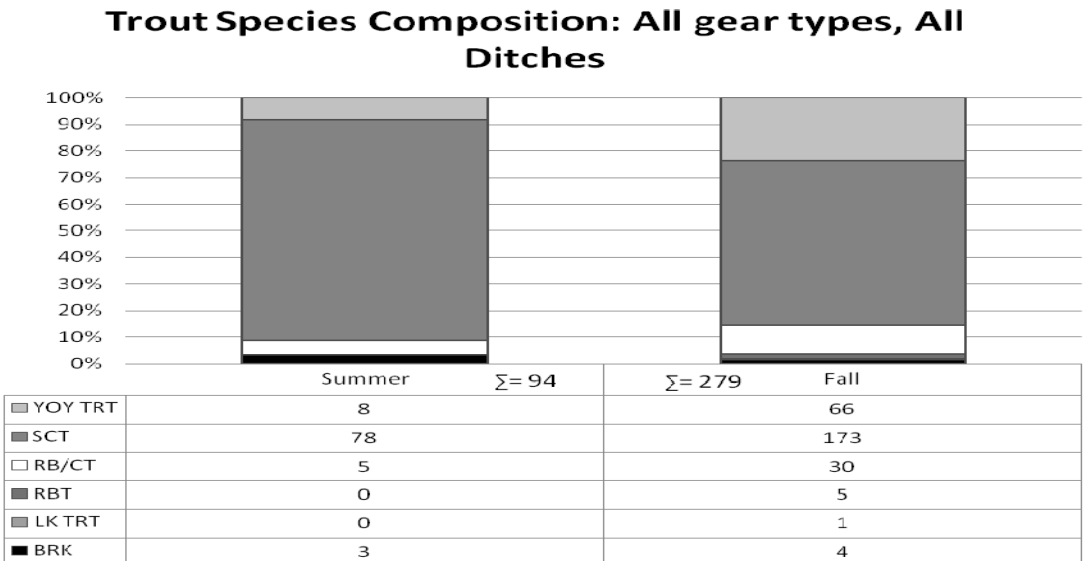


Figure 6. Composition of trout species in all gear types for the summer and fall of 2007.

Impacted life stages: all gear types, all ditches

This data reflects which life stages of non-game species are affected by the ditches, and is a compilation of all sampling methods, in all ditches throughout the sampling season. This includes summer reach surveys, trap nets and closure census surveys. We found that all life stages of all non-game species were present within the irrigation ditches (Table 1).

Table 1. We measured a subsample of nongame fish from each sample reach and net set. Minimum length, average length, maximum length, and number of fish measured for nongame species captured in the summer 2007. These ranges include both electrofishing and trap net samples of all ditches.

	unknown dace	longnose dace	speckled dace	mountain whitefish	redside shiner	sculpin spp.	sucker spp.
Min.(mm)	17	12	10	49		14	10
Avg.(mm)	45	59	56	127	63	60	59
Max.(mm)	121	126	118	270	111	298	390
Number	361	1788	767	141	248	1078	1067

We also captured multiple size classes of trout in both summer and fall. All trout in the samples were measured. The summer trout samples ranged in total length from 29 to 570mm. Fall trout samples ranged from 45 to 476mm with 320 samples measured (Figures 7 and 8). Most notable is the large pulse of small trout seen in the ditches during the fall.

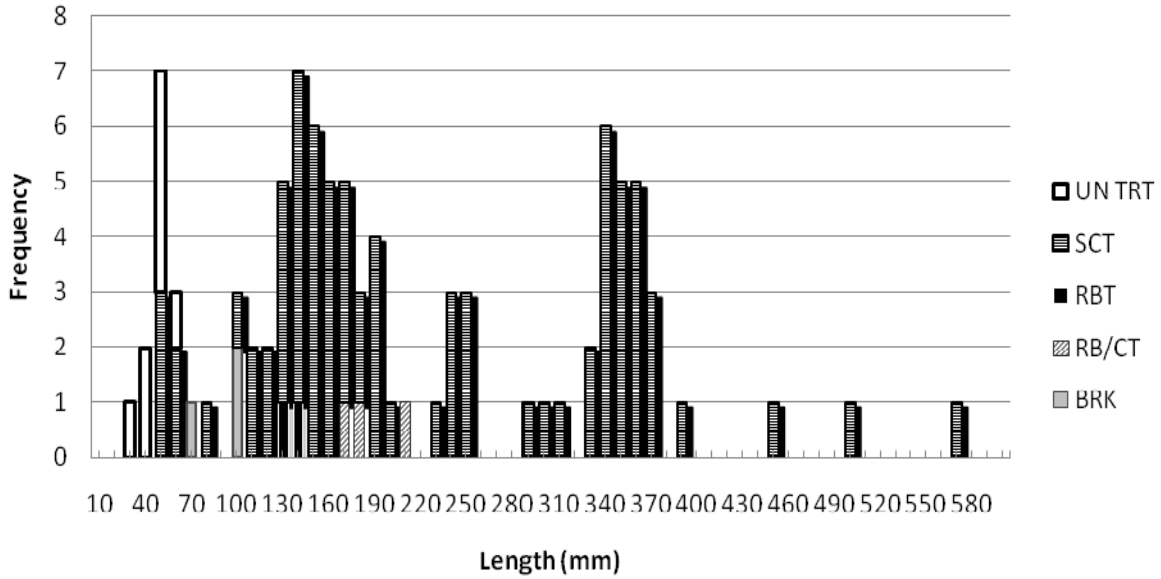


Figure 7. Length frequency distribution of all trout captured in summer electrofishing and trap net samples. Lengths are total lengths.

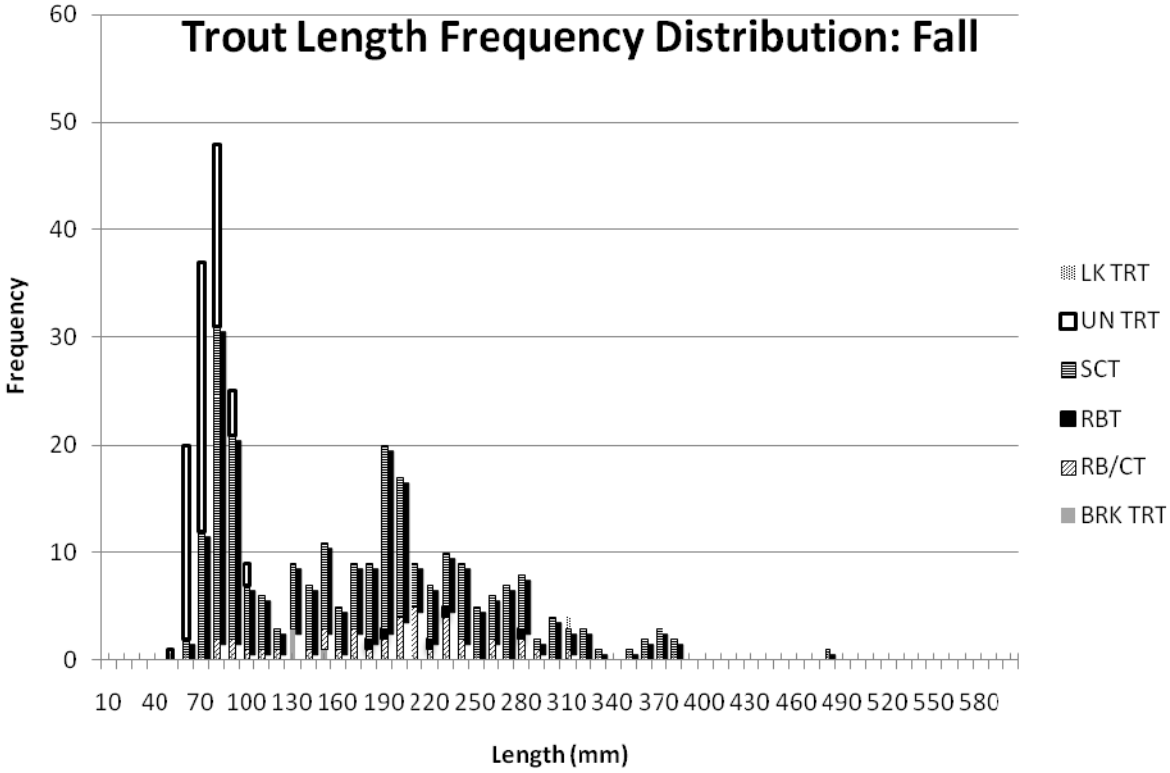


Figure 8. Length frequency distribution of all trout captured in fall electrofishing and trap net samples. Lengths are total lengths.

Objective 2: Do ditches provide useful habitat for Snake River cutthroat trout?

Methods

Within each ditch we conducted a cross-section assessment at each sampling reach with up to three assessments per ditch. At each site, we used the Wyoming Department of Environmental Quality bioassessment and habitat scoring system to standardize the habitat evaluation and be able to compare it with a previous assessment on Spring Creek by Lindsey Patterson which scored 158/200 points or 79% of the possible points. This analysis scores habitat parameters from high to low quality to examine the following aspects: % of fines (bottom substrate), embeddedness of substrate, in-stream fish cover, velocity/depth regime presence/absence, channel flow status, channel shape, pool/riffle sequence, channelization/alteration of streambed, width: depth ratio, vegetation protection at bank-full, bank stability and riparian vegetative zone width. For this assessment there is a total possible score of 200, which would be considered the highest quality habitat. In addition, we sketched the 200m reach, noted direction of flow, GPS coordinates, indicated surrounding land use, general riparian and in-stream habitat, outstanding features such as pools and notes on connectedness to other ditches and/or the Gros Ventre River, and took a photograph. Finally, at each cross-section we measured bank-full width, wetted width, depth at thalwag, depth at banks, temperature, and conductivity. Additionally, we noted any unpredictable and fluctuating flows within the irrigation ditches that were observed.

Results

The average habitat score among all the analyzed ditches was 109.5, or 55% of the potential score of 200. The lowest scoring reach was 3# of Savage Ditch (68.5, 34%) which was the farthest reach from the point of diversion on that ditch. The highest scoring reach was #3 of White Ditch (157.5, 79%) and was roughly 1,000m below the cobble diversion for White Ditch (Tables 2 and 3).

The habitat parameters that consistently scored less than half of the available score were 3 and 4 (16 scores <1/2 available each). Parameter 3 relates to in-stream fish cover (large cobble, gravels, boulders, logs, snags, undercut banks, etc.) and parameter 4 relates to the presence/absence of the four velocity/depth regimes (slow-deep, slow-shallow, fast-deep, fast-shallow). Parameters 6 and 12 both had the least number of low scoring occurrences (2 each). Habitat parameter 6 scores are based on the bank-full channel shape (trapezoidal (highest), rectangular, triangular & inverse trapezoidal (lowest). Parameter 12 scores the extent of riparian vegetation disruption (minimal to high).

One would expect those ditches resembling old side channels and streambeds to have a substantially higher habitat score than that of man made ditches, but that was not the case. Buckskin (1 & 2), South Park Supply (1, 2 &4) and White (1,3 & 4) each were within the Gros Ventre flood-plain and riparian corridor. These ditches visually looked like old stream beds. However, their average score of 57% is similar to that of "channelized" ditches (54%). Even the "more natural" ditch systems do not appear to consistently provide high quality habitat. Price Lucas was subject to sporadic and random on/off flow regimes due to conflicting irrigators throughout the summer of 2007 and therefore reach sampling could not be completed throughout its entirety.

On average the ditches were warm approximately 19. 9º C. The lowest recorded temperature during our summer habitat surveys was 13.4º C in White-Complex 1-3, which was directly below a piped influx of cold groundwater. The lowest temperature recorded without a groundwater spring source was in Enterprise-1, which measured 14.4º C. The average temperature in running ditches was 19.9º C and the highest was in Savage-2 at 26.5º C (excludes SPS (shut-off) and WC1-3(spring influx).

Ditch-Reach (Top-bottom)	Channel Type	Bank-full (cm)	Wetted (cm)	Depth (cm)	Temp. (ºC)	Time of Day
ENT-1	CH	405	390	30	14.4	10:05
ENT-2	CH	372	340	9	20.5	11:54
ENT-4	CH	427	427	31	17.2	10:24
BKS-2	SB	642	562	36	23.5	13:31
BKS-1	SB	647	387	16	17.2	10:14
GLD-1	CH	318	318	61	16.6	11:03
GLD-2	CH	295	177	40	22	14:15
GLD-4	CH	203	203	46	21	13:07
MAY-1	CH	266	160	33	17.7	10:52
PL-3	CH	453	450	14	18.6	16:23
PL-2	CH	322	298	50	17.3	11:25
PL-1	CH	320	310	40	22.3	18:27
SAV-1	CH	385	315	24	20.5	12:44
SAV-2	CH	455	395	27	26.5	14:36
SAV-3	CH	442	372	40	22.3	16:26
SPS-4	SB	787	360*	10*	27.5	13:51
SPS-2	SB	890	684*	6*	17.9	10:44
SPS-1	SB	600	350*	10*	18.7	8:34
WC1-3	CH	282	215	22	13.4	10:30
WC1-2	CH	254	200	20	24	13:38
WC1-1	CH	210	200	21	23.6	15:09
WHIT-4	SB	-	686	69	23.7	15:59
WHIT-3	SB	903	833	35	15.5	10:31
WHIT-1	SB	388	260	23	16	9:14

Table 2: Physical measurements taken for up to three sample reaches in each ditch. Ditch reaches are arranged in order from top of ditch (headgate) to bottom. Channel type indicates whether the ditch is channelized (CH) or appears to be an old streambed (SB). Depth was the maximum depth of water at the cross-section at the time of sampling. Temperature is an instantaneous measure at the time of sampling indicated in the next column. Asterisks (***)** for the SPS ditch indicated that the wetted width and depth are not flowing conditions but represent the stagnant pools as readings were taken after shut-off.

Ditch- Reach (Top-bottom)	Habitat Score (%)	Instream Habitat	Parameters with Low Habitat Scores (< 1/2 total)
ENT-1	0.49	Poor	3,4,7,8,9,11
ENT-2	0.61	Poor	3,4,7,8,9
ENT-4	0.53	Poor	2,3,4,7,8,9
BKS-2	0.73	Okay	9,10
BKS-1	0.69	Okay	5,9
GLD-1	0.58	Poor	1,2,4,7,8
GLD-2	0.58	Poor	1,2,4,7,8
GLD-4	0.56	Poor	2,3,4,8,11
MAY-1	0.43	Poor	1,2,3,4,5,13
PL-3	0.60	Poor/Okay	1,3,4,9
PL-2	0.60	Poor/Okay	2,4,6,7,8
PL-1	0.59	Poor/Okay	1,3,7,8
SAV-1	0.54	Poor/Okay	2,3,4,9
SAV-2	0.38	Poor	1,2,3,4,8,9,10,11
SAV-3	0.34	Poor	1,2,3,4,8
SPS-4	0.40	Poor	2,3,4,5,7,8,9
SPS-2	0.42	Poor	2,3,4,5,7,8,9,11
SPS-1	0.38	Poor	2,3,4,5,7,8,9
WC1-3	0.51	Poor/Okay	3,4,5,7,9,10,12,13
WC1-2	0.67	Poor	9
WC1-1	0.57	Poor/Okay	1,2,3,4,9
WHIT-4	0.69	Good	3,6
WHIT-3	0.79	Good	3
WHIT-1	0.46	Good	3,4,5,7,10,12,13

Table 3. A summary of ditch habitat measures. The habitat score is a percentage of the total habitat score from the WDEQ habitat assessment (out of 200). Instream habitat categories are based on notes regarding presence/ absence of LWD, pools, under-cuts and other general habitat features. The last column indicates the habitat parameters that scored less than 50% of the total potential points.

Parameters Index:

1) Bottom Substrate- % Fines
2) Fine Sediment Covering (Embeddedness)
3) In-stream Fish Cover
4) Velocity/Depth Regimes presence/absence
5) Channel Flow Status
6) Channel Shape
7) Pool/Riffle Sequence
8) Channelization/ Alteration
9) Width: Depth ratio
10) Bank-full Vegetation Protection
11) Bank Stability
12) Riparian Zone Disruptive Pressures
13 Riparian Vegetative Zone Width

Ditch	Flow Modifications	Final Closure Date
Cyclone (#2 Golf Course)	1	7/19/2007
Enterprise/Hobo	1	11/3/2007
Golf Course complex (Gallagher/Buckskin, May & White)	1	11/3/2007
Glidden/Wild Cherry:	1	~8/6/2007
Price-Lucas	16	11/3/2007
Spring Gulch	2	11/5/2007
South Park Supply	1	7/9/2007
White	3	~10/7/2007

Table 4: A summary of flow regimes of study ditches from 7/7/07 to 11/17/07. This is not meant to be all inclusive, but to document the observed changes noted by the field crew as they passed by the various ditches. Flow modifications includes all changes in flow conditions that were noted while in the field, including enlarging cobble diversion with bulldozer, closing cobble diversion with bulldozer, restricting flow with head gates. If there was just one final fall closure then it was given a one. Price Lucas was shut off and on 12 times during the summer & enlarged at diversion 3 times (with backhoe). Spring Gulch headgates were not shut all at once, flow was decreased in October and headgates were completely shut 11/5. Even though headgates were shut, they were damaged or not functioning properly and substantial water flow seeped through gates as late as 11/17/2007. White ditch had the cobble diversion enlarged with a backhoe two times throughout the summer.

Objective 3: What is the entrainment rate of fish into these ditches? How do these numbers compare with Snake River cutthroat populations?

Methods

Daily entrainment of fishes into and out of several ditches was recorded with bidirectional trap nets. Trap nets were placed in Spring Gulch and White ditch in early August and were removed the last week of September due to the amount of debris caught in the nets associated with autumn. Those nets catching downstream moving fish were of a fine mesh and capable of catching young of year fishes. The nets catching upstream moving fish were of larger size and restricted only the passage of larger fish.

A single trap net was deployed in Enterprise ditch (catch downstream moving fish) the last week of July. Initially, this net was placed at the park boundary (edge of park and airport) to detect fish moving downstream of the park boundaries. This was to establish the importance of getting access to land at the end of Enterprise. During the 2 to 3 weeks the net was fishing at this point (far from the headgate), only one sucker was captured. Therefore, net was removed and repositioned closer to the top of the ditch the first week of August to allow us to estimate

entrainment. There was also a trap net deployed in Price-Lucas ditch but it was removed shortly thereafter due to the sporadic flow conditions.

The question concerning the nature of fish movement patterns in and out of ditch systems was addressed by PIT (Passive Integrated Transponder) tagging trout >120mm (TL) with 23mm OR RFID PIT Tags. Tags were dispersed in several ditches and in the Gros Ventre River itself. PIT tagging on the Gros Ventre was done in tandem with the WYG&F electrofishing population survey at end of September. Some of these trout also were implanted with radio-tags by Gregory Aquatics (with Trout Unlimited) for tracking throughout the system. PIT tagging of trout in White Ditch and Spring Gulch was conducted on Oct. 1 &2, respectively. This was accomplished by electrofishing all accessible water in the ditches, from the bottom of the ditch up to the point of diversion. Only SCT, RBT and RB/CT were processed and tagged, no nongame species were collected. Additional tagging was done with trout caught in the SG and WHIT trap nets. Fixed, 2-antannea PIT detection stations were installed in both WHIT and SG on the upper ends of the ditches. The 2-antannea system was chosen to infer direction of movement.

To directly quantify fish mortality due to loss behind headgate closures, we used our fall electrofishing survey information described earlier. Genetic samples were taken via conspicuous notches from the anal fin so recapture in the spring would be detectable in order to detect any overwinter survival in the ditches. Any mortality associated with the processing of trout was noted to maintain accuracy in survival estimates.

Results

Daily Entrainment & Escapement: Trap Nets

Spring Gulch

The bidirectional trap net in Spring Gulch was deployed on August 3 and was maintained through September 27. There were a total of 18 days in August when the nets were fishing, with the nets being checked 17 of those days (Table 5). There were an average of 140.2 nongame fish caught in the downstream net per day equaling a total of 2,523 non-game fishes caught (Fig. 9). Applying this average to the number of days in August gives us an estimated total of 4346.2 nongame fishes entrained for that month. As with the electrofishing survey data, the catch was dominated by dace and suckers.

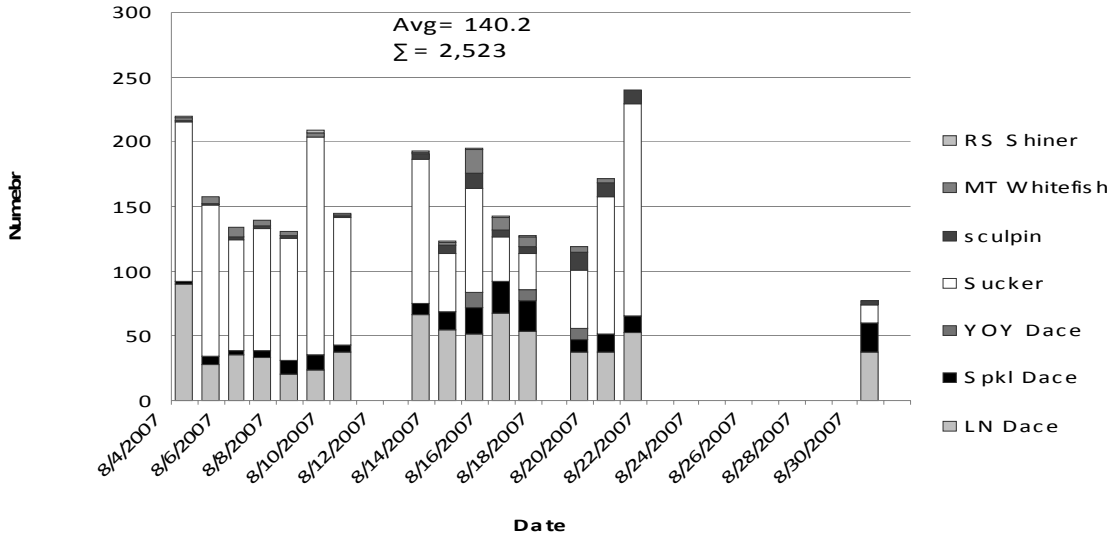


Figure 9. Composition of nongame fish in the downstream trap net at Spring Gulch for each day the trap net was fishing in August.

In September there was an average of 95.2 nongame species per day (16 days fishing) with a total of 1,523 fish entrained in Spring Gulch. There were fourteen days in September that the nets were not operating (Table 5). Applying the average daily entrainment rate to the month, we estimated 2856 entrained nongame species for September. The period from Sept. 18- Sept. 27 had the lowest entrainment rate, which could partially be due to the large quantities of detritus and leaf materials in the nets which reduced the ability to detect fish in the nets and ultimately necessitated net removal.

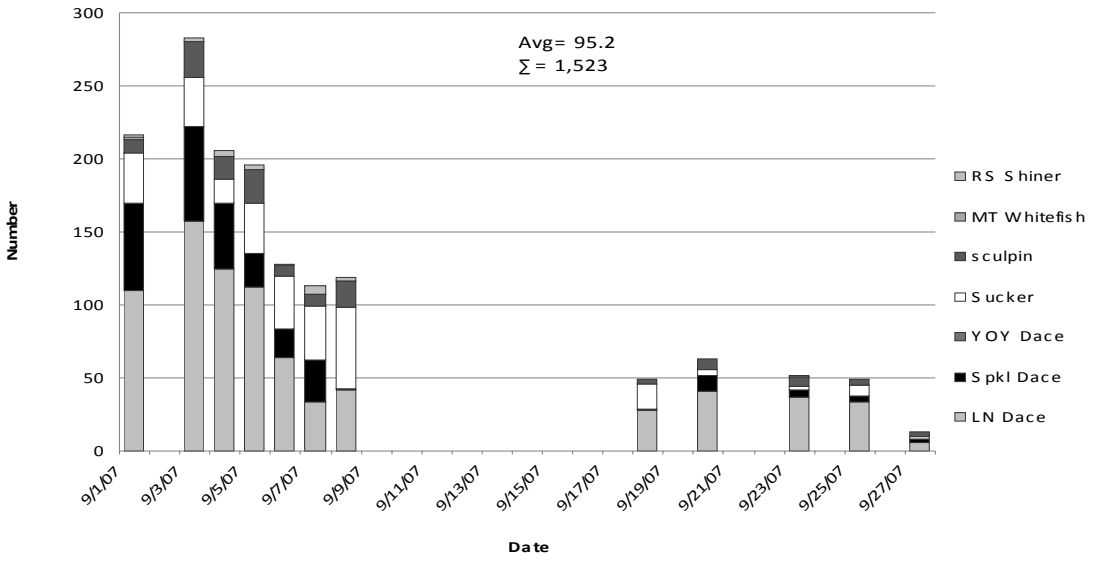


Figure 10. Composition of nongame fish in the downstream trap net at Spring Gulch for each day the trap net was fishing in September.

During the entire trap net period on Spring Gulch, there were a total of 44 trout caught in the downstream net. Snake River Cutthroat was the most abundant species (25 individuals). There were 14 young trout (< 120mm) caught moving downstream (Figure 11). A lake trout (311mm) was caught on September 3rd and several brook trout were also picked up throughout the season. During August and September the nets were fishing 34 days, resulting in an entrainment rate of 1.3 trout/day or 1.2 cutthroat/day.

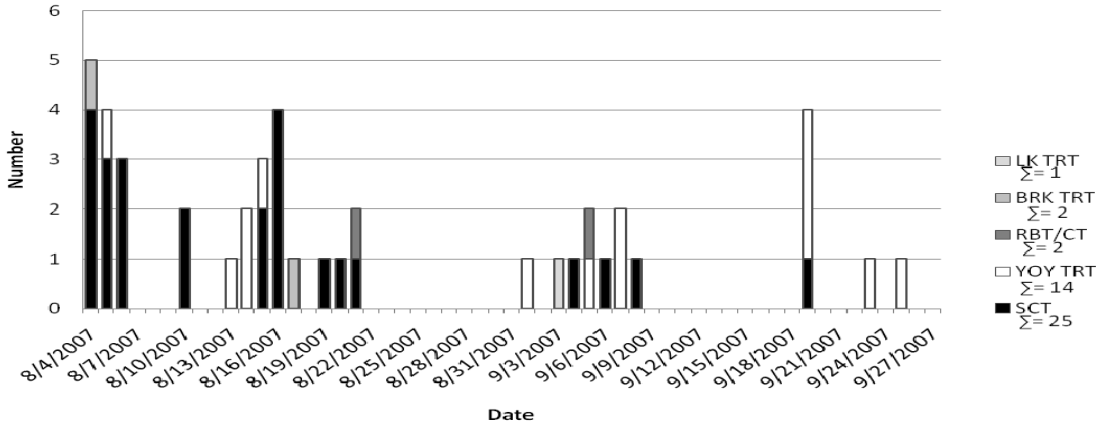


Figure 11. Trout spp. captured in the Spring Gulch downstream trap net from August 4 through September 27 in 2007.

Spring Gulch also had an upstream net to collect fish moving up of the system towards the Gros Ventre River. The mesh size restricted the catch efficiency to larger fish only. The smallest fish caught was a mountain whitefish at 146mm. Thus, we did not expect nongame fish other than suckers and whitefish to be vulnerable to this net. There were a total of 21 fish caught moving up Spring Gulch during the entire season. Again, the most abundant fish was SCT with 17 being caught (Figure 12). During August and September the nets were fishing 34 days, resulting in an upstream movement rate of 0.56 cutthroat/day.

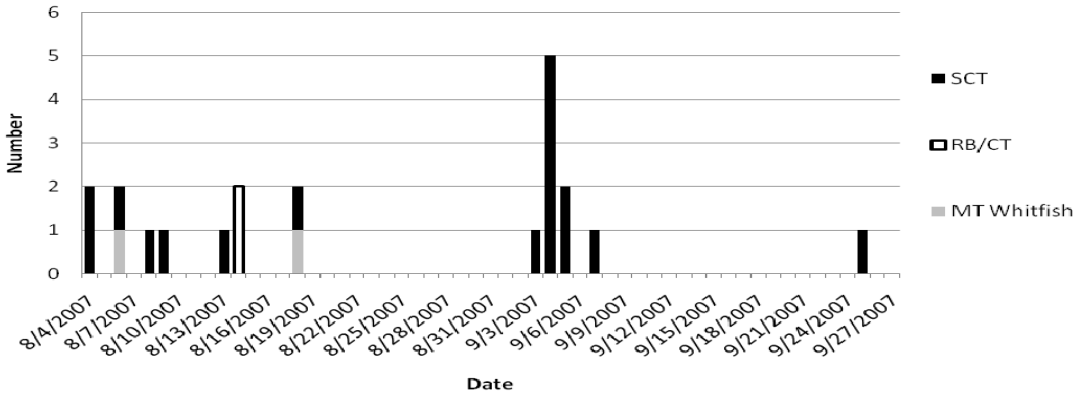


Figure 12. Composition of all fish in the uptream trap net at Spring Gulch for each day the trap net was fishing in during the summer 2007 season.

Table 5: Spring Gulch Trap-net schedule: Installed: 8/3/2007, Removed: 9/27/2007

Not Fishing	Fishing, Not Checked
8/10-8/12/2007	8/31/2007
8/21-8/29/2007	9/2/2007
9/8-9/17/2007	9/24/2007
9/20-9/22/2007	9/26/2007

White Ditch

White Ditch also had a bidirectional trap net system deployed during the same time period. However, the nets were compromised and destroyed almost daily by beavers who chewed holes on all parts of the net. Therefore our data for the White Ditch trap nets was very sporadic and does not warrant graphs or discussion.

Enterprise Ditch

Enterprise Ditch had a single fine mesh downstream trap net, which was deployed in the upper section on August 13 and removed September 27. The average daily entrainment rate (when fishing) was 8.1 fish per day, with a total of 161 non-game species caught (Figure 13). The net was fishing for 20 days. Applying the average entrainment rate to the entire 45 day period from mid-August to the end of September, we estimated a total of 364.5 nongame fish would have been entrained during that period. The only trout caught in the ENT trap net were eight young trout (< 120mm), which were all caught during the last eight days of trapping from 9/19/07 through 9/27/07.

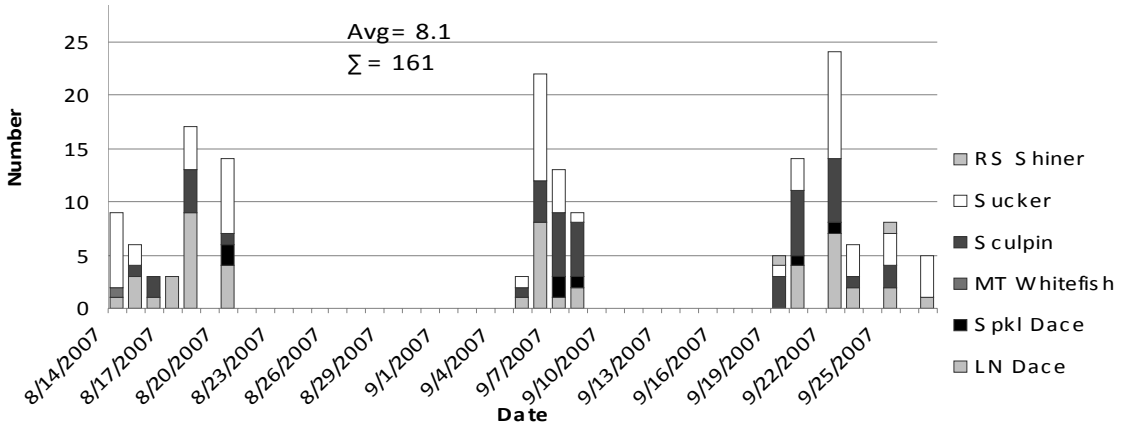


Figure 13. Composition of nongame fish in the trap net (downstream only) at Enterprise for each day the trap net was fishing in during the summer 2007 season.

Direct Measure of Mortality: Ditch Closure Census

Overall, there were a total of 2180 non-game fishes captured during fall closure surveys, of which 57.43% (1252) were in White Ditch. Not only are the differences among ditches a function of entrainment rates, but also the amount (length) of ditch available for survey and how fast we were able to sample the ditch once the gates closed. We captured a total of 274 trout captured comprised of Snake River cutthroat (n=175, 63.87%), young trout (n= 47, 17.15%), hybrids (n= 39, 14.23%), brook (n= 8, 2.92%) and rainbow (n= 5, 1.82%). Although we felt we are able to completely deplete the trout in the fall closure surveys of the available area, this remains an underestimate of the number of trout trapped behind headgates for the winter and is definitely an underestimate of the number of fish entrained for the entire irrigation season. Our estimate includes a wider range of sizes than is present in the WGF population survey. Of the 274 trout behind headgates, only 53% were above 120mm or just under 5 inches. In the fall 2007, Gros Ventre River Population Estimate performed by Wyoming Game and Fish, they estimated 267 trout (SCT and hybrids) per river mile that are 5 inches or greater.

Movement: PIT Tags

We installed two fixed pit tag reading stations (Spring Gulch and White) to be able to detect movement in and out of these ditches. These stations were turned on after the major fall pit tagging that occurred with the Wyoming Game and Fish population estimate survey. We implanted 180 PIT tags from early September through October. One hundred and fifty (150) tags were placed in fish captured in the Gros Ventre during the WYG&F population survey Sept. 25-28. Of the 150 tagged fish, 47 were field identified as RB/CT hybrids, 15 as purely RBT and 88 as SCT. Additionally, all of the radiotagged trout (57) that will be tracked over the next two years by Gregory Aquatics were PIT tagged. In addition, Spring Gulch and White were electrofished to insert PIT tags. On October 2 there were 14 PIT tags implanted in trout in Spring Gulch of which 6 were RB/CT hybrids and 8 were SCT. PIT tagging in WHIT took place on October 1st with a total of 16 tags implanted in 3 RB/CT hybrids and 13 SCT. The Spring Gulch detection station was removed Nov. 17 and will be re-installed in the spring '08. The White ditch detection station was removed during late October and will be re-installed in the spring of '08.

Of the 14 fish tagged in Spring Gulch, 11 were picked up by the pit tag stations for the next week. The last reading on 6 of the fish was that they were headed upstream and 5 were headed downstream. Of the 16 fish tagged in White ditch, 6 were detected by the fixed stations over the two weeks after tagging sessions. Five of these fish were headed downstream and one was headed upstream. There was a beaver impoundment upstream of the station so the ability of

the fish to return to the Gros Ventre was compromised (movement was impeded because of the dam). Of the fish tagged in the Gros Ventre during the end of September, one fish was detected passing down the Spring Gulch ditch and never detected again.

Summary

Overall the ditches entrained a large number of nongame species and a substantial number of trout. They did not provide high quality trout habitat due to the sporadic flows, high temperatures, and lack of instream structures for fish. We are still working on mounting and aging scales to see if we can use age-structure to determine mortality rates for comparison with the entrainment rates. Next summer we plan to redeploy both pit stations and trap nets to better estimate entrainment rates.