

## Beaver Creek

### Introduction

Beaver Creek is one of the largest limestone streams in Maryland. Originating as a freestone stream on the west slope of South Mountain, the majority of the flow during the summer months is influenced by the numerous springs in the Hagerstown Valley. The largest spring (~11,356 l/min) influencing Beaver Creek is used as the water supply for the Albert Powell Trout Hatchery. Upstream of the spring's influence, Beaver Creek is considered a warm-water stream and flows underground much of the year due to local Karst geology. Intensive agricultural operations (dairy and row crop) within the Hagerstown Valley have severely impacted Beaver Creek throughout its length. Various stream improvement projects have been completed on the mainstem and its tributaries to correct harmful effects of improper management practices.

Beaver Creek has historically been managed as a put-and-take trout (P&T) fishery with a five trout per day creel limit. Effective 1 January 2004, approximately one mile of Beaver Creek formerly under the control of the Antietam Fly Anglers was established as a catch-and-return/fly-fishing-only area (C&R) open to the public. This area extends from the mouth of Black Rock Creek downstream to the upper boundary of the Perini property, approximately 161 m above Beaver Creek Road. The special regulation area is entirely on private property. Wild YOY brown trout were transplanted from the Gunpowder River tailwater from 2002 to 2005 to address inadequate natural reproduction from hatchery stock. Due to favorable year-round water temperatures and excellent spawning substrate, a self sustaining brown trout population has developed and this area is now managed for wild trout. Trout populations have been monitored annually since 2003.

Fisheries management activities were conducted to evaluate the coldwater fishery within the Catch-and-Release and Put-and Take areas during this reporting period with the following objectives:

- Obtain estimates of standing crop and abundance for adult and YOY trout.
- Gather baseline trout population data within the Zimmerman property prior to a stream restoration project scheduled to be completed during the summer of 2010. The new survey site will be used to evaluate the response of the trout populations to this restoration and habitat improvement project.
- Obtain basic water quality data.
- Record summer stream temperatures.

## **Methods**

Methodology for monitoring fish populations follow that described in the Study III Job 1 Methods section.

Basic water quality was measured using a HACH Model FF-1A Fish Farming test kit and HACH Model HQ40d multi meter. Stream temperatures were monitored using StowAway TidBit thermographs manufactured by Onset Corp. and Boxcar Pro 4 software. Thermographs were placed at Rt. 70 and Rt. 40 to monitor summer stream temperatures.

## **Results and Discussion**

Two stations within the catch and release area (upper and lower Jackson property) and one within the put-and-take area have been surveyed annually. Overall, both standing crop and density of adult brown trout have increased significantly over the past five years at all three stations (Table 1). Encouraging is the favorable response of trout populations at the upper Jackson station, which is located within a major restoration project completed in 2004. As instream habitat and riparian plantings mature and become more naturalized, trout populations have responded favorably. Adult brown trout standing crop increased significantly ( $\alpha .05$ ) at all three established stations in 2010.

No YOY brown trout have been stocked since 2005. Brown trout natural reproduction has occurred every year since, predominantly in the put-and-take area which contains prolific spawning habitat. Abundant invertebrate populations have continually provided ample forage Beaver Creek trout. The overall mean condition factor K in 2010 for Beaver Creek brown trout was  $1.02 \pm 0.02$  (95% CI) indicating excellent physical condition.

Despite the annual stocking of adult rainbow trout with the Put and Take area, limited numbers are collected at any sample site (Table 2). Supplemental fingerling stockings and the constant potential of escapees from the Albert Powell Hatchery make identifying natural reproduction difficult. Observations of adult rainbow trout winter spawning activity and the smaller fingerling size suggest natural reproduction of rainbow trout may be occurring in Beaver Creek.

An additional in-stream restoration project within the lower end of the Catch and Release area (Zimmerman property) was completed during the summer of 2010. Baseline trout population data was collected at the Zimmerman property prior to construction during 2009 and 2010 (Table 3). As expected, adult and young-of-year trout standing crop and abundance was well below the other stations, largely a function of poor habitat. Past grazing and erosion had resulted in a wide, shallow stream channel with a sandy/silt substrate. A number of rainbow trout YOY were observed during both surveys and are believed to be the result of natural reproduction. Several potential spawning sites were identified and Environmental Services, Inc. maintained these sites in their restoration plans. As these restoration projects mature, annual electrofishing surveys will continue to document the response of the Beaver Creek trout populations to the habitat alterations.

Basic water quality was measured at the uppermost (Put and Take) and lowermost (Zimmerman property) stations and recorded in Table 4. Water quality parameters remained favorable for survival and growth of trout at both sites. Thermographs have been placed above and below the Catch-and-Release area at Rt. 70 and Rt.40 for the past five years. Water temperatures have remained excellent for the survival and growth of trout throughout the catch-and-release area and have continued to improve as riparian plantings mature (Figures 1, 2). During 2010, temperatures generally remained below 19°C (66°F) downstream of Rt. 40, located 3 km below Rt. 70, despite a near record hot, dry summer. Historically runoff from Rt. 70 flowed to Beaver Creek via concrete drainage channels. The Maryland State Highway Administration completed a project that replaced the concrete drainage system with a vegetated channel that has reduced flows and allowed greater infiltration. An additional stream restoration project on Black Rock Creek, a spring fed tributary to Beaver Creek, involved the removal of an instream irrigation pond in 2008. The dam was breached and the pond was allowed to slowly drain, limiting the amount of sediment loss downstream. Eliminating the pond from the stream channel reduced mean summer stream temperatures by 2°C and mean daily stream temperatures rarely rising above 20°C. A new stream channel was constructed and the riparian areas were replanted during 2010.

### **Management Recommendations**

- Monitor adult and YOY trout populations annually documenting natural reproduction, standing crop, and abundance.
- Propose changing Put-and-Take area above current Catch-and-Release area to a more appropriate regulation allowing the wild brown, and potentially rainbow trout, populations to achieve their full potential.
- Explore feasibility of stocking wild rainbow trout fingerlings from Little Antietam Creek to enhance trout populations.
- Document the brown and rainbow trout population's response to stream improvement project at the Zimmerman property.
- Continue to monitor Beaver Creek summer stream temperatures.

Table 1. Adult and YOY brown trout population data collected by electrofishing. Beaver Creek. 2006 - 2010. MD DNR. (95% CL)

<b>STATION</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>Upper Jackson</b>					
Standing Crop (kg/ha)	31 ± 9	29 ± 1	58 ± 3	42 ± 3	105 ± 56
Density – (trout/ha)	81 ± 24	121 ± 0.6	267 ± 14	138 ± 9	483 ± 256
YOY/ha	35	0	17	69 ± 362	121 ± 69
<b>Lower Jackson</b>					
Standing Crop (kg/ha)	6 ± 1	17 ± 0.7	21 ± 1	21 ± 2	26 ± 1
Density – (trout/ha)	48 ± 7	109 ± 5	163 ± 8	93 ± 8	163 ± 8
YOY/ha	435 ± 2927	124 ± 9	116 ± 4	0	116 ± 38
<b>Put and Take</b>					
Standing Crop (kg/ha)	51 ± 8	111 ± 10	148 ± 3	60 ± 2	150 ± 4
Density – (trout/ha)	255 ± 38	974 ± 86	1094 ± 24	321 ± 13	1026 ± 26
YOY/ha	1079 ± 97	1000 ± 41	566 ± 48	885 ± 77	182 ± 38

Table 2. Adult and YOY rainbow trout population data collected by electrofishing. Beaver Creek. 2006 - 2010. MD DNR. (95% CL)

<b>STATION</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>Upper Jackson</b>					
Standing Crop (kg/ha)	47 ± 4	18 ± 5	25	7 ± 3	7
Density – (trout/ha)	173 ± 15	52 ± 15	60	34 ± 17	26
YOY/ha	*2038 ± 132	0	0	2 ± 5	17 ± 43
<b>Lower Jackson</b>					
Standing Crop (kg/ha)	26 ± 2	1	3	8	0
Density – (trout/ha)	76 ± 5	8	8	23	0
YOY/ha	*841 ± 120	* 341 ± 54	* 558 ± 186	0	0
<b>Put and Take</b>					
Standing Crop (kg/ha)	54 ± 51	3	0	0	0
Density – (trout/ha)	240 ± 228	13	0	0	0
YOY/ha	*4076 ± 163	*590 ± 24	*64 ± 6	38 ± 38	91 ± 19

\* - most likely APH fingerlings

Table 3. Adult and YOY trout population data collected by electrofishing, Zimmerman Property, Beaver Creek, 2009-2010. MDDNR. (95%CL)

<b>Zimmerman Property</b>		
<b>Brown Trout</b>	<b>2009</b>	<b>2010</b>
Standing Crop (kg/ha)	29 ± 24	11 ± 2
Density – (trout/ha)	120 ± 99	98 ± 16
YOY/ha	10	33 ± 16
<b>Rainbow Trout</b>		
Standing Crop (kg/ha)	0	8
Density – (trout/ha)	0	24
YOY/ha	10	122 ± 16

Table 4. Water Quality measured at the uppermost (Put and Take) and lowermost (Zimmerman property) sites. Beaver Creek July 1, 2010. MDDNR.

	<b>Upper</b>	<b>Lower</b>
<b>Temperature (°C)</b>	16.7	18.2
<b>pH</b>	7.7	7.9
<b>Alkalinity (mg/l)</b>	51.3	68.4
<b>Hardness (mg/l)</b>	342	359
<b>Conductivity (µS/cm)</b>	554	558
<b>Dissolved Oxygen (mg/l)</b>	9.7	10.5

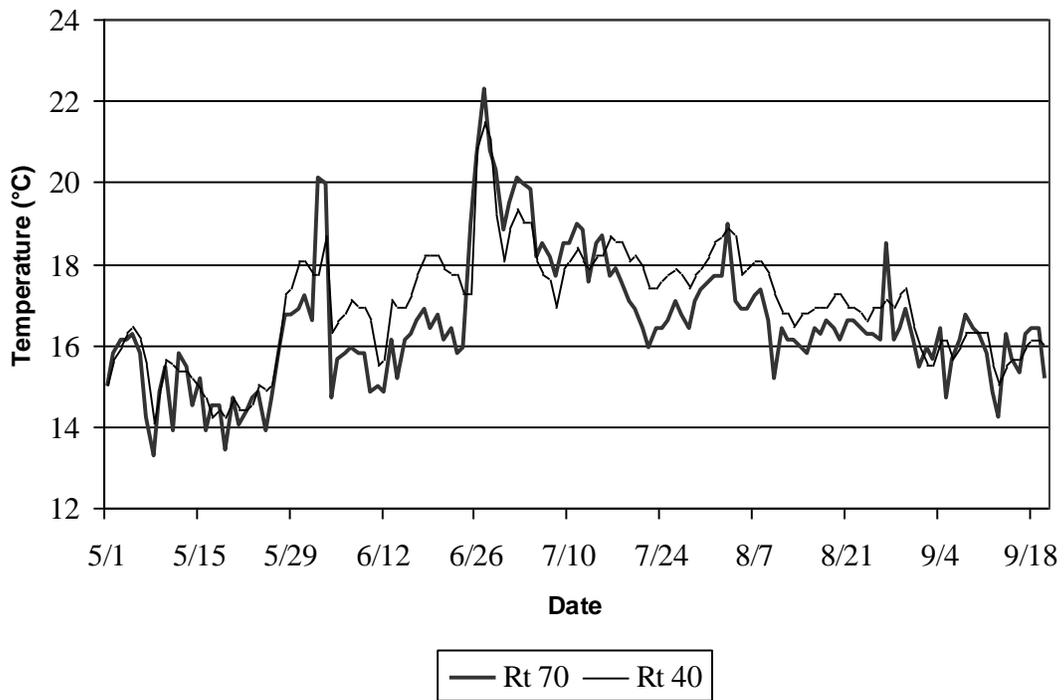


Figure 1. Maximum daily temperatures recorded in Beaver Creek, above and below C&R area Rt. 70 and Rt. 40 respectively during 2006. MD DNR.

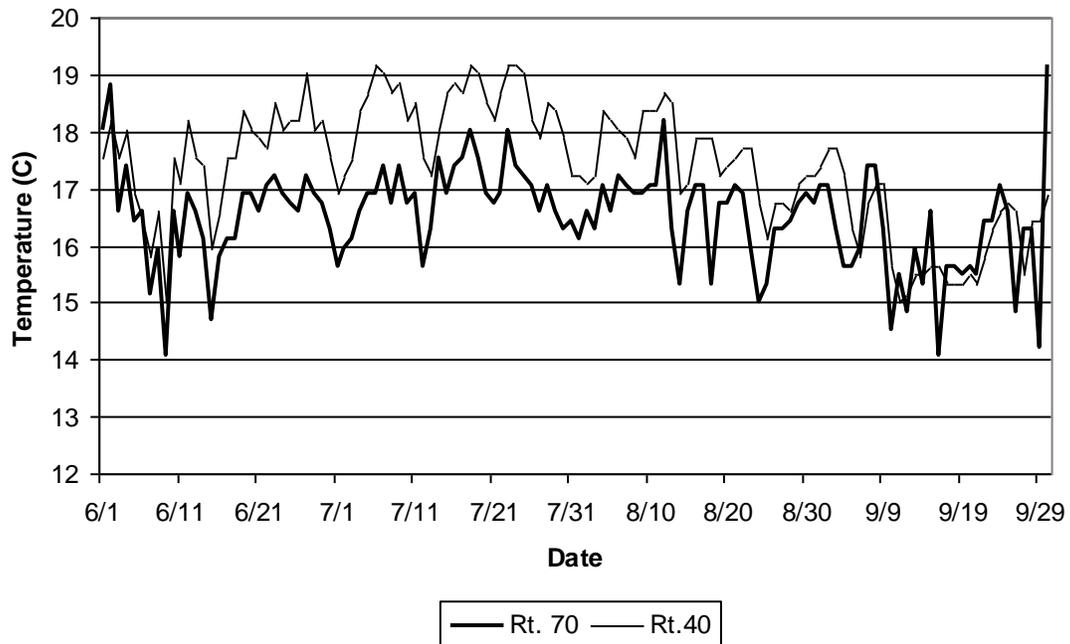


Figure 2. Maximum daily temperatures recorded in Beaver Creek, above and below C&R area Rt. 70 and Rt. 40 respectively during 2010. MD DNR.