

BEAVER KILL WATERSHED TROUT STUDY

Year 2001 Progress Report

Background

Work continued throughout 2001 on a comprehensive assessment of the trout resources and fishery in the Beaver Kill Watershed. This was the second full year of surveys to measure angler use and catch, sampling to determine fish population characteristics and intensive monitoring of the environmental conditions that effect trout distributions and survival.

The study encompasses all the stream resources within the 300 square mile Beaver Kill watershed (Figure 1). This includes the full length of the Beaver Kill and its major tributary, Willowemoc Creek, as well as the Little Beaver Kill, Mongaup Creek and sampling of 161 smaller tributary systems that flow into these streams. The work is a cooperative venture including staff from three Department of Environmental Conservation (DEC) offices, Cornell University researchers, Trout Unlimited (TU) advisors and partial funding support from a Federal Aid in Sport Fish Restoration Grant administered through the U.S. Fish and Wildlife Service.

The Beaver Kill and Willowemoc Creek are renown in angling history for their trout fishing opportunities and traditions. Decreasing levels of fishing use and angler perceptions of inadequate management attention and declining catches triggered concerns about the status and future of the Beaver Kill during the 1990s. TU funded studies beginning in 1994 on the tourism economics of the fishery and on the physical condition of stream channel characteristics relative to trout habitat needs. DEC has surveyed use and trout populations in various segments of the watershed on a periodic basis since the 1930s. The present study builds on these past surveys and is the first effort in New York State to examine the entire watershed on a comprehensive basis that provides concurrent data on both the fishery and the environmental factors believed to

influence trout status. We now have two years of complete information on the range of fishing activities, catch, wild trout distributions, water temperatures, flow rates and other habitat characteristics that will be used to determine what factors control the fishing quality and what features must be protected, or may be enhanced, to help maintain and improve this resource. Fortunately, for the study purposes, the years 2000 and 2001 offered relatively extreme and opposite circumstances in terms of climactic conditions that effect trout. The cool, very wet summer of 2000 provided almost ideal flow and water temperatures throughout the watershed while 2001 presented drought and high temperatures that limited the fishery and trout habitat in much of the lower Beaver Kill and Willowemoc.

The response of the fishery to these variations is quite interesting and is a focus of this summary. The current DEC fisheries management program for the watershed includes special trout harvest regulations of “no-kill” on 4.9 miles of the lower Beaver Kill and 3.2 miles of the Willowemoc and a 9 inch minimum length limit on 19.5 miles of the system. Wild trout populations in mainstem reaches are supplemented each year with stocking of approximately 40,000 brown trout. No brook trout or rainbow trout are stocked in the watershed by DEC.

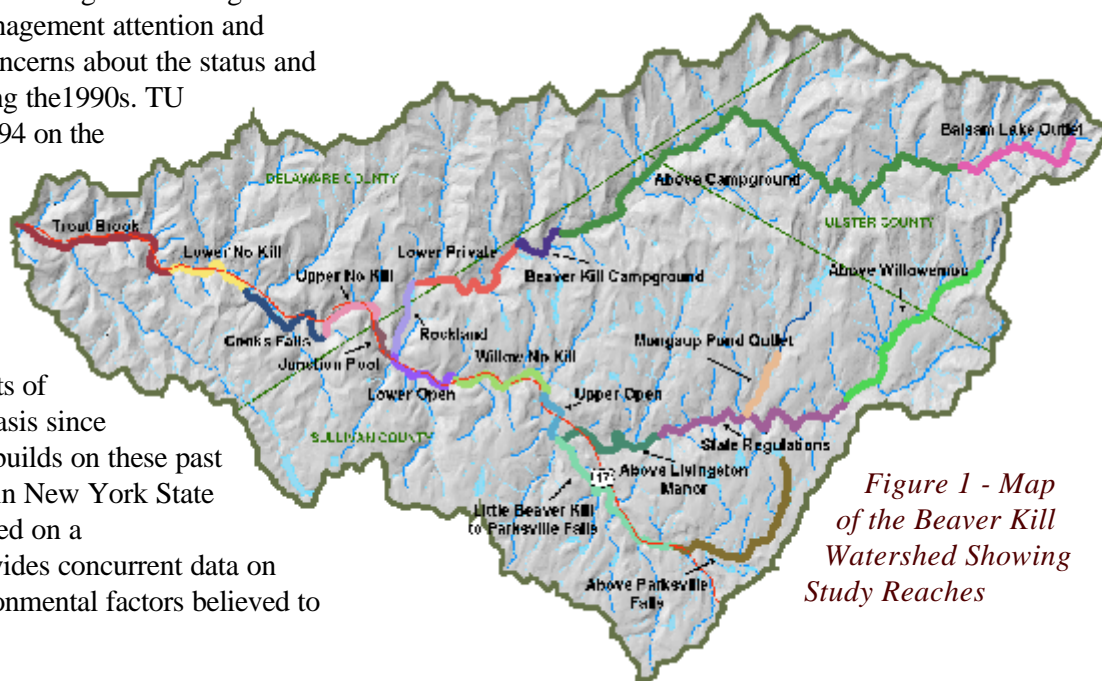


Figure 1 - Map of the Beaver Kill Watershed Showing Study Reaches



Formal public fishing access is provided via 33 miles of stream bank Public Fishing Rights Easements, 20 Fishermen Parking Areas, and substantial areas of State Forest Preserve and campsite lands. Ongoing habitat protection measures are implemented through application of stream protection sections of the Environmental Conservation Law. A variety of local stream channel improvement projects are currently being pursued in cooperation with TU, DEC Operations staff and local highway departments.

Following a third year of field collections during 2002 and a thorough analyses of these data, we will closely examine existing and alternative management activities and work with the many components of the Beaver Kill trout fishing community to develop a long term fisheries plan for the watershed.

Angler Effort

Creel survey agents conducted angler counts and interviews on weekends and three weekdays per week throughout the 2001 fishing season. An estimated 62,316 hours of angling effort occurred on the 15 census reaches. This equates to about 18,000 individual angler trips. During 2001, the heaviest use occurred in the Upper No-Kill reach of the Beaver Kill with a projected 12,695 hours of angling (Figure 2). Annual fishing density was highest on the Junction Pool reach where an effort of 7,056 hours per mile was recorded. June had the most fishing activity with 21,000 hours (Figure 3). Use in three “no-kill” reaches accounted for 50% of the total effort (Figure 4). Mongaup Creek was added to the creel survey study in 2001 and was found to contribute about 800 angler hours of fishing use.

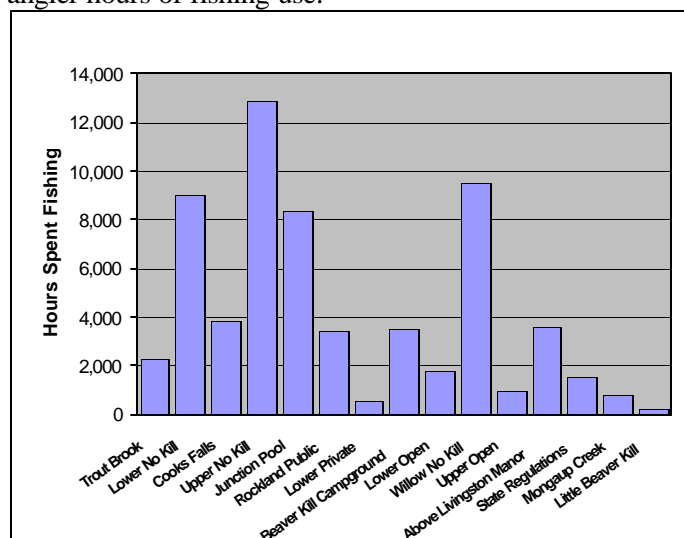


Figure 2 - 2001 Angler Effort by Study Reach

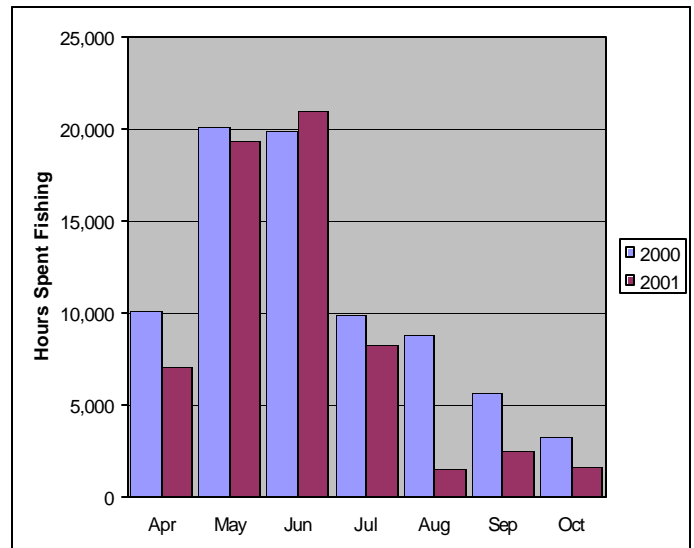


Figure 3 - Angler Effort by Month for 2000 and 2001

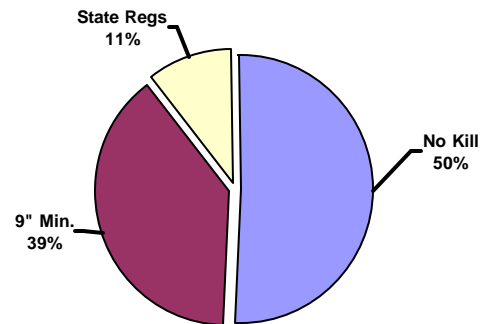


Figure 4 - 2001 Angler Effort by Regulation Type

Overall angling use in the watershed dropped roughly 20% compared to the year 2000 estimates. This was due to drought conditions that developed by mid summer. As illustrated in Figure 3, angling effort during April and May of 2001 was similar to that in 2000, however, as stream flows fell to low levels by mid July, and water temperatures became stressfully high for trout, effort dropped off to nominal levels for a number of weeks. Because trout congregate densely at spring seep locations (thermal refuges) and because hooking and handling mortality of trout increases markedly in warmer waters, anglers were advised not to engage in catch-and-release fishing at refuge sites for much of the summer of 2001.

A special effort was made over the last two years to monitor and quantify angler use at known thermal refuge sites. In 2001, large numbers of trout were concentrated

Catch Composition

Based on angler interviews, brown trout comprised 91.5% of the total catch in 2001 compared to 94.5% in 2000. Noticeable proportions of rainbow trout (30% and 12%) were reported caught in the Trout Brook and Lower No-Kill reaches of the lower Beaver Kill while brook trout comprised 41% and 26% of the catch in Mongaup Creek and the upper Willowemoc (State Regulations study reach). Again in 2001, all hatchery brown trout stocked in public waters received an adipose fin clip (Figure 8) prior to being stocked so that wild and hatchery fish could be distinguished in the angler catch and fish sampling surveys. Of 479 brown trout creel by interviewed anglers during 2001, 88% were fin clipped and known to be of hatchery origin. The angler diary cooperators reported catching 77% hatchery fish. This is about the same proportion of hatchery vs wild trout that were observed in the 2000 survey.

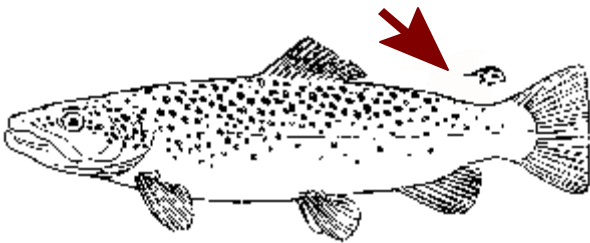


Figure 8 - Stocked brown trout depicting clipped adipose fin

Size composition of caught brown trout varied noticeably from reach to reach (Figure 9). A substantially higher proportion (16%) of the trout caught in the “no-kill” reaches exceeded 15 inches, compared to 8% and 7% in the 9” and no-minimum-size-limit reaches respectively. Approximately 40% of trout reported caught in the “no-kill” area exceeded 12 inches.

The Anglers

A majority of interviewed anglers fly-fished, either exclusively (72.3%) or in combination with bait and/or lure fishing (2.1%). As in 2000, most Beaver Kill use is from visiting or tourist anglers that reside outside the immediate area. Less than 10% of interviewed anglers were from Delaware, Sullivan or Ulster Counties while 47% originated from the New York- New Jersey

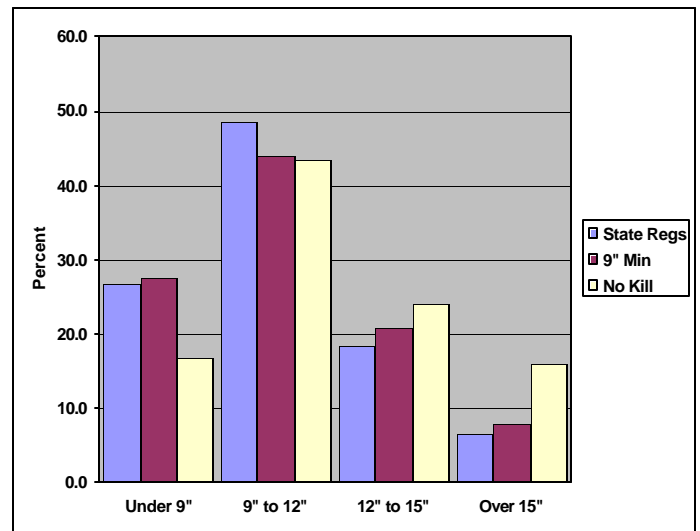


Figure 9 - Length categories of angler caught trout by regulation type

metropolitan area. Visitors from Canada, Germany, Yugoslavia, Japan, South Africa, England and Ireland fished the Beaver Kill in 2001.

Interviewed anglers were also asked to rate their level of satisfaction with their day of fishing. On a scale of -2 to +2, the average, overall watershed rating was 0.92 from 3,678 interviews. This is down from an overall rating of 1.15 in 2000. Levels of satisfaction in 2001 by study reach ranged from 0.5 for the “Above Livingston Manor” section of the Willowemoc to 1.2 for the “Lower Open”, “No-Kill” and “State Regs” reaches.

Fish Population Surveys

Tributary Streams

In 2001, electrofishing surveys were conducted on 57 tributaries. Combining 2000 and 2001, sampling has now been completed on all mainstem Beaver Kill tributaries except for two small streams where landowners would not allow electrofishing. Trout were found in 67 of the 87 Beaver Kill tributaries. Thirty six of the 55 mainstem Willowemoc tributaries have been sampled to date. Surveys for species occurrence and relative abundance will be completed for all Willowemoc and Little Beaver Kill tributaries in 2002.

Brook Trout Distribution

Includes Year 2000 and 2001 data from the Elizabeth Fisheries Database

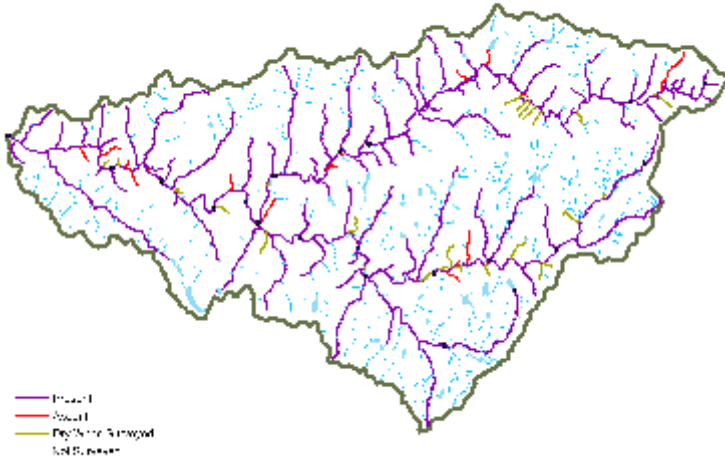


Figure 10 - Distribution of brook trout in Beaver Kill watershed tributaries

Brook trout are the most widely distributed trout species in the watershed (Figure 10). Of the tributaries sampled to date, brown trout were found in 34 tributaries and rainbow trout in ten. Rainbow trout were the dominant species in Trout Brook, Horton Brook and Spring Brook. Trout population estimates were conducted at 17 sites in nine tributaries during 2001 with biomass estimates ranging from 10 to 199 lbs/acre. Dominant non-trout species were slimy sculpin and blacknose dace. Population estimates will be repeated on selected tributaries to determine the extent of year to year variability.

In August, Cornell researchers collected 6 to 20 fingerling brown trout from ten different tributaries to examine differences in otolith (ear bone) microstructure that might be used to distinguish the natal origin of fish in the mainstem fishery. Some progress was made in identifying daily growth ring patterns that were tributary specific.

Mainstem Reaches

Thirteen mainstem sites, one in each creel survey reach, were electrofished during 2001. Total trout abundance (all species-hatchery and wild) estimates ranged from 7 to 71 trout/acre at the Beaver Kill sites and 11 to 267 trout/acre at the Willowemoc sites.

A primary focus of the mainstem sampling was to examine the abundance and distribution of wild trout available to the fishery. In the Beaver Kill reaches, wild trout density and biomass ranged from 4 to 62 fish/acre and 3 to 12 lbs/acre. Brown trout were the dominant trout throughout the Beaver Kill, followed by rainbow trout.

Brook trout were only collected in the upper Beaver Kill. The Upper No-Kill reach had the highest wild trout biomass at 12 pounds/acre with about equal numbers of yearling vs older and larger wild trout.

In the Willowemoc reaches, wild trout densities and biomass ranged from 8 to 126 trout/acre and 1 to 24 pounds/acre with brown trout the dominant trout. No wild rainbow trout were collected. Fingerling and yearling brown trout comprised 55% to 70% of the wild trout collected in the Willowemoc. The “Above Livingston Manor” reach had the highest density including 22 brown trout and 26 brook trout over age two per acre.

The Environment

Temperature Monitoring

Water temperatures were again monitored on a hourly basis using thermographs placed at 72 mainstem and tributary sites. A comparison of the maximum water temperatures observed on the Beaver Kill in 2000 vs 2001 (Figure 11) demonstrates the 10E to 15E F difference that occurred between a relatively wet summer with moderate temperatures (2000) and a dry summer with warmer weather (2001). Figure 12 (on page 6) displays the highest seven day average temperature taken from sites on the mainstem Beaver Kill in 2000 and 2001. In 2000 only the lowest few miles of the river experienced temperatures above 70EF - considered stressful for trout. In contrast, 2001 had one week where stream temperatures averaged 75E F or higher to river mile 15 (Junction Pool) and 70E F up to river mile 23 above the confluence of Berry Brook.

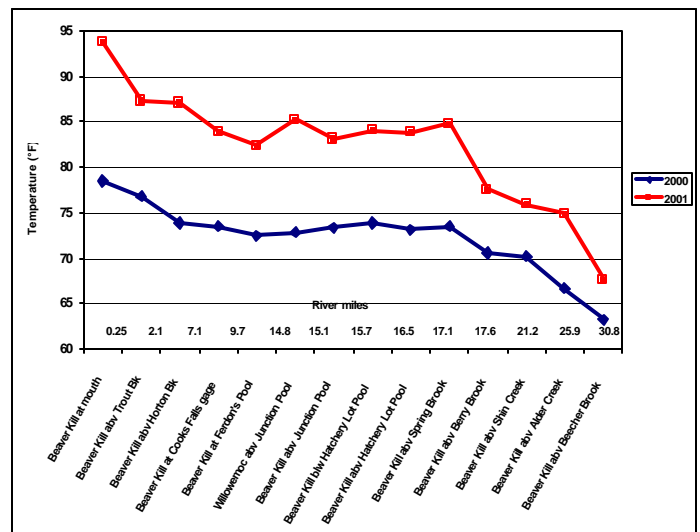


Figure 11 - Maximum recorded water temperatures on the Beaver Kill in 2000 & 2001

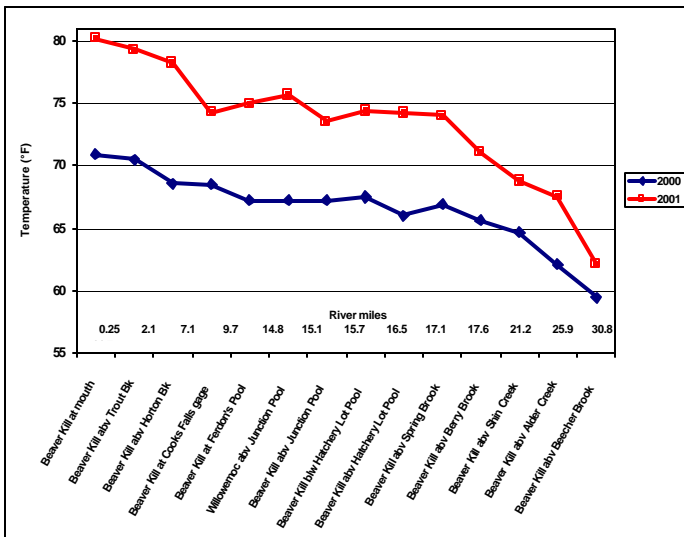


Figure 12 - Beaver Kill highest seven day average water temperatures for the years 2000 & 2001

Maximum water temperatures in Willowemoc Creek demonstrated the same 10E to 15E F increase from year 2000 levels. In 2000, water temperatures did not exceed 70E F average anywhere on the Willowemoc while in 2001 weekly stream temperatures averaging almost 75EF occurred all the way upstream to the mouth of the Little Beaver Kill.

Thermal Refuge Sites

A search for thermal refuge areas was initiated when water temperatures critical to trout survival began to occur. TU and other volunteers along with DEC staff working on the Beaver Kill project were enlisted to take note of any concentrations of trout that might be associated with a refuge site. On August 7 and 8, the Beaver Kill and Willowemoc Creek were waded and floated by DEC staff to identify refuge sites. Combining observations made by eight staff members and four volunteers, a total of 16 potential refuge sites were noted over the course of the summer. Of these 16 sites, five were large pools with mobile schools of trout that did not appear to be concentrated in one location with cooler water. Only five sites seemed to consistently hold trout for long periods of time. The most consistent and largest thermal refuge area, with trout numbers approaching 300 fish, occurred off the mouth of Horton Brook on the lower Beaver Kill.

Trout utilization of thermal refuges was first noticed on July 22, 2001 at the Cooks Falls pool after water temperatures had reached 77°F in that area the previous day. Trout were last noted using a refuge on August 21 at Horton Brook with the mainstem temperature at 73°F.

Stream Flows

Discharge was measured at 38 sites on the Beaver Kill and its tributaries during three different flow regimes over the course of the summer in 2001. Conditions for conducting flow measurement included summer low stream levels and no recent rains in the watershed. We measured flows at our sample sites when the US Geological Survey (USGS) gauge at Cooks Falls was reading, on average: 231 cfs, 86.5 cfs and 47 cfs. At those levels, Willowemoc Creek supplied 54%, 57% and 60% of the flow respectively into Junction Pool where it enters the Beaver Kill in Roscoe. The highest volume tributaries on the Beaver Kill/Willowemoc system at low flows are the Little Beaver Kill and Mongaup Creek. Figure 13 shows the average weekly stream flow for the period beginning at the end of April and continuing to early October and illustrates the difference between the wet summer in 2000 and the dry summer in 2001. For reference, the median summer low flow at the USGS Cooks Falls' gauge, based on 86 years of record, is about 100 cfs.

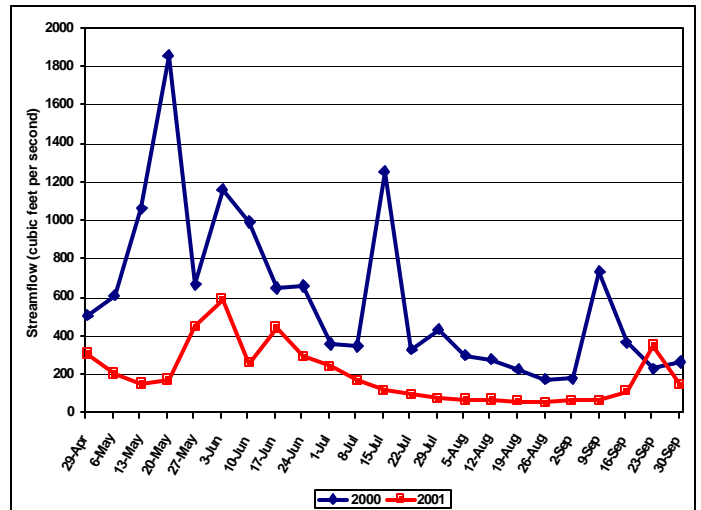


Figure 13 - Average weekly stream flow at USGS Cooks Falls station for 2000 & 2001

Water chemistry tests were conducted at most sample locations where temperatures were monitored, flow measurements were taken, or electrofishing samples were collected. Conductivity and pH were measured at some water temperature sites when installing or servicing thermographs. Conductivity ranged from 20 to 60 μS in May and from 25 to 150 μS in July with measurements of 100 and over coming from the Little Beaver Kill. pH ranged from 6.5 to 8.0 in the mainstem Beaver Kill, with an average of 7.25.



Figure 14 - Horton Brook stream channel restoration project 2001

Physical Habitat Measurements

During the summer of 2001, Cornell researchers mapped and quantified habitat types (e.g. pools, riffles, runs , etc.) for nearly all the mainstem portions of the watershed.

These data will be valuable for developing more accurate assessments of potential trout holding capacity and assessing the “natural” versus disturbed status of stream channel configurations in various river reaches. The habitat measurements were computerized to allow direct application to a variety of mapping projects.

Habitat Protection and Improvement

Substantial flood mitigation and stream restoration work was completed along Horton Brook and a mainstem reach of the lower Beaver Kill in 2001. With design and advisory input from TU staff, DEC crews removed 500 feet of berms and 1500 cubic yards of steam gravel from flood plains and reshaped a total of 700 feet of stream bank into active flood plains at five sites along Horton Brook. The lower 400 feet of Horton Brook was reconstructed to return a natural, stable channel and improve upstream passage of spawning trout. Three 50 foot sections of a berm along the mainstem Beaver Kill near the Sullivan-Delaware County line were removed to reestablish flood plain function in this area and facilitate a

narrowing of the low flow channel.

Meetings were held with USGS and NY City Department of Environmental Protection staff to review possibilities and experiences in applying aerial thermal imaging techniques to the watershed as a means of identifying springs and ground water input sites.

The major highway (Rt 17) that runs through the Beaver Kill watershed corridor is scheduled to be upgraded to interstate standards and re-designated as I-86. Some aspects of this work have potential for significant impacts and opportunities relating to drainage patterns and trout habitat conditions in the study area. The Beaver Kill Study planning work group regularly includes participation by representatives of the New York State Department of Transportation (NYSDOT) at planning meetings to facilitate coordination on highway project developments. Additionally, two special meetings were held with NYSDOT engineering and planning staff to assure up-front consideration of fisheries issues in the Environmental Impact Statement and engineering design phases of the project.

Public Information and Extension

Informational flyers and posters were again distributed in the study area to inform Beaver Kill watershed anglers about the study and to request their cooperation and assistance. Open house events at the Catskill Fly-fishing Center were attended in May and August with a display of study maps, preliminary reports and background watershed information. A portable display “booth” was constructed for these and future outreach opportunities. DEC and TU staff prepared and delivered presentations on the study and trout habitat factors at a regional NYSDOT symposium in March.



This project is funded in part by a Sport Fish Restoration grant administered through the U.S. Fish & Wildlife Service.

Next Steps

The data gathering phase of the study will continue through 2002 including a third year of complete angler counts and creel census. Tributary fish surveys for species composition will be completed in 2002 with sampling of all remaining Willowemoc and Little Beaver Kill tributaries. A second year of electrofishing sampling will be conducted in mainstem study reaches supplemented with snorkeling surveys in June and August. The snorkeling will augment estimates of adult trout density in the deeper pool areas. Monitoring of water temperatures, flows and other environmental conditions will also continue through 2002. Data analysis and surveys to determine variability in

tributary trout production will continue through 2005 along with research to identify wild trout origins. Updates on the study will again be provided at events scheduled at the Catskill Fly Fishing Center.

More Information

For additional information about the Beaver Kill Study, contact either the DEC Region 3 Office in New Paltz at (845) 256-3066 or the DEC Region 4 office in Stamford at (607) 652-7366. A full-color version of this report can be downloaded from the DEC website at:

www.dec.state.ny.us/website/locator/fwmr.html#fishing



Printed on recycled paper 6/2002

New York State Department of Environmental Conservation
625 Broadway
5th Floor
Albany, NY 12233-4753