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Study VIII: New York State Freshwater Angler Creel Census Project

Job 201: Delaware Tailwaters Creel Census

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ABSTRACT

Delaware Tailwaters Creel Census

An April 1 - September 30, 1999 direct contact creel survey was conducted on the 17.7 mi West Branch Delaware River downstream of Cannonsville Reservoir, the 32.1 mi East Branch Delaware River downstream of Pepacton Reservoir, and a 2.3 mi reach on the Delaware River at Lordville. The censuses were conducted to monitor progress towards the attainment of objectives outlined in the 1992 Delaware Tailwaters Management Plan. This report summarizes the results of the 1999 creel census as well as the results of the 1992-96 census efforts which had not previously been reported.

Riverwide fishing effort in 1999 totaled 63,972 h (140 h/acre) on the West Branch, 20,273 h (28 h/acre) on the East Branch, and 3,722 h (37 h/acre) on the Lordville reach of the Delaware River. West Branch fishing effort was down 28% from the last census in 1995. East Branch fishing effort was the lowest recorded for the 10 census years since 1988 and down by half from its peaks. The Delaware River effort at Lordville was down by a third from its 1994 and 1995 levels.

Riverwide catch rates on the West Branch, East Branch, and the Lordville reach of the Delaware River averaged 0.66, 0.26, and 0.32 trout/h. These catch rates failed to meet the near term catch rate objective of 1.0 trout/h from the West Branch and 0.5 trout/h on the East Branch and Delaware River. The inability to achieve the catch rate objectives was attributed to less than optional releases from Cannonsville and Pepacton Reservoirs, the termination of stocking in the West Branch and a reduction in the numbers of trout and mileage of stream stocked in the East Branch. Creel rates in both the East and West Branches averaged 0.03 trout/h. No trout were reportedly creeled in the Delaware River at Lordville.

MANAGEMENT RECOMMENDATIONS

1. Continue the no trout stocking policies on the West Branch and Delaware River and the reduced trout stocking on the East Branch.
2. Continue the annual stocking of 800 two year old brown trout on the East Branch between Downsville and Harvard.
3. Revisit the issue of trout stocking on the West Branch and increased trout stocking on the East Branch at such time when there is strong public interest in such action.
4. Continue the 12 in minimum size and two fish creel limit for trout on the East and West Branch.
5. Continue the "No Kill" regulation on the 2.2 mi reach of the West Branch downstream of the Rt 17 bridge in Deposit.
6. Change the 14 in minimum size and 1 fish creel limit for trout on the Delaware River to 12 in and 2 fish.
7. Update the IFIM studies of the late 1970's with information learned since then to determine if these flow recommendations are still appropriate.

INTRODUCTION

The West Branch of the Delaware River (West Branch) downstream of Cannonsville Reservoir, the East Branch of the Delaware River (East Branch) downstream of Pepacton Reservoir and the Delaware River from Hancock to Callicoon comprise the upper Delaware Tailwaters, a unique fishery resource (Figure 1). Coldwater releases from Cannonsville and Pepacton Reservoirs have resulted in popular, high quality tailwater trout fisheries.

In 1992, a fisheries management plan for the Delaware Tailwaters identified both near and long term objectives and strategies. Sanford (1992) stated that near term objectives were to maximize the more limited opportunities available under the current reservoir releases program. Long term objectives utilize the fisheries potential of an improved reservoir releases program. Although adjustments to the reservoir releases protocols for the West Branch and East Branch have been implemented since 1992, releases are still not sufficient to maximize the fisheries potential on these tailwater rivers. Thus, the near term management objectives are still appropriate. The near term strategies and recommendations will improve angling quality in the tailwaters by producing trout catch rates of 0.5 fish per hour in the Delaware River and East Branch and 1.0 fish per hour in the West Branch (Sanford 1992).

A creel census on the current status of the trout fisheries in the Delaware Tailwaters census was conducted in 1999 to monitor progress towards the attainment of the near term catch rate objectives. Baseline creel census data were collected from 1988 through 1991 to establish a contemporary data base (Sanford 1993, 1994). Additional census data was collected from 1992 through 1996 to evaluate impacts of management changes on catch rates, creel rates, and the size distribution of trout.

This report summarizes the results of the 1999 creel census as well as the results of the 1992-96 census efforts which had not previously been reported. Lastly, the results of the 1988-91 censuses are included for comparative purposes. Creel census methodologies were largely unchanged over the years.

STUDY RIVERS

West Branch Delaware River

The West Branch downstream of Cannonsville Reservoir flows for 17.7 mi before merging with the East Branch to form the Delaware River. The upper 10.2 mi is located entirely in New York while the lower 7.5 mi of river forms the boundary between New York and Pennsylvania. At the USGS gage in Hale Eddy (Figure 1), the 10 year (1990-99) average daily flow for this 595 mi² drainage area was 496, 706, 722, and 476 ft³/s for June, July, August, and September, respectively. Stream flows and summer water temperatures in the river are largely dependent on water releases from Cannonsville Reservoir. Prior to 1997, the release schedule during normal reservoir storage conditions was as follows: 45 ft³/s from April through June 14 and August 16 through October 31; 325 ft³/s from June 15 through August 15; and 33 ft³/s from November 1 through March 31. In 1997 a three year experimental release schedule was implemented to provide a 160 ft³/s flow between June 1 and September 15 and 45 ft³/s for the remainder of the year. Additional releases, usually during the summer months, are often directed by the Delaware River Master to meet minimum flow objectives for the Delaware River at Montague, New Jersey. Summer water temperatures during normal storage condition years are usually suitable for trout growth and survival throughout the West Branch.

The West Branch is a low gradient stream (7.3 ft/mi) characterized by long stretches of flat water broken by moderate flow and riffles around the many islands. Approximately 25% of the river is riffles and 75% pools and runs. Average width is about 200 ft near Deposit and 242 ft near Hancock (Sanford 1993b). Conductivity in 1993 ranged from 51 umhos/cm at Stilesville (Figure 1) to 73 umhos/cm at Balls Eddy (McBride 1995). The river has not been stocked since 1994. The brown trout fishery, with some rainbow trout, is managed with special regulations, either catch and release (1 reach totaling 2.2 mi) or a 12 in minimum size limit with a two fish daily creel limit (2 reaches totaling 14.1 mi). New York City owns and operates the Cannonsville Reservoir and adjacent lands and prohibits fishing in the 1.4 mi reach immediately downstream of the Cannonsville Reservoir dam to the weir at Stilesville.

East Branch Delaware River

The East Branch downstream of Pepacton Reservoir flows for 32.1 mi before merging with the West Branch to form the Delaware River. The Beaver Kill is its largest tributary and enters the East Branch 17.0 mi below Pepacton Reservoir dam. Approximately 3 mi upstream of the Beaver Kill, the 10 year (1990-99) average daily flow at the USGS gage in Harvard (drainage area 458 mi²) was 263, 232, 181, and 246 ft³/s for June, July, August and September, respectively. Approximately 4 mi downstream of the Beaver Kill, the 10 year (1990-99) average daily flow at the USGS gage in Fishs Eddy (drainage area 784 mi²) was 554, 484, 440, and 474 ft³/s for June, July, August and September, respectively.

Stream flows and summer water temperatures in the river are influenced by releases from Pepacton Reservoir. The release schedule during normal reservoir storage conditions since 1993 is 70 ft³/s in May and September, 95 ft³/s from June 1 through August 31, and 45 ft³/s from October

1 through April 30. Summer water temperatures during normal storage condition years are usually suitable for trout growth and survival only in the upper 12.0 mi river reach from Pepacton Reservoir dam to about 4.0 mi below Shinhopple (Figure 1). Warmwater fish species are more common from 4.0 mi below Shinhopple downriver. Strong groundwater infiltration between East Branch and Fishs Eddy (Figure 1) creates summer thermal refugia that sustain localized trout populations on a year round basis (Sanford 1989).

The East Branch is a low gradient stream (6.5 ft/mi) characterized by large stretches of flat water with poor trout habitat. The river is about 40% riffle and 60% pools and runs. Pools containing good trout habitat are scattered. The Beaver Kill contributes significantly to the East Branch. Upstream, the river averages 80 ft wide near Downsville and 135 ft above the confluence at East Branch (Sanford 1993a). Downstream from the Beaver Kill, the average width increases from 202 ft below the confluence at East Branch to 288 ft in Hancock (Sanford 1993a). Conductivity in 1993 ranged from 52 umhos/cm above Corbett (Figure 1) to 75 umhos/cm above Hancock (McBride 1995). Because of the different East Branch flow and thermal characteristics above and below the Beaver Kill, the information on these two reaches are summarized together and separately for this study. The upper East Branch refers to the East Branch upstream of the Beaver Kill and the lower East Branch refers to the downstream reach.

Yearling brown trout are currently stocked in all but the 11.6 mi of river from Downsville to Corbett (4.9 mi) and 1.5 mi downstream of Shinhopple to East Branch (6.7 mi). Approximately 4,900 brown trout yearlings are stocked annually into four reaches of river totaling 20.5 mi. Approximately 800 two year old brown trout (13-16 in long) are stocked from Downsville downstream to the hamlet of East Branch. The fishery for brown and rainbow trout throughout the

East Branch is managed with a 12 in minimum size limit and 2 fish creel limit. New York City prohibits fishing in the 0.8 mi reach immediately downstream of the Pepacton Reservoir dam.

Delaware River

The Delaware River, below the junction of the East and West Branches, flows for 321 mi before entering the Atlantic Ocean. The Region 4 portion of the river, the upper 14.4 mi from Hancock to Long Eddy (Figure 1), is low gradient (4.8 ft/mi) and characterized by long pools connected by short riffle segments. Riverine habitat is about 15 to 20% riffles and 80 to 85% pools which includes runs. Callicoon, located 27 mi downstream of the East and West Branch confluence, is the downstream limit of the Delaware Tailwaters (Sanford 1992). The 10 year (1990-99) average daily flow at Callicoon was 1314, 1420, 1444, and 1130 ft³/s for June, July, August, and September, respectively. Summer water temperatures are strongly influenced by coldwater releases from Cannonsville Reservoir to the West Branch. Release flows from Pepacton Reservoir beginning in the mid to late 1950's and Cannonsville Reservoir beginning in the late 1960's have resulted in water temperatures cooling sufficiently to precipitate a gradual but steady decline in the abundance of warmwater fish populations to their current low levels (Sanford 1990b). The river is wide. A 2.3 mi reach near Lordville averaged 360 ft wide (Sanford 1993b). Unfortunately, width data are unavailable for the rest of the Delaware River between Hancock and Callicoon. Conductivity at two sites sampled in 1993 ranged from 65 to 72 umhos/cm (McBride 1995). The upper Delaware is noted for its wild rainbow trout fishery. The river is not stocked and the trout fishery is managed with a 14 in minimum size limit and a one fish daily creel limit.

BACKGROUND

Stocking History

Stocking recommendations for the East Branch and West Branch have been reduced since creel censuses on these rivers began in 1988 and 1989, respectively. By 1999, yearling stocking has been reduced 55% on the East Branch and terminated on the West Branch. The Delaware River has not been stocked with trout in over 55 years. The stocking recommendations for brown trout yearlings (BTY), fingerlings (BTF), and 2 year olds (BT2Y) are summarized below:

	1988	
<u>East Branch</u>		
Mouth to Beaver Kill	6,000 BTY	
Beaver Kill to Downsville	<u>5,000 BTY</u>	
	11,000 BTY	
	1994	
Mouth to Fishs Eddy Bridge	2,250 BTY	
Fishs Eddy Bridge to Beaver Kill	1,150 BTY	
1.5 mi below Shinhopple to Corbett Bridge	1,500 BTY	
Corbett Bridge to Downsville	<u>1,100 BTY</u>	
	6,000 BTY	
	1995	
Corbett Bridge to Downsville		Not stocked. Stocking terminated.
	1997	
Harvard to Downsville		800 BT2Y
	1988	
<u>West Branch</u>		
Mouth to Rood Creek	40,950 BTF	
Rood Creek to Stilesville weir dam	3,800 BTY, 26,780 BTF	
	1992	
Mouth to Stilesville weir dam		BTF not stocked and BTF stocking terminated.
	1993	
Mouth to Rood Creek	4,400 BTY	
Rood Creek to No Kill	2,550 BTY	
No Kill	800 BTY	
No Kill to Stilesville weir dam	<u>800 BTY</u>	
	8,550 BTY	

1995

Mouth to Stilesville weir dam

Not stocked. Stocking terminated.

Angling Regulations

The New York trout season on the Delaware Tailwaters opens April 1 and closes September 30. On the West Branch and Delaware River forming the state boundary between New York and Pennsylvania, the trout season opens the first Saturday after April 11 (April 17 in 1999) and closes September 30.

Size and creel limits have generally become more restrictive since creel censuses on these rivers began in 1988. These trout regulations are summarized below:

<u>Reach</u>	<u>Size Limit</u>	<u>1988 Creel Limit</u>	<u>Method</u>
Delaware River	12 in	3	
West Branch	9 in	5	
East Branch	9 in	5	
1991			
West Branch	12 in	3	
1992			
West Branch Rt 17 overpass at Deposit downstream 2.0 mi	No Kill	No Kill	Artificials only
1994			
East Branch Rt 17 bridge at East Branch to Fishs Eddy	Slot limit:	possession of 1 trout between 12 and 14 in permitted	Artificials only
1995			
Delaware River	14 in	1	
West Branch	12 in	2	
East Branch	12 in	2	
1997			
East Branch	Slot limit regulation discontinued and changed to 12 in and 2 fish		

METHODS

Census Reaches

For census purposes, the 16.3 mi of the West Branch open to fishing was divided into four census reaches: Stilesville, No Kill, Hale Eddy and the Border Water (Figure 1). The East Branch was divided at bridge crossings into six census reaches: Downsville, Corbett, Shinhopple, Harvard, Fishs Eddy, and Peas Eddy (Figure 1). There was only one census reach on the Delaware River at Lordville (Figure 1). The physical description of the East Branch, West Branch, and Delaware River census reaches are summarized in Table 1.

Creel Census Schedule

Censuses were conducted from April 1 - September 30 on the East and West Branches. The Lordville reach of the Delaware River was censused from April 1 - July 4 by the West Branch creel census agent. Generally, all weekend days and one or two randomly selected weekdays per week were surveyed. April 1, Memorial Day, and Labor Day were treated as weekend days for census purposes. July 4, 1999, was a Sunday. The schedule was designed around the New York State administrative work week which begins on Thursday and ends Wednesday. The census agent generally worked two 13 h days and one 14 h day for a total census effort of 40 h per administrative work week. A census work day began at 0645 hours and continued for 13 or 14 hours.

Angler Count By Vehicles

Instantaneous counts of anglers were conducted on selected reaches of the three tailwater rivers to obtain an index of relative use. These count run reaches are described below:

River	Count Run Reach Description	Length (mi)
West Branch	Stilesville weir dam to Rt 17 bridge overpass	2.4
	Rt 17 overpass to head of Whittaker Island	2.2
	Riverview Inn to 0.2 mi below Rt 191 bridge	2.0
East Branch	0.2 mi above Downsview covered bridge to head of Airport Island	3.1
	Rt 17 overpass below Rest Area to Fishs Eddy Bridge	2.0
Delaware River	Factory Brook, PA to 0.5 mi below Abe Lord Creek	2.3

These reaches were visible from a vehicle on the adjacent roadways and anglers could be conveniently counted by the census agents. In most of the remainder of the census area, anglers were obscured by vegetation and terrain between roadways and the river and ground counts by the census agents were not practical.

Count runs began at 0700 and at 3-h intervals thereafter. The census agents drove from one end of the census area to the other and counted anglers in the count run reaches. Count runs on the West Branch and Delaware River typically required about 1.1 h. After July 4 when the Delaware River census was terminated, the West Branch count runs typically averaged about 0.8 h to complete. On the East Branch, count runs typically required about 0.5 h to complete but could require up to 0.75 h.

Aerial Angler Counts

Fixed wing aircraft were used to count anglers in the river sections where ground counts were made by the census agents and also in sections of river not visible to the census agents. Counts were scheduled for two weekdays and two weekend days each month from April 1 through September 30. The aerial count was typically conducted between 0930 and 1500 hours and, for purposes of expanding census data, was assumed to be representative of average daily fishing pressure.

Angler Interviews

Between count runs, the census agent traveled from one end of the census area to the other contacting as many anglers as possible. Every effort was made to obtain representative samples of angler catches in each census reach. The agent recorded the following information for each angler interviewed: location fished, time started, time finished (or time interviewed), lengths of marked and unmarked fish creeled, fish caught and released, target species, angler origin, whether fishing from boat or shore, type of tackle (bait, fly, or lure), and membership in a fishing organization. Scale samples were taken from all harvested trout, including marked fish. Total length (in), fin clips (if any), and location creeled were recorded on the scale envelope.

At the end of each interview, the agent asked incomplete anglers (anglers who had not finished fishing for the day) to fill out and return a numbered pre-addressed, stamped post card summarizing their catch and harvest information after they completed their trip. Willing anglers were given cards unless they had fished or intended to fish in more than one census reach. Since separation of trip data into the appropriate census reaches was not practical, such anglers were classified as "movers" and were not given cards. The census agent completed the upper part of the card and entered lengths of trout caught prior to the time of the interview. These fish lengths were then circled to differentiate between fish caught before and after the interview. The agent then instructed each angler how to enter their time finished, lengths of creeled trout and number of trout caught and released. Anglers were asked to mail the completed cards as soon as possible after returning home from their trip. After matching returned cards with the appropriate interviews using ID numbers on the card and the interview forms, data provided by anglers were entered on interview forms using red pencil (so card data could be separated from interview data) if there were no obvious

errors or ambiguities. Interviews with card data added were then treated as a completed angler trip when the census data was compiled and catch and harvest reported on cards was considered as part of the catch. Anglers could not be relied upon to correctly identify fin clips on the trout they harvested, so total trout harvest reported on cards was proofed and separated into components (wild or stocked BTY) for each census reach and interval based on the catch composition determined by actual census agent interviews. Cards were necessary to obtain an adequate sample of completed angler trips.

Harvest data from anglers targeting any species were used to determine total trout harvest and to determine return rates of stocked trout from various river reaches. However, because anglers targeting trout were more likely to catch trout than anglers targeting non trout species, only data from anglers targeting trout were used to compare trout catch and harvest rates between the West Branch, East Branch, and Delaware River.

Summary and Expansion of Count Estimates of Angling Effort

The census period was divided into four intervals to summarize and expand census data in each census reach. The first interval extended from April 1 to the day before brown trout yearlings were stocked. The second interval extended from the day of stocking to May 31. The third interval extended from June 1 to July 4 and the fourth from July 5 to September 30.

Calculation of total hours of angling effort was completed by deriving an estimate of hours of angling effort for each census day in each count section by multiplying the census agent's mean daily angler count by the average length of the fishing day for each census interval. Data were summarized separately for weekend days (including holidays) and weekdays in each interval and expanded for days not sampled using simple proportions. Angling effort for an entire interval was

determined by combining weekday and weekend totals. The number of angler trips was estimated by dividing total hours of effort in each interval for each reach by the average length of a completed angler trip for each interval in each census reach.

Mean daily angler count for each census was generally derived by averaging counts obtained on 5 count runs conducted between 0700 and 2015 hours except on a few occasions when less than five values were used because a count run or two was omitted because of vehicle breakdown, fog, or darkness. The average length of the angling day for each census interval was derived by averaging the number of hours between sunrise and sunset on the first day and last day of the interval. The length of the angling day used to estimate effort was 13.75 h for any day between April 1 and May 20, 15.75h for any day between May 21 and July 31, and 13.75 h for the period from August 1 - September 30.

Estimates of angling effort were refined further using aerial angler counts. Aerial counts not only provided a means to estimate effort in extensive reaches of the census area not visible to the census agent, but also provided an opportunity to compare estimates of angling effort in the census agent's count sections using two different techniques. Aerial angler counts were used to estimate effort in all census reaches and all count sections using the methodology in Keller (1988).

Since estimates of effort based on 5 ground counts per day 3 or 4 days per week are far more accurate than estimates of effort based on one aerial count per day for 4 days per month, ground estimates were used in preference to aerial estimate to expand census data in river reaches where both ground and aerial data were available. In the West and East Branch reaches where only aerial data were available, aerial estimates of effort were adjusted based on the difference between ground and aerial estimate observed in the count run sections where the two techniques overlapped.

Adjusted estimates were employed to estimate harvest and catch composition.

The equation employed to adjust angling effort is:

$$\text{Adjusted Hours} = \frac{\text{Aerial Effort Estimates} \quad \text{Ground Effort Estimates}}{\frac{\text{In Census Reach} \quad \text{X} \quad \text{In Count Reach}}{\text{Aerial Effort Estimate in Count Reach}}}$$

Summary And Expansion Of Interview Data - Computation Of Total Harvest

Interview data in each census reach were tabulated separately for the four census intervals to determine catch and harvest rates throughout the open season on trout. Harvest rates based on interview data were multiplied by adjusted hours of effort to compute total estimated harvest in each census reach. Total estimated harvest was then apportioned into appropriate categories (stocked or wild brown trout, etc.) using catch composition data from interviews to quantify total harvest in each category.

RESULTS

During the 1999 creel census on the Delaware Tailwaters, a total of 2,056 anglers were interviewed on the West Branch, 1,403 anglers on the East Branch, and 118 anglers on the Delaware River at Lordville. These interviewed anglers fished a total of 6900, 3673, and 339 h, respectively. West Branch anglers caught 4,529 trout of which 196 were creeled. East Branch anglers caught 671 trout of which 93 were creeled. Delaware River anglers at Lordville caught 81 trout and creeled none.

The percentage of anglers targeting trout on the West Branch, East Branch and Delaware River were 99%, 85% and 67%, respectively (Table 2). Although 85% of the East Branch anglers targeted trout, 90% of the upper East Branch anglers targeted trout compared to only 70% for lower East Branch anglers (Table 2). The percentages of targeted fishing effort for trout on all these river

reaches were very similar to the long term averages. The increased effort directed towards non-trout species in the lower East Branch reflects the warmer water temperatures in this 15 mi reach.

Anglers fishing for "Anything" represented 9% and 20% of the anglers interviewed in 1999 on the upper and lower East Branch, respectively, but only 3% on the Delaware River at Lordville (Table 2). Shad anglers comprised 23% of the anglers interviewed at Lordville on the Delaware River. The percentages of anglers targeting anything, bass, shad, walleye, or other varies from year to year on the lower East Branch and the Lordville reach as illustrated in Table 2.

Angler Effort

Riverwide during the April 1 through September 30 fishing season, an estimated 15,123 anglers (Table 3) fished 63,972 h (Table 4) on the West Branch. An estimated 6,241 anglers fished the East Branch of which 3,343 fished the upper and 2,898 the lower East Branch (Table 3). Total hours fished on the upper, lower and combined East Branch were 11,190, 9,083, and 20,273 h, respectively (Table 4). An estimated 1,149 anglers (Table 3) fished 3,722 h (Table 4) on the 2.3 mi Lordville reach of the Delaware River.

West Branch

The 63,972 h fished on the West Branch during the 1999 fishing season was equivalent to 140 h/acre (Table 5) or 33 trips/acre (Table 6). The distribution of total fishing effort on the Stilesville, No Kill, Hale Eddy, and the Border Water reaches were 11,420, 14,250, 13,853, and 24,449 h, respectively (Table 2). Although total fishing effort was greatest in the Border Water reach, fishing intensity was greatest in the No Kill reach at 264 h/acre (Table 5) followed by the Stilesville (211 h/acre), Border Water (111 h/acre) and Hale Eddy (108 h/acre) reaches (Figure 3). Fishing pressure was greatest in May and lowest in September. The monthly distribution of fishing

effort from April through September was 17%, 44%, 13%, 13%, 8%, and 5%, respectively (Figure 2).

Although the 63,972 h of total fishing effort in 1999 represents a 29% increase from the average of 49,452 h (range was 39,481 - 65,650 h) recorded during the 1989-91 censuses (Sanford 1994), it represents about a 30% decline from its 1992-95 peaks when total fishing effort ranged from 84,152 to 100,695 h and averaged 90,921 h annually (Table 4, Figure 4). The decline in fishing effort was largely due to the lower angling use on the 11.9 mi of river downstream of the No Kill reach (Figure 3). Total angler use in the Hale Eddy and Border Water reaches were down 52% and 37% from the 1992-95 averages of 28,922 and 38,622 h, respectively (Table 4).

An annual summary of total fishing effort riverwide and in each of the four census reaches on the West Branch for the eight census years between 1989 and 1999 are presented in Tables 3 (trips) and 4 (hours). Fishing intensity as h/acre and trips/acre are summarized in Tables 5 and 6, respectively.

East Branch

East Branch fishing pressure in 1999 totaled 20,273 h which was equivalent to 28 h/acre (Table 5) or 10 trips/acre (Table 6). Upper and lower East Branch fishing effort was 11,190 (47 h/acre) and 9,083 h (19 h/acre), respectively. The distribution of total fishing effort for the upper East Branch on the Downsville, Corbett, Shinhopple and Harvard census reaches was 1,946, 406, 677, and 314 h, respectively (Table 4). Total fishing effort in the lower East Branch on the Fishs Eddy and Peas Eddy census reaches were 951 and 1,947 h, respectively (Table 4). Although the highest total fishing effort occurred in the Downsville (1,946 h) and Peas Eddy (1,947 h) census reaches, fishing intensity was greatest in the Downsville reach at 130 h/acre compared to 16 h/acre

on the Peas Eddy reach (Figure 5). Fishing intensity on the four remaining census reaches at Corbett, Shinhopple, Harvard, and Fishes Eddy was 44, 25, 25, and 28 h/acre, respectively (Table 5).

The East Branch fishing effort of 20,273 h recorded for 1999 was the lowest recorded for the 10 census years between 1988 and 1999 (Figure 4). It represents a 15% decline from the previous low of 23,747 h recorded in 1995 and a 58% decline from the peak of 48,184 h recorded in 1988 (Table 4). The decline in total fishing pressure began during the 1994 fishing season (Figure 4). For the six year period between 1988 and 1993, total fishing effort averaged 41,022 h (range was 27,682 to 48,184 h) per year compared to 24,270 h (range was 20,273 to 27,772 h) for the 1994 through 1999 census years (Table 4).

An annual summary of total fishing effort in the upper, lower and combined East Branch and in each of the census reaches between 1988 and 1999 are presented in Tables 3 (trips) and 4 (hours). Fishing intensity as h/acre and trips/acre are summarized in Tables 5 and 6, respectively.

Delaware River at Lordville

Fishing pressure in the Lordville reach of the Delaware River during the April 1 - July 4, 1999, census period totaled 2,568 h or 26 h/acre. For the six years when the entire fishing season was censused, an average of 69% of the fishing pressure occurred by July 4. Projecting this average to the 1999 results suggests that the estimated fishing pressure for the entire fishing season through September 30 was 3,722 h or 37 h/acre. This represents a 35% decline from the 1995 and 1996 average of 5,684 h (range was 5,595 to 5,773 h) but comparable to the four year average of 3,904 h (range was 3,665 to 4,411 h) recorded from 1989-92 (Table 4, Figure 4).

An annual summary of total fishing effort on the Delaware River at Lordville are presented in Tables 3 (trips) and 4 (hours). Fishing intensity as h/acre and trips/acre are summarized in Tables 5 and 6, respectively.

Trout Catch Rates

West Branch

Anglers targeting trout in the West Branch averaged 0.66 trout/h in 1999 which ranked fifth overall for the eight years censused between 1989 and 1999 with the highest and lowest riverwide catch rate of 0.88 and 0.48 trout/h recorded in 1991 and 1995, respectively (Table 7). The eight year average was 0.70 trout/h. In 1999, catch rates were highest in the Stilesville and No Kill reaches at 0.84 and 0.81 fish/h, respectively (Figure 6). In the Hale Eddy and Border Water reaches, catch rates were 0.47 and 0.54 trout/h, respectively. Catch rates for all census years and reaches are summarized in Table 7.

Anglers fishing with bait, lures, and flies averaged 0.61, 0.73, and 0.77 trout/h. Bait anglers averaged 0.70 trout/h in the Stilesville reach and 0.40 and 0.36 trout/h in the Hale Eddy and Border Water reaches, respectively. Anglers fishing with lures averaged 1.15 trout/h on the No Kill reach and 0.62 to 0.66 trout/h elsewhere on the river. Fly fishermen averaged 1.08 and 0.80 trout/h in the Stilesville and No Kill reaches and 0.52 and 0.56 trout/h in the Hale Eddy and Border Water reaches, respectively.

West Branch anglers in 1999 creel an average of 0.03 fish/h riverwide with the highest creel rate recorded in the Stilesville reach (0.08 fish/h) and the lowest (0.01 fish/h) in the Border Water reach (Table 8). No fish were creel in the No Kill reach. The highest riverwide creel rates recorded were 0.14 and 0.12 trout/h in 1989 and 1990, respectively (Table 8) which occurred prior

to implementation of the 12 in size and 3 fish creel limit in 1991. Since then, the overall creel rate has declined by over half from 0.08 trout/h in 1991 to 0.03 trout/h in 1999. Typically, the highest creel rate on the West Branch occurs in the Stilesville census reach.

East Branch

Anglers targeting trout in the East Branch averaged 0.26 trout/h in 1999 with anglers in the upper and lower East Branch averaging 0.29 and 0.28 trout/h, respectively (Table 7). The riverwide catch rate was lower than those recorded on the upper or lower East Branch because it includes movers who are anglers that fish two or more census reaches. The 1999 riverwide catch rate was the lowest recorded to date with the previous low of 0.27 fish/h recorded in 1995 (Figure 7). The highest overall catch rate recorded was the 0.64 trout/h in 1990 (Table 7).

During the 1999 fishing season, catch rates in the six census reaches were similar with a range from 0.24 to 0.35 trout/h (Figure 8). Catch rates were highest in Fishes Eddy reach where anglers averaged 0.35 trout/h and lowest in the Harvard and Peas Eddy reaches where anglers averaged 0.24 trout/h (Table 7). Over the years, catch rates have been highly variable between census reaches with no obvious trends. Ranking catch rates for each census reach on a scale of 1 (high) to 6 (low) for each census year and then averaged yielded the following results: Corbett (2.1), Downsville (2.4), Fishes Eddy (2.4), Shinhopple (3.2), Peas Eddy (4.0) and Harvard (5.4). Thus, the Corbett and Harvard reaches typically had the highest and lowest catch rates, respectively. Catch rates for all census years and reaches are summarized in Table 7.

East Branch creel rates in 1999 ranged from 0.02 to 0.04 trout/h and averaged 0.03 trout/h (Table 8). Riverwide creel rates have never exceeded 0.09 fish/h (Table 8). Table 8 summarize creel

rates for the 1988-99 census years. The Downsville reach typically has the highest creel rates on the East Branch.

Delaware River at Lordville

Angler targeting trout during the April 1 - July 4 census period in 1999 averaged 0.32 fish/h (Table 7). During the same period for 1989-92 and 1994-95, anglers averaged 0.27, 0.19, 0.23, 0.31, 0.18, and 0.14 trout/h, respectively. No fish were creeled in 1999 or 1995 (Table 8). The highest creel rates recorded on this reach was 0.05 trout/h in both 1990 and 1994 (Table 8).

TOTAL HARVEST AND YIELD

West Branch

Riverwide, the estimated trout harvest on the West Branch during the 1999 fishing season was 1,852 trout including 55 reservoir brown trout, 128 hatchery brown trout, 1,601 wild brown trout, and 68 rainbow trout (Table 9). All the hatchery brown trout creeled were from the Stilesville and Border Water reaches and probably originated from Oquaga Creek which is stocked annually with approximately 3,200 yearling brown trout and 270 two year old brown trout. Forty one of the rainbow trout were creeled in the Border Water reach and the remaining 27 were caught in the Stilesville reach. The 55 reservoir brown trout that were creeled from the Stilesville and Hale Eddy reaches arrived there via spillage over the dam or through the water release structure. Of the 1,601 wild brown trout creeled, 815 were caught in the Stilesville reach, 582 in the Hale Eddy reach, and 204 in the Border Water reach.

The 1,852 trout creeled during 1999 is the lowest recorded for the eight census years between 1989-99 although it is similar to the 2,037 trout creeled in 1995 (Table 9). However, during the 1989-94 census years when the river was stocked, the number of trout creeled riverwide annually

ranged from 4,111 to 6,967 fish and averaged 5,136 fish (Table 9). This represents a 62% decline in total harvest from when the West Branch was stocked. Termination of trout stocking following the 1994 fishing season resulted in a 91% reduction of creel hatchery trout. During 1995 and 1999, an average of 140 hatchery trout (range was 128-152 fish) were creel compared to 1,623 hatchery trout (range was 1,131-1,911 fish) between 1989 and 1994. In addition to the reduction of hatchery brown trout harvest, there was also a 50% reduction in the harvest of wild brown trout. An average of 1,496 wild brown trout were harvested annually in 1995 and 1999 (range was 1,391-1,601 fish) compared to 2,989 wild brown trout (range was 2,331-4,580 fish) annually between 1989 and 1994 (Table 9).

The 1,852 trout creel riverwide, but not including the No Kill reach, in 1999 had an estimated total weight of 2,778 lbs or 6.9 lb/acre (Table 10). This riverwide yield was comparable to those recorded in 1989, 1990, and 1995 which ranged from 7.0 to 7.4 lb/acre (Table 10). However, these yields were much lower than the 10.8 to 16.7 lbs/acre reported between 1989 and 1994 that averaged 14.0 lb/acre (Table 10). The reduced yield observed in 1999 can be largely attributed to the 1.6 lb/acre trout yield in the Border Water reach. The previous lows in this reach were 4.8 and 5.1 lb/acre in 1995 and 1989, respectively.

The 1999 trout yields on the Stilesville, Hale Eddy and Border Water reaches were 27.1, 7.6, and 1.6 lb/acre, respectively (Table 10). Higher yields closer to the dam is typical. Only in 1990 and 1991 was this not true. In those two years, trout yields in the Border Water reach were 2.0 to 4.0 lb higher than those in the Hale Eddy reach. Although the 27.1 lb/acre of trout harvest at Stilesville seems unusually high, trout yields in 1992 and 1993 in this census reach were 40.7 and 50.9 lb/acre, respectively (Table 10).

East Branch

The 583 trout creeled riverwide in 1999 (Table 11) was the second lowest on record with only the 1995 catch of 398 creeled trout being lower. On the upper East Branch, 459 trout were creeled including 8 reservoir brown trout, 359 hatchery brown trout, and 92 wild brown trout. In the lower East Branch, 124 trout were creeled including 16 hatchery brown trout, 51 wild brown trout, 50 rainbow trout, and 7 brook trout. The 124 trout creeled on the lower East Branch in 1999 was also the lowest ever recorded on this reach. The highest trout harvest for the upper, lower and combined East Branch occurred in 1990 when 2,705, 2,116, and 4,821 trout were creeled, respectively (Table 11).

The creeled catch of reservoir brown trout, hatchery brown trout, wild brown trout, and brook trout are typically higher on the upper East Branch. The creeled catch of rainbow trout is typically greatest in the lower East Branch. Except for brook trout, this was true in 1999.

The 375 hatchery trout creeled in 1999 included 242 two year old brown trout stocked in May and 133 holdover brown trout that were stocked in 1998 or 1997. The 242 two year old brown trout creeled represented 33% of these fish stocked in 1999. No yearling fish stocked in 1999 were creeled that year. The 133 holdover brown trout creeled in 1999 included 82 two year old fish from 1998, 35 yearlings from the 1998 stocking, and 16 yearlings stocked in 1997.

The 583 fish creeled riverwide in 1999 had an estimated total weight of 816.2 lbs or 1.1 lb/acre with the per acre yield in the upper and lower East Branch being 2.7 and 0.5 lb/acre, respectively (Table 10). For the 10 years censused between 1988-99, the 1999 yields in the upper, lower, and entire East Branch ranked 9th, 8th (tied), and 9th overall (Table 10). The 1999 trout yields on the Downsville, Corbett, Shinhopple, Harvard, Fishes Eddy, and Peas Eddy census reaches were

9.2, 2.5, 0.7, 1.3, 1.4, and 0.3 lbs/acre, respectively. The Downsville and Peas Eddy reaches typically have the highest and lowest yields, respectively.

Delaware River at Lordville

No trout were creeled on the Lordville reach of the Delaware River in 1999 between April 1 and July 4 (Table 9). This was also true in 1995 when the entire fishing season was censused. For the five years between 1989 and 1994, the estimated trout yield ranged from 0.8 to 3.0 lb/acre and averaged 1.7 lb/acre (Table 10). In the past, rainbow trout were the most abundant fish in the creel.

Fishing Gear Preference

Fishing with flies was the preferred method of fishing during the 1999 fishing season on the West Branch, East Branch, and Delaware River. Sixty-six percent of the West Branch anglers, 47% of the East Branch anglers, and 51% of the Delaware River anglers at Lordville fished with fly fishing gear (Table 12). With a few exceptions, this has been the case on all rivers over the years since 1989 when gear type used was first recorded. Use of fly gear by upper and lower East Branch anglers were similar at 45% and 51% in 1999, respectively. Lower East Branch anglers typically have a higher use rate of fly equipment especially since 1993. West Branch anglers have shown increasing preferences towards fly fishing. From 1989-91, 42% of the anglers (range was 37-47%) fished with flies compared to 69% in 1996 and 1999 (Table 12). Fly fishing use is particularly popular on the 2.2 mi No Kill reach. Since 1992 when this regulation was established, 91% to 97% of the anglers interviewed on this reach fished with flies.

Fishing with bait and lure were the second and third choices of anglers interviewed on the West and East Branch in 1999. On the Delaware River at Lordville fishing with lures was the

second choice (33%) followed by fishing with bait (2%). On the West and East Branch, 16% and 23% of the anglers fished with bait compared to 9% and 14% with lures, respectively (Table 12). Although upper and lower East Branch angler uses of bait and lures was somewhat similar in 1999, traditionally bait use on the upper East Branch is 2-3 times higher than on the lower East Branch. Bait use on the West Branch has declined almost steadily since 1989 from 33% of the anglers interviewed to 16% in 1999 (Table 12).

ANGLER ORIGIN

West Branch

New York residents comprised 57% of the anglers interviewed during the 1999 fishing season with Pennsylvania and New Jersey residents comprising 17% and 16%, respectively (Table 13). The seven year averages for New York, Pennsylvania, and New Jersey residents for the censuses between 1989 and 1999 were 56% (range was 45-62%), 24% (range was 17-27%), and 15% (range was 11-20%), respectively (Table 13). Approximately 26% of the New York anglers resided in Broome County followed by Delaware County at 4% (Table 14). This has been typical over the years and is due to the fact that both counties border the West Branch.

East Branch

New York residents comprised 65% of the anglers interviewed during the 1999 fishing season with New Jersey and Pennsylvania residents comprising 23 and 7%, respectively (Table 13). The seven year average for New York, New Jersey, and Pennsylvania residents for the censuses between 1988-99 was 63% (range was 59-65%), 25% (range was 23-27%), and 8% (range was 7-10%), respectively (Table 13). Approximately 23% of the new York anglers resided in Delaware County followed by New York City at 5% (Table 14). The relatively high use by Delaware County

anglers compared to the West Branch or Delaware River is because the entire East Branch is located in Delaware County.

Delaware River at Lordville

Pennsylvania residents comprised 48% of the anglers interviewed during the 1999 fishing season with New York and New Jersey residents comprising 26% and 20%, respectively (Table 13). The seven year average for the censuses between 1989 and 1999 for Pennsylvania, New York, and New Jersey residents was 40% (range was 35-48%), 30% (range was 25-40%), and 21% (range was 18-24%), respectively (Table 13). Approximately 5% of the New York residents resided in Broome County followed by Delaware County at 4% (Table 14).

Fishing Club Membership

Thirty two percent, 27%, and 34% of the anglers interviewed (1st time interview only) in 1999 on the West Branch, East Branch, and Delaware River at Lordville were members of a fishing club or organization such as Trout Unlimited, B.A.S.S., a local rod and gun club, etc (Table 15). Although club membership rates on the upper (25%) and lower (31%) East Branch were similar in 1999, lower East Branch anglers typically have a higher club membership rate than the lower East Branch. The five year average for the lower and upper East Branch was 39% and 22%, respectively. Club membership was highest on the Delaware River. For the three years this question was asked, an average of 49% (range was 34% to 62%) of the anglers interviewed belonged to a fishing organization. Except for the Delaware River reach which was lower than previous years, the 1999 membership rate was comparable to the long term averages.

DISCUSSION

Fishing Effort

Total fishing effort on the West Branch, East Branch, and Delaware River at Lordville during the 1999 fishing season was 63,972, 20,273, and 3,833 h, respectively (Table 4). The effort on the West Branch was the lowest recorded for the six census years between 1991 and 1999 and a 28% decline from the last census in 1995 (Figure 4). The East Branch fishing effort was the lowest recorded for the 10 census years between 1988 and 1999 and down by over half from its peaks (Figure 4). The Delaware River fishing effort on the Lordville reach was down about a third from its 1994 and 1995 levels but similar to the level of effort from 1989 through 1992 (Figure 4).

Fishing pressure per acre on the West Branch, East Branch and the Lordville reach on the Delaware River averaged 140, 47, and 38 h/acre in 1999, respectively (Table 5). However, peak fishing pressure on these rivers were 221, 66, and 58 h/acre, respectively. By New York standards, fishing pressure on the Delaware Tailwaters is light. According to Engstrom-Heg (1990), light fishing pressure in New York is 150 h/acre or less and moderate or average fishing pressure is 300 h/acre. Only the No Kill census reach on the West Branch has what could be described as average fishing pressure which was 351 and 264 h/acre in 1995 and 1999, respectively (Table 5).

Pressure estimates on other New York tailwater trout fisheries also suggest that Delaware Tailwater fishing pressure is low. In 1992 on the 11.9 mi Esopus Creek tailwater in Ulster County, fishing pressure averaged 283 to 344 h/acre from April 1 through September 30 (Mike Flaherty, NYSDEC Region 3 Fisheries Office, personal communication). The 17 mi Neversink River tailwater in Ulster County averaged 318 and 218 h/acre during the 1996 and 1999 fishing seasons, respectively (Bob Angyal, NYSDEC Region 3 Fisheries Office, personal communication).

Among the Delaware Tailwaters, the East Branch had shown the biggest declines. Although the 1999 effort of 20,273 h was the lowest recorded for the 10 years of census, it continued a decline that began in 1994 (Figure 4). In 1993, total angler use was 38,006 h compared to 27,772 h in 1994 (Table 4). Except for 1989, total angler use between 1988 and 1993 was between 38,000 and 48,000 h annually. The most logical explanation for the decline in East Branch effort was a transference of fishing effort from the East Branch to the West Branch. The general consensus among many Delaware Tailwater anglers is that trout fishing in the West Branch is better than the East Branch. Trout are more abundant, quality size trout are more abundant, and trout are more catchable in the West Branch. Except for 1990, riverwide West Branch trout catch rates were 1.6 to 2.5 times higher than those recorded on the East Branch. Because of the close proximity of the East Branch, West Branch, Delaware River, and Beaver Kill, anglers will move readily between rivers.

Factors Potentially Effecting 1999 Fishing Effort

There is probably no single explanation for the decline in fishing effort from 1995 or 1996 to 1999. Several factors in combination probably contributed to the decline. A big factor may have been the summer weather in 1999.

The summer of 1999 was unusually hot and dry. According to the Northeast Regional Climate Center (Janet Foster, personal communication), the summer of 1999 was the ninth warmest and fourth driest on record for the last 106 years throughout the Northeast. On non-tailwater streams, stream flows were generally low and many were warm. The combination of hot weather and low stream flows may have discouraged many anglers from fishing in general or caused them to redirect their effort away from stream trout fishing.

On the West Branch, the hot, dry summer in 1999 resulted in large River Master directed releases. Between June 1 and August 31, 1999, there were 33 days when the water releases averaged 1,000 ft³/s or higher and another 14 days when the release was between 900 and 999 ft³/s (Office of the Delaware River Master, weekly summary). Some anglers, primarily the waders, viewed these high releases as unsafe and/or unfishable in complaints made to the Region 4 Fisheries Office. Consequently, angling use was probably discouraged.

The availability of stream flow information on the internet and the release schedule via a telephone hotline allowed the angler to make an informed decision on whether a trip to the West Branch was worthwhile. By mid-August, releases became turbid and warm as the high quality hypolimnetic cold water in Cannonsville Reservoir was depleted. Once this occurred, the West Branch ran turbid throughout its 17.7 mi length for the remainder of the fishing season. The turbid water certainly discouraged angler use. Lastly, construction activities associated with the bridge replacement at Hale Eddy resulted in the loss of angler access to this popular fishing area.

On the East Branch, the American shad fishing was the worst in recent memory. The number of shad migrating into the Delaware River system past the I-202 bridge in Lambertville, New Jersey in 1999 was only 24,700 fish compared to 289-524 thousand fish in 1992, 1995, 1996, and 1998 (Allen, et al 2000). Consequently, the number of anglers targeting shad was down. The hot summer elevated water temperatures in the lower East Branch into the 70's and higher for much of the summer. During July, the mean daily water temperature at the USGS gage at Fishs Eddy averaged 72.5°F (Butch, et al 2000).

Catch Rates

The riverwide catch rates on the West Branch, East Branch, and the Lordville reach of the Delaware River in 1999 were 0.66, 0.26, and 0.32 trout/h in 1999 respectively (Table 7). Peak catch rates were 0.88, 0.64, and 0.34 trout/h (Figure 7). For all census years on the West Branch, East Branch, and the Lordville reach on the Delaware River, catch rates averaged 0.70, 0.39, and 0.24 trout/h, respectively.

Comparisons with other tailwater rivers suggest that West Branch catch rates are typical while those on the East Branch and Delaware River were low. Trout catch rates on the tailwater reaches of Esopus Creek in 1992 and the Neversink River in 1996 and 1999 were 0.50, 0.77, and 0.57 fish/h, respectively (Unpublished data, NYSDEC Region 3 Fisheries Office). Unlike the West Branch, both the Esopus and Neversink are stocked annually with yearlings and two year old brown trout.

Catch rates in 1999 failed to meet the near term catch objectives of 1.0 trout/h for the West Branch and 0.5 trout/h for the East Branch and Delaware River (Figure 7) as stated in the Delaware Tailwaters Management Plan (Sanford 1992). This was also true for all census years for both the West Branch and Delaware River. In the East Branch, catch rates approached (2 years) or exceeded (1 year) the 0.5 trout/h catch rate objective in three of the 10 years censused. New York guidelines suggests an annual catch rate of 0.5 trout/h for average trout streams (Engstrom-Heg 1990). Delaware River and East Branch catch rates are consistently below this statewide standard.

The failure to attain near term catch objectives maybe due to two key variables. The first and most important are directly related to the basic, augmented, or augmented experimental conservation releases (Table 16), that have been in effect on the East and West Branches since Pepacton and

Cannonsville Reservoir were created in 1955 and 1967, respectively. Second is the termination and/or reduction of trout stocking in the West and East Branches.

Flow Releases

Release flows to the West and East Branches are less than optimal for a number of reasons. The Delaware River Masters directed releases, which are intended to meet the 1,750 ft³/s minimum flow requirement on the Delaware River at Montague, New Jersey, are typically released out of Cannonsville Reservoir to the West Branch. These releases can result in large daily fluctuations in stream flow. In a worse case scenario, flow releases could go from 160 ft³/s to over 1,000 ft³/s or the reverse within a 24 h period. High releases have resulted in entry into drought warning condition that have caused releases to revert to an extremely inadequate level eight times between 1980 and 1996 (Elliot 2000). Depletion of the high quality, oxygenated cold water in Cannonsville Reservoir typically occurs by mid-August in high water release years. The absence of cold water combined with a prolonged hot weather period could result in a major fish kill which last occurred in 1985. As water levels in Cannonsville Reservoir approach elevation 1,120 ft (the spillway crest is 1,150 ft) the discharge becomes turbid (Sanford 1992) and can cause the entire 17.7 mi West Branch and the upper reaches of the Delaware River to run turbid. The potential impacts of turbidity on invertebrates and trout spawning are well documented. Winter releases in both the West and East Branches provide minimal wetted perimeter and habit especially during periods of winter drought when releases are only 8 and 6 ft³/s respectively. East Branch flows are believed to be too low in general. Although the East Branch drainage area upstream of the Pepacton dam is only 19.5% smaller than the 456 sq mi drainage basin above the Cannonsville dam, the West Branch base summer flow is 68% to 464% higher than the East Branch base summer flow depending on whether

augmented or experimental releases are being made (Table 16).

Fish Stocking

Termination of trout stocking after 1994 in the West Branch and reductions in the number of fish and mileage of stream stocked in the East Branch have led to declines of the riverwide trout catch rate in both rivers (Figure 7). On the West Branch, the riverwide catch rate declined 23% from an average of 0.74 trout/h (range was 0.56 to 0.88 fish/h) when the river was stocked to 0.57 trout/h (range was 0.48 to 0.66 fish/h) during the post stocking years. The catch rate declines are most noticeable in the Hale Eddy and Border Waters reaches where catch rates between 1989 and 1994 averaged 0.64 to 0.75 trout/h when the river was stocked to 0.43 to 0.46 trout/h after stocking was terminated.. Riverwide East Branch catch rates declined from an average of 0.44 trout/h when 11,000 yearling trout were stocked over 32.1 mi of river to 0.30 trout/h in 1994 when 6,000 trout were stocked over 24.6 mi of river to 0.27 trout/h in 1995 and 1999 when 4,900 trout were stocked over 20.5 mi. The 1996 catch rate was not included because it was only a partial census through July 6.

Although the West Branch trout stocking program contributed 26% to 41% of the total trout harvest from 1989 to 1994 (Table 9) and 9% to 64% on the East Branch from 1988 to 1999 (Table 11), the contribution of stocked trout to the catch is much higher than their contribution to the harvest (Sanford 1993). A previous New York study showed that hatchery trout were six times more vulnerable to angling than their wild counter parts (Engstrom-Heg and Hulbert 1982). In retrospect, termination of trout stocking in the West Branch and the reduction in the East Branch stocking rate was probably premature. To meet the stated near term catch objective of 1.0 and 0.5 trout/h in the West and East Branches, stocking must be resumed in the West Branch and the stocking rate increased on the East Branch. Although the low catch rates in the Delaware River suggests that

stocking is warranted to attain the targeted catch rate of 0.5 trout/h, stocking is not recommended. The river has not been stocked in over 55 years and the anglers who fish this river seem satisfied with the low catch rates.

Angling Regulations

West Branch - No Kill

The No Kill regulation was established on the 2.2 mi reach downstream of the Rt 17 bridge in Deposit (Figure 1) in 1992 to demonstrate the trout potential of the West Branch. This regulation has proven to be very popular among anglers, especially those in the fly fishing fraternity, in recent years. In 1995 and 1999, 21 to 22% of the total West Branch angling effort occurred on this reach compared to 10-12% between 1992 and 1994. Catch rates are high (Figure 6) and have averaged 0.76 trout/h (range was 0.54 to 0.93 fish/h) since this special regulation area was created in 1992.

The standing crop of trout on the West Branch is highest in the No Kill reach. Since 1993, trout biomass has been measured annually at four locations. On the No Kill study section, preliminary trout biomass estimates were 33.5, 58.3, 28.2, 115.1, 46.5, and 48.4 lbs/acre in 1993, 1994, 1995, 1996, 1998 and 1999, respectively (Unpublished data, Region 4 Fisheries Office). The six year average was 55 lbs/acre. Over the same time frame, the trout biomass at the Stilesville, Hale Eddy, and Border Water study sections averaged 38, 27, and 34 lb/acre, respectively (Unpublished data, Region 4 Fisheries Office). Under the existing flow regimes, it would appear that the trout carrying capacity for the West Branch may be around 45-55 lbs/acre. Although this trout population study will continue through 2003, the preliminary data suggests no evidence to support the conclusion of many anglers that wild trout populations will increase dramatically when trout stocking is discontinued.

West Branch - 12 in Size Limit

The 12 in minimum size and 3 fish creel limit was implemented in 1991 throughout the West Branch because it was felt that the 9 in size limit did not make good use of the excellent trout growth and survival potential offered by the river. It was expected that the 12 in size limit would improve the quality of the fishery by increasing the angler catch rate of trout and the average size of creeled trout.

Although trout catch rates did not improve, they did remain the same despite a doubling in the amount of total fishing effort. With the 9 in size limit, the riverwide catch rate averaged 0.71 trout/h (range was 0.56 to 0.85 fish/h) in 1989 and 1990 compared to the average catch of 0.75 trout/h (range was 0.60 to 0.88 fish/h) between 1991 and 1994 (Figure 7). Riverwide catch rates declined to an average of 0.57 trout/h in 1995 and 1999 but this decline was probably related to the termination of trout stocking after 1994. The mean size of trout creeled riverwide in 1989 and 1990 was 11.5 and 12.0 in, respectively (Sanford 1994). Since the 12 in size limit has been in effect, the mean length of trout creeled riverwide has varied from 13.5 to 15.7 in annually.

East Branch - slot limit

In 1994, an experimental slot limit regulation was implemented on the 4.6 mi Fishs Eddy census reach (Figure 1) from the Beaver Kill downstream to the Fishs Eddy bridge. This regulation protected all trout under 12 in and over 14 in. Only one (1) trout between 12 and 14 in could be creeled. Terminal tackle was limited to artificials only to reduce hooking mortality. The intent of the regulation was to protect young trout and to improve the quality of fishing for trout in the highly desirable 14 to 20 in range.

The quality of the fishery in the Fishs Eddy reach did not improve as a result of the more restriction regulations. The pre-slot limit catch rate averaged 0.49 trout/h (range was 0.38 to 0.74 fish/h) compared to 0.25 trout/h (range was 0.20 to 0.32 fish/h) for the three slot limit census years from 1994 to 1996 (Table 6 and Figure 8). Over the same time frames, fishing effort decreased 29% from an average of 56 h/acre to 40 h/acre (Figure 5). The 1995 radiotelemetry study demonstrated that trout typically migrate out of the slot limit area during the summer when water temperatures are elevated (McBride 1997). Lastly, the regulation proved confusing with frequent complaints by anglers. For these reasons, the slot limit regulation was discontinued after the 1997 fishing season.

East Branch - 12 in size limit

The 12 in minimum size and two (2) fish creel limit was implemented in 1995 throughout the East Branch except for the Fishs Eddy census reach (Figure 1) where the slot limit regulation was in effect. This regulation was adopted because a similar regulation on the West Branch had proven very popular with anglers. It was expected that the 12 in size limit would improve the quality of the fishing in the East Branch by increasing the angler catch rate of trout and the average size of creeled trout.

There is no evidence to date that the more restrictive regulations have improved trout catch rates in the East Branch (Figure 7) despite a 41% decline in overall fishing effort (Figure 4). On the upper East Branch which has the more favorable summer water temperature because of the cold water releases from Pepacton Reservoir, catch rates averaged 0.43 trout/h between 1988 and 1994 compared to the average catch of 0.41 trout/h recorded for the three census years between 1995 and 1999 (Table 7). On the Peas Eddy reach on the lower East Branch, average catch rates declined from 0.42 trout/h between 1988 and 1994 to 0.23 trout/h with the 12 in size limit (Table 7). Although

catch rates did not improve, the mean length of creel trout increased riverwide from an average of 12.4 in (range was 11.6 to 13.2 in) before the regulation change to 15.2 in (range was 15.1 to 15.4 in) following the adoption of the more restrictive regulation. Although the failure to improve trout catch rates may be due in part to the reduced trout stocking that begun in 1994, most of the blame is likely the result of inadequate flow releases from Pepacton Reservoir. Despite the drainage area of Pepacton Reservoir being 19.5% smaller than the 456 sq mi drainage basin above the Cannonsville Reservoir dam, East Branch base summer water releases are 22% of the 325 ft³/s augmented and 59% of the experimental 160 ft³/s releases on the West Branch (Table 16).

Delaware River

The 12 in minimum size limit and 3 fish creel limit on the Delaware River was changed to the current 14 in minimum size and one (1) fish creel limit in 1995. The more restrictive regulations were implemented to increase the abundance of trout with the expectation that the catch rate would approach the 0.5 trout/h target outlined in the management plan.

The regulation change has had no apparent impacts on catch rates. Under the 12 in size and 3 fish creel regulation, the Lordville reach catch rates averaged 0.26 trout/h (range was 0.19 to 0.32 fish/h) compared to an average catch rate of 0.23 trout/h (range was 0.14 to 0.32 fish/h) under the more restrictive regulations (Table 7). Catch rates may be unaffected because of trout movement. During the 1995 radiotelemetry study, four of the five radiotagged trout being monitored in the Delaware River migrated into the West Branch (McBride 1997). Although catch rates were unchanged, no fish were reportedly creel in 1995 and 1999 at Lordville under the 14 in minimum size and the one (1) fish creel limit compared to the 0.03 to 0.05 trout/h creel rate recorded between 1989 and 1994 (Table 8). Under no circumstances should it be assumed that trout harvest has been

eliminated on the Delaware River as a result of the increased minimum size and reduced creel limit. Creel rates were low before the regulation change and although they may have been reduced further, the movement of trout into the East and/or West Branches where less restrictive size and creel limits are in effect probably renders the benefit of the more restrictive regulation moot.

Angler Residence

Out of state angler use in 1999 on the Delaware Tailwaters is high ranging from 42% on the West Branch, 35% on the East Branch, and 73% on the Delaware River. On non-tailwater trout streams, the percentage of non-New York residents was 4% on the Roeliff Jansen Kill (Zielinski 2000), 9% on the Genesee River (Evans 1994), and 1% on East Koy Creek (Evans 1998). The high use of the Delaware Tailwaters by non-New York residents is probably the result of extensive publicity in a variety of outdoor magazines especially those publications geared towards the fly fisherman and the close proximity of other states. Pennsylvania borders the West Branch and Delaware River. Connecticut, Massachusetts, and New Jersey are within 150 mi of the Delaware Tailwaters. These waters plus the Beaver Kill are a mecca to the fly fishing fraternity in the metropolitan Northeast.

Fishing Club Membership

Approximately one third of the anglers on the West Branch and Delaware River at Lordville and 27% of the East Branch anglers were members of a fishing club or organization (Table 15). During the 1996 New York statewide angler survey, 24% of fishing license holders belonged to organized fishing groups (Connelly, et. al. 1998).

MANAGEMENT RECOMMENDATIONS

Regulations

Except for the slot limit regulation on the East Branch which has since been discontinued, the restrictive angling regulation throughout the Delaware Tailwaters have been well accepted by the angling public. Nevertheless, it is recommended that the 14 in minimum size and 1 fish creel limit on the Delaware River be changed to a 12 in size and 2 fish creel limit. There is no evidence to suggest that the more restrictive regulations have improved trout catch rates on the Delaware River. The change would standardize trout regulations throughout the Delaware Tailwaters. Results of the 1995-97 radiotelemetry study demonstrates that the Tailwaters should be managed as one system as opposed to separately because of the extensive movement of trout between rivers (McBride 2002). Five of seven and 13 of 21 trout radiotagged throughout the Delaware River in 1995 and 1996 migrated into the West or East Branch (McBride 2002), where less restrictive size and creel limits are in effect. This movement probably negates the potential benefits of the more restrictive regulation in the Delaware River.

Trout Stocking

Catch rate objectives for the East and West Branches cannot be achieved unless the wild trout population is augmented by stocking. According to Sanford (1994), the near term catch rate objective of 1.0 trout/h in the West Branch and 0.5 trout/h in the East Branch are clearly unachievable without stocked trout unless angler use dropped to very low levels, harvest was dramatically decreased, and/or wild trout recruitment and abundance has increased dramatically.

West Branch and East Branch fishing pressure in 1999 had declined by 30% and 58% from their peaks, respectively. Trout harvest has been greatly reduced on both rivers: 62% on the West

Branch from the 1989-94 average of 5,136 trout annually and 74% on the East Branch from the 1988-94 average of 2,854 trout annually. Despite the declines in fishing pressure and trout harvest on the West and East Branches, riverwide catch rates still failed to meet the stated catch rate objectives for these two rivers. In retrospect, termination of trout stocking in the West Branch and reducing the number of trout stocked in the East Branch was premature.

Despite the lower trout catch rates that have resulted from terminating stocking in the West Branch and reducing stocking in the East Branch, the angling public seems satisfied with the quality of the existing fishery throughout the Delaware Tailwaters. There have been no complaints about the current stocking programs nor have there been any demands by the public to resume stocking in the West Branch or increasing trout stocking in the East Branch. The absence of complaints negates the immediate need to resume stocking. Alternatively, catch rate objectives identified in the 1992 Delaware Tailwaters fisheries management plan could be amended downward to better reflect conditions of the existing fishery.

It is recommended that the resumption of stocking in the West Branch and increased stocking in the East Branch be deferred until such time that there is strong public interest for such action. Any future stocking of the West Branch should be limited to 40,950 fingerling brown trout in the 7.5 mi Border Water reach only. Although trout stocking of the 8.8 mi New York reach is justifiable, stocking is not recommended. Limiting stocking to the Border Water reach should provide a better measure to evaluate the impact of stocking on catch rates. Fingerling brown trout are being recommended instead of yearlings because of their ability to disperse rapidly upstream, an important consideration in the West Branch where access is poor and few stocking points are available. Some of these fish are expected to migrate upstream into the New York reach. Since

fingerling trout are typically stocked in the fall, these fish will develop more wild characteristics by the following fishing seasons. The 40,950 brown trout fingerlings being recommended for stocking is a resumption of the stocking program in place from 1988 through 1991. Stocking responsibility for the Border Water reach should be shared equally between NYSDEC and the Pennsylvania Fish and Boat Commission. Interstate cooperation has occurred in the past and is expected to continue in the future.

The East Branch stocking should be returned to its pre-1994 riverwide stocking of 11,000 yearling brown trout annually. This would be an increase of 6,100 trout yearling from the 4,900 yearling trout currently being stocked.

Flow Releases

It must be recognized that the flow releases to the West and East Branches may never be optimal for trout. The sole purpose for the construction of Cannonsville and Pepacton Reservoir was to provide water for New York City. From the City's perspective, any water not directed their way may compromise their water supply. The large River Master directed releases are required to satisfy the 1954 U.S. Supreme Court decree. Additional releases to benefit the fisheries below the reservoirs are thus a competing demand to New York City priorities. In some years, there may not be enough water to meet both the drinking waters and fisheries needs. However, it is likely that a better balance between water supply needs and tailwater releases can be attained during most years.

It is recommended that the instream flow incremental methodology (IFIM) studies completed in the late 1970's and summarized in Sheppard's (1983) report be revisited with respect to updating what has been learned on the Delaware Tailwater system since then. New information includes documentation of main stem spawning in the East and West Branch, redd counts, creel census,

radiotelemetry, and trout population studies. These biological data and valid desires of the stakeholders are critical elements for proposing reallocation of available storage.

SUMMARY OF MANAGEMENT RECOMMENDATIONS

1. Continue the no trout stocking policies on the West Branch and Delaware River and the reduce trout stocking on the East Branch.
2. Continue the annual stocking of 800 two year old brown trout on the East Branch between Downsville and Harvard.
3. Revisit the issue of trout stocking on the West Branch and increased trout stocking on the East Branch at such time when there is strong public interest in such action.
4. Continue the 12 in minimum size and 2 fish creel limit for trout on the East and West Branch.
5. Continue the "No Kill" regulation on the 2.2 mi reach of the West Branch downstream of the Rt 17 bridge in Deposit.
6. Change the current 14 in minimum size and 1 fish creel limit for trout on the Delaware River to 12 in and 2 fish.
7. Update the IFIM studies of the late 1970's with information learned since then to determine if these flow recommendations are still appropriate.

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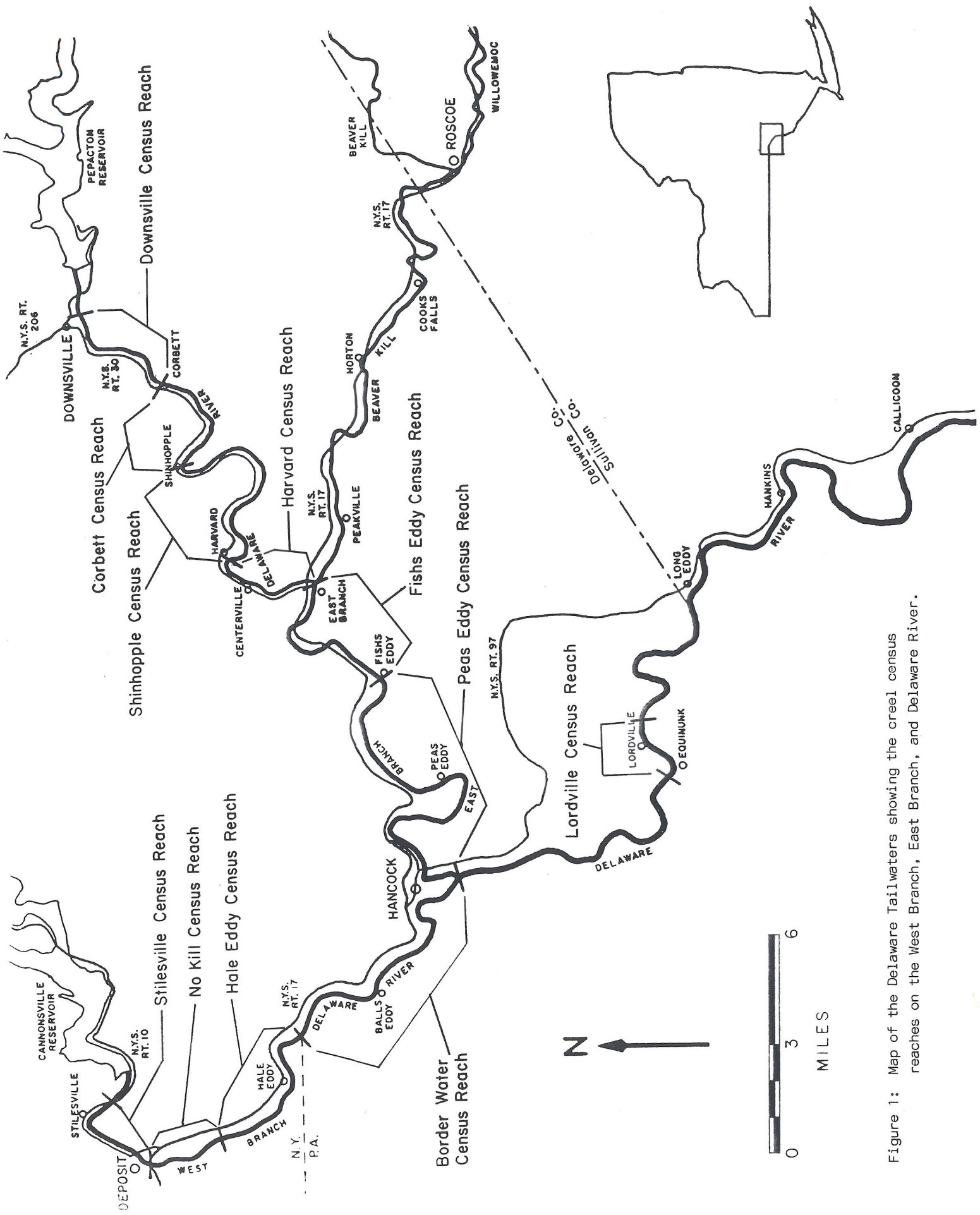


Figure 1: Map of the Delaware Tailwaters showing the creel census reaches on the West Branch, East Branch, and Delaware River.

Adjusted Angling Effort on the West Branch by Month in 1999

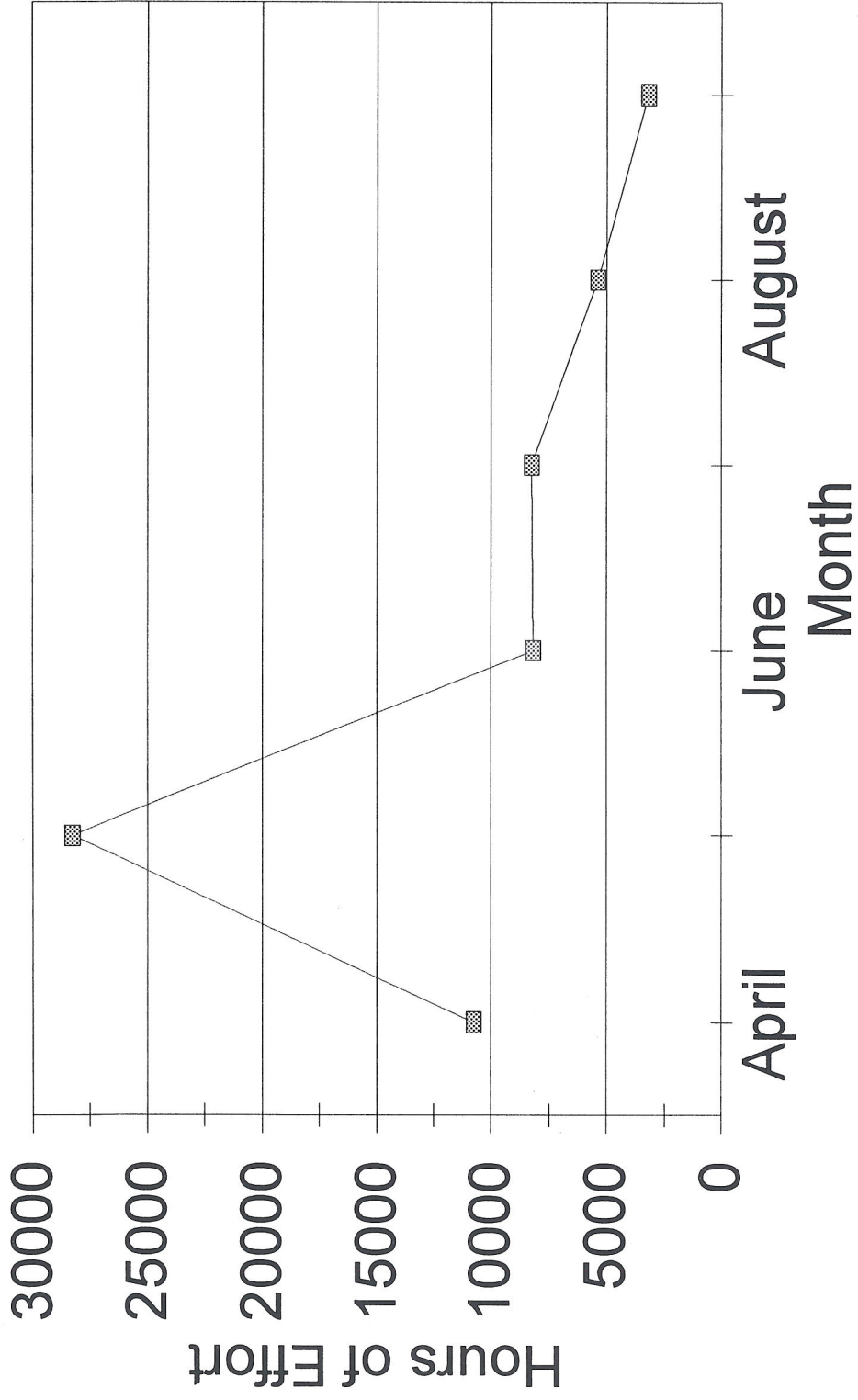


Figure 2: The monthly distribution of fishing effort on the West Branch in 1999.

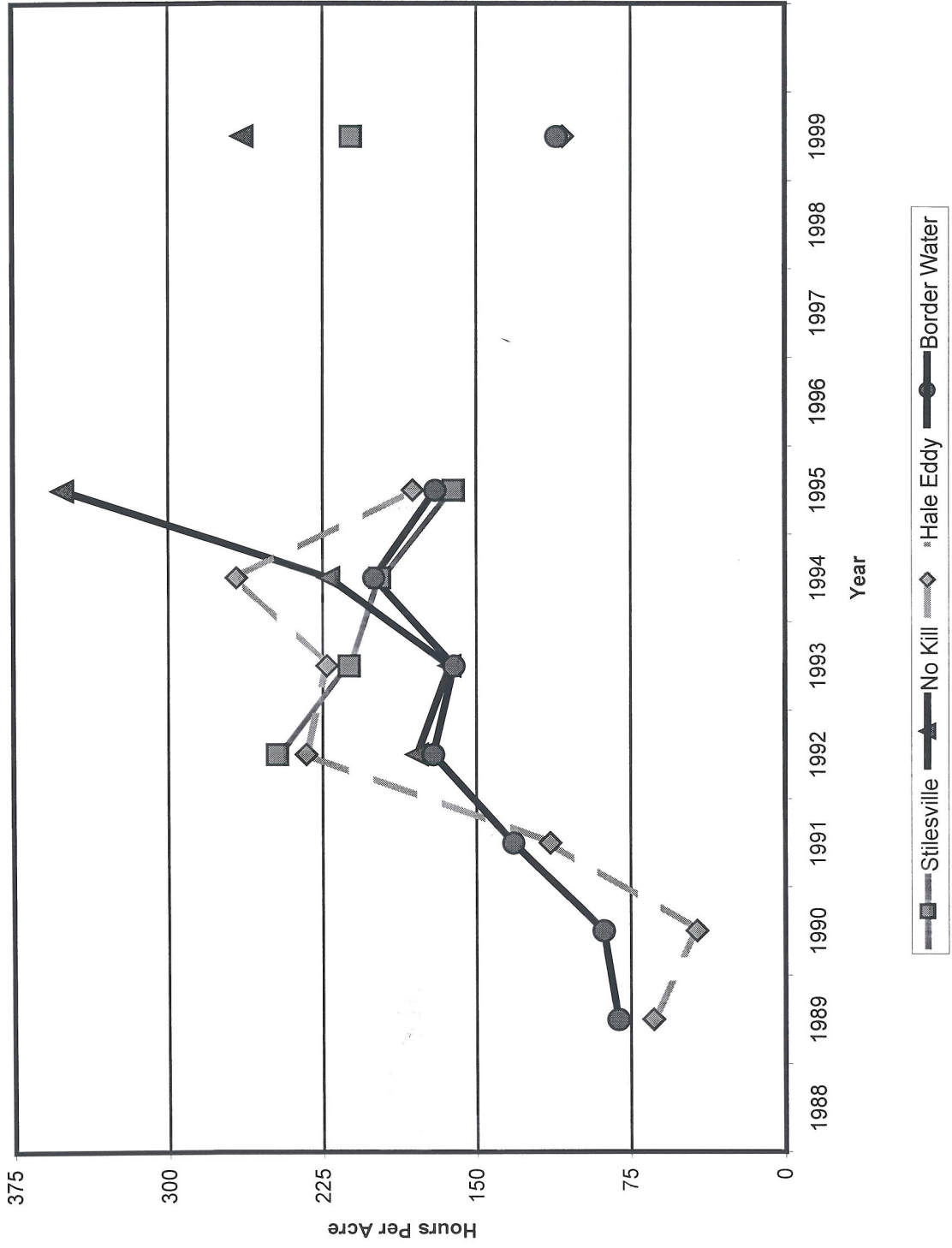


Figure 3: Fishing pressure (h/acre) by census reach on the West Branch, 1989-1999.

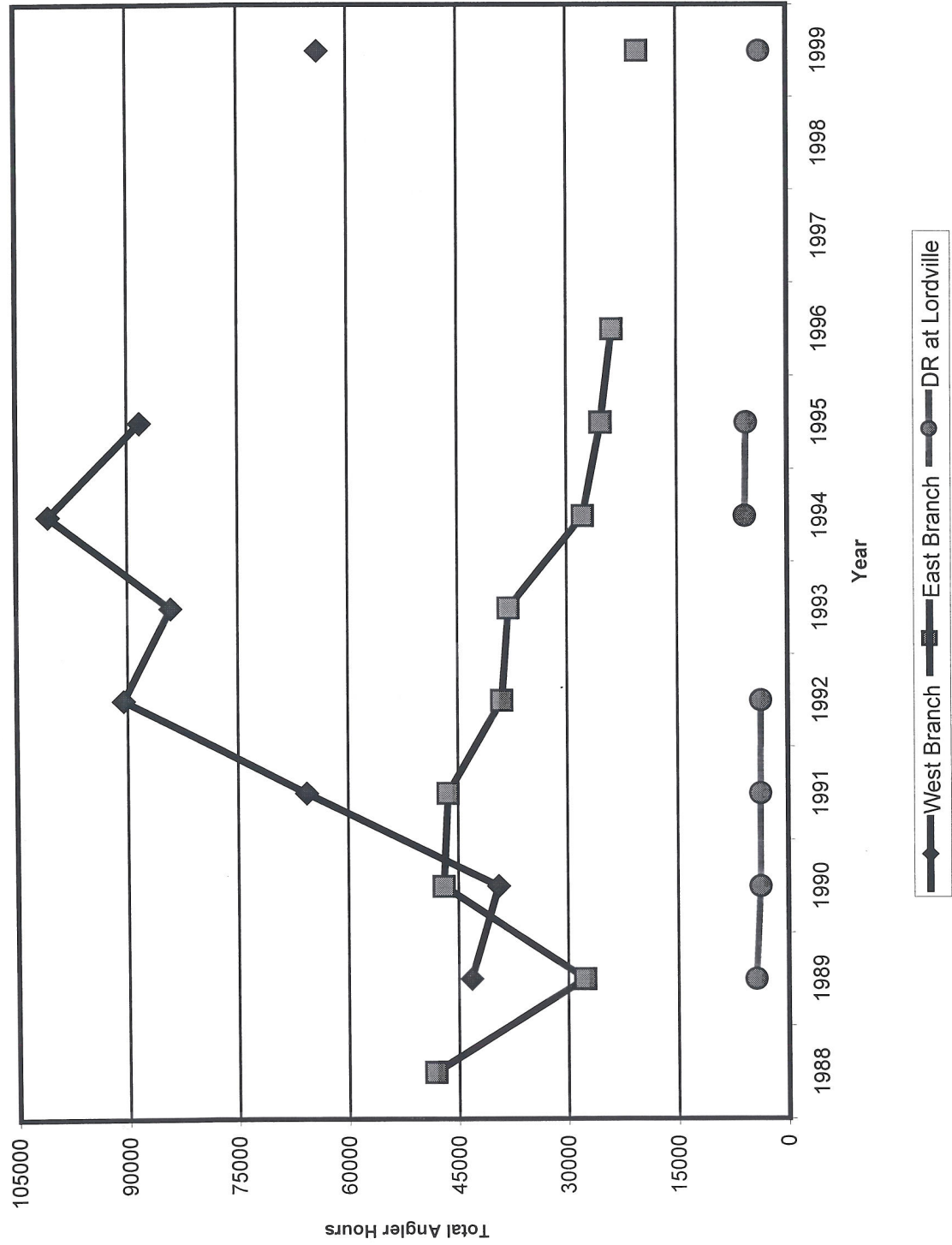


Figure 4: Total angler hours on the East Branch, West Branch, and the Lordville reach on the Delaware River, 1988-1999.

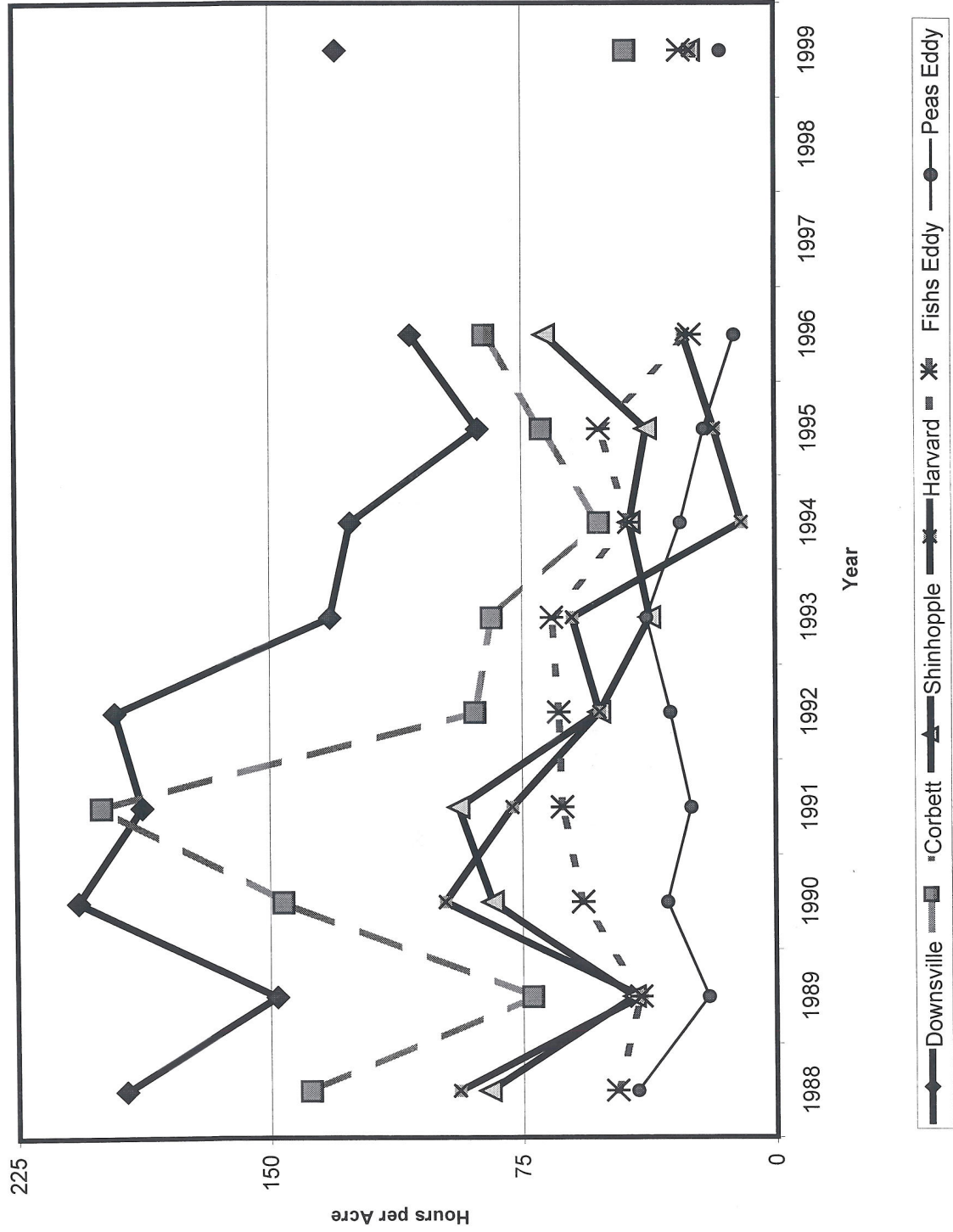


Figure 5: Fishing pressure (h/acre) by census reach on the East Branch, 1988-1999.

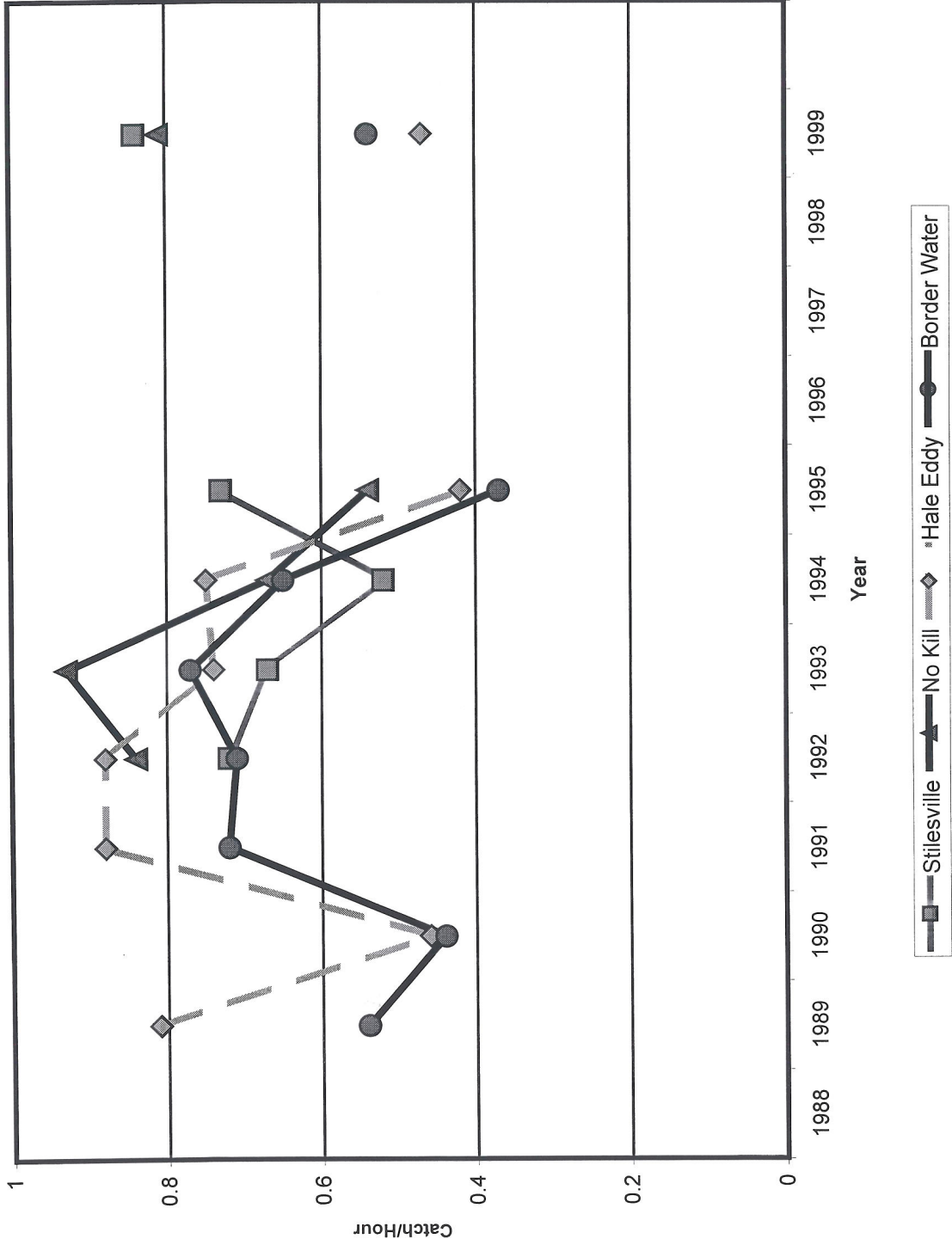


Figure 6: Catch rate of trout (fish/h) by census reach on the West Branch, 1989-1999.

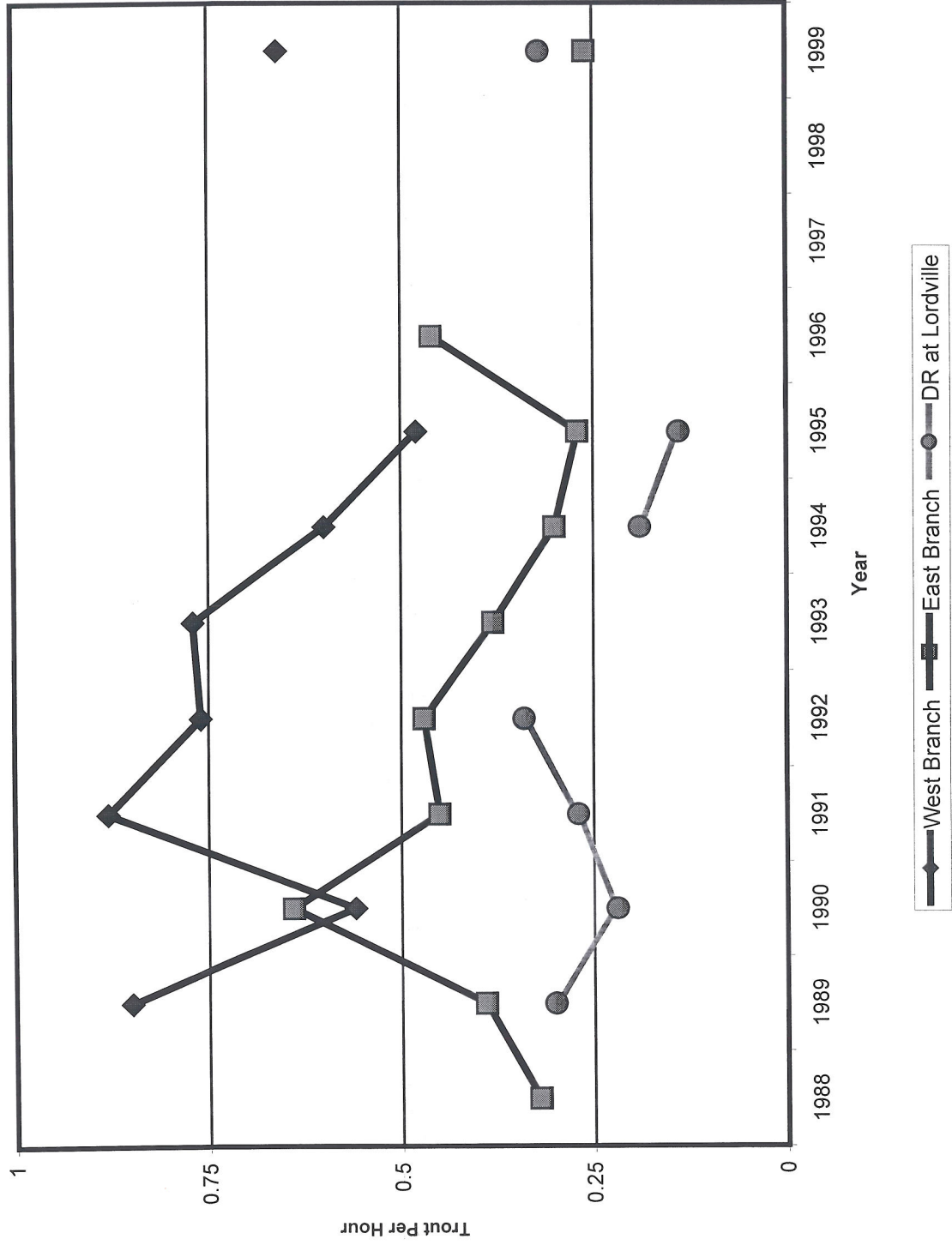


Figure 7: Trout catch rates (fish/h) on the West Branch, East Branch, and the Lordville reach of the Delaware River, 1988-1999.

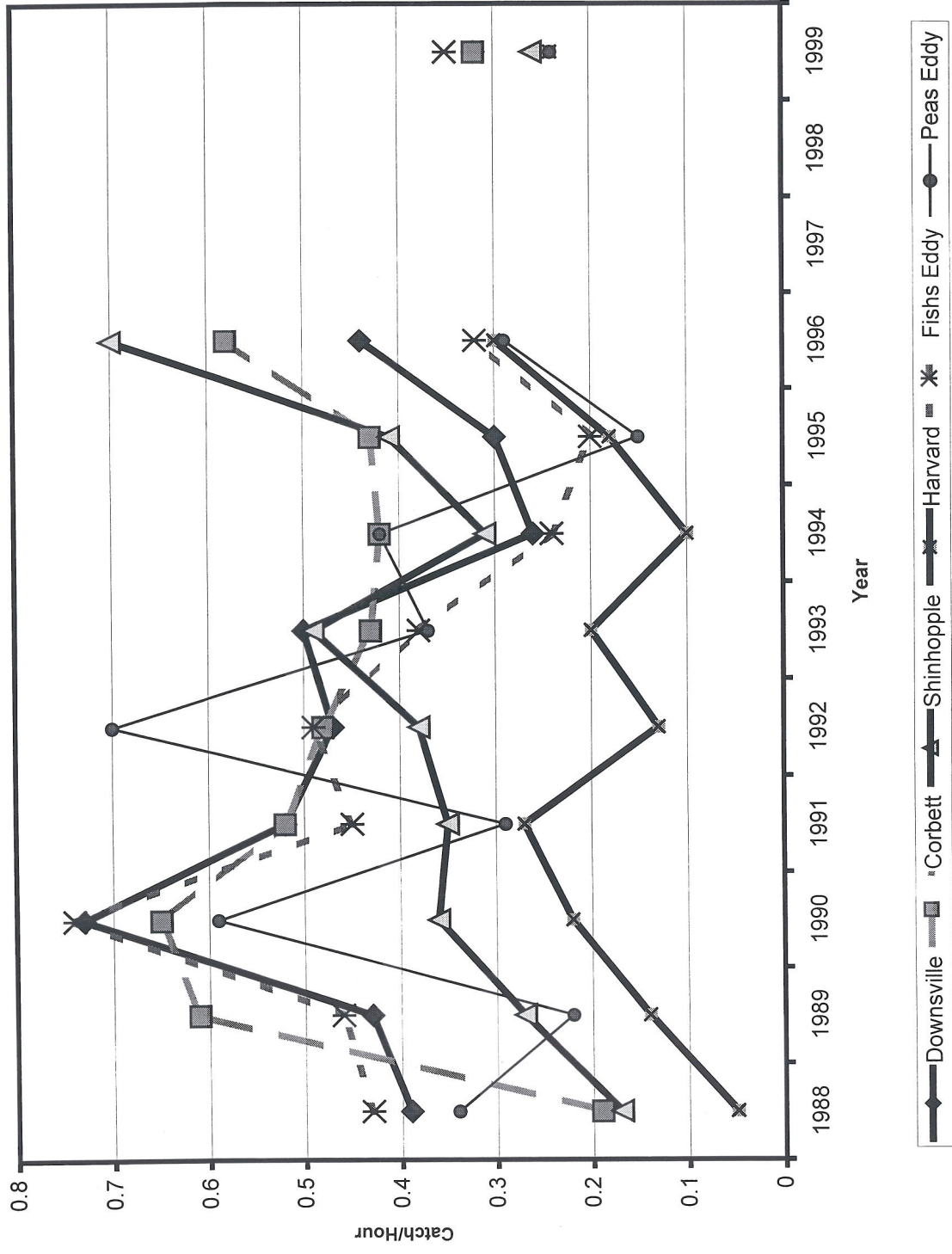


Figure 8: Catch rate of trout (fish/h) by census reach on the East Branch, 1988-1999.

Table 1: Physical characteristics of the census reaches on the West Branch, East Branch, and Delaware River.

Census Reach	Length (Mi)	Average Width (Ft)	Acres
West Branch			
Stilesville	2.2	200	54
No Kill	2.2	200	54
Hale Eddy	4.4	240	128
Border Water	7.5	242	220
East Branch			
Downsville	4.1	80	43
Corbett	3.6	96	42
Shinhopple	5.7	140	97
Harvard	3.3	135	54
Fishs Eddy	4.6	202	113
Peas Eddy	10.8	288	337
Delaware River			
Lordville	2.3	360	100

Table 2: Summary of directed fishing effort on the West Branch, East Branch, and Delaware River At Lordville, 1988-1999.

WEST BRANCH^a						
	TROUT	ANYTHING	NON-TROUT		WALLEYE	OTHER
			BASS	SHAD		
1999	99%	<1%		<1%	<1%	<1%
1995	99%	<1%	<1%	<1%		
1994	98%	1%		<1%		<1%
1993	100%					<1%
1992	99%		<1%	<1%	<1%	
1991	99%	<1%	<1%	<1%	<1%	<1%
1990	99%	1%				
1989	96%	1%	2%		1%	
Average	99%	<1%	<1%	<1%	<1%	<1%
UPPER EAST BRANCH						
1999	90%	9%				1%
1996 ^b	96%	3%		1%		<1%
1995	93%	5%	<1%	<1%		2%
1994	87%	7%	1%	<1%		4%
1993	98%	1%	<1%			<1%
1992	97%	2%	1%	1%		
1991	90%	7%	1%	1%		1%
1990	89%	7%	1%	<1%	<1%	3%
1989	85%	10%	1%	<1%		4%
1988	89%	9%	<1%	1%		<1%
Average	91%	6%	<1%	<1%	<1%	2%
LOWER EAST BRANCH						
1999	70%	20%	5%	3%	2%	<1%
1996 ^b	78%	3%	1%	18%		<1%
1995	78%	6%	9%	7%	<1%	<1%
1994	72%	7%	7%	13%	<1%	1%
1993	78%	5%	7%	8%	<1%	1%
1992	78%	4%	5%	13%		
1991	74%	5%	10%	10%	1%	
1990	73%	4%	9%	10%	3%	1%

Table 2: Continued

LOWER EAST BRANCH (CONTINUED)

	TROUT	ANYTHING	NON-TROUT		WALLEYE	OTHER
			BASS	SHAD		
1989	69%	9%	8%	12%	1%	1%
1988	59%	6%	12%	19%	1%	3%
Average	73%	7%	7%	11%	<1%	1%

EAST BRANCH (COMBINED)^a

1999	86%	11%	2%	<1%	<1%	1%
1996 ^b	90%	3%	<1%	7%		<1%
1995	86%	5%	4%	4%	<1%	<1%
1994	81%	7%	4%	6%	<1%	1%
1993	90%	3%	3%	4%	<1%	<1%
1992	90%	3%	2%	5%		<1%
1991	84%	6%	5%	5%	<1%	<1%
1990	83%	6%	4%	4%	1%	2%
1989	79%	10%	4%	5%	1%	1%
1988	77%	7%	5%	8%	<1%	3%
Average	85%	6%	3%	5%	<1%	1%

DELAWARE RIVER AT LORDVILLE

1999 ^a	67%	3%	2%	23%	5%	<1%
1995	70%	11%		17%	1%	1%
1994	70%	4%	4%	18%	4%	<1%
1992	78%	<1%	11%	7%	4%	<1%
1991	74%	5%	2%	18%	1%	<1%
1990	86%	6%		6%	2%	<1%
1989	54%	9%	6%	12%	14%	5%
Average	71%	5%	4%	14%	4%	1%

^aIncludes movers: anglers who fished 2 or more census reaches.

^bCensus period was April 1 - July 4.

Table 3: Estimated fishing pressure in total trips by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville reach on the Delaware River, 1988-1999

TOTAL ANGLER TRIPS

	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville		4652	3730	6515	4562	3782	3051	2645	2613	
No-Kill					2626	2338	2716	4006	3425	
Hale Eddy		1982	1531	4665	8631	8744	7959	6036	4198	
Border Water		3975	4795	7379	8253	7955	9209	8937	6367	
Entire West Branch		10609	10056	18559	24072	22819	22935	21624	15123	
East Branch										
Downsville	3007	2697	2899	2428	2753	1789	1966	1402	1641	1946
Corbett	2247	1356	1671	2727	1089	1071	559	902	1168	406
Shinhopple	2577	2289	2829	4089	1408	1253	1283	1127	1910	677
Harvard	1738	947	2262	2149	1007	1461	221	298	389	314
Fishes Eddy	1960	1815	1872	2260	2111	2064	1279 ^f	1669 ^f	839 ^f	951
Peas Eddy	4938	3351	4008	4080	3485	4650	3141	2868	1534	1947
Upper East Branch	9569	7289	9661	11393	6257	5574	4029	3729	5108	3343
Lower East Branch	6898	5166	5880	6340	5596	6714	4420	4567	2373	2898
Entire East Branch	16467	12455	15541	17733	11853	12288	8449	8296	7481	6241
Delaware River										
Lordville		952	1061	989	901	1223	1332			1149 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

Implementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY.

Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^eCensused through July 6. Extrapolated through Sept 30.

^fSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^gCensused through July 4. Extrapolated through Sept 30.

Table 4: Summary of estimated fishing pressure by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville reach on the Delaware River, 1988-1999.

TOTAL ANGLER HOURS

	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville		17352	14548	22020	13321	11460	10647	8703		11420
No-Kill					9661	8789	11977	18949		14250
Hale Eddy		8147	5467	14555	29863	28504	34146	23177		13853
Border Water		17727	19466	29075	37716	35399	43925	37448		24449
Entire West Branch		43226	39481	65650	90561	84152	100695	88277		63972
East Branch										
Downsville	8299	6364	8901	8084	8423	5689	5506	3772	4628	5584
Corbett	5796	3024	6132	8400	3746	3514	2163	2915	3620	1847
Shinhopple	8245	4074	8148	9118	5040	3608	4143	3640	6588	2390
Harvard	5076	2160	5292	4212	2819	3243	558	960	1438	1369
Fishes Eddy	5311	4520	6441	7119	7221	7492	4849 ^f	5912 ^f	2809 ^f	3203
Peas Eddy	15457	7540	12064	9425	11676	14460	10533	8088	4664	5880
Upper East Branch	27416	15622	28473	29814	20028	16054	12370	11287	16274	11190
Lower East Branch	20768	12060	18505	16544	18897	21952	15402	14000	7473	9083
Entire East Branch	48184	27682	46978	46358	38925	38006	27772	25287	23747	20273
Delaware River										
Lordville		4411	3783	3757	3665		5773	5595		3722 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

Implementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY.

Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^eCensused through July 6. Extrapolated through Sept 30.

^fSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^gCensused through July 4. Extrapolated through Sept 30.

Table 5: Estimated fishing pressure in hours/acre by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville Reach in the Delaware River, 1988 - 1999.

	ANGLER HOURS/ACRE									
	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville		161	135	204	247	212	197	161		211
No-Kill		64	43	114	233	223	267	181		264
Hale Eddy		81	88	132	171	161	200	170		108
Border Water		95	87	144	199	185	221	194		111
Entire West Branch										140
East Branch										
Downsville	193	148	207	188	196	132	126	88	108	130
Corbett	138	72	146	200	89	84	52	69	86	44
Shinhopple	85	42	84	94	52	37	43	38	68	25
Harvard	94	40	98	78	52	60	10	18	27	25
Fishes Eddy	47	40	57	63	64	66	43 ^f	52 ^f	25 ^f	28
Peas Eddy	41	20	32	25	31	38	28	21	12	16
Upper East Branch	116	66	121	126	85	68	52	47	69	47
Lower East Branch	42	25	38	34	39	45	31	29	15	19
Entire East Branch	66	38	65	64	54	52	38	35	33	28
Delaware River										
Lordville		44	38	38	37		58	56		37 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

Implementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY. Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^eCensused through July 6. Extrapolated through Sept 30.

^fSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^gCensused through July 4. Extrapolated through Sept 30.

Table 6: Summary of estimated fishing pressure in trips/acre by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville reach on the Delaware River, 1988-1999.

	ANGLER TRIPS/ACRE									
	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville			35	60	84	70	57	49		48
No-Kill	43				49	43	50	74		63
Hale Eddy	15	12	36	36	67	68	62	47		33
Border Water	18	22	34	34	38	36	42	41		29
Entire West Branch	23	22	22	41	53	50	50	47		33
East Branch										
Downsville	70	63	67	56	64	42	46	33	38	45
Corbett	54	32	40	65	26	26	13	21	28	10
Shinhopple	27	24	29	42	15	13	13	12	20	7
Harvard	32	18	42	40	19	27	4	6	7	6
Fishes Eddy	17	16	17	20	19	18	11 ^f	15 ^f	7 ^f	8
Peas Eddy	13	9	11	11	9	12	8	8	4	5
Upper East Branch	41	31	41	48	27	24	17	16	22	14
Lower East Branch	14	10	12	13	11	14	9	9	5	6
Entire East Branch	23	17	21	24	16	17	12	11	10	9
Delaware River										
Lordville		10	11	10	9		12	13		11 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

Implementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY.

Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^eCensused through July 6. Extrapolated through Sept 30.

^fSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^gCensused through July 4. Extrapolated through Sept 30.

Table 7: Summary of catch rates (creeled and released) for trout by anglers targeting trout by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville reach on the Delaware River, 1988-1999.

	CATCH RATE (trout/hour)									
	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville		1.06	0.67	0.96	0.72	0.67	0.52	0.73		0.84
No-Kill					0.84	0.93	0.67	0.54		0.81
Hale Eddy		0.81	0.46	0.88	0.88	0.74	0.75	0.42		0.47
Border Water		0.54	0.44	0.72	0.71	0.77	0.65	0.37		0.54
Movers		0.54	0.28	0.94	0.61	0.76	0.36	0.35		0.50
Entire West Branch		0.85	0.56	0.88	0.76	0.77	0.60	0.48		0.66
East Branch										
Downsville	0.39	0.43	0.73	0.52	0.47	0.50	0.26	0.30	0.44	0.32
Corbett	0.19	0.61	0.65	0.52	0.48	0.43	0.42	0.48	0.58	0.32
Shinhopple	0.17	0.27	0.36	0.35	0.38	0.49	0.31	0.41	0.70	0.26
Harvard	0.05	0.14	0.22	0.27	0.13	0.20	0.10	0.18	0.30	0.24
Fishes Eddy	0.43	0.46	0.74	0.45	0.49	0.38	0.24 ^f	0.20 ^f	0.32 ^f	0.35
Peas Eddy	0.34	0.22	0.59	0.29	0.70	0.37	0.42	0.15	0.29	0.24
Upper East Branch	0.29	0.41	0.62	0.48	0.44	0.47	0.31	0.39	0.55	0.29
Lower East Branch	0.39	0.38	0.69	0.40	0.55	0.34	0.31	0.20	0.31	0.28
Movers	0.29	0.30	0.51	0.13	0.37	0.20	0.27	0.30	0.30	0.16
Entire East Branch	0.32	0.39	0.64	0.45	0.47	0.38	0.30	0.27	0.46	0.26
Delaware River										
Lordville		0.30	0.22	0.27	0.34		0.19	0.14		0.32 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

Implementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY. Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^eCensused through July 6.

^fSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^gCensused through July 4.

Table 8: Summary of creel rates for trout by anglers targeting trout by census reaches and the entire river for the West Branch and East Branch tailwaters and the Lordville reach on the Delaware River, 1988-1999.

	CREEL RATE (TROUT/HOUR)									
	1988	1989	1990	1991 ^a	1992 ^b	1993	1994 ^c	1995 ^d	1996 ^e	1999
West Branch										
Stilesville		0.18	0.13	0.08	0.15	0.15	0.07	0.06		0.08
No-Kill					0.01	0.00	0.00	0.00		0.00
Hale Eddy		0.14	0.11	0.08	0.10	0.04	0.06	0.03		0.05
Border Water		0.07	0.08	0.07	0.05	0.05	0.03	0.02		0.01
Movers		0.07	0.06	0.08	0.03	0.04	0.01	0.01		0.01
Entire West Branch		0.14	0.12	0.08	0.06	0.06	0.04	0.02		0.03
East Branch										
Downsville	0.09	0.10	0.11	0.12	0.13	0.15	0.08	0.03	0.09	0.04
Corbett	0.08	0.11	0.12	0.08	0.08	0.13	0.06	0.02	0.06	0.04
Shinhopple	0.07	0.05	0.09	0.05	0.06	0.08	0.11	0.01	0.06	0.02
Harvard	0.03	0.04	0.03	0.02	0.01	0.05	0.06	0.04	0.06	0.02
Fishes Eddy	0.10	0.06	0.17	0.07	0.05	0.05	0.01 ^f	0.00 ^f	0.00 ^f	0.02
Peas Eddy	0.08	0.04	0.13	0.08	0.04	0.05	0.06	0.03	0.04	0.02
Upper East Branch	0.08	0.09	0.11	0.10	0.10	0.13	0.08	0.02	0.07	0.03
Lower East Branch	0.09	0.05	0.16	0.08	0.05	0.05	0.03	0.01	0.02	0.02
Movers	0.08	0.01	0.12	0.13	0.05	0.04	0.04	0.01	0.06	0.04
Entire East Branch	0.08	0.07	0.09	0.09	0.08	0.09	0.05	0.02	0.06	0.03
Delaware River										
Lordville		0.04	0.05	0.03	0.03		0.05	0.00		0.00 ^g

^aImplementation of the 12 in minimum size and 3 fish creel limit on the West Branch.

^bNo Kill reach established on the West Branch.

^cStocking of West Branch discontinued after 1994. East Branch stocking reduced from 11,000 to 6,000 BTY.

^dCreel limit reduced to 2 fish on the West Branch.

^eImplementation of 12 in minimum size and 2 fish creel limit on the East Branch. Stocking reduced from 6000 to 4900 BTY. Implementation of 14 in minimum size and 1 fish creel limit on the Delaware River.

^fCensused through July 6.

^gSlot limit regulation in effect on the Fishes Eddy reach of East Branch.

^hCensused through July 4.

Table 9: Calculated total trout harvest for all anglers on the West Branch and the Lordville reach of the Delaware River, 1989-1999.

WEST BRANCH						
Year	Reservoir Brown Trout # (%)	Hatchery Brown Trout # (%)	Wild Brown Trout # (%)	Rainbow Trout # (%)	Brook Trout # (%)	Totals
1999	55(3)	128(7)	1601(86)	68(4)		1852
1995 ¹	71(3)	152(7)	1391(68)	404(20)	19(1)	2037
1994	7(<1)	1131(28)	2651(64)	274(7)	48(1)	4111
1993	532(11)	1256(27)	2367(51)	426(9)	48(1)	4629
1992		1844(26)	4580(66)	533(8)		6967
1991 ²		1899(38)	2595(52)	440(9)	28(1)	4962
1990		1911(41)	2331(50)	383(8)	16(<1)	4641
1989		1696(31)	3412(62)	347(6)	50(1)	5505

DELAWARE RIVER AT LORDVILLE						
1999						0
1995 ³						0
1994			29(50)	29(50)		58
1992		5(4)	18(17)	87(79)		110
1991		12(11)	24(21)	77(68)		113
1990		29(15)	15(8)	145(77)		189
1989				132(100)		132

¹Stocking discontinued after 1994. Creel limit reduced from 3 fish to 2.

²Size limit increased from 9 in to 12 in. Creel limit reduced from 5 fish to 3.

³Size limit increased from 12 in to 14 in. Creel limit reduced from 3 fish to 1.

Table 10: Estimated yield (lb/acre) of trout (brook, brown, and/or rainbow trout) from the West Branch, East Branch, and Lordville reach of the Delaware River, 1988-1999.

	1988	1989	1990	1991	1992	1993	1994	1995	1996 ^a	1999
WEST BRANCH										
Stilesville					40.7	50.9	16.5	12.6		27.1
	14.5	11.3	17.9							
No Kill					1.0	0	0	0		0
Hale Eddy		5.3	3.1	7.3	23.3	9.8	16.0	6.5		7.6
Border Water		5.1	7.1	9.3	11.1	9.7	7.2	4.8		1.6
Entire West Branch		7.4	7.0	10.8	16.7	16.1	12.3	6.4		6.9
EAST BRANCH										
Downsville	10.4	9.3	19.9	17.1	19.2	19.1	10.3	3.7	12.6	9.2
Corbett	5.8	3.6	9.5	8.0	5.6	7.6	2.2	1.9	8.3	2.5
Shinhopple	4.2	1.7	3.8	5.3	2.5	1.8	2.8	0.4	5.7	0.7
Harvard	3.4	0.6	1.2	3.1	1.3	3.9	0.6	0.8	3.2	1.3
Fishs Eddy	2.5	1.0	5.5	4.9	2.7	2.7	0.5	0.1	<0.1	1.4
Peas Eddy	0.8	0.6	2.0	1.1	0.6	0.8	0.8	0.6	0.6	0.3
Upper East Branch	4.9	2.9	8.0	7.5	5.5	6.1	3.6	1.4	6.6	2.7
Lower Eats Branch	1.1	0.8	2.6	2.0	1.1	1.4	0.8	0.5	0.4	0.5
Entire East Branch	2.5	1.6	4.7	3.4	2.5	3.1	1.7	0.8	2.4	1.1
DELAWARE RIVER										
Lordville		1.6	3.0	1.6	1.7		0.8	0		0 ^b

^a Creel census for April 1 - July 6

^b Creel census from April 1 - July 4

Table 11: Calculated total trout harvest for all anglers on the upper, lower, and combined East Branch, 1988-1999.

<u>Year</u>	<u>Reservoir Brown Trout # (%)</u>	<u>Hatchery Brown Trout # (%)</u>	<u>Wild Brown Trout # (%)</u>	<u>Rainbow Trout # (%)</u>	<u>Brook Trout # (%)</u>	<u>Totals</u>
UPPER EAST BRANCH						
1999	8(2)	359(78)	92(20)			459
1996 ^a	33(3)	114(10)	906(81)	30(3)	32(3)	1115
1995 ^b		41(17)	181(77)	14(6)		236
1994	36(3)	486(46)	523(49)	9(1)	7(1)	1061
1993	130(7)	502(28)	1146(64)		10(1)	1788
1992		589(32)	1229(66)		46(2)	1864
1991		1025(41)	1495(59)		16(1)	2536
1990		1102(41)	1501(55)		102(4)	2705
1989		451(40)	605(54)	31(3)	35(3)	1122
1988		959(50)	929(48)		45(2)	1933
LOWER EAST BRANCH						
1999		16(13)	51(41)	50(40)	7(6)	124
1996 ^a			20(14)	121(86)		141
1995 ^b		8(5)	52(32)	102(63)		162
1994 ^c		193(41)	50(11)	228(48)		471
1993		293(40)	41(6)	401(55)		735
1992		385(49)	128(16)	271(35)		784
1991		409(42)	111(11)	429(44)	20(2)	969
1990		1171(55)	341(16)	604(29)		2116
1989		223(28)	447(56)	120(15)	9(1)	799
1988		701(64)	101(9)	278(25)	16(1)	1096

^aCreel census from April 1 - July 6.

^bSize limit increased from 9 in to 12 in. Creel limit reduced from 5 fish to 2.

^cSlot limit regulation in the Fish Eddy reach established. Possession of 1 trout between 12-14 in and artificials only. Discontinued after the 1997 fishing season.

Table 11: Continued

<u>Year</u>	<u>Reservoir Brown Trout # (%)</u>	<u>Hatchery Brown Trout # (%)</u>	<u>Wild Brown Trout # (%)</u>	<u>Rainbow Trout # (%)</u>	<u>Brook Trout # (%)</u>	<u>Totals</u>
ENTIRE EAST BRANCH						
1999	8(1)	375(64)	143(25)	50(9)	7(1)	583
1996 ^a	33(3)	114(9)	926(74)	151(12)	32(3)	1256
1995 ^b		49(12)	233(59)	116(29)		398
1994 ^c	36(2)	679(45)	573(37)	237(15)	7(<1)	1532
1993	130(5)	795(32)	1187(47)	401(16)	10(<1)	2523
1992		974(37)	1357(51)	271(10)	46(2)	2648
1991		1434(41)	1606(46)	429(12)	36(1)	3505
1990		2273(47)	1842(38)	604(13)	102(2)	4821
1989		674(35)	1052(55)	151(8)	44(2)	1921
1988		1660(55)	1030(34)	278(9)	61(2)	3029

^aCreel census from April 1 - July 6.

^bSize limit increased from 9 in to 12 in. Creel limit reduced from 5 fish to 2.

^cSlot limit regulation in the Fish Eddy reach established. Possession of 1 trout between 12-14 in and artificials only. Discontinued after the 1997 fishing season.

Table 12: Percentage of anglers using bait, lure, or fly on the West Branch, East Branch, and Delaware River at Lordville, 1989-99.

WEST BRANCH

	<u>Bait</u>	<u>Lure</u>	<u>Fly</u>	<u>Combinations</u>
1999	16%	9%	66%	9%
1995	19%	4%	72%	5%
1994	26%	6%	58%	10%
1993	25%	9%	49%	17%
1992	26%	7%	54%	13%
1991	33%	7%	47%	13%
1990	39%	11%	37%	13%
1989	33%	14%	42%	11%

UPPER EAST BRANCH

1999	26%	10%	45%	19%
1996	48%	11%	30%	11%
1995	34%	6%	49%	11%
1994	35%	8%	42%	15%
1993	46%	9%	33%	12%
1992	34%	7%	44%	15%
1991	35%	7%	45%	13%
1990	36%	13%	33%	18%
1989	41%	15%	32%	12%

LOWER EAST BRANCH

1999	23%	16%	51%	10%
1996	13%	17%	62%	8%
1995	10%	11%	71%	8%
1994	12%	16%	66%	6%
1993	20%	12%	50%	18%
1992	28%	11%	48%	13%
1991	27%	16%	47%	10%
1990	18%	18%	45%	19%
1989	24%	27%	38%	11%

Table 12: Continued

EAST BRANCH (COMBINED)

	<u>Bait</u>	<u>Lure</u>	<u>Fly</u>	<u>Combinations</u>
1999	23%	14%	47%	16%
1996	34%	14%	42%	10%
1995	22%	8%	60%	10%
1994	23%	12%	53%	12%
1993	31%	10%	47%	12%
1992	26%	11%	48%	15%
1991	32%	11%	46%	11%
1990	30%	15%	36%	19%
1989	34%	19%	36%	11%

DELAWARE RIVER AT LORDVILLE

1999	2%	33%	51%	14%
1995	15%	16%	62%	7%
1994	8%	12%	72%	8%
1992	20%	7%	54%	19%
1991	20%	3%	63%	14%
1990	31%	11%	49%	9%
1989	24%	25%	35%	16%

Table 13: Angler origin on the West Branch, East Branch, and Delaware River at Lordville, 1988-1999

WEST BRANCH

	Percentage of Anglers from				
	NY	PA	NJ	Other States	Foreign Countries
1999	57%	17%	16%	9%	1%
1995	47%	25%	21%	6%	<1%
1994	45%	27%	20%	7%	1%
1993	Not Asked				
1992	56%	24%	13%	7%	
1991	54%	27%	15%	4%	<1%
1990	61%	25%	11%	3%	
1989	62%	22%	11%	5%	<1%

EAST BRANCH

1999	65%	7%	23%	5%	<1%
1996	63%	9%	24%	4%	<1%
1995	59%	10%	27%	4%	<1%
1994	60%	9%	25%	6%	<1%
1993	Not Asked				
1992	Not Asked				
1991	Not Asked				
1990	64%	8%	24%	4%	<1%
1989	63%	7%	25%	3%	1%
1988	64%	7%	24%	3%	1%

DELAWARE RIVER AT LORDVILLE

1999	26%	48%	20%	5%	1%
1995	36%	35%	23%	6%	
1994	26%	38%	18%	18%	
1992	27%	41%	24%	8%	
1991	25%	47%	18%	7%	2%
1990	30%	38%	22%	10%	
1989	40%	36%	21%	3%	

Table 14: County of origin (percentage of total anglers interviewed) of New York anglers fishing the West Branch, East Branch, and Delaware River at Lordville, 1988-99.

WEST BRANCH

1999	Broome (26%)	Delaware (4%)	Onondaga (4%)	New York City (3%)
1995	Broome (15%)	Onondaga (4%)	New York (3%)	Delaware (2%)
1994	Broome (15%)	Delaware (7%)	New York (3%)	Orange (2%)
1992	Broome (31%)	Delaware (3%)	Chenango (3%)	New York (2%)
1991	Broome (27%)	Delaware (6%)	Chenango (3%)	Onondaga (1%)
1990	Broome (36%)	Delaware (9%)	New York (1%)	Chenango (1%)
1989	Broome (36%)	Delaware (8%)	Chenango (3%)	Otsego (1%)

EAST BRANCH

1999	Delaware (23%)	New York City (5%)	Broome (4%)	Suffolk (4%)
1996	Delaware (22%)	Broome (7%)	Rockland (5%)	New York City (4%)
1995	Delaware (17%)	New York City (8%)	Rockland (8%)	Broome (7%)
1994	Delaware (13%)	New York City (5%)	Broome (5%)	Westchester (3%)
1990	Delaware (18%)	Broome (8%)	Orange (3%)	Suffolk (3%)
1989	Delaware (19%)	Broome (8%)	Suffolk (5%)	Nassau (4%)
1988	Delaware (21%)	Broome (7%)	Orange (4%)	Queens (3%)

DELAWARE RIVER AT LORDVILLE

1999	Broome (5%)	Delaware (4%)	New York City (4%)	Queens (3%)
1995	Delaware (7%)	New York (5%)	Suffolk (3%)	Broome (3%)
1994	Delaware (3%)	Onondaga (3%)	New York (3%)	Erie (3%)
1992	Broome (5%)	Suffolk (4%)	New York (2%)	Nassau (2%)
1991	Broome (5%)	Delaware (3%)	Onondaga (3%)	New York (2%)
1990	New York (7%)	Delaware (6%)	Westchester (6%)	Sullivan (2%)
1989	Delaware (19%)	Broome (3%)	Orange (3%)	Erie (2%)

Table 15: Angler response to the question about belonging to a fishing club by West Branch, East Branch, and Delaware River at Lordville anglers, 1993-99.

	% YES				
	West Branch	East Branch (Combined)	Upper East Branch	Lower East Branch	Delaware River at Lordville
1999	32%	27%	25%	31%	34%
1996	-	27%	17%	42%	
1995	39%	32%	25%	40%	62%
1994	38%	32%	26%	39%	51%
1993	32%	29%	18%	43%	Not Asked
Average	35%	29%	22%	39%	49%

Table 16: Basic, augmented and augmented experimental flow releases (ft³/s) from Cannonsville and Pepacton Reservoirs (Elliot 2000).

Reservoir and Operative Dates	Basic Conservation Release^a	Current Augmented Conservation Release^b	Augmented Experimental Conservation Release^c
Cannonsville Reservoir			
4/1-4/15	8	45	4/1-5/31:45
4/16-6/14	23	45	
6/15-8/15	23	325	6/1-9/15:160
8/16-10/31	23	45	
11/1-11/30	23	33	
12/1-3/31	8	33	9/16-3/31:45
Pepacton Reservoir			
1/1-3/31	6	50	45
4/1-4/7	6	70	45
4/8-4/30	19	70	45
5/1-5/31	19	70	70
6/1-8/31	19	70	95
9/1-9/30	19	70	70
10/1-10/31	19	70	45
11/1-12/31	6	50	45

^aPrior to 1983

^bFrom 1983 to 1993 on Pepacton Reservoir and 1983 to 1996 on Cannonsville Reservoir

^cFrom 1997 to 2000 on Cannonsville Reservoir
From 1993 to 2000 on Pepacton Reservoir