Management Plan for the Wilbur Tailwater Trout Fishery 2004-2008


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Wilbur Tailwater Trout Fishery Management Plan (2004-2008)

I. Goal

The Tennessee Wildlife Resources Agency (TWRA) seeks to complete restoration of the trout fishery that existed in the lower half of the Wilbur tailwater (Watauga River) prior to the fish kill in February 2000 and to maintain a quality trout fishery throughout the tailwater concurrent with increasing fishing pressure and the variety of anglers who enjoy this resource.

II. Objectives

To meet the management goal for the Wilbur tailwater, TWRA will continue to provide put-and-take and put-and-grow fisheries for rainbow trout *Oncorhynchus mykiss* and brown trout *Salmo trutta* capable of sustaining at least 25,000 trips/year during. Greater emphasis will remain on put-and-grow management, particularly in the lower portion of the tailwater (fish kill zone). Given these basic strategies, TWRA will strive to meet the following management objectives during 2004-2008:

- *Re-establish trout abundance and size structure in the fish-kill zone.* Restoration and maintenance (at 1999 levels or better) of electrofishing catch rates for trout ≥7 inches, ≥14 inches, and ≥18 inches will achieve this objective

- *Optimize rainbow trout stocking rates.*

- *Establish a brook trout (Salvelinus fontinalis) fishery.* Annual fingerling stockings will be made to achieve this objective, with a target electrofishing catch rate of at least 5 fish/h ≥7 inches by March 2008.

III. Background

The Watauga River flows northwest from the mountains of northwestern North Carolina into Carter County, Tennessee. It is impounded near Hampton, forming Watauga Reservoir (6,432 acres). Most of the reservoir's watershed (468 $mi.^2$) is forested and much of the Tennessee portion lies within the Cherokee National Forest. Wilbur Dam is located about 3 miles downstream of Watauga Dam and impounds a small reservoir. Wilbur Dam's four turbines are capable of releasing a total flow of 2,680 ft^3/s (cfs) and because one turbine has a much higher capacity (1,766 cfs) than the other three, more discharge options are available than at other Tennessee hydroelectric facilities (Bettoli 1999). The Watauga River flows from Wilbur Dam through Carter and part of Washington County before entering Boone Reservoir. Surface area of the tailwater at base flow is 334 acres (Bettoli 1999).

The 10-mile Watauga River segment downstream of Elizabethton has a long history of degradation (Bivens 1988). Biological surveys during 1970-1982 documented the presence of only the most pollution-tolerant forms of aquatic life (Mullican and Leming 1970; McKinney et al. 1987). Consequently, few angling opportunities existed at that time. Reductions in effluent toxicity from industrial point sources resulted in recovery of macroinvertebrate and fish communities in the lower portion of the river by the mid to late 1980's. This recovery prompted TWRA to implement a trout-stocking program and later to establish a 2.7-mile Quality Zone (QZ) downstream of Smalling Bridge in 1989. Special angling regulations apply in the QZ and comprise a two-fish creel, 14-inch minimum size limit, and the exclusion of bait. Currently, only one other Tennessee tailwater (Hiwassee River below Apalachia Dam) has a specially regulated QZ.

The Tennessee Valley Authority (TVA) began reservoir release improvements in 1991 to address problems with low dissolved oxygen (DO) and flow throughout the tailwater. A minimum flow of 107 cfs provided by pulsing one Wilbur turbine 1 h every 4 h (coordinated with pulses from

Watauga Dam) was established that year (Scott et al. 1996). Later, turbines at Watauga Dam were fitted with hub baffles in 1993 and 1994 to aerate discharges (Scott et al. 1996). Turbine venting has helped Watauga Dam discharges meet TVA's target DO concentration of 6.0 mg/L (6 parts per million) and maintain at least 4.0 mg/L in most years when the target is not attained (Bettoli 2003).

By the late 1990's, water quality and flow improvements, along with TWRA's stocking program, had created one of the finest trout fisheries in the state. Bettoli (1999) estimated the abundance of overwintering trout in the Watauga River to be 109 lbs/acre (122 kg/ha), second only to the South Fork of the Holston River in Tennessee. The Watauga River below Wilbur Dam (Figure 1) now supports a 16-mile fishery (primarily for rainbow and brown trout) with a total economic value estimated at $836,373 (Williams and Bettoli 2003). Put-and-take and put-and-grow fisheries have been provided by annually stocking fingerling and adult trout. There is also some natural reproduction, particularly by brown trout (Banks and Bettoli 2000); these wild browns are genetically similar to the Plymouth Rock strain currently stocked in the Wilbur tailwater (Habera et al. 2003). While it is obvious that there is some recruitment of natural reproduction to the fishery, it appears less significant than in the South Holston tailwater (Bettoli et al. 1999) and could not support this fishery without supplementation.

TWRA has a rather extensive fisheries database for the Wilbur tailwater that dates back to 1987, when biological conditions had begun to improve and a trout fishery was starting to develop. Three sites were sampled in 1987 and five were sampled in 1988 with a combination of explosives, ichthyocide (sodium cyanide), and backpack electrofishing gear (Bivens 1988; Bivens 1989). All of these sites were located in the river segment downstream of Elizabethton except for one near Siam Bridge (Figure 1) in 1988. These initial sampling efforts were primarily qualitative in nature and produced few trout (average of about 4/site in 1987; 10/site in 1988).

Later, TWRA established and monitored three stations on the Wilbur tailwater each summer during 1991 through 2000 (Bivens et al. 1992-1998; Habera et al. 1999-2001). These stations were located near Siam Bridge, at the Blevins Bend access area, and near what is now the River Bend Campground in the QZ (Figure 1). Trout and non-salmonids were sampled with boat and backpack electrofishing gear (1 h of effort each) during low flow in July or August. Electrofishing catch rates indicated that the average abundance of trout ≥7 inches was relatively low (<30 trout/h) prior to 1995, then increased afterward to 40-60 trout/h (Figure 2). Catch rates for larger trout also generally increased after 1995 (Figure 2). This was particularly true at the station in the QZ, where catch rates for trout ≥14 inches exceeded corresponding rates at the other monitoring stations by 1998 (Habera et al. 1999, 2000). While these efforts provided useful information about the fish community in the Wilbur tailwater, the relatively small number of sites and potential for bias associated with stocking events rendered them inadequate for assessing the developing trout fishery.

Benthic macroinvertebrate samples were collected along with the fish samples at the three sites monitored during 1991-2000. Mean benthic taxa richness and organism abundance were relatively stable during the period; however, bioclassification scores (Habera et al. 2001) generally improved (Figure 3). The mean bioclassification score increased from the fair range prior to 1996 to the fair-good range afterward (Figure 3). By 2000, the score at Site 1 had reached the good range (4.0). Site 3 (nearest Wilbur Dam) also improved substantially, rising from poor (1.0) in 1994 and 1995 to fair-good (3.0) in 1998 (Figure 3). The observed benthic bioclassification improvements most likely reflect DO increases resulting from TVA's efforts in 1993 and 1994 to address DO problems in the Wilbur tailwater (turbine venting). The previously mentioned increases in trout abundance also closely followed the improving quality of the benthic community.

The first intensive study of the Wilbur tailwater trout fishery was conducted during 1998 and 1999 (Bettoli 1999). This study included an estimation of the composition and biomass of the overwintering trout population, assessments of survival and growth of stocked trout, and a creel survey. Standing crop (65% brown trout) was estimated to be 109 lbs./acre (122 kg/ha). Bettoli (1999) also found that the density of trout ≥14 inches was higher in the QZ than elsewhere in the river, but recognized that limited fishing access to the QZ at that time could have been a contributing factor (along with special regulations) to the high-quality fishery there. Throughout the tailwater, rainbow trout over 16 inches were uncommon (maximum size was 21 inches) while browns over 16 inches were common (maximum size was 28 inches).

Bettoli (1999) reported good 200-d survival (17-27%) of stocked catchable rainbow trout and a return (harvest) rate of 27%, which is intermediate among Tennessee tailwaters. However, these fish grew relatively slowly (0.20-0.28 inches/month), as did stocked brown trout (46% survival), and condition of both species declined significantly after stocking (Bettoli 1999). Fingerling rainbows stocked in June survived well and grew faster (0.55 inches/month), although this rate was generally lower than that for the Norris and South Holston tailwaters (Bettoli 1999). Growth and condition characteristics of Wilbur tailwater trout indicated to Bettoli (1999) that the relatively low basic productivity of the Watauga River was insufficient to maintain existing levels of stocked and overwintering trout.

Unfortunately, toxic runoff resulting from a fire at the North American Corporation in February 2000 killed nearly all the trout fishery in the 10-mile river section downstream of Elizabethton (Habera et al. 2001). This area includes the QZ, which had been providing improved opportunities for catching larger trout. Despite the nearly complete trout kill, the river's benthic community was not substantially impacted (Figure 3; Habera et al. 2001) and many non-salmonid fishes also survived (Habera et al. 2001). TWRA's efforts to restore the trout fishery in

the lower Watauga River began later in 2000 (Habera et al. 2001) and recovery is proceeding satisfactorily.

IV. Current Status

Trout Abundance

TWRA began more intensive annual monitoring of the Wilbur tailwater trout fishery in 2000 (just after the fish kill) using the boat electrofishing stations (Figure 1) and protocol established by Bettoli (1999). These monitoring stations are sampled during the day in early March at a flow of approximately 2,400 cfs and provide an assessment of the overwintering trout populations each year before stocking begins (Habera et al. 2001, 2002, 2003).

Mean catch rate for trout ≥7 inches, the minimum size considered fully recruited to the sampling gear and technique, fell to 2.4 fish/h (none were brown trout) at the five monitoring stations in the fish kill zone in 2000 (Figure 4). Consequently, mean catch rate for this size group decreased nearly 50% (from 109 fish/h) throughout the entire tailwater in 2000 (Figure 5). Additionally, large trout (≥14 inches) were eliminated in the fish kill zone in 2000 (Figure 4) and the loss of those fish substantially reduced mean catch rates for trout ≥14 inches and ≥18 inches throughout the tailwater that year (Figure 5).

When it was determined that adequate food supplies existed after the fish kill (the benthic community remained intact), efforts to restore the trout fishery in the fish kill zone focused on increased stocking rates (particularly for fingerling rainbow trout). The success of these stocking efforts is reflected in the catch rates obtained after 2000. The mean catch rate for all trout ≥7 inches in the fish kill zone rose to nearly 200 fish/h in 2001, although there was substantial variability among sites (Figure 4). Mean catch rates for all trout ≥7 inches have decreased since 2001, suggesting that the carrying capacity of this part of the tailwater may have

been exceeded; however, the mean remained at or slightly above the pre-fish kill (1999) level in 2003 (Figure 4). Catch rates for trout ≥7 inches throughout the tailwater improved with the recovery of the fish kill zone and have averaged between 125 fish/h and 139 fish/h (similar to the pre-fish kill level) after 2000 (Figure 5).

The abundance of larger trout, as expected, has recovered more slowly in the fish kill zone. The mean catch rate for trout ≥14 inches increased every year since 2000 and reached the pre-fish kill level (about 10 fish/h) in 2003 (Figure 4). Some of these larger trout have been brood fish (rainbows) provided by the federal hatchery in Erwin. However, brown trout, which must recruit to this size group from natural reproduction or the 6-8 inch fish typically stocked, have continued to increase in abundance. By 2003, most of the catch ≥14 inches consisted of brown trout (7.2 fish/h), as it had in 1999 (8.4 fish/h). Mean catch rates for trout ≥18 inches exceeded 2 fish/h in 2002 and 2003, indicating recovery to the pre-fish kill level (Figure 5). Although these fish were rainbows (stocked brood fish) initially, one brown trout in this size group was included in the 2003 survey (as was the case in 1999). Throughout the Wilbur tailwater, mean catch rates for both size groups of larger trout have generally increased with the recovery of the fish kill zone, which now produces most of these fish (Figure 5).

The relative abundance of brown trout exceeded 50% in 1995 (summer sampling at three stations) and the proportion of browns in each year's sample has generally increased to about 75% since then (Figure 6). The only exception occurred in 2001 (Figure 6), when the high restoration-stocking rate of rainbow trout effectively compensated for the higher tendency of browns to overwinter.

Stocking

Nearly 250,000 trout were stocked in the Wilbur tailwater during 2000 (Figure 7). Over half of those fish, including 102,000 fingerling rainbows and all 36,000 brown trout, were released in the fish kill zone. Emphasis was placed on fingerlings (particularly in the fish kill zone), as they exhibit the best growth and have the best chance for long-term survival in the river (Bettoli 1999). The previous annual stocking rate for the entire tailwater (1990-1999) was 89,000 trout per year and included about 32,000 catchable rainbows and 9,500 brown trout (typically 6-9 inches). The annual stocking rate for catchable rainbows, which are typically 9 inches or larger, was increased to about 51,000 in 2000 to compensate for the loss of angling opportunities in the lower portion of the tailwater.

Wilbur tailwater stocking rates have remained relatively high since 2000, particularly for rainbow trout (average of 199,000 per year, including 52,000 catchables; Figure 7). Fingerling brook trout were added to the stocking program in 2001 and 2002 (Figure 7), making the Watauga River the only tailwater in Tennessee to currently receive this species. All 23,000 brook trout stocked in 2001 were released in the QZ, while the 2002 fish were distributed throughout the tailwater. Most of the 174,000 brook trout stocked in 2002 (77%) were 1-inch fish produced at the Erwin hatchery and included 40,000 fish released in December. The December fish would ordinarily have been stocked in early 2003, but were ready for release earlier than expected. Future brook trout stocking rates will depend upon egg availability, but will probably be 30,000 to 40,000 fish per year. Some of the fish stocked earlier in 2002 (probably the 4-inch fish from Buffalo Springs hatchery) had grown to about 8 inches by late summer and anglers reported catching 34 during the 2002 creel survey (Bettoli 2003). If brook trout can survive and grow as rainbow and brown trout fingerlings do, they will provide a unique dimension to the Wilbur tailwater trout fishery.

The large number of brook trout stocked in 2002 raised the total number of trout stocked to over 400,000 fish, which rivals the current stocking rate for the more productive Norris tailwater (Habera et al. 2003). Since the February 2000 fish kill, about 287,000 trout (~70% rainbows) have been stocked on average each year in the Wilbur tailwater. Despite the predominance of rainbow trout in the stocking program and only limited natural reproduction by brown trout, rainbows have not, as previously discussed, dominated monitoring samples since the early 1990s. This, coupled with the declining electrofishing catch rate for rainbow trout since 2001 (to the pre-fish kill level; Figure 8), the addition of brook trout to the program, and the limited productivity of the Watauga River (Bettoli 1999), suggests that the current rainbow trout stocking rate is too high. In fact, Bettoli (1999) cited relatively poor growth rates and declining condition, even for trout that were not recently stocked, as evidence that the stocking rate was too high at that time (144,000 rainbows and 19,000 browns in 1999).

Angler Use

TVA documented an average of 60,413 angler-h/year on the Wilbur tailwater during 1990-1998. Trout (primarily rainbows) were harvested at an average rate of 0.21 fish/h during 1991-1997. Later, Bettoli (1999) estimated 65,188 hours of fishing pressure (20,564 trips) on the tailwater during 1998. Anglers caught 1.40 fish/h and harvested trout at the rate of about 0.25 fish/h (Bettoli 1999), which was similar to the rates reported by TVA for most years. Another creel survey of the Wilbur tailwater during March-October 2002 (Bettoli 2003) indicated a 50% increase in fishing pressure, making it one of the most heavily fished trout streams in Tennessee. Although the estimated number of fishing trips decreased slightly during 2002 compared to a similar period in 1998, mean trip length increased substantially from 3.2 h in 1998 to 5.2 h in 2002 (Bettoli 2003). Mean catch rate increased significantly to 1.6 fish/h, while the mean harvest rate decreased to 0.16 fish/h (Bettoli 2003). Catch rates over 0.7 fish/h are generally considered representative of good fishing (McMichael and Kaya 1991; Wiley et al. 1993).

Composition of the anglers using the Watauga River trout fishery also changed substantially from 1998 to 2002. Out-of-state anglers (mostly from North Carolina) increased from 10% to 32% while the percentage of bait anglers decreased from 68% to 36% and fly anglers increased from 18% to 47% (Bettoli 2003). These changes are likely due, in large part, to the opening of a campground and day-use area in the QZ (Figure 1) and the high level of guided fishing activity (Bettoli 2003), facilitated by the new TWRA access area at the CSX railroad bridge.

A study of the attitudes and motivations of Tennessee tailwater trout anglers (Hutt and Bettoli 2003) revealed the presence of five angler subgroups based on experience, resource use, expenditures, and the importance of angling. The two most specialized angler subgroups identified were consumptive and non-consumptive specialists. Both groups emphasize angling as a form of recreation and direct most of their effort (80-90%) toward trout; however, consumptive anglers have a much higher tendency to harvest and eat the trout they catch (Hutt and Bettoli 2003). Consumptive (35%) and non-consumptive (26%) specialists dominated the Wilbur tailwater trout fishery in Hutt and Bettoli's (2003) survey. The proportion of non-consumptive specialists fishing the Wilbur tailwater exceeded that for any other Tennessee tailwater surveyed by Hutt and Bettoli (2003), and this contributed to harvest frequency being lowest on the Wilbur tailwater (52% harvested trout 'rarely' or 'never'). The influence of non-consumptive specialists is probably also reflected in the strong support of Wilbur tailwater anglers for management options that involve reducing the daily creel limit and creating catch-and-release areas (Hutt and Bettoli 2003).

Given their willingness to pay ($91.69/day) for current conditions, Wilbur tailwater anglers value their fishing opportunities more highly than on any other major tailwater trout fishery in Tennessee (contingent valuation method; Williams and Bettoli 2003). Wilbur tailwater anglers were also unique, along with South Holston tailwater anglers, in their willingness to pay more for

the opportunity to catch more trout as opposed to the opportunity to catch larger trout (contingent valuation method; Williams and Bettoli 2003).

Regulations

TWRA recently acquired and is developing a new access area on the lower part of the Watauga River (inside the original QZ). It is located near the town of Watauga, about 165 ft. downstream of the CSX railroad bridge. TWRA's Area 43 law enforcement personnel suggested moving the lower QZ boundary from the Highway 400 Bridge to the CSX Bridge (about 525 ft.) to accommodate bank anglers desiring to fish with bait from this new access area. Region IV coldwater biologists also suggested a concomitant extension of the upper QZ boundary from Smalling Bridge to the lower end of the island immediately downstream of the Blevins Road access--a net gain of 0.9 miles. There is no public access in this area, bank access in general is limited, and a survey by wildlife officers indicated that landowners in the affected area would accept the change.

The proposal to shift the QZ boundaries was accepted by the Tennessee Wildlife Resources Commission (TWRC) and became effective on March 1, 2003. However, some landowners involved retracted their initial support for extending the upstream boundary and strong local opposition developed, fueled by a misrepresentation of the change in an area newspaper. Consequently, the TWRC amended the original proclamation in April 2003 and reset the upper QZ boundary to its original location at Smalling Bridge. The new lower QZ boundary (CSX railroad bridge) was retained, making the new QZ 2.6 miles in length.

V. Management Recommendations

Based on the current status of the Wilbur tailwater, the following actions are recommended during 2004-2008 to achieve the management objectives and ultimately fulfill the management goal for this extremely popular trout fishery.

Objective 1: Re-establish trout abundance and size structure in the fish-kill zone

Recovery of the lower portion of the Wilbur tailwater is nearly complete and will ultimately succeed as long as water quality in the river is maintained. Trout catch rates have returned to pre-fish kill levels, but the brown trout population's size structure remains somewhat truncated (fish up to 28 inches previously occurred). Brown trout in the 16-18 inch size range were collected at fish-kill zone monitoring stations in 2003 for the first time since 1999. It may take a few more years for brown trout to naturally achieve the size and age structures present before the fish kill. Given the QZ's presence within the fish kill zone and low overall harvest rate for the Wilbur tailwater, no other management actions are considered necessary to facilitate the restoration of large brown trout in this part of the tailwater.

It is recommended that the Wilbur tailwater trout fishery be monitored annually by electrofishing the 12 established monitoring stations in March to determine trout abundances (catch rates) and size structures. Electrofishing catch rates returned to pre-fish kill levels in 2003, so the primary objective over the next four years will be to at least maintain these catch rates (Table 1) while addressing the other management objectives. If the electrofishing catch rate objectives for the fish kill zone and overall can be met following the March 2008 monitoring samples, then the primary objectives of this management plan will have been achieved.

Table 1. Catch rate objectives for the Wilbur tailwater trout fishery (2004-2008).

	Fish Kill Zone		**Overall**	
Electrofishing catch rates (trout/h)	**1999 (pre-fish kill)**	**2004-2008 Mean**	**1999 (pre-fish kill)**	**2004-2008 Mean**
≥7 inches	67	≥67	109	≥109
≥14 inches	9.6	≥9.6	11.5	≥11.5
≥18 inches	1.2	≥1.2	1.5	≥1.5

Objective 2: Optimize rainbow trout stocking rates

Steady declines in electrofishing catch rates for rainbow trout and the low overall harvest frequency of Wilbur tailwater anglers clearly indicate that the current stocking rate is too high, particularly for fingerlings. Since the fish kill in 2000, 100,000 more rainbow trout fingerlings, on average, have been stocked annually than during 1990-1999 (47,000/ year). The increased stocking rate was warranted immediately following the fish kill, but should now be reduced, especially since Bettoli (1999) considered the trout-stocking rate for the Wilbur tailwater too high at that time. The stocking rate for catchable rainbows is 56% higher now than it was prior to the fish kill (32,000/year), and should be reduced some as well. The current brown trout stocking rate (about 20,000/year) can be maintained given their level of success in the tailwater.

Recommended stocking rates for rainbow and brown trout beginning in 2004 are:

- 40,000 catchable (9-13 inch) rainbow trout each year
- 50,000 fingerling (~4-inch) rainbow trout each year
- 20,000 brown trout (6-8-inch) each year

The recommended fingerling rainbow trout stocking rate is 87,000 lower than the 2000-2002 rate and 40,000 lower than the 1999 rate. This reduction in rainbow trout stocking rates should better fit the Wilbur tailwater's capacity to support trout and will permit the addition of brook trout to the stocking program. The excess fingerling rainbows can be diverted to the Norris tailwater, which needs supplemental trout (TWRA 2002). Stabilization of the overall mean rainbow trout catch rate (for fish $\geq$7 inches) at 25-50 fish/h (pre-fish kill level) will indicate that the lower stocking rates are adequate. Most of the brown trout (15,000) should be stocked in the lower portion of the tailwater (from the US 19E bridge downstream), as wild brown trout seem to be much more abundant in the upper portion of the river.

Objective 3: Establish a brook trout fishery

In 1999, water temperatures in the Wilbur tailwater remained below 62.6°F (17°C) all year at Bee Cliff (about 0.6 mi. below Wilbur Dam) and did not exceed 68°F (20°C) at the CSX railroad bridge in the lower reach of the tailwater (Bettoli 1999). Brook trout generally require colder water than either rainbow or brown trout, thus making the Watauga River and ideal tailwater to attempt to establish a fishery. Currently, brook trout angling is only available in headwater streams in the mountains of east Tennessee and these fish seldom exceed 9 inches in length. The Wilbur tailwater represents an opportunity to provide a larger, more accessible brook trout fishery, as well as the potential for producing bigger brook trout.

The Arkansas Game and Fish Commission currently stocks brook trout in the Norfork, Beaver, Bull Shoals, and Greers Ferry tailwaters (D. Bowman, AGFC, personal communication). Put-and-grow brook trout management has been quite successful in the Norfork tailwater, where high survival and good growth rates have produced fish up to 5 lbs recently. Arkansas uses Owhi-strain brook trout from a state hatchery in Utah and meets their entire need (44,000 fish) with production from one raceway at the Greers Ferry hatchery. The brook trout stocking rate for the Norfork tailwater is about 2,600/mile and these fish are stocked as 6-inch fingerlings in the winter (D. Bowman, AGFC, personal. communication).

Brook trout stocking efforts in the Wilbur tailwater began in 2000 and have had only limited success to date. TWRA's brook trout egg sources include Pisgah, NC (Pisgah strain) and Paint Bank, WV (Nashua strain). Eggs have also been obtained from the Utah source used by Arkansas, and those fish have performed well in tailwater environments. Therefore, given that water quality is not an issue, the general lack of success may be related to the size of the fish being used and the excessive stocking rate for other trout in the Wilbur tailwater. Because the smaller (1-inch) brook trout appeared to have poor survival, it is recommended that the use of

brook trout fingerlings less than 4 inches be discontinued and that 5-inch fish be used, if possible. Production of brook trout at the Dale Hollow Hatchery would help ensure a reliable supply for the Wilbur tailwater.

The recommended stocking rate is 40,000 fish/year (2,500 fish/mile), which is similar to the rate Arkansas uses in the Norfork tailwater. Using larger brook trout fingerlings and reducing the excess of rainbow trout should help produce better results. Successful establishment of brook trout in the Wilbur tailwater will be indicated by a mean catch rate of at least 5 fish/h (≥7 inches) during the annual electrofishing samples in March 2008. This approximates catching an average of one brook trout (≥7 inches) per monitoring station.

Evaluation

Following the completion of the 2008 Wilbur tailwater monitoring samples, an assessment of management objective accomplishments will be made and strategies will be adjusted, if necessary, to meet the goal for managing the Wilbur tailwater.

VI. References

Banks, S. M., and P. W. Bettoli. 2000. Reproductive potential of brown trout in Tennessee tailwaters. Fisheries Report No. 00-19. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bettoli, P. W. 1999. Creel survey and population dynamics of salmonids stocked into the Watauga River below Wilbur Dam. Fisheries Report No. 99-41. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bettoli, P. W. 2003. Survey of the trout fishery in the Watauga River: March – October 2002. Fisheries Report No. 03-05. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bettoli, P. W., S. J. Owens, and M. Nemeth. 1999. Trout habitat, reproduction, survival, and growth in the South Fork of the Holston River. Fisheries Report No. 99-3. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D. 1988. Region IV stream fishery data collection report: 1986-1987. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D. 1989. Region IV stream fishery data collection report: 1988. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., M. T. Fagg, and C. E. Williams. 1992. Region IV trout fishery data collection report: 1991. Fisheries Report No. 93-17. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., M. T. Fagg, and C. E. Williams. 1993. Region IV trout fishery data collection report: 1992. Fisheries Report No. 94-12. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., B. D. Carter, and C. E. Williams. 1994. Region IV trout fishery data collection report: 1993. Fisheries Report No. 94-21. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., B. D. Carter, and C. E. Williams. 1995. Region IV trout fishery data collection report: 1994. Fisheries Report No. 95-59. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., B. D. Carter, and C. E. Williams. 1996. Region IV trout fisheries report: 1995. Fisheries Report No. 96-5. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., B. D. Carter, and C. E. Williams. 1997. Region IV trout fisheries report: 1996. Fisheries Report No. 97-2. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bivens, R. D., B. D. Carter, and C. E. Williams. 1998. Region IV trout fisheries report: 1997. Fisheries Report 98-3. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Habera, J. W., R. D. Bivens, B. D. Carter, and C. E. Williams. 1999. Region IV trout fisheries report: 1998. Fisheries Report No. 99-4. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Habera, J. W., R. D. Bivens, B. D. Carter, and C. E. Williams. 2000. Region IV trout fisheries report: 1999. Fisheries Report No. 00-9. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Habera, J. W., R. D. Bivens, B. D. Carter, and C. E. Williams. 2001. Region IV trout fisheries report: 2000. Fisheries Report No. 01-03. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Habera, J. W., R. D. Bivens, B. D. Carter, and C. E. Williams. 2002. Region IV trout fisheries report: 2001. Fisheries Report No. 02-04. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Habera, J. W., R. D. Bivens, B. D. Carter, and C. E. Williams. 2003. Region IV trout fisheries report: 2002. Fisheries Report No. 03-03. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Hutt, C. P., and P. W. Bettoli. 2003. Recreational specialization, preferences, and management attitudes of trout anglers utilizing Tennessee tailwaters. Fisheries Report No. 03-01. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

McKinney, A. D., D. L. Melgaard, J. A. Wojtowicz, and R. D. Martin. 1987. Restoration of the Watauga River in upper east Tennessee through reduction in textile mill effluent toxicity. Tennessee Department of Health and Environment, Division of Water Pollution Control, Knoxville, Tennessee.

Mullican, H. N., and E. C. Leming. 1970. Biological conditions of the Watauga River as presented to the Tennessee Stream Pollution Control Board. Tennessee Department of Public Health, Tennessee Stream Pollution Control Board, Nashville, Tennessee.

McMichael, G. A., and C. M. Kaya. 1991. Relations among stream temperature, angling success for rainbow and brown trout, and fishermen satisfaction. North American Journal of Fisheries Management 11:190-199.

Scott, E. M., K. D. Gardner, D. S. Baxter, and B. L. Yeager. 1996. Biological and water quality responses in tributary tailwaters to dissolved oxygen and minimum flow improvements. Tennessee Valley Authority, Water Management Services, Norris, Tennessee.

Tennessee Wildlife Resources Agency (TWRA). 2002. Management plan for the Norris tailwater trout fishery: 2002-3006. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Wiley, R. W., R. A. Whaley, J. B. Satake, and M. Fowden. 1993. Assessment of stocking hatchery trout: a Wyoming perspective. North American Journal of Fisheries Management 13:160-170.

Williams, J. S., and P. W. Bettoli. 2003. Net value of trout fishing opportunities in Tennessee tailwaters. Fisheries Report No. 03-21. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

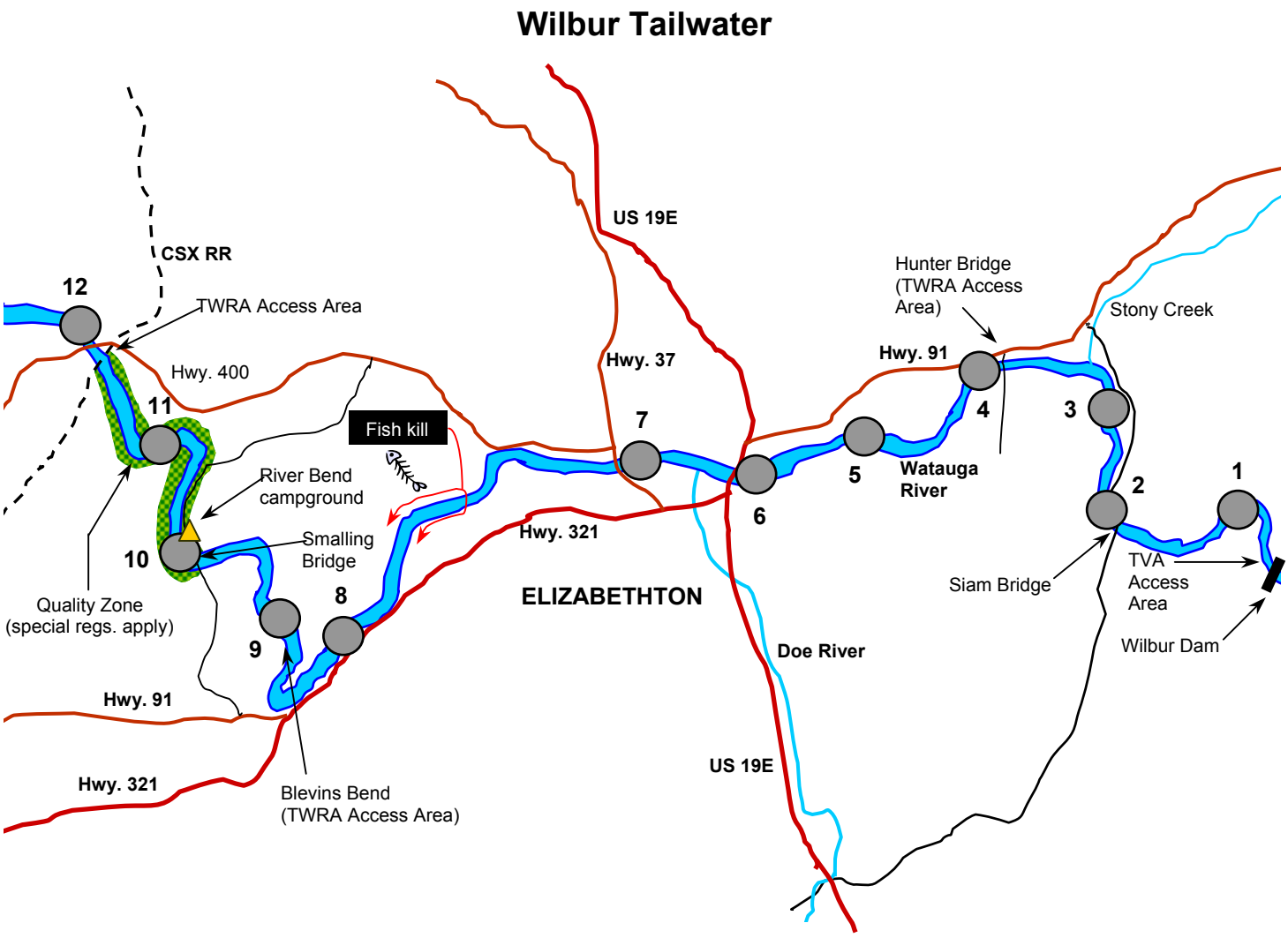

Figure 1. Locations of the Wilbur tailwater (Watauga River) monitoring stations. The lower boundary of the Quality Zone has been updated to reflect change established in April 2003.

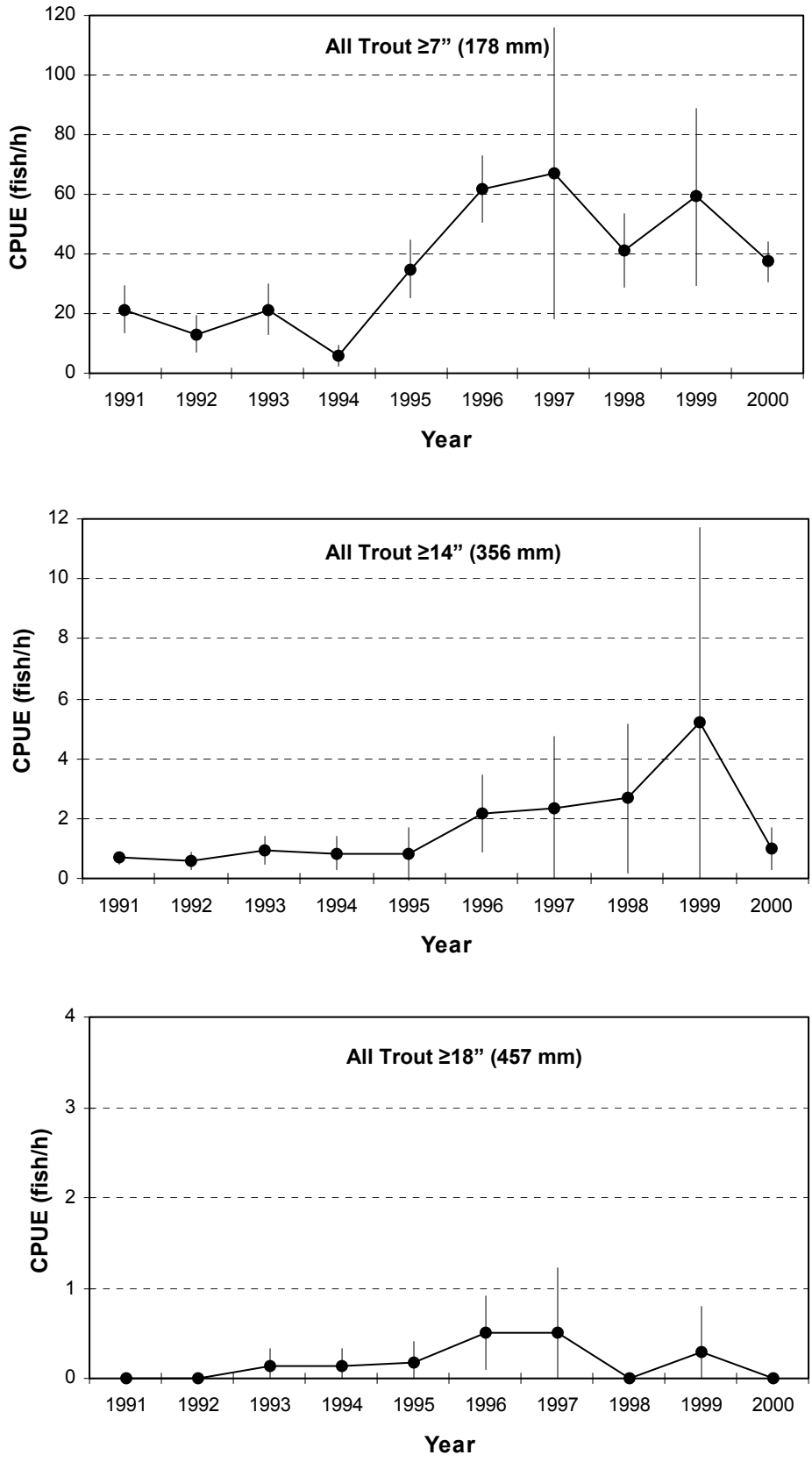

Figure 2. Mean catch rates (all trout) at the three original Wilbur tailwater monitoring stations (1991-2000). Bars indicate 90% confidence intervals.

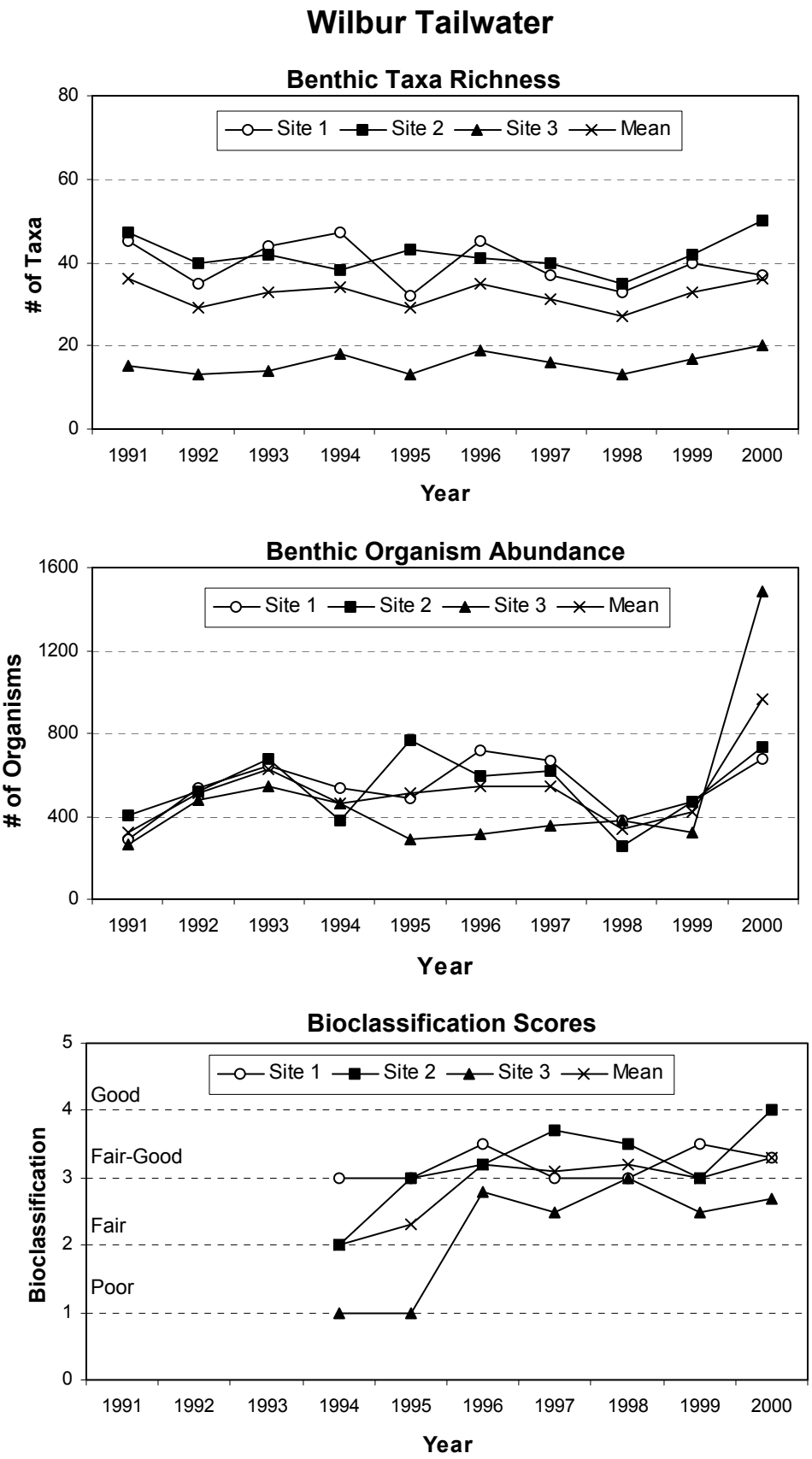

Figure 3. Benthic community characteristics for the three original Wilbur tailwater monitoring stations (1991-2000).

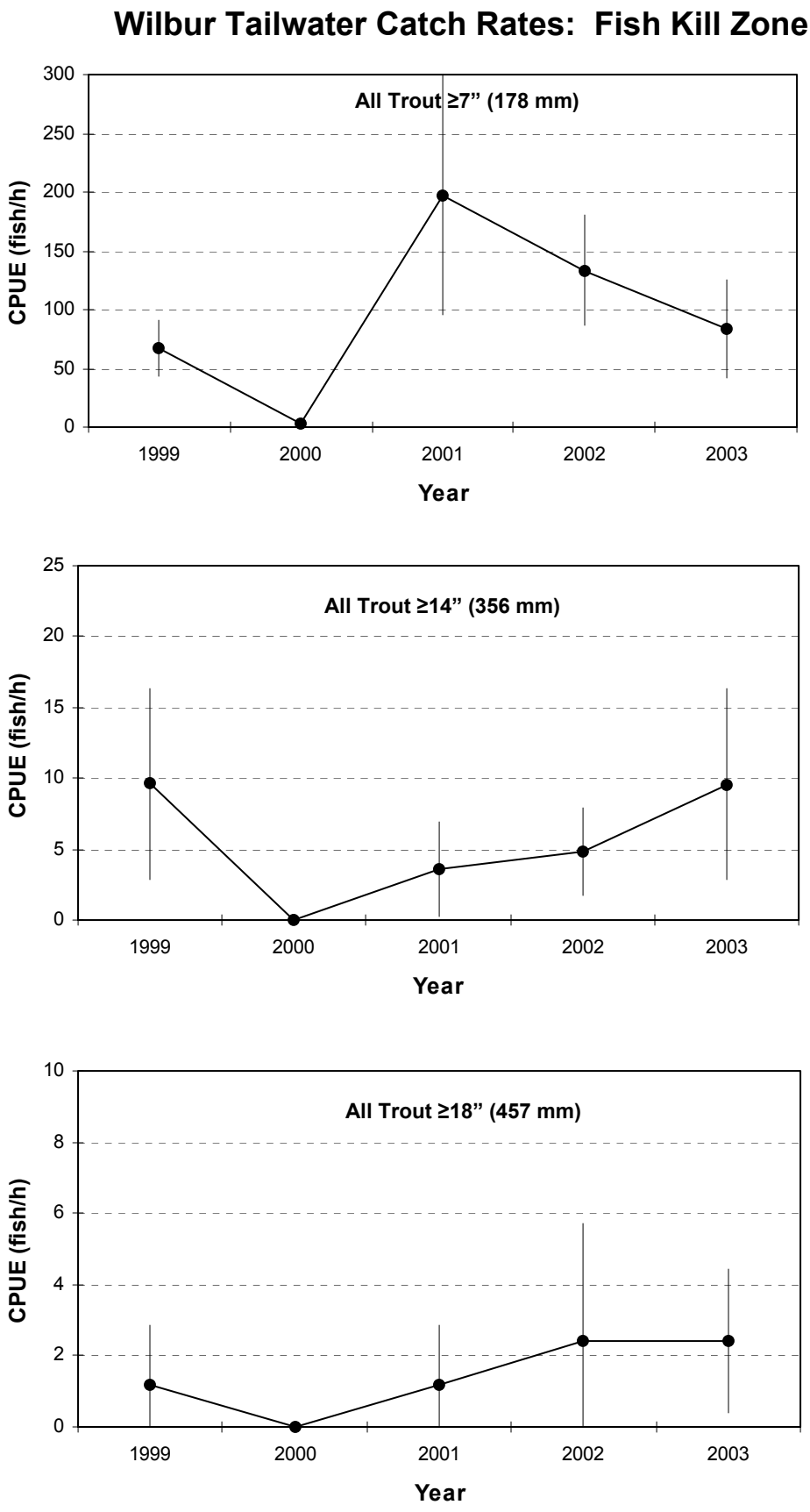

Figure 4. Catch rates (all trout) at the 5 monitoring stations in the fish kill zone on the Wilbur tailwater. Bars indicate 90% confidence intervals.

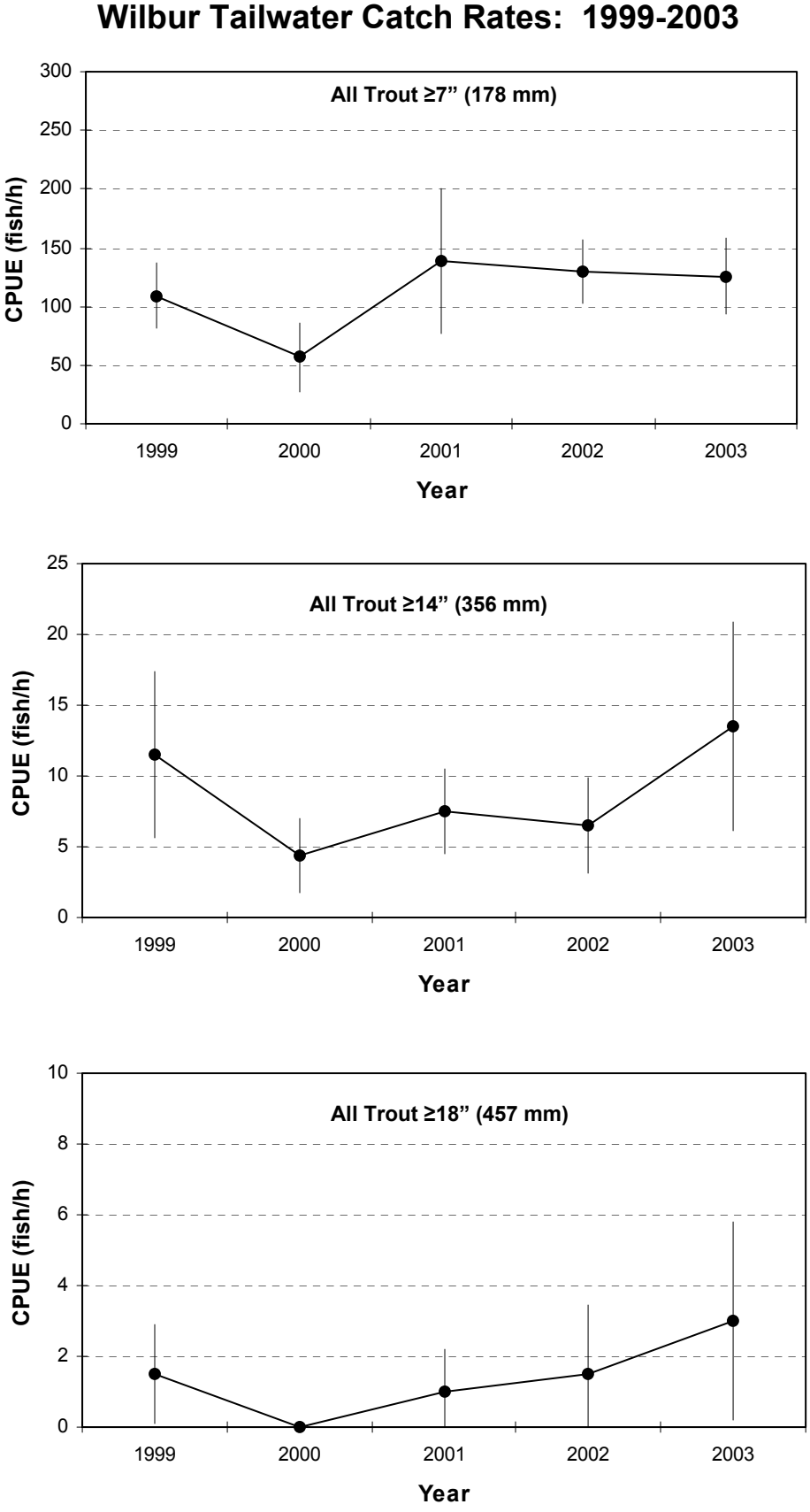

Figure 5. Catch rates (all trout) for the 12 Wilbur tailwater monitoring stations established in 1999. Bars indicate 90% confidence intervals.

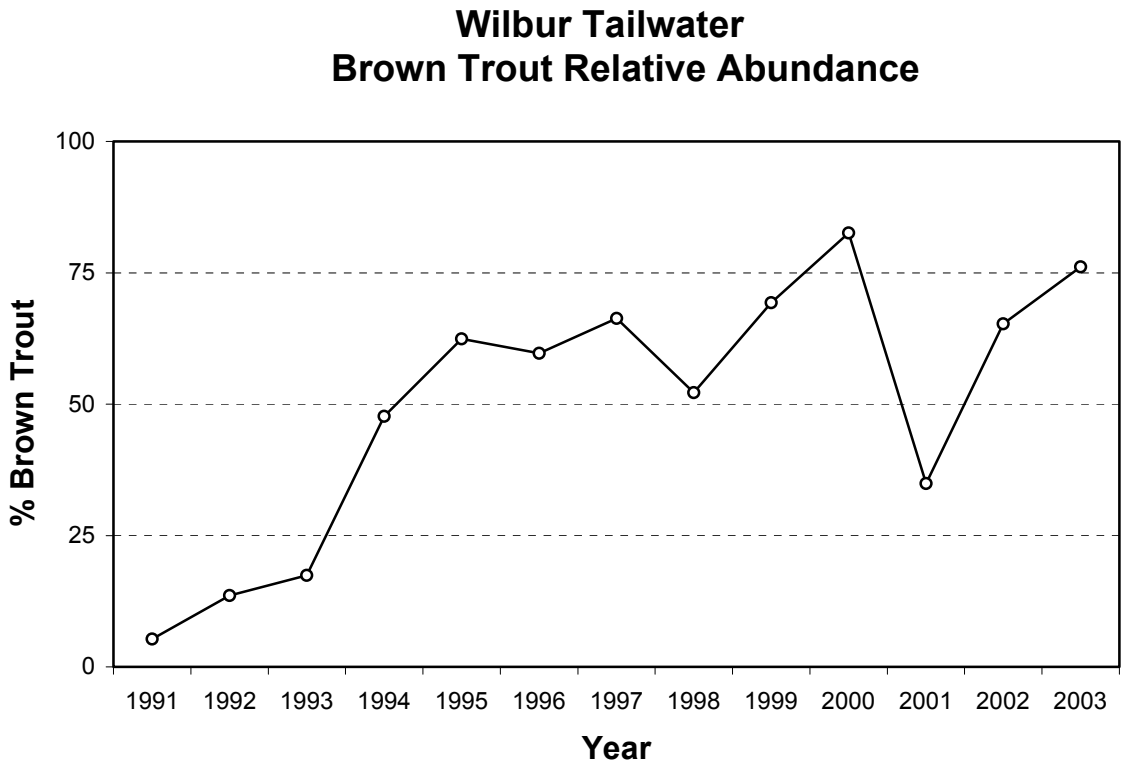

Figure 6. Brown trout relative abundances for all Wilbur tailwater samples since 1991. Relative abundances are based on fish ≥7 inches (178 mm). Data for 1991-1998 are from late July/early August; data after 1998 are from early March.

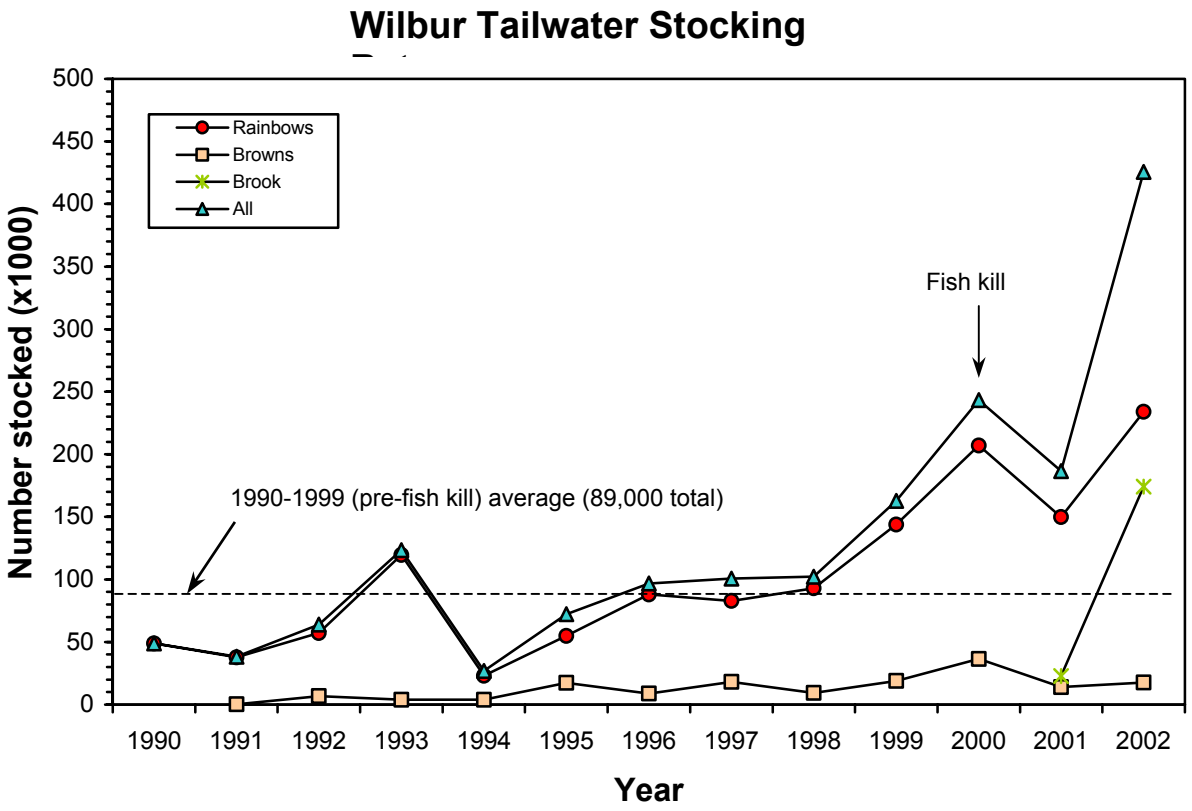

Figure 7. Recent trout stocking rates for the Wilbur tailwater. Most fish stocked were rainbow trout fingerlings (particularly post-fish kill. About 32,000 catchable rainbow trout were stocked annually during 1990-1999 (pre-fish kill) and about 52,000 have been stocked annually since.

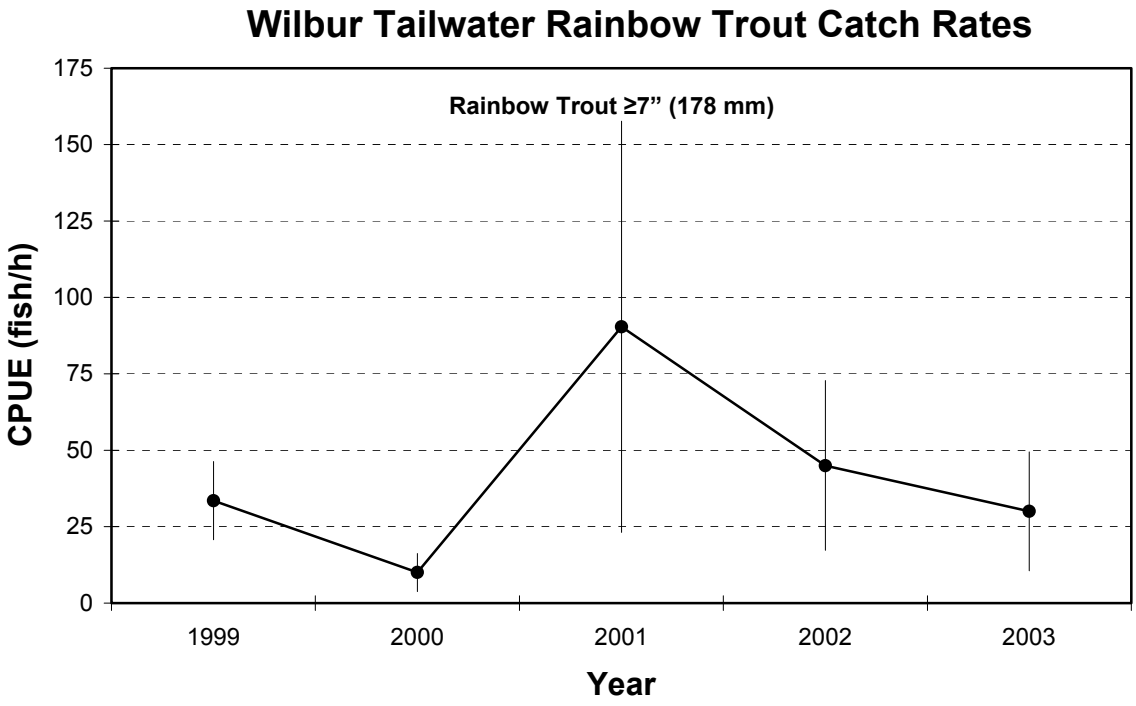

Figure 8. Rainbow trout catch rates for the Wilbur tailwater monitoring stations since 1999. Catch rates increased substantially in 2001 (following the increased stocking rate in 2000) but declined to the pre-fish kill level by 2003 even though the annual rainbow trout stocking rate has remained relatively high (192,000/year since 2000). Bars indicate 90% confidence intervals.