

**Management Plan for the  
Tims Ford Tailwater Trout Fishery  
(2017-2022)**



**Prepared by:**

James C. Pipas

Justin G. Spaulding

**Tennessee Wildlife Resources Agency**

**April 2017**



**Management Plan for the  
Tims Ford Tailwater Trout Fishery  
(2017-2022)**

Prepared by:

James C. Pipas and Justin G. Spaulding

November 2016

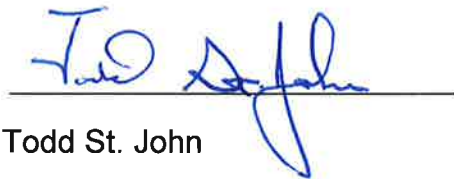
Approved by:



Bobby Wilson  
Assistant Director



Frank Fiss  
Chief of Fisheries



Todd St. John  
Region 2 Fisheries Manager



## **I. Introduction**

Over the past fifteen years, the Tennessee Wildlife Resources Agency (TWRA) has committed substantial resources to manage and evaluate the trout fishery below Tims Ford Dam. This trout fishery, which is comprised of Rainbow, Brook, and Brown trout, provides trout angling opportunities for southern middle Tennessee and northern Alabama trout anglers. This management plan will identify TWRA's goal, objectives, and management strategies for the trout fishery below Tims Ford Dam.

## **II. Goal**

TWRA seeks to enhance the quality of the trout fishery in the Tims Ford tailwater (Elk River) by increasing the abundance of larger Brown Trout *Salmo trutta* in the tailwater, and by providing "put-and-grow" and "put-and-take" fisheries for Rainbow Trout *Oncorhynchus mykiss* and Brook Trout *Salvelinus fontinalis*, respectively.

## **III. Objectives**

To attain the Tims Ford management goal, TWRA will continue yearly trout stockings at the following rates: Rainbow Trout (38,000 per year), Brown Trout (20,000 per year), and Brook Trout (3,000 per year). Maintaining these stocking rates for the duration of this management plan (2017 to 2022) will permit proper evaluation of the following management objectives:

- *Provide Rainbow Trout, Brook Trout, and Brown Trout fisheries capable of sustaining a minimum of 6,000 angler trips from March through October annually.*
- *As measured by yearly electrofishing surveys, maintain catch rates of Brown Trout (from the dam to Farris Creek Bridge) at a minimum of 30.0 fish per hour.*
- *Increase the abundance of memorable length Brown Trout (15.0 to 17.9 inches) by 2022. This objective will be fulfilled when electrofishing catch rates of memorable length Brown Trout exceed 5.0 fish per hour of sampling.*

- *Increase the abundance of Brown Trout  $\geq 20.0$  inches by 2022. This objective will be fulfilled when yearly electrofishing catch rates of Brown Trout  $\geq 20.0$  inches exceed 2.0 fish per hour per sampling event.*

With the recent enactment of a twenty inch minimum length limit and a reduction in the daily creel limit to one Brown Trout twenty inches or longer per day, changes in yearly Brown Trout electrofishing catch rates should occur. Additional anticipated results of the recently enacted minimum length limit include an initial increase in the abundance of memorable length Brown Trout, followed shortly thereafter by an increase in abundance of Brown Trout  $\geq 20.0$  inches. The anticipated results will be evaluated yearly by electrofishing surveys. Obtaining the stated catch rates for memorable length Brown Trout and Brown Trout  $\geq 20.0$  inches by the fifth year of the current management plan will indicate that the minimum length limit and reduced creel limit have been effective in obtaining the stated management goal and associated objectives.

#### **IV. Background**

From its headwaters on the Cumberland Plateau in Grundy County to its confluence with the Tennessee River in northern Alabama, the Elk River flows southwest for approximately 195 miles. The Elk River has two major impoundments along its length: Woods Reservoir (river mile 170.0) and Tims Ford Reservoir (river mile 133.3). Woods Reservoir was impounded in 1952 as a water supply for cooling operations at Arnold Airforce Base, and has relatively little effect on downstream aquatic populations. Tims Ford Dam (TFD) impounds 10,700 acres and was completed by the Tennessee Valley Authority (TVA) in 1970; TFD was designed for recreation, flood control, power generation, and water supply. Tims Ford Reservoir drains a watershed area of approximately 528.9 square miles. Hypolimnetic releases from Tims Ford Reservoir historically cooled the river for a distance of over forty miles. Native aquatic organisms less tolerant of cold water in the Elk River were adversely affected by altered temperatures and flow regimes. To mitigate for this loss, trout were stocked in the tailwater. However, water discharged through TFD in summer months was low in dissolved oxygen and prevented stocked trout from holding over. Additionally, low flows associated with hydropower regimes would dewater portions of the channel and exacerbated poor water quality conditions for trout and native organisms (TVA 2008).

Over the decades, TVA has made several efforts to improve water quality downstream of TFD. Tims Ford Dam was the first of TVA's dams to be retrofitted with a generator to provide minimum flow downstream in place of the original binary operation. In 1993,

TVA established a minimum flow requirement and installed blowers and oxygen injection systems into the hydropower units to maintain dissolved oxygen (DO) concentrations at 6.0 mg/l. However, a subsequent report still observed poor trout survival and condition (Bettoli and Bessler 1996). Additionally, the minimum flow turbine was damaged by a flood in 2004, and minimum flows had to be maintained by sluicing. Subsequently, in 2005, TVA installed a forebay aeration system to diffuse oxygen through several miles of line during critical parts of the year to satisfy state DO criterion and sustain a coldwater fishery. Most recently, in 2008, TVA modified its hydropower release to improve downstream habitat for the Boulder Darter *Etheostoma wapiti* and the Cracking Pearlymussel *Hemistena lata* (TVA 2008). Operations were modified to include a combination of sluicing, spilling, and power generation during spring and summer months. This change removed “peaking” hydropower releases and warmed temperatures to be more ecologically suitable for downstream imperiled species. Although the length of river suitable for year-round trout now ends at Beans Creek (river mile 119), stable flows have increased fishing opportunities for anglers (Bettoli 2001).

Protocols for annual sampling on the Elk River tailwater have varied over the years, but the current technique was finalized in 2005. Prior to 1995, the Elk River tailwater was managed as a “put-and-take” fishery, and formal sampling had not been conducted. Quantitative assessments of the trout stocking program began in 1995. Twelve electrofishing sites were sampled for fifteen minutes each by boat electrofishing. All sampling was conducted at night in either February or March. The total distance of Elk River traveled during the electrofishing survey was approximately thirty-six river miles. Protocols were adjusted in 2004-2005 into the current methods utilized today. Sampling switched to daytime electrofishing at five sites for fifteen minute intervals in 2004. In 2005, six sites were sampled at thirty minute intervals (Figure 1). Sampling period was established as the second week of March. During this sampling period, requested flows from TVA have ranged from 240 cfs to 280 cfs. In the past, sampling at flows greater than 300 cfs had resulted in numerous trout that were not able to be netted. The final protocol focused sampling on the upper eleven miles, where creel surveys had indicated a majority of fishing pressure and access occurred. Changes to TFD operations in 2008

did not negatively affect sampling design. Updated protocols focus effort on sites that best represent the distribution of suitable trout habitat. Lastly, it is important to consider that the differences in sampling protocols between earlier (before 2005) and standardized data are so stark that comparisons would be uninformative.

Rainbow and Brown trout were initially stocked into the TFD tailwater in 1970. Based on TVA release operations, the tailwater fishery can be characterized by three historical phases. From 1970 to 1987, poor water quality and unstable flows resulted in a

seasonal “put-and-take” fishery. In 1987, the retrofitting of an aerator to a small turbine improved water quality, but only a few holdover Brown Trout were detected in annual samples. Finally, the modified operations (initiated in 2008) improved the trout fishery to a “put-grow-and-take” fishery. Since 2008, holdover Brown Trout have been increasing in abundance and holdover Rainbow Trout have remained uncommon. Natural trout reproduction has not been documented, and the Tims Ford tailwater is maintained entirely through stocking. Brook Trout stocking began in 2012 to create additional “put-and-take” fishing opportunities for anglers. However, stocking frequency has varied depending on production at Dale Hollow National Fish Hatchery (DHNFH).

The first recreational creel survey of the Tims Ford tailwater was conducted from 1986-1988; additional creel surveys were conducted in 1995, 2000, and 2013. Of all of the Tennessee tailwaters that have been surveyed, Tims Ford tailwater historically received the lowest amount of fishing pressure (Bettoli 2001). However, angler catch rates on the Tims Ford tailwater have always been classified as “good” to “excellent”; the aforementioned classification is based on a national metric that indicates that catch rates of over 0.7 fish / hour are desirable (McMichael and Kaya 1991). Calculated angler catch rates from the 1987 and the 1995 creel surveys averaged 0.9 fish / hour, while angler catch rates in 2000 and 2013 were 2.64 fish / hour and 1.82 fish / hour, respectively. The 2013 creel survey indicated a drastic increase in fishing pressure and a large increase in the number of recreational boaters. Stabilized dam releases for “sensitive” species have improved fishing conditions, and have made recreational boating on Tims Ford tailwater safer and easier. Even with increased fishing pressure, the documented angling effort on Tims Ford tailwater is less than the neighboring “put-and-take” Normandy tailwater, and still pales in comparison to Tennessee’s traditionally most heavily fished tailwater, the South Holston tailwater (Bettoli 2001).

As a result of historically poor trout survival (Bettoli 1989; Bettoli and Besler 1996), Tims Ford tailwater had been managed as a “put-and-take” fishery under the statewide regulation of no minimum length limit and a seven trout (in combination) creel per day. Annual stocking rates were reduced in 1999 to improve growth, survival, and return rate of stocked fish. Subsequent yearly monitoring detected an increase in overwintering of both Brown and Rainbow trout (Cleveland et al. 1999, 2000). After several years of continued improvement, stocking rates were again lowered in 2006 to enhance the Brown Trout fishery and fingerling stockings were abandoned. In 2016, a 20-inch minimum length limit for Brown Trout with a daily creel of one fish per day for Brown Trout was enacted to enable increased numbers of fish to recruit to the trophy length category.

## V. Current Status

### Trout Abundance

The relative abundance of Rainbow Trout  $\geq 7.0$  inches (the length fully recruited to the sampling gear) has displayed minimal variation since 2008 (the year in which TVA initiated changes to water releases from Tims Ford Reservoir). In 2008, the mean relative abundance of Rainbow Trout was approximately 38.7 fish / hour; in 2016, the relative abundance of Rainbow Trout was slightly above 41.0 fish / hour. The low variation in relative abundance was the result of consistency in stocking time and stocking numbers (year to year). The two years (2009 and 2015) in which Rainbow Trout relative abundance was elevated ( $> 50.0$  fish / hour), additional Rainbow Trout stockings had occurred the year prior to the documented elevated relative abundance. In November of 2008, surplus Rainbow Trout (4,906) from Flintville hatchery were stocked in the Elk River tailwater. Additionally, 1,501 Rainbow Trout were stocked in the Elk River tailwater in December of 2014. However, the relative abundance of larger Rainbow Trout ( $\geq 12.0$  inches) has remained cyclic since 2008. Within this time period, the mean relative abundance of Rainbow Trout  $\geq 12.0$  inches has cycled from a low of 0.3 fish / hour (2010) to greater than 16.0 fish / hour (2011). This cycle repeats approximately every three to seven years, and is expected to continue in the future (Figure 2). The reason for this cycle has yet to be determined.

The mean relative abundance of Brown Trout  $\geq 7.0$  inches has displayed moderate variation since 2008. In 2008, the mean relative abundance of Brown Trout was 26.3 fish / hour; in 2016, the relative abundance of Brown Trout was 35.7 fish / hour. From 2008 to 2010, variation in mean relative abundance was much higher, with mean relative abundance estimates ranging from 24.7 fish / hour (2010) to 59.7 fish / hour (2009). During this period of time, the high variation in relative abundance was the result of inconsistent stocking times and locations. Additionally, in 2009, a surplus stocking of Brown Trout (N=12,800) occurred. This surplus stocking increased the total relative abundance of Brown Trout. Over the past nine years, the total mean relative abundance value of Brown Trout (2009) was the highest documented, and exceeded the second highest relative abundance value of Brown Trout (2016) by approximately 40.2 %. From 2011 to 2013, the mean relative abundance of Brown Trout declined for three consecutive years from a high of 29.0 fish / hour to a low of 16.7 fish / hour. However, over the last two years (2015 and 2016), the mean relative abundance of Brown Trout has increased by 6.0 fish / hour. Since 2005 when stocking locations, numbers, and stocking times were standardized, the variation in Brown Trout mean relative abundance has been reduced to a "low" level. The mean relative abundance of Brown Trout  $\geq 14.0$  inches has fluctuated moderately since 2008. Within this time period, the mean relative abundance of Brown Trout  $\geq 14.0$  inches ranged from a high

of 10.0 fish / hour in 2011 to a low of 2.0 fish / hour in 2015. For Brown Trout  $\geq 20.0$  inches, the yearly mean relative abundance values have displayed minimal variation. Yearly values ranged from a low of 0.7 fish / hour (2015) to a high of 3.0 fish / hour in 2013. Over the last two years, the yearly mean relative abundance value of Brown Trout ( $\geq 20.0$  inches) has more than doubled, yet remained at a low level (1.7 fish / hour) (Figure 3).

Brook Trout total mean relative abundance has been very low since the inception of the stocking program in 2012. Over the last five years, a total of 22,159 Brook Trout have been stocked into the Tims Ford tailwater at two locations per stocking event. With the moderate number of Brook Trout stocked over the past five years, holdover Brook Trout were only detected in 2014 and 2015. Brook Trout yearly total mean relative abundance values were 0.3 fish / hour (2014) and 0.9 fish / hour (2015). Both of these values were rated as low. Possible explanations for the lack of Brook Trout longevity in the Tims Ford tailwater include high angler exploitation in combination with stocking locations (bias toward dam), emigration up tributaries, unfavorable habitat and water temperatures, and lack of flows during the summer months.

### Stocking

The Tims Ford tailwater regularly receives stockings of Rainbow Trout, Brown Trout, and when available, Brook Trout. The earliest documented stocking records (by species) date back to 1990. From 1990 to 2005, trout stockings were comprised of catchable (9.0 – 12.0 inches) and fingerling ( $\leq 3.0$  inches) Rainbow Trout and Brown Trout. The total number of catchable Rainbow Trout stocked per year during this time period ranged from a low of 12,558 to a high of 52,559. In five of the fifteen years, stocking numbers of catchable Rainbow Trout exceeded 45,000 per year; furthermore, in three of the fifteen years, stocking numbers of catchable Rainbow Trout exceeded 50,000 per year (Figure 4). During this time period, yearly fingerling Rainbow Trout stockings also occurred. Yearly fingerling Rainbow Trout stockings ranged from a low of 30,000 per year to a high of 51,099 per year (Figure 5). The total number of catchable Brown Trout (6.0 – 8.0 inches) stocked per year during this time period ranged from a low of 10,002 to a high of 38,939. In two of the fifteen years, stocking numbers of catchable Brown Trout exceed 20,000 per year. But, in only one of the fifteen years did stocking numbers of catchable Brown Trout exceeded 30,000 per year (Figure 4). Fingerling Brown Trout stockings were limited to one stocking in 1996, three consecutive yearly stockings from 2002 to 2004, and one 2014 stocking (which was the result of surplus Brown Trout at DHNFH). Yearly fingerling Brown Trout stockings ranged from a low of 5,004 per year to a high of 13,436 per year (Figure 5).



With the standardization of yearly electrofishing surveys in 2005, subsequently collected yearly electrofishing data indicated the absence of recruitment of stocked fingerling Rainbow Trout and Brown Trout to the fishery. As a result, fingerling trout stockings have been eliminated. Based on the results of the 1995 creel survey (Bettoli and Besler, 1996), and annual electrofishing data, the yearly total number of stocked catchable trout has been reduced. Currently, the total number of stocked catchable trout is approximately 58,000 per year. Of the 58,000 trout per year, 20,000 are Brown Trout (stocked in April and May of each year) and 38,000 are Rainbow Trout (stocked March through December of each year). Prior to the reduction in the number of stocked catchable trout, the yearly stocking rate of catchable trout in Tims Ford tailwater was 7.4 % to 14.7 % higher than the current rate (Figure 4). To increase angler satisfaction, catchable Brook Trout stockings were initiated in Tims Ford tailwater in 2012. The initial stocking rate was 11,119; this rate was higher than requested as a result of Rainbow Trout production issues. Since angler feed-back was positive in regards to the initial Brook Trout stocking, yearly Brook Trout stockings will continue to be requested. The requested yearly Brook Trout stocking rate will remain at 3,000 per year.

### Angler Use

Over the past thirty years, four creel surveys have been conducted on the tailwater below TFD. The initial creel survey, which was conducted during an eight month period (March through October) of 1986, was conducted by Tennessee Technological University personnel (Bettoli 1989). In 1986, catchable Rainbow Trout were stocked from below the dam to Dickey Bridge. As a result, the creel survey conducted in 1986 encompassed a much longer reach of the Elk River (27.8 miles) than is currently recognized as "managed" trout water. Based on the results of the 1986 creel survey, annual total fishing effort was 25,000 hours. During this period, anglers were targeting 40,000 catchable Rainbow Trout and 31,000 fingerling Rainbow Trout (stocked annually). But, over the next fourteen years, operational and structural changes to TFD affected the quality and volume of water released into the tailwater. As a result of the changes, the length of the tailwater decreased by over 50% from the resultant increase in water temperatures. Therefore, the discussion of angler use of the Tims Ford tailwater will be limited to the last three creel surveys conducted in 1995, 2000, and 2013 (Table 1).

The 1995 and 2000 creel surveys were, like the initial survey, conducted by Tennessee Technological University personnel (graduate students in both cases). The last creel survey (2013) was conducted by TWRA personnel, with final analysis of creel data completed by TWRA's statistician. Since the last three creel surveys were established as roving creel surveys encompassing the identical eight month time period (April to

October), and the same three access areas, creel results were comparable for the three separate creel data sets. Creel results from 1995 indicated that total fishing effort was low at 14,340 hours. Estimated catch of Rainbow Trout was 12,802, and estimated catch of Brown Trout was 12,668. Estimated harvest of Rainbow Trout was 5,211 and estimated harvest of Brown Trout was 2,058. Furthermore, the harvest rate of trout was determined to be approximately 40.7 % for Rainbow trout and 16.2 % for Brown trout. These values were rated as moderate and low, respectively. Additionally, the catch rate per hour for Rainbow Trout was 0.78 fish / hour, and was 0.52 fish / hour for Brown Trout. The total catch rate (all trout) was 1.27 fish / hour. Lastly, angler data collected during the 1995 creel survey indicated the percent of non-local residents to be approximately 62.0 %. The primary angling method was spin fishing (54%) followed by still fishing (with bait; 21 %) and fly-fishing (25 %). Of all of the tailwaters on which creel data was collected in 1995 (N=4), only the Tims Ford tailwater had a higher percentage of anglers fly-fishing than still fishing (16.0 %; Bettoli and Besler 1996).

Results of the 2000 creel survey indicated numerous changes had occurred to the Tims Ford trout fishery. Estimated total fishing effort decreased by 38.6 %; estimated catch of Rainbow Trout increased minimally by 1.5 %, and estimated catch of Brown Trout decreased by 58.6 %. However, harvest rates of both Rainbow and Brown trout declined by 50.8 % and 65.9 % respectively. The decline in the harvest rates of Rainbow and Brown trout was not unexpected, but the extent of the decreases in harvest rates was unexpected. Total catch rate (all trout) increased in 2000 by 1.33 fish / hour. The Tims Ford tailwater total catch rate (all trout) was very high, and was one of the highest catch rates documented in statewide tailwater creel surveys conducted in 2000. Again, angler data indicated the percent of non-local residents to be “elevated” at approximately 50.0 %. The methods of fishing employed by anglers (fly-fishing and still fishing) did not change, but the number of anglers employing each method did change. Surprisingly, the number of anglers fly-fishing (artificial lures or flies) increased by 50.0 % (N = 65.0 %) since the previous creel survey. Anglers that preferred to “still fish” decreased by 66.7 % (N = 7.0 %) since the previous creel survey (Bettoli 2001).

The last creel survey of the Tims Ford tailwater (2013) occurred during the same eight month period (April to October) as the two previous creel surveys. The 2013 creel survey methodology was not able to determine if trailers and vehicles were associated with fishing activities. Stable summer flows have led to an increase in non-fishing activities on the Elk River. An adjusted instantaneous count would likely overestimate fishing pressure (36,420 hours), while the unadjusted count would likely underestimate actual pressure. Regardless, the 2013 creel survey (using unadjusted instantaneous counts) documented a marked increase in total fishing pressure. In 2013, total fishing pressure increased by 63.4 % to 21,444 hours (Table 1). This value was the highest value documented, and indicated that trout angling opportunities had improved since

TVA's operational changes of TFD were initiated in 2008. Harvest rates of Rainbow and Brown trout remained low; the harvest rate of Rainbow Trout increased by 29.3%, and the harvest rate of Brown Trout decreased by 34.7 % since the 2000 creel survey. The harvest rate of Brook Trout, initially "split-stocked" (two locations) in 2012, was 5.9 %. Catch rates of Rainbow and Brown trout have approximately doubled since the previous creel. Total catch rate (all trout) remained fairly uniform at 1.82 fish / hour. Additionally, angler data indicated the percent of non-local residents fishing Tims Ford tailwater had increased "slightly" to 57.0 %. Of all of the anglers fishing the tailwater, approximately 43.0 % had incomes of \$70,000 or greater; furthermore, 58.0 % of all tailwater anglers had incomes of \$50,000 or greater. When asked about a size limit regulation for Brown Trout, 79.0 % of all surveyed

anglers (N=479) "supported" or "strongly supported" a minimum length limit and less than 1.0 % were "opposed" or "strongly opposed" to a minimum length limit. Ten percent were neutral, and the remaining 10.0 % had no opinion concerning the minimum length limit (Pipas 2014).

## **V. Management Recommendations**

Since TVA's operational changes went into effect in 2008, improvement in the trout fishery below TFD has been noted. Although the operational changes have decreased the amount of managed trout water, the trout fishery has improved. For Brown Trout, maximum length of collected "trophy" Brown Trout continues to increase. However, the Rainbow Trout population has displayed year-to-year consistency; size structure and holdover rate have remained relatively unchanged. Numerous management recommendations proposed by Bettoli (2001) have already been enacted; only one trout stocking (December) occurs at Old Dam Ford. The total number of stocked trout per year has been reduced, and additional access areas continue to be pursued. Based on the recently enacted management changes and the results of the last angler creel survey (2013), the following actions are recommended (from 2017 to 2022) to realize the management goal and objectives of this management plan.

**Objective 1:** *Provide Rainbow Trout, Brook Trout, and Brown Trout fisheries capable of sustaining a minimum of 6,000 angler trips from March through October annually.*

To provide opportunities for anglers to better utilize the tailwater trout fishery below TFD, river access areas need to be maintained, and when possible, enhanced. In 2015, the parking lot and ramp area were graveled at the Farris Creek access area. Additionally, TVA completed extensive work on the parking area and ramp at the Old

Dam Ford access area. Work included enlarging and graveling the parking area, rip-rap placement immediately upstream of the ramp area, and grading and graveling of the ramp. With the completion of the highway 50 bridge work in 2013, an additional ten parking spaces were created underneath of highway 50 bridge. With the creation of the additional parking spaces, angler access has been much improved. Prior to the creation of the ten parking spaces, anglers often had to park on a large shoal downstream of the ramp on the left bank descending of the Elk River. An additional benefit of the newly created parking spaces has been the increased ability to back a boat trailer down the ramp as a result of a large "turn around area" at the entrance of the parking area under the highway 50 bridge.

Prior to 2016, an undeveloped access area (located approximately 4.5 miles downstream of the highway 50 bridge access) was available for use by both "wade" and "float" anglers. This access, owned by a private landowner, enabled anglers to fish in an area with a high abundance of Brown Trout. Furthermore, "float" anglers were able to either "put-in" or "take out" at this access; by so doing, float trips to this access area or originating at this access area and ending at the Farris Creek access area were limited in distance to under five miles. But, with the passing of the private landowner in the fall of 2015, the property was sold. One of the first actions undertaken by the new landowner was the closing of the access area so that additional crops could be planted. In spite of a meeting with TWRA personnel, the current land owner remains insistent that the property will remain closed to both anglers and recreational boaters. Prior to the loss of this access area, another access area was present approximately 2.2 miles upstream. The upstream access area was sold to B & W Quality Growers, Inc. approximately twelve years ago, and after developing the area for the commercial production of watercress, the owners posted the property. They were also approached by TWRA personnel to see if anglers could still access the river from their property, but the owners declined all offers presented by TWRA. Therefore, with the loss of both of these "mid-reach" access areas and the objective of increasing the number of angler trips (> 6,000 from March to October annually), acquiring another access area in this reach of the tailwater is critical. Currently, TWRA and TVA are working together to acquire property in this area that could be developed for anglers and recreational boaters. Until property is procured and developed, meeting objective one will be difficult.

Finally, stocking rates of Rainbow Trout, Brook Trout, and Brown Trout will remain consistent for the next two years until additional creel data (collected during a 2018 creel survey) are collected. Based on the previous three years of electrofishing data and the 2013 creel data, current stocking rates (all species) provided an elevated abundance of trout that should increase anglers' use of Tims Ford tailwater.

**Objective 2:** *As measured by yearly electrofishing surveys, maintain catch rates of Brown Trout (from the dam to Farris Creek Bridge) at a minimum of 30.0 fish per hour.*

Since the initiation of electrofishing surveys in 1996, numerous changes to electrofishing protocols have occurred. Initial electrofishing surveys were conducted at night, with sampling effort per site set at fifteen minutes. Furthermore, additional sites were present below Farris Creek Bridge; the last electrofishing site was located just above Old Dam Ford access area. Initial electrofishing surveys were conducted to gather preliminary trout data on the Elk River tailwater. After numerous years of refinement, locations of electrofishing sites, numbers of electrofishing sites (N=6), duration of electrofishing samples, and time period of electrofishing samples (March, daytime) were standardized in 2005 to ensure that yearly electrofishing data sets are comparable.

In addition to the improvements in sampling methodology, enhanced Brown Trout stocking was initiated in 2008. Rather than simply stocking “stock length” Brown Trout (6.0 - 8.9 inches) at the primary access area below Tims Ford Dam, three stocking locations were established “mid-reach” of the Elk River tailwater in areas of “above average” trout habitat. Consequently, since 2008, yearly Brown Trout stockings have occurred at the three established stocking locations. From 2008 to 2013, the number of “stock length” Brown Trout stocked per year varied moderately; however, over the past three years, yearly stocking numbers have varied only minimally from a low of 19,999 (2014) to a high of 20,008 (2016). For the remainder of the management plan, the number of stocked Brown Trout will remain at 20,000 per year to allow for complete assessment of the Brown Trout population.

From 2005 to 2009, mean catch rates of Brown Trout were highly variable. Likely contributing factors included variation in stocking rates (2005 to 2008), and TVA’s tailwater operations prior to 2008. In 2008, TVA initiated an operational release schedule that more closely mimicked the natural flow regime of the Elk River. Variation in mean catch rates of Brown Trout (post-operational change, 2010 to 2013) was moderate, with yearly mean catch rates only exceeding 30.0 fish / hour once (2010). However, over the past three years, yearly mean catch rates of Brown Trout have exceeded 30.0 fish / hour twice (2014 and 2016) (Table 2). With the recently enacted minimum length limit and standard stocking numbers, dates, and locations, obtaining yearly mean catch rates above 30.0 fish / hour will occur by the end of the current management plan.

**Objective 3:** *Increase the abundance of memorable length Brown Trout (15.0 to 17.9 inches) by 2022. This objective will be fulfilled when electrofishing catch rates of memorable length Brown Trout exceed 5.0 fish / hour per sampling event.*

With the enactment of the 20.0 inch MLL and reduction in the daily creel limit of Brown Trout to one over 20.0 inches, the mortality rate of Brown Trout through angler harvest should decline. As a result, the total number of Brown Trout in the population is anticipated to increase over the next five years. The primary factors contributing to an increase in memorable length Brown Trout abundance include consistent recruitment of stocked Brown Trout (20,000 / year stocked “mid-reach” of the Elk River tailwater), and the elimination of harvest pressure on memorable length Brown Trout (as a result of the recently enacted 20.0 inch minimum length limit regulation). With consistent yearly stocking rates, stocking locations, and a reduction in mortality, objective three should be attained by the end of the current management plan.

To evaluate whether objective three has been attained, yearly standardized electrofishing sampling will continue to be conducted during the second week of March. Since TVA changed their water release schedule for Tims Ford Dam to mimic a natural riverine flow regime in 2008, annual electrofishing data has indicated an increase in Brown Trout longer than 12.0 inches. However, calculated relative abundance values of memorable length Brown Trout over the past nine years have not displayed a pattern of increasing or decreasing. Rather, moderate variability persists from year to year. Since 2008, mean relative abundance values of memorable length Brown Trout have ranged from a high of 4.7 fish / hour (2011) to a low of 0.7 fish / hour (2015; Table 2). To fully meet objective three, yearly relative abundance values for memorable length Brown Trout must continually equal or exceed 5.0 fish / hour. With a decrease in angler induced mortality through a reduced creel limit, consistent stocking locations “mid-reach” of the Elk River tailwater, and the recently enacted MLL, obtaining yearly mean relative abundance values equal to or exceeding 5.0 fish / hour will be obtainable by the end of the current management plan.

***Objective 4:*** Increase the abundance of Brown Trout  $\geq 20.0$  inches by 2022. This objective will be fulfilled when yearly electrofishing catch rates of Brown Trout  $\geq 20.0$  inches exceed 2.0 fish per hour for each electrofishing event.

Attaining objective four will be dependent on the successful attainment of objective three. If objective three is attained, and recruitment from the memorable length category to the trophy length category displays “year-to-year” consistency, objective four should be reached by 2022. Factors leading to the successful attainment of objective four include above average relative weights of “holdover” Brown Trout ( $> 10.0$  inches) and consistent yearly stockings (numbers, locations, and time of year). Factors that potentially could preclude the successful attainment of objective four include the continued “bottle-neck” in recruitment of Brown Trout within the 16.0 – 19.0 inch length range, and low adherence to the recently enacted MLL.

If the recently enacted MLL is capable of increasing the abundance of Brown Trout  $\geq$  20.0 inches in Tims Ford tailwater, it will be documented by higher catch rates near the end of this management plan (2022). Electrofishing data since 2008 (the year in which TVA changed their water release schedule for TFD to mimic a natural riverine flow regime) indicated that a mean catch rate of 3.0 fish ( $\geq$  20.0 inches) per hour was possible in the absence of the MLL. However, mean catch rates of Brown Trout  $\geq$  20.0 inches has varied from a low of 0.7 fish / hour (2015) to a high of 2.7 fish / hour (2013). Over the nine year period, mean catch rates of Brown Trout  $\geq$  20.0 inches exceeded 2.0 fish / hour in four of the nine years (2009, 2010, 2011, and 2013). However, the three years prior to the adoption of the new water release schedule by TVA, the mean catch rate of trophy length Brown Trout never exceeded 1.0 fish / hour. Therefore, the documented increase in abundance of trophy length Brown Trout since 2008 may have been the result of the improved water release schedule in combination with standardizing the stocking locations, stocking times, and stocking numbers of Brown Trout.

In addition to an increase in abundance of trophy length Brown Trout near the end of this management plan (2022), a lower rate of variability in catch rate (abundance) of trophy length Brown Trout should be evident by the last year of the management plan. If the MLL is effective, increases in abundance of memorable and trophy length Brown Trout will coincide with decreasing variability in abundance for both length categories. When this occurs, consistent catch rates (memorable and trophy length Brown Trout) equal to, or exceeding, 2.0 fish / hour should become a yearly event. By the end of this management plan, if objectives three and four are not obtained, the MLL will be reevaluated and adjusted (if necessary) based on data collection from 2016 to 2022.

### *Management Plan Evaluation*

Sampling of the six Tims Ford tailwater sampling sites will continue annually for the next six years (2017-2022). This annual data, in addition to the scheduled 2018 creel survey data, will assist in determining if progress is being made toward the attainment of the four management objectives. Once the 2022 electrofishing samples are completed, a final assessment of management objective accomplishments will be conducted, and if required, will be adjusted to meet the management goal for Tims Ford tailwater.

## **VI. References**

- Bettoli, P. W. 1989. Survey of the recreational fisheries in the Caney Fork, Elk, and Hiwassee Rivers. Final Report. Tennessee Wildlife Resources Agency, Nashville, Tennessee.
- Bettoli, P. W., and D. A. Bessler. 1996. An investigation of the trout fishery in the Elk River below Tims Ford Dam. Fisheries Report No. 96-22. Tennessee Wildlife Resources Agency, Nashville, Tennessee.
- Bettoli, P. W. 2001. Elk River creel survey results: April-October 2000. Unpublished report submitted to Tennessee Wildlife Resources Agency.
- Cleveland, T., J. Prestwich, and J. Pipas. 1999. Trout fisheries—Region II 1998. Fisheries Report No. 99-14, Tennessee Wildlife Resources Agency, Nashville, Tennessee.
- Cleveland, T., J. Prestwich, and J. Pipas. 2000. Trout fisheries—Region II 1999. Fisheries Report No. 00-18, Tennessee Wildlife Resources Agency, Nashville, Tennessee.
- McMichael, G. A., and C. M. Kaya. 1991. Relations among stream temperature, angling success for rainbow trout and brown trout, and fisherman satisfaction. *North American Journal of Fisheries Management* 11: 190-199.
- Pipas, J. C. 2014. Elk River tailwater creel survey results: March-October 2013. Unpublished report. Tennessee Wildlife Resources Agency.
- Tennessee Valley Authority. 2008. Tims Ford Dam release water quality improvements. Project Number 2007-44. Franklin County, Tennessee.



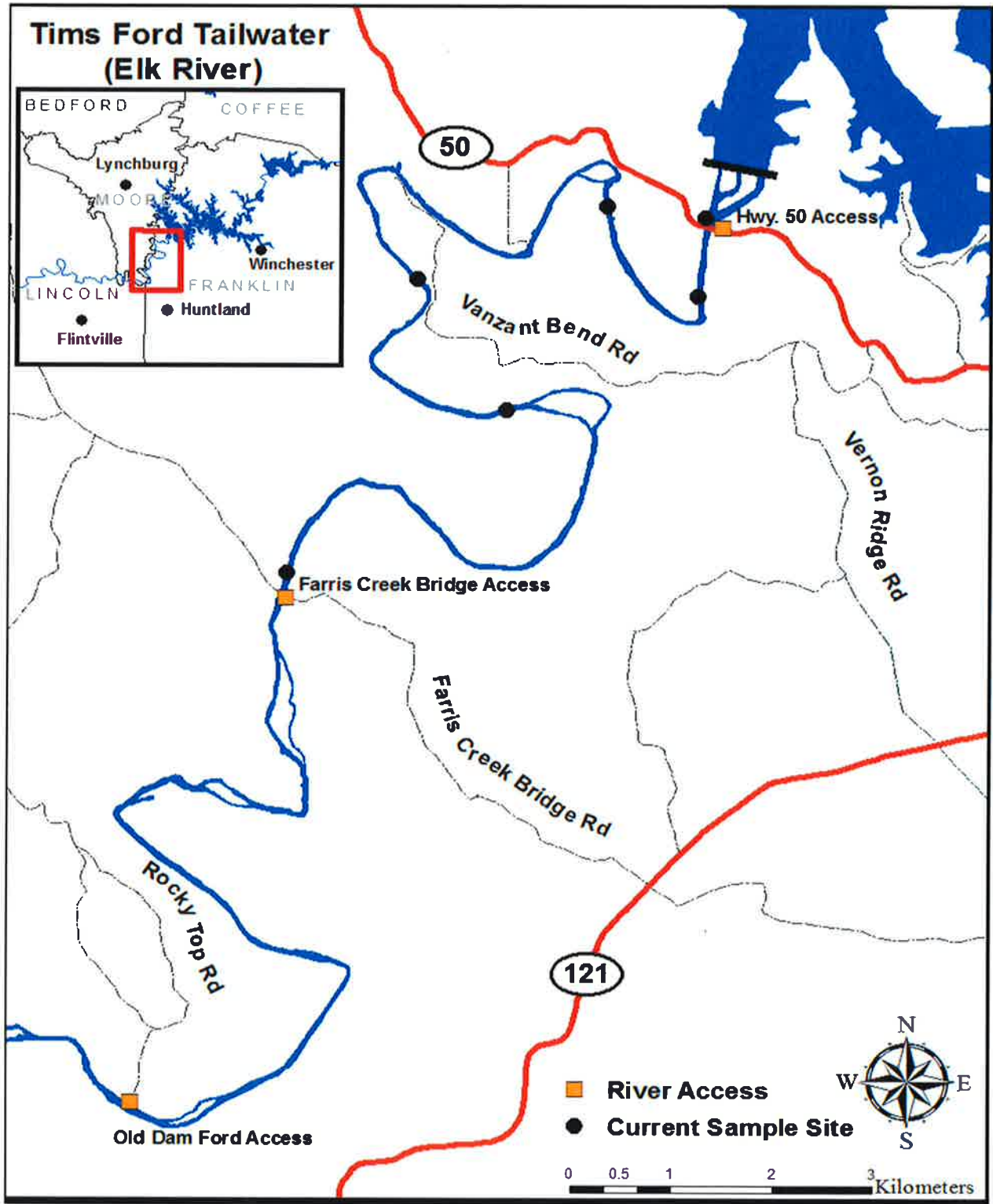


Figure 1.- Locations of Tims Ford tailwater electrofishing sites (N=6).

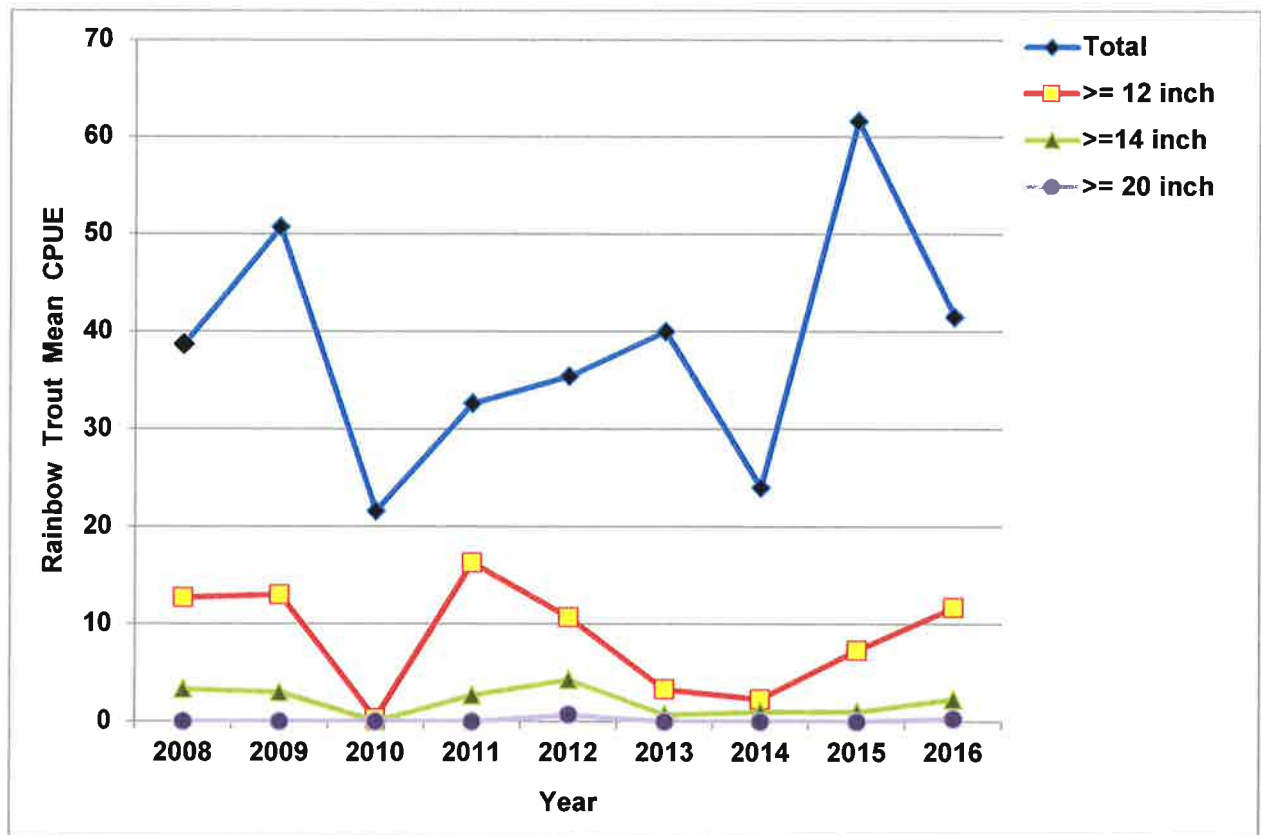


Figure 2.- Mean catch rates of Tims Ford tailwater Rainbow Trout by minimum length groups and by total number (2008-2016).

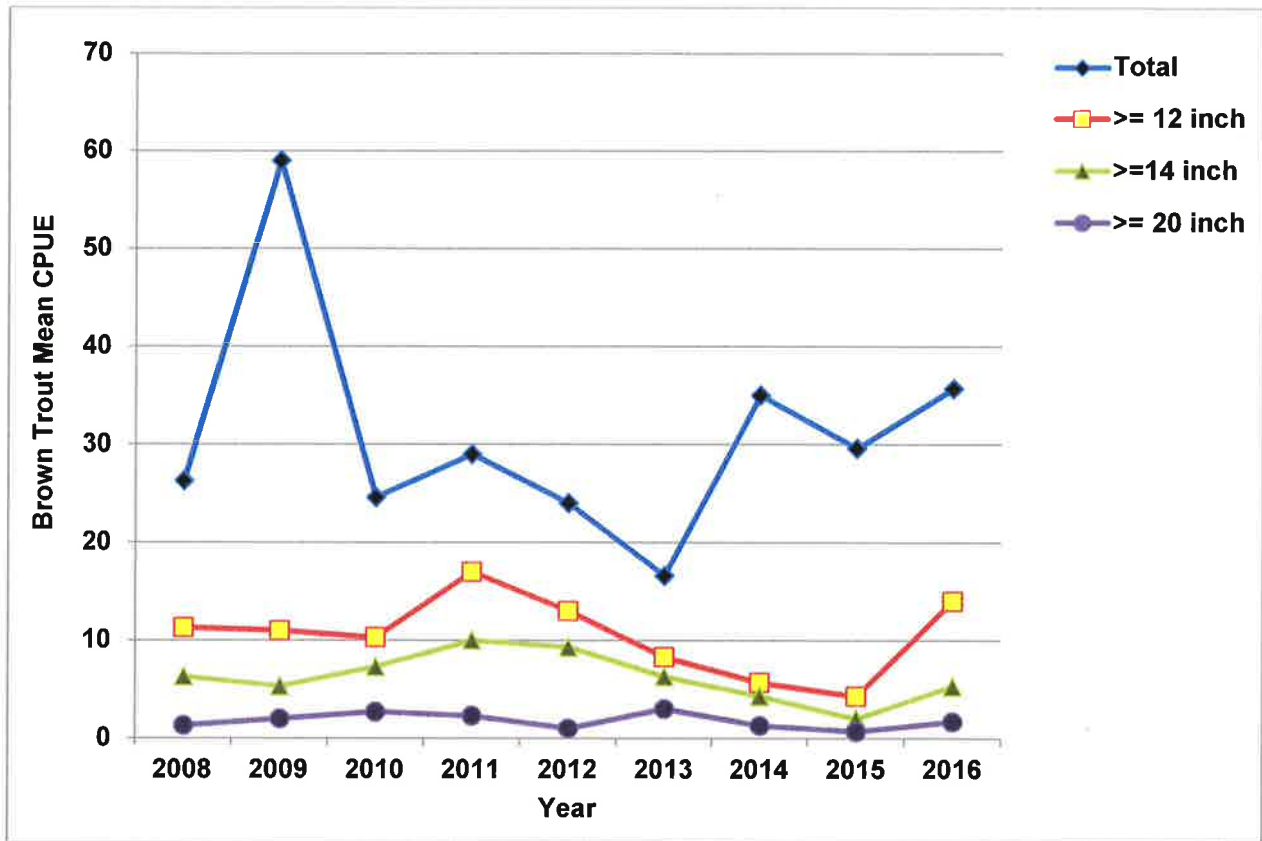


Figure 3.- Mean catch rates of Tims Ford tailwater Brown Trout by minimum length groups and by total number (2008-2016).

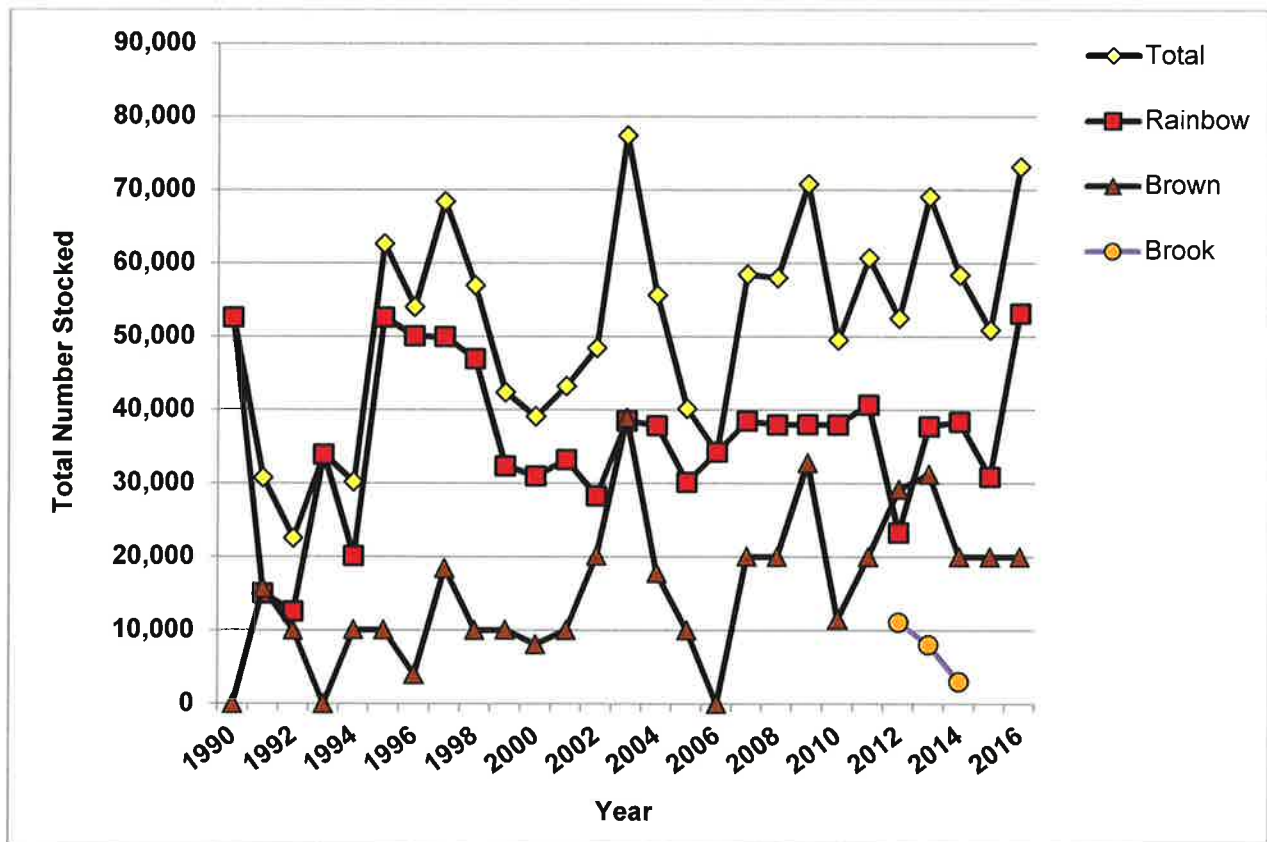


Figure 4.- Stocking rates of Tims Ford tailwater catchable Rainbow Trout, Brown Trout, and Brook Trout (1990-2016). From 1990 to 2005, catchable Rainbow Trout were provided primarily by TWRA's Flintville hatchery. Since 2005, catchable Rainbow Trout have been provided by DHNFH. Catchable Brown Trout and catchable Brook Trout were provided by DHNFH; catchable Brook Trout stockings were initiated in 2012.

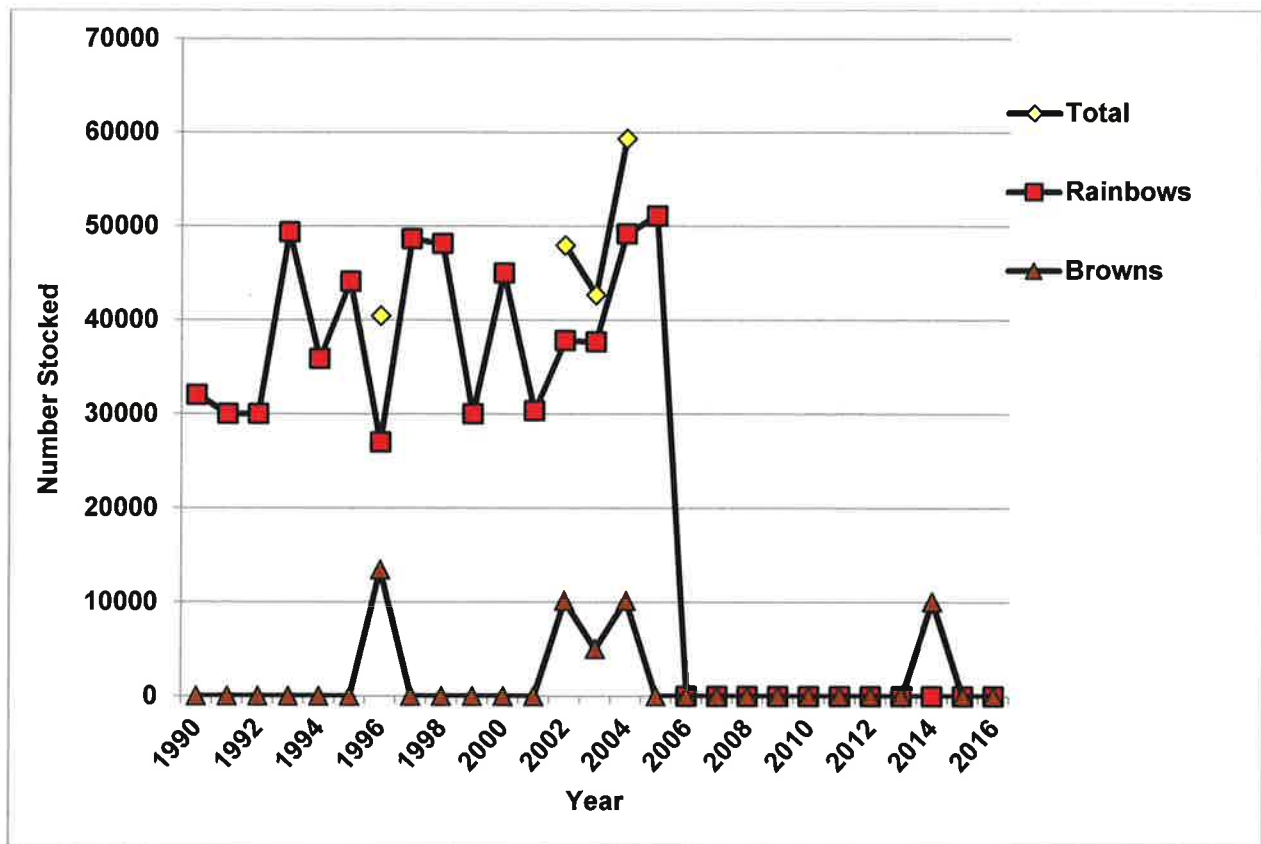


Figure 5.- Stocking rates of Tims Ford tailwater fingerling Rainbow Trout and Brown trout (1990-2016). During this time period, fingerling Rainbow Trout were provided by TWRA's Flintville hatchery and DHNFH. Fingerling Brown Trout were provided by DHNFH. Fingerling stockings ceased in 2005; the 2014 Brown Trout fingerling stocking was the result of surplus Brown Trout at DHNFH.

Table 1.- Angler pressure (hours) and harvest data for Rainbow Trout (RBT) and Brown Trout (BNT) on Tims Ford tailwater (1995, 2000, and 2013). The 2013 results use an unadjusted instantaneous count because of a drastic increase in the amount of non-fishing activity on the river. Adjusted counts (used in 1995 and 2000) would overestimate pressure.

| Year | Pressure | Number of RBT |           | Number of BNT |           | Catch Rate |
|------|----------|---------------|-----------|---------------|-----------|------------|
|      |          | Caught        | Harvested | Caught        | Harvested |            |
| 1995 | 14,340   | 12,802        | 5,211     | 12,668        | 2,058     | 1.27       |
| 2000 | 7,858    | 13,174        | 2,565     | 5,247         | 700       | 2.64       |
| 2013 | 21,444   | 26,301        | 3,630     | 9,699         | 457       | 1.82       |

Table 2.- Brown Trout population metrics collected by electrofishing on Tims Ford tailwater (2008-2016) include catch-per-unit-effort (CPUE) in fish per hour and total length (TL) is measured in inches (in), standard error in parentheses, proportional stock density (PSD), relative stock density (RSD; Milewski and Brown 1994), and relative weights (Wr).

|                      | 2008       | 2009       | 2010       | 2011       | 2012       | 2013       | 2014       | 2015       | 2016       |
|----------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| N                    | 79         | 179        | 74         | 87         | 72         | 48         | 105        | 89         | 107        |
| <b>CPUE (SE)</b>     |            |            |            |            |            |            |            |            |            |
| All                  | 26.3 (0.8) | 59.7 (1.8) | 24.7 (1.2) | 29.0 (1.3) | 24.0 (1.8) | 16.7 (1.4) | 35.7 (1.6) | 29.7 (1.9) | 35.7 (1.4) |
| 6.0 - 8.9            | 5.7 (0.7)  | 8.3 (0.9)  | 0.3 (0.4)  | 0          | 3.7 (0.9)  | 4.0 (0.9)  | 21.0 (1.3) | 1.3 (0.6)  | 1.7 (0.9)  |
| 9.0 - 11.9           | 9.3 (0.9)  | 41.3 (1.6) | 14.0 (1.0) | 12.0 (1.7) | 7.7 (1.1)  | 3.7 (0.6)  | 7.3 (0.7)  | 24.0 (1.8) | 13.7 (1.6) |
| 12.0 - 14.9          | 6.0 (0.8)  | 7.3 (0.8)  | 4.7 (0.5)  | 9.0 (0.9)  | 6.0 (1.1)  | 2.3 (0.7)  | 1.7 (0.7)  | 2.3 (0.4)  | 5.0 (0.8)  |
| 15.0 - 17.9          | 3.3 (0.5)  | 1.3 (0.4)  | 2.7 (0.9)  | 4.7 (0.7)  | 4.3 (1.2)  | 1.7 (0.9)  | 2.3 (0.6)  | 0.7 (0.6)  | 2.3 (0.4)  |
| ≥ 18.0               | 2.0 (0.5)  | 3.0 (0.7)  | 3.0 (0.7)  | 3.3 (0.7)  | 3.0 (0.9)  | 4.3 (1.3)  | 1.7 (0.3)  | 1.3 (0.5)  | 2.3 (0.6)  |
| ≥ 20.0               | 1.3 (0.4)  | 2.0 (0.6)  | 2.7 (0.7)  | 2.3 (0.6)  | 1.0 (0.7)  | 2.7 (1.0)  | 1.3 (0.4)  | 0.7 (0.4)  | 1.7 (0.5)  |
| <b>Length Data</b>   |            |            |            |            |            |            |            |            |            |
| Mean                 | 12         | 11         | 13         | 14         | 13         | 14         | 10         | 11         | 12         |
| Median               | 11         | 10         | 12         | 12         | 13         | 13         | 8          | 11         | 12         |
| Mode                 | 10         | 9          | 11         | 12         | 13         | 9          | 8          | 11         | 12         |
| Range                | 8 - 22     | 7 - 23     | 9 - 24     | 9 - 23     | 8 - 25     | 8 - 24     | 3 - 29     | 8 - 23     | 8 - 29     |
| <b>Stock Density</b> |            |            |            |            |            |            |            |            |            |
| PSD                  | 78         | 86         | 99         | 100        | 85         | 75         | 38         | 96         | 94         |
| RSD-Preferred        | 43         | 20         | 42         | 59         | 54         | 52         | 17         | 15         | 38         |
| RSD-Memorable        | 20         | 7          | 23         | 28         | 29         | 38         | 12         | 7          | 16         |
| RSD-Trophy           | 8          | 5          | 12         | 11         | 13         | 27         | 5          | 4          | 8          |
| RSD ≥ 20.0           | 5          | 3          | 11         | 8          | 4          | 17         | 4          | 2          | 6          |

Table 2.- (Continued)

|           | 2008                        | 2009 | 2010 | 2011        | 2012       | 2013        | 2014        | 2015         | 2016         |
|-----------|-----------------------------|------|------|-------------|------------|-------------|-------------|--------------|--------------|
|           | <b>Relative Weight (Wr)</b> |      |      |             |            |             |             |              |              |
| All       | .                           | .    | .    | 96.1 (2.0)  | 96.7 (2.0) | 96.6 (2.4)  | 93.2 (2.3)  | 91.7 (2.4)   | 107.1 (4.3)  |
| Stock     | .                           | .    | .    | .           | 92.0(2.0)  | 89.8 (2.4)  | 93.0 (2.1)  | 89.1 (8.0)   | 132.3 (14.8) |
| Quality   | .                           | .    | .    | 99.8 (1.7)  | 89.1 (1.6) | 92.9 (1.9)  | 96.3 (2.2)  | 90.1 (1.8)   | 116.6 (5.1)  |
| Preferred | .                           | .    | .    | 99.8 (2.1)  | 96.7 (1.6) | 93.1 (2.4)  | 96.1 (3.4)  | 104.2 (5.0)  | 106.5 (2.6)  |
| Memorable | .                           | .    | .    | 100.4 (3.3) | 96.6 (3.9) | 102.0 (4.7) | 103.3 (5.5) | 93.9 (5.9)   | 110.1 (2.4)  |
| Trophy    | .                           | .    | .    | 86.6 (0.2)  | 92.3 (3.2) | 99.1 (5.3)  | 105.1 (0.0) | 101.1 (8.9)  | 105.1 (5.5)  |
| ≥ 20.0    | .                           | .    | .    | 95.3 (6.7)  | 91.6 (6.0) | 102.6 (5.0) | 101.7 (6.1) | 105.1 (13.8) | 108.2 (4.2)  |