

PCB Fish Consumption Advisory for Tellico Reservoir

by

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Introduction

This document is intended to present data and justification for amending or removing an advisory for fish consumption currently in effect for Tellico Reservoir. The background concerning the sources of the pollutants is explained and how these sources have been significantly reduced or eliminated. The original potential health effects are explained. Also presented are results of laboratory analyses of fish collected beginning in 1988, less than 10 years after the gates of Tellico Dam were closed creating Tellico Reservoir. These data reveal how levels of the toxins have decreased over time and are currently below the thresholds for imposing such an advisory throughout the entirety of Tellico Reservoir.

The Tennessee Department of Environment and Conservation (TDEC) imposed this advisory for consumption of fish from Tellico Reservoir because elevated concentrations of Polychlorinated Biphenyls (PCBs) were detected in flesh of fish collected from this reservoir. PCBs are an acknowledged health threat to humans who consume fish containing these toxins over an extended period. These limits were established as a threshold below which fish consumption is considered safe.

The Tennessee Valley Authority (TVA) collects and prepares fish for laboratory analysis from all TVA reservoirs on a biannual rotating schedule. For several years, TVA has been collecting fish in Tellico Reservoir for analysis of PCBs every two years. Both TDEC and EPA have also collected fish for analysis to complement the TVA database, but much less frequently and not routinely.

Fish consumption advisories are justified when limits of toxins exceed the established limits in fish flesh and have apparently been successful in protecting the public from many health threats, but there are negative aspects to such advisories. Tellico Reservoir is the newest reservoir in the TVA system. The adjacent land surrounding this reservoir is strictly managed consistent with a TVA Reservoir Land Management Plan administered by the Tellico Reservoir Development Agency (TRDA). This reservoir is the primary driving force for expanding the economy in much of the three counties joining the reservoir. Several communities adjacent to the reservoir, founded since closure of Tellico Dam in 1979, account for well over 10,000 new residents to the area. The industries located within the TRDA Tellico

West Industrial Park provide employment to more than 2,000 residents of the surrounding counties where unemployment rates have been historically higher than average.

Tellico Reservoir is a very popular recreational destination for boating, fishing, camping, etc. It has the reputation of being a clean reservoir. However, there is one blight on the reputation of this reservoir. TDEC classifies Tellico Reservoir as polluted with PCBs. This is undoubtedly a detriment to recruitment of new residents and industry to the area. Continuing with the Fish Consumption Advisory throughout the entire 16,500 acres of the reservoir extending 34 miles upstream seems entirely unnecessary. Figure 1 from a TDEC report incorrectly implies that Tellico Reservoir is highly polluted and dangerous. It is important that this stigma be removed as soon as possible without endangering public health. The data presented herein support limiting this fish consumption advisory.

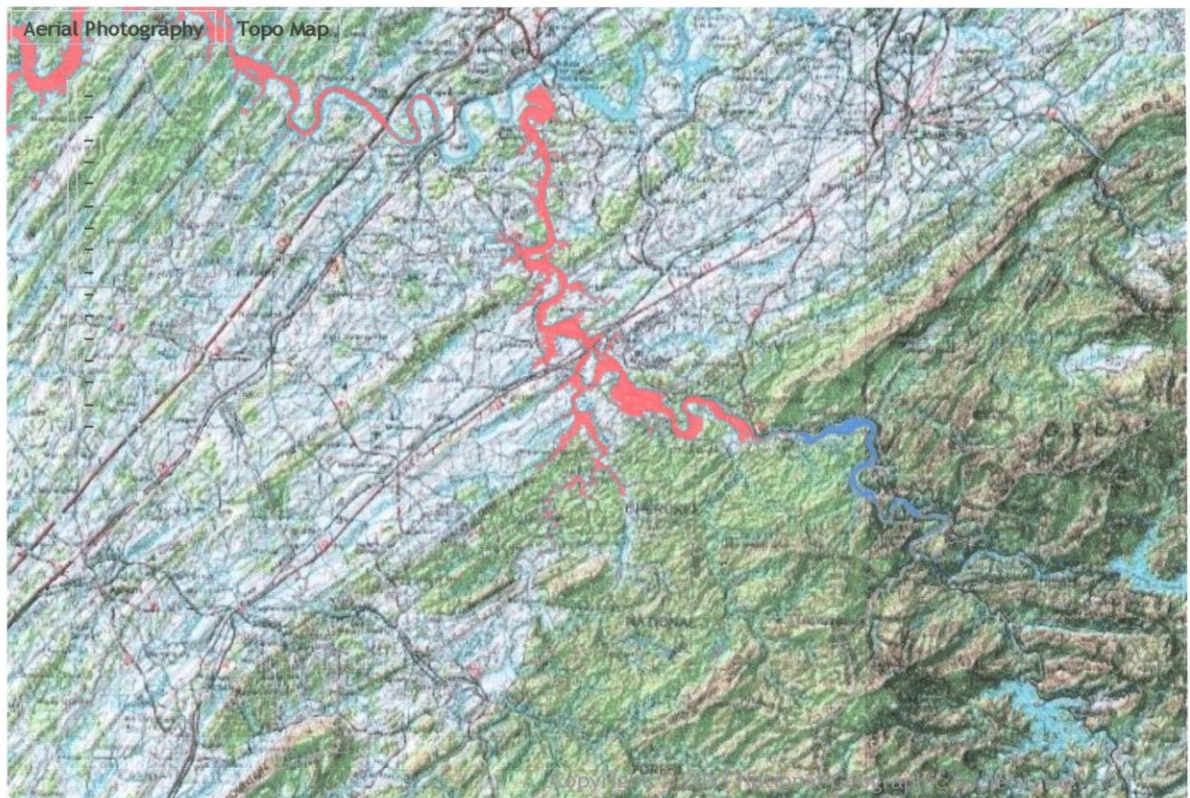


Figure 1: TDEC Map Showing Entire Tellico Lake Polluted with PCBs

Properties of PCBs

When PCBs were first created about a century ago, they were heralded by industry as a miracle compound. They are derived from coal tar and consist of carbon rings bonded by chlorine to form a very stable compound. They are nonflammable and possess excellent insulating capacity, making them extremely useful for a wide range of industrial applications. Their stability and inert property made them ideal for insulating transformers and capacitors. However, eventually it became apparent that they also possessed toxic properties and are probably a carcinogen. They may also disrupt the reproduction cycle of animals and possibly humans, and may cause developmental and learning difficulties in children.

Finally, EPA banned the use of PCBs in 1979. Unfortunately, after decades of extensive use and careless distribution, these contaminants found their way into sediment of many rivers throughout the USA and the world. The PCBs then got into the fish food chain and thus concentrated in fish, especially bottom feeders such as catfish.

Normally, Tellico Reservoir should not have been subjected to PCB contamination; essentially no heavy industry is located upstream, and the headwaters of the Little Tennessee River originate predominately from a national park and national forest. However, TVA testing for heavy metals in the newly created reservoir revealed elevated levels of PCB in the flesh of channel catfish. The source of the PCBs was located and removed in the 1980s. Transformers containing PCBs had been illegally dumped into Chilhowee Reservoir immediately upstream of Tellico Reservoir. Leakage from these transformers adhered to sediment and was deposited downstream in the bed of the Little Tennessee River likely before closure of the Tellico Dam. Those responsible for the illegal disposal was never clearly established.

Data Trend

Unfortunately, the stability that once made PCBs so valuable is now a liability. They break down from exposure to natural environmental processes extremely slowly. However, with the source eliminated, the contaminated sediment of Tellico Reservoir is slowly being covered and thus isolated from the ecosystem by the deposition of new clean sediment of silt, clay, and organic material. This bonding and the resulting isolation are apparent in the decreasing rate of the concentrations found in analyses of fish.

The actual maximum limit for concentrations of PCB in fish flesh is somewhat ambiguous. A recent CDC publication entitled Environmental Health and Medicine Education states "FDA mandates tolerances of 0.2-3.0 parts per million (ppm) PCBs for all foods, with a tolerance level in fish of 2 ppm." A search of TDEC documents did not reveal a definitive PCB limit for fish. Previous discussions with staff of TDEC in Knoxville indicated that the limit was between 0.23 and 0.18 ppm. Johnathon Burr, Deputy Director of TDEC, stated in late 2017 that TDEC considers 0.2 ppm as the limit for PCB in fish flesh. However, this limit was revised downward to 0.094 ppm during the annual classification meeting of TDEC staff in June 2018.

This limit is considered conservative in that it is less than one twenty (1/20) that of the FDA 2.0 ppm limit for PCBs in fish.

TVA began collecting fish for analysis in 1988 from two locations in the reservoir – at Mile 1 near the face of Tellico Dam, and at Mile 15 near the mouth of Baker Creek (Figure 2). Six fish of moderate size are collected and filleted just as a fisherman would prepare for cooking. The fish are frozen before they are shipped to a laboratory for analysis. Although results of these fish are analyzed individually, the results are typically reported as a composite of all six fish. This provides a realistic evaluation of how a pollutant in fish would be consumed from fish caught in the reservoir.

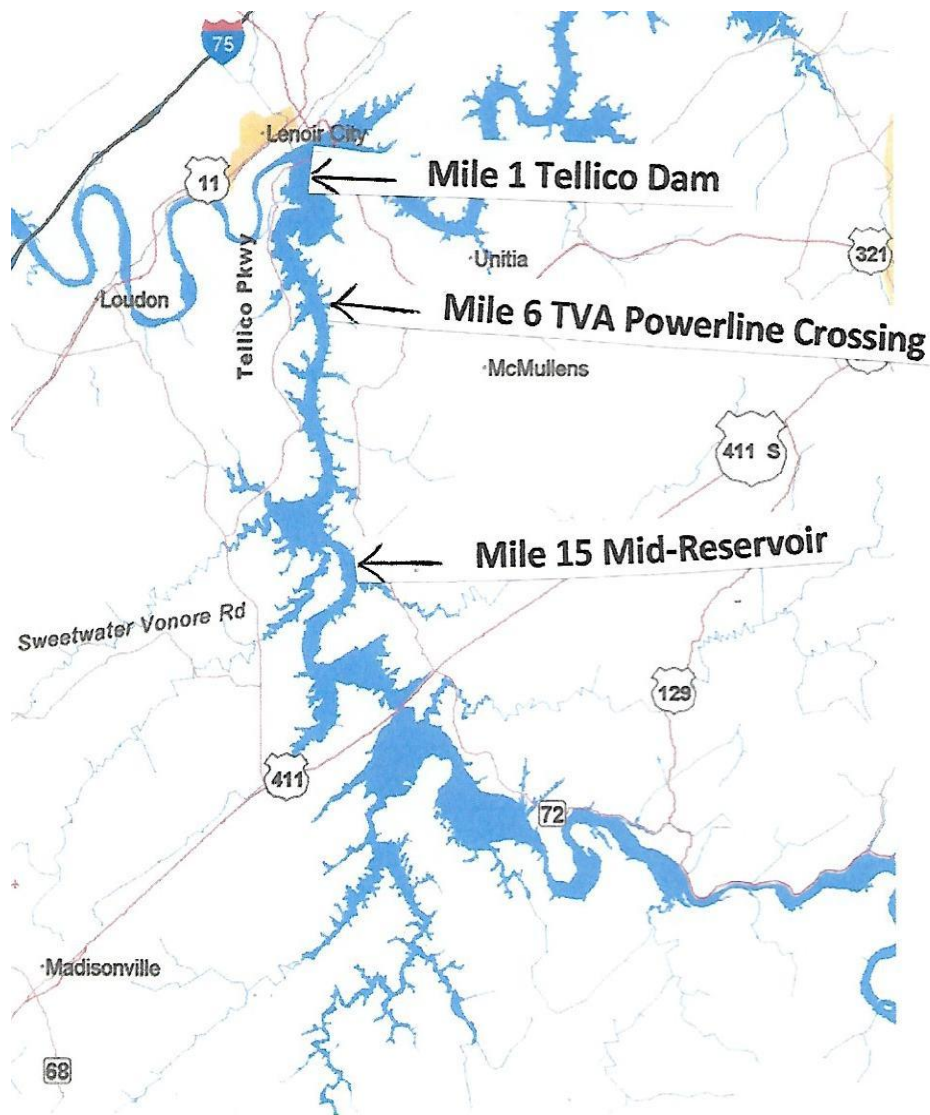


Figure 2: Location of Fish Collection Sites

Results from laboratory analysis of catfish dating from initial testing in 1988 through 2014 are presented at three or four-year intervals in Figure 3. These data reveal that concentrations of PCBs in catfish have been systematically decreasing with time. Furthermore, concentrations of PCBs in catfish were always greater at the downstream location than catfish collected 14 miles upstream at Mile 15. Both trends are consistent with an explanation of the hydrodynamics and related sediment transport in Tellico Reservoir.

As previously stated, PCBs adhere to sediment in the deeper portion of the reservoir. This contaminated sediment is constantly transported downstream by flow. When sediment is transported to the vicinity of Tellico Dam, there is no outlet for the sediment near the lake bed. The depth is about 90 feet in this area, but the only outlet for flow is through a canal only 25 feet deep connecting to Ft. Loudoun Reservoir. This effectively creates a sediment trap near Tellico Dam. Fortunately, with removal of the source of the PCBs more than three decades ago, it is logical to assume that most contaminated sediment currently resides in this area and is systemically becoming isolated by more recently deposited clean sediment. The contaminated sediment transport explanation is substantiated by laboratory results in **Figure 3 which reveals concentrations of PCB in catfish from Mile 15 have been consistently less than those recorded near Tellico Dam and sometimes are near the laboratory detection level of 0.02 ppm.**

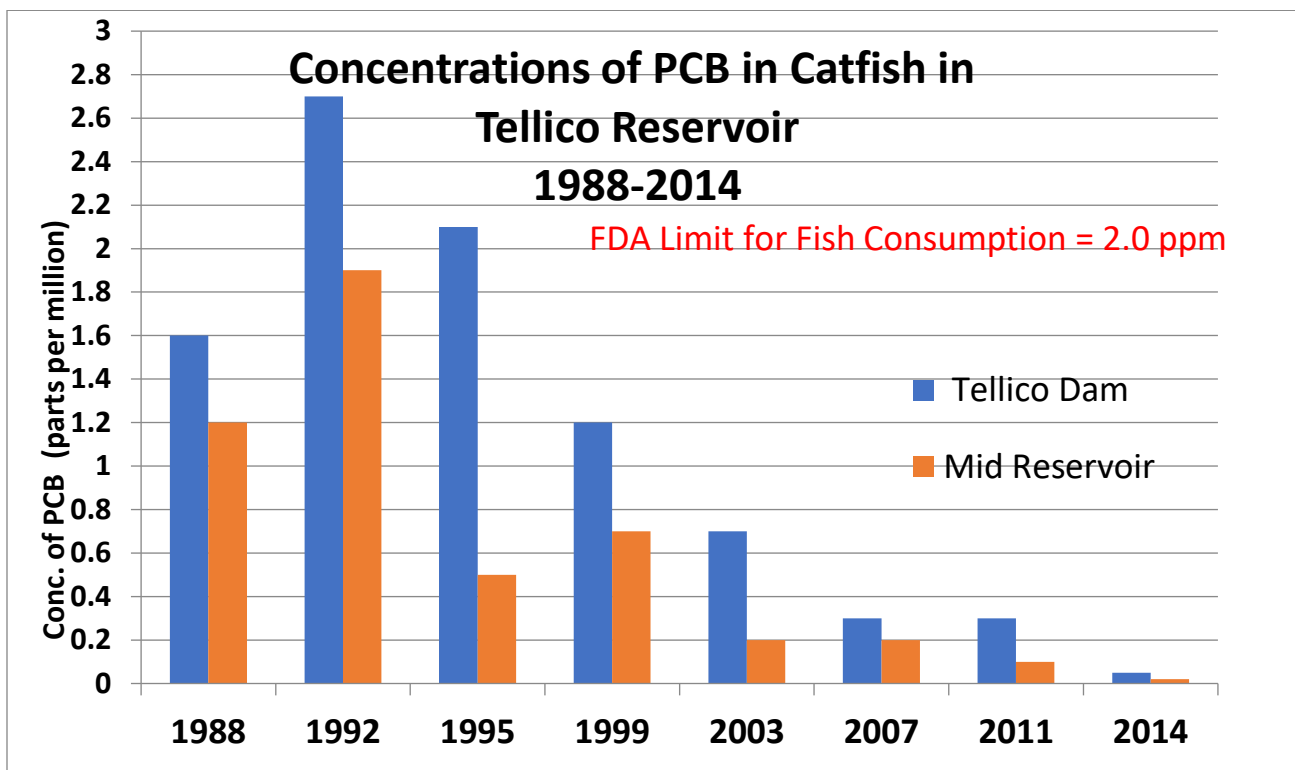


Figure 3: Concentrations of PCB in Catfish Samples Spanning 26 Years

The design of the Tellico Dam and the canal for outflow to Ft. Loudoun Reservoir adds another factor that might contribute to the higher concentrations of PCBs in catfish near the dam. Catfish in this region are free to swim back and forth through the canal linking these two bodies of water. The fish collected for analysis are as likely to have accumulated PCBs from Ft. Loudoun Reservoir as from Tellico Reservoir.

Figure 4 presents concentrations of PCB in composite flesh of catfish for all samples collected throughout the past eight years. Although concentrations of PCBs in catfish from Mile 1 at the dam have fluctuated and routinely exceeded the current TDEC limit of 0.094 ppm, concentrations of fish upstream at Mile 15 were consistently at or below the limit.

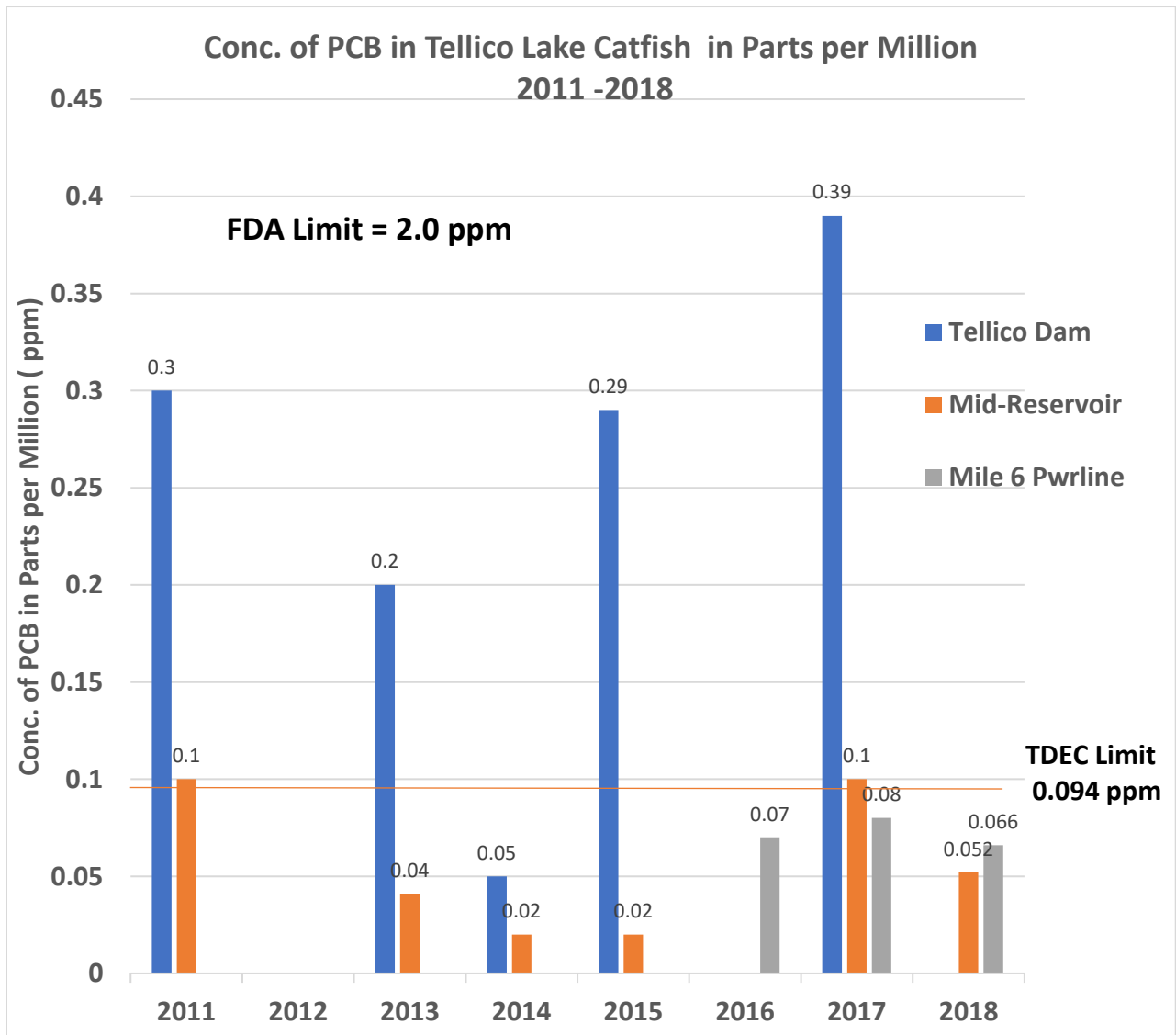


Figure 4: Recent Concentrations of PCB in Catfish Composite Samples

It is conceded that for partitioning of the reservoir for applying the Advisory for fish consumption to be effective, then a clear demarcation must be established for the boundary of the Advisory. In 2015 WATeR proposed that the TVA powerline crossing near Mile 6 would serve as a clearly visible line for demarcation (Figure 5). However, no analysis of catfish from this location was available to substantiate this as a valid line of demarcation. TDEC declined to support collection and analysis at Mile 6 because of the expense. As a result, WATeR requested TVA to collect the fish at this location and paid for the analysis from the WATeR operating budget for three years - 2016, 2017, and 2018.



Figure 5: TVA Powerline Crossing at Mile 6 of Tellico Reservoir

Results from the laboratory analysis of catfish from Mile 6 are included in Figure 4. The analysis showed that the composite results of all three years were less than the 0.094 ppm TDEC limit. Therefore, the TVA powerline crossing can serve as a clearly visible marker for partitioning the reservoir. By rescinding the Advisory in the 28 miles of Tellico Reservoir upstream from Mile 6, this would:

- Eliminate the burden and doubt of more than 10,000 residents concerned with living adjacent to a water body classified by TDEC as polluted with PCBs;
- Help the new communities attempting to promote home sales and new residents to locate in the region around Tellico Lake, and;
- Support the Tellico Reservoir Development Agency in recruiting new clean industry to the Tellico West Industrial Park.

The criteria for calculating the consumption limits presented in Section 3.2.1 of EPA 823-B-008, Nov. 2000, lead to a quite different conclusion from that of TDEC. These guidelines state

“This document presents consumption limits that were calculated using a risk level of 1 in 100,000 ... based on a 70-year lifetime exposure.”

The clear intent is that randomly consuming a catfish with PCBs slightly in excess of the specified limit (0.094 ppm) is of negligible concern. The Consumption Advisory is intended to warn against regularly eating catfish containing PCBs in excess of the specified limit. Using this logic, instead of focusing on results of analysis of a sample size of only six catfish from a single site, it is more appropriate to combine results to evaluate consumption over an extended period to time.

Averaging data from Figure 4 provides a sample size of 36 catfish covering a span of eight years at Mile 15. A similar calculation that includes three sample results at Mile 6 provides a sample size of 54 catfish from Mile 6 and upstream over eight years. Results of this analysis are presented in the table below:

Ave. Concentration of PCBs in Catfish Sampled since 2011

Sample Location	No. of Years	No. Catfish	Ave. ppm of PCBs	TDEC Limit
Mile 15	8	36	0.053 ppm <	0.094 ppm
Mile 6	8	18	0.072 ppm <	0.094 ppm
Mile 6 & 15	8	54	0.058 ppm <	0.094 ppm
Mile 1	8	30	0.246 ppm >	0.094ppm

This table clearly demonstrates that catfish upstream from Mile 6 throughout the eight years would have contained significantly less PCBs than the current TDEC limit of 0.094 ppm. Consequently, it is reasonable to limit the Advisory to the region downstream from the TVA powerline crossing at Mile 6. The Advisory should remain in affect near the Tellico Dam until sampling demonstrates the concentrations are clearly less than the TDEC limit of 0.094 ppm.

Those concerned with protecting and improving the environment throughout Tennessee support TDEC in their role of enforcing environmental laws and protections. However, overzealous interpretation of classifications, such as continuing the PCB Fish Consumption Advisory now imposed on Tellico Reservoir, is counter productive and undermines confidence and support for TDEC.