



## Is My Reservoir Healthy?

TVA uses five indicators to tell whether a reservoir is healthy: the amount of oxygen in the water; the amount of chlorophyll (a measure of the amount of algae); the number and variety of healthy fish; the number and variety of animals living on the reservoir bottom; and the amount of PCBs, pesticides, and metals in the bottom sediment. Scores for these indicators are then combined to generate an overall ecological health rating of good, fair, or poor.

## Sport Fishing Index Ratings

The Sport Fishing Index ratings below are based both on population measures (the size and health of individual fish, along with the number of fish present) and information on fishing pressure and success. The index was developed by TVA and the states to help anglers decide where they have the best chance of catching their favorite species.

RESERVOIR	OVERALL HEALTH RATING	ECOLOGICAL HEALTH INDICATOR RATINGS					COMMENTS	BLACK BASS	BLUEGILL	CHANNEL CATFISH	CRAPPIE	WALLEYE/ SAUGER
		Dissolved Oxygen	Chlorophyll	Fish	Bottom Life	Sediment Quality						
Apalachia	■	■	□	■	■	■	Increase in chlorophyll levels in recent years could signal nutrient enrichment and will be watched closely.	○	○	○		○
Bear Creek*	□	□	□	■	■	■	Typically rates poor. High chlorophyll and low DO are consistent issues.	●	○	○	●	
Beech	□	□	□	■	■	■	Typically rates poor. High chlorophyll and low DO are consistent issues.	○	○	●		
Blue Ridge*	■	■	■	■	■	■	Ratings are consistently among the highest of all the reservoirs monitored by TVA.	○	○	●		●
Boone*	□	□	□	■	□	□	Consistently rates poor. 1999 score was even lower than in previous years because of low ratings for all indicators.	○	○	●		○
Cedar Creek*	■	□	■	■	■	■	Score improved compared to previous years. Low summer DO levels are a consistent problem.	●	○	○	●	
Chatuge	□	□	■	■	□	□	Overall score improved in 2000, compared to 1998 and 1999, but still rated poor. Rated good in mid-1990s.	●	○	●		●
Cherokee	□	□	□	■	■	■	Typically rates poor. High chlorophyll and low DO levels are consistent issues.	●	○	●	●	○
Chickamauga*	■	■	■	■	■	■	Typically rates good. Elevated levels of zinc and copper are found consistently in the bottom sediment.	●	●	●	●	●
Douglas*	□	□	■	■	■	■	Low DO levels, high chlorophyll levels, and lack of diversity among bottom life are consistent issues.	●	●	○	○	○
Fontana	■	■	■	■	□	■	Typically rates fair with poor ratings for bottom life. Increase in chlorophyll levels in mid-reservoir areas deserves watching.	○	○	○		●
Fort Loudoun	□	■	□	■	□	■	Typically rates fair or poor due to high chlorophyll levels and lack of diversity among bottom life.	●	○	○		●
Ft. Patrick Henry*	□	■	□	□	■	■	High chlorophyll levels and a high proportion of pollution-tolerant fish species are consistent problems.	●	○	○		
Guntersville	■	■	■	■	■	■	Consistently rates good. 2000 score dropped slightly due to low diversity and abundance of fish and bottom life.	●	○	●		●
Hiwassee	■	■	■	■	□	■	Typically rates fair with poor ratings for bottom life. Increase in chlorophyll levels in mid-reservoir area bears watching.	●	○	○		●
Kentucky*	■	■	□	■	■	■	Typically rates good or fair. 1999 rating was just one point below good. Lower scores found in Big Sandy embayment.	●	●	●	●	●
Little Bear Creek*	■	□	■	■	■	■	Always rates fair. Summer DO levels are consistently low at mid to bottom depths.	●	○	○	●	
Melton Hill	■	■	■	■	□	■	Consistently rates fair. Recent trend toward higher chlorophyll and lower spring/summer DO levels bears watching.	●	○	●		○
Nickajack*	■	■	■	■	■	■	Consistently rates high because it is a small, narrow reservoir with a short retention time.	●	○	○	●	○
Normandy	□	□	□	■	■	■	Rated poor for the first time in 2000, compared to fair in previous years due largely to higher chlorophyll levels.	○	●	○	○	○
Norris*	■	□	■	■	■	■	Low summer DO levels and elevated levels of lead and arsenic in bottom sediment near the dam are consistent issues.	○	●	○	○	○
Nottely*	□	□	□	■	■	■	Low DO levels and high chlorophyll levels are consistent issues, indicating nutrient enrichment.	●	●	●		●
Parksville*	□	■	■	□	□	□	Sediment quality consistently rates poor due to very high concentrations of metals from past mining activities.	○	○	○		
Pickwick	■	■	□	■	■	■	Typically rates good or fair, depending mostly on fluctuations in chlorophyll levels. Bear Creek embayment scores low.	●	●	○	○	●
South Holston	□	□	■	■	□	■	Rated poor since 1996, compared to fair in early 1990s. Scores for DO and bottom life are consistently low.	●	○	○	○	●
Tellico*	■	■	□	■	□	■	Trend toward increased chlorophyll levels bears watching. Low DO levels and cold bottom water affect bottom life.	○	○	●		●
Tims Ford	□	□	■	■	□	■	Typically rates poor. Low DO near bottom and sparse bottom life are consistent issues.	○	●	○	○	○
Watauga	■	□	■	■	□	■	Typically rates fair. Low DO near bottom and sparse bottom life are consistent issues.	●	○	○	●	●
Watts Bar	■	■	□	■	□	■	Changes in chlorophyll, bottom life, and sediment quality have contributed to declining health scores since 1990.	●	○	●	●	●
Wheeler*	■	■	□	■	■	■	1999 ratings for chlorophyll and DO near dam dropped due to low flows. Elk River embayment consistently rates poor.	●	○	○		○
Wilson	□	□	□	■	□	■	Typically rates good or fair. 2000 score was lowest to date due to high chlorophyll, low DO, and sparse bottom life.	●	○			

\*Reservoirs marked with an asterisk were monitored in 1999; all others were monitored in 2000. Reservoirs are generally monitored every other year unless a substantial change is observed in ecological conditions at a particular location. Fort Loudoun is monitored every year because of persistent ecological health problems.

■ good ■ fair □ poor

● above average ● average ○ below average

## Can I Eat the Fish?

State agencies are responsible for advising the public of health risks from eating contaminated fish. Each state uses its own criteria for deciding whether an advisory is necessary. TVA assists the states by collecting fish from TVA reservoirs and checking the tissue for metals, pesticides, PCBs, and other chemicals that could affect human health. State-issued advisories for Valley waters are summarized in the table to the right. Check the fishing regulations published by your state (available wherever fishing licenses are sold) for more specific advice.

Two national advisories also are in effect related to mercury in fish. In January 2001, the Environmental Protection Agency (EPA) advised pregnant women, nursing mothers, and young children to limit fish consumption to one meal per week. EPA's advice is for freshwater fish caught by friends and family from local waters. The Food and Drug Administration issued a companion advisory for the same groups, recommending against consumption of shark, swordfish, king mackerel, and tilefish purchased in stores and restaurants.

### FISH CONSUMPTION ADVISORIES FOR VALLEY WATERS

Location	Pollutant	State-Issued Advice
<b>Alabama</b>		
Huntsville Spring Branch and Indian Creek (from Redstone Arsenal to the TN River)	DDT	Smallmouth buffalo and bigmouth buffalo should not be consumed.
<b>Georgia</b>		
Blue Ridge Reservoir	Mercury	Limit consumption of white bass and largemouth bass between 12 and 16 inches to one meal per week.
Nottely Reservoir	Mercury	Limit consumption of largemouth bass greater than 12 inches and striped bass greater than 16 inches to one meal per week.
Chickamauga Creek (West)	Mercury	Limit consumption of spotted bass to one meal per week.
<b>Kentucky</b>		
All Kentucky streams and reservoirs	Mercury	Women of childbearing age and children 6 years and younger should not eat more than one meal per week of larger, older fish.
<b>North Carolina</b>		
Pigeon River	Dioxin	Carp and catfish should not be eaten.
<b>Tennessee</b>		
North Fork Holston River (mile 0.0-6.2)	Mercury	Fish should not be consumed.
East Fork of Poplar Creek (mile 0.0-15.0)	Mercury, PCBs	Fish should not be consumed.
Chattanooga Creek (mouth to GA line)	PCBs, chlordane	Fish should not be consumed.
Woods Reservoir	PCBs	Catfish should not be consumed.
Fort Loudoun Reservoir	PCBs	Catfish, largemouth bass over two pounds, or any largemouth bass from the Little River embayment should not be consumed.
Tellico Reservoir	PCBs	Catfish should not be consumed.
Melton Hill Reservoir	PCBs	Catfish should not be consumed.
Watts Bar Reservoir—TN River arm	PCBs	Catfish, striped bass, and hybrid striped bass-white bass should not be consumed. Precautionary advisory* for white bass, sauger, carp, smallmouth buffalo, and largemouth bass.
Watts Bar Reservoir—Cinch River arm	PCBs	Striped bass should not be consumed. Precautionary advisory for catfish and sauger.
Boone Reservoir	PCBs, chlordane	Precautionary advisory for carp and catfish.
Nickajack Reservoir	PCBs	Precautionary advisory for catfish.
Pigeon River (NC line to Douglas Reservoir)	Dioxin	Precautionary advisory for carp, catfish, and redbreast sunfish.
<b>Virginia</b>		
North Fork Holston River (from Saltville to the VA/TN state line)	Mercury	Fish should not be consumed.

\*A precautionary advisory, as defined by the State of Tennessee, means that children, pregnant women, and nursing mothers should not consume the species named. All other persons should limit consumption of the named species to one meal per month.

## Is It Safe to Swim?

State agencies determine whether it is safe to swim or wade in a reservoir or stream based on the amount of E. coli or fecal coliform bacteria in the water. The presence of these bacteria indicate that the water has been contaminated by animal or human waste, which may contain bacteria that can cause illness.

TVA checks fecal coliform bacteria levels in water samples from recreation areas on TVA reservoirs and major Valley streams. The states use this information in deciding if a site is safe for water contact and in compiling Clean Water Act Section 303(d) lists. These lists, which are updated every other year, identify bodies of water which do not meet state water quality goals.

Current bacteriological monitoring advisories in the Tennessee portion of the Tennessee River watershed are listed to the right. Similar information is available by calling other states or checking their Web sites.

### BACTERIOLOGICAL ADVISORIES IN TENNESSEE

County	Stream	Bacteria Source
<b>Anderson</b>	Coal Creek (sewage treatment plant to Clinch River)	Lake City sewage treatment plant
<b>Cocke</b>	Trail Fork Big Creek (mile 0.0 to mouth of John River); Johns, Baker, Black, and Dry Fork Big Creeks (entirety); Bear Branch (entirety)	Failing septic tanks
<b>Coffee</b>	Duck and Little Duck Rivers (Old Stone Fort State Park)	Manchester collection system
<b>Grund</b>	Little Fiery Gizzard, including portions of Clouse Hill, Slaughter Pen, and Hedden Branches (mile 0.7 to 2.2)	Failing septic tanks in Tracy City
<b>Hamblen</b>	Turkey Creek (mile 0.0 to 5.3)	Morristown collection system
<b>Hamilton</b>	Chattanooga Creek (mouth to GA line)	Chattanooga collection system
	Stringers Branch (mile 0.0 to 5.4)	Red Bank collection system
	Unnamed tributary to Citico Creek (mile 0.0 to 5.0)	General urban and stormwater runoff
<b>Jefferson</b>	Leadvale Creek (mile 1.5 to Douglas Reservoir)	White Pine sewage treatment plant
<b>Knox</b>	Goose Creek (4.0 miles); First Creek (mile 0.2 to 1.5); Second Creek (mile 0.0 to 1.4, mile 3.3); East Fork of Third Creek (mile 0.0 to 0.8)	Knoxville urban runoff
	Sinking Creek embayment of Fort Loudoun Reservoir (1.5 miles from head of embayment to cave)	Knoxville Sinking Creek sewage treatment plant
<b>McMinn</b>	Oostanaula Creek (mile 28.4-31.2)	Athens sewage treatment plant and upstream dairies
<b>Sevier</b>	Little Pigeon River (mile 0.0 to 4.6); West Prong of Little Pigeon (mile 0.0 to 4.6); Beech, King, Knatty, Holy, & Baskin Branches (entirety); Roaring & Dudley Creeks (entirety)	Improper connections to storm sewers, leaking sewers, and failing septic tanks
	Beaver Creek (TN/VA line to Boone Reservoir)	Nonpoint sources
<b>Sullivan</b>	Cash Hollow Creek (mile 0.0 to 1.4)	Failing septic tanks
<b>Washington</b>	Sinking Creek (mile 0.0 to 2.8)	Agriculture and urban runoff

# 1999 - 2000 Reservoir Monitoring Results

Conditions in Valley reservoirs clearly have been impacted by several years of hot, dry weather, but the news is actually pretty good: most reservoirs seem to be holding their own despite a cumulative rainfall deficit of 34 inches since July 1998. Of the 31 reservoirs monitored by TVA in 1999 and 2000, 23 received the same overall ecological health rating as in most previous years. Seven reservoirs—Boone, Normandy, Parksville, Watauga, Watts Bar, Wilson, and Wheeler—rated lower, and one reservoir—Cedar Creek—rated higher.

### Weather: A Key to Reservoir Health

Considering the lack of rainfall, it wouldn't have been surprising to see lower ecological health scores on more reservoirs. It's been three years now since the rainfall spigot virtually shut off. Valley rainfall was only about 75 percent of normal in 2000, and runoff—the portion of rainfall which actually finds its way into streams and reservoirs—was only about 55 percent of normal. The heat was a problem, too. Temperatures were above normal during 11 out of 12 months in 1999 and during the first few months of 2000. February 2000 was especially warm: about 6° F above normal.

The upshot? Low flows and increased water temperatures in many reservoirs at the start of the summer—an unfortunate combination with the potential to produce stagnant conditions. Three of the five indicators TVA uses to measure reservoir health did not show significant effects in recent monitoring. On balance, ratings for fish and bottom life stayed about the same as in previous years, and there was little change in sediment quality—the amount of pesticides, PCBs, and metals found on the reservoir bottom. But dissolved oxygen (DO) and chlorophyll were a different story.

### Low Flows Affect Dissolved Oxygen Levels

Lower ratings for dissolved oxygen are typical in low-flow years, and 1999 and 2000 were no exception. Because there was less

water moving through the river system, some reservoirs stratified earlier—that is, the water separated into a warm upper layer and a cold bottom layer, with little mixing to replenish the oxygen near the bottom as it was used up by decaying plants and other materials.

The results were apparent in TVA monitoring results, which revealed an increase in both the volume and duration of low-DO water in many reservoirs. Even some main-river reservoirs, which generally have enough flow to maintain adequate DO levels, were affected—although not enough to change their overall ecological health rating. Fortunately, TVA was able to keep DO problems from getting as bad as they could have been by adjusting flows and operating aeration equipment at several dams.

### Chlorophyll Levels Continue to Increase

Of all the indicators TVA monitors, the one which has changed the most in recent years is chlorophyll. (A measure of the amount of algae, chlorophyll is a critical part of the aquatic food web, but it can create a variety of water quality problems in excess amounts.) Of the 58 locations TVA monitored in 1999 and 2000, 35 showed higher chlorophyll levels than in previous years, while 23 had similar concentrations and not a single one exhibited lower levels.

The hot, dry weather is undoubtedly a contributing factor. The resulting low flows and clearer water provided ideal growing conditions. But nutrient over-enrichment—from agriculture, municipal sewage treatment plants, urban runoff, and storm sewers—also may be partly to blame. This problem is affecting many of our nation's waters. In extreme cases, it can cause potentially harmful blooms of algae, which in turn can lead to oxygen declines, imbalance of aquatic species, and higher water treatment costs. Although Valley reservoirs are not yet to the point of being severely impacted, TVA is keeping a close watch on this trend.

*TVA's goal is to set the standard for other regions of the country in terms of environmentally sound river management. Toward this end, we keep close tabs on conditions in TVA reservoirs. The information we collect helps us operate the river system to protect water quality and guides our watershed restoration and protection efforts. This publication provides a brief summary of our monitoring results for 1999 and 2000, along with information on sport fishing and state-issued advisories on swimming and fish consumption. More detailed information on conditions in individual reservoirs is available by visiting TVA's web site at [www.tva.gov](http://www.tva.gov) or by calling 423-751-3164.*