Appendix A.

Watershed and Reservoir Physical Description Including Summary of Ecological Health Results for Each Reservoir Sampled in 1999

Kentucky Watershed

Duck Watershed

Pickwick - Wilson Watershed

Wheeler - Elk Watershed

Guntersville - Sequatchie Watershed

Nickajack - Chickamauga Watershed

Hiwassee Watershed

Fort Loudoun Reservoir - Melton Hill - Watts Bar Watershed

Clinch - Powell Watershed

Little Tennessee Watershed

French Broad Watershed

Holston Watershed

Table 1. List of Vital Signs Monitoring Reservoirs and Years When Vital Signs Monitoring Activities Have Occurred and Are Planned for The Future.

Reservoir	Numer of Sites	CY 1990	CY 1991	CY 1992	CY 1993	CY 1994	CY 1995	CY 1996	CY 1997	CY 1998	CY 1999	CY 2000
RUN-OF-THE-RIVER RES.												
KY Tailrace	1	X	X	X	X	X						
Kentucky	4	X	X	X	X	X	X		X		X	
Pickwick	4	X	X	X	X	X		X		X		X
Wilson	2	X	X	X	X	X		X		X		X
Wheeler	4	X	X	X	X	X	X		X		X	
Guntersville	3	X	X	X	X	X		X		X		X
Nickajack	2	X	X	X	X	X	X		X		X	
Chickamauga	4	X	X	X	X	X	X		X		X	
Watts Bar	4	X	X	X	X	X		X		X		X
Fort Loudoun	3	X	X	X	X	X	X	X	X	X	X	X
Tellico	2		X	X	X	X	X		X		X	
Melton Hill	3		X	X	X	X		X		X		X
	{36}											
HIWASSEE WATERSHED												
Apalachia	1							x***	X	X	X	X
Hiwassee	2		X*	X*	X	X		X		X		X
Chatuge	2		X*	X*	X	X		X		X		X
Nottely	2		X*	X*	X	X	X		X		X	
Blue Ridge	1		X*	X*	X	X	X		X		X	
Parksville	1		X*	X*	X	X	X		X		X	
	{9}											
HOLSTON WATERSHED												
Cherokee	2	X	X	X	X	X	X	X**		X		X
Fort Patrick Henry	1		X*	X*	X	X	X	X**	X		X	
Boone	3		X*	X*	X	X	X		X		X	
South Holston	2		X*	X*	X	X		X		X		X
Watauga	2		X*	X*	X	X		X		X		X
	{9}											
CLINCH/POWELL WS												
Norris	3	X	X	X	X	X	X		X		X	
LITTLE TENNESSEE WS												
Fontana	3				X	X	X	X		X		X
FRENCH BROAD WS												
Douglas	2	X	X	X	X	X	X		X		X	
OTHER WATERSHEDS												
Tims Ford	2			X*	X	X	X	X		X		X
Normandy	1				X	X	X	X		X		X
Bear	1				X	X	X	X	X		X	
Little Bear	1				X	X	X	X	X		X	
Cedar	1				X	X	X	X	X		X	
Beech	1		X*		X	X	X	X		X		X
	{7}											
Total Sites	69	38	60	61	69	69	45	40	36	37	36	38
Sites with all 5 Indicators							39	33	31	30	31	31
Sites with only Fish, Benthos, & DO							6	7	5	7	5	7
Total Lakes	31	12	23	23	30	30	21	19	17	16	17	16
* Limited Monitoring in Tribs (DO,Chloro., & Fish);					** Cooperative Efforts;				***Benthos and fish only			
ResMonitSum98.xls(12/17/98)												

KENTUCKY RESERVOIR WATERSHED

The Kentucky Reservoir watershed area includes all streams flowing into the Tennessee River downstream of Pickwick Landing Dam at Tennessee River mile (TRM) 206.7 to the confluence of the Tennessee River with the Ohio River. The one exception is the Duck River which is considered a separate watershed. The Kentucky Reservoir watershed area is relatively large (4590 square miles) and has an average annual discharge of about 67,200 cfs. Of that, about 83 percent (56,000 cfs) comes into Kentucky Reservoir from Pickwick Landing Dam. The Duck River supplies about 6 percent (4075 cfs), with the remaining 11 percent coming from local inflows.

Kentucky Reservoir is the dominant feature of this watershed. There are four monitoring sites on Kentucky Reservoir--forebay, transition zone, inflow, and Big Sandy River embayment

The watershed also includes the seven small reservoirs on the Beech River. The largest, Beech Reservoir, is the only one included in Vital Signs monitoring. Given its small size, the forebay is the only site monitored.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Kentucky Reservoir

Kentucky Reservoir is the largest reservoir on the Tennessee River. The dam is located at Tennessee River Mile (TRM) 22.4, and the reservoir extends 184 miles upstream to Pickwick Dam at TRM 206.7. At full pool the surface area is 160,300 acres, and the shoreline is 2280 miles. Average annual discharge is about 67,200 cfs, which provides an average hydraulic retention time of about 21 days.

The Duck River, a major tributary to the Tennessee River (and Kentucky Reservoir), provides about 6 percent of the total flow through Kentucky Reservoir. The confluence of the Duck River with the Tennessee River is at TRM 110.7.

The transition zone sample location was moved prior to the 1992 sample season from TRM 112.0 to TRM 85.0. Results for 1990 and 1991 at TRM 112.0 indicated that location was more representative of a riverine environment than a transition environment. Results of sampling since then indicate the new transition zone site is correctly located.

Vital Signs monitoring was expanded in 1993 to include a sample site in four of the largest embayments in the Tennessee Valley. One, the Big Sandy River embayment on Kentucky Reservoir,

is the largest embayment in the Tennessee Valley. It covers 15,238 surface acres and has over 93 miles of shoreline. Because its watershed is only 629 square miles, there is very little water exchange.

Beech Reservoir

Beech Reservoir, the largest of seven small flood control projects on the Beech River system in western Tennessee, is formed by Beech Dam at Beech River mile 35.0. Beech Reservoir is only 5.3 miles long and averages only about 12 feet deep. It has no hydropower generating facilities, but is the primary source of water for the city of Lexington. The reservoir is an urban lake with considerable residential lakefront development. Consequently, it receives a large amount of recreational use relative to its small size (about 900 acres). Discharge from Beech Dam averages only about 14 cfs per day, resulting in a long hydraulic residence times of 300 to 400 days.

Reservoir: Kentucky **1999 Score: 72%**

	Previous Scores		
	Reported	1999 Criteria	Comments
1991	77		(no embayments/no transition)
1992	88		(no embayment)
1993	75		
1994	71	74	(84 if Big Sandy were excluded)
1995	74	71	(77 if Big Sandy were excluded)
1997	78	78	(83 if Big Sandy were excluded)
1999		72	(78 if Big Sandy were excluded)

Kentucky	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	R 2.3	G 5.0	R 1.0		8.3
DO	G 4.5	G 5.0	G 4.5	ns	14.0
Fish	Y 3.0	Y 3.0	Y 3.0	Y 4.0	13.0
Benthos	Y 3.0	G 5.0	Y 3.0	Y 3.0	14.0
Sediment	G 2.5	G 2.5	Y 1.5		6.5
Total	15.3	20.5	13.0	7.0	55.8

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
1.3	0.0	0.0		1.3
-0.5	0.0	-0.5		-1.0
-1.0	-1.0	0.0	1.0	-1.0
-1.0	0.0	0.0	-1.0	-2.0
0.0	0.0	-1.0		-1.0
-1.2	-1.0	-1.5	0.0	-3.7

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Kentucky Reservoir was fair in 1999, only one point from a score in the good range. All environmental indicators rated either good or fair except chlorophyll, which rated poor at the forebay and Big Sandy sites (same as 1997) due to high concentrations on all sample dates. DO rated good at all sites. Fish rated fair at all sites (same as 1997) with an average number of species and fair composition, but low catch rates. Sediment rated good at the forebay and transition and fair at Big Sandy embayment due to the present of arsenic.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Since 1994, the rating for Kentucky Reservoir has ranged from 71 to 78, alternating between fair and good with only small changes among indicators. As in previous years, the transition had the highest score and Big Sandy the lowest. In 1999, average chlorophyll concentrations at the forebay and Big Sandy were substantially lower (by 5 to 6 mg/m^3) than 1997, which had the highest average concentrations among years for these sites. However, chlorophyll concentrations were sufficiently high in 1999 to warrant poor ratings. In Big Sandy embayment, arsenic concentrations in the sediment exceeded suggested criteria. In past surveys, the level of arsenic had been slightly below the suggested criteria. New laboratory techniques provided for better recovery of arsenic and may explain the apparent increased concentration.

Aquatic Macrophytes in 1999: TVA did not monitor macrophyte acreage in 1998. Casual observations indicates coverage nominal coverage of only about 100 acres in 1999.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Kentucky Reservoir. TVA last analyzed channel catfish (pesticides, PCBs, and metals) and largemouth bass (mercury) from Kentucky Reservoir in 1995. Concentrations of most chemicals were either below detection levels or below levels typically used to issue fish consumption advisories. These same species were collected again in autumn 1999, but results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Kentucky Lake. TVA checked fecal coliform bacteria levels at 18 sites in 1998 and 15 in 1999. Two of the beaches checked in 1998 and four in 1999 did not meet guidelines for water contact for their respective state because of high levels of bacteria.

DUCK RIVER WATERSHED

The Duck River Watershed includes all streams flowing into the Duck River. It has an area of 3500 square miles and an average annual discharge of 4075 cfs to Kentucky Reservoir on the Tennessee River. The Duck River basin is underlain almost entirely by limestone, or phosphatic limestone; consequently, waters in the streams draining this basin are fairly hard and contain large concentrations of minerals. Large deposits of phosphate ores permit phosphate mining and refining operations in the basin. Phosphate concentrations in surface and groundwater are significantly higher than in most of the Tennessee Valley. The soils are thin with limestone outcrops at the surface in many places, and sinkholes are common throughout the watershed.

Normandy Reservoir is the only reservoir in this watershed. This is a relatively small reservoir and only the forebay is included in the Vital Signs monitoring program.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on Normandy Reservoir. It also provides planned activities in the future .

Normandy Reservoir

Normandy Reservoir is formed by Normandy Dam at Duck River mile (DRM) 248.6. Normandy Reservoir, constructed primarily for flood control and water supply, has a drainage area of 195 square miles and no electric power generation capacity. One of TVA's smaller reservoirs, Normandy at full pool elevation has about 3200 surface acres, 73 miles of shoreline, and about 17 miles of impounded backwater. The reservoir has an average depth of about 35 feet and an average annual drawdown of about 11 feet. The average annual discharge from Normandy Dam is about 344 cfs, providing an average annual retention time of about 161 days.

PICKWICK RESERVOIR - WILSON RESERVOIR WATERSHED

Pickwick Reservoir and Wilson Reservoir on the Tennessee River are the most notable features of this drainage area. Only a small part of the flow leaving this watershed actually originates within the watershed itself. The average annual discharge from Pickwick Dam is about 56,000 cfs. Of that, 52,500 cfs (94 percent) is the discharge from Wheeler Dam into Wilson Reservoir. About 1840 cfs enters Wilson Reservoir through local tributaries and about 3500 cfs originates in tributaries to Pickwick Reservoir. The streams within this watershed drain an area of about 3230 square miles. The largest tributaries are Bear Creek, a tributary to Pickwick Reservoir with a drainage area of about 945 square miles, and Shoal Creek, a tributary to Wilson Reservoir, with a drainage area of about 445 square miles.

Four small reservoirs were built on Bear Creek in the late 1970s and early 1980s for flood control and recreation. These are Bear Creek, Little Bear Creek, Cedar Creek, and Upper Bear Creek Reservoirs.

Reservoir monitoring activities occur at the forebay, transition zone, and inflow on Pickwick Reservoir and at the forebay and inflow on Wilson Reservoir. Wilson is relatively short and has no definable transition zone. Because of their smaller size, only the forebays of Bear Creek, Little Bear Creek, and Cedar Creek Reservoirs are monitored. No monitoring activities are conducted on Upper Bear Creek because of TVA's program to destratify and oxygenate water in the forebay.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Pickwick Reservoir

Pickwick Reservoir is immediately upstream of Kentucky Reservoir on the Tennessee River. Pickwick Dam is located at TRM 206.7. Like the rest of the mainstream, run-of-the-river reservoirs, Pickwick is much shorter (53 miles long) and smaller (43,100 acres and shoreline of 496 miles) than Kentucky Reservoir. Average annual discharge is about 56,000 cfs, which provides an average hydraulic retention time of about eight days.

A major tributary, Bear Creek, joins the Tennessee River in Pickwick Reservoir at about mile 225. Bear Creek provides, on the average, about 2.5 percent of the flow through Pickwick Reservoir.

Reservoir Monitoring activities were expanded on Pickwick Reservoir in 1993 to include a Vital Signs monitoring site in Bear Creek embayment. This rather large embayment (7200 acres) extends from the mouth of Bear Creek upstream about 17 miles to the point where flow is not affected by backwater from Pickwick Dam.

Wilson Reservoir

Wilson Reservoir is quite different from other mainstream Tennessee River reservoirs in both length and depth. Wilson Dam is located at TRM 259.4 and Wheeler Dam is at TRM 274.9, providing a length of only 15.5 miles, a shoreline of 154 miles, and surface area of 15,500 acres. Water depth in the forebay is slightly over 100 feet. This short, deep pool, coupled with the largest hydroelectric generating plant in the TVA system, provides for short hydraulic retention times (six days). Average annual discharge from Wilson is 52,500 cfs. Because of the physical characteristics, design, and operation of Wilson Dam (primarily upper strata withdrawal for hydropower generation), low DO conditions develop in deeper strata of the forebay during summer months.

Bear Creek Reservoir

With a surface of only 700 acres, Bear Creek is one of the smallest reservoirs in the TVA system. It is relatively long (16 miles), narrow, and deep (74 feet at the dam). The average annual discharge is 406 cfs providing an average hydraulic retention time of about 12 days. Average annual drawdown is about 11 feet. Bear Creek Reservoir stratifies in the summer and develops hypolimnetic anoxia. Another water quality concern is abandoned strip mines in the watershed.

Little Bear Creek Reservoir

Little Bear Creek Reservoir is relatively short (7.1 miles long) and deep (84 feet at the dam). It has a surface area of 1600 acres. With an average annual discharge of 109 cfs, the hydraulic retention time is 209 days. Compared to Bear Creek Reservoir, the lower flow into the reservoir and larger reservoir volume make the retention time much longer in Little Bear Creek Reservoir. Average annual drawdown is about 12 feet.

Cedar Creek Reservoir

Like the other reservoirs in the Bear Creek watershed, Cedar Creek Reservoir is small (only nine miles long and 4200 acres surface area) and deep (79 feet at the dam). The low average annual discharge from the dam (313 cfs) creates a relatively long average retention time (152 days). This combination of physical features lead to thermal stratification and hypolimnetic anoxia in the summer. Average annual drawdown is about 14 feet.

Reservoir: Bear **1999 Score: 52%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1993	60		
1994	56	**60**	
1995	46	**51**	
1996	47	**47**	
1997	42	**42**	
1999		**52**	

Bear	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	R 1.2				1.2
DO	R 1.0				1.0
Fish	Y 4.0				4.0
Benthos	Y 3.0				3.0
Sediment	G 2.5				2.5
Total	11.7				11.7

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.2				0.2
0.0				0.0
0.0				0.0
2.0				2.0
0.0				0.0
2.2				2.2

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Bear Creek was poor again in 1999. Chlorophyll and DO rated poor. The average chlorophyll concentration declined substantially from previous years (1995 through 1997), but still remained elevated enough to warrant a poor rating. Much of the water column had low DO (<2ppm) during the summer months with extended periods (July - September) of anoxic conditions near bottom. Benthos was represented by animals tolerant of poor conditions. The fish assemblage rated fair, but was only one point below the rating of good.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Since first monitored in 1993, Bear Creek Reservoir has rated poor or at the low end of the fair range. High chlorophyll and low DO are consistent problems for this reservoir. Chlorophyll levels (and nutrient levels) are much higher in Bear Creek Reservoir than in the neighboring two reservoirs (Little Bear Creek and Cedar Creek). As compared to 1995, 1996, and 1997 (summer average 18.3, 21.9, and 27.0 mg/m^3, respectively), chlorophyll levels declined substantially in 1999 (summer average 15.6 mg/m^3), but remained higher than desired. The fish assemblage has consistently scored on the upper end of the fair range to good. Sediments scores have been good with no analytes exceeding the guidelines. The benthic community has scored fair in all years except 1997 (poor) which had significantly lower density.

Aquatic Macrophytes in 1999: Not an issue on Bear Creek Reservoir.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Bear Creek Reservoir. TVA sampled channel catfish and largemouth bass from Bear Creek in autumn 1999 but results were not available at the time this document was prepared. Fish last sampled from Bear Creek in 1996 had contaminant levels either below detection levels or below the levels used by the state of Alabama to issue fish consumption advisories.

Status of Swimming Advisories in 1999: There are no swimming advisories on Bear Creek Reservoir. Fecal coliform bacteria levels in samples collected at the swimming beaches at Piney Point and Horseshoe Bend in 1999 were within State of Alabama guidelines for water contact.

Reservoir: Little Bear **1999 Score: 69%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1993	64		
1994	64	**64**	
1995	69	**64**	
1996	64	**64**	
1997	64	**64**	
1999		**69**	

Little Bear	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0				5.0
DO	R 1.0				1.0
Fish	G 4.0				4.0
Benthos	Y 3.0				3.0
Sediment	G 2.5				2.5
Total	15.5				15.5

Change between 1996 and 1997				
FB	TZ	Emb	Inf	Total
0.0				0.0
0.0				0.0
-1.0				-1.0
2.0				2.0
0.0				0.0
1.0				1.0

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Little Bear Creek Reservoir was fair again in 1999. Chlorophyll, fish, and sediment rated good and ~~fish~~ benthos rated fair. DO was very poor due to anoxic conditions and extended periods (June through September)of greater than 50% of the water column and greater than 80% of the bottom length having concentrations <2 mg/l. Because of the low DO, expectations are low for the benthic community. Benthos is sparse and dominated by tolerant organisms, but the occurrence of a few less tolerant taxa helped bring the score into the fair range. The fish assemblage had a lower catch rate than expected, but a fair number of species and good composition among species and trophic structure..

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Little Bear Creek Reservoir scored 69 compared to 64 in all previous years (1999 criteria). The DO has been poor in all years, chlorophyll and sediment good, and benthos fair or poor. The fish assemblage has consistently rated in the upper end of the fair range or good.

Aquatic Macrophytes in 1999: Not an issue on Little Bear Creek

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Little Bear Creek Reservoir. The last time TVA sampled channel catfish and largemouth bass from Little Bear Creek Lake was in autumn 1999. Catfish fillets were analyzed for pesticides, PCBs, and metals bass fillets for mercury. Results were not available at the time this document was prepared. They were provided to the state agencies in Alabama when available.

Status of Swimming Advisories in 1999: There are no swimming advisories on Little Bear Creek Reservoir. Fecal coliform bacteria levels in samples collected at the swimming beaches at Elliot Branch and Williams Hollow in 1999 were within State of Alabama guidelines for water contact.

Reservoir: Cedar **1999 Score: 73%**

	Previous Scores		
	Reported	1999 Criteria	Comments
1993	56		
1994	80	**72**	
1995	60	**60**	
1996	64	**64**	
1997	69	**69**	
1999		**73**	

Cedar	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0				5.0
DO	R 1.0				1.0
Fish	Y 4.0				4.0
Benthos	G 4.0				4.0
Sediment	G 2.5				2.5
Total	16.5				16.5

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.0				0.0
0.0				0.0
-1.0				-1.0
2.0				2.0
0.0				0.0
1.0				1.0

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Cedar Creek Reservoir was good in 1999 with good ratings for chlorophyll, benthos, and sediment. Fish rated fair and DO poor. The fish assemblage was in fair condition with good species diversity and fair overall composition, but low catch rate and high percent of anomalies. Cedar Creek had very poor DO rating because of anoxic conditions and a large proportion (> 40%, June through August) of the water column with DO concentrations <2.0 mg/l. The good rating for the benthos was driven by the occurrence of mayflies and the low composition of oligochaetes.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological health score for Cedar Creek Reservoir has ranged from 60 to 73. The most significant problem continues to be the low (<2 mg/l) DO concentrations during the summer. A problem common to all the reservoir in the Bear Creek system. Much of the variation in the ecological health score has been due to fluctuations in the rating for the benthos (good in 1994, poor in 1995, fair in 1996, poor in 1997, and good in 1999). Because of the poor DO conditions, the benthos is sparse and ratings are easily influenced by the absence or presence of a few taxa. Although the reasoning is not understood, this seems to cause more fluctuation in benthos ratings on Cedar Creek than on Bear Creek or Little Bear Creek reservoirs. On the good side, average chlorophyll concentration have remained good (low), no analytes have been detected in the sediment, and the fish assemblage has remained in the upper end of the fair range or good.

Aquatic Macrophytes in 1999: Not an issue on Cedar Creek.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Little Bear Creek Reservoir. The last time TVA sampled channel catfish and largemouth bass from Little Bear Creek Lake was in autumn 1999. Catfish fillets were analyzed for pesticides, PCBs, and metals bass fillets for mercury. Results were not available at the time this document was prepared. They were provided to the state agencies in Alabama when available.

Status of Swimming Advisories in 1999: There are no swimming advisories on Cedar Creek Lake. Fecal coliform bacteria levels in samples collected at the swimming beach at Slickrock Ford in 1999 were within State of Alabama guidelines for water contact.

WHEELER RESERVOIR - ELK RIVER WATERSHED

The Wheeler Reservoir - Elk River watershed drains about 5140 square miles in north central Alabama and south central Tennessee. Wheeler Reservoir is the fourth of nine reservoirs on the Tennessee River. About 24,500 square miles of the Tennessee Valley are upstream of this watershed. Wheeler Reservoir receives an average annual inflow of 41,790 cfs from Guntersville Dam. Discharges from Wheeler Dam average 50,630 cfs on an annual basis leaving 8840 cfs which originate within the watershed.

The largest tributary to Wheeler Reservoir is the Elk River, which has a drainage area of about 2250 square miles and contributes about 3000 cfs. The remaining flow enters from tributaries directly to Wheeler Reservoir.

Wheeler Reservoir is the largest reservoir within this watershed followed by Tims Ford Reservoir on the Elk River. There are four Vital Signs monitoring sites on Wheeler Reservoir--forebay, transition zone, inflow, and the Elk River embayment. Two sites are monitored for Vital Signs on Tims Ford Reservoir--forebay and mid-reservoir. Woods Reservoir on the Elk River is not included in this monitoring program because it is property of the Arnold Engineering Development Center, Arnold Air Force Base.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Wheeler Reservoir

Wheeler Reservoir has the third-largest surface area (67,100 acres) of all reservoirs in the TVA system. It is 74 miles long (dam at TRM 274.9) and has 1063 miles of shoreline. Average annual discharge is about 50,630 cfs which provides an average hydraulic retention time of about 12 days. Information collected in 1990 and 1991 indicated a more riverine than transition environment at TRM 307.5; consequently, in 1992 the transition zone sampling location was relocated further downstream to TRM 295.9. Results since the relocation indicate the new site is at the upstream end of the transition zone area. This means that the site may be too far upstream under moderate to high flow conditions.

The Elk River joins the Tennessee River in the downstream portion of Wheeler Reservoir at about mile 284 and provides, on the average, about 6 percent of the flow through Wheeler Reservoir.

Vital Signs monitoring activities were expanded in 1993 to include a site in the Elk River embayment. The Elk River embayment covers about 4900 acres. Given the relatively high flows in the Elk River (about 3000 cfs annual average), there is substantial water exchange in this embayment.

Tims Ford Reservoir

Tims Ford Reservoir in middle Tennessee is formed by Tims Ford Dam at Elk River mile (ERM) 133.3. The reservoir is 34 miles long at full pool and has a surface area of 10,600 acres. The depth at the dam is 143 feet and the average depth is about 50 feet. Average annual discharges from Tims Ford Dam are about 980 cfs, resulting in a hydraulic residence time of about 270 days. Tims Ford Reservoir is designed for a useful controlled drawdown of 30 feet (895-865 feet MSL) for flood protection; however, annual drawdowns average about 18 feet.

Reservoir: Wheeler **1999 Score: 60%**

	---------Previous Scores--------- Reported	1999 Criteria	Comments
1991	89		(no embayment/no transition)
1992	80		(no embayments)
1993	72		(82 if Elk River were excluded)
1994	75	**74**	(81 if Elk River were excluded)
1995	69	**68**	(77 if Elk River were excluded)
1997	76	**75**	(84 if Elk River were excluded)
1999		**60**	(66 if Elk River were excluded)

Wheeler	1999 Results									
	FB		TZ		Emb		Inf		Total
Chlorophyll	R	1.5	G	4.6	R	1.0			7.1
DO	R	2.0	G	5.0	R	2.0	G	ns	9.0
Fish	Y	3.0	Y	2.0	Y	3.0	Y	3.0	11.0
Benthos	Y	2.0	G	5.0	R	2.0	Y	3.0	12.0
Sediment	G	2.5	G	2.5	G	2.5			7.5
Total		11.0		19.1		10.5		6.0	46.6

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
-1.2	-0.1	-1.0		-2.3
-3.0	0.0	1.0		-2.0
-1.0	-1.0	-1.0	-1.0	-4.0
-1.0	0.0	0.0	-1.0	-2.0
0.0	0.0	0.0		0.0
-6.2	-1.1	-1.0	-2.0	-10.3

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Wheeler Reservoir was fair in 1999; just above poor with an overall score of 60. The relatively low score was caused by most indicators rating either poor or fair; only sediment quality rated good at all sites. Chlorophyll and DO rated poor at two sites and benthos at one. Chlorophyll concentrations were quite high during most sample periods at both the forebay and the Elk River embayment resulting in the poor ratings for these sites. Low DOs (<2.0 mg/L) occurred during summer at both these site; at times comprising up to 25% of the water column and 75% of the bottom length. The benthos rated poor at the Elk River embayment site where oligochaetes dominated the relatively sparse community. The fish index rated fair for all sites due to low catch rates and low (fair) species diversity.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The fair, almost poor, ecological health score for Wheeler Reservoir in 1999 is lower than scores for previous years which have scored either good or at the high end of the fair range. Conditions at the Elk River embayment site are usually poor – 1999 was no exception (high chlorophyll concentrations, low DOs, and poor benthos). The biggest differences for 1999 occurred at the forebay, where most indicators typically rate good or fair. In 1999, chlorophyll and DO rated poor, fish and benthos fair, and sediment quality good. Much of the summer of 1999 was characterized by low flows, which would have increased reservoir retention time thereby allowing increased algal production and greater time for oxygen demand to be manifested. Of the four monitoring sites on Wheeler, the forebay is the one most likely to reflect poor conditions under low flow conditions. This appeared to be the case in 1999 and in previous low flow periods (1993 and 1995).

Aquatic Macrophytes in 1999: Surface coverage for previous years was estimated to be in the range of 5,000 to 7,500 acres. Casual observations in 1999 indicated about the same coverage.

Status of Fish Consumption Advisories in 1999: The State of Alabama advises people not to eat channel catfish, brown bullhead, small mouth buffalo, big mouth buffalo, and white bass from the Indian Creek embayment on Wheeler Lake because of DDT contamination. TVA last sampled channel catfish (fillets analyzed for pesticides, PCBs, and metals) and largemouth bass (mercury) in autumn 1999. Results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Wheeler Reservoir. Fecal coliform bacteria levels in samples collected at five swimming beaches and four boat ramps in 1999 were all within State of Alabama guidelines for water contact.

GUNTERSVILLE RESERVOIR - SEQUATCHIE RIVER WATERSHED

This watershed includes Guntersville Reservoir and all tributaries draining directly to Guntersville Reservoir. As with the other watershed areas on the mainstem of the Tennessee River, most of the water leaving the watershed through Guntersville Dam enters the watershed area through discharges from the upstream dam (Nickajack). About 37,200 cfs enter from Nickajack Dam and about 41,800 cfs is discharged from Guntersville Dam on an annual average basis. The remaining 4600 cfs originates with the Guntersville Reservoir-Sequatchie River watershed area. The largest contributor of this flow is the Sequatchie River (about 800 cfs). The total watershed area is 2669 square miles. The area drained by the Sequatchie River is about 600 square miles.

Guntersville Reservoir is the dominant characteristic of this watershed. There are three Vital Signs monitoring site on Guntersville Reservoir: forebay, transition zone, and inflow.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on Guntersville Reservoir. It also provides planned activities in the future .

Guntersville Reservoir

Guntersville Dam, located at TRM 349.0, creates a 76 mile long reservoir with a surface area of 67,900 acres and a shoreline of 949 miles at full pool. Average annual discharge is about 41,800 cfs, corresponding to an average hydraulic retention time of about 12 days.

Guntersville Reservoir is similar to Wheeler Reservoir in several size characteristics, but it differs in one important feature. The average controlled storage volume of Guntersville is about half that of Wheeler. This is due to the shallow nature of Guntersville Reservoir at the inflow area and extensive shallow overbank areas. As a result, winter drawdown on Guntersville Reservoir is nominal to maintain navigation. The shallow drawdown allows the large overbank areas to be permanently wetted creating good habitat for aquatic macrophytes. Guntersville has the greatest area coverage of aquatic plants of any TVA reservoir.

The Sequatchie River joins the Tennessee River at about TRM 423, in the upstream portion of Guntersville Reservoir, just downstream from Nickajack Dam. On the average the Sequatchie River contributes less than 2 percent to the total flow of the Tennessee River through Guntersville Reservoir.

Data collected in 1990 and 1991, indicated a more riverine than transition environment at TRM 396.8. Consequently, in 1992 the transition zone sampling location was relocated further downstream to TRM 375.2.

NICKAJACK RESERVOIR - CHICKAMAUGA RESERVOIR WATERSHED

Nickajack and Chickamauga Reservoirs are primary features of this watershed. The Hiwassee River is the only sizeable tributary which merges with the Tennessee River within the watershed area. The drainage basin of the Hiwassee River is large enough to be designated a separate watershed. The remaining area drained by tributaries to these two reservoirs is 1780 square miles. On an annual average basis, about 3900 cfs is contributed to the Tennessee River from streams within this watershed. This compares to 27,700 cfs entering the upper end of Chickamauga Reservoir from Watts Bar Dam and 5600 cfs from the Hiwassee River, for a total average annual discharge from Nickajack Dam of 37,200 cfs.

There are two Vital Signs monitoring sites on Nickajack Reservoir, one at the forebay and one at the inflow. There is no transition zone site on Nickajack because the reservoir is short and water exchange is quite rapid. This causes conditions at the location which might be considered the transition zone to be similar to conditions at the forebay. Chickamauga Reservoir has four Vital Signs monitoring sites--the forebay, the transition zone, the inflow, and a new site established in 1993 in the Hiwassee River embayment.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Nickajack Reservoir

Nickajack Reservoir is one of the smallest reservoirs on the mainstem of the Tennessee River. With the dam at TRM 424.7, Nickajack has a length of 46 miles, surface area of 10,370 acres, and a shoreline of 192 miles at full pool. Average annual discharge from Nickajack is approximately 37,200 cfs which provides an average hydraulic retention time of only about three or four days, the shortest retention time among the reservoirs monitored in this program.

Results from the 1990 and 1991 monitoring indicated that both the forebay and transition zone sampling sites had quite similar water quality. This was expected since the two sites are relatively close together (separated by only 7.5 river miles), and Nickajack is a well-mixed, run-of-the-river reservoir. Therefore, sampling at the transition zone in Nickajack Reservoir was discontinued in 1992.

Chickamauga Reservoir

Chickamauga Dam is located at TRM 471.0. The reservoir is 59 miles long, has 810 miles of shoreline, and has a surface area of 35,400 acres at full pool. The average annual discharge is approximately 34,900 cfs which provides an average hydraulic retention of nine to ten days.

The Hiwassee River, a major tributary to the Tennessee River, flows into the middle portion of Chickamauga Reservoir at about TRM 499. The flow from the entire Hiwassee River watershed contributes approximately 16 percent of the flow through Chickamauga Reservoir. About 10 percent of the 16 percent is from the Ocoee River and tributaries in the lower end of the Hiwassee watershed (i.e., downstream of Apalachia Dam).

Vital Signs monitoring activities were expanded in 1993 to include a site in the Hiwassee River embayment, which covers about 6500 acres. Given the relatively high flows in the Hiwassee River (about 5600 cfs annual average), there is substantial water exchange in this embayment, much greater than in any of the other three embayments monitored.

Reservoir: Nickajack **1999 Score: 85%**

	Previous Scores		
	Reported	1999 Criteria	Comments
1991	89		
1992	83		
1993	88		
1994	90	**91**	
1995	92	**89**	
1997	88	**88**	
1999		**85**	

Nickajack	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0				5.0
DO	G 5.0			G ns	5.0
Fish	Y 3.0			G 4.0	7.0
Benthos	G 5.0			G 4.0	9.0
Sediment	Y 1.5				1.5
Total	19.5			8.0	27.5

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.3				0.3
0.0				
0.0			0.0	0.0
0.0			-1.0	-1.0
0.0				0.0
0.3			-1.0	-0.7

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Nickajack Reservoir was good in 1999, same as previous years. Most all of the ecological indicators rated good. The only fair ratings were fish and sediment at the forebay (same as 1997). The fish assemblage had fewer species and lower catch rates than expected, and low levels of PCBs were present in the sediment.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Since Vital Signs monitoring began in 1990, the ecological health of Nickajack Reservoir has consistently rated good and has been among the highest of the 31 reservoirs monitored. Nickajack is a small, narrow reservoir with short retention time (3 to 4 day average, the shortest among the reservoirs monitored), which prevents thermal stratification and limits algal productivity. This helps to maintain better overall oxygen concentrations throughout the water column, and chlorophyll levels remain relatively low. The only indicator to have ever received a poor rating was DO at the inflow just downstream of Chickamauga Dam. This occurred in 1992 and 1993, concurrent with low summer flows and intermittent low DO releases from Chickamauga Dam. In 1997 and 1999, the fair rating for the fish at the forebay represented a decrease in rating from previous years. This resulted from collecting fewer fish and fewer species than expected (only electrofishing). As in previous years, low levels of PCBs were present in the forebay sediment.

Aquatic Macrophytes in 1999: About 1400 acres, compared to about 600-1000 throughout the 90's.

Status of Fish Consumption Advisories in 1999: The State of Tennessee has issued a precautionary advisory for channel catfish from Nickajack Reservoir because of PCB contamination. The last time TVA did a complete screening of fish from Nickajack was autumn 1997. The results, which were provided to state agencies, were similar to previous years. Channel catfish were collected in autumn 1999and fillets analyzed for PCBs. Results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Nickajack Lake, although the State of Tennessee advises against water contact in Chattanooga Creek and in the lower five miles of Stringer's Branch.. TVA checked fecal coliform bacteria levels at Shellmound recreation area, Marion County Park, Smiths Camp-on-Lake, and Maple View recreation area in 1999 and found high concentrations of fecal coliform bacteria following rain events, when bacteria levels typically go up due to local runoff. In addition, large numbers of waterfowl were present at Smith's Camp-on-Lake beach and are a likely source of contamination.

Reservoir: Chickamauga **1999 Score: 82%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1991	90		
1992	73		
1993	83		
1994	87	**85**	
1995	81	**78**	
1997	88	**86**	
1999		**82**	

Chickamauga	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0	R 2.5	G 4.9		12.4
DO	G 4.5	G 5.0	G 5.0	G ns	14.5
Fish	Y 4.0	Y 4.0	G 4.0	Y 4.0	16.0
Benthos	Y 4.0	G 5.0	Y 3.0	Y 3.0	15.0
Sediment	Y 2.0	G 2.5	Y 1.5		6.0
Total	19.5	19.0	18.4	7.0	63.9

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
1.0	-2.5	0.1		-1.4
-0.5	0.0	0.0		
1.0	1.0	0.0	-1.0	1.0
0.0	0.0	-1.0	-1.0	-2.0
0.5	0.0	-1.0		-0.5
2.0	-1.5	-1.9	-2.0	-2.9

Summary/Key Ecological Health Finding for 1999: The overall ecological condition for Chickamauga Reservoir was good in 1999. The only ecological indicator to rate poor was chlorophyll at the transition zone. Chlorophyll concentrations at all locations were elevated in spring and early summer 1999, but especially so at the transition zone. Longer reservoir retention times such as those in 1999 (due to lower than normal rainfall and decreased reservoir flows) are expected to produce higher concentrations in reservoirs such as Chickamauga where retention time is the primary limiting factor. The fair ratings for sediments at the forebay and Hiwassee River embayment sites were due to elevated concentrations of copper and zinc; probably associated with past mining activities in the Copper Basin.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Ecological conditions in Chickamauga Reservoir were good in 1999, same as previous years The only indicator expected to rate in the poor or fair category on a year-to-year basis is sediment quality due to elevated concentrations of selected metals (generally zinc and copper); the result of historic mining activities in the Ocoee watershed. Two other indicators are negatively influence during years when low flows exist, which was the case in 1999. High chlorophyll levels were found at the transition zone and embayment sites; in fact, the highest summer average observed to date for these sites were found in 1999. Concentrations at the transition zone rated poor but those at the embayment site, although elevated, were still sufficiently low to rate good. Low DO levels did not occur in 1999 as they had during past low flow years. This is likely due to the recently activated oxygen injection systems at Watts Bar and Fort Loudoun dams.

Aquatic Macrophytes in 1999: TVA no longer monitors coverage of aquatic macrophytes. Casual observations on Chickamauga Reservoir in 1999 indicated coverage of about 2,500 acres.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Chickamauga. Channel catfish and largemouth bass were last collected for tissue analysis in autumn 1999. Results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Chickamauga Reservoir. Seventeen sites were sampled for fecal coliform bacteria in 1999. All but four of these sites were within the State of Tennessee guidelines for water contact. Large numbers of waterfowl (Canadian geese) may have been an important source at some of these sites.

HIWASSEE RIVER WATERSHED

The headwaters of the Hiwassee River extend into the Blue Ridge Mountains in Tennessee, North Carolina, and Georgia. Streams in this watershed have naturally low concentrations of nutrients and dissolved minerals. These streams change from steep gradient, cold water trout streams in the mountains to lower gradient warm water streams in the valley.

The Hiwassee River Watershed has an area of 2700 square miles and an average annual discharge to the Tennessee River of 5640 cfs. The confluence of the Hiwassee River with the Tennessee River is in Chickamauga Reservoir at Tennessee River Mile 499.4. The lower portion of the Hiwassee River is impounded by backwater from Chickamauga Dam. The impounded portion of the Hiwassee River forms a large embayment (about 6500 surface acres) which extends over 20 miles up the Hiwassee River.

The largest tributary to the Hiwassee River is the Ocoee River, with a drainage area of about 640 square miles. Due to past copper mining and industrial activities in the Copperhill area, several streams and reservoirs in the Ocoee River basin have degraded water quality.

There are eight TVA reservoirs in the Hiwassee River. Through 1996, Vital Signs monitoring activities were conducted on only the five largest reservoirs: Hiwassee Reservoir (forebay and mid-reservoir); Chatuge Reservoir (forebay sites on the Hiwassee River and Shooting Creek arms); Nottely Reservoir (forebay and mid-reservoir); Ocoee Reservoir No. 1 (forebay only); and Blue Ridge Reservoir (forebay only). Beginning in 1997, Apalachia (forebay only) was added to the sampling schedule for the full complement of indicators; two indicators (benthic community and fish assemblage had been sampled in 1996). Ocoee No. 2 and Ocoee No. 3 Reservoirs are not included in this monitoring because of their small size.

Vital Signs monitoring also includes a site on the Hiwassee River embayment (at HiRM 10) of Chickamauga Reservoir with results reported with the Chickamauga/Nickajack Watershed.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Apalachia Reservoir

Apalachia Reservoir is formed by Apalachia Dam at Hiwassee River mile 66.0 in western North Carolina near the Tennessee state line. At full pool elevation, the reservoir is 10 miles long, covers 1100 acres, and has a maximum depth of about 110 feet at the dam. Long-term flows from

Apalachia Dam average about 2090 cfs which result in an average hydraulic retention time of about 14 days. The annual drawdown averages about 4 feet on Apalachia Reservoir.

Hiwassee Reservoir

Hiwassee Reservoir, in the southwestern corner of North Carolina, is the second-largest of the five reservoirs in the Hiwassee River watershed included in the Vital Signs monitoring program. Hiwassee Reservoir is impounded by Hiwassee Dam at river mile 75.8. At full pool level, its backwater storage pool is about 22 miles long, 6100 acres in surface area, and has a mean depth of about 69 feet (with a maximum depth of about 255 feet at the dam). It has an average annual discharge of about 2060 cfs and average residence time of about 103 days. Hiwassee Reservoir has an average annual drawdown of 45 feet.

Chatuge Reservoir

Chatuge Reservoir is located on the Georgia-North Carolina state line in northeastern Georgia and is formed by Chatuge Dam at Hiwassee River mile (HiRM) 121.0. At full pool elevation, the reservoir is 13 miles long and has a surface area of about 7000 acres. Its maximum depth at the dam is 124 feet, and it has a mean depth of 33 feet. An average annual discharge of 464 cfs results in an average hydraulic residence time of about 254 days. Chatuge Reservoir has a potential useful controlled storage of 23 feet (1928-1905 feet MSL), however, the annual drawdown averages only ten feet.

Only the forebay of Chatuge Reservoir was monitored prior to 1993. A new monitoring site was added in 1993 in the Shooting Creek arm to further evaluate this rather large part of the lake. Because of its physical features, the Shooting Creek site would be expected to be representative of forebay conditions.

Nottely Reservoir

Nottely Reservoir is formed by Nottely Dam at Nottely River mile 21.0 in northern Georgia. At full pool elevation, the reservoir is 20 miles long, covers 4200 acres, and has a mean depth of 40 feet, with a maximum depth of about 165 feet at the dam. Long-term flows from Nottely Dam average about 420 cfs which result in an average hydraulic retention time of about 205 days. The annual drawdown averages about 24 feet on Nottely Reservoir.

Blue Ridge Reservoir

Blue Ridge Dam impounds the Toccoa River at mile 53.0 in rural northwest Georgia. The watershed is mountainous and forested, with a significant portion of the basin lying within the Chattahoochee National Forest. At full pool, Blue Ridge Reservoir is about 11 miles long, 3300 acres in surface area, and 155 feet deep at the dam, with a average depth of 59 feet. The rate of discharge of water from Blue Ridge Reservoir averages about 615 cfs, which results in an average theoretical residence time of 158 days. The annual drawdown of Blue Ridge Reservoir averages 36 feet.

Ocoee Reservoir No. 1 (Parksville Reservoir)

Ocoee No. 1 Reservoir, also known as Parksville Reservoir, is formed by Ocoee No. 1 Dam at Ocoee River mile 11.9. At full pool elevation, the reservoir has a surface area of about 1900 acres and length of 7.5 miles. Ocoee No. 1 Reservoir is located downstream from the Copper Basin, and decades of erosion have caused significant filling of the reservoir. Ocoee No. 1 Reservoir has lost about 25 percent of its original volume, has an average depth of 45 feet and is about 115 feet deep at the dam. An average annual discharge of about 1426 cfs from Ocoee No. 1 Dam results in a reservoir retention time of approximately 30 days. Although Ocoee No. 1 Reservoir is not operated for flood control (only for peaking power generation), its annual drawdown averages about seven feet.

Reservoir: Apalachia **1999 Score: 59%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1995	n/s	n/s	(Not part of Vital Signs Monitoring prior to 1996)
1996	60	**60**	(Only fish and benthos data in 1996)
1997	73	**69**	
1998	66	**61**	
1999		**59**	

Apalachia	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	Y 3.3				3.3
DO	Y 3.5				3.5
Fish	R 2.0				2.0
Benthos	Y 2.0				2.0
Sediment	G 2.5				2.5
Total	13.3				13.3

Change between 1998 and 1999				
FB	TZ	Emb	Inf	Total
-1.0				-1.0
0.0				0.0
-1.0				-1.0
1.0				1.0
0.5				0.5
-0.5				-0.5

Summary/Key Ecological Health Finding for 1999: The overall ecological health rating for Apalachia Reservoir was fair in 1999. Of the five indicators, only sediment quality rated good. Of the other four indicators three rated fair and one poor. The fair rating for DO was due a small zone of low DO water confined to the bottom in the original river channel in late summer. The fair rating for the benthos (near the lower end of the fair range) and poor rating for the fish assemblage resulted from collection of relatively few organisms, which in turn had a negative effect on several of the characteristics (metrics) used to evaluate these groups. Chlorophyll rated fair because of higher than expected concentrations for a reservoir in this nutrient poor watershed.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological health score for Apalachia has been in the fair category for the three years in which all five ecological indicators have been monitored. Three of the indicators have provided a relatively consistent rating. The fish assemblage has rated poor during all three years due to low fish density and diversity. Similarly, relatively few benthic macroinvertebrates, although not to the same extent as the fish, have been collected each year resulting in a fair ratings. Each year a small zone of water with low DO concentrations has been found at the bottom of Apalachia resulting in fair rating. Chlorophyll concentrations were within the expected range in 1997 and 1998 and rated good. However, elevated concentration in 1999 resulted in a fair rating. Sediment Quality rated good two years and fair the other due to presence of chlordane at low concentrations.

Aquatic Macrophytes in 1999: Not an issue on Apalachia.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Apalachia Reservoir. TVA last collected fish from Apalachia Reserovir in autumn 1998. Results were provided to North Carolina agencies. All contaminant levels were either below detection levels or below the levels used by the state to issue fish consumption advisories. Fish from Apalachia will be collected for tissue analysis again in autumn 2002

Status of Swimming Advisories in 1999: There are no swimming advisories on Apalachia Lake. Fecal coliform bacteria levels in samples collected at the boat launch in the tailwater of Hiwassee Dam in 1999 were well within State of North Carolina guidelines for water contact.

Reservoir: Chatuge

1999 Score: 49%

	Previous Scores: Reported	1999 Criteria	Comments
1991	60	59	FB only and no sediment, no benthos
1992	56	79	FB only and no sediment, no benthos
1993	67	79	
1994	77	72	
1996	84	78	
1998	52	49	
1999		49	

Chatuge	1999 Results				
	FB	Sh. Cr.	Emb	Inf	Total
Chlorophyll	G 4.3	Y 3.8			8.1
DO	R 1.5	R 1.5			3.0
Fish	Y 3.0	Y 3.0			6.0
Benthos	R 1.0	R 2.0			3.0
Sediment	Y 1.5	R 0.5			2.0
Total	11.3	10.8			22.1

Change between 1998 and 1999				
FB	Sh. Cr.	Emb	Inf	Total
0.4	0.1			0.4
-0.5	0.5			0.0
1.0	1.0			2.0
-2.0	-1.0			-3.0
0.5	0.0			0.5
-0.6	0.6			-0.1

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Chatuge Reservoir rated poor based on 1999 monitoring results. Two of the five indicators (DO and benthos) rated poor at both the forebay and Shooting Creek sites. Only one indicator – chlorophyll at the forebay – received a good rating in 1999. The poor rating for DO occurred because low (<2 ppm) DO concentrations were found near bottom. The poor rating for the benthic macroinvertebrates occurred because only a few animals were collected. In fact, 3 of the 10 samples at the forebay and 5 of the 10 at Shooting Creek contained no animals at all. Sediment quality rated fair at the forebay due to a high concentration of copper and poor at Shooting Creek due to high levels of copper, chromium, and nickel. The fish assemblage rated fair at both monitoring sites – relatively few fish were collected but they represented a variety of species. The rating for chlorophyll was good at the forebay and fair at Shooting Creek where concentrations were relatively high for a lake in the Blue Ridge Ecoregion and hence rated fair.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The poor rating for Chatuge in 1999 (49) matches that in 1998 (49), which was in stark contrast to good ratings for previous years (78, 72, and 79 in 1996, 1994,and 1993, respectively). In fact, the reason Chatuge was included in the monitoring rotation in 1999 despite being a planned "off" year was because of the substantial decrease in ecological health score in 1998. The issues in 1998 were low DO levels, relatively high chlorophyll levels, and poor ratings for the fish assemblage. Similar issues were found in 1999; the primary exception being improved ratings for the fish assemblage (fair) yet a decline in ratings for the benthos (poor). Also, anoxic conditions did not occur in 1999 as in 1998 when rotten egg odors were reported in the Chatuge Dam tailwater area. Although it was not possible to identify the reasons(s) responsible for the decline in ecological condition in 1998, it was speculated that the very dry, hot weather which occurred in late summer was a likely contributing factor. This unusual weather pattern occurred again in 1999 and Chatuge was again characterized by poor ecological conditions. Chatuge will be monitored again in 2000 - it will be interesting to see if a more normal weather pattern results in improved ecological conditions.

Aquatic Macrophytes in 1999 : Not an issue on Chatuge Reservoir.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Chatuge Lake. The last time TVA sampled channel catfish and largemouth bass from Chatuge Lake was in autumn 1996. Fillets were analyzed for pesticides, PCBs, and metals. The results were provided to state agencies in Georgia. All contaminant levels were either below detection levels or below the levels used by the state to issue fish consumption advisories. Chatuge will be sampled again in autumn 2000.

Status of Swimming Advisories in 1999: There are no swimming advisories on Chatuge Lake. Fecal coliform levels in samples collected at Jackrabbit Campground, Clay County Park, and the boat ramps at Chambers Cove and Chatuge Dam in 1999 were well within North Carolina guidelines for water contact. Hiwassee Beach Towns County recreation area was also sampled in 1999 and met Georgia guidelines for water contact.

Reservoir: Nottley **1999 Score: 48%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1991	60		(No benthos or sediment data in 1991)
1992	60		(No benthos or sediment data in 1992)
1993	64		
1994	56	**56**	
1995	47	**49**	
1997	48	**48**	
1999		**48**	

Nottely	1999 Results				
	FB	Mid	Emb	Inf	Total
Chlorophyll	R 1.0	R 1.0			2.0
DO	R 1.5	R 1.0			2.5
Fish	Y 3.0	Y 3.0			6.0
Benthos	R 2.0	Y 4.0			6.0
Sediment	G 2.5	G 2.5			5.0
Total	10.0	11.5			21.5

Change between 1997 and 1999				
FB	Mid	Emb	Inf	Total
-0.6	0.0			-0.6
0.5	0.0			0.5
0.0	-1.0			-1.0
0.0	1.0			1.0
0.0	0.0			0.0
-0.1	0.0			-0.1

Summary/Key Ecological Health Finding for 1999: Nottely had a poor ecological health score (48) in 1999. The only indicator which rated good was sediment. Chlorophyll and DO rated poor at both monitoring sites. Chlorophyll concentrations at the mid-reservoir site were higher than any previous year except 1997 when maximum levels were found. Concentrations at the forebay were the highest found to date. Considering the low chlorophyll concentrations expected for reservoirs in nutrient poor watersheds such as the Hiwassee River, these high concentrations in Nottely indicate local sources of nutrient enrichment. The poor ratings for DO were driven by existence of near anoxic conditions with low DO concentrations extending from the bottom upwards to as much as 50% of the water column during mid-August to mid-September. Benthos scores at the forebay were poor. Samples contained relatively few animals and those collected are known to be tolerant of poor water quality conditions.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The most notable observation in the 1999 results was the high chlorophyll concentrations, especially at the forebay. Chlorophyll concentrations have historically been higher in Nottely than the other reservoirs in the Blue Ridge Ecoregion (e.g., Blue Ridge, Chatuge, Hiwassee), but the 1997 and 1999 levels were almost twice the already high levels observed in previous. Another consistent problem in Nottely is low DO concentrations at mid and bottom strata – observed every year since monitoring began in 1991. The overall ecological health rating for Nottely Reservoir has been poor since 1994. Prior to that the rating was fair, but just above the level considered poor. It appears cultural eutrophication is taking a toll on this reservoir.

Aquatic Macrophytes in 1999: Not an issue on Nottely Reservoir.

Status of Fish Consumption Advisories in 1999: The State of Georgia advises against eating more than one meal per week of largemouth bass from Nottely Reservoir because of mercury contamination. TVA last sampled fish from Nottely in autumn 1997. The results, which were provided to state agencies in Georgia for appropriate action, were similar to previous years.

Status of Swimming Advisories in 1999: There are no swimming advisories on Nottely Reservoir. Poteet Creek recreation area and Butternut Creek at the Union County Recreation Complex were sampled in 1999. Butternut Creek did not meet State of Georgia guidelines for water contact due to continuously high concentrations of fecal coliform bacteria.

Reservoir: Blue Ridge **1999 Score: 84%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1991	87		(no benthos/no sediment)
1992	73		(no benthos/no sediment)
1993	72		
1994	86	**80**	
1995	84	**84**	
1997	82	**82**	
1999		**84**	

Blue Ridge	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0				5.0
DO	G 4.5				4.5
Fish	G 4.0				4.0
Benthos	Y 3.0				3.0
Sediment	G 2.5				2.5
Total	19.0				19.0

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.0				0.0
0.5				0.5
1.0				1.0
-1.0				-1.0
0.0				0.0
0.5				0.5

Summary/Key Ecological Health Finding for 1999: The overall ecological health rating for Blue Ridge was good again in 1999. All indicators except one (benthos) rated good. Of the tributary reservoirs sampled in 1999, Blue Ridge received the highest ecological score. The only fair rating was for the benthic community because diversity (low taxa richness and large proportion of community comprised by the two dominant taxa) was lower than expected. Chlorophyll concentrations were low as expected for a reservoir in this nutrient-poor watershed.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological health score for Blue Ridge has been similar in all years (ranging from 80 - 84) and is consistently among the highest of all reservoirs monitored. The good rating for DO was a return to conditions observed in the early 1990's and an improvement over the fair ratings for DO in 1995 and 1997. During 1995 and 1997 a small proportion of the bottom length (14 and 10%, respectively) at the forebay sample site had DO <2 mg/l. This proportion was smaller (only 1.6%) in 1999 and hence the improved rating.

Aquatic Macrophytes in 1999: Not an issue on Blue Ridge Reservoir.

Status of Fish Consumption Advisories in 1999: The State of Georgia advises against eating more than one meal per week of white bass from Blue Ridge Reservoir due to mercury contamination. TVA last collected channel catfish (fillets analyzed for pesticides, PCBs, and metals) and largemouth bass (fillets analyzed for mercury) in autumn 1997. The results, which were provided to state agencies in Georgia for appropriate action, were similar to previous years.

Status of Swimming Advisories in 1999: There are no swimming advisories on Blue Ridge Reservoir. Samples collected at the swimming beach at the Morgantown Point recreation area in 1999 contained low concentrations of fecal coliform bacteria, easily meeting State of Georgia guidelines for water contact.

Reservoir: Ocoee #1 **1999 Score: 58%**

	Previous Scores		
	Reported	1999 Criteria	Comments
1991	47		(no benthos/no sediment)
1992	53		(no benthos/no sediment)
1993	52		
1994	60	**67**	
1995	71	**67**	
1997	71	**67**	
1999		**58**	

Ocoee #1	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	G 5.0				5.0
DO	G 5.0				5.0
Fish	R 2.0				2.0
Benthos	R 1.0				1.0
Sediment	R 0.0				0.0
Total	13.0				13.0

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.0				0.0
0.0				0.0
-1.0				-1.0
-1.0				-1.0
0.0				0.0
-2.0				-2.0

Summary/Key Ecological Health Finding for 1999: Ecological conditions in Parksville Reservoir rated poor in 1999; just below the fair range. Two indicators (chlorophyll and DO) rated good. Chlorophyll concentrations were quite low, as expected for this nutrient-poor region, and DO concentrations remained relatively high throughout the year. Sediment quality rated poor due to presence of PCBs and high concentrations of several metals. Several metals were found at much higher concentrations than at any of the other Vital Signs monitoring sites – arsenic, cadmium, copper, iron, lead, and zinc (a legacy of past mining activities in the Copper Hill basin). Both fish and benthos rated poor, primarily due to a lack of species diversity and low overall density. Six of the 12 metrics used to evaluate the fish assemblage and 6 of the 7 metrics to evaluate the benthic community received the lowest possible rating of one.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological health score for Parksville was poor in 1999, with the lowest score found to date for this reservoir. As in past years, chlorophyll and DO rated good and sediments rated poor (due to presence of PCB's and high concentrations of metals, a persistent issue on Parksville). The lower score in 1999 was driven by poor ratings for fish and benthos. The benthos had rated either fair or poor in previous years, while the fish assemblage had always rated fair. The fish assemblage sampled in 1999 (poor) was not greatly different than 1997 (fair). A large number of brook silverside were collected in 1997 yet none in 1999 causing the difference in ratings. Fish density and diversity were higher in 1994 and 1995.

Aquatic Macrophytes in 1999: Not an issue on Parksville.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Parksville. TVA studies found elevated PCB concentrations in catfish fillets in the late 1980's and early 1990's. Concentrations were slightly lower in 1995, elevated again in 1996, and lower in 1998, the last year TVA examined contaminants in fish from Parksville Lake. Channel catfish and largemouth bass were collected from Parksville in autumn 1999, but results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Parksville or on the Ocoee River flowing into the reservoir. Fecal coliform bacteria levels were monitored at seven sites in 1999, including two sites on the lake, four sites on the floatway upstream of the lake, and one site downstream of Ocoee #1 Dam. All sites met the State of Tennessee guidelines for water contact.

WATTS BAR RESERVOIR, FORT LOUDOUN RESERVOIR, AND MELTON HILL RESERVOIR WATERSHED

This watershed area is relatively small (2860 square miles) and includes three reservoirs: Fort Loudoun and Watts Bar Reservoirs on the Tennessee River and Melton Hill Reservoir on the Clinch River. All three are run-of-the-river reservoirs with relatively short retention times and annual pool drawdowns of only a few feet. The inflow of Fort Loudoun Reservoir is actually the origin of the Tennessee River. The Holston and French Broad Rivers merge at that point to form the Tennessee River. The Little Tennessee River, another major tributary to the Tennessee River, enters Fort Loudoun Reservoir near the forebay. Watts Bar Reservoir is immediately downstream of Fort Loudoun. The Clinch River, another major tributary, merges with the Tennessee River upstream of the transition zone on Watts Bar Reservoir. Melton Hill Dam bounds the upper end of Watts Bar Reservoir on the Clinch River and Fort Loudoun Reservoir bounds it on the Tennessee River.

Like the other watershed areas formed around one or more of the reservoirs on the mainstream of the Tennessee River, very little of the water leaving this watershed area originates from within. The average annual discharge through Watts Bar Reservoir is about 27,700 cfs. Of this, about 25 percent (6800 cfs) enters from the French Broad River, 16 percent (4500 cfs) from the Holston River, 21 percent (5700 cfs) from the Little Tennessee River, and 17 percent (4600 cfs) from Norris Dam on the Clinch River. Another five percent (1400 cfs) is contributed by the Emory River, a tributary to the Clinch River near the confluence with the Tennessee River. The remaining 17 percent (4700 cfs) originates from streams which drain directly to one of these reservoirs.

Vital Signs monitoring activities are conducted at the forebays, transition zones, and inflows of all three of these reservoirs. Watt Bar Reservoir has two inflow sites, one near Fort Loudoun Dam and one near Melton Hill Dam.

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Watts Bar Reservoir

Watts Bar Reservoir impounds water from both the Tennessee River and one of the major tributaries to the Tennessee River, the Clinch River. The three dams which bound Watts Bar Reservoir are: Watts Bar Dam located at Tennessee River Mile (TRM) 529.9, Fort Loudoun Dam located at TRM 602.3, and Melton Hill Dam located at Clinch River mile (CRM) 23.1. The total length of Watts Bar Reservoir, including the Clinch River arm is 96 miles, the shoreline length is 783

miles, and the surface area is 39,000 acres. The average annual discharge from Watts Bar is approximately 27,700 cfs, providing an average hydraulic retention time of about 18 days.

The confluence of the Clinch and Tennessee Rivers is upstream of the transition zone sampling location in Watts Bar, so biological sampling was conducted at the forebay, transition zone, and both the Tennessee River and Clinch River inflows. Water entering Watts Bar from Melton Hill Reservoir is quite cool due to the hypolimnetic withdrawal from Norris Reservoir (a deep storage impoundment) upstream from Melton Hill. Water entering Watts Bar Reservoir from Fort Loudoun Dam is usually warmer and lower in DO during summer months than water entering from Melton Hill Dam.

The Emory River is a major tributary to the Clinch River arm of Watts Bar Reservoir and supplies about 5 percent of the average annual flow through Watts Bar Reservoir. The Tennessee and Little Tennessee Rivers (i.e., discharge from Fort Loudoun Dam) account for about 75 percent of the flow, and the Clinch River (i.e., discharge from Melton Hill Dam) accounts for about 15 percent through Watts Bar Reservoir.

Fort Loudoun Reservoir

Fort Loudoun Reservoir is the ninth and uppermost reservoir on the Tennessee River with the dam located at TRM 602.3. The surface area and shoreline are relatively small (14,600 acres and 360 miles, respectively) considering the length (61 miles), indicating it is mostly a run-of-the-river reservoir. The average annual discharge from Fort Loudoun Dam is 18,900 cfs which provides an average hydraulic retention time of about ten days.

Fort Loudoun Reservoir (and the Tennessee River) is formed by the confluence of the French Broad and Holston Rivers, with both of these rivers having a major reservoir upstream. Douglas Dam, 32.3 miles up the French Broad River, and Cherokee Dam, 52.3 miles up the Holston River, form deep storage impoundments, each having long retention times. Both of these deep storage impoundments become strongly stratified during summer months resulting in the release of cool, low DO, hypolimnetic water during operation of the hydroelectric units. Some warming and reaeration of the water occurs downstream from Cherokee and Douglas Dams, but both temperature and DO levels are sometimes low when the water reaches Fort Loudoun Reservoir. Installation of aeration facilities at both these dams has helped abate this situation.

Fort Loudoun Reservoir also receives surface waters from the Little Tennessee River, via the Tellico Reservoir canal, which connects the forebays of the two reservoirs. (Since Tellico Dam

has no outlet, under most normal conditions, water flows into Fort Loudoun Reservoir from Tellico Reservoir.) Water from Tellico Reservoir (Little Tennessee River) is often cooler and higher in DO, and has a much lower conductivity than water in Fort Loudoun Reservoir (Tennessee River). In 1992, the forebay sampling location on Fort Loudoun Reservoir (originally located at TRM 603.2) was moved upstream to TRM 605.5. This resulted in a better assessment of the water quality conditions of the Tennessee River in the forebay portion of Fort Loudoun Reservoir by minimizing the effects of the Little Tennessee River and Tellico Reservoir on the data gathered in the forebay of Fort Loudoun Reservoir.

Although Fort Loudoun Reservoir is a mainstream reservoir, its complex set of hydrologic conditions (cool water inflows from the Holston, French Broad, and Little Tennessee Rivers) often causes it to exhibit several characteristics that are more typical of a storage impoundment. In fact, analysis of historical fisheries data for the Tennessee Valley indicates the fish community of Fort Loudoun Reservoir is more similar to that in Valley storage impoundments than in other mainstream reservoirs.

Melton Hill Reservoir

Melton Hill Dam is located at mile 23.1 on the Clinch River and is 56.7 miles downstream of Norris Dam. Impounded water extends upstream from Melton Hill Dam about 44 miles. Melton Hill Reservoir has about 170 miles of shoreline and 5690 surface acres at full pool. Average flow through Melton Hill is about 5140 cfs resulting in an average retention time of approximately 12 days. Melton Hill is TVA's only tributary dam with a navigation lock.

The predominant factor influencing the aquatic resources of Melton Hill Reservoir, especially the inflow and mid-reservoir areas, is the cold water entering from Norris Dam discharges. During summer, water discharged from Norris is cold and low in oxygen content. Oxygen concentrations are improved by a re-regulation weir downstream of Norris Dam and by atmospheric reaeration in the river reach between Norris Dam and upper Melton Hill Reservoir. However, water is warmed little and is still quite cool when it enters upper Melton Hill Reservoir. Bull Run Steam Plant, located at about CRM 47, warms the water some, but water temperatures are still marginally low to support warm water biota and marginally warm to support cold water biota.

Reservoir: Fort Loudoun **1999 Score: 49%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1991	60		
1992	53		
1993	58		
1994	61	62	
1995	49	47	
1996	52	52	
1997	58	57	
1998	64	62	
1999		49	

Fort Loudoun	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	R 1.0	R 1.0			2.0
DO	R 1.5	G 5.0			6.5
Fish	G 4.0	Y 3.0		G 4.0	11.0
Benthos	R 1.0	Y 3.0		R 1.0	5.0
Sediment	Y 1.5	R 1.0			2.5
Total	9.0	13.0		5.0	27.0

Change between 1998 and 1999				
FB	TZ	Emb	Inf	Total
-0.2	0.0			-0.2
-3.5	0.0			-3.5
0.0	0.0		2.0	2.0
-1.0	-1.0		0.0	-2.0
0.0	-0.5			-0.5
-4.7	-1.5		2.0	-4.2

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Fort Loudoun Reservoir was poor in 1999 with few indicators receiving a good rating. The year 1999 was characterized by low flows and increased retention time. Indicators affected most by these conditions responded as expected and resulted in poor ratings – chlorophyll concentrations were quite high at both monitoring sites and DO concentrations in bottom strata at the forebay were low (<2 mg/l). Other indicators to rate poor were benthos and sediment quality. Benthos rated poor at the forebay and inflow due low diversity and abundance with only tolerant, short-lived animals present. Sediment quality rated poor at the transition zone due to PCBs, chlordane, and zinc. These same chemicals were found at the forebay, but a slightly lower concentration of zinc allowed the sediment rating to be fair. Fish rated good at forebay and inflow sites due to presence of a good mix of species.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological condition for Fort Loudoun has generally rated at the low end of the fair range during most years except when low flows occur. This was the case in 1995 and 1999 and conditions rated poor. The indicator most influenced by flows is DO. Under normal flow regimes DO concentrations remain relatively high and rate good. During extended periods of low flows DO concentrations at deeper forebay strata decrease and rate poor, such as in 1995 and 1999. Low flows also tend to exacerbate the already high chlorophyll concentration in Fort Loudoun. Concentrations in 1999 were the highest found to date. Issues which exist virtually every year regardless of flows are poor to fair benthos (low diversity and abundance with only tolerant, short-lived animals present) and poor sediment quality (presence of PCBs, chlordane, and zinc). Interestingly, the ratings for fish were higher in 1998 and 1999 than in previous years.

Aquatic Macrophytes in 1999: Only nominal amounts of macrophytes occur on Fort Loudoun (about 25 acres).

Status of Fish Consumption Advisories in 1999: The State of Tennessee advises against eating catfish from due to PCB contamination. Also, largemouth bass greater than two pounds, or any size if caught from the Little River embayment, should not be eaten. Results from catfish collected from the transition zone in 1998, like those collected in 1996 and 1997, had slightly lower PCBs concentration than in 1995 and earlier. Channel catfish and largemouth bass collected in 1998 and analyzed for a broad array of contaminants did not reveal any new concerns.

Status of Swimming Advisories in 1999: There are no swimming advisories on Fort Loudoun Lake. Bacteriological monitoring was conducted at 19 sites on Fort Loudoun Lake and tailwaters in 1999. Only two sites had high concentrations of fecal coliform bacteria which exceeded State of Tennessee guidelines for water contact. The large numbers of waterfowl (Canadian geese) present at both sites are a likely source of contamination.

CLINCH RIVER AND POWELL RIVER WATERSHED

This long, narrow watershed lies in southwest Virginia and northeast Tennessee. Streams in the watershed have high concentrations of dissolved minerals and generally low concentrations of nutrients.

For management purposes, an artificial ending point of the watershed has been established at Norris Dam, which is near Clinch River mile 80. The remainder of the Clinch River is associated with the Watts Bar, Fort Loudoun, and Melton Hill Reservoir Watershed area. As defined, this watershed drains an area of 2912 square miles and has an average annual discharge of about 4300 cfs. The Clinch and Powell Rivers contribute about 80 percent of this flow.

Norris Reservoir is the only major reservoir in the watershed; essentially all streams upstream from Norris are free flowing. There are three Vital Signs monitoring sites in Norris Reservoir (forebay and mid-reservoir sites on the Clinch and Powell arms).

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on Norris Reservoir. It also provides planned activities in the future .

Norris Reservoir

Norris Reservoir is formed by Norris Dam at Clinch River mile (CRM) 79.8. It is a large, dendritic, tributary storage impoundment of the Clinch and Powell Rivers which flow together about nine miles upstream of the dam. Norris is one of the deeper TVA tributary reservoirs, with depths over 200 feet. Annual drawdown averages about 32 feet. At full pool, the surface area of the reservoir is 34,200 acres, the shoreline is about 800 miles in length, and water is impounded 73 miles upstream on the Clinch River and 53 miles upstream on the Powell River. Norris Reservoir has a long average retention time (about 239 days) and an average annual discharge of approximately 4300 cfs. Due to the great depth and long retention time of Norris Reservoir, significant vertical stratification is expected.

Because of the confluence of the Clinch and Powell Rivers relatively close to the dam, three reservoir sampling locations were established: one forebay site; and two mid-reservoir sites--one on the Clinch River and one on the Powell River.

Reservoir: Norris **1999 Score: 70%**

	----------Previous Scores--------- Reported	1999 Criteria	Comments
1991	57		
1992	67		
1993	67		
1994	69	**66**	
1995	60	**61**	
1997	62	**67**	
1999		**70**	

Norris	1999 Results				
	FB	Mid_CL	Mid_PL	Inf	Total
Chlorophyll	G 5.0	G 5.0	G 5.0		15.0
DO	R 1.5	R 1.0	R 1.0		3.5
Fish	Y 3.0	G 5.0	G 5.0		13.0
Benthos	R 2.0	Y 3.0	G 5.0		10.0
Sediment	R 1.0	G 2.5	G 2.5		6.0
Total	12.5	16.5	18.5		47.5

Change between 1997 and 1999				
FB	Mid-CL	Mid-PL	Inf	Total
0.0	0.0	0.0		0.0
0.5	0.0	0.0		0.5
0.0	1.0	1.0		2.0
-2.0	0.0	1.0		-1.0
-0.5	0.0	1.5		1.0
-2.0	1.0	3.5		2.5

Summary/Key Ecological Health Finding for 1999: Norris had a fair ecological health score in 1999, near the good range. All ecological indicators rated fair or good at the mid-reservoir sites except for DO. Poor DO ratings at all sites resulted from a large percentage of the water column being < 2 mg/l during summer (July-September for mid-reservoir, September - October for the forebay). The forebay rated poor for three of the five indicators; DO, benthos, and sediment. Forebay sediments had elevated concentrations of arsenic, chlordane (found for the first time in 1999), and lead; and the benthos had low density, primarily comprised of tolerant oligochaetes. The fish assemblage rated "excellent" at both mid reservoir sites due to very good species diversity and composition. This wasn't the case at the forebay where the lower than expected catch rate and species diversity resulted in a lower (fair) fish score.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Similar to previous years, Norris had a fair ecological score in 1999. The most significant problem on Norris is low DO levels in the lower half of the water column during late summer and early autumn at all three sites. Norris is a deep tributary storage reservoir with long summer residence time, which result in the water stratifying into density/temperature layers during the summer. Oxygen in the cold, bottom layer is gradually depleted by natural decomposition processes. Another frequently occurring issue is poor to fair sediment quality due to elevated levels of lead and arsenic at the forebay. The sediment at mid-reservoir Powell River, which rated poor in 1997 due to elevated levels of lead and nickel, returned to the good ratings observed in previous years with 1999 concentrations being within suggested criteria. Prior to poor rating in 1999, the benthos at the forebay had always rated fair. Fewer organisms, particularly chironomids were found in 1999.

Aquatic Macrophytes in 1999: Not an issue on Norris Reservoir.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Norris Reservoir. TVA last collected channel catfish and largemouth bass for tissue analysis in autumn 1997. All contaminant levels were either below detection levels or below the levels used by the state to issue fish consumption advisories. Norris will be sampled again in 2001.

Status of Swimming Advisories in 1999: There are no swimming advisories on Norris Lake. TVA monitored fecal coliform bacteria levels at three swimming beaches in 1998. Samples taken at Loyston Point and Big Ridge State Park were well within State of Tennessee guidelines for water contact. One of the ten samples collected at Anderson County Park contained high levels of fecal coliform bacteria in a sample collected shortly after a rainstorm.

LITTLE TENNESSEE RIVER WATERSHED

The Little Tennessee River Watershed encompasses 2672 square miles, mostly in Tennessee and North Carolina with a small area in Georgia. Much of the watershed is forested, with the headwaters in the Blue Ridge Mountains. The basin is underlain mostly by crystalline and metasedimentary rocks of the Blue Ridge province. This watershed is home to a large variety of federally listed threatened and endangered species.

Most of the streams in the watershed are steep gradient and generally have low concentrations of both dissolved minerals and nutrients. The two largest tributaries to the Little Tennessee River are the Tuckasegee River which merges with the Little Tennessee in Fontana Reservoir and the Tellico River which merges with the Little Tennessee in Tellico Reservoir.

There are several reservoirs in the watershed but only Fontana Reservoir in the mountainous area and Tellico Reservoir at the lower end of the watershed are monitored. TVA does not monitor the other reservoirs either because of their small size or because they are owned by the Aluminum Company of America (ALCOA).

Two sites are monitored on Tellico Reservoir (the forebay and transition zone) and three sites on Fontana Reservoir (the forebay and mid-reservoir sites on the Little Tennessee River and Tuckasegee River).

Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Tellico Reservoir

Tellico Dam is located on the Little Tennessee River just upstream of the confluence of the Little Tennessee and Tennessee Rivers. It is the last dam completed in the TVA system with dam closure in 1979. Tellico Reservoir is 33 miles long, has a shoreline of 373 miles, and has a surface area of about 16,000 acres at full pool. The average estimated flow through Tellico Reservoir is approximately 6200 cfs which provides an average retention time of about 34 days. Very little of this water is discharged through Tellico Dam. Rather, it is diverted through a navigation canal to Fort Loudoun Reservoir near the dam for hydroelectric power production. Water characteristics in these two reservoirs differ considerably. The hydrodynamics and exchange of water via the inter-connecting canal significantly affect water quality within Tellico Reservoir (and Fort Loudoun Reservoir). The canal is only 20-25 feet deep, but the depth of Tellico Reservoir at the forebay is about 80 feet. Thus, water in deeper strata in the forebay is essentially trapped and becomes anoxic during the summer.

The impounded water of Tellico Reservoir extends upstream of the confluence of the Little Tennessee and Tellico Rivers. The transition zone site selected for sample collection in 1990, 1991, and 1992 was in the Little Tennessee River, just upstream of the confluence with the Tellico River at Little Tennessee River Mile (LTRM) 21.0. Water conditions at that site are largely controlled by discharges from Chilhowee Dam at LTRM 33.6. This water is cold, nutrient poor, and has a low mineral content, conditions that are not conducive to establishing a diverse, abundant aquatic community. In 1993, the transition zone sampling location in Tellico Reservoir was moved six miles downstream to LTRM 15.0, just below the confluence of the Tellico River--a site more characteristic of a transition environment rather than riverine conditions.

Fontana Reservoir

Fontana Reservoir is located in the Blue Ridge Mountains of western North Carolina. Fontana is the deepest reservoir in the TVA system. At full pool it has a maximum depth of 460 feet, a length of 29 miles, a shoreline of 248 miles, and a surface area of 10,640 acres. Fontana Reservoir has a relatively large drawdown, which averages about 64 feet annually. Every fifth year Fontana is drawn even deeper to allow sluice gate access for maintenance.

Fontana Dam is located at Little Tennessee River Mile 61.0. Average annual discharge is 3950 cfs which provides an average hydraulic retention time in the reservoir of 181 days.

Water in Fontana Reservoir is quite clear due to limited photosynthetic activity and a mostly forested watershed. Water entering the reservoir is low in nutrients and dissolved minerals.

Reservoir: Tellico **1999 Score: 59%**

	Previous Scores: Reported	1999 Criteria	Comments
1991	48		
1992	48		
1993	63		
1994	71	72	
1995	53	53	
1997	62	62	
1999		59	

Tellico	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	R 1.0	R 1.3			2.3
DO	G 4.5	G 5.0			9.5
Fish	G 4.0	G 4.0			8.0
Benthos	R 1.0	R 1.0			2.0
Sediment	G 2.5	G 2.5			5.0
Total	13.0	13.8			26.8

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.0	-1.7			-1.7
0.5	0.0			0.5
0.0	0.0			0.0
0.0	0.0			0.0
0.0	0.0			0.0
0.5	-1.7			-1.2

Summary/Key Ecological Health Finding for 1999: Tellico Reservoir had a fair ecological health rating in 1999. Similar results were found at both sample locations – the fish assemblage, DO, and sediment quality rated good, while chlorophyll and benthos rated poor. The poor rating for chlorophyll at both sites was caused by higher than expected concentrations given that the water entering the reservoir originates in the nutrient-poor Blue Ridge Ecoregion. The poor ratings for the benthos resulted from collection of only 12 organisms from each site; mostly chironomids and oligochaetes with a few clams. Definitive causes of such a poor benthic community can only be speculated, but sporadic low DO levels (near anoxia) and cold bottom water are likely contributing factors. Also, the criteria used to evaluate the benthic community in Tellico is the same used for the run-of-the-river reservoirs, which rarely experience such low DO levels.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological health score for Tellico Reservoir has varied over the years from poor to the upper end of the fair range. The overall score for 1999 was at the lower end of the fair range. DO ratings in the forebay have shown the most variation through time—good in 1994, poor in 1995, fair in 1997, and good in 1999. In contrast, the benthic community has consistently rated poor at both locations, while chlorophyll has shown an upward trend over the last seven years. At the forebay, chlorophyll levels are affected by the exchange of water from the highly productive forebay of Ft. Loudoun Reservoir via the canal connecting the two reservoirs. However, there is no such influence at the transition zone, and average summer chlorophyll levels increased about 140% from 1993 to 1999. Chlorophyll had always rated good at the transition zone prior to the fair rating in 1997 and poor rating in 1999. This is a trend which bears watching.

Aquatic Macrophytes in 1999: Macrophytes were not surveyed on Tellico in 1999.

Status of Fish Consumption Advisories in 1999: The State of Tennessee advises against eating catfish from Tellico Lake because of PCB contamination. TVA last analyzed largemouth bass for mercury and channel catfish from Tellico Lake for pesticides, PCBs, and metals in autumn 1997. The results were similar to previous years. Channel catfish were collected again in autumn 1999 and analyzed for PCBs and selected pesticides. Results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Tellico Lake. TVA monitored fecal coliform bacteria levels at four beaches in 1998. All were within State of Tennessee guidelines for water contact, except for elevated bacteria levels in one of the ten samples collected at the Toqua site following a rainfall event.

FRENCH BROAD RIVER WATERSHED

The French Broad River watershed is one of the largest (5124 square miles) watersheds in the Tennessee Valley. About half the watershed is in Tennessee and half is in North Carolina. The French Broad River and its two large tributaries (Nolichucky and Pigeon Rivers) originate in the Blue Ridge Mountains. All three of these rivers merge at the upper end of Douglas Reservoir, the only sizable reservoir in the watershed. The water in the French Broad River is moderately hard and relatively high in nutrients.

There are two reservoir Vital Signs monitoring sites on Douglas. Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on Douglas Reservoirs. It also provides planned activities in the future .

Douglas Reservoir

Douglas Reservoir is a deep storage impoundment (tributary reservoir) on the French Broad River. Douglas Dam is located 32.3 miles upstream of the confluence of the French Broad and Holston Rivers which form the Tennessee River. Reservoir drawdown during late summer and autumn is rather large, with an annual average of about 48 feet. The large annual fluctuation in surface water elevation causes other physical characteristics such as surface area, reservoir length, and retention time to vary greatly during the year. At full pool, maximum depth at the dam is 127 feet, surface area is 30,400 acres, the shoreline is 555 miles, and the length is 43 miles. Average annual discharge is approximately 6800 cfs, which provides an average hydraulic retention time of about 104 days.

Lengthy retention times and lack of mixing due to their deep nature tend to cause storage impoundments to have strong thermal stratification during summer months. Undesirable conditions often develop in the hypolimnion due to anoxia, which in most cases extends from the forebay to the mid-reservoir sampling location.

Reservoir: Douglas **1999 Score: 56%**

	----------Previous Scores--------- Reported	1999 Criteria	Comments
1991	42		(only Forebay)
1992	56		(only Forebay)
1993	58		
1994	64	**62**	
1995	45	**45**	
1997	54	**54**	
1999	--	**56**	

Douglas	1999 Results				
	FB	Mid	Emb	Inf	Total
Chlorophyll	G 4.6	R 1.6			6.2
DO	R 1.0	R 1.0			2.0
Fish	Y 4.0	G 4.0			8.0
Benthos	Y 3.0	Y 3.0			6.0
Sediment	Y 1.5	Y 1.5			3.0
Total	14.1	11.1			25.2

Change between 1997 and 1999				
FB	Mid	Emb	Inf	Total
1.3	0.6			1.9
0.0	0.0			0.0
0.0	0.0			0.0
0.0	1.0			1.0
-1.0	-1.0			-2.0
0.3	0.6			0.9

Summary/Key Ecological Health Finding for 1999: The overall ecological condition of Douglas Reservoir was poor in 1999, close to the fair category. Summer DO levels were very low in the mid and lower strata of the water column at both the forebay and mid-reservoir monitoring sites. Low levels of chlordane were reported for both locations resulting in sediment ratings of fair. Benthic ratings were fair. The average chlorophyll concentration at both sites declined substantially from 1997. This resulted in a good rating for the forebay. However, chlorophyll at the mid-reservoir was still elevated enough to warrant a poor rating. Overall, the fish assemblage appeared healthy (good diversity and composition) with a rating of good for the mid-reservoir site and fair (upper end of the fair range) for the forebay.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: The ecological condition for Douglas Reservoir has been fair to poor in all previous years. The 1999 score was poor, but was at the upper end of the poor range. Consistent with past years, problems observed in 1999 were very low DO levels at both sites, high chlorophyll concentrations at the mid-reservoir site, chlordane present at low concentrations at both sites (which has been found sporadically in earlier years), and low (poor - fair) benthic scores due to the lack of species diversity and the dominance of tolerant species. The fish assemblage has scored in the upper end of the fair range or good for the past four monitoring years (1994, 1995, 1997, and 1999). TVA is working to improve poor DO conditions in Douglas and other, similarly large storage reservoirs.

Aquatic Macrophytes in 1999: Not an issue on Douglas.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Douglas Reserovir. TVA last collected fish for tissue analysis from Douglas in autumn 1994 and the state of Tennessee in 1996. Contaminant levels in both sets of samples were either below detection levels or below levels used by the state to issue fish consumption advisories. Additional fish were collected by TVA in autumn 1999 but results were not available at the time this document was prepared.

Status of Swimming Advisories in 1999: There are no swimming advisories on Douglas Lake. Only one of the ten samples collected in 1998 at the swimming beach at Douglas Dam contained high levels of fecal coliform bacteria. This sample was collected after a rainstorm, when bacteria levels typically go up due to local runoff. Bacteria levels at the beach at Douglas Dam have been consistently low in previous years.

HOLSTON RIVER WATERSHED

The Holston River Watershed encompasses 3776 square miles, mostly in upper east Tennessee and southwest Virginia and a small area in North Carolina. The area is relatively highly populated with substantial industrial development.

Much of the area is underlain with limestone and dolomite which results in high concentrations of dissolved minerals in the streams. There is also substantial zinc mining in the watershed.

There are several reservoirs in the watershed with varying size, depth, flow, and water quality characteristics. The largest is Cherokee Reservoir on the Holston River near the lower end of the watershed. The uppermost reservoirs are Watauga Reservoir on the Watauga River and South Holston Reservoir on the South Fork Holston River. Downstream from these reservoirs, the Watauga and South Holston Rivers merge in Boone Reservoir. Immediately downstream from Boone Dam is Fort Patrick Henry Reservoir, the smallest of the five reservoirs in this watershed included in the Vital Signs Monitoring Program. A few miles downstream from Fort Patrick Henry Dam the South Fork and North Fork Holston Rivers merge to form the Holston River.

The average annual discharge from Cherokee Dam is 4600 cfs. The Holston River merges with the French Broad River at Knoxville to form the Tennessee River.

Vital Signs monitoring activities are conducted at one, two, or three locations depending on reservoir size and characteristics. Table 1 of this appendix identifies the years when Vital Signs Monitoring activities have occurred on reservoirs in this watershed. It also provides planned activities in the future .

Cherokee Reservoir

Cherokee Reservoir is formed by Cherokee Dam at Holston River mile (HRM) 52.3. Like Norris and Douglas Reservoirs, it is a large, relatively deep, tributary storage impoundment with a substantial drawdown which begins in late summer. When the water surface is at full pool, maximum depth at the dam is 163 feet and winter drawdown is 53 feet. However, full pool is not reached most years, and the long-term average drawdown is about 28 feet. At full pool, Cherokee Reservoir is 54 miles long, has a surface area of 30,300 acres, and a shoreline of 393 miles. Average annual discharge is about 4600 cfs which provides an average hydraulic retention time (at full pool) of approximately 162 days.

Like other deep storage impoundments with long retention times, Cherokee Reservoir exhibits strong vertical stratification during summer months. The hypolimnetic oxygen deficit on Cherokee is one of the worst of all Vital Signs monitoring reservoirs and has been well documented in numerous past studies (Iwanski, 1978; Iwanski et al., 1980; Hauser et al., 1987).

Fort Patrick Henry Reservoir

Fort Patrick Henry Reservoir is one of the smaller reservoirs included in the Vital Signs Monitoring Program. It is only ten miles long, has a surface area of about 870 acres, and has a shoreline of 37 miles. Although it is a tributary reservoir, it has characteristics of a run-of-river reservoir, rather than a storage reservoir. Annual fluctuation in elevation is only five feet. Also, retention time is short; with an average discharge of 2690 cfs, the hydraulic retention time is only about five days. Maximum depth is about 80 feet. Fort Patrick Henry Dam is located at South Fork Holston River mile 8.2.

This reservoir had not been sampled as part of this monitoring effort prior to 1993. Because of its small size, only the forebay is monitored for Vital Signs.

Boone Reservoir

Boone Dam is located at South Fork Holston River mile (SFHRM) 18.6, approximately 1.4 miles downstream of the confluence of the South Fork Holston and the Watauga Rivers. At normal maximum pool (1384 feet MSL), Boone Reservoir extends upstream approximately 17.4 miles on the South Fork Holston River and 15.3 miles on the Watauga River for a total reservoir length of approximately 32.7 miles. Boone Reservoir has a surface area of 4300 acres, a shoreline length of approximately 122 miles, an average depth of 44 feet, and a maximum depth of 129 feet near the dam. Annual average discharge from Boone Dam is about 2700 cfs, which results in an average hydraulic residence time of about 37 days. Annual drawdowns of Boone Reservoir usually average about 25 feet.

Three locations were selected for ecological health monitoring in Boone Reservoir, one at the forebay and two mid-reservoir sampling locations, one on the Watauga River arm and one on the South Fork Holston River arm. Sediment and benthic macroinvertebrate sampling were added for the first time in 1993.

South Holston Reservoir

South Holston Reservoir in northeastern Tennessee and southwestern Virginia is created by South Holston Dam, located on the South Fork of the Holston River at mile 49.8. The dam creates a storage pool approximately 24 miles long, over 230 feet deep near the dam, with an average depth of 86.5 feet and approximately 7600 acres in surface area. With an average annual discharge of about 990 cfs from the dam, the average hydraulic residence time is almost one year (334 days)--one of the longest residence times of any TVA reservoir. Average annual drawdown of South Holston Reservoir is about 33 feet.

Two locations are monitored for Vital Signs--the forebay and mid-reservoir. Sediment and benthic macroinvertebrate sampling were added for the first time in 1993.

Watauga Reservoir

Watauga Dam in the northeastern corner of Tennessee impounds the Watauga River at mile 36.7. It forms a pool 16 miles in length, approximately 6400 acres in surface area, about 274 feet deep at the dam, and an average depth of about 89 feet, making it the second-deepest reservoir sampled as part of TVA's Vital Signs Monitoring Program. With an annual average discharge of about 720 cfs, Watauga Reservoir also has the longest hydraulic residence time of any of the Vital Signs reservoirs (about 400 days). Average annual drawdown of Watauga Reservoir is about 26 feet.

Two locations are monitored on Watauga Reservoir, the forebay and mid-reservoir. Sediment quality and benthic macroinvertebrates were examined for the first time in 1993.

Reservoir: Fort Patrick Henry **1999 Score: 56%**

	Previous Scores		
	Reported	1999 Criteria	Comments
1993	72		
1994	60	**60**	
1995	51	**51**	
1996	59	**55**	
1997	56	**56**	
1999		**56**	

Fort Pat Henry	1999 Results				
	FB	TZ	Emb	Inf	Total
Chlorophyll	R 1.0				1.0
DO	G 4.5				4.5
Fish	R 2.0				2.0
Benthos	Y 3.0				3.0
Sediment	Y 2.0				2.0
Total	12.5				12.5

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
0.0				0.0
-0.5				-0.5
0.0				0.0
1.0				1.0
0.5				0.5
1.0				1.0

Summary/Key Ecological Health Finding for 1999: The ecological condition of Fort Patrick Henry Reservoir was poor in 1999. DO was the only indicator to rate good, largely due to the small size and short retention time of this reservoir, which prevent stratification and thus oxygen depletion. Benthos rated fair. Only chironomids and oligochaetes (both generally considered tolerant groups of organisms) were found, yet diversity and abundance of chironomids was good which allowed the fair rather than poor rating. Sediment quality also rated fair due to presence of low levels of chlordane and slightly elevated copper concentrations. The other two indicators rated poor -- chlorophyll due to high levels throughout the summer and fish due to poor community structure (mostly tolerant, omnivorous species).

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Overall conditions for Ft. Pat were poor in 1999; comparable to previous years. The ecological health score for this reservoir has been just below or just above the break point between fair and poor scores. The main problems in Ft. Pat are consistent from year to year -- poor chlorophyll and fish ratings. The low chlorophyll ratings are due to high levels of chlorophyll throughout most summer months. This was especially the case in 1999 when chlorophyll concentrations were the highest observed to date. The poor fish community ratings reoccur due to a high proportion of tolerant, omnivorous species (predominantly gizzard shad) and presence of few sucker species.

Aquatic Macrophytes in 1999: Not an issue on Fort Patrick Henry Reservoir.

Status of Fish Consumption Advisories in 1999: There are no fish consumption advisories on Fort Patrick Henry Reservoir. The last time TVA sampled channel catfish and largemouth bass from this reservoir was in autumn 1997. Fillets were analyzed for pesticides, PCBs, and metals. The results were provided to state agencies in Tennessee. All contaminant levels were either below detection levels or below the levels used by the state to issue fish consumption advisories. Fort Patrick Henry will be sampled again in 2001.

Status of Swimming Advisories in 1999: There are no swimming advisories on Fort Patrick Henry Reservoir. Fecal coliform bacteria levels in samples collected in 1998 at the swimming beach at Warrior Path State Park and at the Fordtown bridge boat ramp were within Tennessee guidelines for water contact.

Reservoir: Boone **1999 Score: 39%**

	----------Previous Scores---------		
	Reported	1999 Criteria	Comments
1991	51		No benthos or sediment quality
1992	64		No benthos or sediment quality
1993	59		
1994	59	**56**	
1995	49	**49**	
1997	55	**55**	
1999		**39**	

Boone	1999 Results				
	FB	Mid-sfh	Mid-wat	Inf	Total
Chlorophyll	R 1.1	R 1.0	R 1.0		3.1
DO	R 1.0	R 1.0	G 4.5		6.5
Fish	Y 3.0	Y 3.0	Y 2.0		8.0
Benthos	R 2.0	R 2.0	R 1.0		5.0
Sediment	Y 1.5	Y 1.5	R 0.5		3.5
Total	8.6	8.5	9.0		26.1

Change between 1997 and 1999				
FB	TZ	Emb	Inf	Total
-1.7	-0.6	0.0		-2.3
-3.0	-3.5	-0.5		-7.0
0.0	0.0	-1.0		-1.0
0.0	1.0	-1.0		0.0
0.0	0.0	-0.5		-0.5
-4.7	-3.1	-3.0		-10.8

Summary/Key Ecological Health Finding for 1999: The overall ecological condition for Boone Reservoir was poor in 1999 with the lowest score found to date. The only indicator to rate good was DO at the Watauga River mid-reservoir site. Only a few indicators rated fair in 1999. The fish assemblage at all three sites rated fair (the number of fish collected was less than expected and few intolerant species were found). The only other fair ratings were for sediment at the forebay and South Holston River mid-reservoir site (chlordane was found at these sites). All other indicators rated poor. Sediment Quality rated poor at the Watauga River mid-reservoir site due to presence of chlordane and elevated copper and zinc concentrations. Chlorophyll concentrations were quite high at all locations throughout the summer, which resulted in poor ratings at all three sites. DO at the forebay and South Holston River mid reservoir site rated poor due to low DOs (<2ppm), mostly at mid water column strata, although concentrations were also low near bottom at the forebay. Anoxic conditions were found in the mid water column strata in late summer at the South Holston mid-reservoir site but not at the forebay. The benthos rated poor at all three sites with the common problem of having only tolerant animals present such as tubificid worms.

Explanation of Differences in Ecological Health Scores in 1999 and Previous Years: Ecological conditions in Boone Reservoir have been in the poor to fair range for the duration of this monitoring program. Results for 1999 provided the lowest reservoir ecological health score found to date. Although the same ecological indicators rated poor in 1999 as in past years (high levels of chlorophyll, poor benthic macroinvertebrate community, presence of metals and organic contaminants in the sediments, and low DO levels), the poor ratings occurred simultaneously at more sample sites in 1999 than in other years. The most notable results for 1999 are very high chlorophyll concentrations (highest observed to date in an already highly productive reservoir) and low DO concentrations at the forebay and South Holston River mid reservoir sites. The severity of low DO levels varies from year to year. DO levels were relatively high in 1997 but relatively low in 1999. Meteorological conditions and the resulting shifts in reservoir flows appear to be a significant factor in differences among years.

Aquatic Macrophytes in 1999: Not as issue on Boone.

Status of Fish Consumption Advisories in 1999: The State of Tennessee has issued a precautionary advisory for catfish and carp from Boone Reservoir because of PCB contamination. The last time TVA sampled Boone was in autumn 1997. Channel catfish fillets were analyzed for pesticides, PCBs, and metals and largemouth bass for mercury. The results, which were provided to state agencies for appropriate action, were similar to previous years.

Status of Swimming Advisories in 1999: There are no swimming advisories on Boone Reservoir. Fecal coliform bacteria levels in samples collected in 1998 at the Boone Dam swimming beach were within state guidelines for water contact. The State of Tennessee advises against water contact in the lower parts of Cash Hollow Creek, Sinking Creek, and Beaver Creek□ □all of which flow into Boone Lake..

Appendix B.

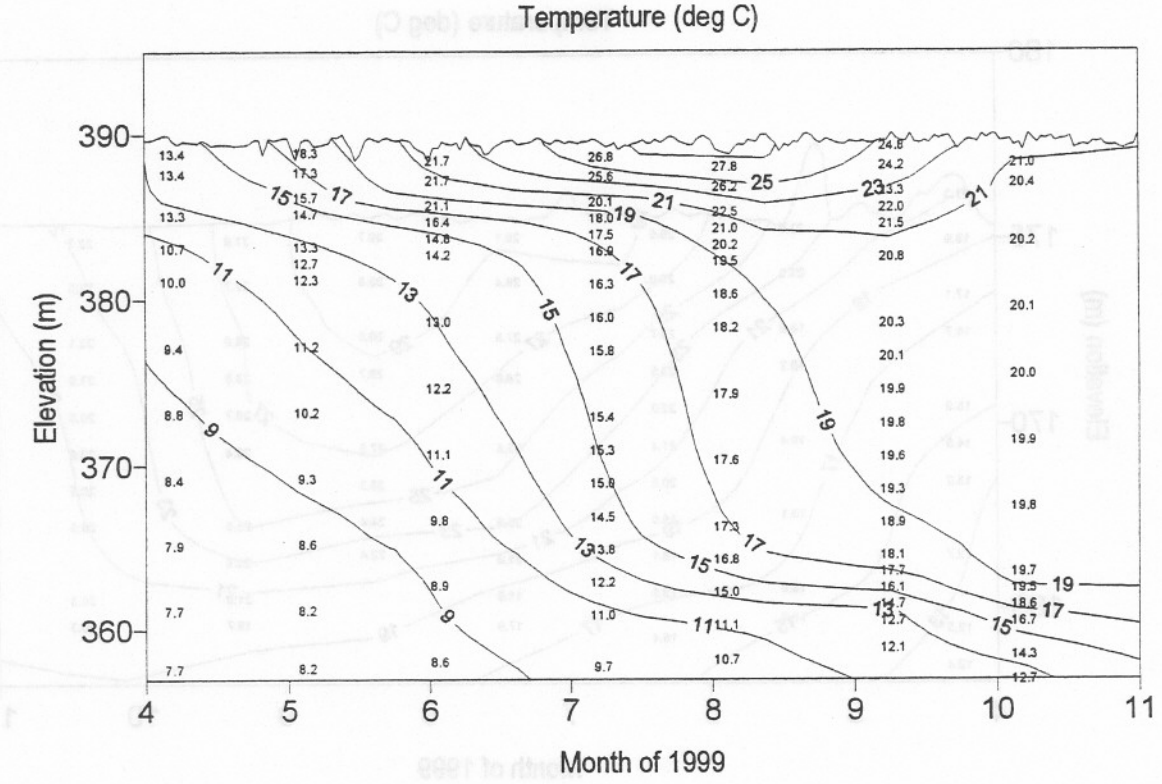
Temperature and Dissolved Oxygen Isopleths for All Sample Locations Monitored in1999

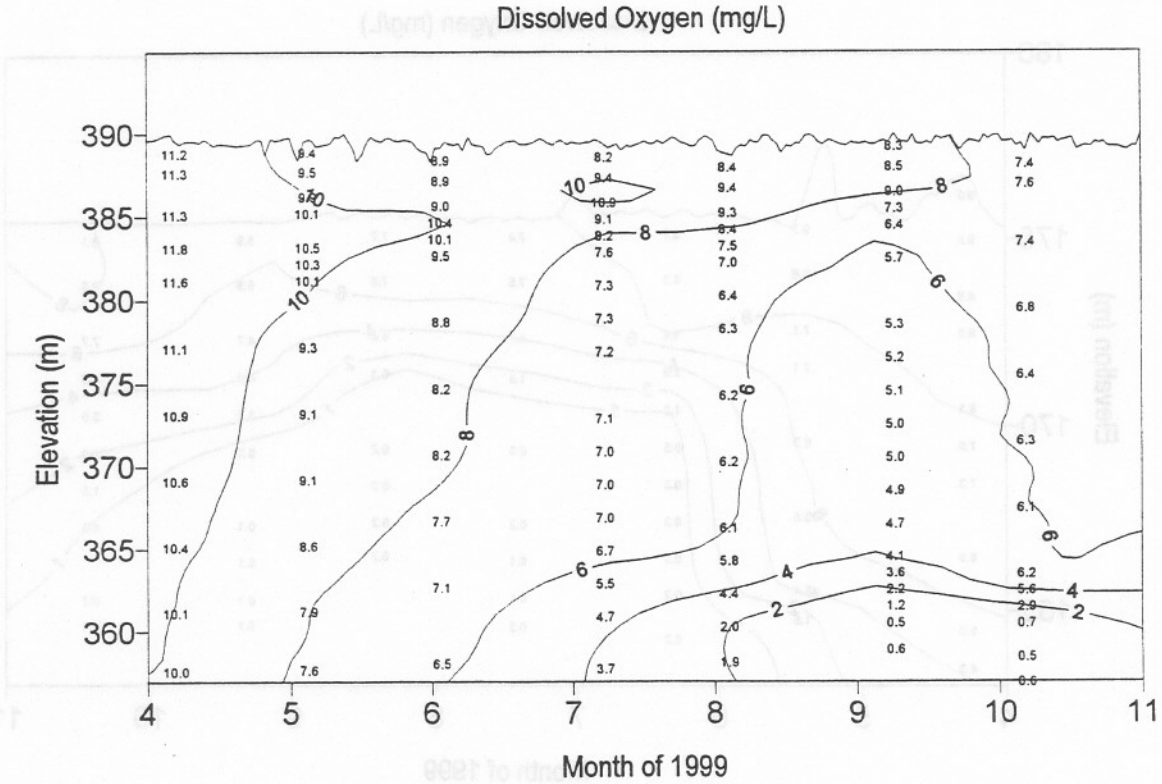
Most Locations Were Monitored as Part of Routine Vital Signs Monitoring. Water Quality Measurements Including Temperature and DO Were Taken at Several Additional Locations to Meet Specific Needs. Isopleths for Locations Monitored as Part of Routine Vital Signs Monitoring Are Provided at the Front of This Appendix Followed by Isopleths for the Additional Locations.

Appendix B

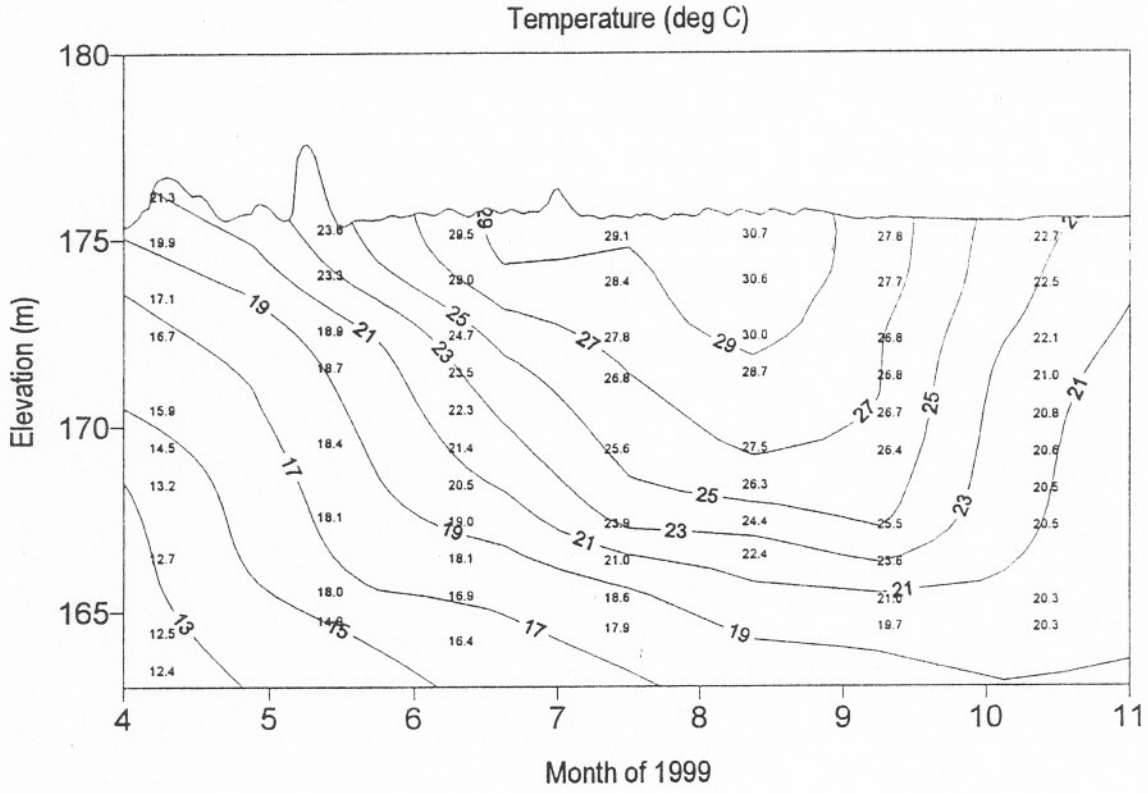
Temperature and DO Isopleths for Locations Monitored as Part of Routine Vital Signs Monitoring in 1999

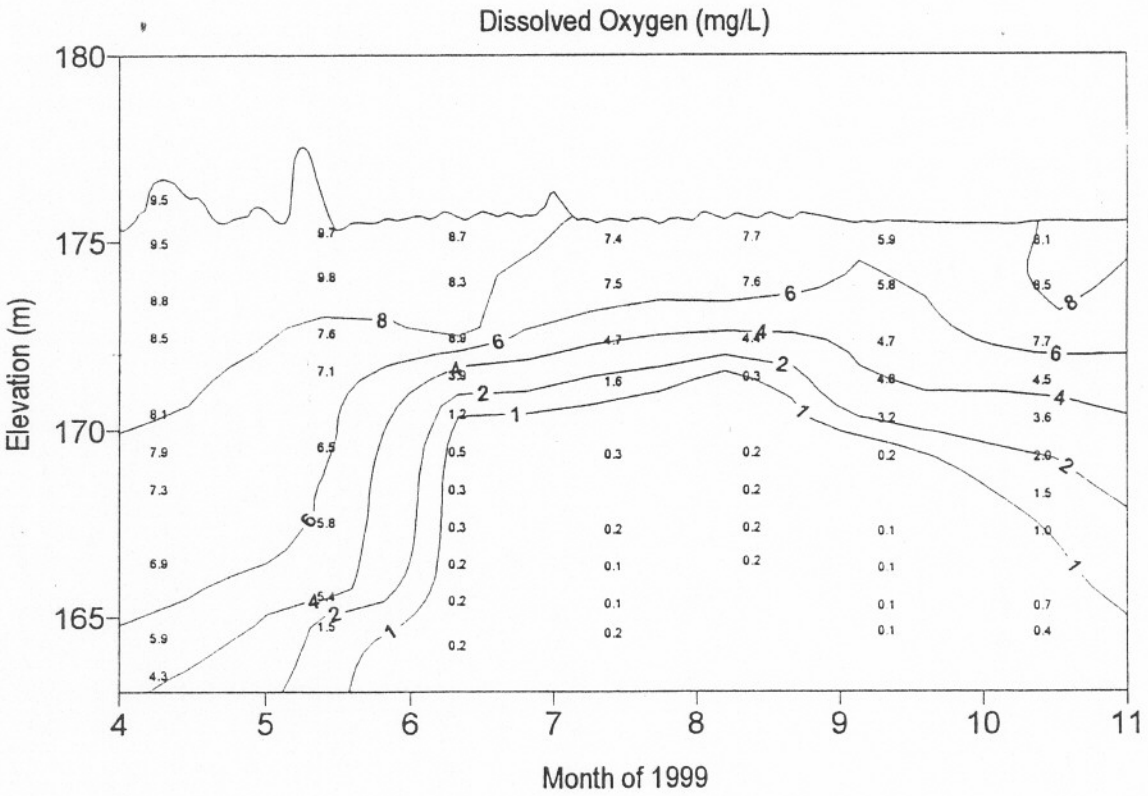
Apalachia Reservoir - HiRM 67.0





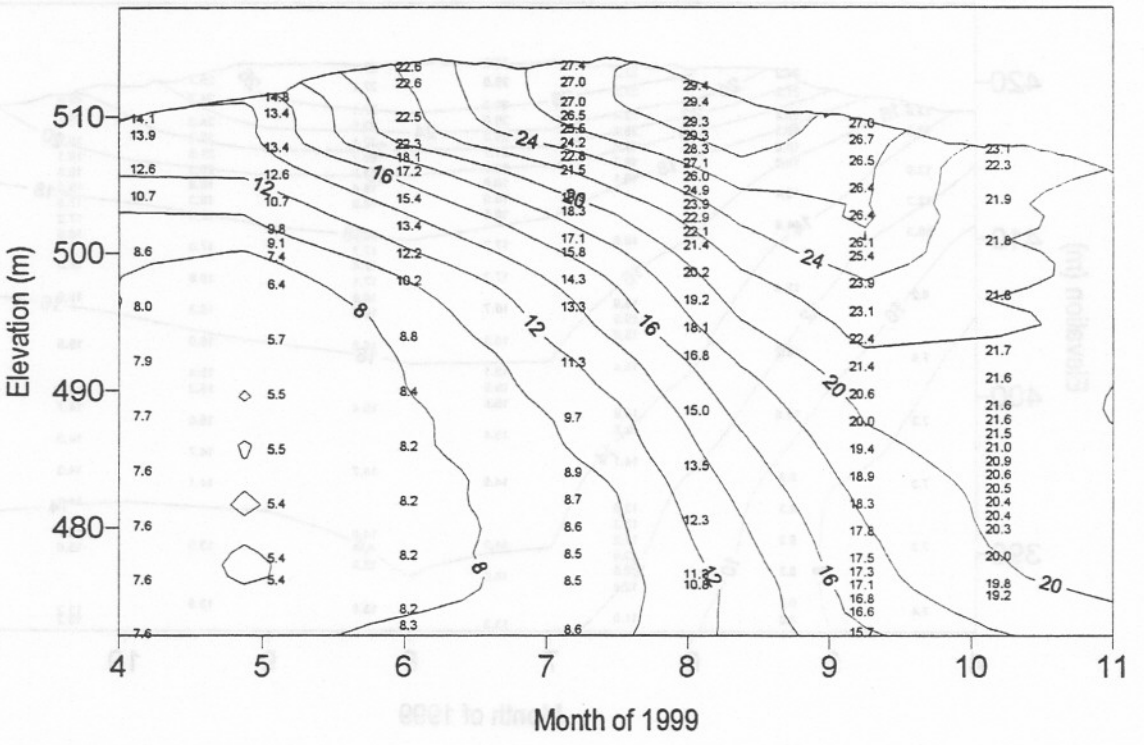
Bear Creek Reservoir - BCM 75.0



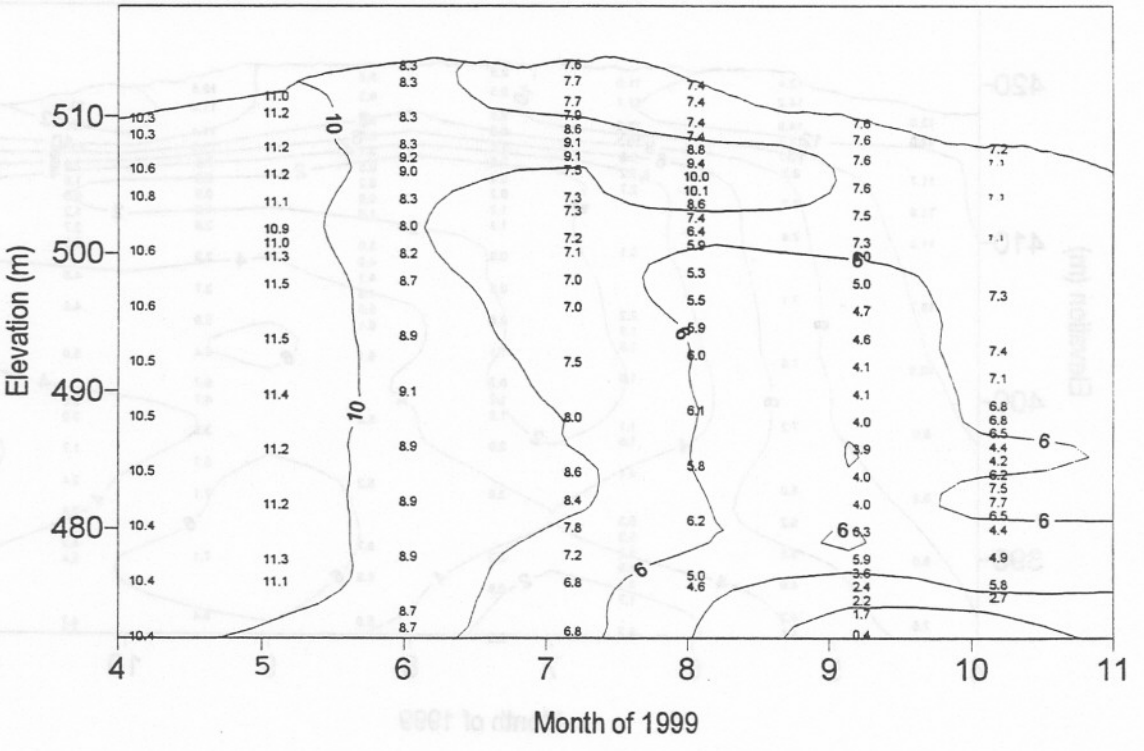


Blue Ridge Reservoir - ToRM 54.1

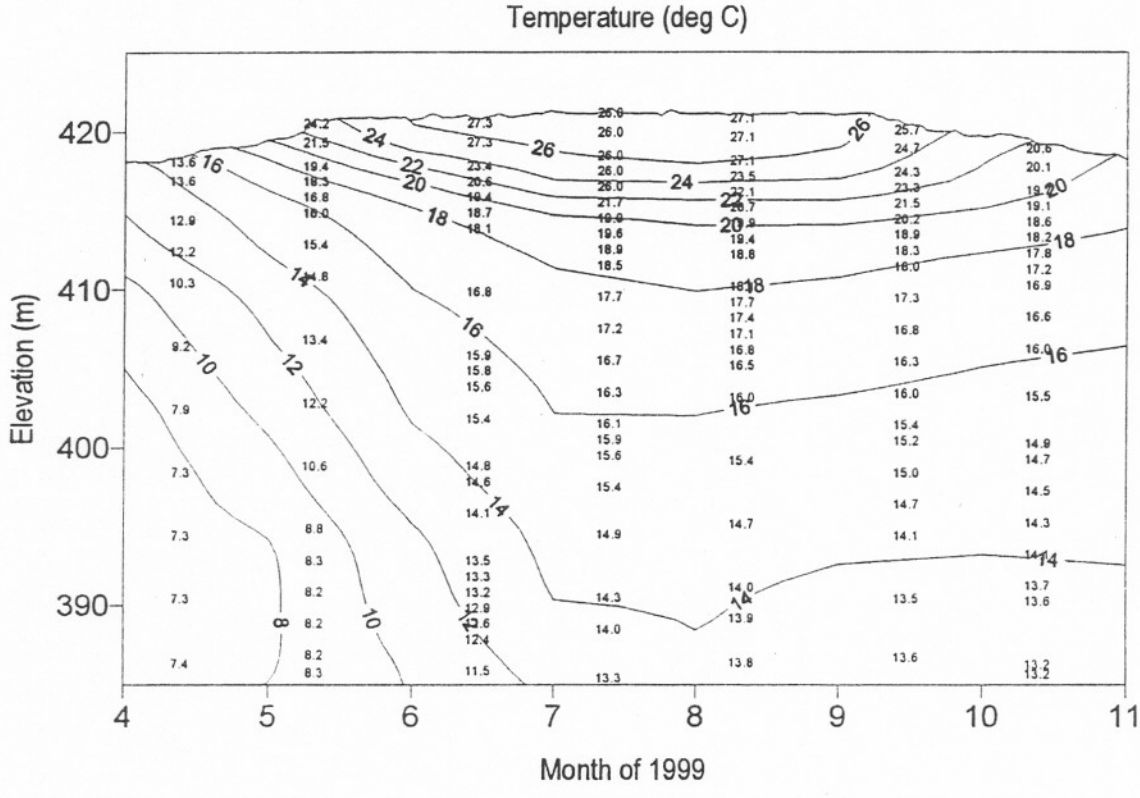
Temperature (deg C)

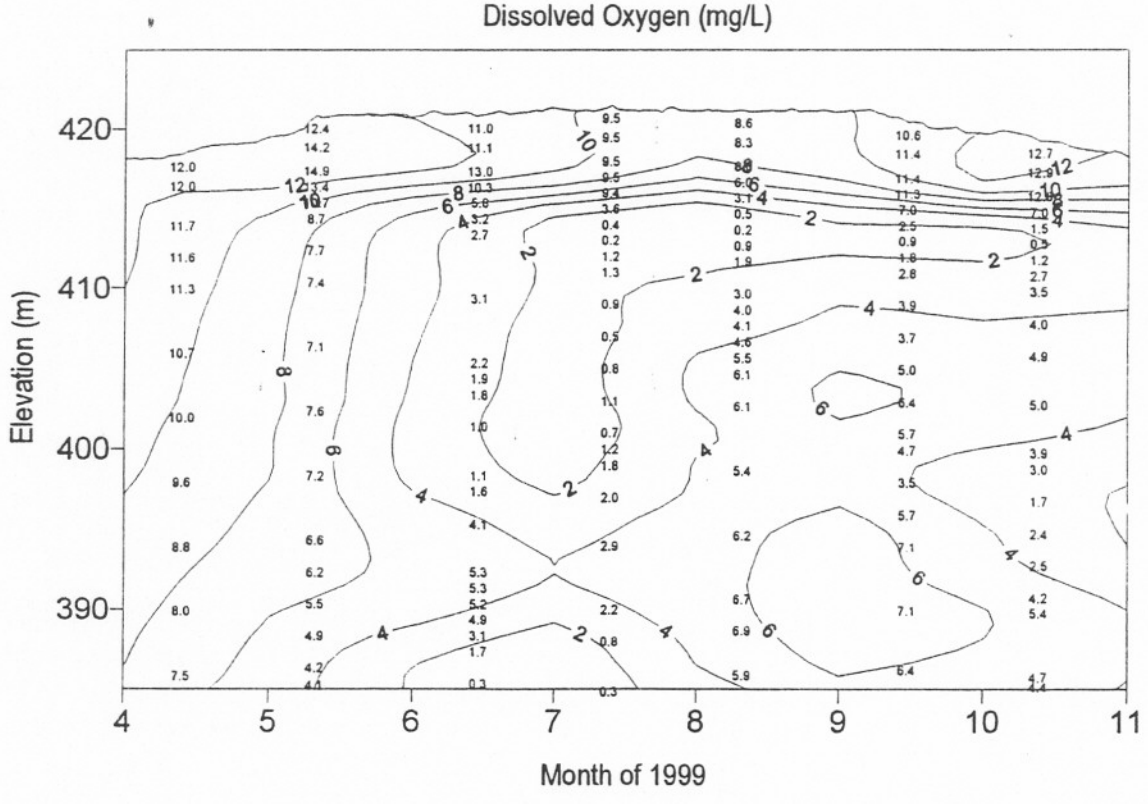


Dissolved Oxygen (mg/L)

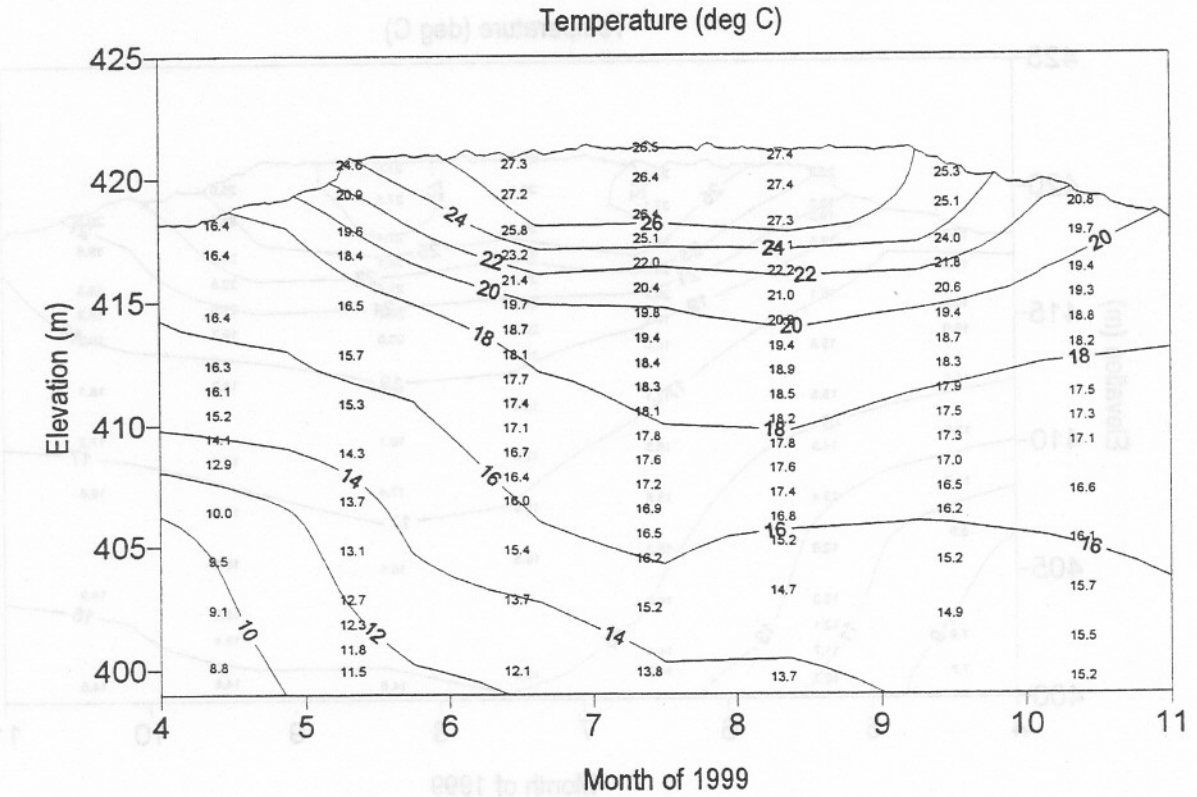


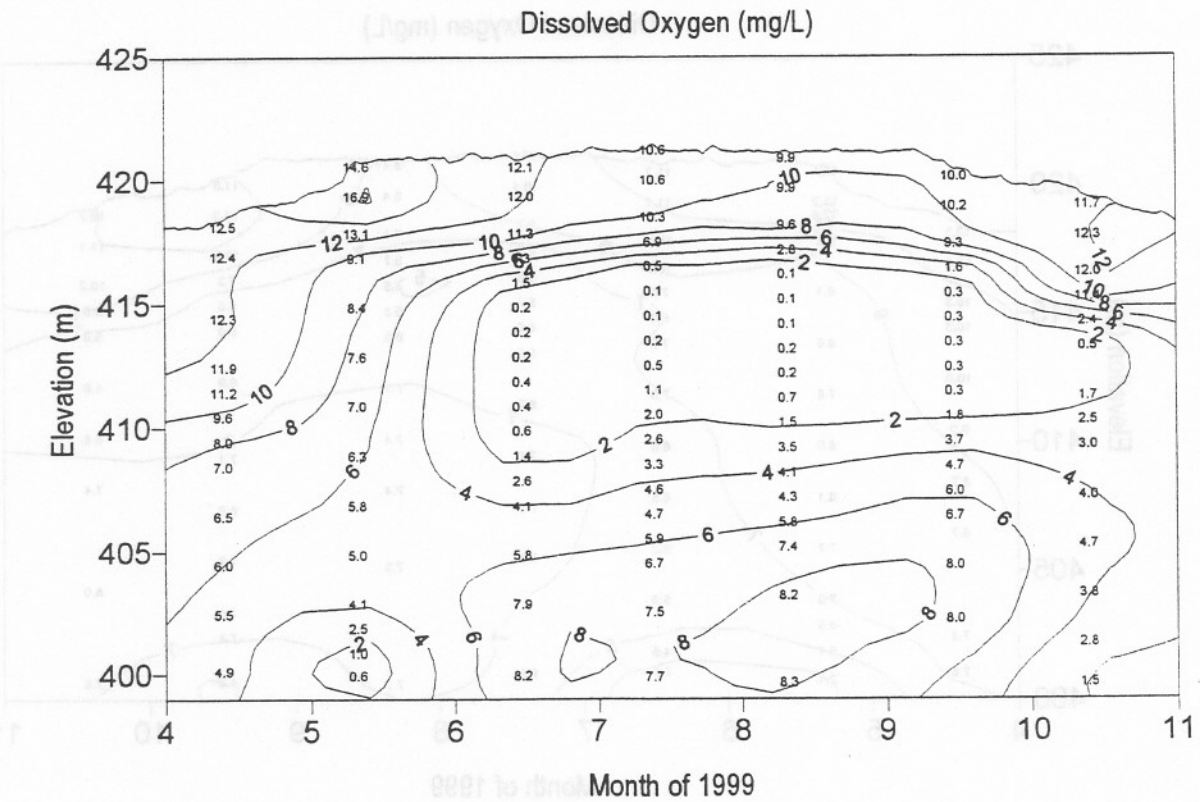
Boone Reservoir - SFHRM 19.0



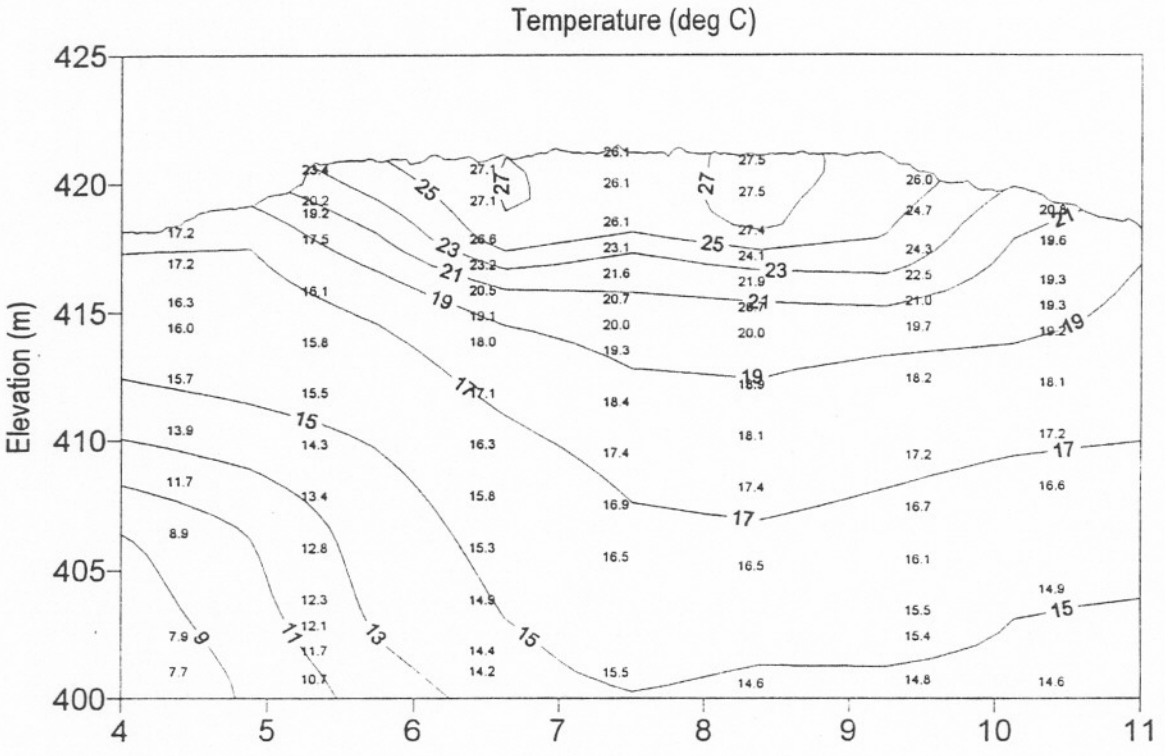


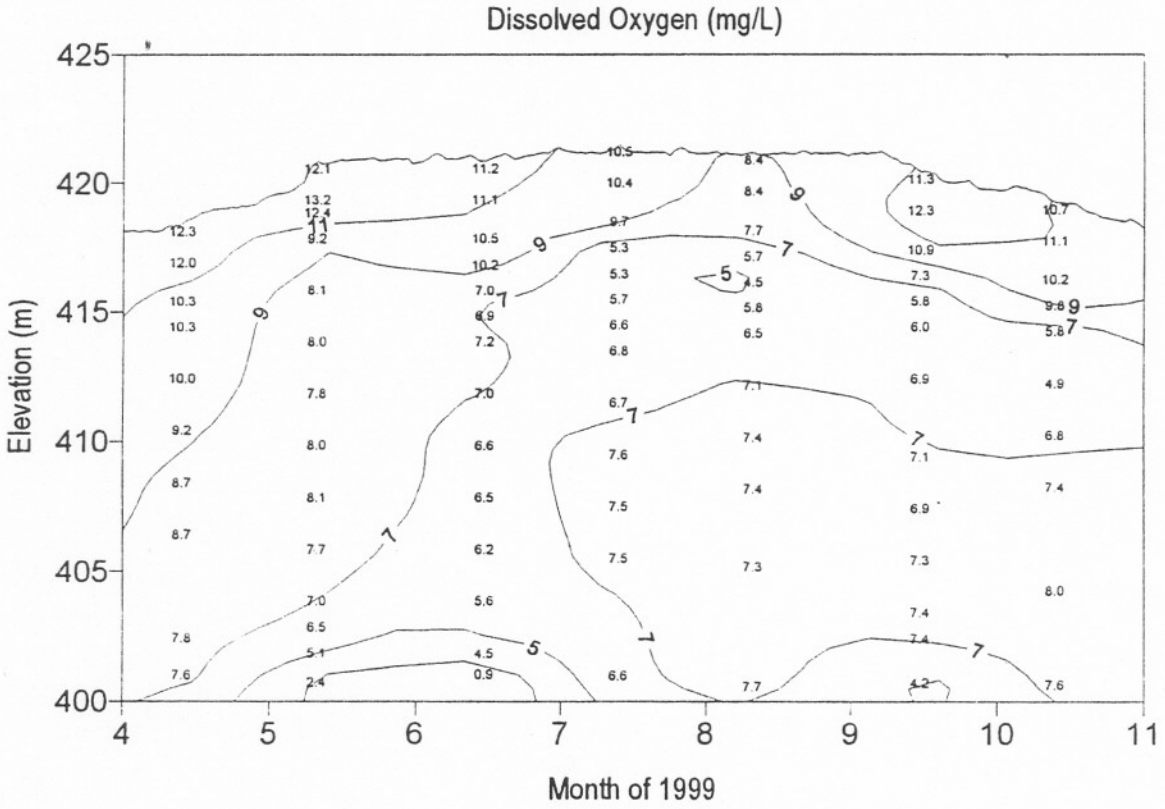
Boone Reservoir - SFHRM 27.0



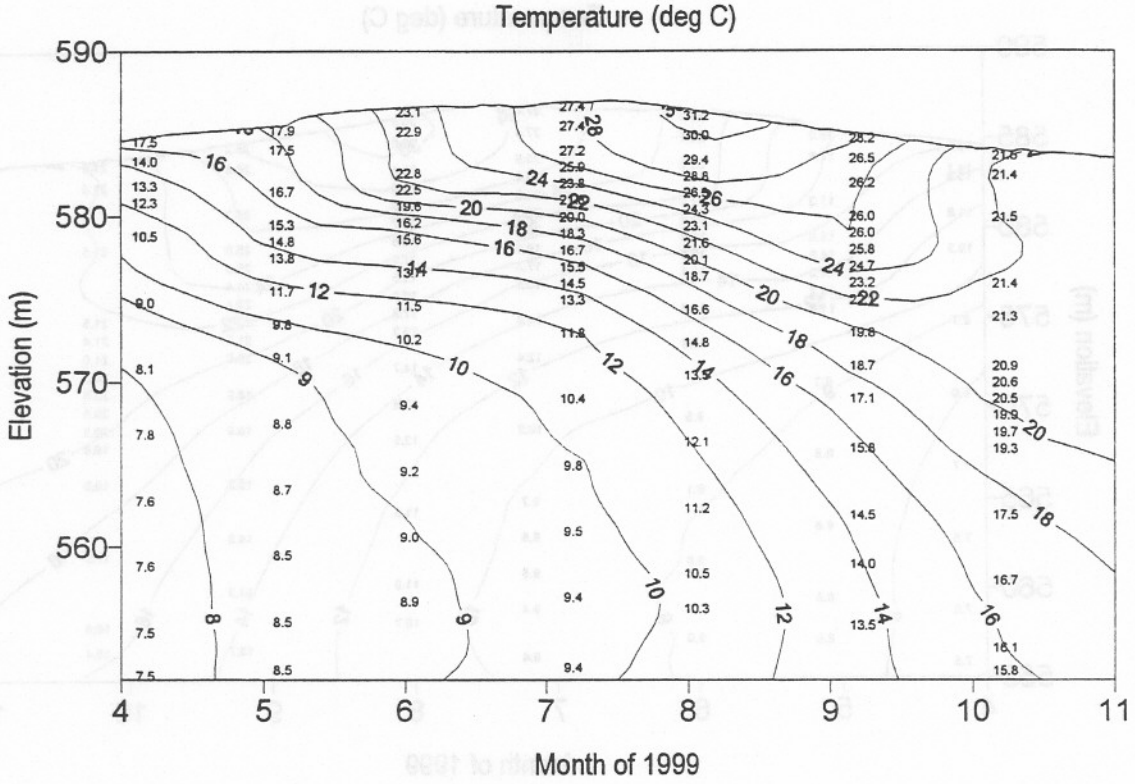


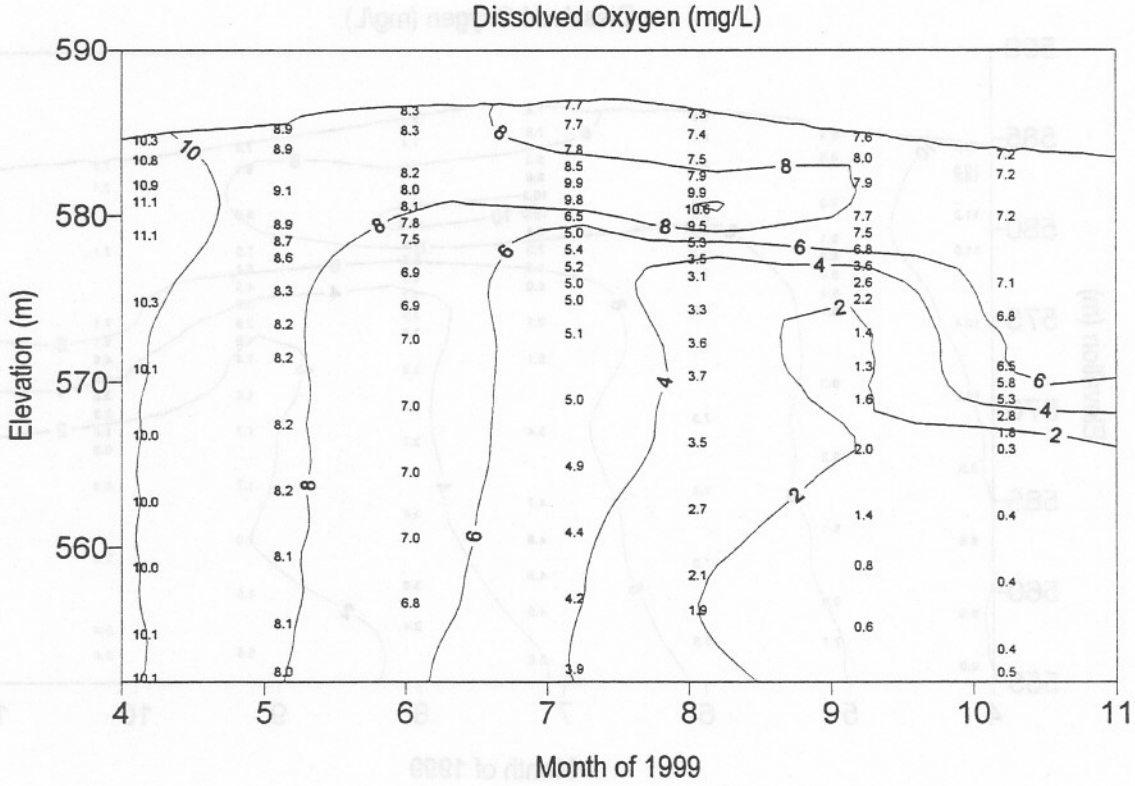
Boone Reservoir - WRM 6.5



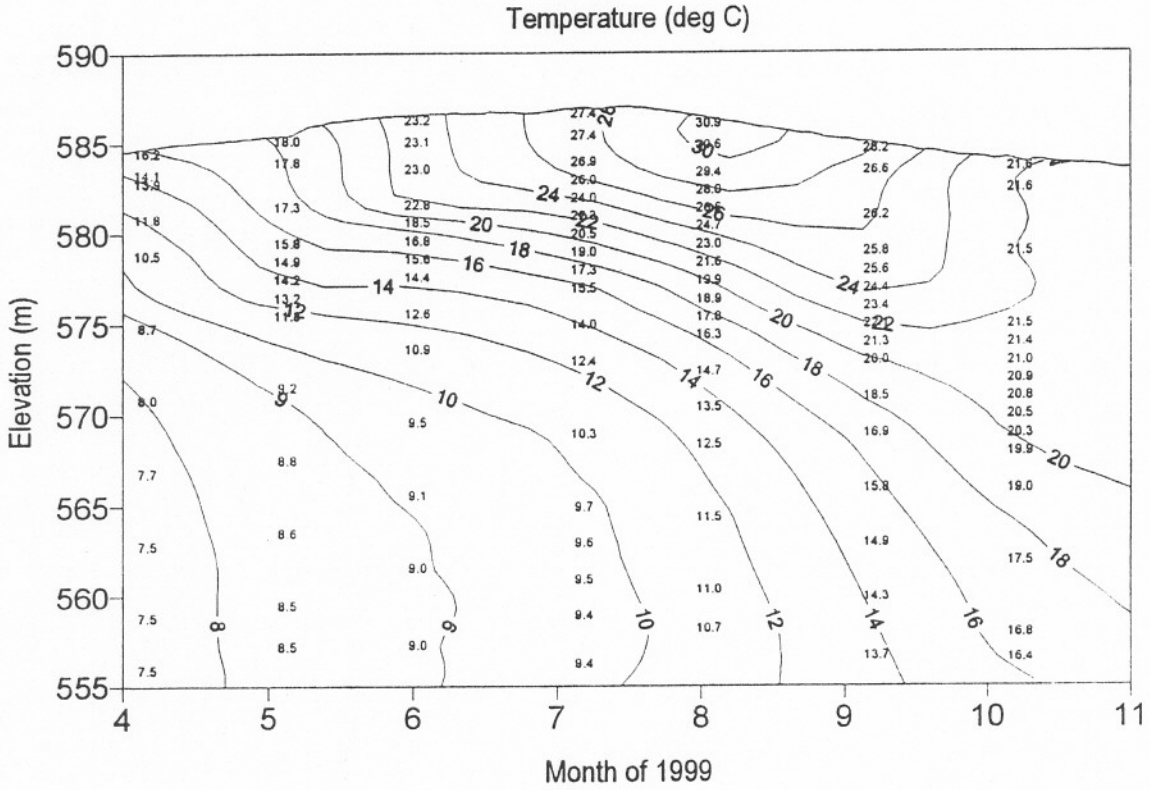


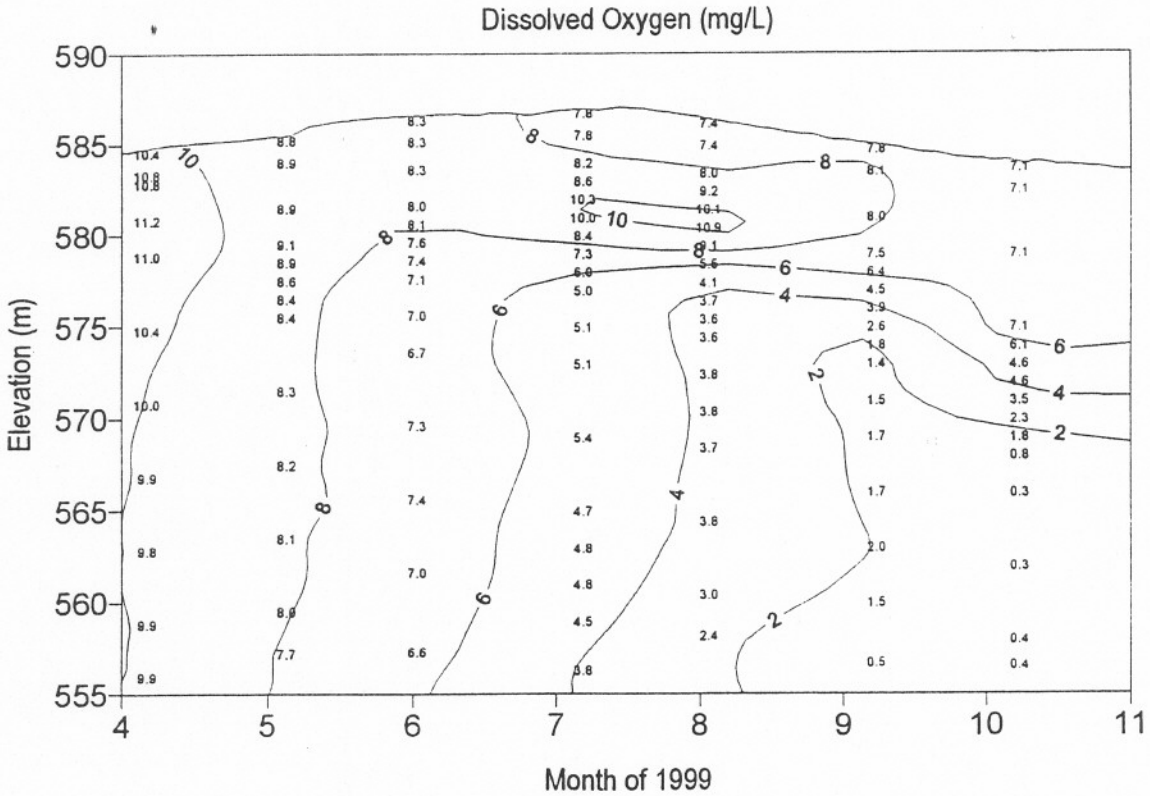
Chatuge Reservoir - HiRM 122.0



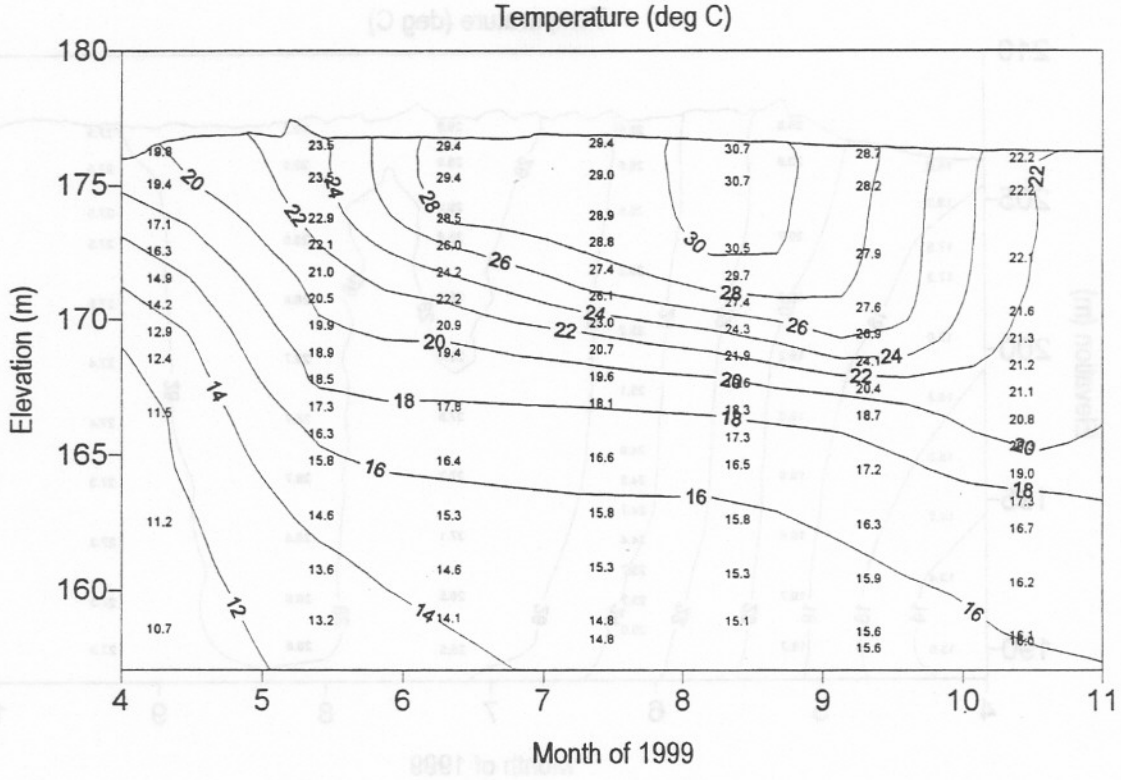


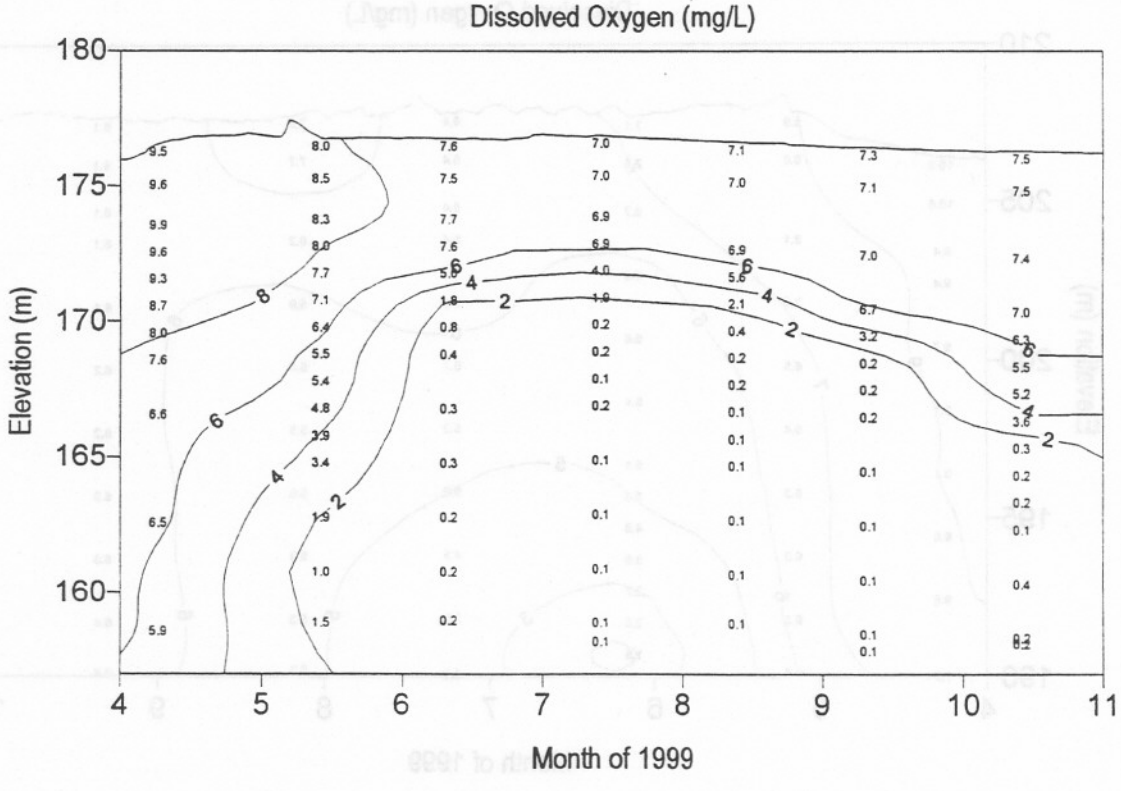
Chatuge Reservoir - Shooting Creek 1.5



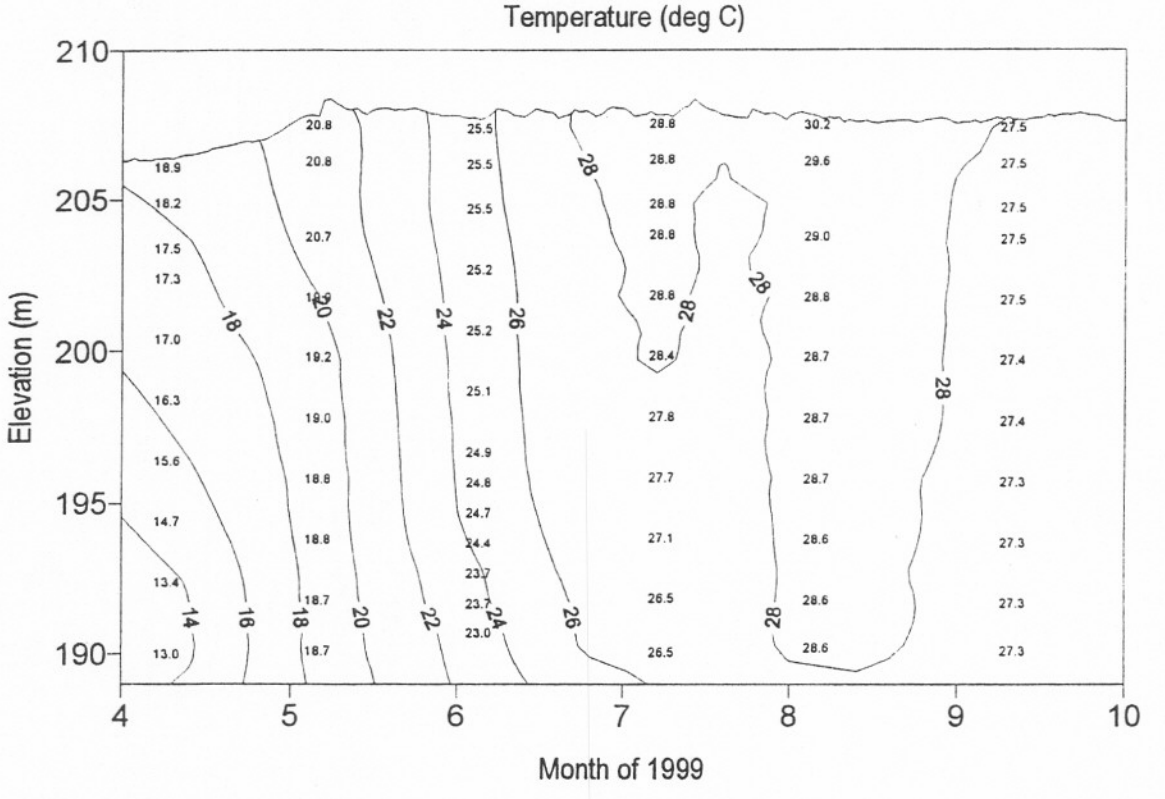


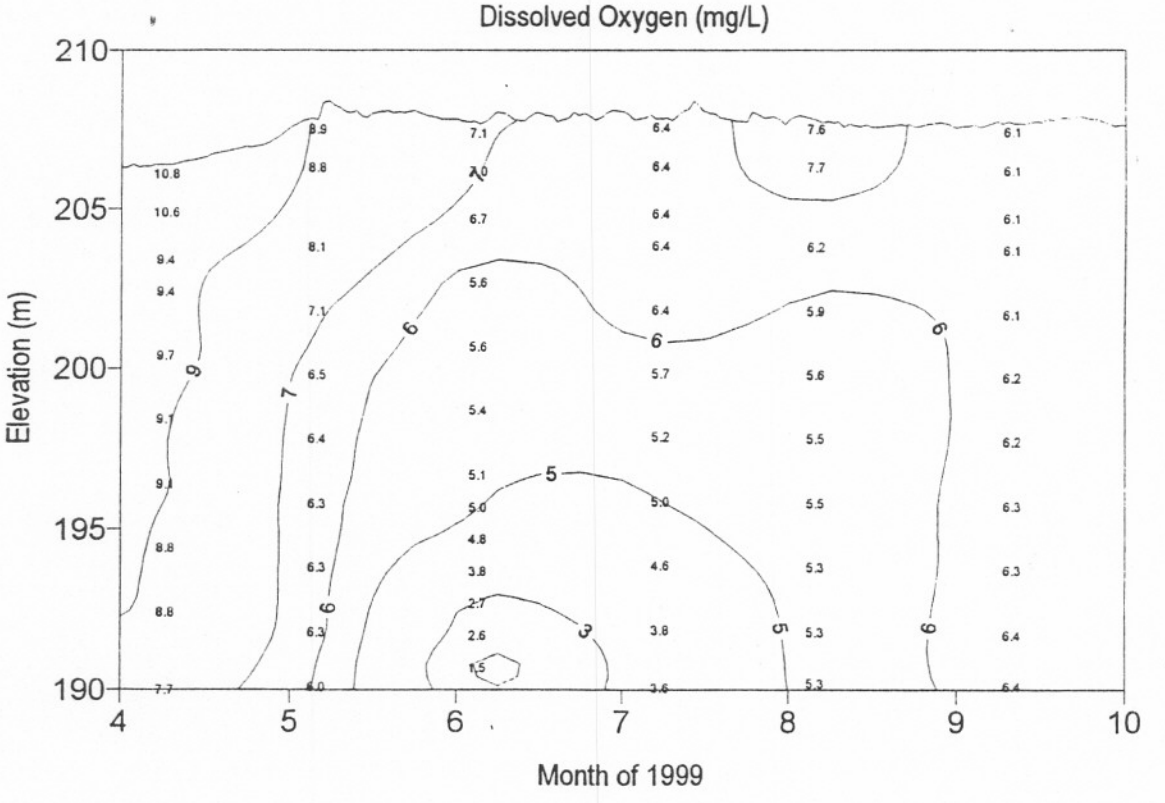
Cedar Creek Reservoir - CCM 25.2



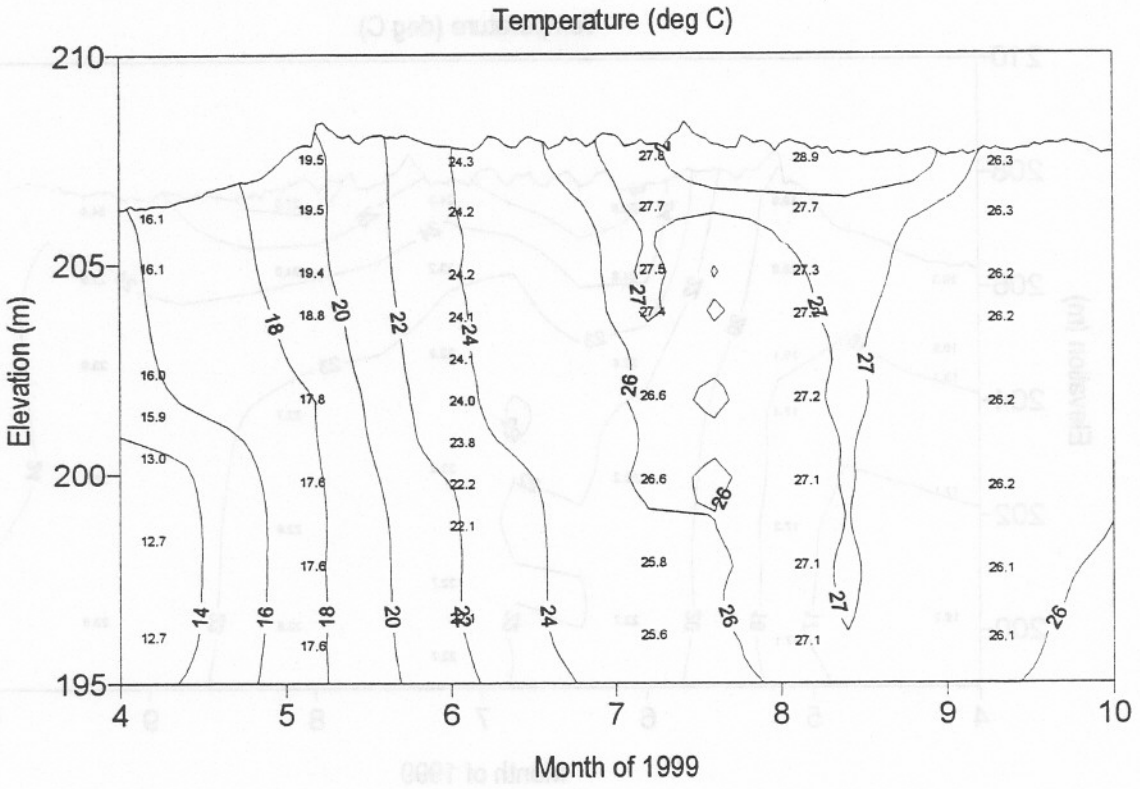


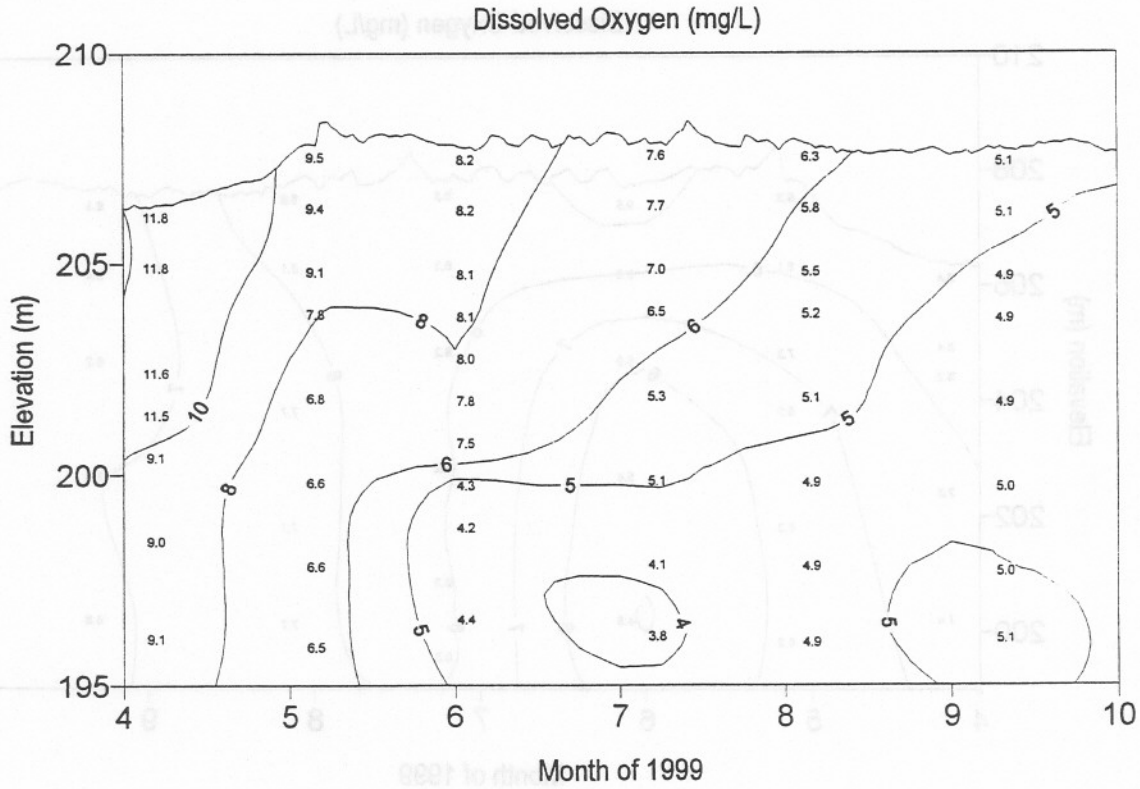
Chickamauga Reservoir - TRM 472.3



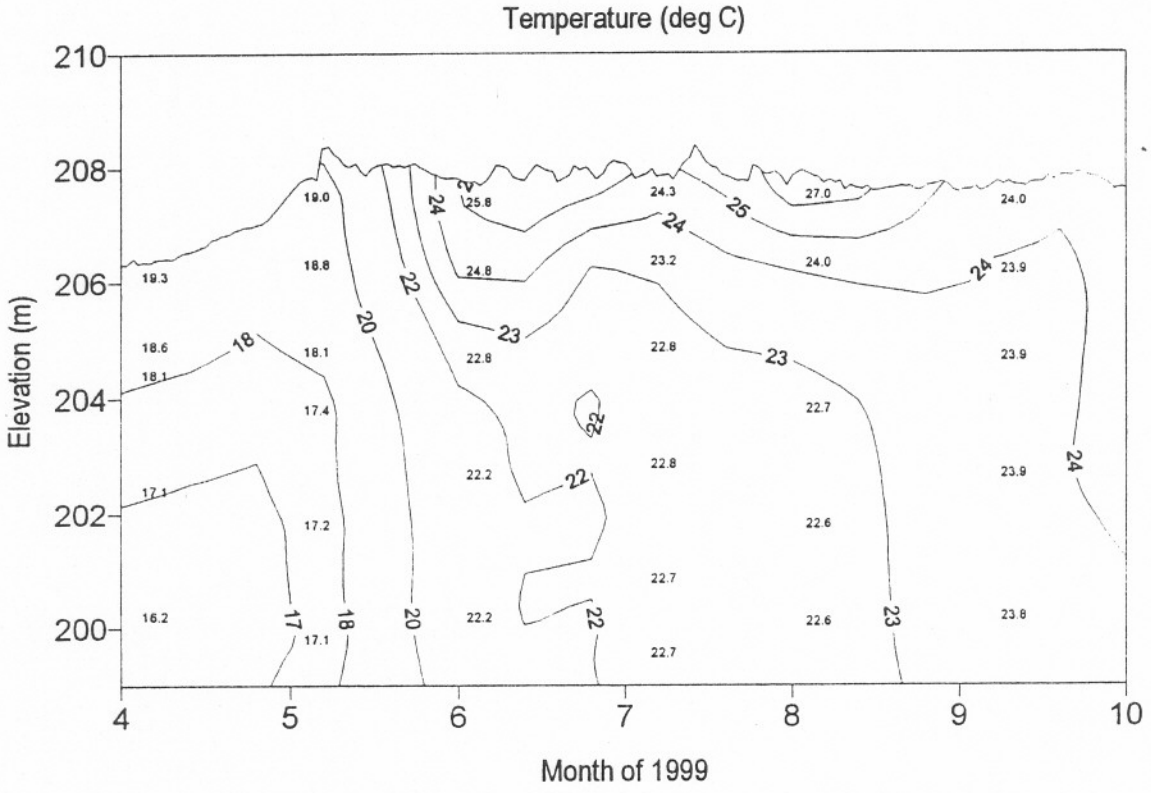


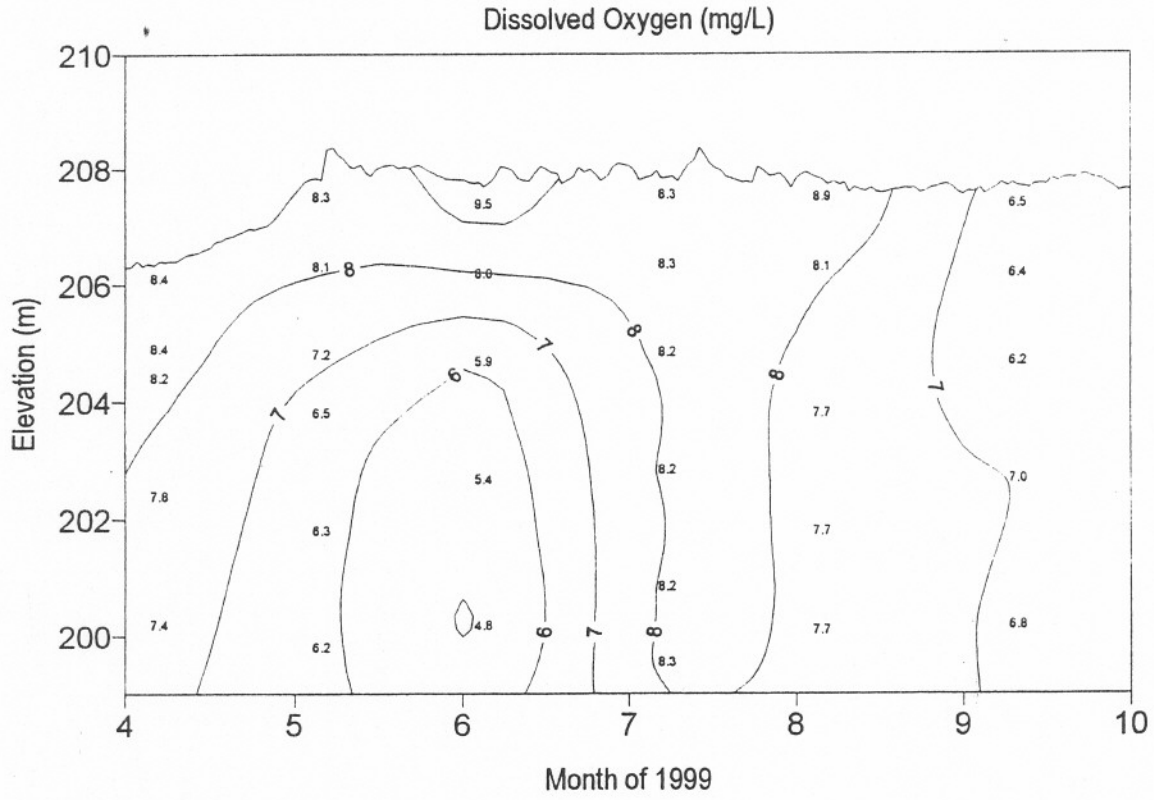
Chickamauga Reservoir - TRM 490.5



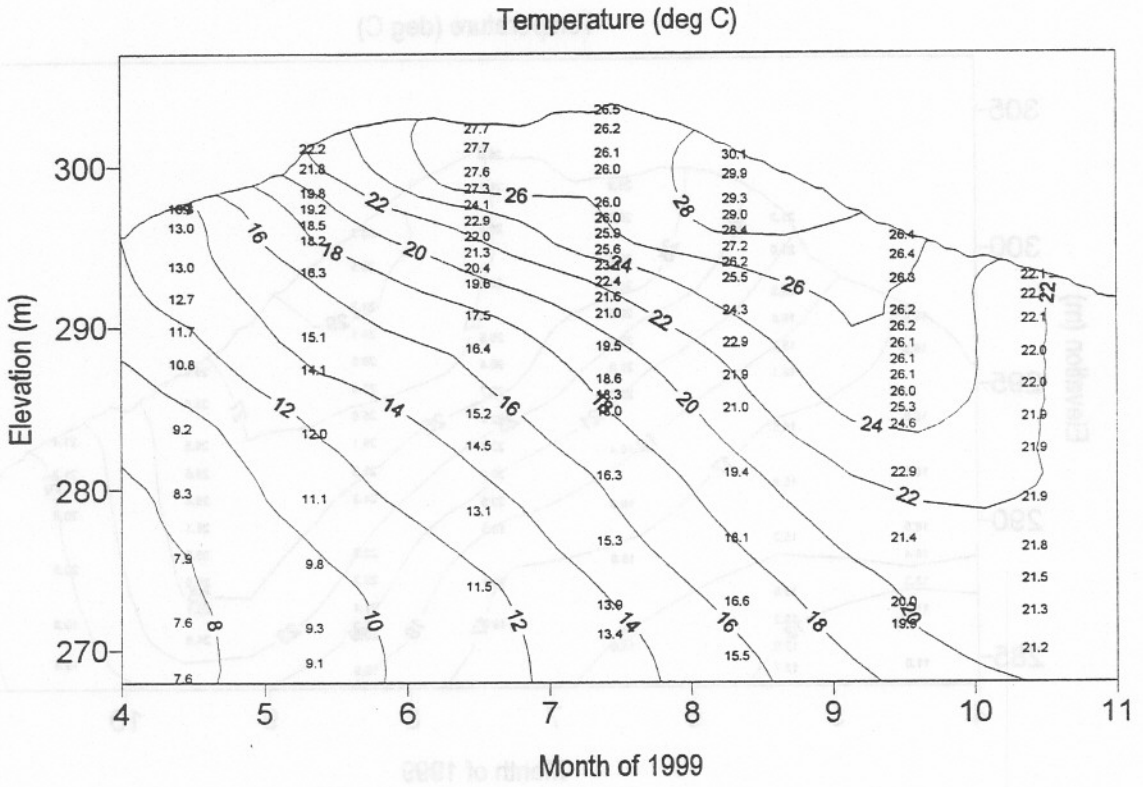


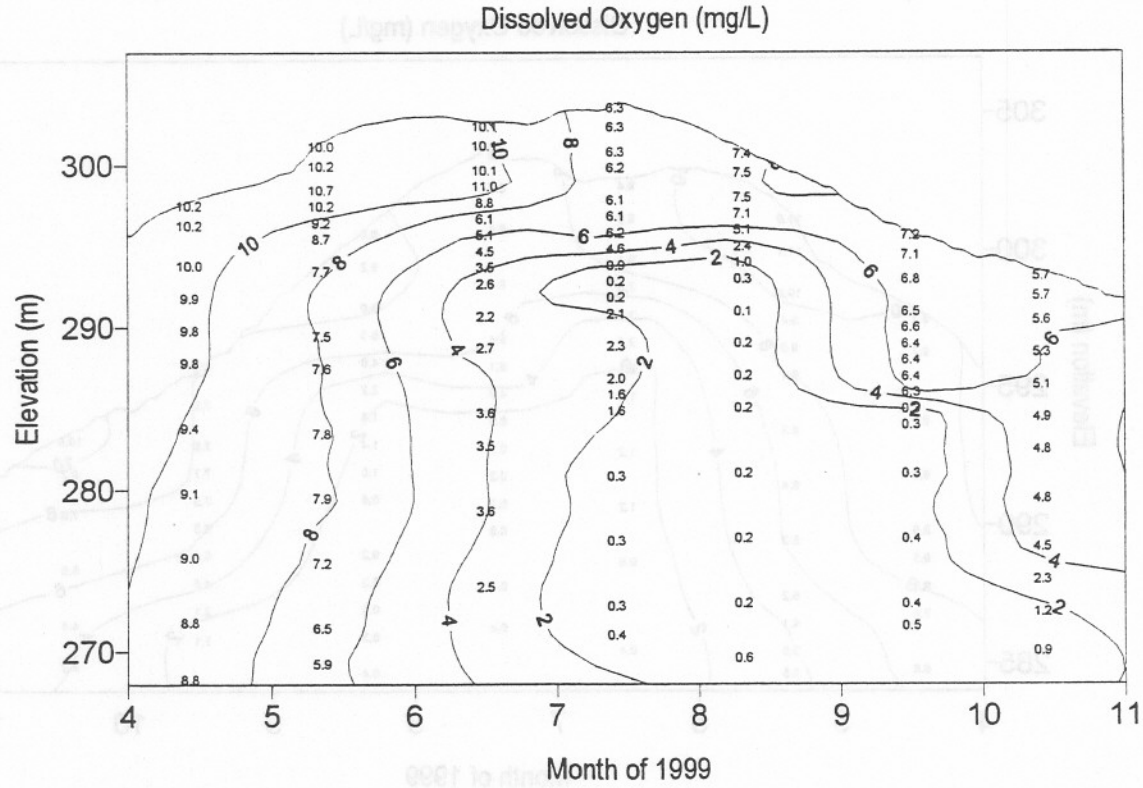
Chickamauga Reservoir - Hiwassee 8.5



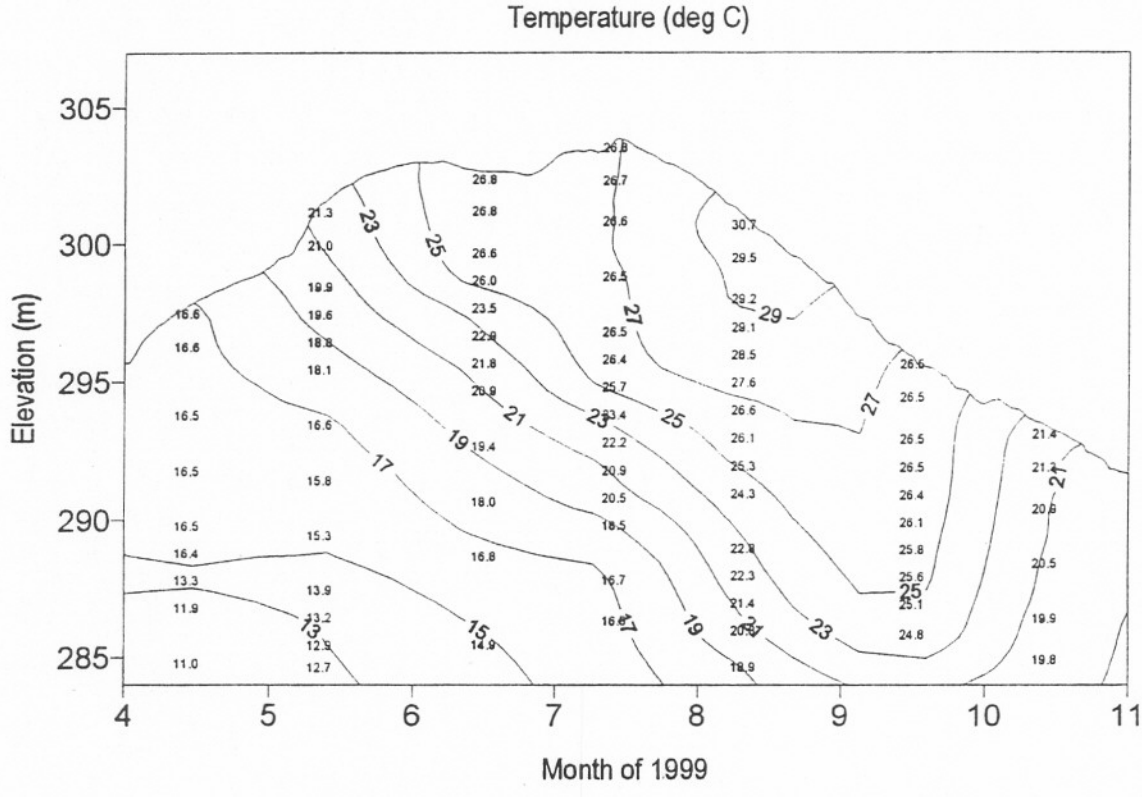


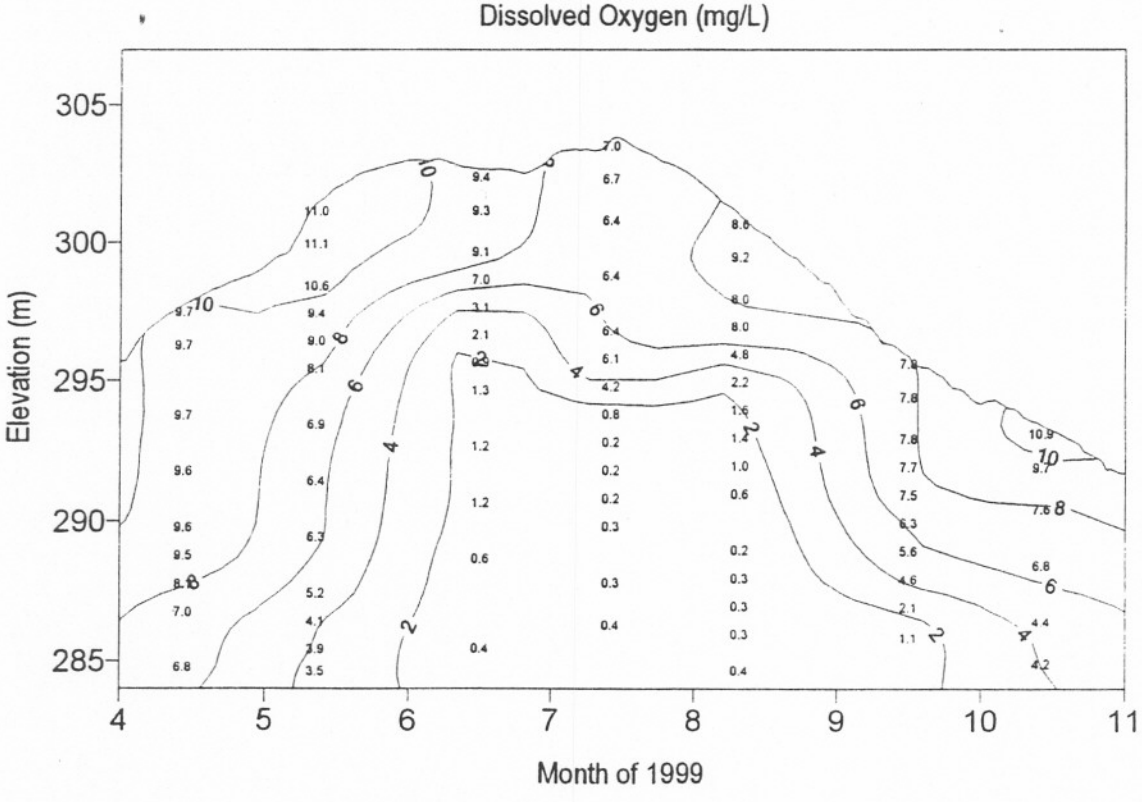
Douglas Reservoir - FBRM 34.5



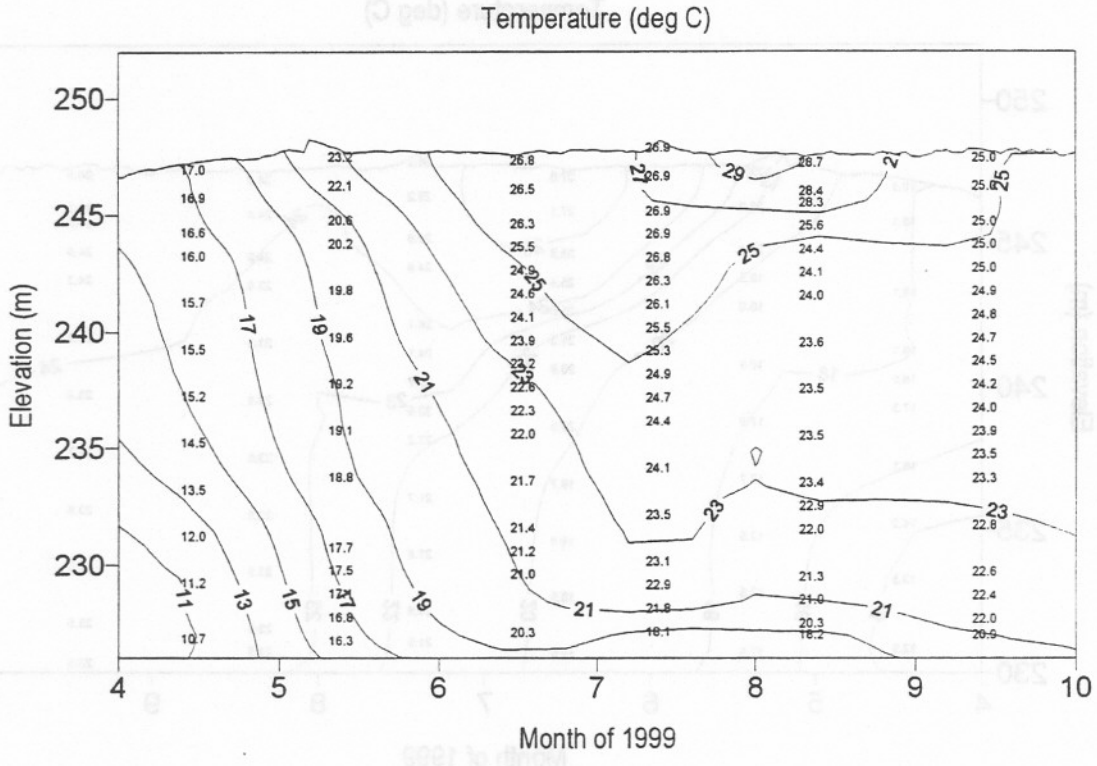


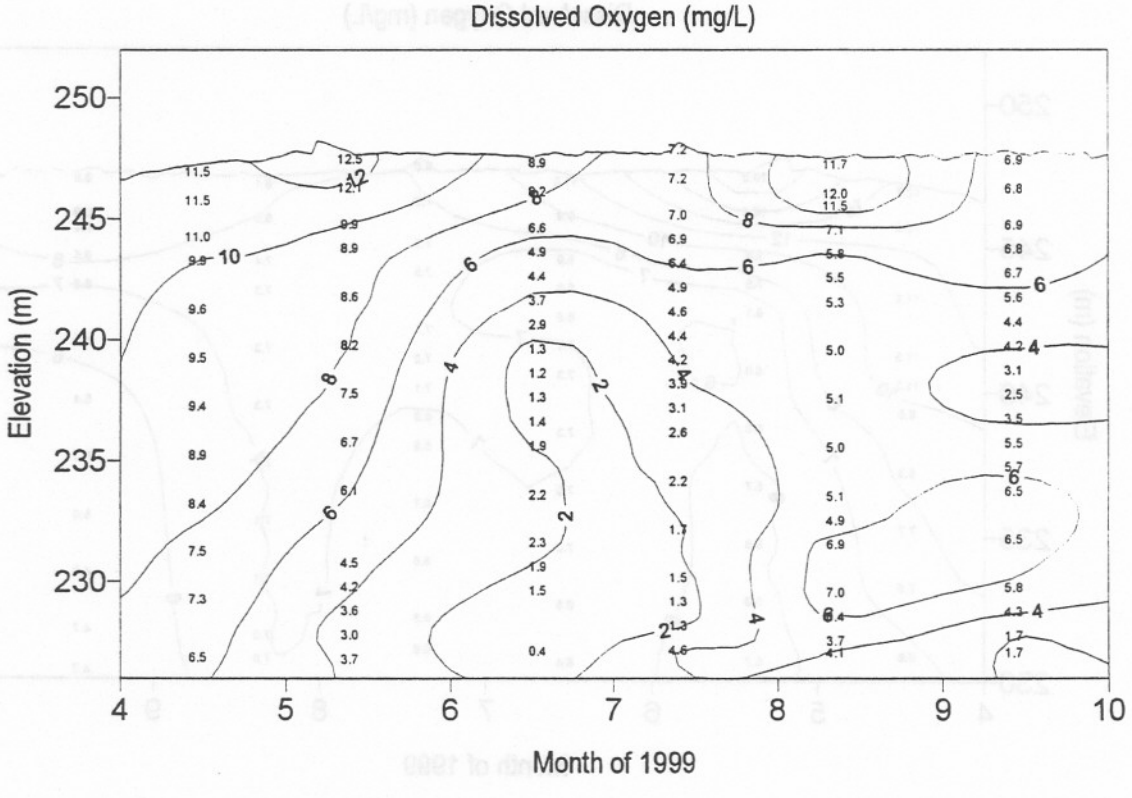
Douglas Reservoir - FBRM 51.0



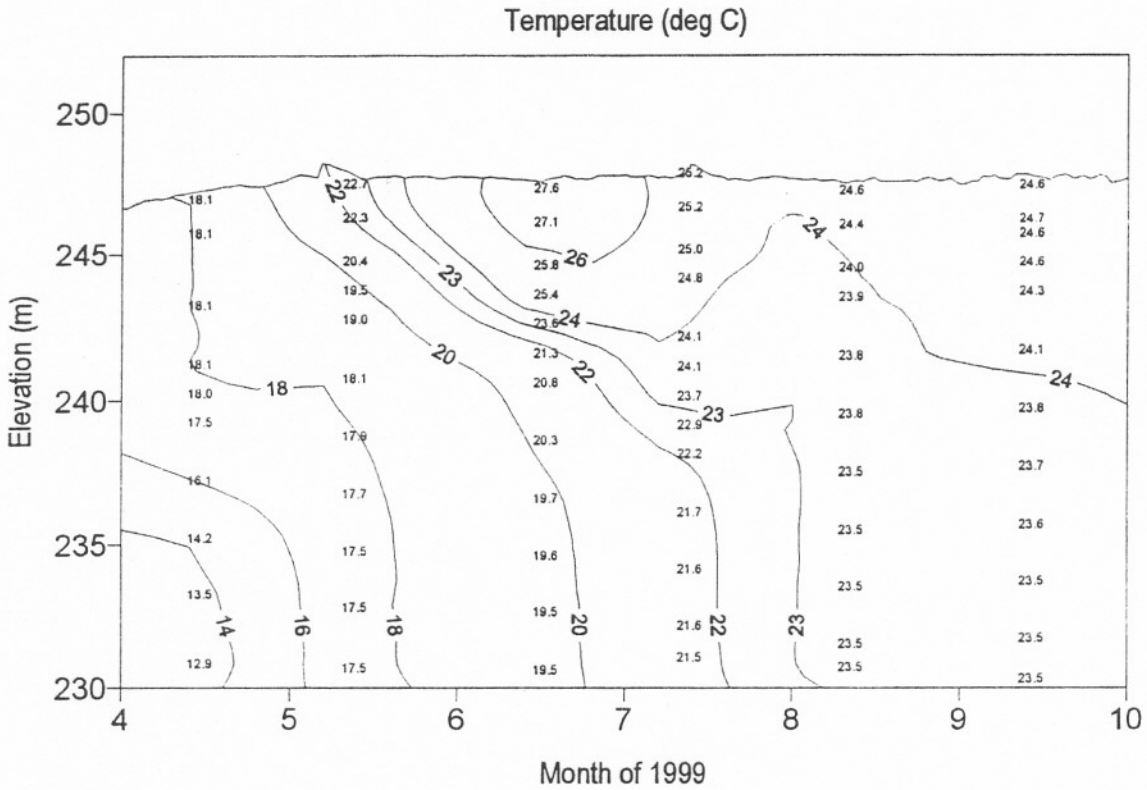


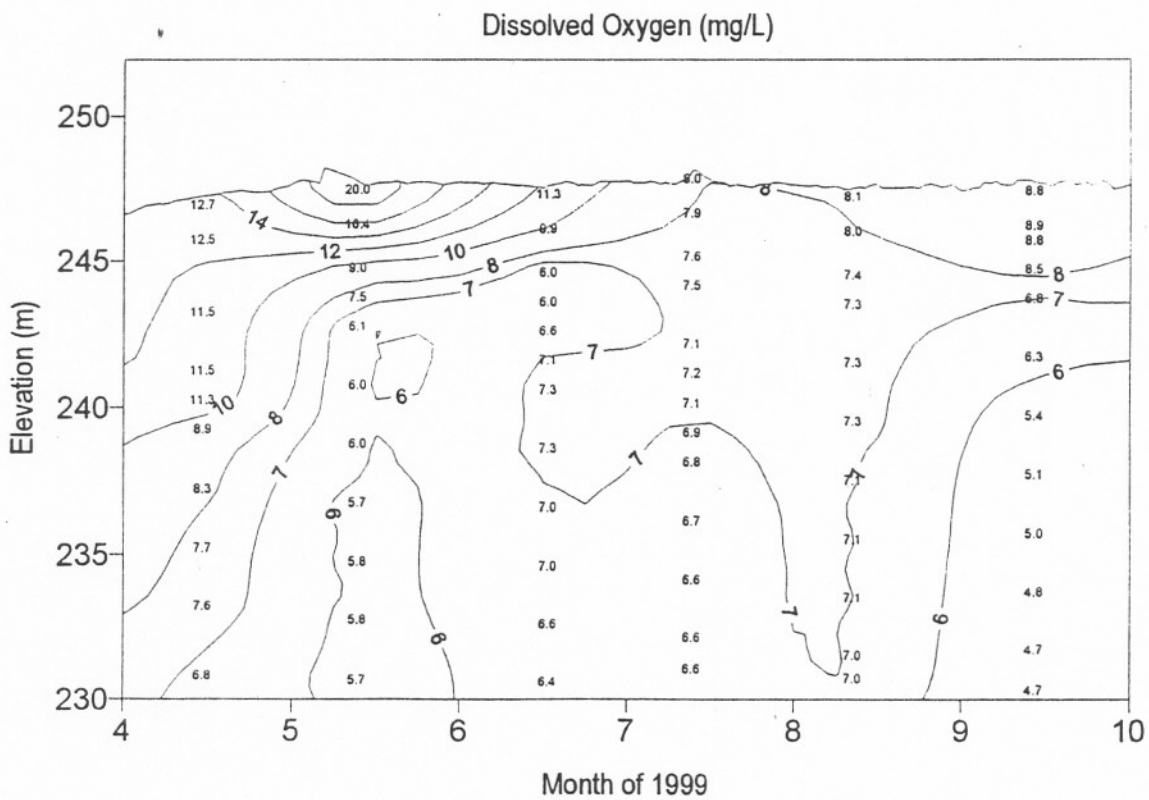
Fort Loudoun Reservoir - TRM 605.5



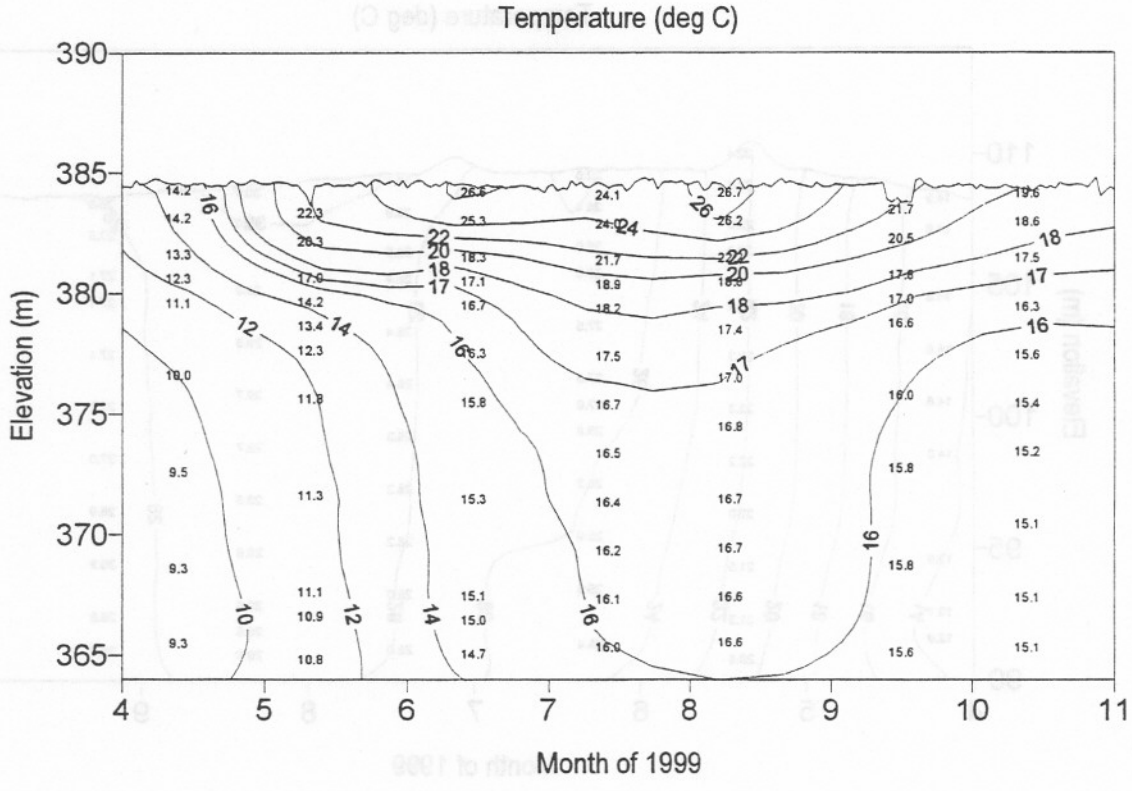


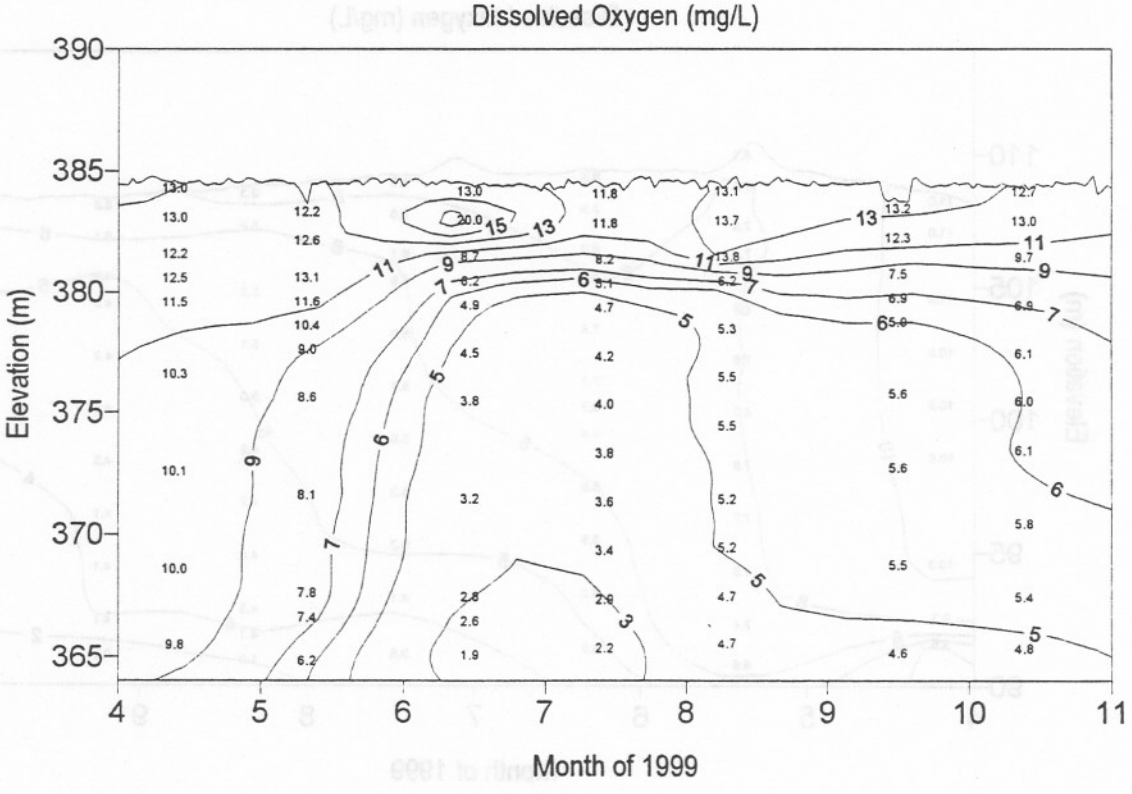
Fort Loudoun Reservoir - TRM 624.6



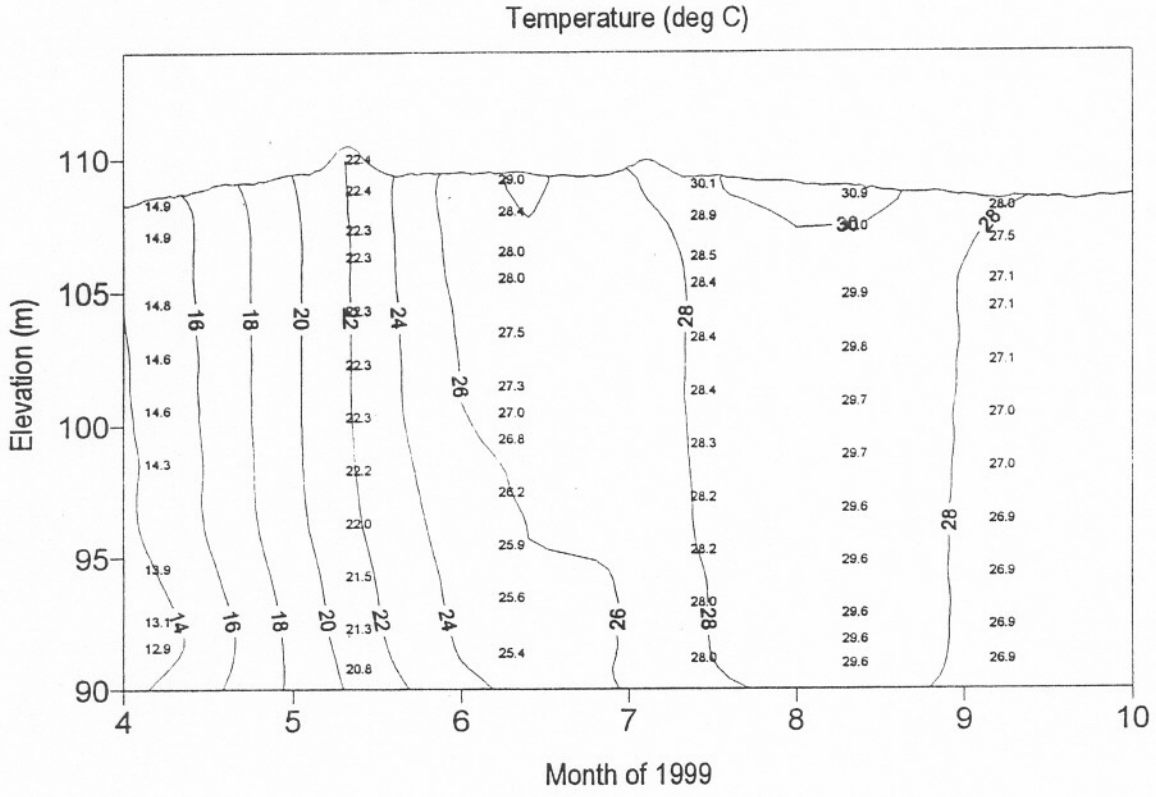


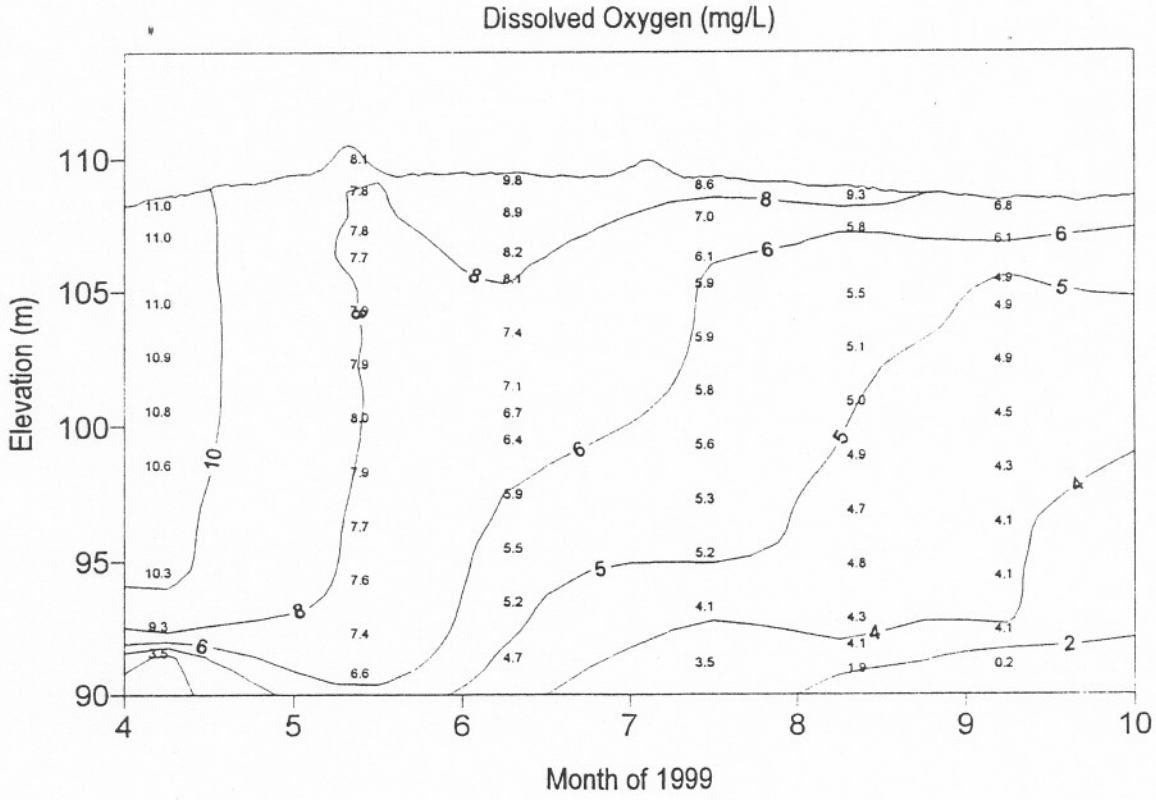
Ft. Pat Henry Reservoir - SFHRM 8.7



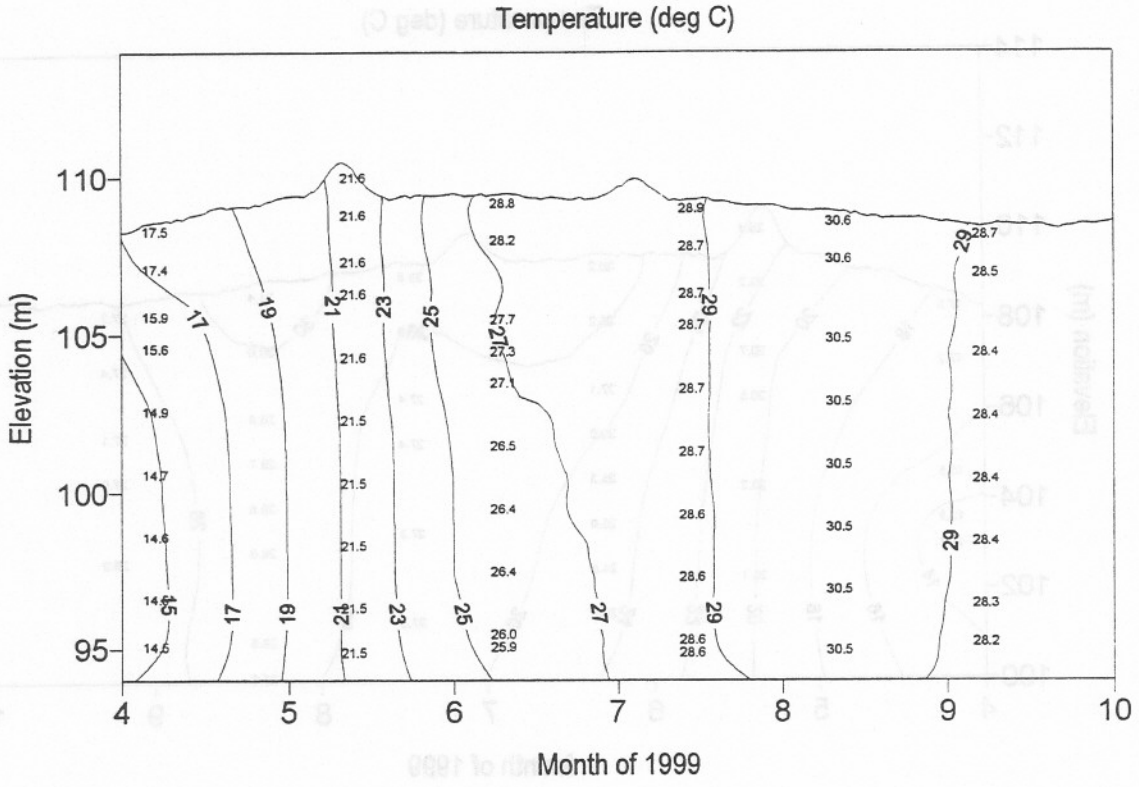


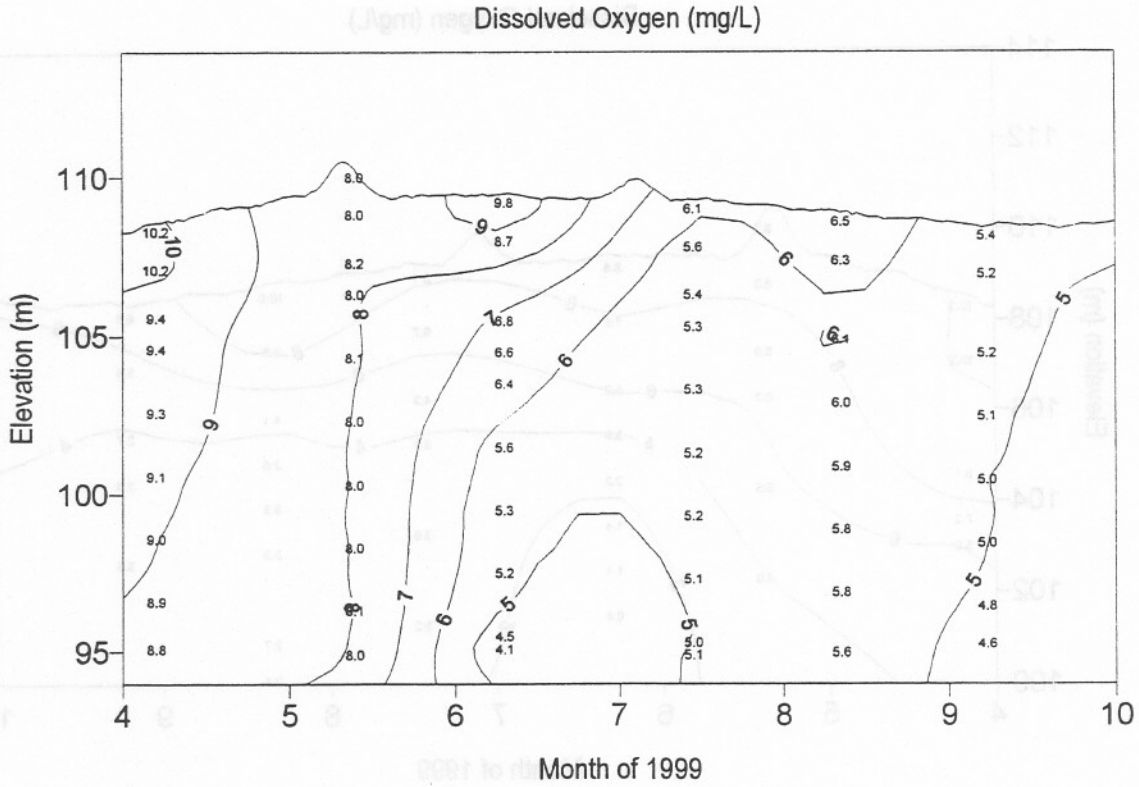
Kentucky Reservoir - TRM 23.0



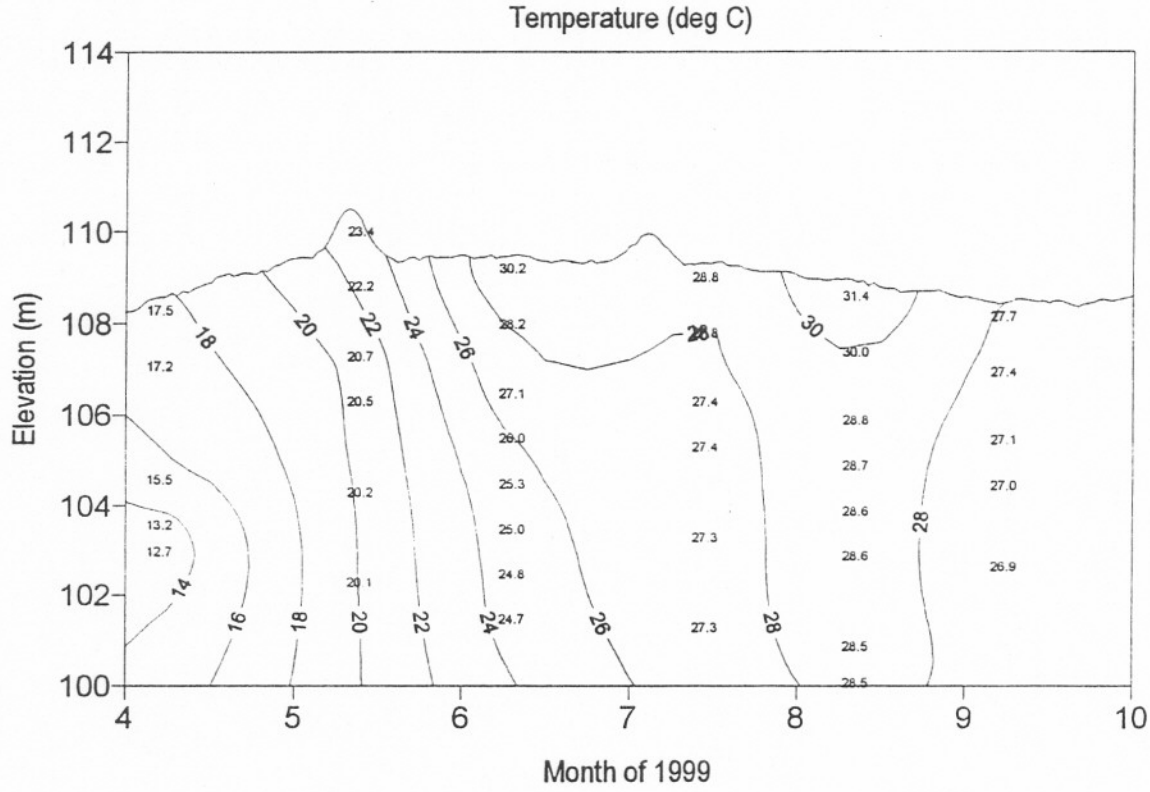


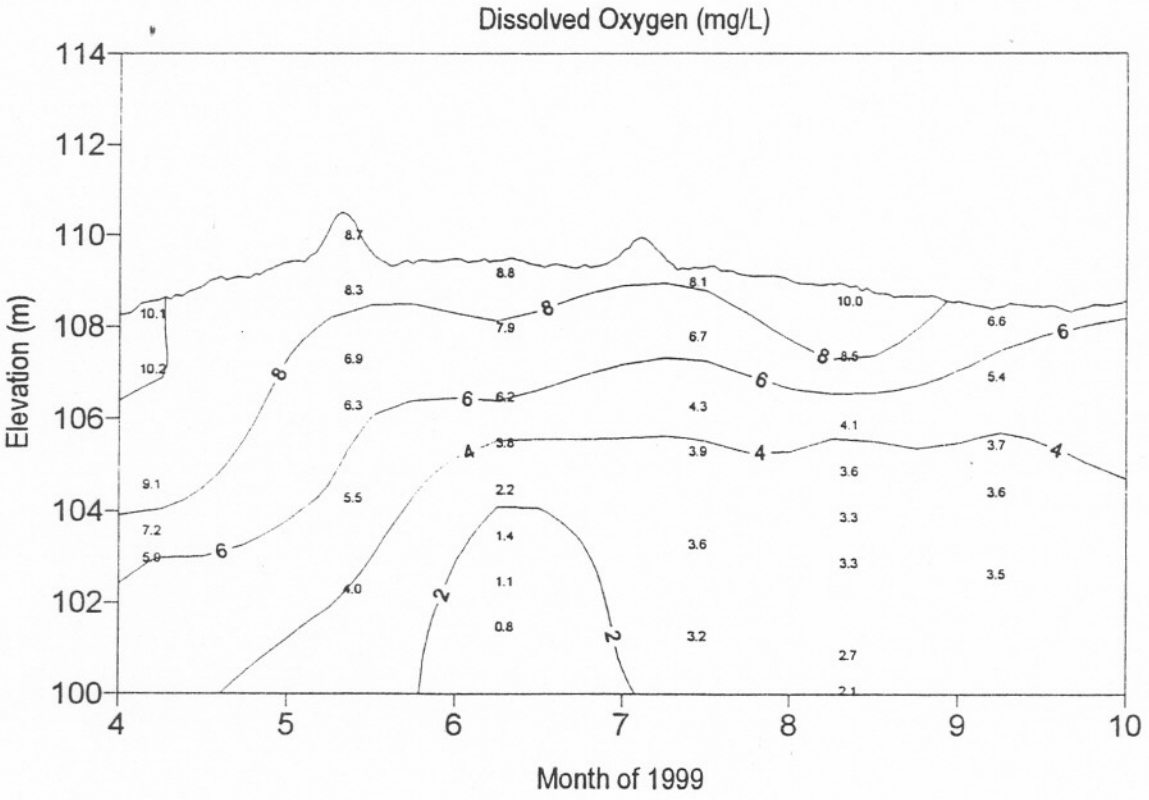
Kentucky Reservoir - TRM 85.0



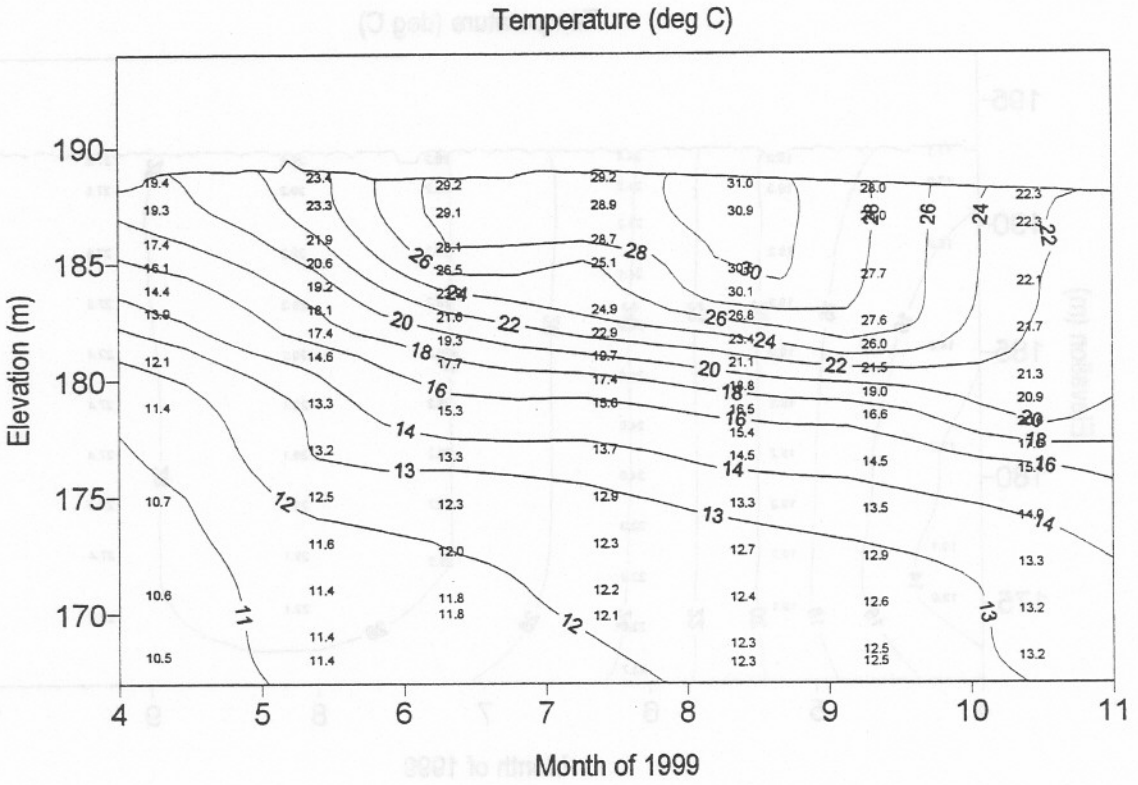


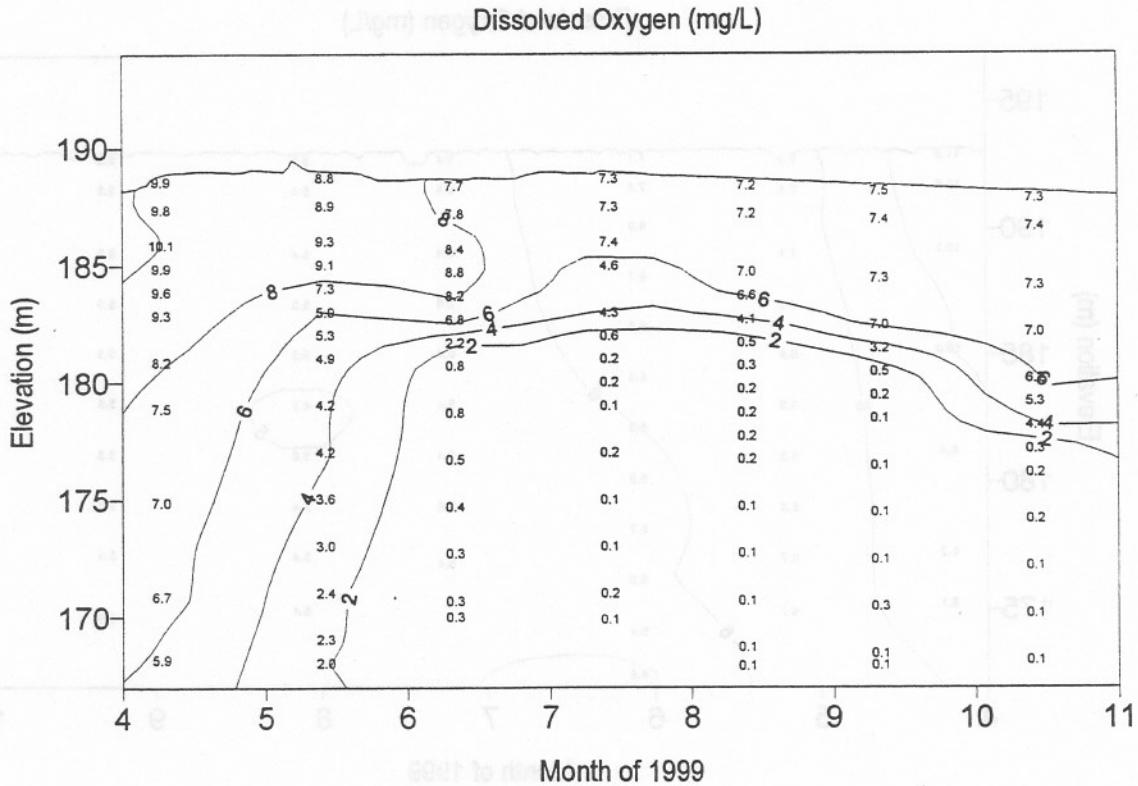
Kentucky Reservoir - Big Sandy 7.4



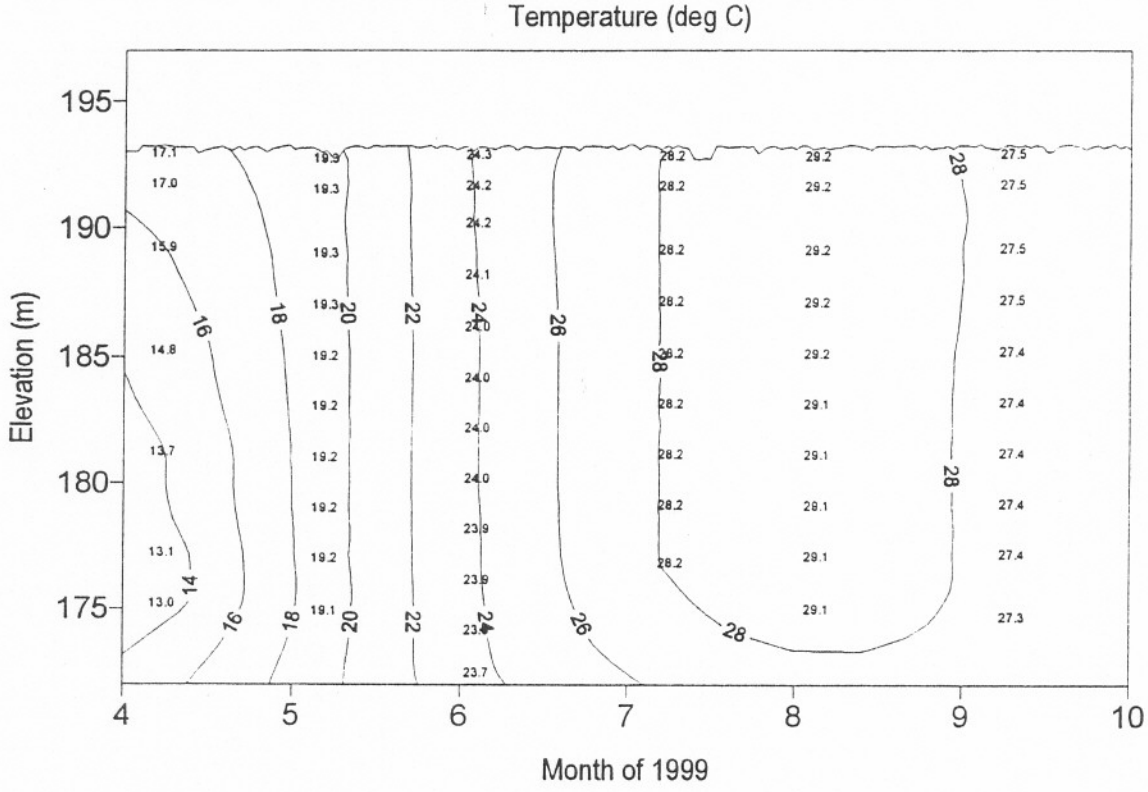


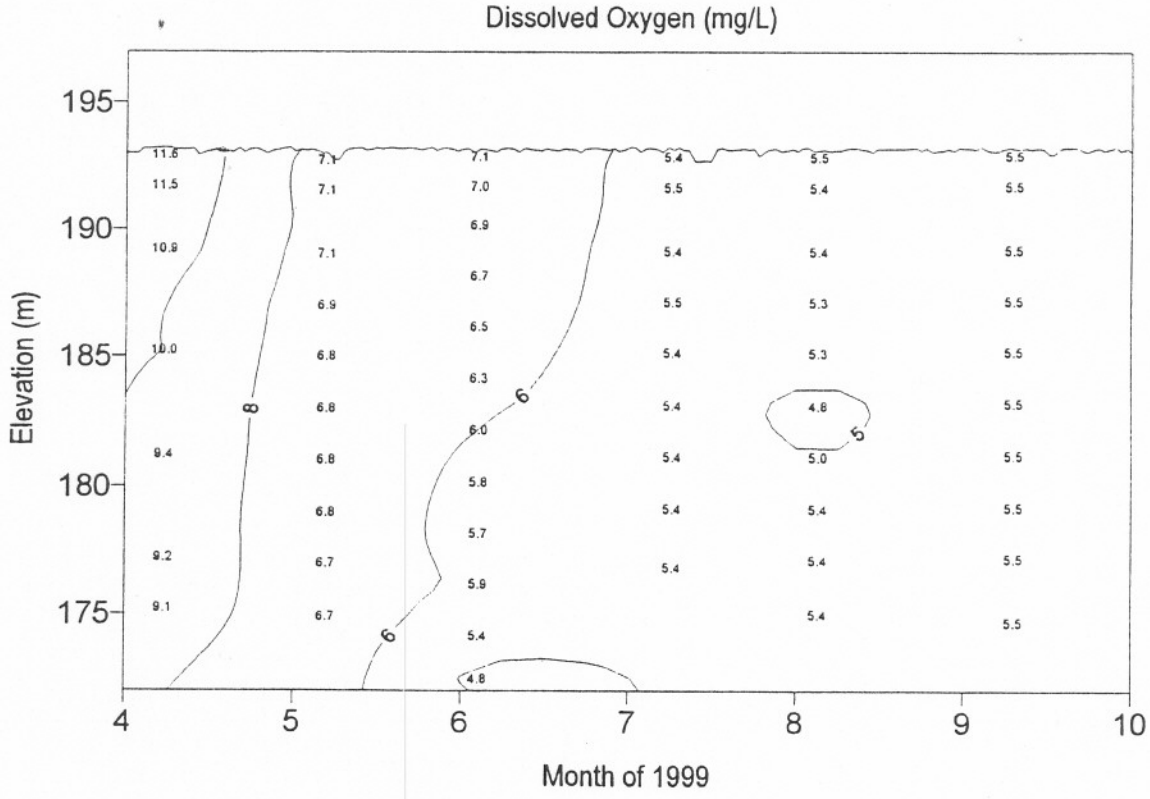
Little Bear Creek Reservoir - LBCM 12.5





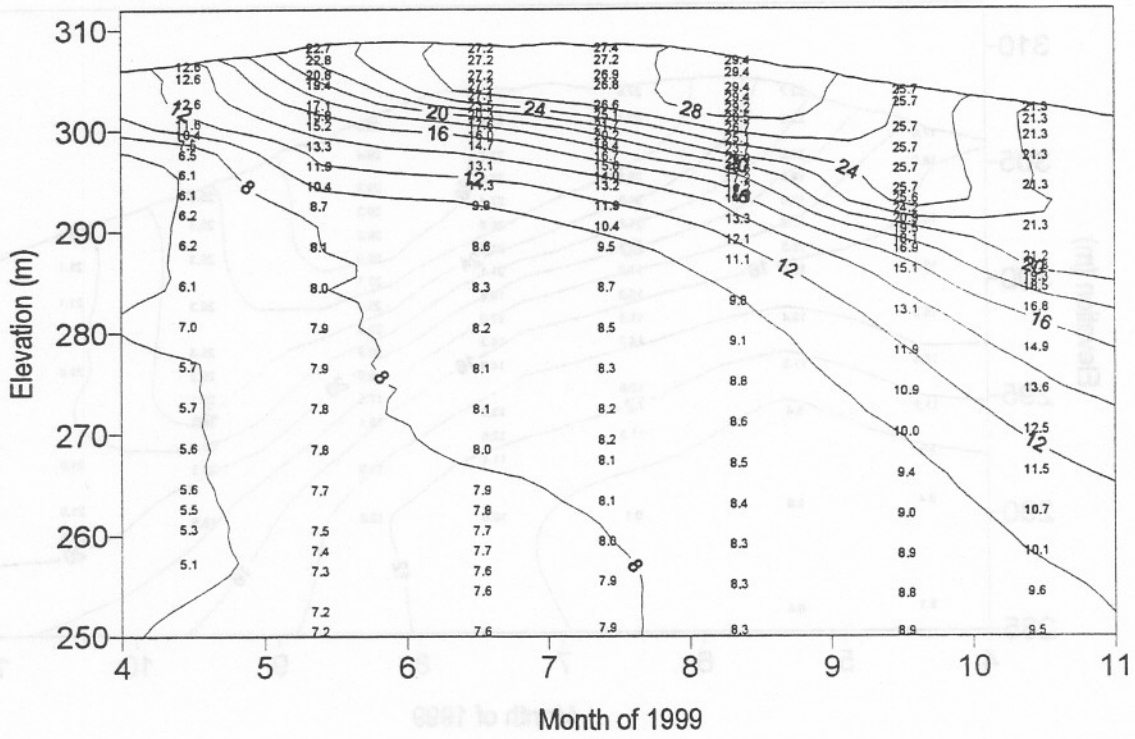
Nickajack Reservoir - TRM 425.5



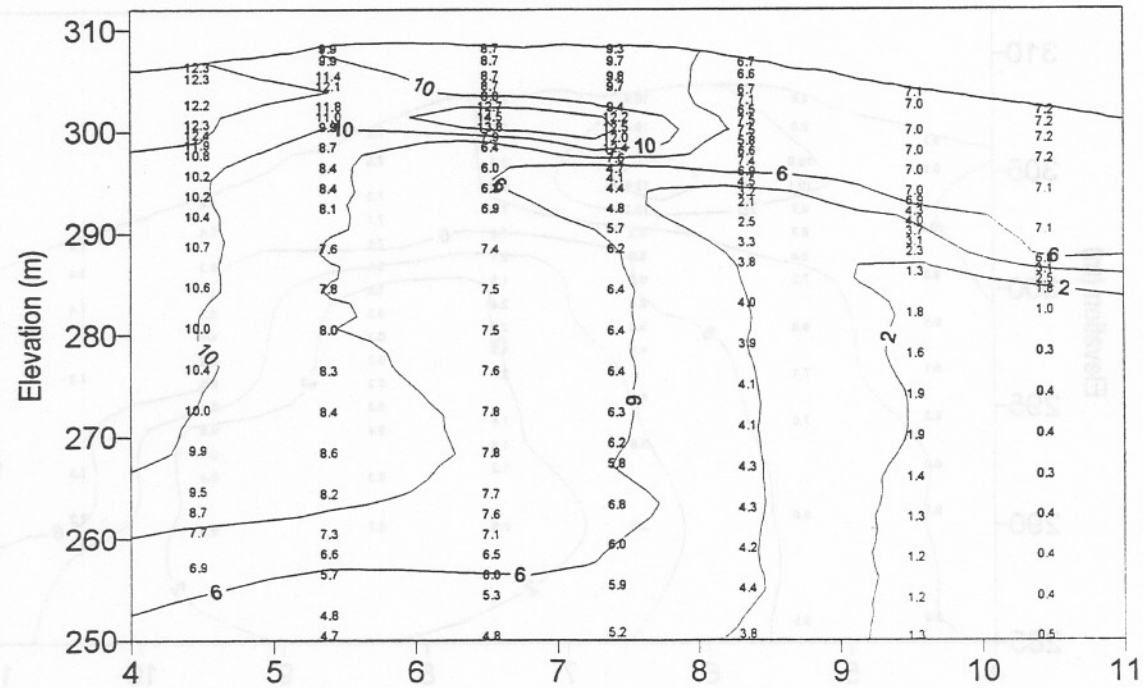


Norris Reservoir - CRM 80.0

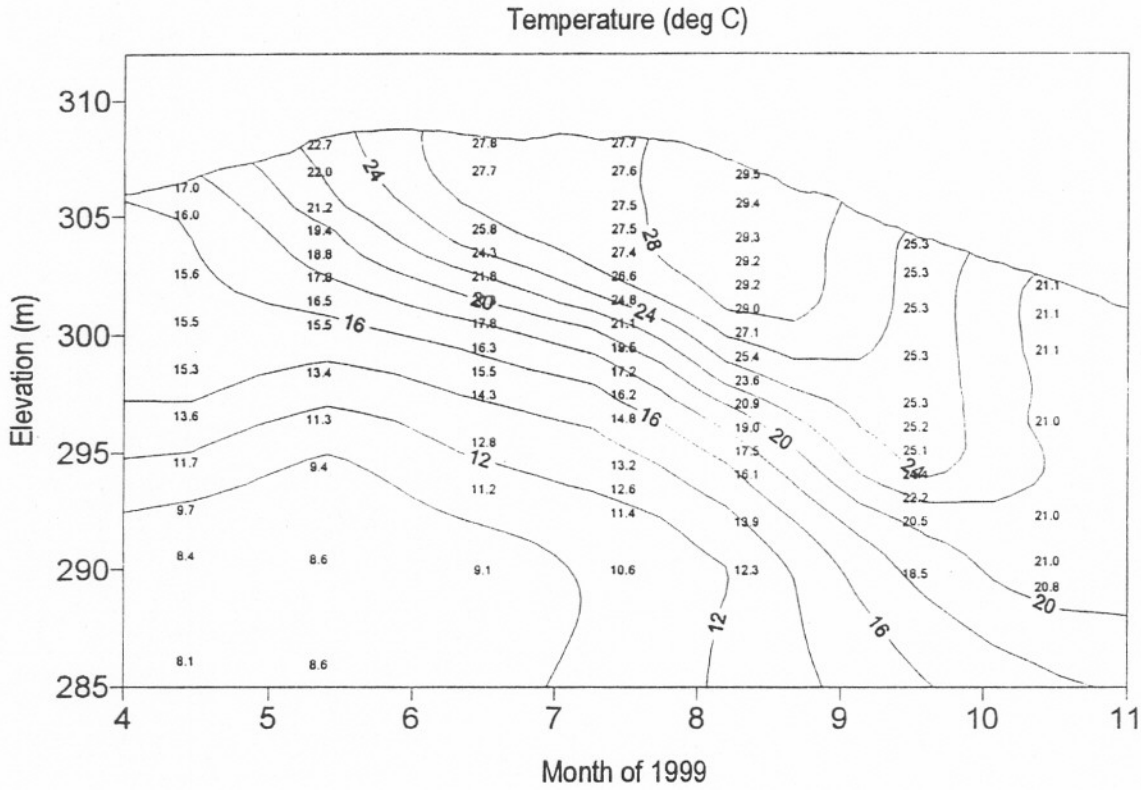
Temperature (deg C)

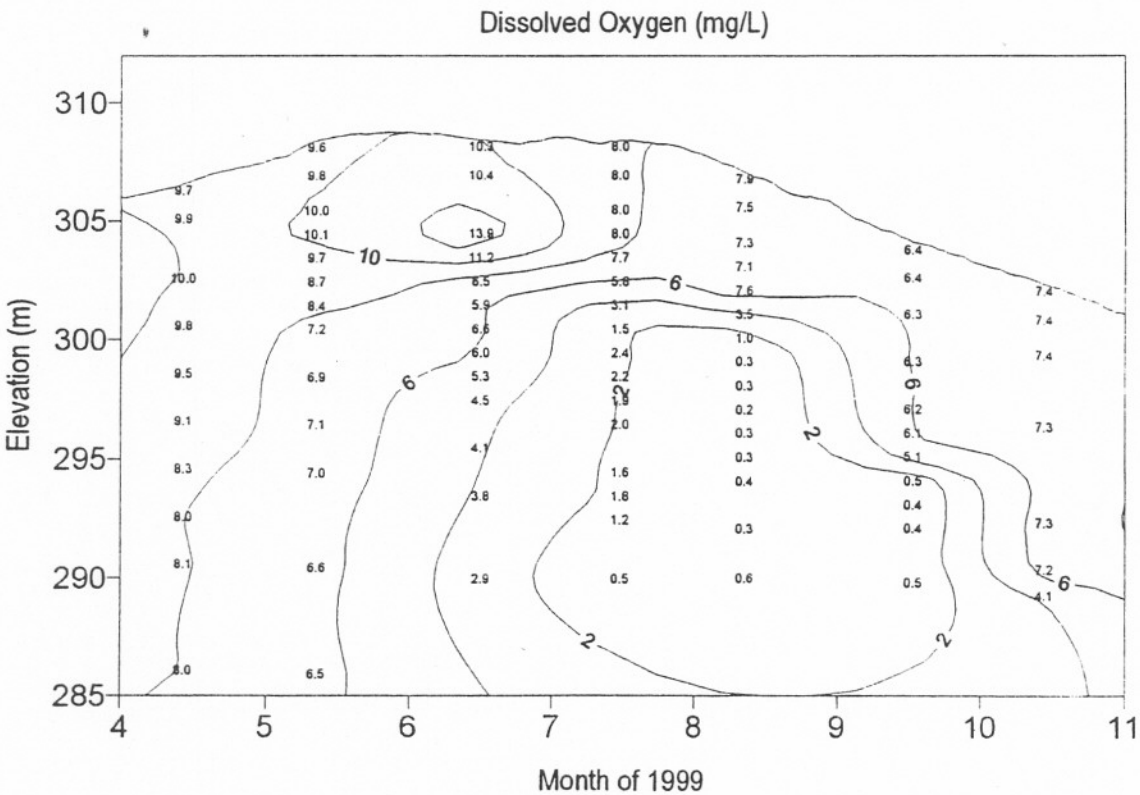


Dissolved Oxygen (mg/L)

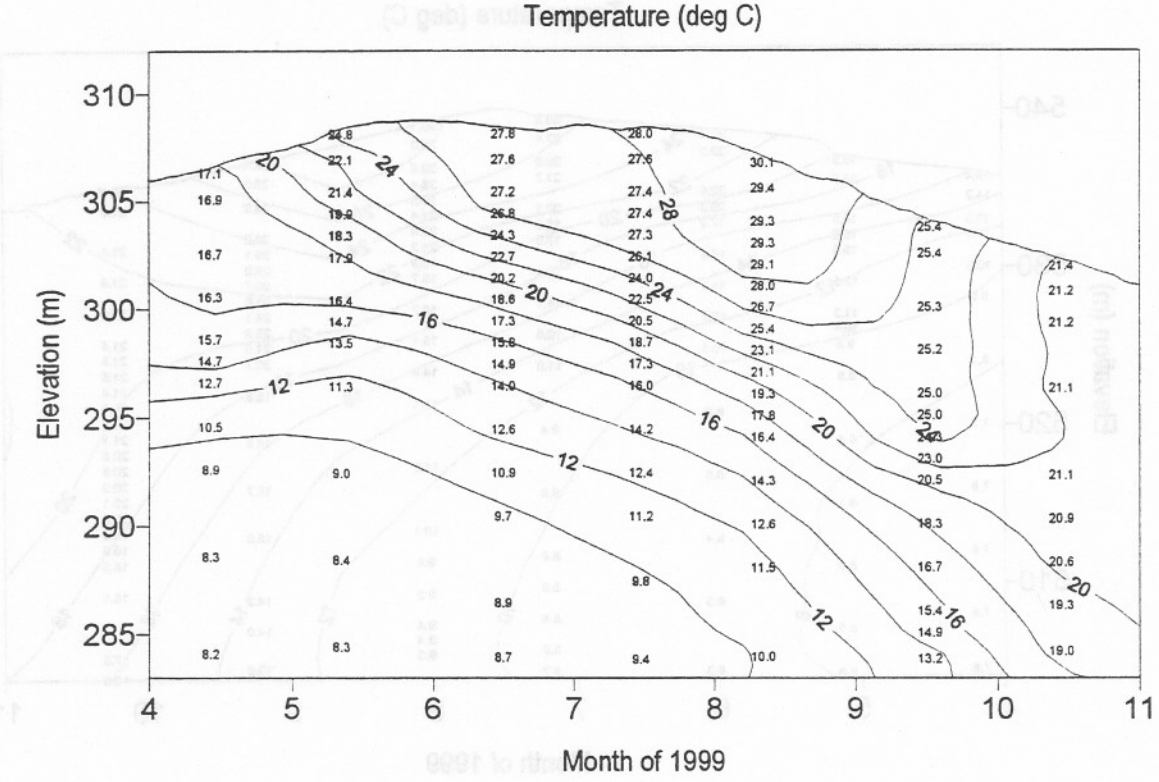


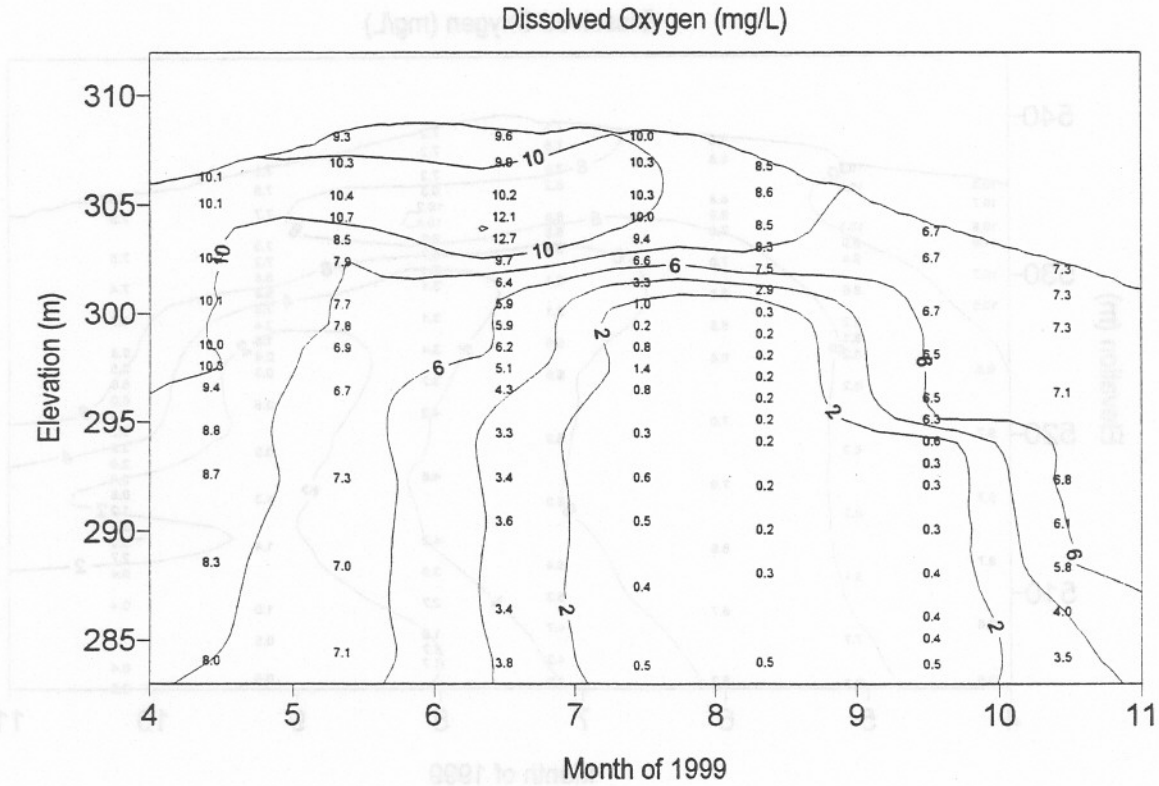
Norris Reservoir - CRM 125.0



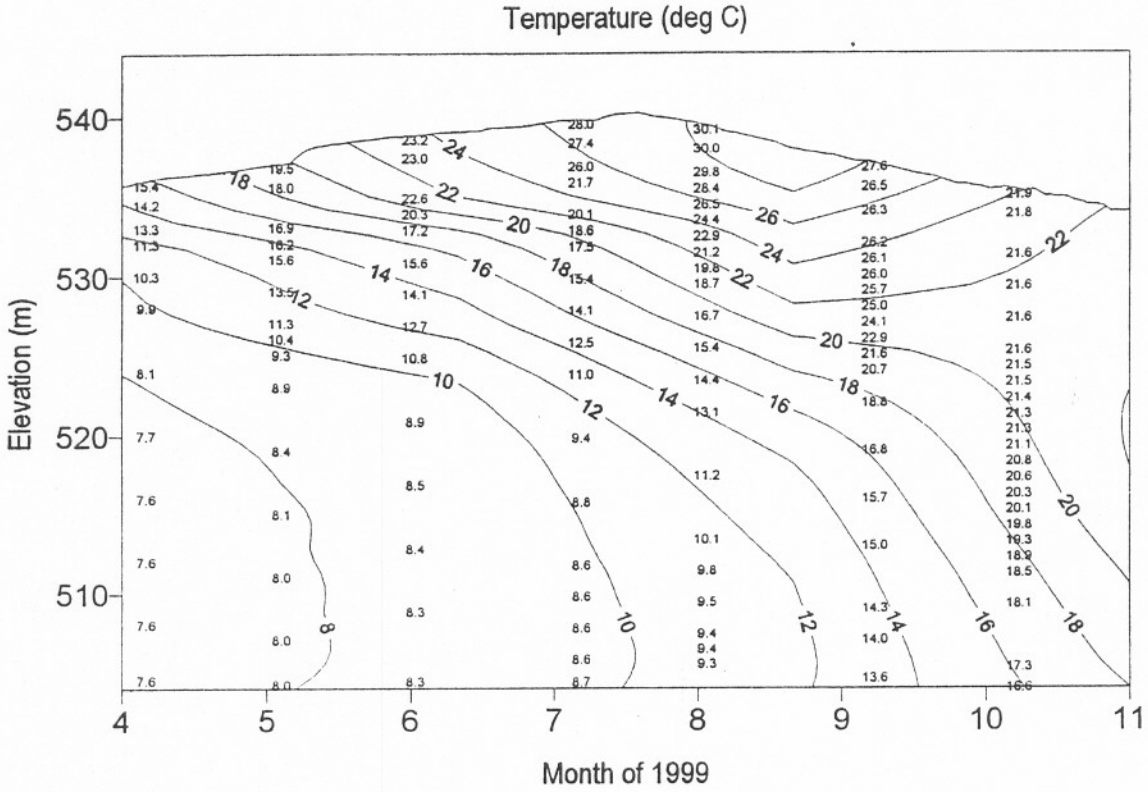


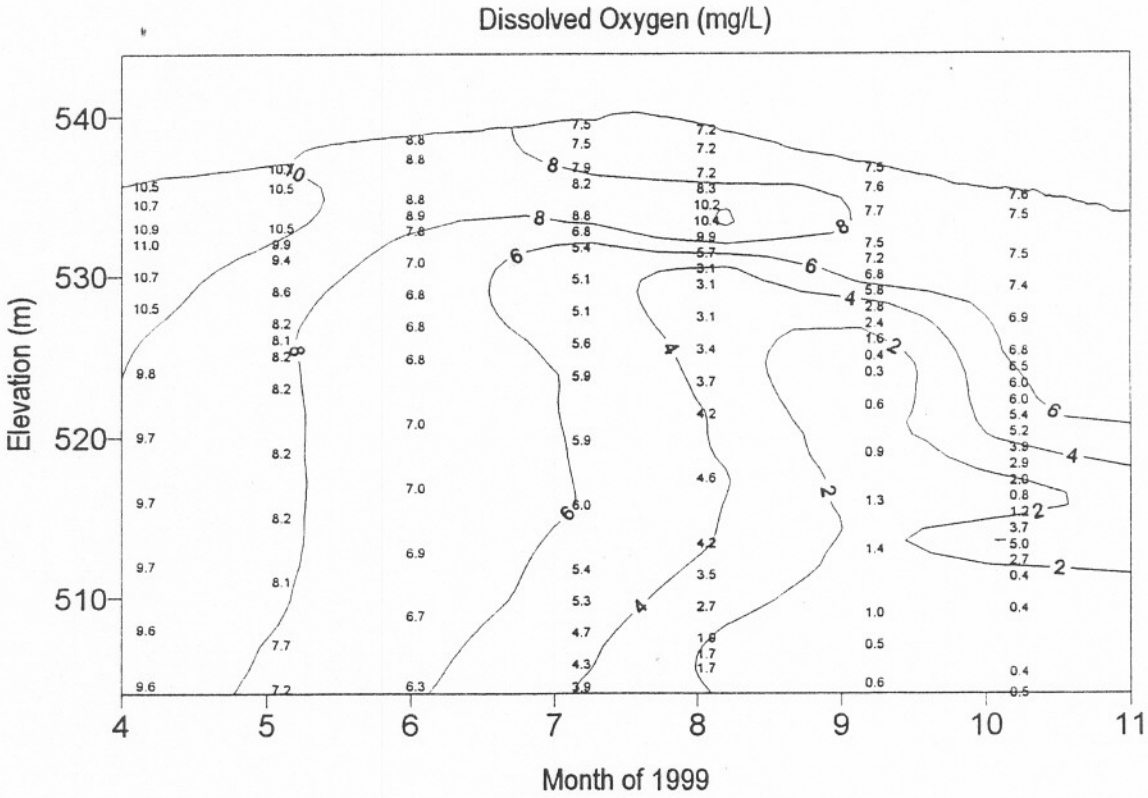
Norris Reservoir - PRM 30.0



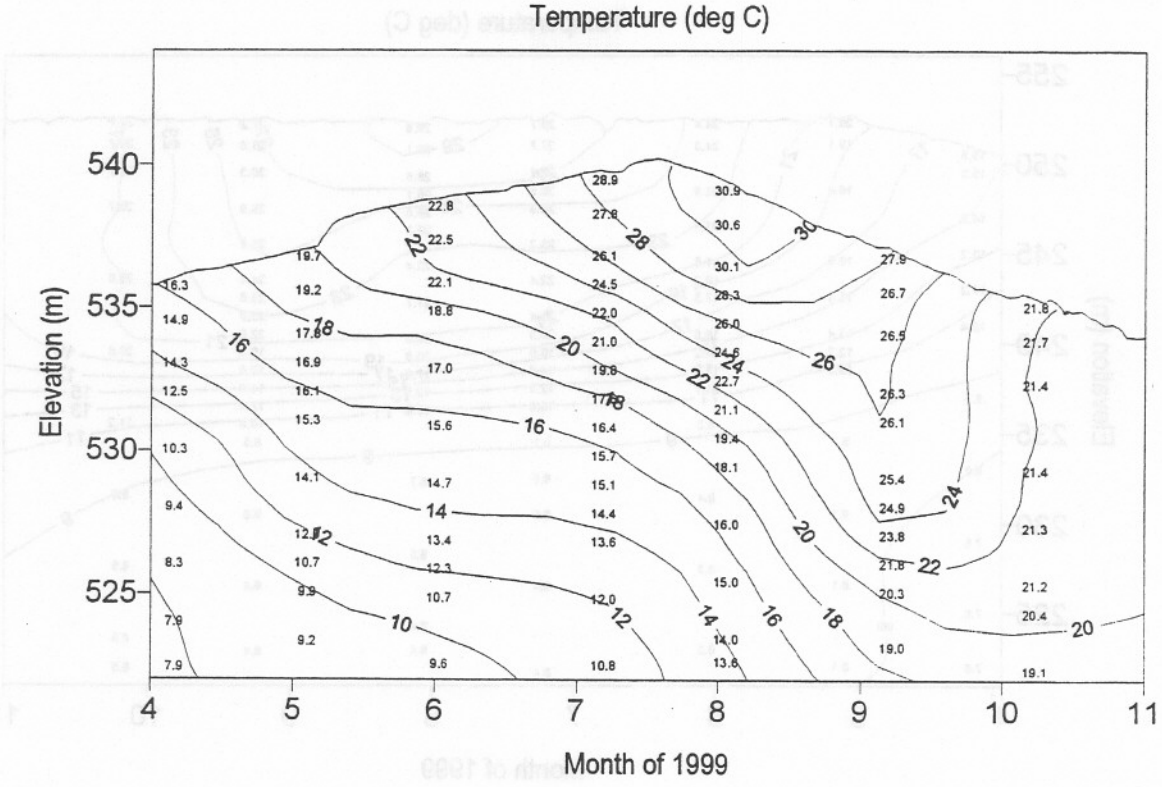


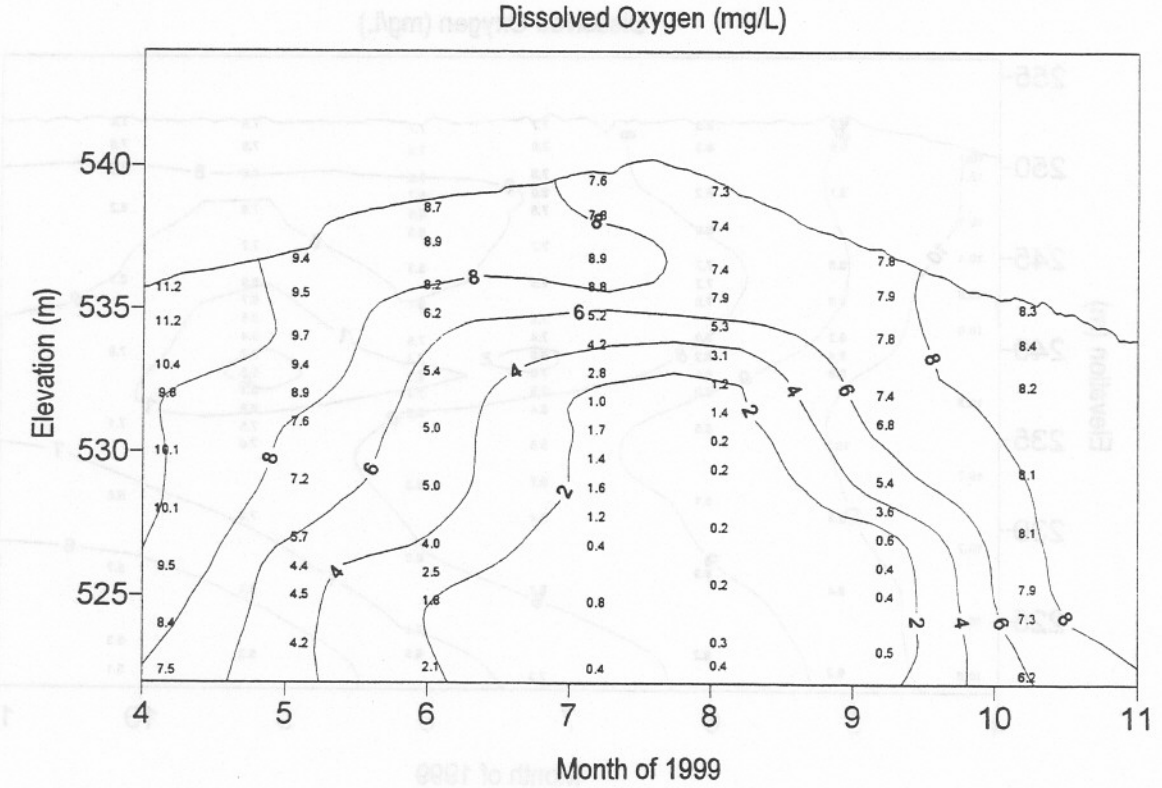
Nottely Reservoir - NRM 23.5



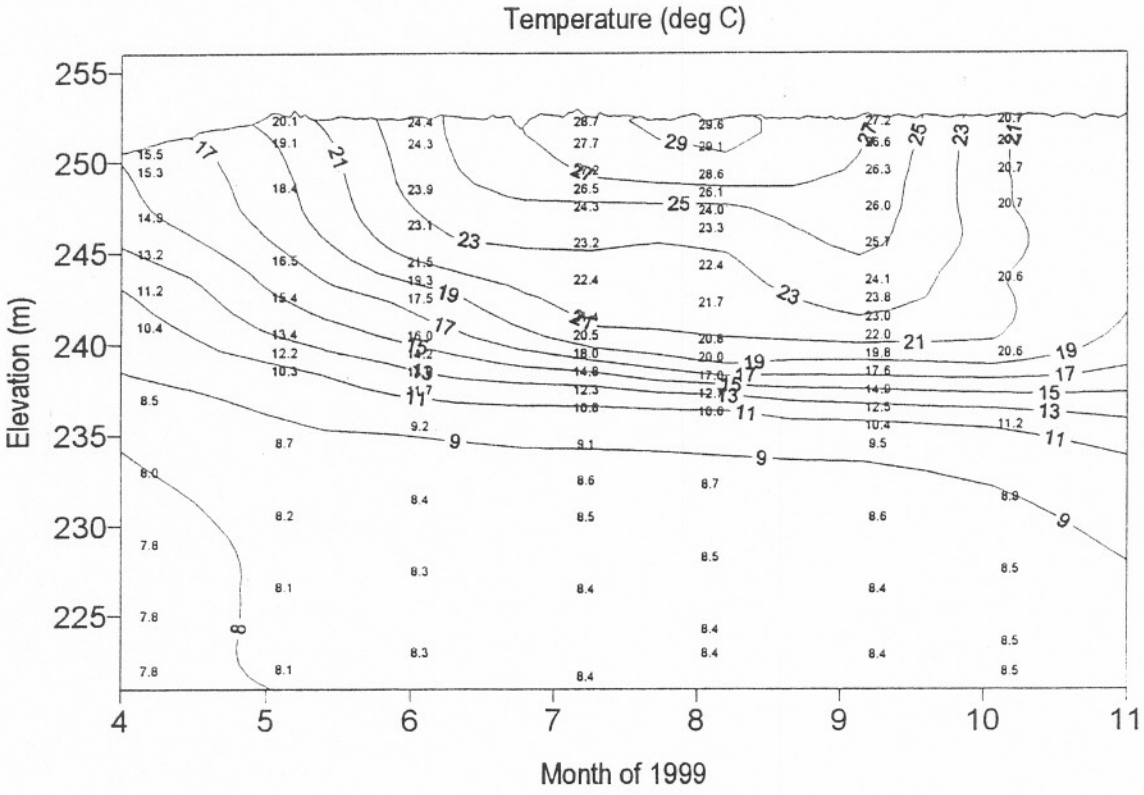


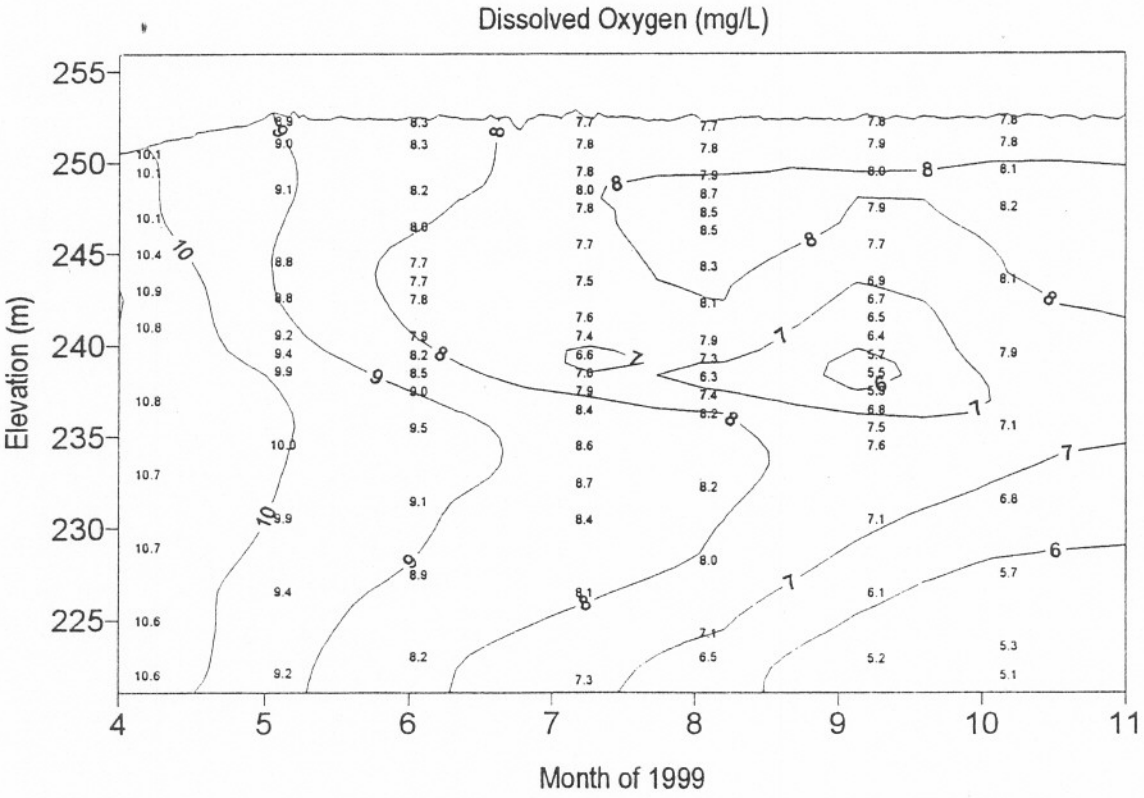
Nottely Reservoir - NRM 31.0



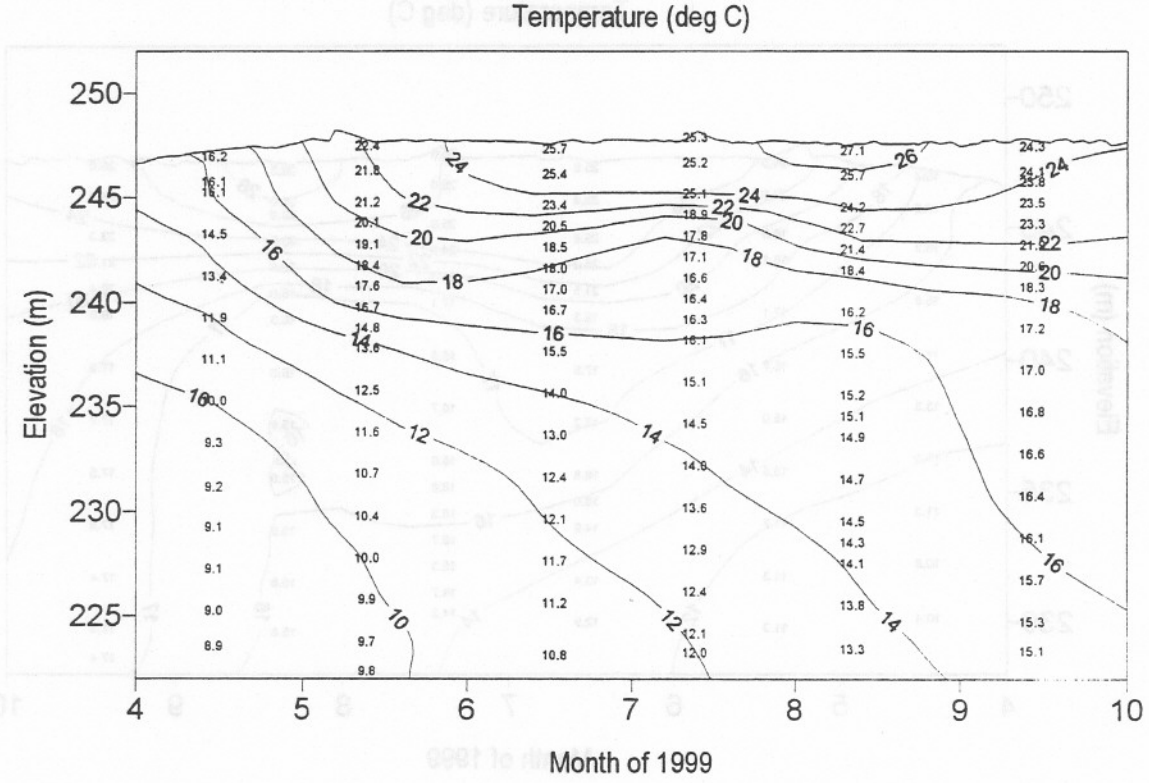


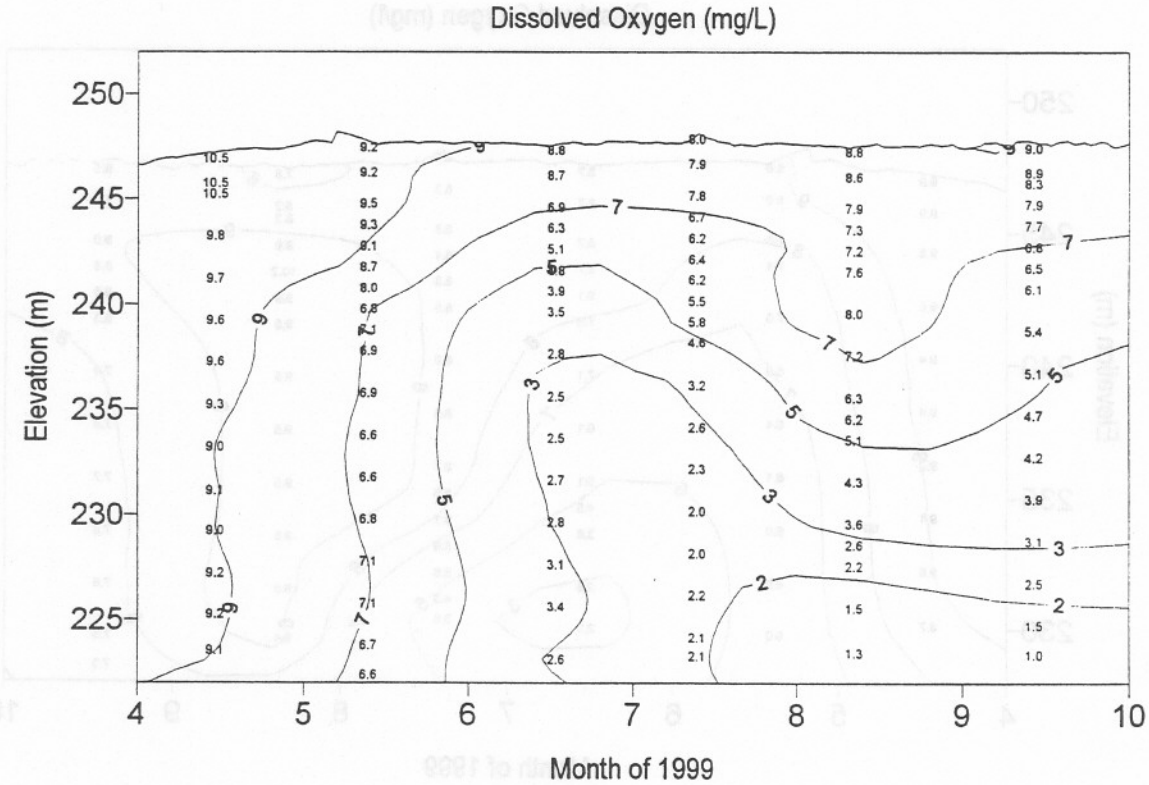
Ocoee No. 1 - ORM 12.5



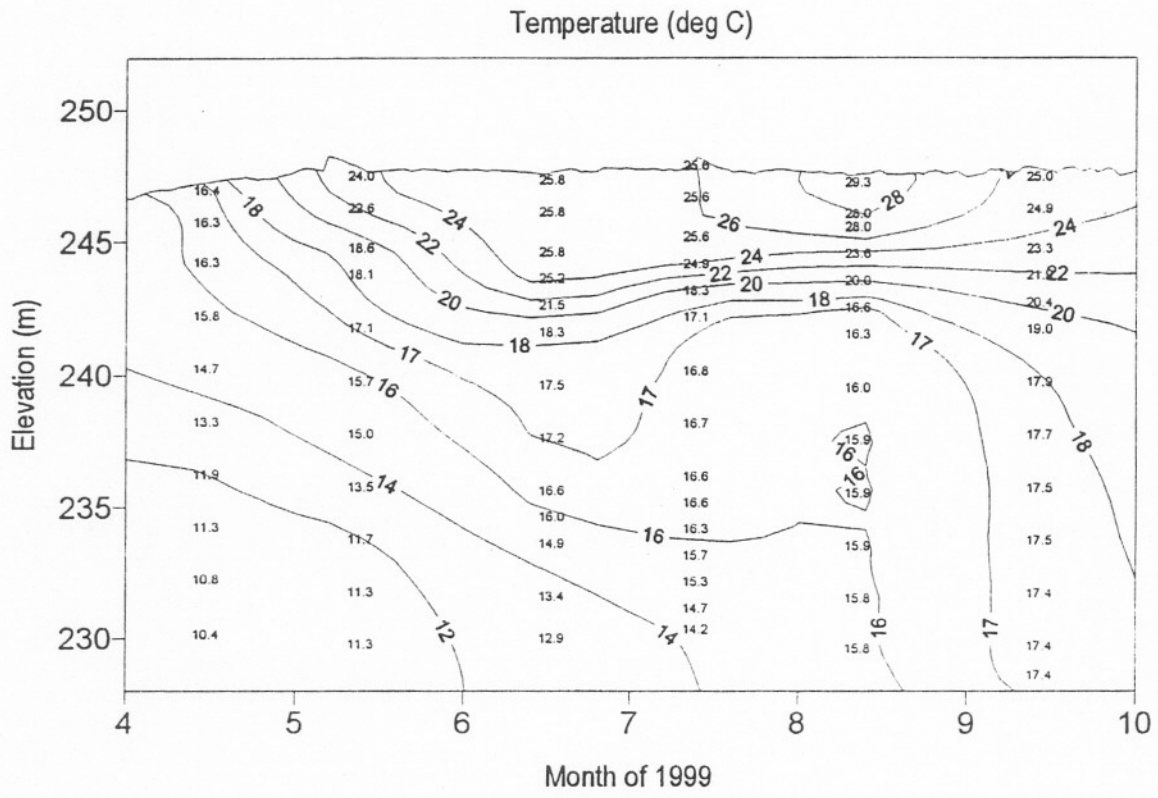


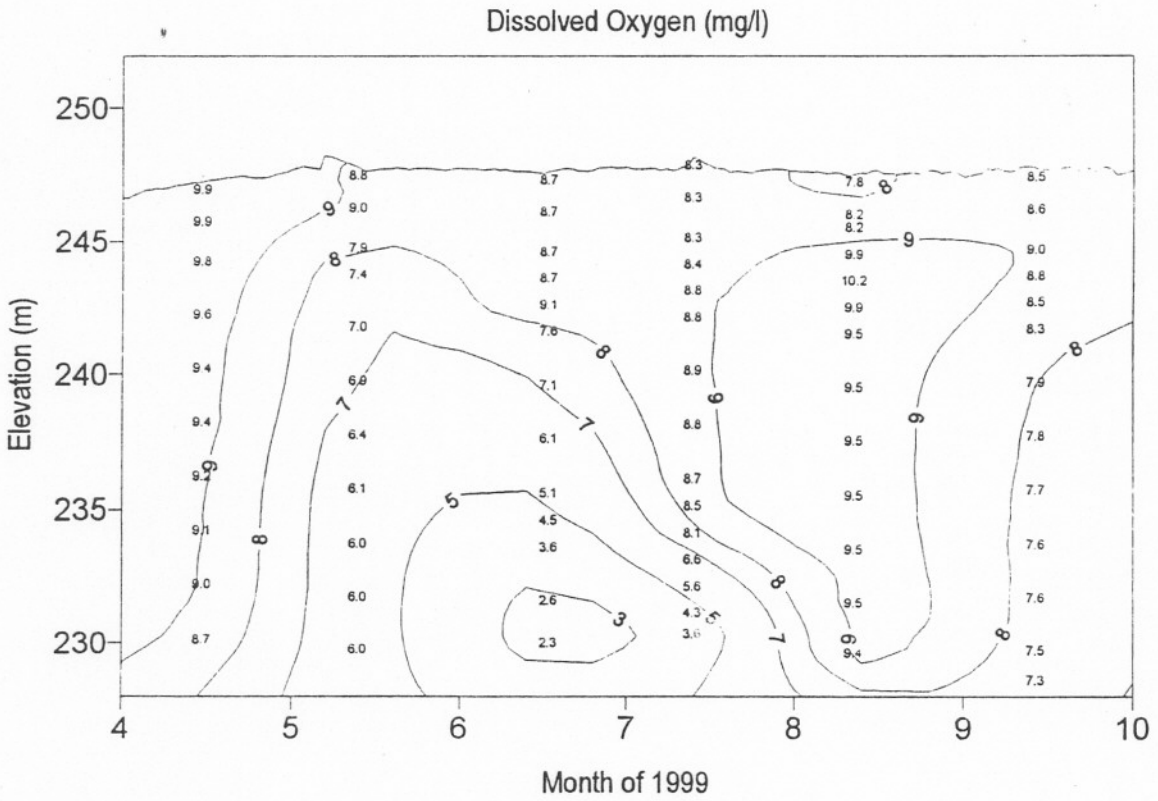
Tellico Reservoir - LTRM 1.0



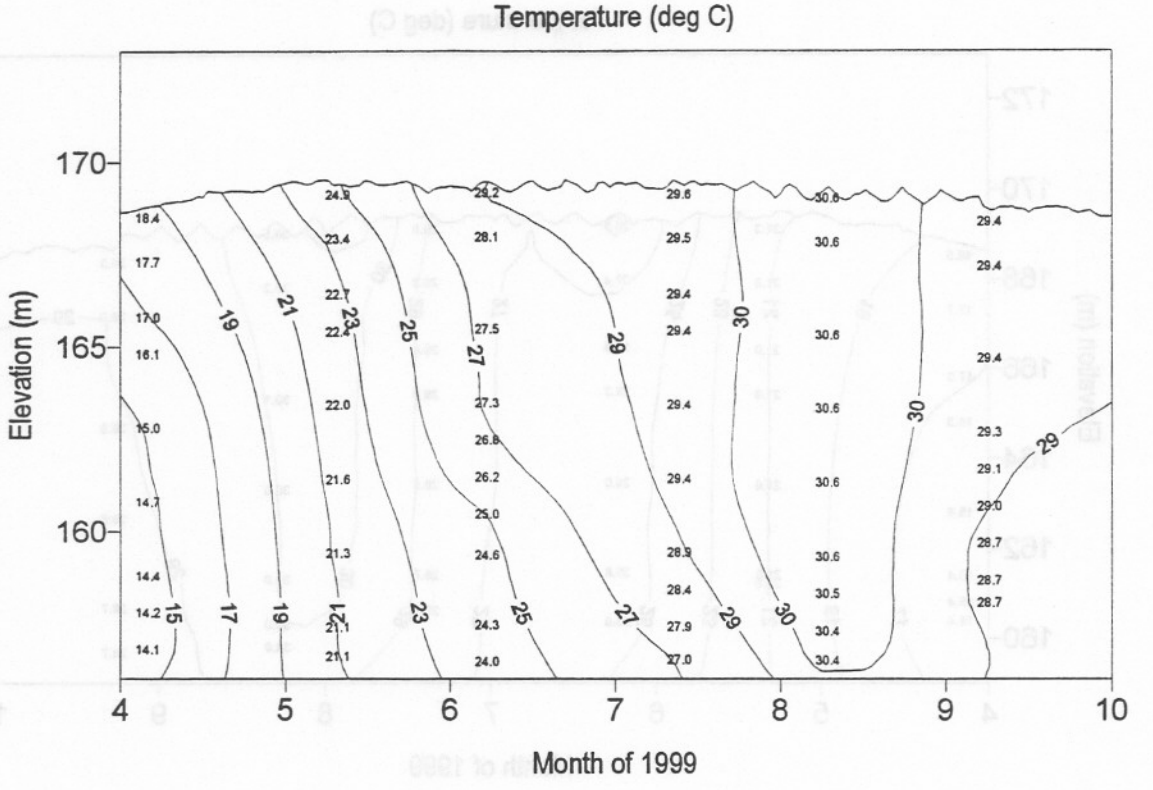


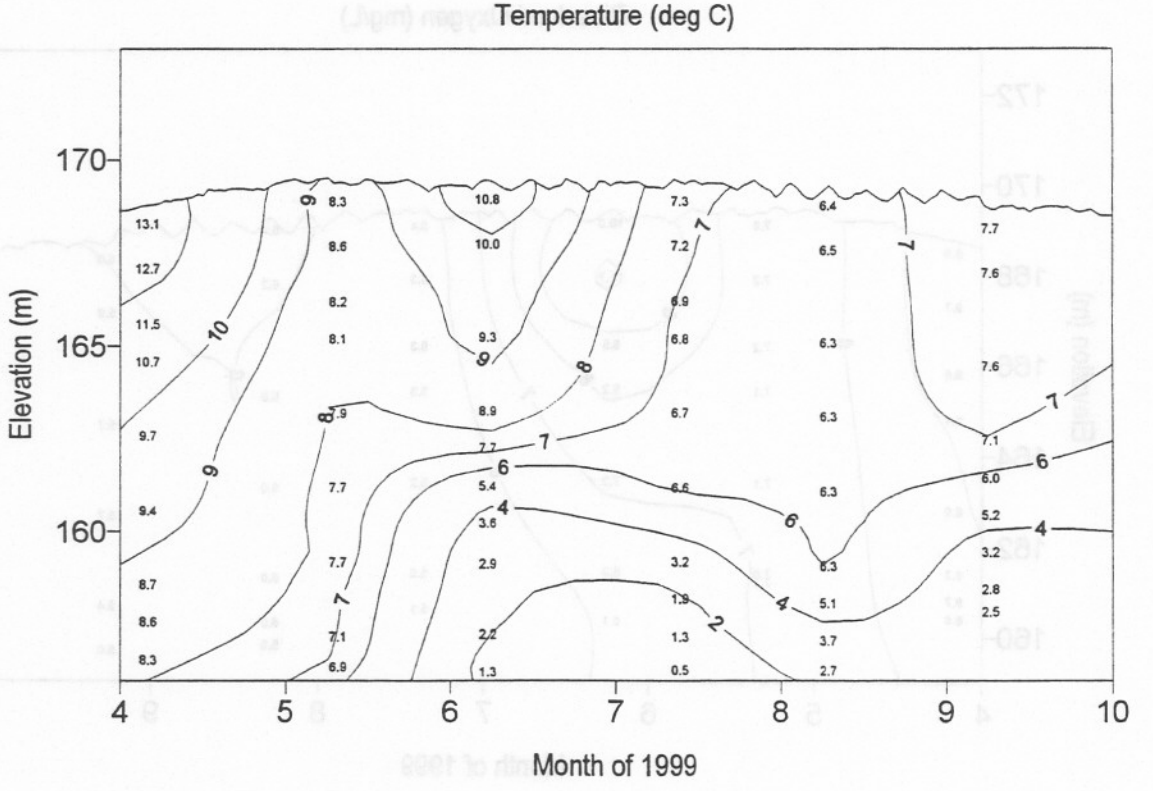
Tellico Reservoir - LTRM 15.0



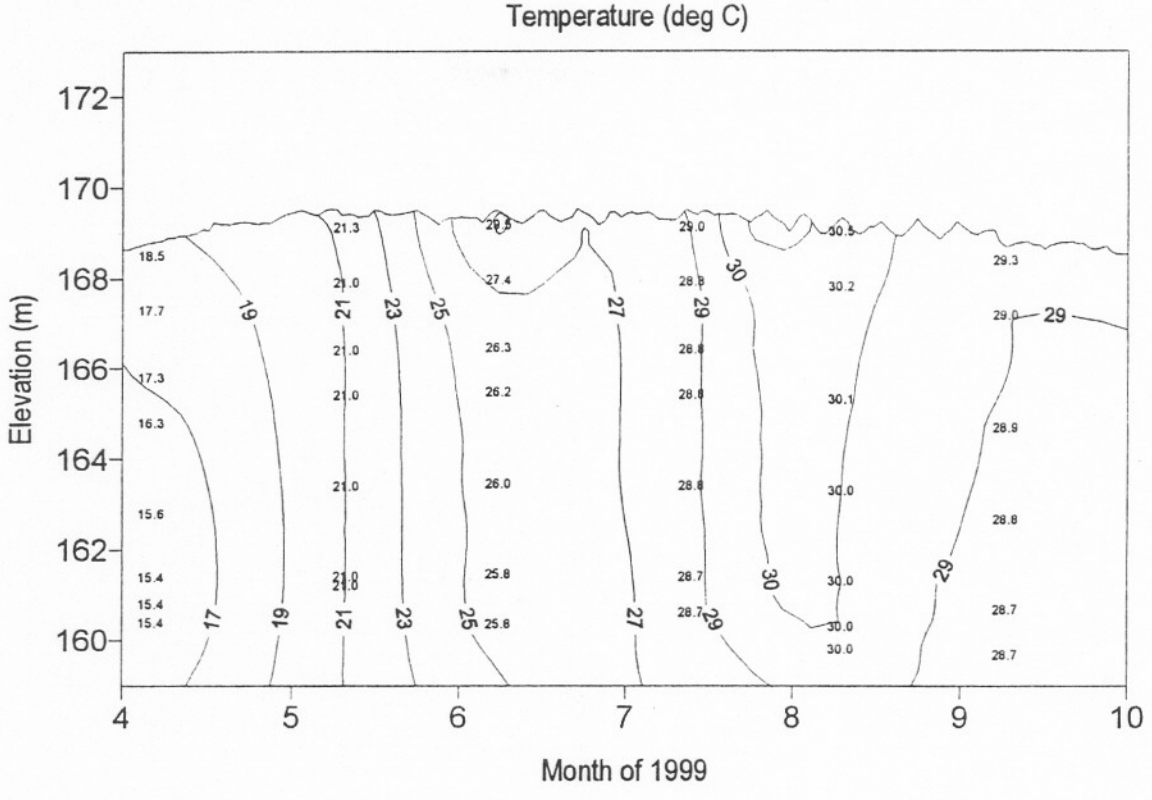


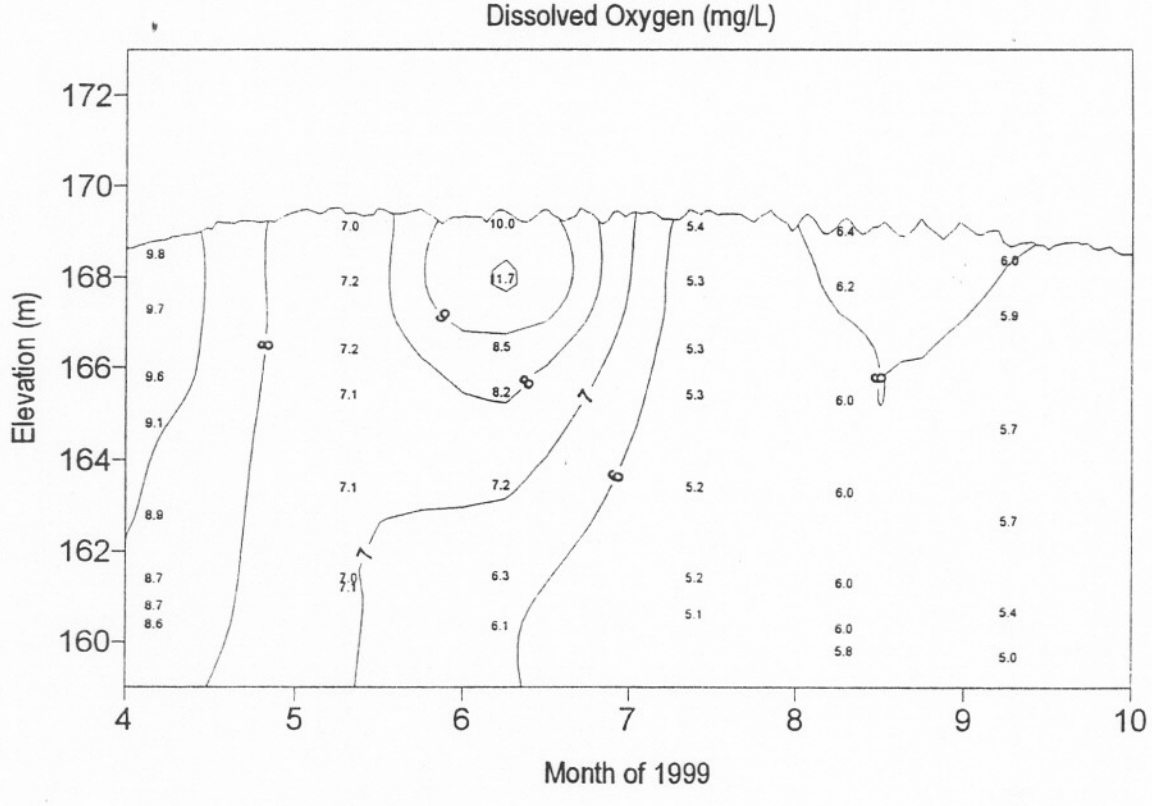
Wheeler Reservoir - TRM 277.0



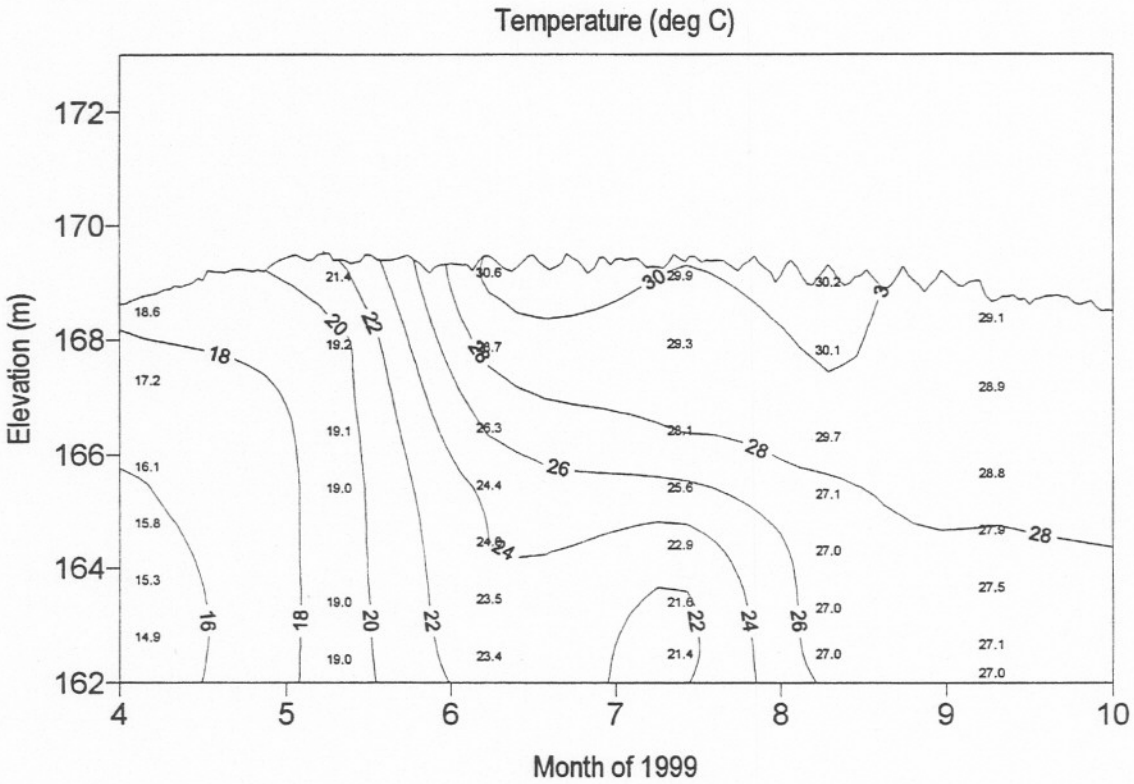


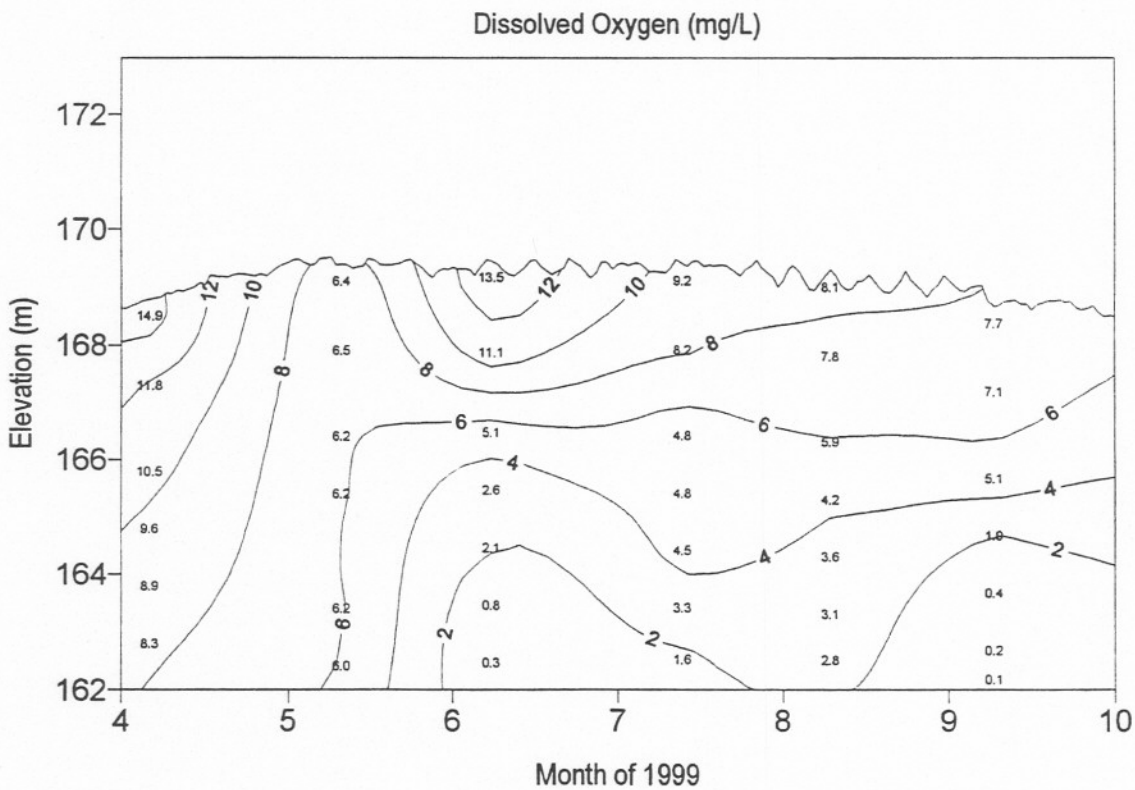
Wheeler Reservoir - TRM 295.9





Wheeler Reservoir - Elk River 6.0





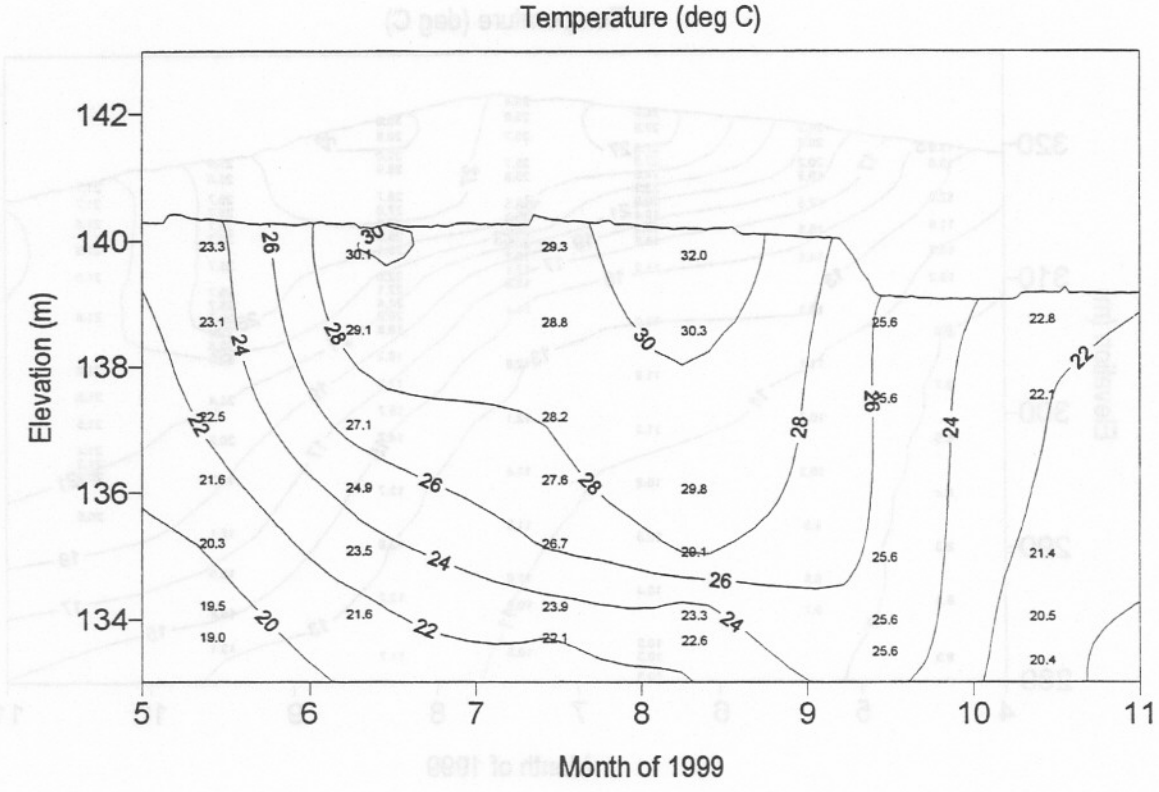
Appendix B

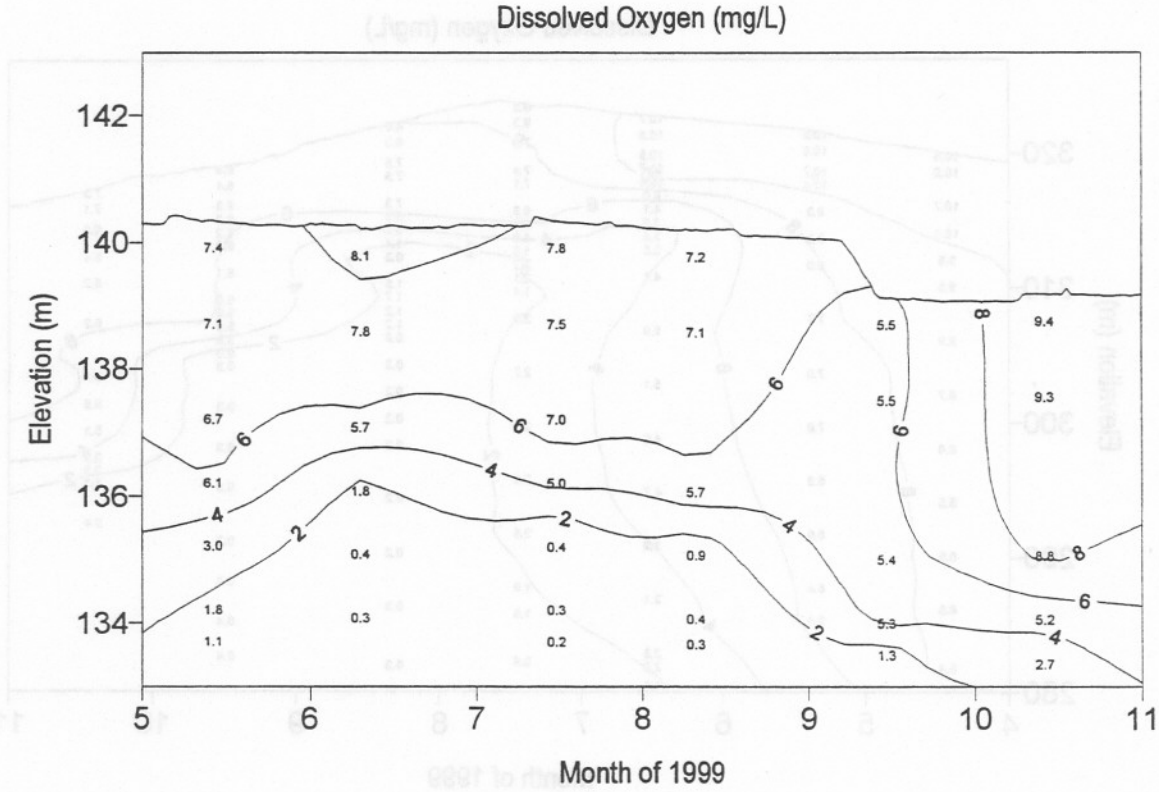
Temperature and DO Isopleths for "Extra" Locations Monitored in 1999 To Meet Specific Needs

Note: Guntersville, Pickwick, and Wilson Reservoirs were Monitored from April - September to Support a Nutrient Loading Study Being Conducted in Corporation with the Alabama Department of Environmental Management.

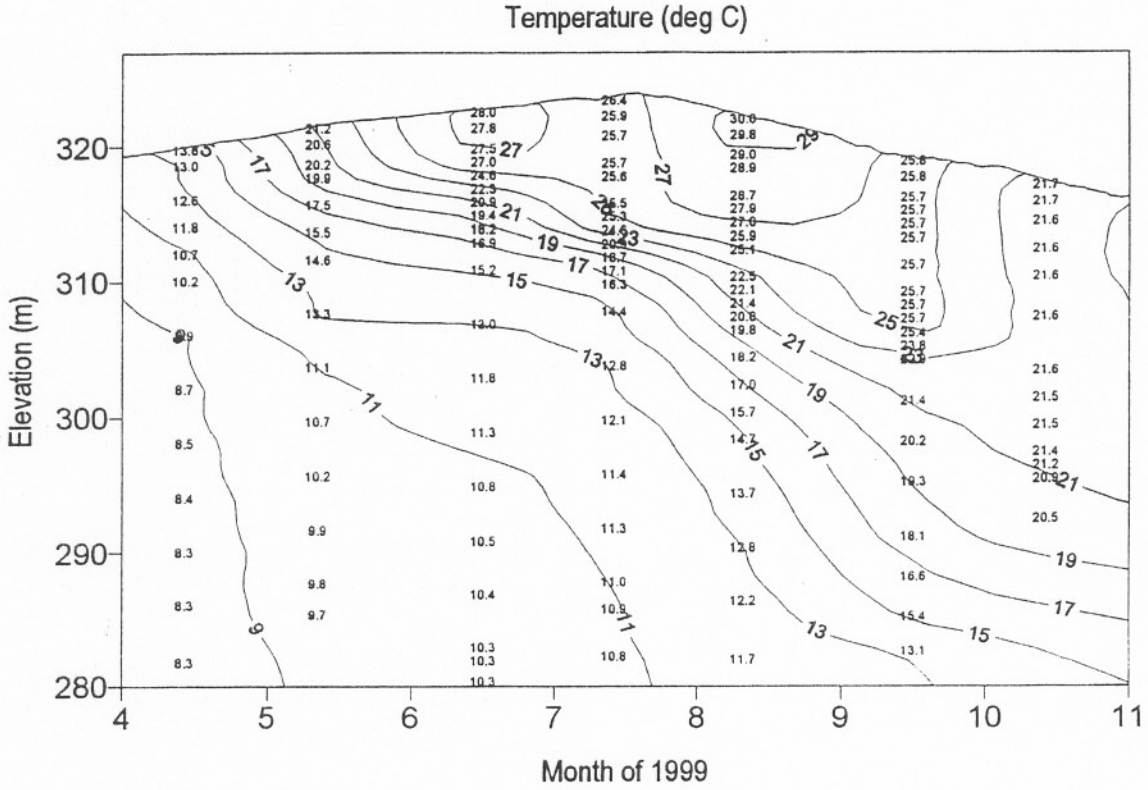
Beech, Cherokee, Hiwassee, Melton Hill, South Holston, and Watts Bar Reservoirs Were Monitored Beginning in May to Support River Operation Decisions Due to Developing Drought Conditions Throughout the Tennessee Valley.

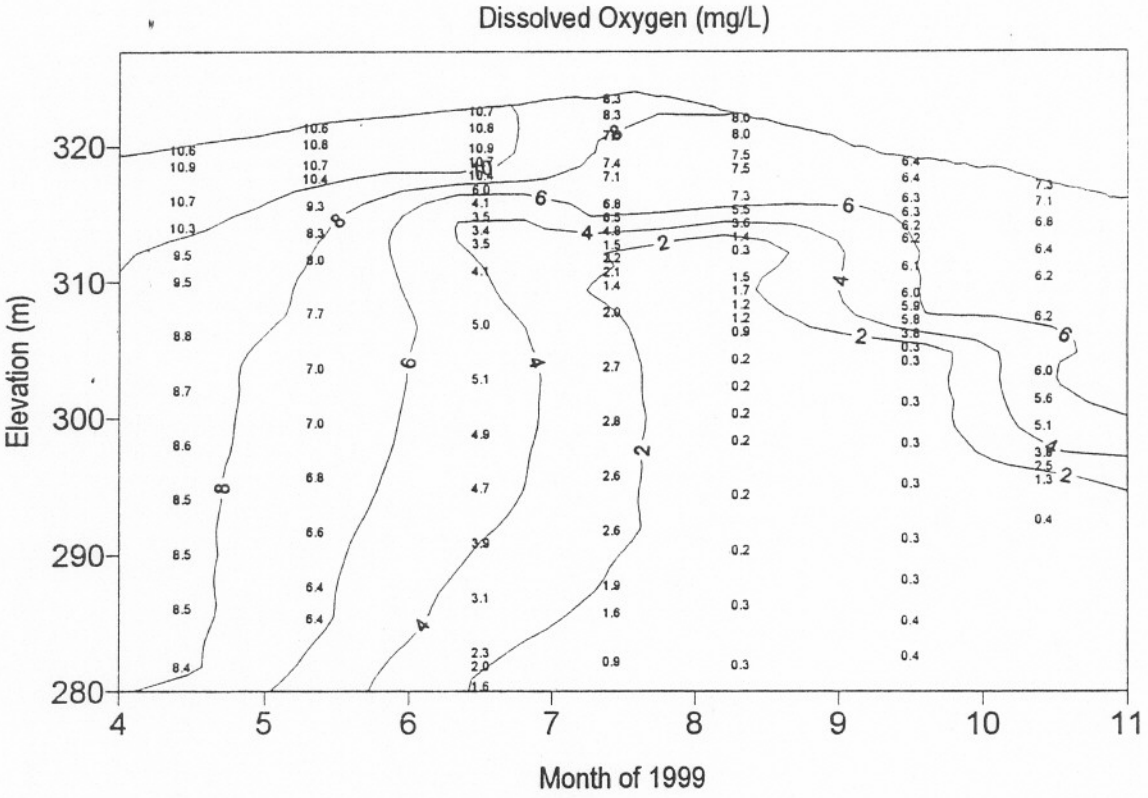
Beech Reservoir - BRM 36.0



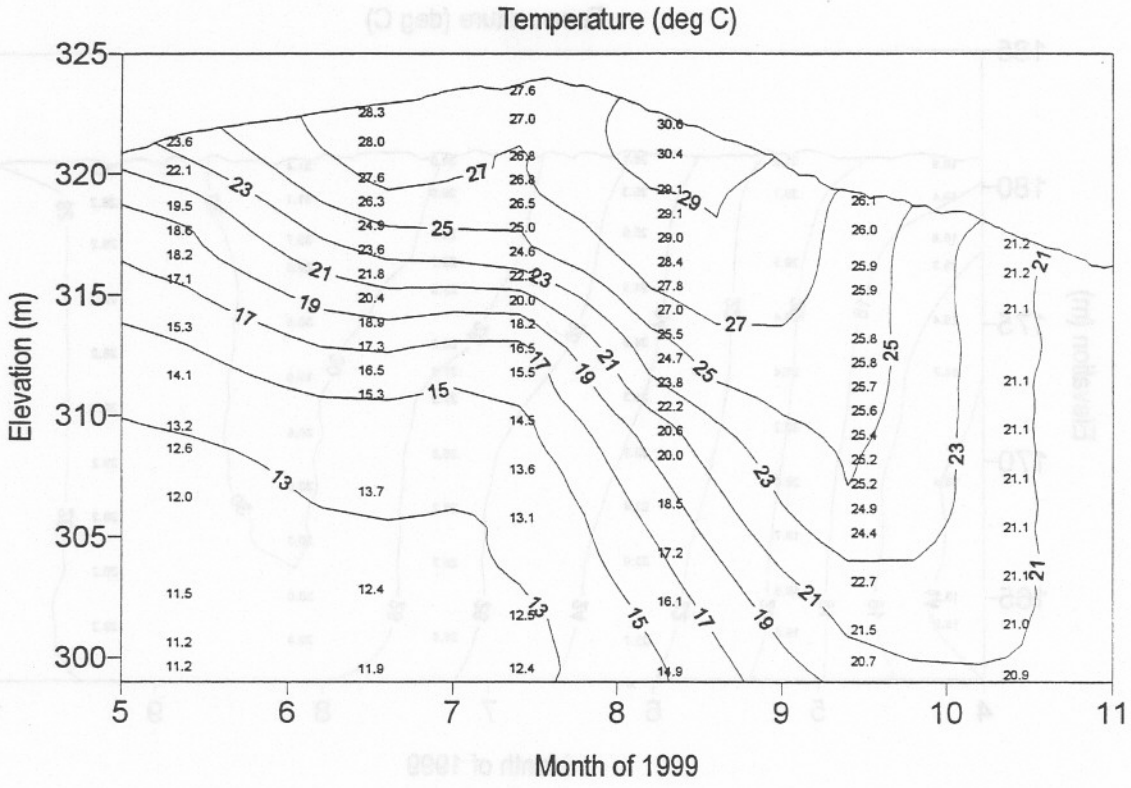


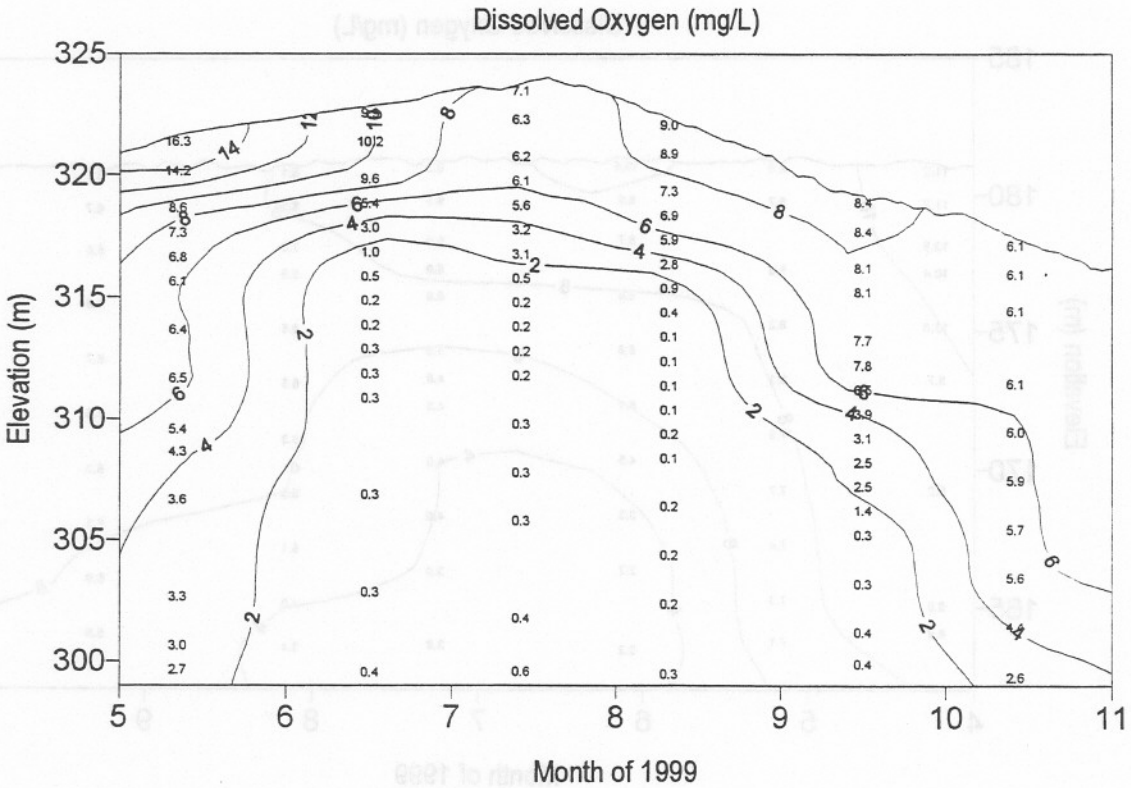
Cherokee Reservoir - HRM 55.0



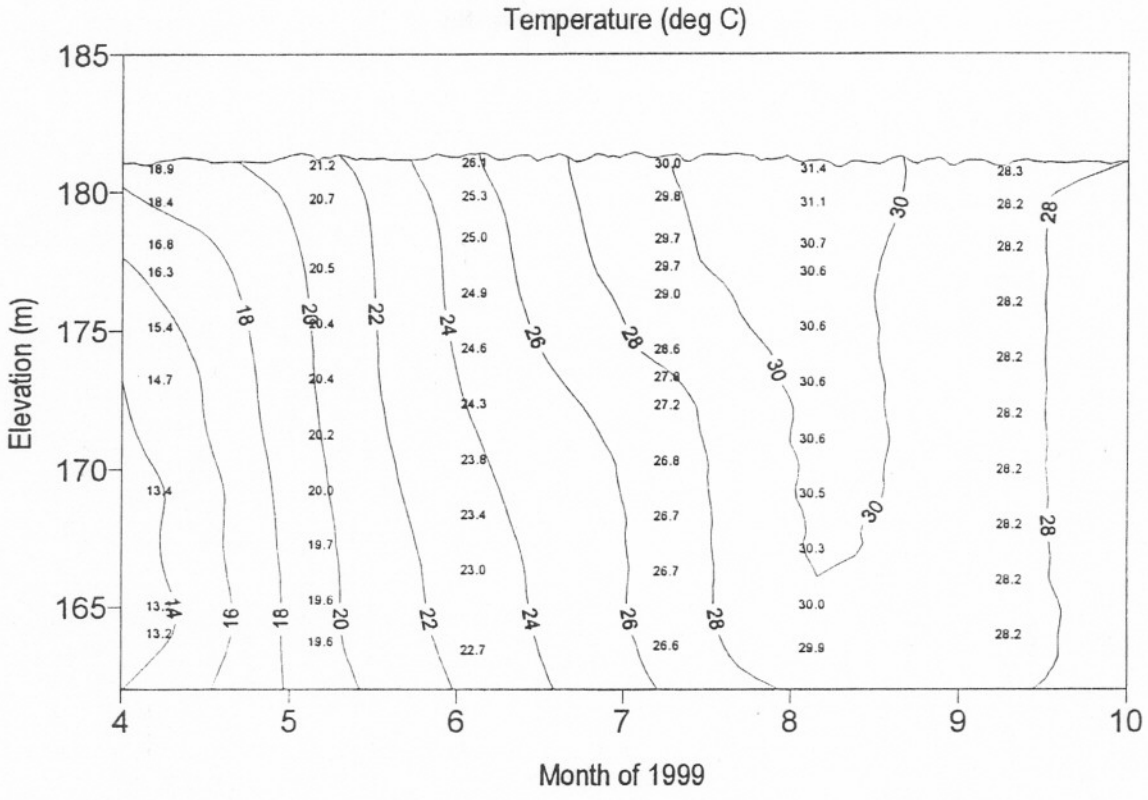


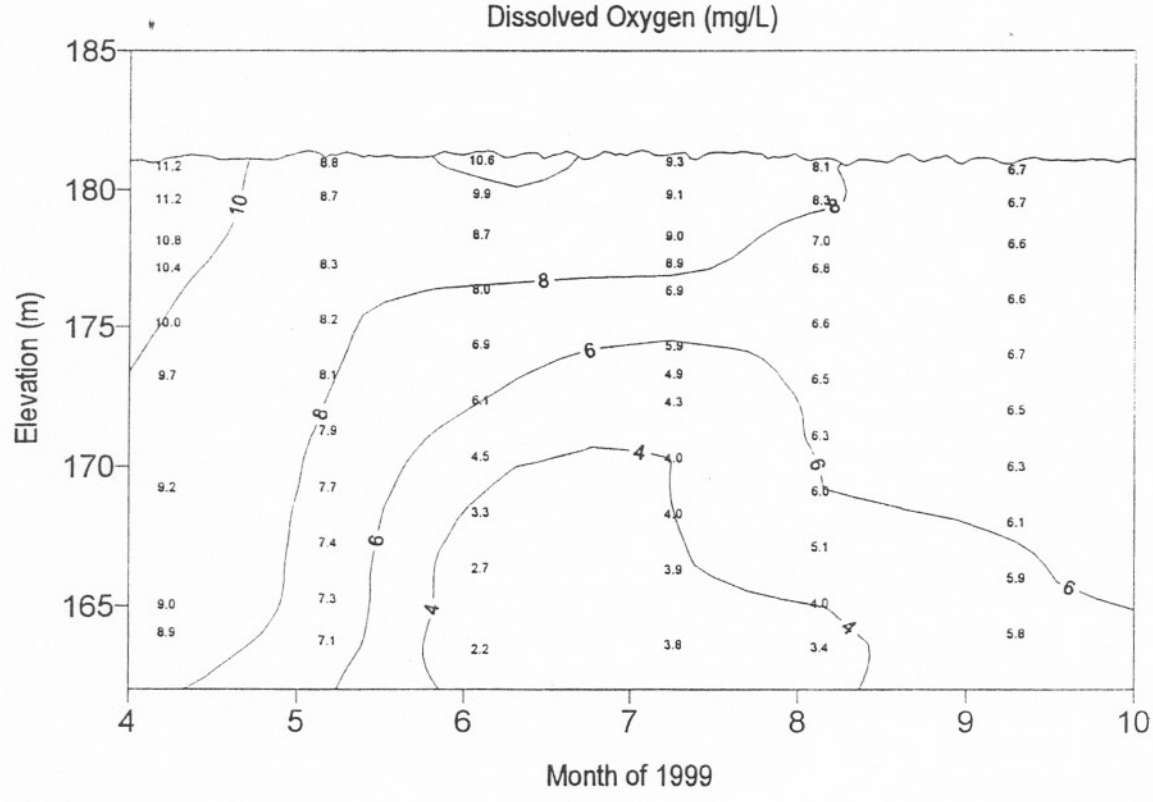
Cherokee Reservoir - HRM 76.0



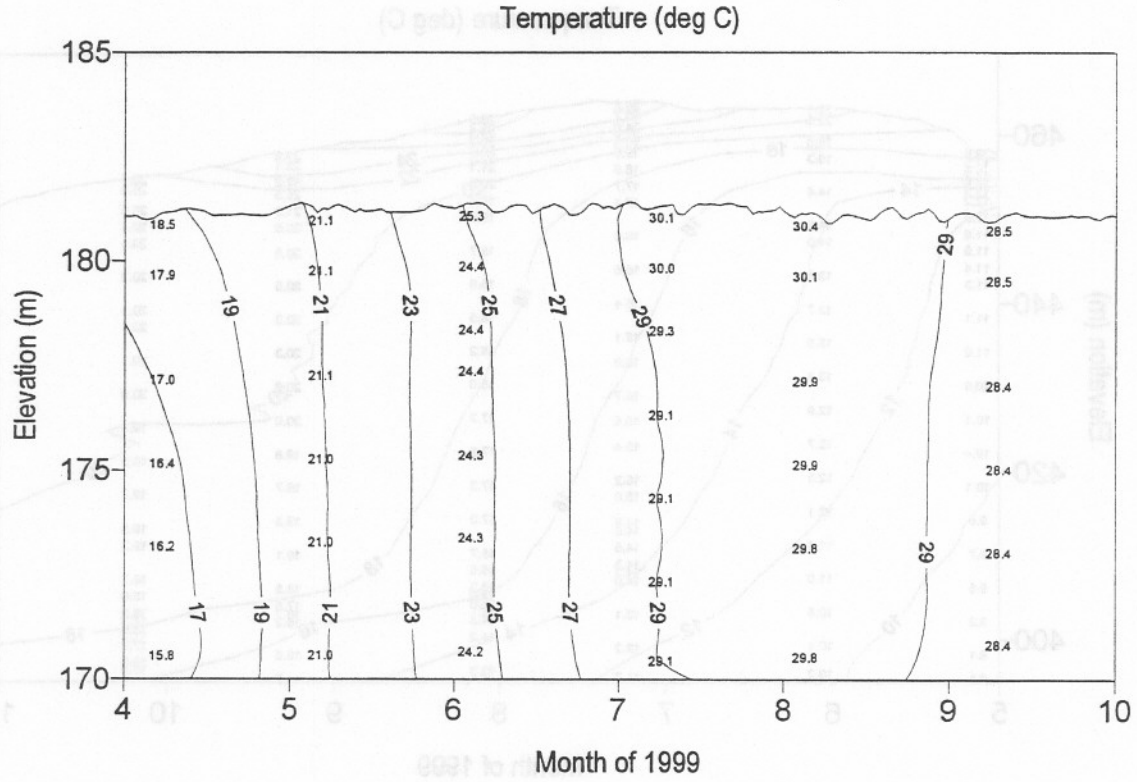


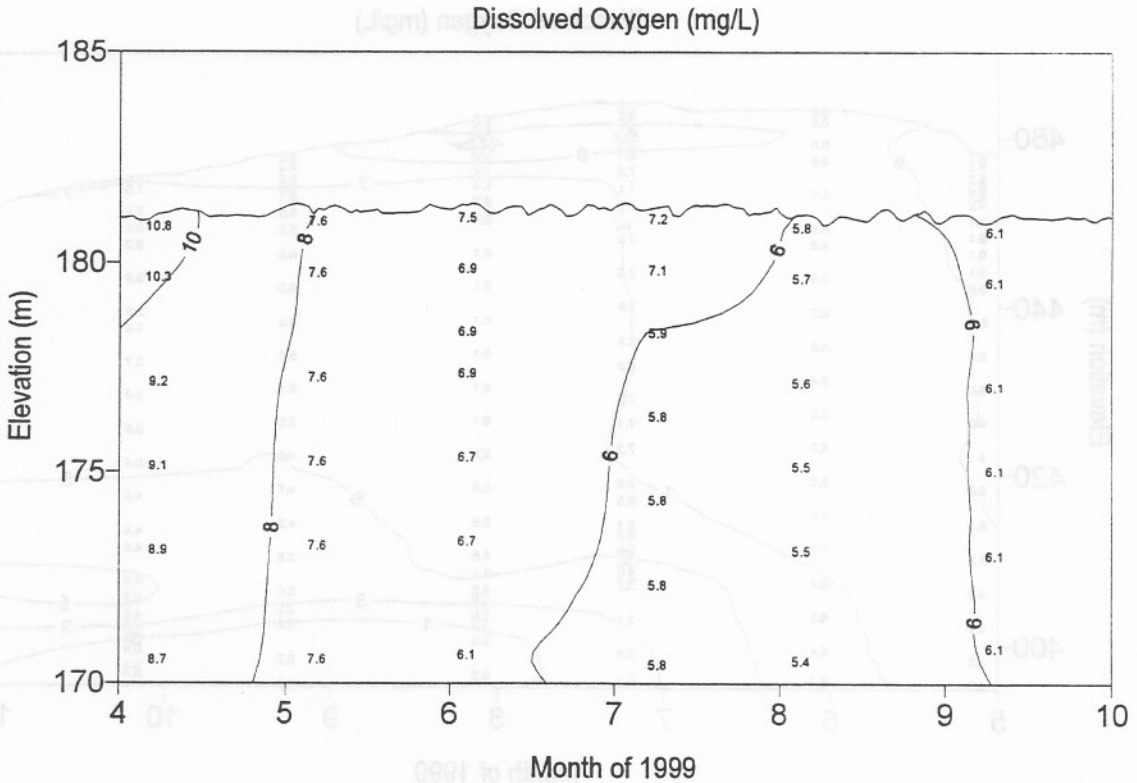
Guntersville Reservoir - TRM 350.0



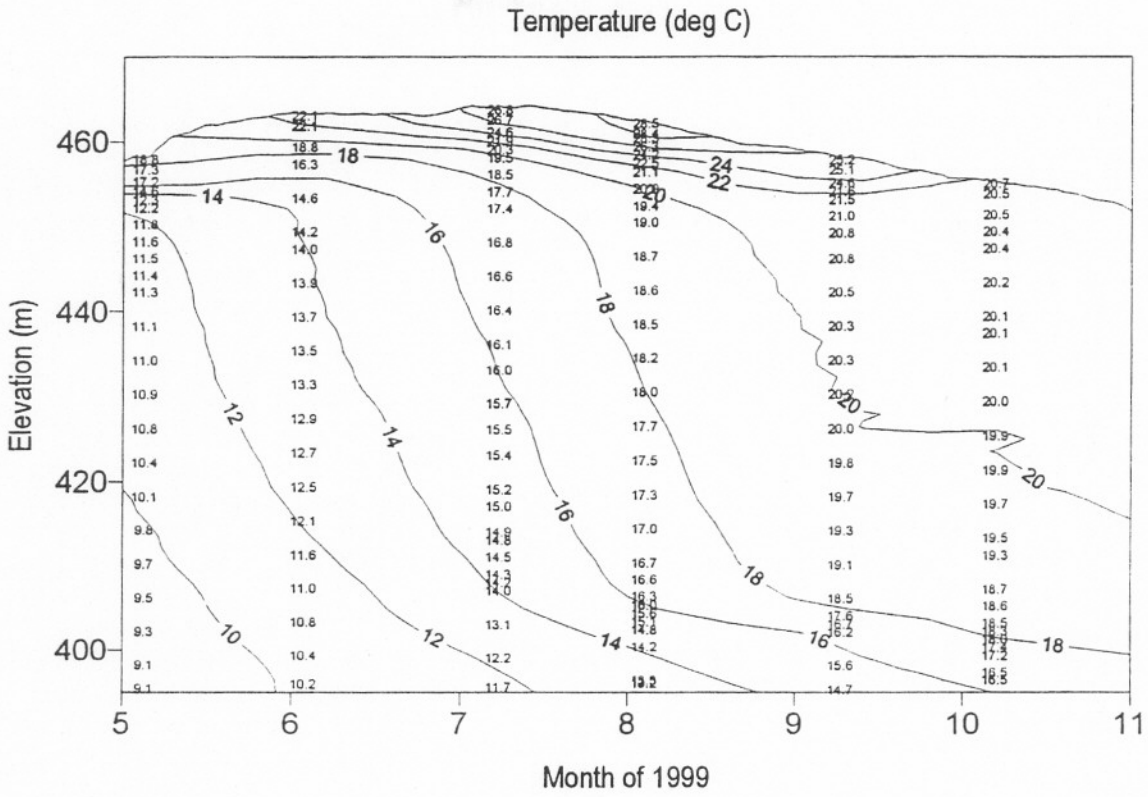


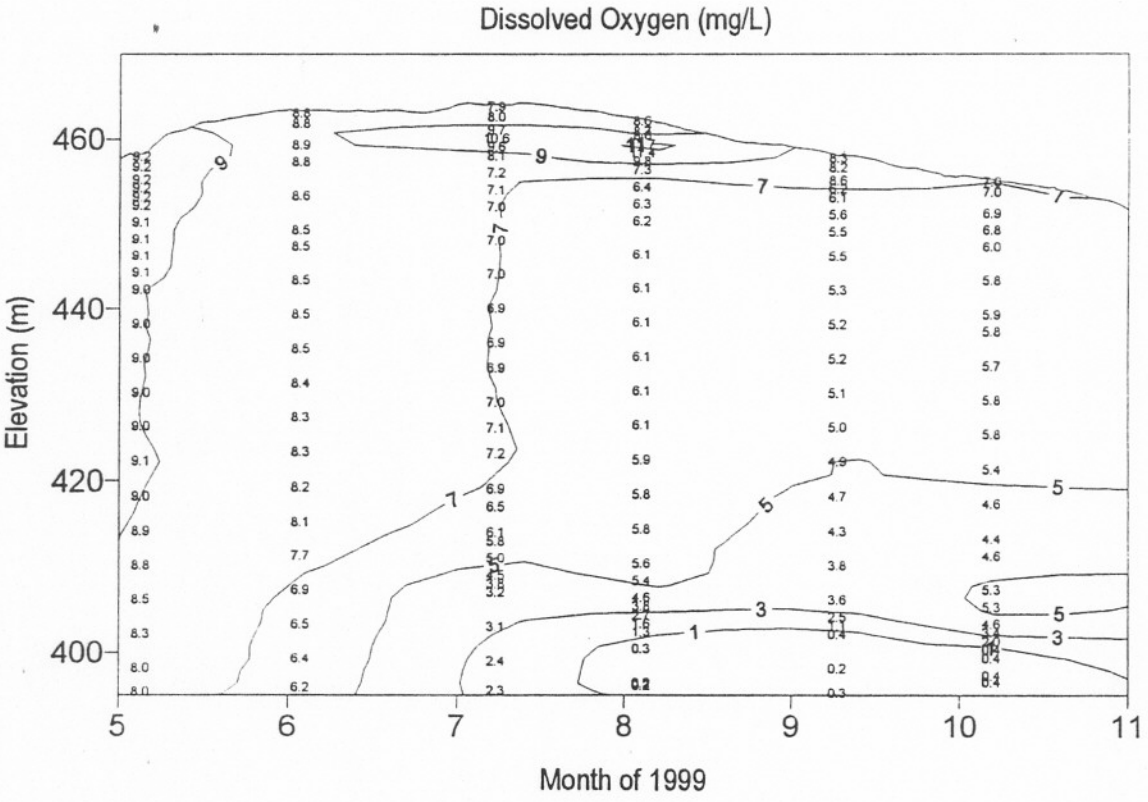
Guntersville Reservoir - 375.2



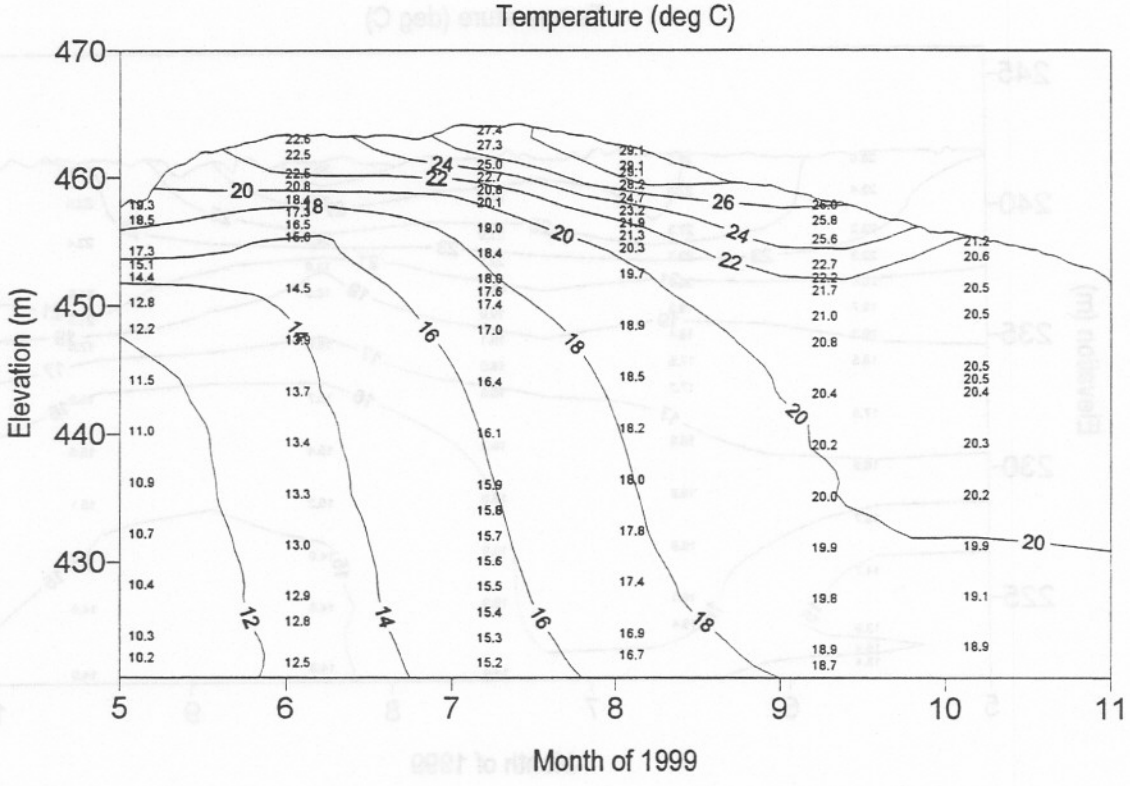


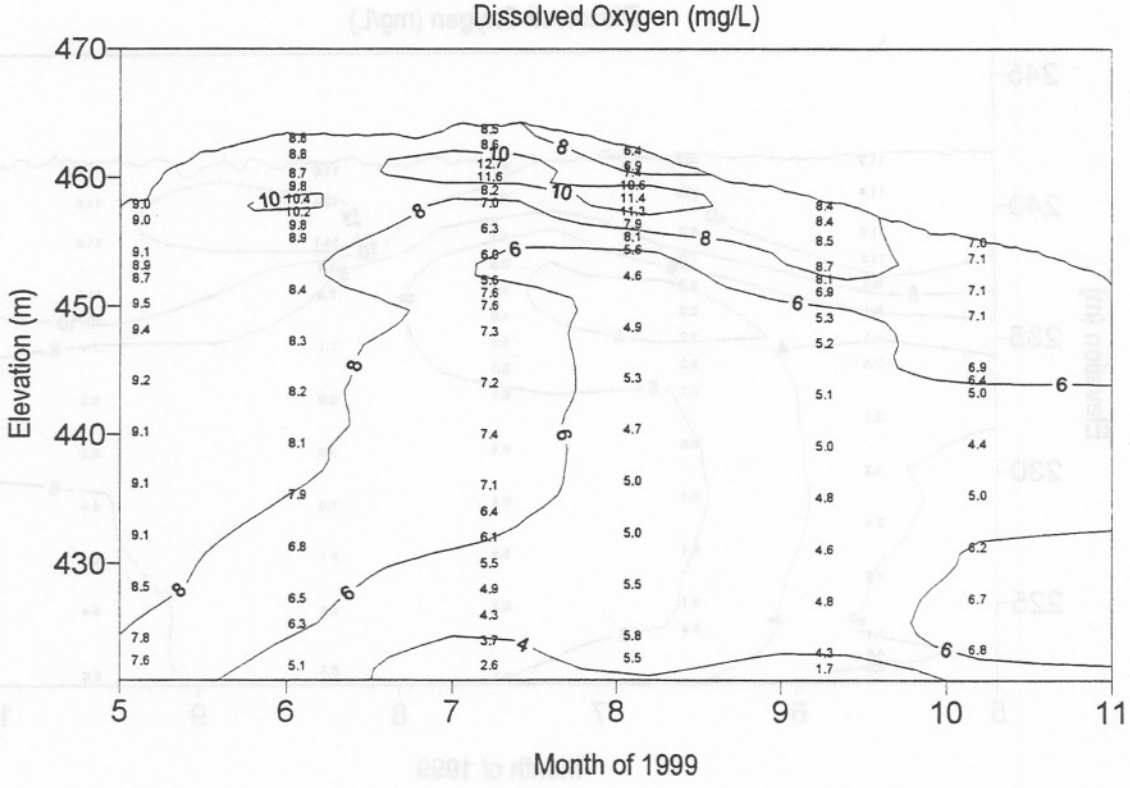
Hiwassee Reservoir - HiRM 77.5



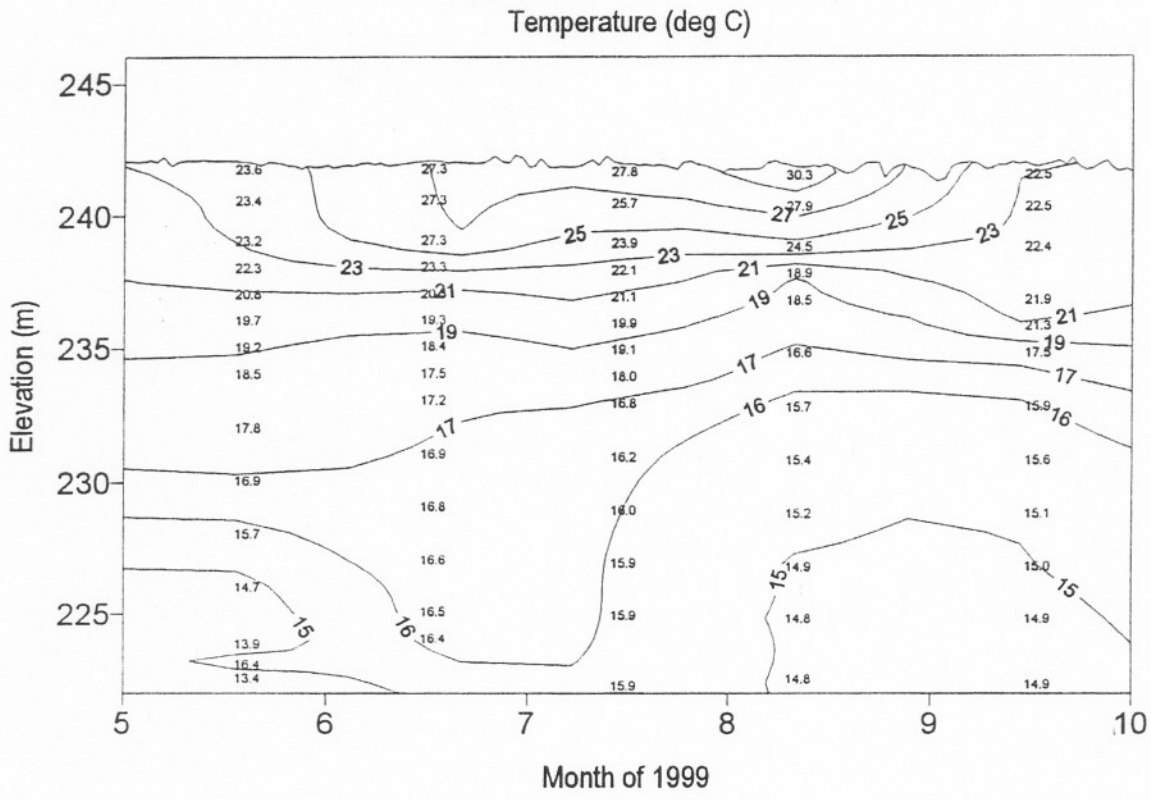


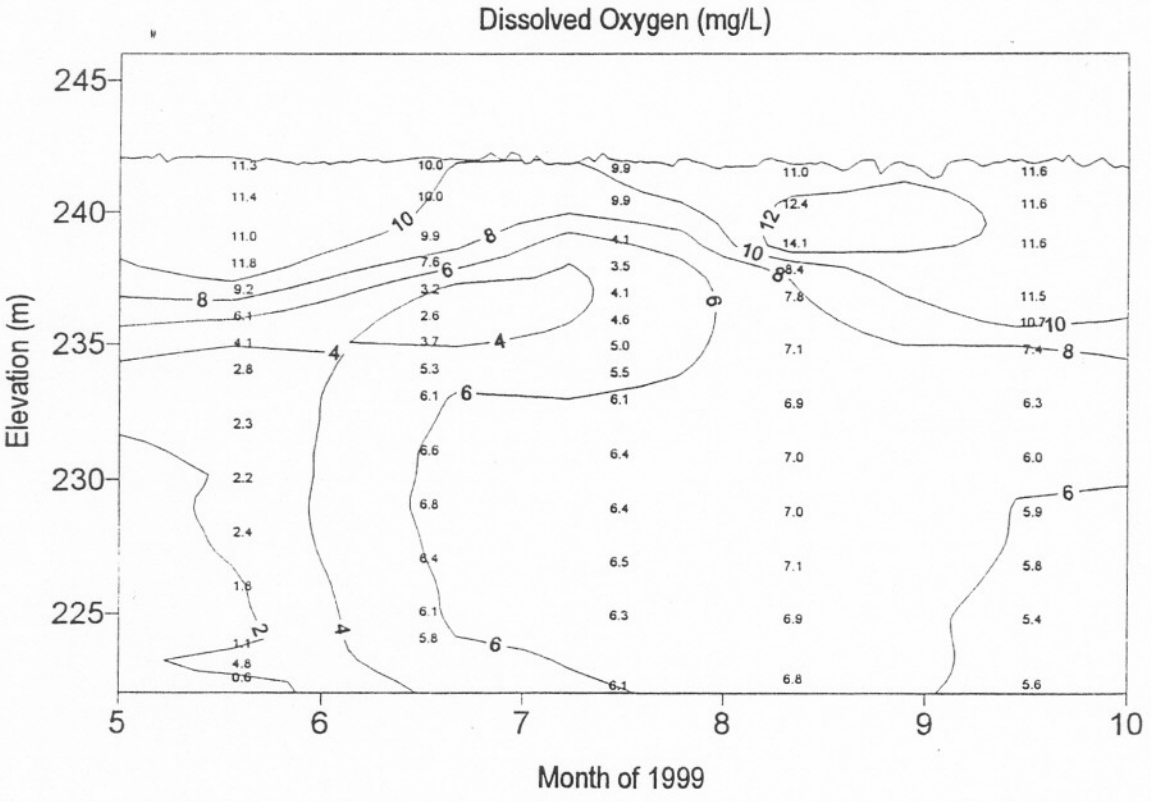
Hiwassee Reservoir - HiRM 85.0



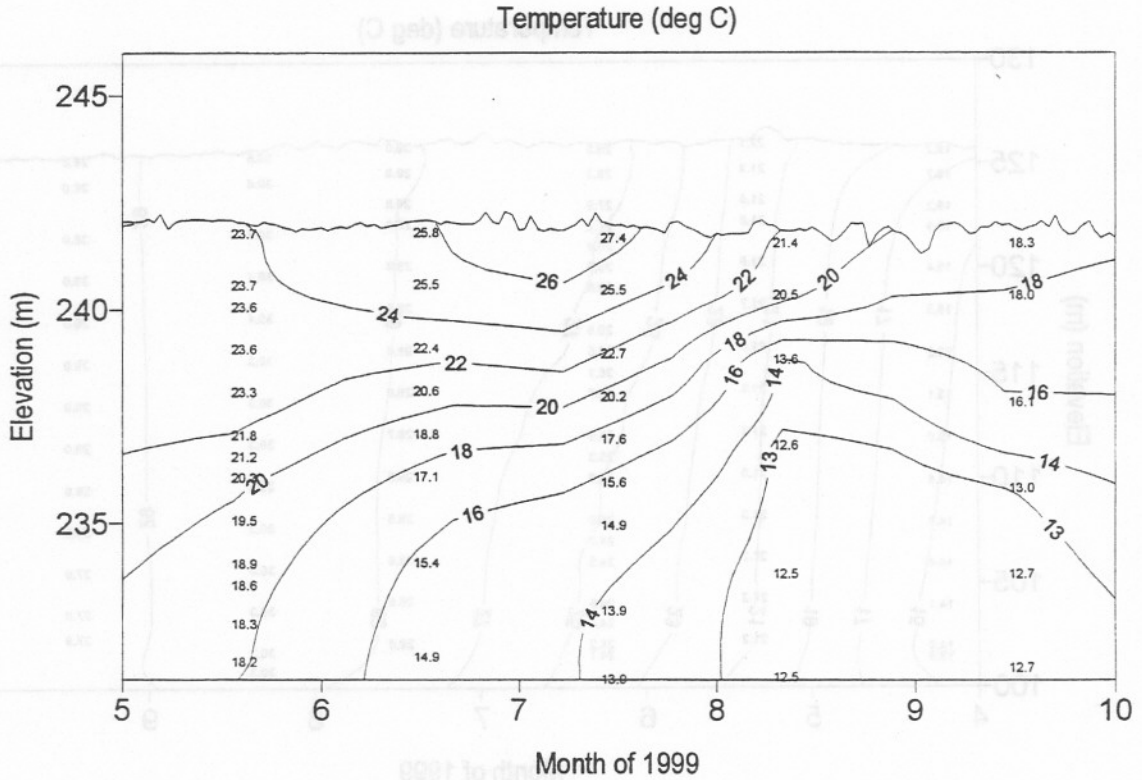


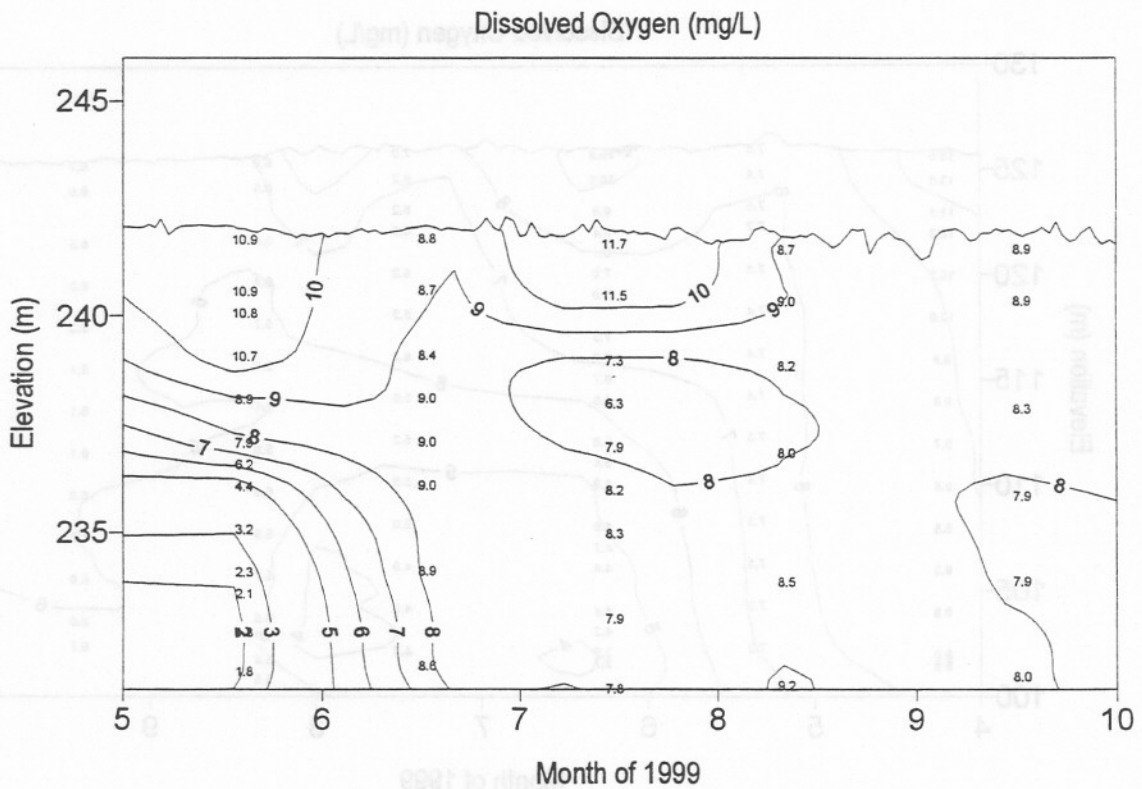
Melton Hill Reservoir - CRM 24.0



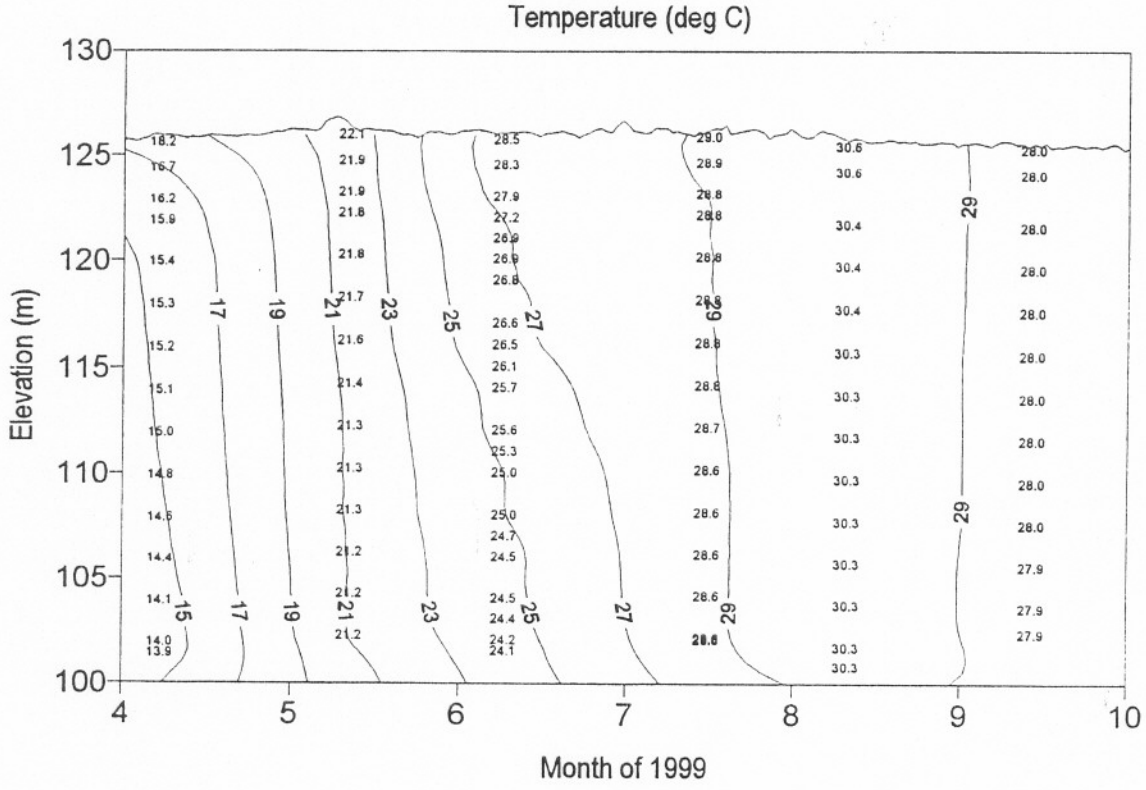


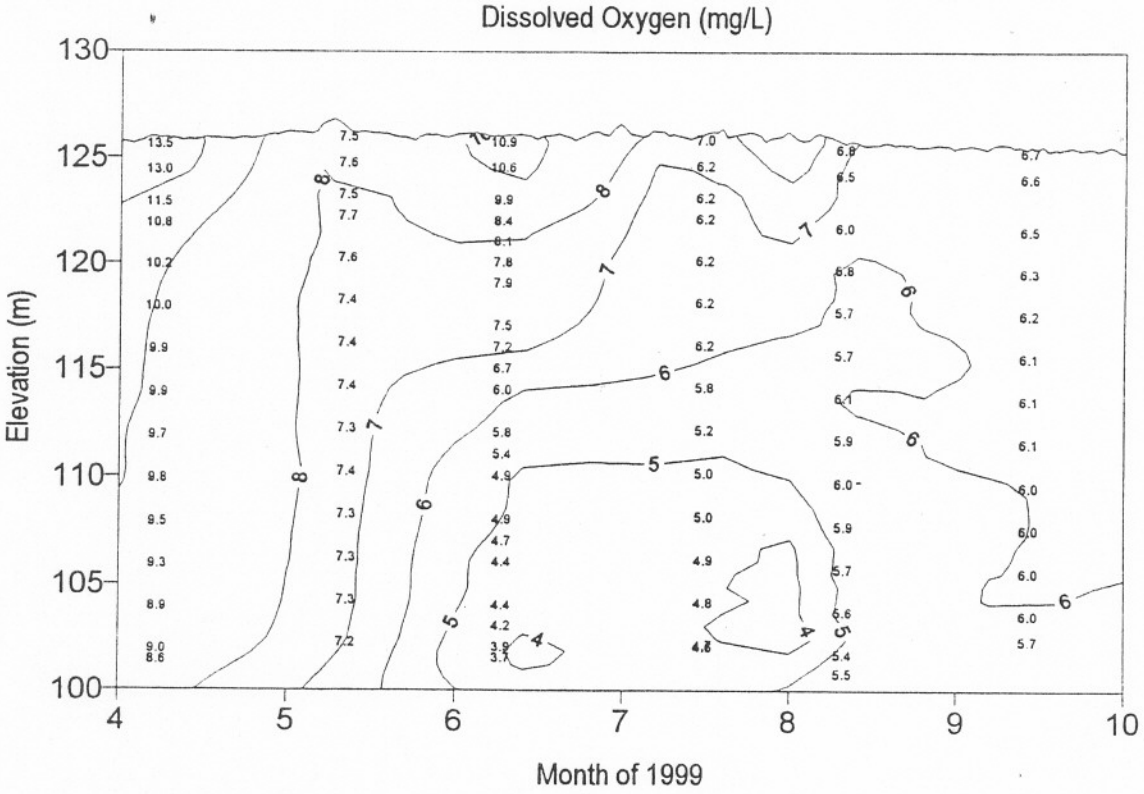
Melton Hill Reservoir - CRM 45.0



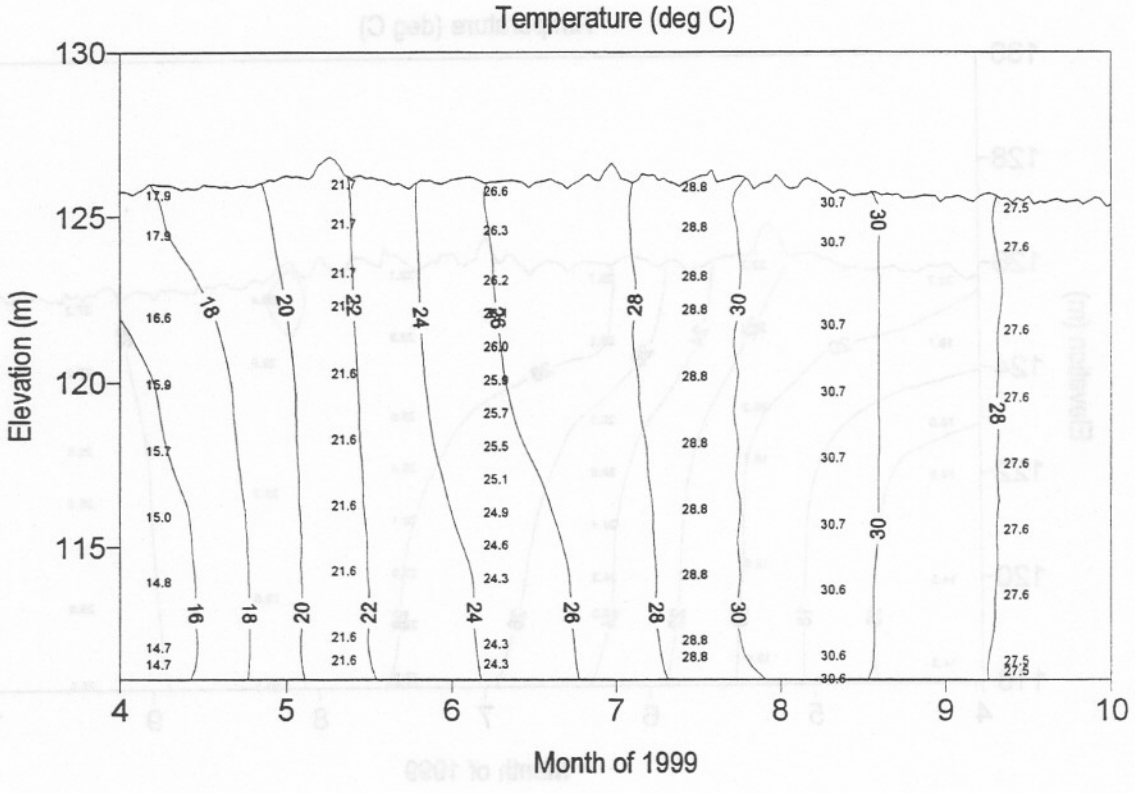


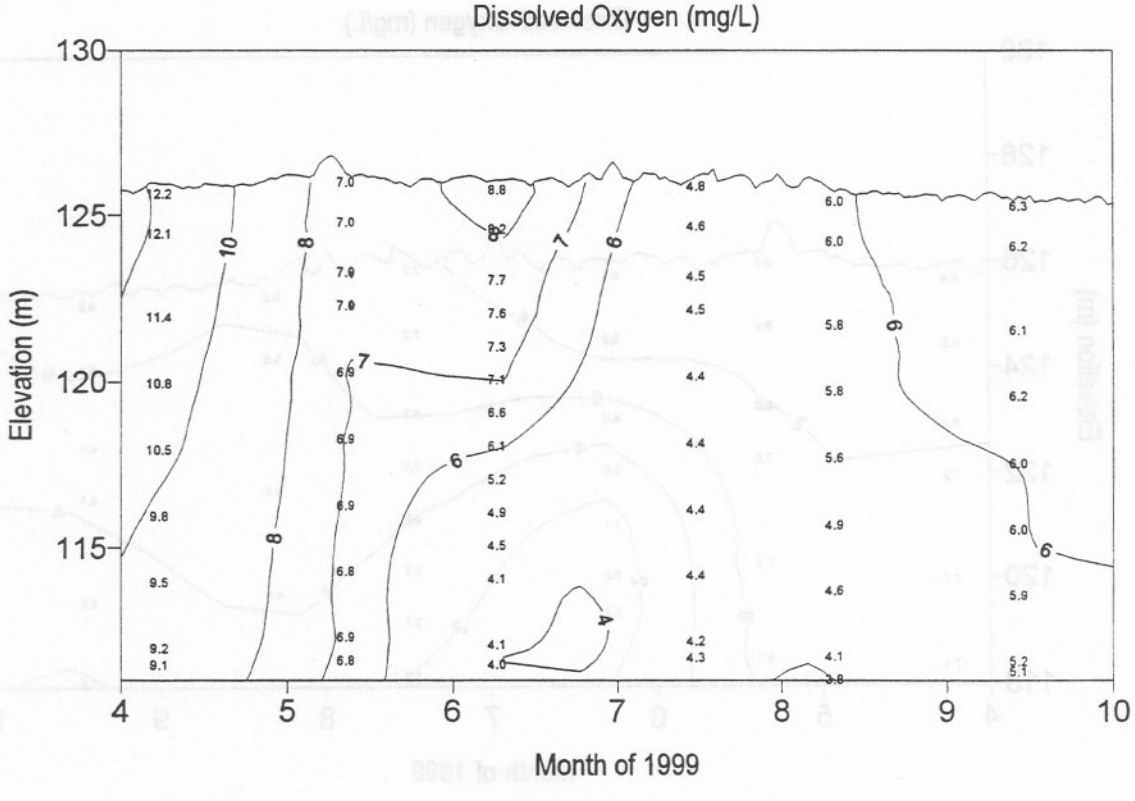
Pickwick Reservoir - TRM 207.3



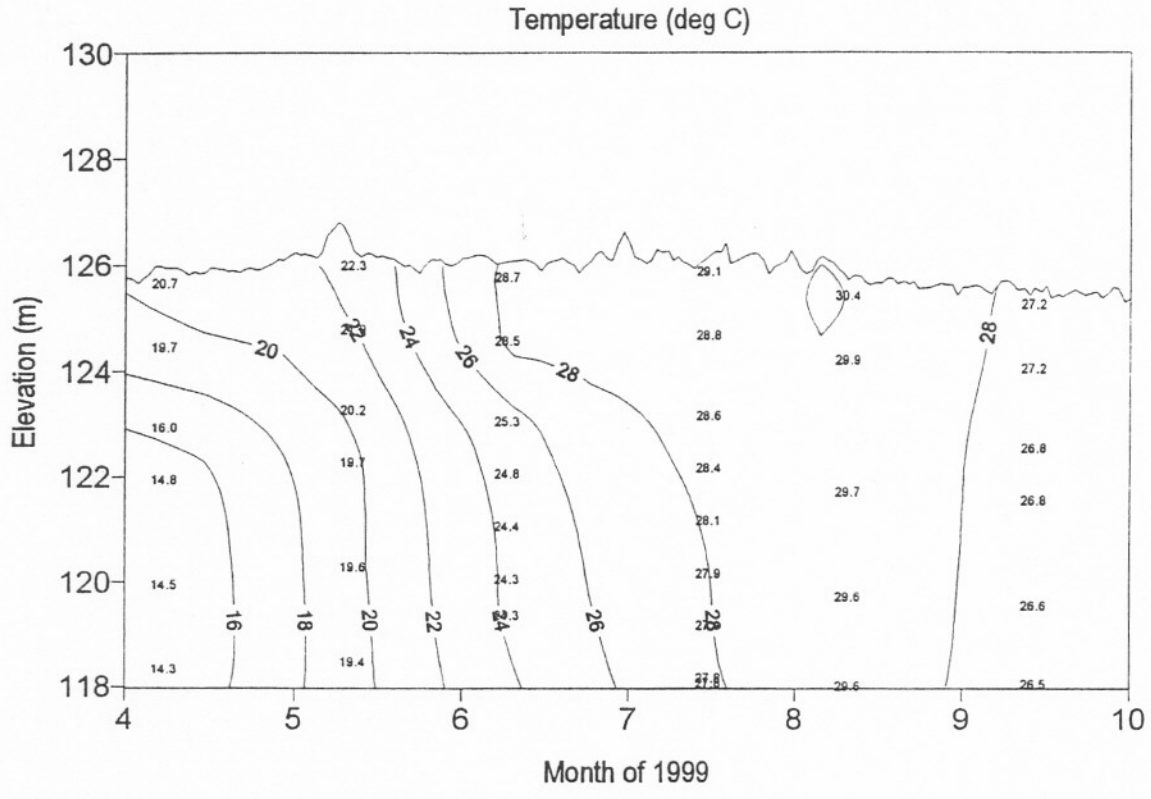


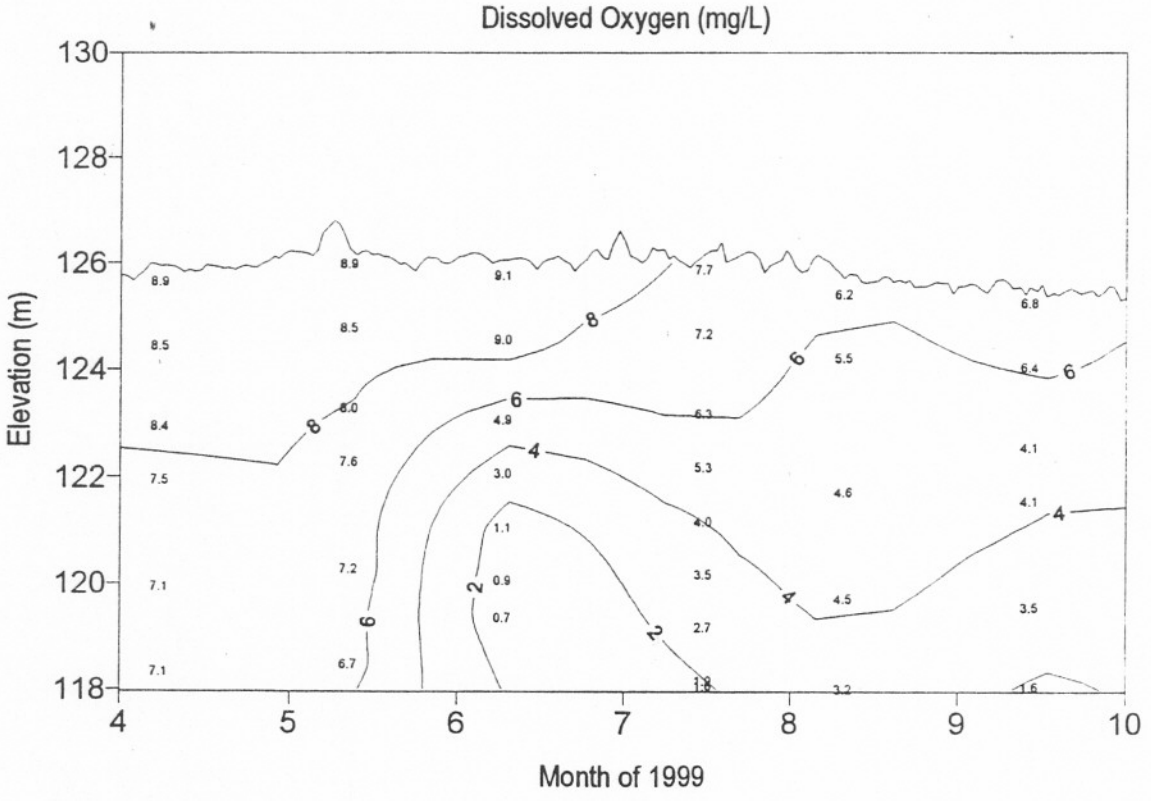
Pickwick Reservoir - TRM 230.0



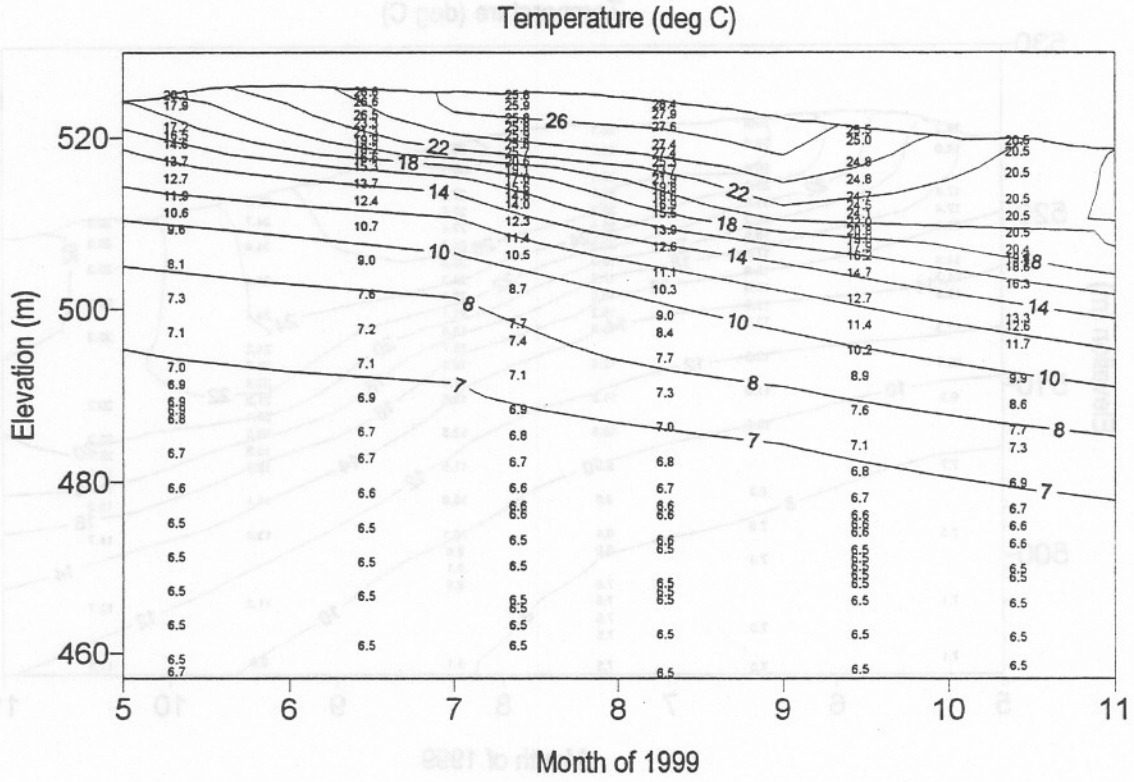


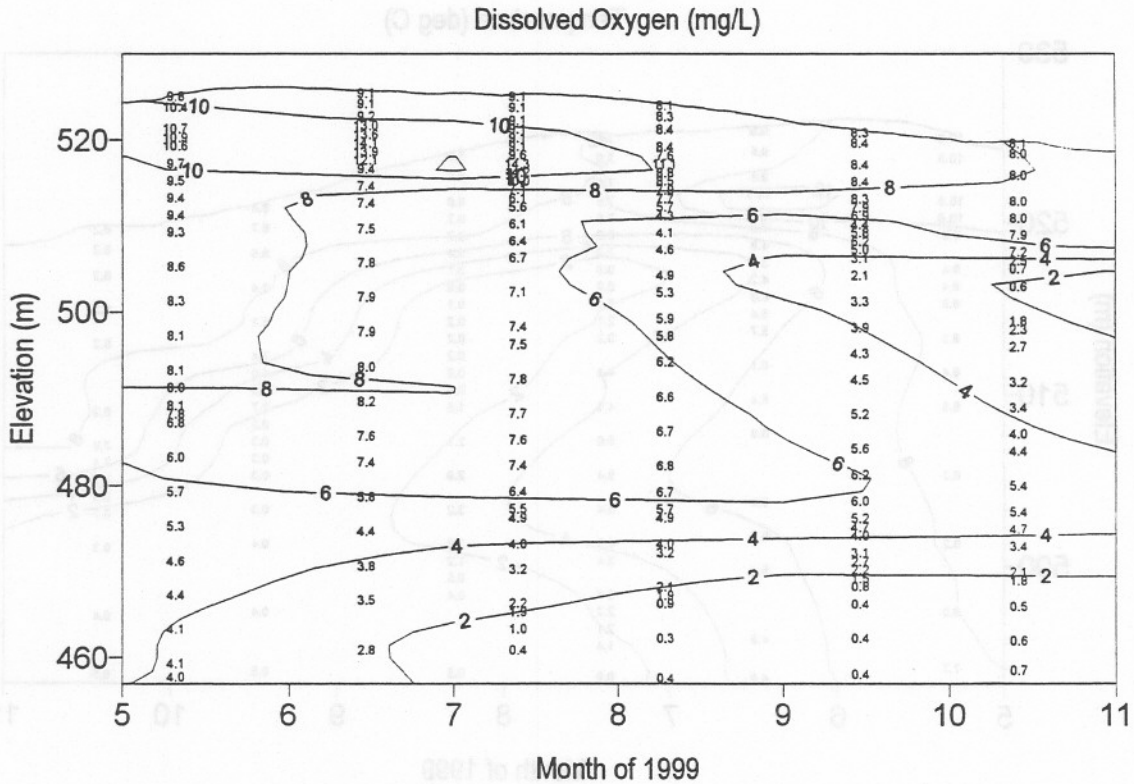
Pickwick Reservoir - Bear Creek 8.4



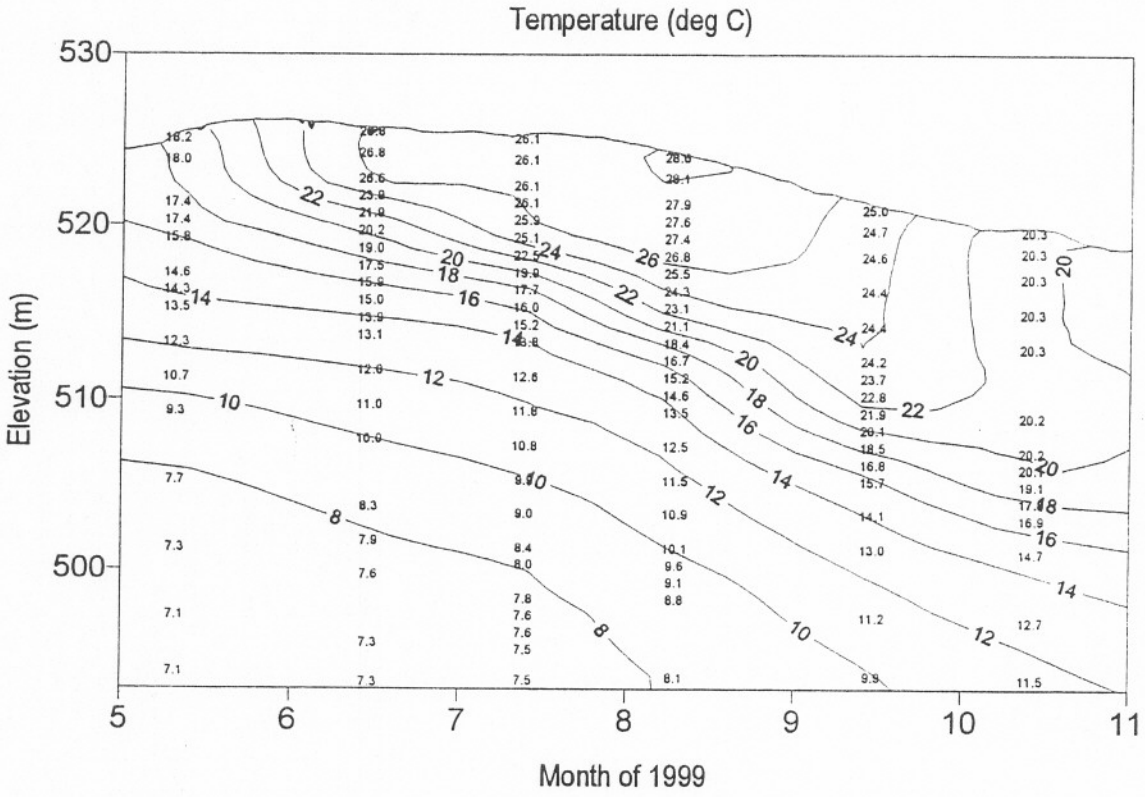


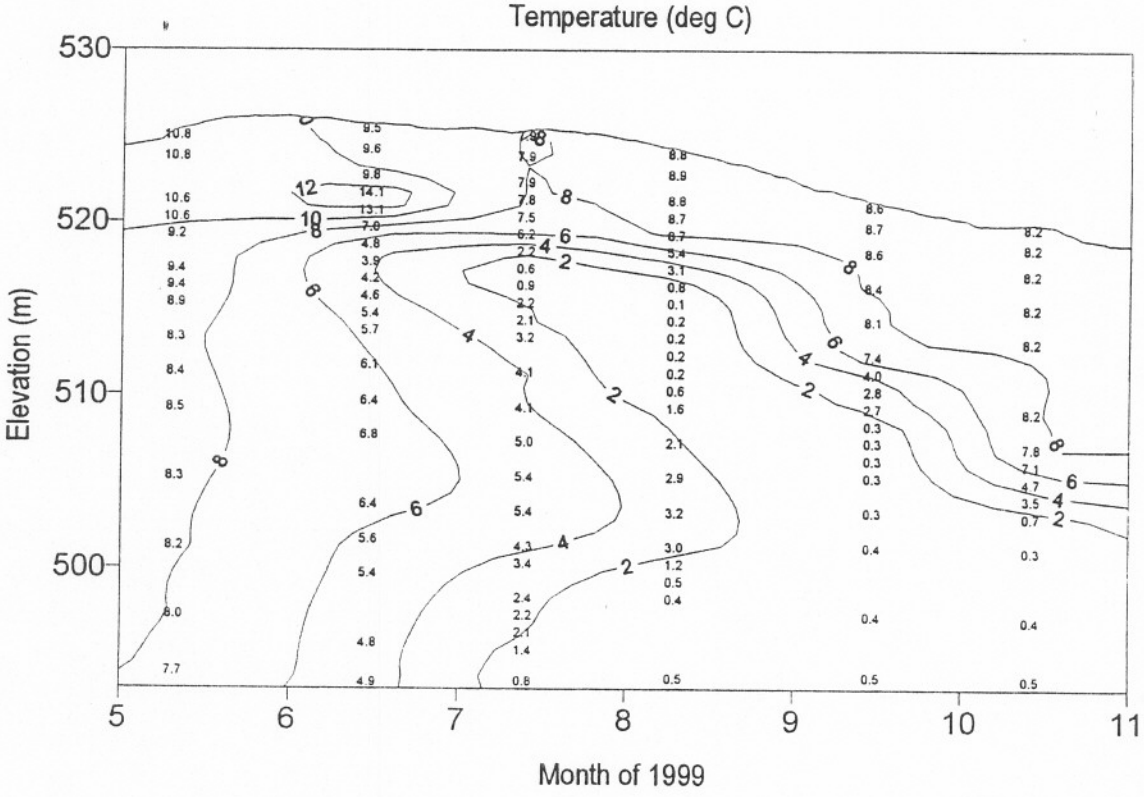
South Holston Reservoir - SFHRM 51.0



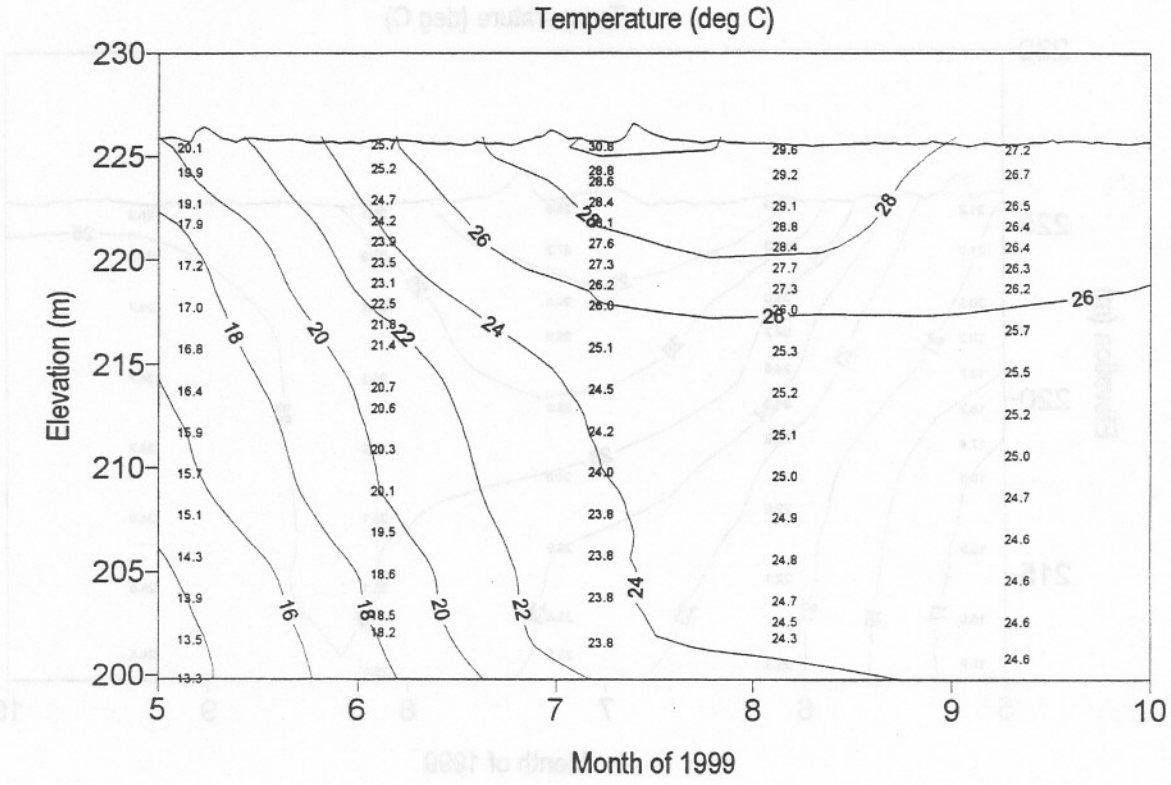


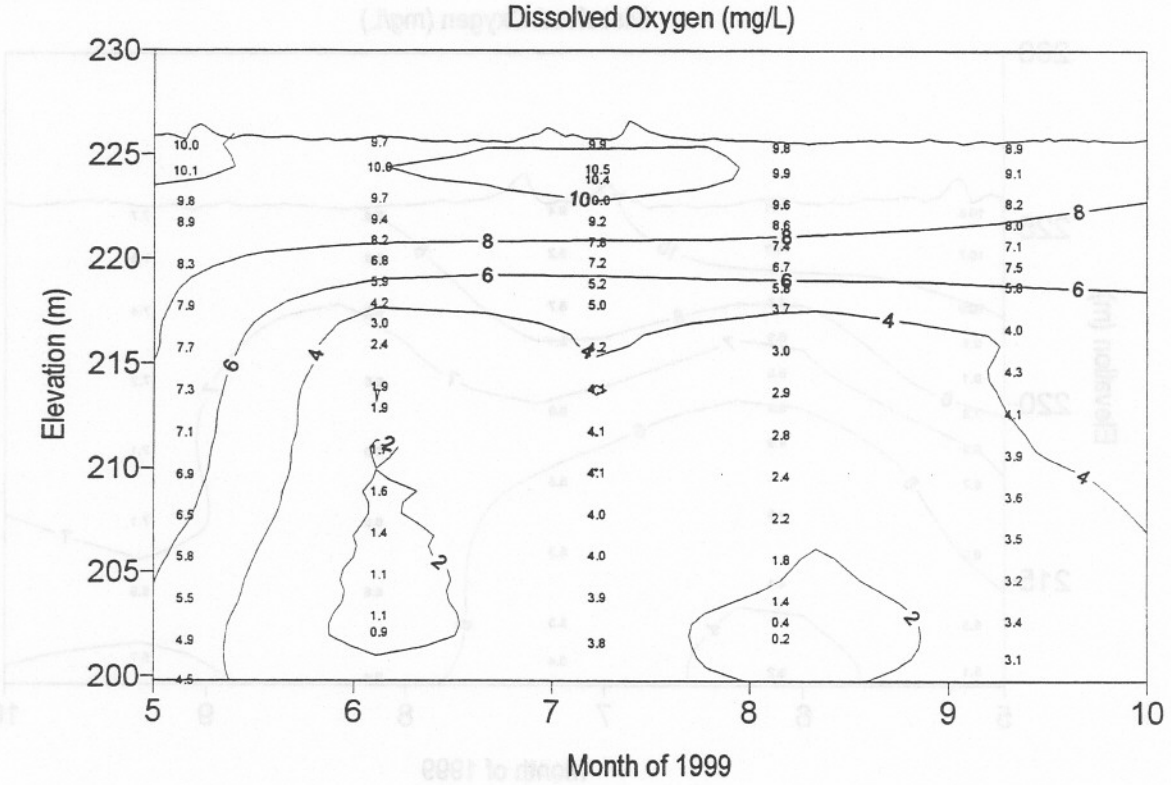
South Holston Reservoir - SFHRM 62.5



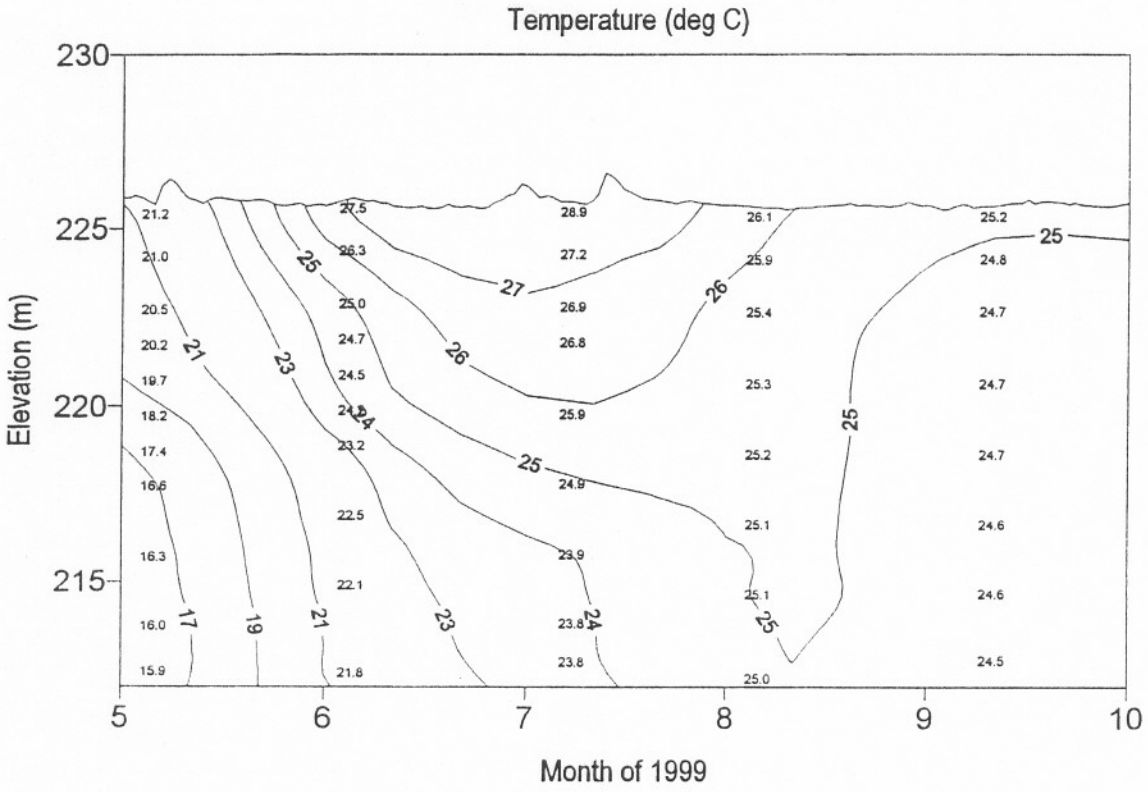


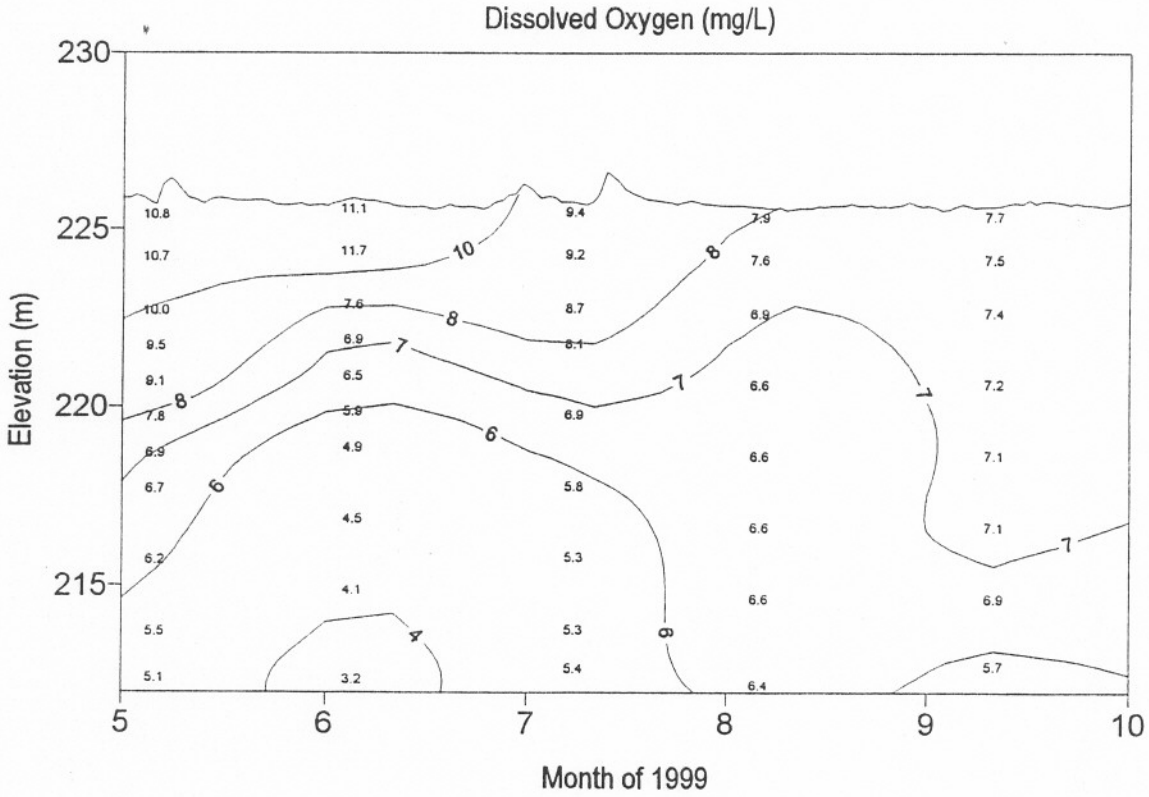
Watts Bar Reservoir - TRM 532.5



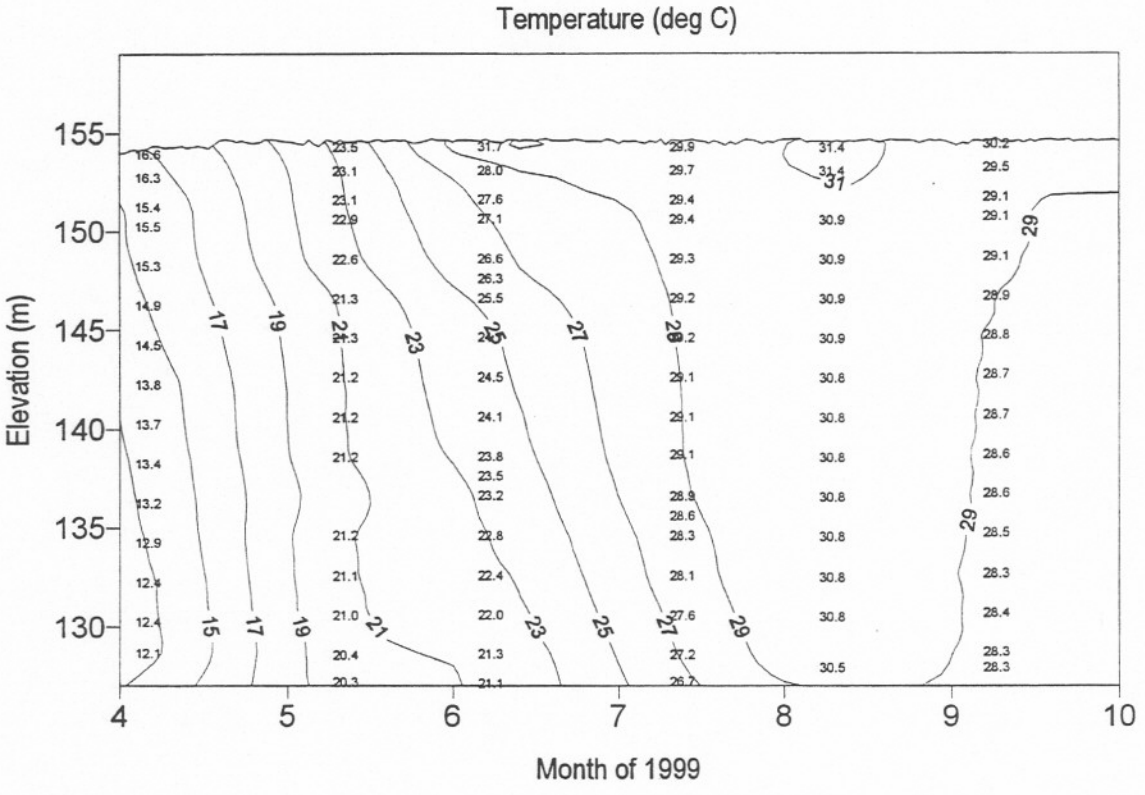


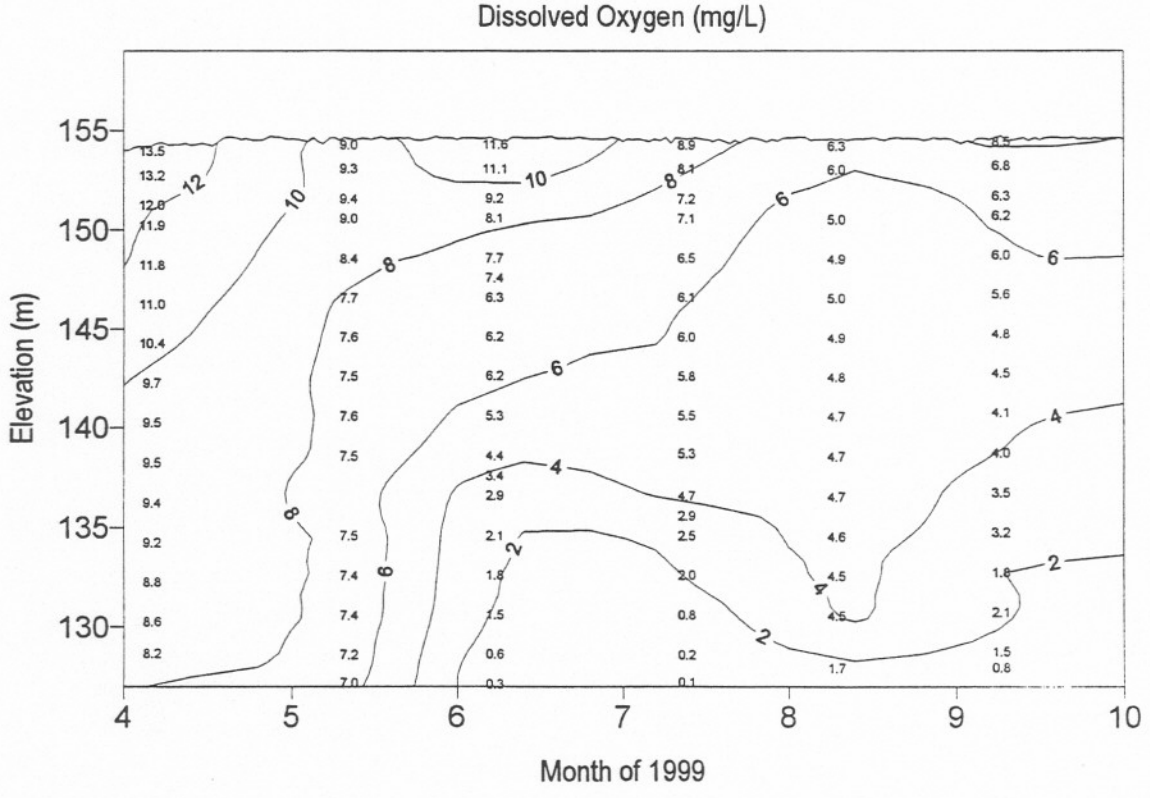
Watts Bar Reservoir - TRM 560.8





Wilson Reservoir - TRM 260.8





Appendix C.

Reservoir Benthic Macroinvertebrates -- Mean Density of Each Taxon at Each Sample Location in 1999 Including Results for Both Field Processed and Lab Processed Samples

Appendix C.

Reservoir Benthic Macroinvertebrates -- Mean Density Results for Field Processed Samples in 1999

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Apalachia Reservoir	HiRM
	67.0
Species	
Oligocheata	
Oligochaetes	25
Crustacea	
Amphipoda	5
Insecta	
Ephemeroptera	
Ephemeridae	
Hexagenia (>10 mm)	5
Megaloptera	
Sialidae	
Sialis sp.	8
Diptera	
Chironomidae	
Chironomids	22
Sphaeriidae	
Fingernail clams	3
Number of samples	10
Sum	68
Sum of area sampled	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Bear Creek Reservoir	BCM	
	75	75QA
Species		
Oligocheata		
Oligochaetes	5	8
Insecta		
Diptera		
Chironomidae		
Chironomids	613	562
Number of samples	10	10
Sum	618	570
Sum of area sampled	0.6	0.6

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Blue Ridge Reservoir	ToRM	
	54.1	54.1QA
Species		
Oligocheata		
Oligochaetes	112	152
Crustacea		
Isopoda	.	7
Insecta		
Ephemeroptera		
Ephemeridae		
Hexagenia (<=10 mm)	.	2
Hexagenia (>10 mm)	8	.
Diptera		
Chironomidae		
Chironomids	32	17
Bivalvia		
Veneroida		
Sphaeriidae		
Fingernail clams	190	127
Number of samples	10	10
Sum	342	303
Sum of area sampled	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Boone Reservoir	SFHRM		WRM
	19	27	6.5
Species			
Oligocheata			
Oligochaetes	250	130	50
Hirudinea	2	.	.
Insecta			
Diptera			
Chironomidae			
Chironomids	23	48	20
Bivalvia			
Unionoida			
Unionidae			
Mussels	.	2	.
Veneroida			
Corbiculidae			
Corbicula (<=10mm)	.	2	.
Corbicula (>10mm)	.	3	.
Number of samples	10	10	10
Sum	275	185	70
Sum of area sampled	0.60	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Cedar Creek Reservoir	CCM
	25.2
Species	
Oligocheata	
Oligochaetes	7
Insecta	
Ephemeroptera	
Mayflies	5
Diptera	
Chironomidae	
Chironomids	213
Bivalvia	
Veneroida	
Corbiculidae	
Corbicula (<=10mm)	8
Sphaeriidae	
Fingernail clams	2
Number of samples	10
Sum	235
Sum of area sampled	0.6

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Chatuge Reservoir	SCM	HiRM
	1.5	122
Species		
Oligocheata		
Oligochaetes	7	3
Insecta		
Ephemeroptera		
Ephemeridae		
Hexagenia (>10 mm)	3	.
Megaloptera		
Sialidae		
Sialis sp.	5	.
Diptera		
Chironomidae		
Chironomids	37	22
Bivalvia		
Veneroida		
Sphaeriidae		
Fingernail clams	.	2
Number of samples	10	10
Sum	52	27
Sum of area sampled	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Chickamauga Reservoir	TRM				HiRM
	472.3	490.5	490.5QA	518	8.5
Species					
Tubellaria					
Tricladida					
Planariidae	.	.	2	1	.
Oligocheata					
Oligochaetes	62	103	75	1	143
Hirudinea	7	2	2	3	3
Crustacea					
Amphipoda	.	2	8	124	.
Insecta					
Ephemeroptera					
Ephemeridae					
Hexagenia (<=10 mm)	2	15	13	.	8
Hexagenia (>10 mm)	8	32	12	.	23
Trichoptera					
Caddisflies	.	.	.	1	.
Diptera					
Ceratopogonidae	.	.	.	.	2
Chironomidae					
Chironomids	300	250	210	1	58
Gastropoda					
Snails	5	.	2	16	.
Bivalvia					
Unionoida					
Unionidae					
Mussels	.	.	.	1	.
Veneroida					
Corbiculidae					
Corbicula (<=10mm)	3	.	3	4	23
Corbicula (>10mm)	102	162	162	57	5
Sphaeriidae					
Fingernail clams	15	58	63	15	17
Number of samples	10	10	10	10	10
Sum	503	623	552	224	283
Sum of area sampled	0.60	0.60	0.60	1.10	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Douglas Reservoir	FBRM		
	51	33	33QA
Species			
Oligocheata			
Oligochaetes	15	55	70
Insecta			
Diptera			
Chironomidae			
Chironomids	675	268	247
Number of samples	10	10	10
Sum	690	323	317
Sum of area sampled	0.60	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Fort Loudoun	TRM		
	605.5	624.6	652
Species			
Oligocheata			
Oligochaetes	77	22	32
Hirudinea	.	3	.
Insecta			
Ephemeroptera			
Ephemeridae			
Hexagenia (<=10 mm)	.	23	.
Hexagenia (>10 mm)	.	2	.
Diptera			
Ceratopogonidae	.	2	.
Chironomidae			
Chironomids	130	237	20
Bivalvia			
Veneroida			
Corbiculidae			
Corbicula (>10mm)	2	5	3
Sphaeriidae			
Fingernail clams	2	23	.
Number of samples	10	10	10
Sum	210	316	55
Sum of area sampled	0.60	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Ft. Patrick Henry Reservoir	SFHRM
	8.7
Species	
Oligocheata	
Oligochaetes	58
Insecta	
Diptera	
Chironomidae	
Chironomids	120
Number of samples	10
Sum	178
Sum of area sampled	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Kentucky Reservoir	TRM			BSRM
	85	23	200	7.4
Species				
Oligocheata				
Oligochaetes	83	48	2	87
Hirudinea	7	2	2	7
Crustacea				
Isopoda	.	.	2	.
Insecta				
Ephemeroptera				
Mayflies	.	.	5	.
Ephemeridae				
Hexagenia (<=10 mm)	10	.	.	.
Hexagenia (>10 mm)	85	.	.	10
Odonata	.	.	3	.
Trichoptera				
Caddisflies	.	.	2	.
Diptera				
Ceratopogonidae	.	12	.	33
Chironomidae				
Chironomids	182	260	7	903
Gastropoda				
Snails	8	20	75	.
Bivalvia				
Unionoida				
Unionidae				
Mussels	2	.	18	.
Veneroida				
Corbiculidae				
Corbicula (<=10mm)	12	.	152	.
Corbicula (>10mm)	153	30	.	.
Sphaeriidae				
Fingernail clams	25	42	.	37
Number of samples	10	10	10	10
Sum	567	413	267	1077
Sum of area sampled	0.60	0.60	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Little Bear Reservoir	LBCM
	12.5
Species	
Oligocheata	
Oligochaetes	267
Insecta	
Diptera	
Chironomidae	
Chironomids	63
Gastropoda	
Snails	5
Bivalvia	
Veneroida	
Corbiculidae	
Corbicula (>10mm)	7
Number of samples	10
Sum	342
Sum of area sampled	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Nickajack Reservoir	TRM		
	469	469QA	425.5
Species			
Tubellaria			
Tricladida			
Planariidae	14	16	.
Oligocheata			
Oligochaetes	9	6	25
Hirudinea	2	1	.
Crustacea			
Amphipoda	88	66	3
Isopoda	12	12	.
Insecta			
Ephemeroptera			
Mayflies	16	36	.
Ephemeridae			
Hexagenia (<=10 mm)	.	.	103
Hexagenia (>10 mm)	.	.	205
Odonata	.	1	.
Trichoptera			
Caddisflies	5	9	.
Diptera			
Chironomidae			
Chironomids	2	1	125
Gastropoda			
Snails	33	17	45
Basommatophora			
Ancylidae			
Ferrissia sp.	10	7	.
Bivalvia			
Veneroida			
Corbiculidae			
Corbicula (<=10mm)	85	20	2
Corbicula (>10mm)	327	245	123
Sphaeriidae			
Fingernail clams	.	4	35
Number of samples	10	10	10
Sum	603	443	667
Sum of area sampled	1.10	1.10	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Norris Reservoir	CRM		PRM	
	80	125	30	30QA
Species				
Oligocheata				
Oligochaetes	145	40	55	47
Insecta				
Ephemeroptera				
Ephemeridae				
Hexagenia (>10 mm)	.	.	.	2
Megaloptera				
Sialidae				
Sialis sp.	2	.	.	.
Diptera				
Ceratopogonidae	.	2	2	.
Chironomidae				
Chironomids	5	725	963	895
Bivalvia				
Veneroida				
Corbiculidae				
Corbicula (<=10mm)	3	.	.	.
Sphaeriidae				
Fingernail clams	.	7	28	28
Number of samples	10	10	10	10
Sum	155	773	1048	972
Sum of area sampled	0.60	0.60	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Nottely Reservoir	NoRM	
	23.5	31
Species		
Oligocheata		
Oligochaetes	23	3
Insecta		
Ephemeroptera		
Ephemeridae		
Hexagenia (>10 mm)	.	2
Insecta		
Diptera		
Chironomidae		
Chironomids	17	553
Number of samples	10	10
Sum	40	558
Sum of area sampled	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Parksville-Ocoee No. 1 Reservoir	ORM
	12.5
Species	
Oligocheata	
Oligochaetes	10
Crustacea	
Amphipoda	2
Insecta	
Diptera	
Chironomidae	
Chironomids	2
Number of samples	10
Sum	13
Sum of area sampled	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Tellico Reservoir	LTRM	
	1	15
Species		
Oligocheata		
Oligochaetes	18	3
Insecta		
Diptera		
Chironomidae		
Chironomids	8	12
Bivalvia		
Veneroida		
Corbiculidae		
Corbicula (>10mm)	2	3
Number of samples	10	10
Sum	28	18
Sum of area sampled	0.60	0.60

VS 99 RAPID BIOASSESSMENT
MeanDensity/SQMeter

Wheeler Reservoir	TRM				ERM
	277	277QA	295.9	347	6
Species					
Tubellaria					
Tricladida					
Planariidae	.	.	.	3	.
Oligocheata					
Oligochaetes	42	63	13	3	218
Hirudinea	.	.	.	2	3
Crustacea					
Amphipoda	.	.	.	18	.
Isopoda	.	.	.	1	.
Insecta					
Ephemeridae					
Hexagenia (<=10 mm)	.	.	98	.	.
Hexagenia (>10 mm)	5	.	170	.	.
Trichoptera					
Caddisflies	.	.	.	2	.
Diptera					
Ceratopogonidae	.	.	.	.	17
Chironomidae					
Chironomids	208	170	120	.	312
Gastropoda					
Snails	2	8	18	75	.
Basommatophora					
Ancylidae					
Ferrissia sp.	.	.	.	4	.
Bivalvia					
Unionoida					
Unionidae					
Mussels	.	.	2	3	.
Veneroida					
Corbiculidae					
Corbicula (<=10mm)	.	.	17	181	.
Corbicula (>10mm)	53	90	165	291	.
Sphaeriidae					
Fingernail clams	10	7	42	2	18
Number of samples	10	10	10	10	10
Sum	320	338	645	583	568
Sum of area sampled	0.60	0.60	0.60	1.10	0.60

Appendix C.

Reservoir Benthic Macroinvertebrates -- Mean Density
Results for Lab Processed Samples in 1999

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Bear Creek Reservoir BCM 75.0	
Species	
Oligocheata	
Naididae	3
Nais sp.	2
Tubificidae	18
Insecta	
Ephemeroptera	
Caenidae	
Caenis sp.	2
Diptera	
Chironomidae	
Chironomus sp.	690
Cryptochironomus fulvus	15
Cladopelma sp.	3
Dicrotendipes sp.	7
Polypedilum convictum	2
Procladius sp.	20
Number of samples	10
Sum	762
Number of taxa	9
Number of EPT taxa	1
Sum of area sampled	0.60

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Blue Ridge Reservoir ToRM 54.1	
Species	
Oligocheata	
Tubificidae	120
Limnodrilus hoffmeisteri	22
Crustacea	
Amphipoda	
Crangonyx sp.	3
Insecta	
Ephemeroptera	
Ephemeridae	
Hexagenia (<10 mm)	17
Diptera	
Ceratopogonidae	
Bezzia sp.	5
Chironomidae	
Chironomus sp.	28
Cladopelma sp.	2
Cryptochironomus fulvus	2
Procladius sp.	28
Tanytarsus sp.	3
Bivalvia	
Veneroida	
Sphaeriidae	158
Musculium transversum	5
Number of samples	10
Sum	393
Number of taxa	10
Number of EPT taxa	1
Sum of area sampled	0.60

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Chickamauga Reservoir	TRM 490.5
Species	
Oligocheata	
Tubificidae	258
Limnodrilus hoffmeisteri	30
Lumbricidae	2
Hirudinea	
Erpobdellidae	7
Crustacea	
Amphipoda	
Gammarus sp.	2
Isopoda	
Insecta	
Ephemeroptera	
Ephemeridae	
Hexagenia (<10 mm)	22
Hexagenia (>10 mm)	23
Diptera	
Chironomidae	
Ablabesmyia annulata	7
Chironomus sp.	3
Coelotanypus sp.	255
Hemerodromia sp.	2
Bivalvia	
Veneroida	
Corbiculidae	
Corbicula fluminea (<10mm)	10
Corbicula fluminea (>10mm)	162
Sphaeriidae	
Musculium transversum	60
Number of samples	10
Sum	843
Number of taxa	11
Number of EPT taxa	1
Sum of area sampled	0.60

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Douglas Reservoir FBRM 33	
Species	
Nematoda	3
Oligocheata	
Tubificidae	35
Limnodrilus cervix	3
Crustacea	
Ostracoda	2
Insecta	
Diptera	
Chironomidae	
Chironomus sp.	283
Cryptochironomus fulvus	3
Dicrotendipes sp.	10
Glyptotendipes sp.	2
Polypedilum halterale	2
Polypedilum illinoense	2
Procladius sp.	15
Number of samples	10
Sum	360
Number of taxa	9
Number of EPT taxa	0
Sum of area sampled	0.60

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Nickajack Reservoir TRM 469.0	
Species	
Tubellaria	
Tricladida	
Planariidae	
Dugesia tigrina	43
Oligocheata	
Tubificidae	13
Lumbriculus sp.	2
Hirudinea	
Erpobdella punctata	1
Erpobdella sp.	1
Crustacea	
Amphipoda	
Gammarus sp.	207
Isopoda	
Lirceus sp.	16
Insecta	
Ephemeroptera	
Heptageniidae	3
Stenacron interpunctatum	22
Tricorythodes sp.	3
Trichoptera	
Cheumatopsyche sp.	16
Diptera	
Chironomidae	
Cryptochironomus fulvus	3
Stenochironoms sp.	1
Gastropoda	
Mesogastropoda	
Bulimidae	
Somatogyrus sp.	15
Plenorbidae	
Menetus dilatatus	1
Pleuroceridae	
Elimia laqueata	12
Pleurocera sp.	3
Viviparidae	
Viviparus Georgianus	10
Basommatophora	
Ancylidae	
Ferrissa Rivularis	7
Bivalvia	
Veneroida	
Corbiculidae	
Corbicula fluminea (<10mm)	82
Corbicula fluminea (>10mm)	331
Sphaeriidae	
Eupera cubensis	1
Number of samples	10
Sum	793
Number of taxa	18
Number of EPT taxa	3
Sum of area sampled	1.10

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Norris Reservoir PRM 30.0	
Species	
Nematoda	5
Oligocheata	
Tubificidae	163
Branchiura sowerbyi	2
Limnodrilus hoffmeisteri	8
Lumbricidae	2
Insecta	
Diptera	
Chironomidae	
Chironomus sp.	1207
Cryptochironomus fulvus	32
Nanocladius sp.	2
Polypedilum halterale	2
Procladius sp.	17
Bivalvia	
Veneroida	
Sphaeriidae	
Musculium transversum	30
Number of samples	10
Sum	1470
Number of taxa	10
Number of EPT taxa	0
Sum of area sampled	0.60

VS 99 LAB PROCESSED
MEAN DENSITY/SQMETER

Wheeler Reservoir TRM 277.0	
Species	
Oligocheata	
Tubificidae	37
Hirudinea	3
Insecta	
Ephemeroptera	
Ephemeridae	
Hexagenia (<10 mm)	2
Hexagenia (>10 mm)	5
Diptera	
Chironomidae	
Ablabesmyia annulata	5
Chironomus sp.	2
Coelotanypus sp.	247
Bivalvia	
Veneroida	
Corbiculidae	
Corbicula fluminea (<10mm)	2
Corbicula fluminea (>10mm)	52
Sphaeriidae	7
Number of samples	10
Sum	362
Number of taxa	8
Number of EPT taxa	1
Sum of area sampled	0.60

Appendix D.

Results and Ratings for Individual Metrics and Final RAFI Score for Each Sample Location in 1999 Including Both Regular and Repeat QA Sampling

Appendix D.

Results and Ratings for Individual Metrics and Final RAFI Score for Each Sample Location in 1999 for Regular Sampling

Table 1. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Appalachia Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		10	3
2. Piscivore species		4	3
3. Sunfish species		2	3
4. Sucker species		1	1
5. Intolerant species		1	1
6. Percent tolerant species	electrofishing	18.2%	1.5
	gill netting	52.6%	0.5
7. Dominance*	electrofishing	63.6%	0.5
	gill netting	42.1%	1.5
B. Trophic composition			
8. Percent omnivores	electrofishing	0.0%	2.5
	gill netting	78.9%	0.5
9. Percent insectivores	electrofishing	27.3%	0.5
	gill netting	0.0%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		1	1
D. Fish abundance and health			
11. Average number of individuals	electrofishing	0.7	0.5
	gill netting	1.9	0.5
12. Percent anomalies		0.0%	5
RFAI			26 poor

* Percent composition of the most abundant species

Table 2. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Bear Creek Reservoir.

		Forebay	
Metric		Obs.	Score
A. Species richness and composition			
1. Number of species		22	5
2. Piscivore species		5	3
3. Sunfish species		4	5
4. Sucker species		7	5
5. Intolerant species		3	5
6. Percent tolerant species	electrofishing	31.0%	0.5
	gill netting	20.8%	1.5
7. Dominance*	electrofishing	29.9%	2.5
	gill netting	20.8%	2.5
B. Trophic composition			
8. Percent omnivores	electrofishing	32.1%	0.5
	gill netting	56.6%	1.5
9. Percent insectivores	electrofishing	39.7%	0.5
	gill netting	22.6%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		5	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	12.3	0.5
	gill netting	5.3	0.5
12. Percent anomalies		0.0%	5
RFAI			44 good

* Percent composition of the most abundant species

Table 3. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Blue Ridge Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		16	5
2. Piscivore species		7	5
3. Sunfish species		4	5
4. Sucker species		2	3
5. Intolerant species		1	1
6. Percent tolerant species	electrofishing	7.1%	2.5
	gill netting	6.8%	2.5
7. Dominance*	electrofishing	39.8%	2.5
	gill netting	25.0%	2.5
B. Trophic composition			
8. Percent omnivores	electrofishing	0.0%	2.5
	gill netting	17.0%	1.5
9. Percent insectivores	electrofishing	75.5%	1.5
	gill netting	5.7%	1.5
C. Reproductive composition			
10. Lithophilic spawning species		4	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	6.5	0.5
	gill netting	8.8	0.5
12. Percent anomalies		0.5%	5
RFAI			45 good

* Percent composition of the most abundant species

Table 4. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Boone Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		19	3
2. Piscivore species		7	5
3. Sunfish species		3	3
4. Sucker species		2	1
5. Intolerant species		0	1
6. Percent tolerant species	electrofishing	10.5%	2.5
	gill netting	48.9%	1.5
7. Dominance*	electrofishing	60.5%	0.5
	gill netting	36.3%	1.5
B. Trophic composition			
8. Percent omnivores	electrofishing	10.3%	1.5
	gill netting	78.5%	0.5
9. Percent insectivores	electrofishing	78.2%	1.5
	gill netting	0%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		2	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	38.3	0.5
	gill netting	13.5	0.5
12. Percent anomalies		0.3%	5
RFAI			32 Fair

* Percent composition of the most abundant species

Table 5. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Boone Reservoir.

Metric		Transition Watauga Obs.	Transition Watauga Score	Transition South Fork Holston Obs.	Transition South Fork Holston Score
A. Species richness and composition					
1. Number of species		18	3	21	5
2. Piscivore species		6	3	8	5
3. Sunfish species		3	3	3	3
4. Sucker species		2	1	3	3
5. Intolerant species		0	1	1	1
6. Percent tolerant species	electrofishing	14.9%	2.5	30.5%	0.5
	gill netting	35.3%	1.5	52.6%	0.5
7. Dominance*	electrofishing	50.4%	1.5	31.5%	2.5
	gill netting	20.0%	2.5	30.4%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	13.3%	1.5	30.5%	0.5
	gill netting	71.2%	0.5	61.5%	0.5
9. Percent insectivores	electrofishing	55.5%	1.5	59.5%	1.5
	gill netting	0.6%	0.5	2.2%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		1	1	4	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	37.5	0.5	39.3	0.5
	gill netting	17.0	1.5	13.5	0.5
12. Percent anomalies		0.4%	5	0.5%	5
RFAI			31 Poor		34 Fair

* Percent composition of the most abundant species.

Table 6. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Cedar Creek Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		21	5
2. Piscivore species		6	3
3. Sunfish species		5	5
4. Sucker species		5	3
5. Intolerant species		3	5
6. Percent tolerant species	electrofishing	17.7%	1.5
	gill netting	20.9%	1.5
7. Dominance*	electrofishing	30.6%	2.5
	gill netting	31.8%	1.5
B. Trophic composition			
8. Percent omnivores	electrofishing	16.1%	1.5
	gill netting	40.0%	1.5
9. Percent insectivores	electrofishing	48.4%	0.5
	gill netting	32.7%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		7	5
D. Fish abundance and health			
11. Average number of individuals	electrofishing	8.3	0.5
	gill netting	11.0	1.5
12. Percent anomalies		6.8%	1.0
RFAI			42 good

* Percent composition of the most abundant species

Table 7. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Chatuge Reservoir.

Metric		Forebay Obs.	Forebay Score	Shooting Creek Obs.	Shooting Creek Score
A. Species richness and composition					
1. Number of species		16	5	17	5
2. Piscivore species		6	5	5	3
3. Sunfish species		4	5	5	5
4. Sucker species		0	1	1	1
5. Intolerant species		0	1	1	1
6. Percent tolerant species	electrofishing	1.5%	2.5	1.9%	2.5
	gill netting	8.6%	2.5	12.6%	1.5
7. Dominance*	electrofishing	27.3%	2.5	25.0%	2.5
	gill netting	32.8%	1.5	38.6%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	2.3%	2.5	1.9%	2.5
	gill netting	10.3%	2.5	16.5%	1.5
9. Percent insectivores	electrofishing	51.5%	0.5	68.6%	0.5
	gill netting	3.4%	1.5	0.8%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		2	1	3	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	8.8	0.5	10.4	0.5
	gill netting	5.8	0.5	12.7	1.5
12. Percent anomalies		1.6%	5	1.1%	5
RFAI			40 fair		38 fair

* Percent composition of the most abundant species

Table 8. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Chickamauga Reservoir.

Metric		Forebay Obs.	Forebay Score	Embayment Obs.	Embayment Score
A. Species richness and composition					
1. Number of species		27	3	31	5
2. Piscivore species		11	5	12	5
3. Sunfish species		5	5	4	3
4. Sucker species		2	1	5	3
5. Intolerant species		3	3	2	3
6. Percent tolerant species	electrofishing	23.2%	1.5	4.7%	2.5
	gill netting	27.1%	1.5	4.0%	2.5
7. Dominance*	electrofishing	22.4%	2.5	25.7%	2.5
	gill netting	26.7%	2.5	38.3%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	22.4%	1.5	7.3%	2.5
	gill netting	38.1%	1.5	52.5%	0.5
9. Percent insectivores	electrofishing	64.0%	1.5	53.8%	1.5
	gill netting	9.0%	1.5	24.1%	2.5
C. Reproductive composition					
10. Lithophilic spawning species		6	3	8	5
D. Fish abundance and health					
11. Average number of individuals	electrofishing	8.3	0.5	45.9	0.5
	gill netting	21.0	1.5	16.2	1.5
12. Percent anomalies		0.0%	5	0.4%	5
RFAI			41 good		47 good

* Percent composition of the most abundant species.

Table 9. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Chickamauga Reservoir.

Metric		Inflow Obs.	Inflow Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		28	5	30	5
2. Piscivore species		9	5	10	5
3. Sunfish species		4	3	5	5
4. Sucker species		5	3	3	1
5. Intolerant species		3	3	3	3
6. Percent tolerant species	electrofishing	13.0%	5	21.2%	2.5
	gill netting	.	.	50.8%	0.5
7. Dominance*	electrofishing	46.1%	3	15.9%	2.5
	gill netting	.	.	50.8%	0.5
B. Trophic composition					
8. Percent omnivores	electrofishing	12.3%	5	17.8%	2.5
	gill netting	.	.	54.5%	0.5
9. Percent insectivores	electrofishing	33.1%	3	59.1%	1.5
	gill netting	.	.	10.2%	1.5
C. Reproductive composition					
10. Lithophilic spawning species		9	5	7	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	39.1	1	13.9	0.5
	gill netting	.	.	24.6	1.5
12. Percent anomalies		2.3%	3	1.3%	5
RFAI			44 good		41 good

* Percent composition of the most abundant species.

Table 10. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Douglas Reservoir.

Metric		Forebay Obs.	Forebay Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		23	5	27	5
2. Piscivore species		6	3	8	5
3. Sunfish species		2	3	5	5
4. Sucker species		7	5	6	3
5. Intolerant species		3	5	2	3
6. Percent tolerant species	electrofishing	19.9%	1.5	24.6%	1.5
	gill netting	61.2%	0.5	42.8%	1.5
7. Dominance*	electrofishing	28.9%	2.5	41.0%	1.5
	gill netting	60.3%	0.5	38.9%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	19.1%	1.5	24.6%	1.5
	gill netting	73.7%	0.5	61.1%	0.5
9. Percent insectivores	electrofishing	52.3%	0.5	24.0%	0.5
	gill netting	4.3%	1.5	12.3%	2.5
C. Reproductive composition					
10. Lithophilic spawning species		9	5	7	5
D. Fish abundance and health					
11. Average number of individuals	electrofishing	17.1	0.5	45.2	1.5
	gill netting	23.2	1.5	28.5	1.5
12. Percent anomalies		1.8%	5	1.0%	5
RFAI			42 good		45 good

* Percent composition of the most abundant species.

Table 11. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Fort Loudon Reservoir.

Metric		Forebay Obs.	Forebay Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		31	5	28	3
2. Piscivore species		10	5	11	5
3. Sunfish species		4	3	3	3
4. Sucker species		5	3	2	1
5. Intolerant species		3	3	2	3
6. Percent tolerant species	electrofishing	28.9%	1.5	25.9%	1.5
	gill netting	14.6%	2.5	19.2%	2.5
7. Dominance*	electrofishing	30.4%	2.5	32.6%	2.5
	gill netting	29.5%	2.5	43.9%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	31.3%	1.5	28.8%	1.5
	gill netting	23.5%	2.5	29.9%	2.5
9. Percent insectivores	electrofishing	37.6%	1.5	40.0%	1.5
	gill netting	1.8%	0.5	4.5%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		7	5	7	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	27.7	0.5	22.7	0.5
	gill netting	33.6	1.5	35.5	2.5
12. Percent anomalies		1.6%	5	0.9%	5
RFAI			46 good		40 fair

* Percent composition of the most abundant species.

Table 12. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Fort Loudoun Reservoir.

Metric		Inflow Obs.	Score
A. Species richness and composition			
1. Number of species		28	5
2. Piscivore species		6	3
3. Sunfish species		4	3
4. Sucker species		8	5
5. Intolerant species		4	3
6. Percent tolerant species	electrofishing	38.9%	3
7. Dominance*	electrofishing	27.4%	5
B. Trophic composition			
8. Percent omnivores	electrofishing	37.1%	3
9. Percent insectivores	electrofishing	52.9%	5
C. Reproductive composition			
10. Lithophilic spawning species		8	5
D. Fish abundance and health			
11. Average number of individuals	electrofishing	21.9	1
12. Percent anomalies		0.9%	5
RFAI			46 good

* Percent composition of the most abundant species

Table 13. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Fort Patrick Henry Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		12	3
2. Piscivore species		3	3
3. Sunfish species		2	3
4. Sucker species		1	1
5. Intolerant species		0	1
6. Percent tolerant species	electrofishing	29.8%	1.5
	gill netting	55.7%	0.5
7. Dominance*	electrofishing	59.5%	1.5
	gill netting	35.2%	1.5
B. Trophic composition			
8. Percent omnivores	electrofishing	31.4%	0.5
	gill netting	80.7%	0.5
9. Percent insectivores	electrofishing	60.7%	1.5
	gill netting	0%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		0	1
D. Fish abundance and health			
11. Average number of individuals	electrofishing	29.3	0.5
	gill netting	8.8	0.5
12. Percent anomalies		0.3%	5
RFAI			26 Poor

* Percent composition of the most abundant species

Table 14. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Kentucky Reservoir.

Metric		Forebay Obs.	Forebay Score	Big Sandy Obs.	Big Sandy Score
A. Species richness and composition					
1. Number of species		27	3	21	3
2. Piscivore species		9	5	7	3
3. Sunfish species		3	3	3	3
4. Sucker species		5	3	2	1
5. Intolerant species		3	3	3	3
6. Percent tolerant species	electrofishing	25.9%	1.5	41.9%	1.5
	gill netting	32.9%	1.5	51.3%	0.5
7. Dominance*	electrofishing	23.8%	2.5	41.3%	1.5
	gill netting	38.2%	1.5	46.9%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	28.3%	1.5	41.9%	1.5
	gill netting	46.4%	0.5	64.6%	0.5
9. Percent insectivores	electrofishing	49.0%	1.5	22.7%	0.5
	gill netting	4.0%	0.5	11.1%	1.5
C. Reproductive composition					
10. Lithophilic spawning species		6	3	4	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	19.3	0.5	11.5	0.5
	gill netting	42.2	2.5	22.6	1.5
12. Percent anomalies		0.1%	5	0.0%	5
RFAI			39 fair		32 fair

* Percent composition of the most abundant species.

Table 15. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Kentucky Reservoir.

Metric		Inflow Obs.	Inflow Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		24	3	26	3
2. Piscivore species		10	5	10	5
3. Sunfish species		3	3	4	5
4. Sucker species		3	1	3	1
5. Intolerant species		3	3	3	3
6. Percent tolerant species	electrofishing	21.4%	5	34.2%	1.5
	gill netting	.	.	23.8%	1.5
7. Dominance*	electrofishing	18.9%	5	32.5%	2.5
	gill netting	.	.	23.3%	2.5
B. Trophic composition					
8. Percent omnivores	electrofishing	24.6%	5	34.2%	1.5
	gill netting	.	.	56.7%	0.5
9. Percent insectivores	electrofishing	45.4%	3	49.1%	1.5
	gill netting	.	.	13.8%	1.5
C. Reproductive composition					
10. Lithophilic spawning species		7	3	6	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	18.7	1	7.6	0.5
	gill netting	.	.	21.0	1.5
12. Percent anomalies		0.0%	5	0.0%	5
RFAI			42 good		40 fair

* Percent composition of the most abundant species.

Table 16. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Little Bear Creek Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		18	3
2. Piscivore species		6	3
3. Sunfish species		4	5
4. Sucker species		3	3
5. Intolerant species		3	5
6. Percent tolerant species	electrofishing	0.9%	2.5
	gill netting	15.0%	2.5
7. Dominance*	electrofishing	21.2%	2.5
	gill netting	20.6%	2.5
B. Trophic composition			
8. Percent omnivores	electrofishing	5.3%	2.5
	gill netting	50.5%	1.5
9. Percent insectivores	electrofishing	68.1%	1.5
	gill netting	25.2%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		4	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	7.5	0.5
	gill netting	10.7	1.5
12. Percent anomalies		0.0%	5
RFAI			47 good

* Percent composition of the most abundant species

Table 17. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Nickajack Reservoir.

Metric		Forebay Obs.	Forebay Score	Inflow Obs.	Inflow Score
A. Species richness and composition					
1. Number of species		24	3	25	3
2. Piscivore species		10	5	8	5
3. Sunfish species		4	3	6	5
4. Sucker species		1	1	3	3
5. Intolerant species		3	3	2	3
6. Percent tolerant species	electrofishing	52.7%	0.5	11.6%	5
	gill netting	33.9%	1.5		
7. Dominance*	electrofishing	42.0%	1.5	28.4%	5
	gill netting	32.3%	1.5		
B. Trophic composition					
8. Percent omnivores	electrofishing	43.8%	1.5	13.4%	5
	gill netting	38.7%	1.5		
9. Percent insectivores	electrofishing	20.5%	0.5	30.6%	3
	gill netting	8.9%	1.5		
C. Reproductive composition					
10. Lithophilic spawning species		4	3	5	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	7.5	0.5	17.9	1
	gill netting	12.4	0.5		
12. Percent anomalies		0.0%	5	0.7%	5
RFAI			34 fair		46 good

* Percent composition of the most abundant species.

Table 18. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Norris Reservoir.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		16	3
2. Piscivore species		6	3
3. Sunfish species		2	3
4. Sucker species		1	1
5. Intolerant species		2	3
6. Percent tolerant species	electrofishing	1.4%	2.5
	gill netting	21.6%	2.5
7. Dominance*	electrofishing	65.7%	0.5
	gill netting	52.0%	0.5
B. Trophic composition			
8. Percent omnivores	electrofishing	1.4%	2.5
	gill netting	25.5%	2.5
9. Percent insectivores	electrofishing	83.7%	2.5
	gill netting	7.8%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		2	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	19.3	0.5
	gill netting	10.2	0.5
12. Percent anomalies		0.5%	5
RFAI			38 fair

* Percent composition of the most abundant species

Table 19. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Norris Reservoir.

Metric		Transition Powell River Obs.	Score	Transition Clinch River Obs.	Score
A. Species richness and composition					
1. Number of species		25	5	27	5
2. Piscivore species		9	5	9	5
3. Sunfish species		2	3	3	3
4. Sucker species		7	5	7	5
5. Intolerant species		3	5	4	5
6. Percent tolerant species	electrofishing	0.7%	2.5	0.9%	2.5
	gill netting	32.6%	1.5	38.6%	1.5
7. Dominance*	electrofishing	14.5%	2.5	34.2%	2.5
	gill netting	22.3%	2.5	34.6%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	0.7%	2.5	0.9%	2.5
	gill netting	39.7%	2.5	49.0%	1.5
9. Percent insectivores	electrofishing	63.2%	1.5	74.5%	2.5
	gill netting	10.5%	2.5	4.6%	1.5
C. Reproductive composition					
10. Lithophilic spawning species		11	5	9	5
D. Fish abundance and health					
11. Average number of individuals	electrofishing	10.1	0.5	21.4	0.5
	gill netting	18.4	1.5	15.3	1.5
12. Percent anomalies		0%	5	1.7%	5
RFAI			53 Excellent		51 Excellent

* Percent composition of the most abundant species.

Table 20. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Nottley Reservoir.

Metric		Forebay Obs.	Forebay Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		16	5	20	5
2. Piscivore species		6	5	6	5
3. Sunfish species		3	3	5	5
4. Sucker species		3	3	2	3
5. Intolerant species		2	3	1	1
6. Percent tolerant species	electrofishing	22.5%	1.5	5.7%	2.5
	gill netting	16.1%	1.5	27.0%	0.5
7. Dominance*	electrofishing	26.3%	2.5	66.4%	0.5
	gill netting	23.2%	2.5	28.1%	2.5
B. Trophic composition					
8. Percent omnivores	electrofishing	10.0%	1.5	2.0%	2.5
	gill netting	25.0%	1.5	31.5%	0.5
9. Percent insectivores	electrofishing	38.8%	0.5	72.1%	0.5
	gill netting	3.6%	1.5	0%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		5	5	4	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	5.3	0.5	43.2	1.5
	gill netting	5.6	0.5	8.9	0.5
12. Percent anomalies		9.6%	1	1.8%	5
RFAI			39 Fair		39 Fair

* Percent composition of the most abundant species.

Table 21. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Ocoee Reservoir.

Metric		Forebay Obs.	Forebay Score
A. Species richness and composition			
1. Number of species		8	3
2. Piscivore species		2	1
3. Sunfish species		2	3
4. Sucker species		0	1
5. Intolerant species		0	1
6. Percent tolerant species	electrofishing	2.8%	2.5
	gill netting	14.3%	1.5
7. Dominance*	electrofishing	71.4%	0.5
	gill netting	57.1%	0.5
B. Trophic composition			
8. Percent omnivores	electrofishing	0.0%	2.5
	gill netting	35.7%	0.5
9. Percent insectivores	electrofishing	28.6%	0.5
	gill netting	0.0%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		0	1
D. Fish abundance and health			
11. Average number of individuals	electrofishing	2.3	0.5
	gill netting	1.4	0.5
12. Percent anomalies		0.0%	5
RFAI			25 poor

* Percent composition of the most abundant species

Table 22. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Tellico Reservoir.

Metric		Forebay Obs.	Forebay Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		29	5	29	5
2. Piscivore species		13	5	13	5
3. Sunfish species		3	3	3	3
4. Sucker species		4	3	4	3
5. Intolerant species		4	5	3	3
6. Percent tolerant species	electrofishing	29.8%	1.5	13.9%	2.5
	gill netting	15.7%	2.5	16.5%	2.5
7. Dominance*	electrofishing	33.1%	2.5	32.8%	2.5
	gill netting	17.0%	2.5	20.3%	2.5
B. Trophic composition					
8. Percent omnivores	electrofishing	26.8%	1.5	16.1%	2.5
	gill netting	28.9%	2.5	34.6%	1.5
9. Percent insectivores	electrofishing	52.9%	1.5	75.2%	2.5
	gill netting	4.7%	0.5	6.0%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		7	3	6	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	18.1	0.5	9.1	0.5
	gill netting	23.5	1.5	13.3	0.5
12. Percent anomalies		1.7%	5	1.1%	5
RFAI			46 Good		45 Good

* Percent composition of the most abundant species.

Table 23. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Wheeler Reservoir.

Metric		Inflow Obs.	Inflow Score	Embayment Obs.	Embayment Score
A. Species richness and composition					
1. Number of species		19	3	21	3
2. Piscivore species		7	3	7	3
3. Sunfish species		2	3	3	3
4. Sucker species		3	1	4	3
5. Intolerant species		0	1	3	3
6. Percent tolerant species	electrofishing	26.4%	5	19.1%	2.5
	gill netting			44.6%	0.5
7. Dominance*	electrofishing	31.3%	5	21.8%	2.5
	gill netting			44.3%	1.5
B. Trophic composition					
8. Percent omnivores	electrofishing	28.2%	5	23.4%	2.5
	gill netting			48.3%	0.5
9. Percent insectivores	electrofishing	16.0%	1	46.3%	1.5
	gill netting			8.9%	1.5
C. Reproductive composition					
10. Lithophilic spawning species		4	3	6	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	10.9	1	12.5	0.5
	gill netting			32.7	1.5
12. Percent anomalies		0.0%	5	0.0%	5
RFAI			36 Fair		38 Fair

* Percent composition of the most abundant species.

Table 24. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for Wheeler Reservoir.

Metric		Forebay Obs.	Forebay Score	Transition Obs.	Transition Score
A. Species richness and composition					
1. Number of species		25	3	22	3
2. Piscivore species		11	5	7	3
3. Sunfish species		4	5	2	3
4. Sucker species		3	1	3	1
5. Intolerant species		3	3	2	1
6. Percent tolerant species	electrofishing	28.1%	1.5	39.2%	1.5
	gill netting	26.4%	1.5	20.1%	1.5
7. Dominance*	electrofishing	28.1%	2.5	36.5%	2.5
	gill netting	40.8%	1.5	51.1%	0.5
B. Trophic composition					
8. Percent omnivores	electrofishing	33.3%	1.5	44.6%	1.5
	gill netting	36.1%	1.5	30.3%	1.5
9. Percent insectivores	electrofishing	49.0%	1.5	23.0%	0.5
	gill netting	3.6%	0.5	3.0%	0.5
C. Reproductive composition					
10. Lithophilic spawning species		5	3	5	3
D. Fish abundance and health					
11. Average number of individuals	electrofishing	6.4	0.5	4.9	0.5
	gill netting	27.7	1.5	13.9	0.5
12. Percent anomalies		0.0%	5	0.5%	5
RFAI			39 Fair		30 Poor

* Percent composition of the most abundant species.

Appendix D.

Results and Ratings for Individual Metrics and Final RAFI Score for Each Sample Location in 1999 for Repeat QA Sampling

Table 1. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Bear Creek Reservoir.

		Forebay	
Metric		Obs.	Score
A. Species richness and composition			
1. Number of species		22	5
2. Piscivore species		5	3
3. Sunfish species		6	5
4. Sucker species		6	5
5. Intolerant species		4	5
6. Percent tolerant species	electrofishing	20.4%	1.5
	gill netting	11.5%	2.5
7. Dominance*	electrofishing	26.0%	2.5
	gill netting	23.1%	2.5
B. Trophic composition			
8. Percent omnivores	electrofishing	8.7%	2.5
	gill netting	53.8%	1.5
9. Percent insectivores	electrofishing	70.2%	1.5
	gill netting	17.3%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		5	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	17.7	0.5
	gill netting	5.2	0.5
12. Percent anomalies		2.2%	3
RFAI			47 good

* Percent composition of the most abundant species

Table 2. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Chickamauga Reservoir.

Metric		Transition Obs.	Score
A. Species richness and composition			
1. Number of species		24	3
2. Piscivore species		9	5
3. Sunfish species		5	5
4. Sucker species		2	1
5. Intolerant species		3	3
6. Percent tolerant species	electrofishing	31.0%	1.5
	gill netting	20.7%	1.5
7. Dominance*	electrofishing	33.5%	2.5
	gill netting	20.7%	2.5
B. Trophic composition			
8. Percent omnivores	electrofishing	28.5%	1.5
	gill netting	25.2%	2.5
9. Percent insectivores	electrofishing	58.1%	1.5
	gill netting	32.4%	2.5
C. Reproductive composition			
10. Lithophilic spawning species		7	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	23.9	0.5
	gill netting	11.1	0.5
12. Percent anomalies		3.4%	3
RFAI			40 fair

* Percent composition of the most abundant species

Table 3. Scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Douglas Reservoir in 1999.

Metric		Forebay Obs.	Score
A. Species richness and composition			
1. Number of species		17	3
2. Piscivore species		7	5
3. Sunfish species		1	1
4. Sucker species		3	3
5. Intolerant species		1	1
6. Percent tolerant species	electrofishing	50.0%	0.5
	gill netting	71.9%	0.5
7. Dominance*	electrofishing	49.1%	1.5
	gill netting	71.1%	0.5
B. Trophic composition			
8. Percent omnivores	electrofishing	50.0%	0.5
	gill netting	77.9%	0.5
9. Percent insectivores	electrofishing	4.7%	0.5
	gill netting	0.4%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		6	5
D. Fish abundance and health			
11. Average number of individuals	electrofishing	7.1	0.5
	gill netting	23.5	1.5
12. Percent anomalies		0.0%	5
RFAI			30 poor

* Percent composition of the most abundant species

Table 4. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Nickajack Reservoir.

Metric		Inflow Obs.	Score
A. Species richness and composition			
1. Number of species		31	5
2. Piscivore species		9	5
3. Sunfish species		5	5
4. Sucker species		4	3
5. Intolerant species		5	5
6. Percent tolerant species	electrofishing gill netting	9.6%	5
7. Dominance*	electrofishing gill netting	30.5%	5
B. Trophic composition			
8. Percent omnivores	electrofishing gill netting	8.5%	5
9. Percent insectivores	electrofishing gill netting	53.8%	5
C. Reproductive composition			
10. Lithophilic spawning species		10	5
D. Fish abundance and health			
11. Average number of individuals	electrofishing gill netting	45.7	1
12. Percent anomalies		0.7%	5
RFAI			54 Excellent

* Percent composition of the most abundant species

Table 5. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Norris Reservoir.

Metric		Transition Powell River Obs.	Score
A. Species richness and composition			
1. Number of species		18	3
2. Piscivore species		8	5
3. Sunfish species		1	1
4. Sucker species		5	3
5. Intolerant species		1	1
6. Percent tolerant species	electrofishing	18.8%	2.5%
	gill netting	37.0%	1.5%
7. Dominance*	electrofishing	25.0%	2.5%
	gill netting	27.0%	2.5%
B. Trophic composition			
8. Percent omnivores	electrofishing	18.8%	2.5%
	gill netting	36.0%	1.5%
9. Percent insectivores	electrofishing	37.5%	1.5%
	gill netting	24.0%	2.5%
C. Reproductive composition			
10. Lithophilic spawning species		8	5
D. Fish abundance and health			
11. Average number of individuals	electrofishing	2.1	0.5
	gill netting	10.0	0.5
12. Percent anomalies		0.0%	5
RFAI			41 Good

* Percent composition of the most abundant species

Table 6. 1999 scoring results for the twelve metrics and overall Reservoir Fish Assemblage Index (RFAI) for QA repeat samples from Wheeler Reservoir.

Metric		Obs.	Transition Score
A. Species richness and composition			
1. Number of species		33	5
2. Piscivore species		10	5
3. Sunfish species		5	5
4. Sucker species		4	3
5. Intolerant species		5	5
6. Percent tolerant species	electrofishing	26.8%	1.5
	gill netting	31.5%	1.5
7. Dominance*	electrofishing	21.5%	2.5
	gill netting	31.5%	1.5
B. Trophic composition			
8. Percent omnivores	electrofishing	32.1%	1.5
	gill netting	47.6%	0.5
9. Percent insectivores	electrofishing	41.9%	1.5
	gill netting	6.5%	0.5
C. Reproductive composition			
10. Lithophilic spawning species		7	3
D. Fish abundance and health			
11. Average number of individuals	electrofishing	16.4	0.5
	gill netting	12.4	0.5
12. Percent anomalies		2.2%	3
RFAI			41 Good

* Percent composition of the most abundant species

Appendix E.

Mean Catch Per Effort by Species For Electrofishing and Gill Netting Efforts at Each Location in 1999 Including Both Regular and Repeat QA Sampling

Appendix E.

Mean Catch Per Effort by Species
For Electrofishing and Gill Netting Efforts
at Each Location in 1999 for Regular Sampling

Table 1. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Appalachia, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	.	0.8	.
Common Carp	.	0.2	.
Northern Hog Sucker	0.1	.	0.4
Channel Catfish	.	0.5	.
Flathead Catfish	.	0.2	.
Redbreast Sunfish	0.1	.	0.4
Green Sunfish	0.1	.	0.4
Smallmouth Bass	0.1	.	0.4
Spotted Bass	.	0.1	.
Largemouth Bass	0.5	0.1	2.8
Total	0.9	1.9	4.4
Number of samples	15	10	15
Number collected	11	19	11
Species collected	5	6	5

Table 2. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Bear Creek, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	3.7	1.1	21.8
Threadfin Shad	0.6	.	3.6
Quillback	0.1	1.1	0.4
Northern Hogsucker	0.2	.	1.2
Smallmouth Buffalo	0.1	.	0.4
Black Buffalo	.	0.1	.
Spotted Sucker	0.5	0.9	3.2
Black Redhorse	0.5	0.2	2.8
Golden Redhorse	0.5	.	4.8
Blue Catfish	.	0.1	.
Channel Catfish	0.1	0.6	0.8
Flathead Catfish	0.1	0.4	0.4
Blackspotted Topminnow	0.1	.	0.4
Yellow Bass	0.1	.	0.4
Green Sunfish	0.1	.	0.8
Bluegill	1.5	0.1	8.7
Longear Sunfish	0.6	.	3.6
Redear Sunfish	0.1	.	0.8
Spotted Bass	1.2	.	7.1
Largemouth Bass	0.9	0.1	5.6
White Crappie	0.6	0.6	3.6
Logperch	0.5	.	2.8
Total	12.4	5.3	73.2
Number of samples	15	10	15
Number collected	184	53	184
Species collected	20	11	20

Table 3. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Blue Ridge, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

	Electrofishing	Gill Netting	Electrofishing Catch Rate Per Hour
Common name	Forebay	Forebay	Forebay
Gizzard Shad	.	0.6	.
Whitetail Shiner	2.6	.	14.7
River Redhorse	0.1	.	0.4
Golden Redhorse	.	0.3	.
Channel Catfish	.	0.9	.
Flathead Catfish	.	1.7	.
White Bass	0.2	1.5	1.1
Redbreast Sunfish	0.3	0.1	1.9
Green Sunfish	0.1	.	0.8
Warmouth	0.1	.	0.8
Bluegill	1.7	0.1	9.4
Smallmouth Bass	0.1	2.2	0.8
Spotted Bass	0.1	0.1	0.4
Largemouth Bass	1.1	0.1	6.0
Black Crappie	0.1	.	0.8
Walleye	.	1.2	.
Total	6.5	8.8	37.1
Number of samples	15	10	15
Number collected	98	88	98
Species collected	11	11	11

Table 4. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Boone, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Longnose Gar	.	0.1	.
Gizzard Shad	3.9	4.9	22.3
Threadfin Shad	0.1	0.1	0.4
Common Carp	0.1	1.6	0.4
Spotfin Shiner	23.1	.	133.5
Quillback	.	3.2	.
Golden Redhorse	0.1	.	0.8
Blue Catfish	.	0.1	.
Channel Catfish	.	0.8	.
Flathead Catfish	.	0.3	.
White Bass	0.3	0.1	1.5
Striped Bass	.	0.6	.
Green Sunfish	0.1	.	0.4
Warmouth	0.1	.	0.4
Bluegill	6.5	.	37.7
Smallmouth Bass	1.7	0.5	9.6
Largemouth Bass	1.7	0.3	10.0
White Crappie	0.1	.	0.4
Black Crappie	0.6	0.9	3.5
Total	38.4	13.5	220.9
Number of samples	15	10	15
Number collected	574	135	574
Species collected	13	13	13

* - Indicates only Young of Year collected.

Table 5. Species listing and catch per unit effort at the transition during the fall electrofishing and gill netting on Boone, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Transition Watauga	Gill Netting Transition Watauga	Electrofishing Catch Rate Per Hour Transition Watauga	Electrofishing Transition South Fork Holston	Gill Netting Transition South Fork Holston	Electrofishing Catch Rate Per Hour Transition South Fork Holston
Longnose Gar	.	0.1	.	.	1.0	.
Gizzard Shad	4.5	3.4	25.8	10.9	4.1	64.2
Brown Trout	.	.	.	.	0.1	.
Common Carp	0.3	2.5	1.5	1.1	2.0	6.3
Goldfish	.	.	.	0.1	.	0.4
Golden Shiner	0.1	.	0.4	.	.	.
Spotfin Shiner	0.9	.	4.9	10.1	.	59.8
Quillback	.	2.0	.	.	1.5	.
Northern Hog Sucker	.	.	.	0.2	.	1.2
White Sucker	0.1	0.3	0.8	.	.	.
Golden Redhorse	.	.	.	0.7	0.1	3.9
Blue Catfish	.	0.5	.	.	.	.
Channel Catfish	.	3.4	.	.	0.7	.
Flathead Catfish	0.1	0.7	0.4	.	0.6	.
White Bass	0.1	.	0.4	0.1	0.6	0.4
Striped Bass	0.1	0.4	0.4	.	0.7	.
Green Sunfish	0.8	.	4.5	.	.	.
Warmouth	0.3	.	1.5	0.1	.	0.8
Bluegill	18.9	0.1	107.2	12.4	0.2	73.2
Redear Sunfish	.	.	.	0.1	.	0.4
Smallmouth Bass	2.3	0.9	12.9	0.9	0.6	5.1
Largemouth Bass	8.5	0.6	48.5	2.2	0.2	13.0
White Crappie	.	.	.	0.5	.	2.8
Black Crappie	0.7	2.1	3.8	0.1	1.0	0.8
Walleye	.	.	.	.	0.1	.
Total	37.7	17.0	213.0	39.5	13.5	232.3
Number of samples	15	10	15	15	10	15
Number collected	562	170	562	590	135	590
Species collected	14	13	14	14	15	14

* - Indicates only Young of Year collected.

Table 6. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Cedar Creek, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	1.0	1.2	6.0
Common Carp	0.3	1.1	2.0
Quillback	.	1.8	.
Northern Hogsucker	0.1	.	0.4
Spotted Sucker	0.2	3.5	1.2
Shorthead Redhorse	.	0.1	.
Golden Redhorse	0.1	.	0.1
Channel Catfish	.	0.3	.
Flathead Catfish	0.1	0.1	0.4
Brook Silverside	0.1	.	0.4
White Bass	.	1.0	.
Yellow Bass	.	1.3	.
Green Sunfish	0.1	.	0.8
Warmouth	0.1	.	0.4
Bluegill	2.1	.	12.7
Longear Sunfish	0.8	.	4.8
Redear Sunfish	0.1	.	0.4
Spotted Bass	2.5	0.1	15.1
Largemouth Bass	0.3	0.4	2.0
White Crappie	.	0.1	.
Logperch	0.3	.	2.0
Total	8.2	11.0	49.4
Number of samples	15	10	15
Number collected	124	110	124
Species collected	15	12	15

Table 7. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Chatuge, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Shooting Creek	Gill Netting Shooting Creek	Electrofishing Catch Rate Per Hour Shooting Creek
Gizzard shad	.	0.4	.	0.1	1.5	0.4
Common carp	0.1	0.1	0.7	0.1	0.1	0.8
Whitetail shiner	0.5	.	2.7	1.9	.	11.5
Snail bullhead	.	0.2	.	0.1	.	0.4
Channel catfish	0.1	0.1	0.3	*	0.5	*
White bass	.	1.9	.	.	4.9	.
Striped x white	.	1.0	.	.	1.6	.
Redbreast Sunfish	0.9	.	4.8	2.6	.	16.0
Green Sunfish	.	.	.	0.1	.	0.4
Warmouth	0.2	.	1.0	0.5	.	2.9
Bluegill	2.3	.	12.0	1.9	.	11.9
Redear Sunfish	0.1	.	0.3	0.1	.	0.4
Hybrid sunfish	.	.	.	0.2	.	0.8
Smallmouth Bass	0.1	0.1	0.3	.	.	.
Spotted bass	2.4	1.8	12.3	0.9	3.5	5.7
Largemouth bass	1.5	0.1	7.9	1.9	0.1	11.9
Black crappie	0.1	.	0.3	.	0.3	.
Yellow perch	0.5	.	2.4	*	.	*
Walleye	.	0.1	.	.	0.1	.
Total	8.8	5.8	45.0	10.5	12.7	63.5
Number of samples	15	10	15	15	10	15
Number collected	132	58	132	156	127	156
Species collected	12	10	12	15	10	15

* - Indicates only Young of the Year collected.

Table 8. Species listing and catch per unit effort at the forebay and embayment during fall electrofishing and gill netting on Chickamauga, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Embayment	Gill Netting Embayment	Electrofishing Catch Rate Per Hour Embayment
Spotted Gar	.	.	.	0.5	0.2	3.2
Longnose Gar	.	0.1	.	.	0.1	.
Skipjack Herring	0.1	5.2	0.4	.	0.4	.
Gizzard Shad	1.9	5.6	11.8	1.9	6.2	11.1
Threadfin Shad	.	0.3	.	11.8	.	70.2
Common Carp	.	.	.	0.2	0.1	1.2
Emerald Shiner	1.0	.	6.3	3.3	.	19.4
Bluntnose Minnow	.	.	.	0.1	.	0.4
Quillback	.	.	.	.	0.1	.
Carpsucker						
Northern Hog Sucker	0.1	.	0.4			
Smallmouth Buffalo	.	.	.	1.3	1.4	7.5
Spotted Sucker	0.1	.	0.4	4.1	1.4	24.2
Shorthead Redhorse	.	.	.	0.1	.	0.4
Golden Redhorse	.	.	.	.	0.2	.
Blue Catfish	.	1.9	.	.	0.2	.
Channel Catfish	.	0.5	.	.	0.5	.
Flathead Catfish	.	0.2	.	0.1	0.2	0.4
Brook Silverside	0.6	.	3.8	.	.	.
White Bass	.	0.1	.	.	0.2	.
Yellow Bass	0.1	3.7	0.4	1.7	0.7	9.9
Striped Bass	.	.	.	.	0.4	.
Redbreast Sunfish	1.6	.	10.1	0.1	.	0.4
Green Sunfish	0.1	.	0.4			
Warmouth	0.1	.	0.4	0.1	.	0.4
Bluegill	0.9	0.3	5.9	10.2	0.1	60.7
Redear Sunfish	0.5	0.3	2.9	5.5	0.7	32.9
Smallmouth Bass	0.1	.	0.4	.	.	.
Spotted Bass	0.5	0.4	2.9	0.2	0.2	1.2
Largemouth Bass	0.4	0.3	2.5	3.0	.	17.9
White Crappie	.	0.3	.	0.1	0.1	0.8
Black Crappie	0.1	0.4	0.4	0.4	0.3	2.4
Yellow Perch	0.1	.	0.8	0.5	.	3.2
Sauger	.	0.1	.	.	0.6	.
Walleye	.	.	.	.	0.4	.
Logperch	0.2	.	1.3	0.6	.	3.6
Freshwater Drum	0.1	1.3	0.8	0.3	1.5	1.6
Total	8.6	21.0	52.3	46.1	16.2	273
Number of samples	15	10	15	15	10	15
Number collected	125	210	125	688	162	688
Species collected	19	17	19	22	23	22

Table 9. Species listing and catch per unit effort at the inflow and transition during the fall electrofishing and gill netting on Chickamauga, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Longnose Gar	0.1	0.8	.	.	.
Spotted Gar	.	.	0.1	.	0.8
Skipjack Herring	.	.	.	3.4	.
Gizzard Shad	3.5	21.0	1.9	12.5	10.8
Threadfin Shad	18.0	107.1	0.7	0.2	3.9
Mooneye	.	.	.	0.1	.
Common Carp	0.3	1.6	0.2	.	1.2
Golden Shiner	0.4	2.4	0.1	.	0.4
Emerald Shiner	0.5	2.8	1.8	.	10.4
Spotfin Shiner	0.6	3.6	.	.	.
Bluntnose Minnow	0.2	1.2	0.1	.	0.4
Northern Hog Sucker	0.3	1.6	.	.	.
Smallmouth Buffalo	.	.	0.1	0.1	0.8
Spotted Sucker	0.7	4.0	0.3	.	1.5
Shorthead Redhorse	0.1	0.4	.	.	.
Black Redhorse	0.3	2.0	.	.	.
Golden Redhorse	0.5	2.8	0.3	.	1.9
Blue Catfish	.	.	.	0.3	.
Channel Catfish	0.4	2.4	0.1	0.5	0.8
Flathead Catfish	0.4	2.4	0.1	0.1	0.4
White Bass	0.3	1.6	.	0.5	.
Yellow Bass	0.4	2.4	.	3.8	.
Striped x White Bass	.	.	.	0.1	.
Redbreast Sunfish	0.4	2.4	0.8	.	4.2
Green Sunfish	0.3	2.0	0.1	.	0.4
Bluegill	3.7	21.8	1.9	0.1	11.2
Longear Sunfish	.	.	0.3	.	1.5
Redear Sunfish	4.1	24.6	2.2	0.9	12.7
Hybrid Sunfish	0.1	0.4	.	.	.
Smallmouth Bass	0.2	1.2	0.9	.	5.0
Spotted Bass	0.7	4.0	0.9	0.1	5.4
Largemouth Bass	0.8	4.8	0.3	0.1	1.9
Black Crappie	0.3	1.6	0.1	0.1	0.4
Yellow Perch	.	.	0.1	.	0.4
Sauger	0.1	0.8	0.1	0.3	0.4
Walleye x Sauger	.	.	0.1	.	0.4
Logperch	1.3	7.5	0.1	.	0.4
Freshwater Drum	0.3	1.6	0.5	1.4	2.7
Total	39.3	232.8	14.2	24.6	80.3
Number of samples	15	15	15	10	15
Number collected	586	586	208	246	208
Species collected	28	28	26	18	26

* Only Young of Year Collected

Table 10. Species listing and catch per unit effort at the forebay and transition during the fall electrofishing and gill netting on Douglas, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Longnose Gar	.	.	.	.	0.2	.
Gizzard Shad	3.1	14.0	18.0	10.5	11.1	58.5
Threadfin Shad	.	0.8	.	*	.	*
Hybrid Shad	.	0.4	.	.	.	.
Common Carp	0.1	0.2	0.7	0.1	0.4	0.7
Goldfish	.	.	.	0.1	0.5	0.4
Golden Shiner	.	.	.	0.1	.	0.4
Spotfin Shiner	2.4	.	13.8	3.3	.	18.5
River Carpsucker	.	.	.	.	1.5	.
Quillback Carpsucker	.	1.1	.	0.1	1.2	0.4
Northern Hog Sucker	0.1	.	0.8	.	0.1	.
Smallmouth Buffalo	.	1.0	.	0.1	0.7	0.7
Shorthead Redhorse	0.3	0.2	1.9	0.1	0.3	0.7
River Redhorse	0.5	.	3.1	0.3	.	1.9
Black Redhorse	0.1	.	0.4	.	.	.
Golden Redhorse	0.1	.	0.4	.	.	.
Channel Catfish	.	0.8	.	0.1	2.0	0.7
Flathead Catfish	.	.	.	0.1	0.2	0.4
White Bass	0.5	0.9	2.7	1.9	1.1	10.4
Redbreast Sunfish	.	.	.	0.1	.	0.7
Green Sunfish	0.1	.	0.8	0.2	.	1.1
Warmouth	.	.	.	0.1	.	0.7
Bluegill	4.9	0.5	28.4	4.0	0.1	22.2
Redear Sunfish	.	.	.	0.1	.	0.4
Smallmouth Bass	0.1	.	0.4	.	.	.
Largemouth Bass	2.9	0.8	16.9	18.5	0.5	103.0
White Crappie	.	0.4	.	0.1	0.9	0.4
Black Crappie	1.4	1.0	8.0	2.6	0.4	14.4
Sauger	.	0.2	.	.	3.9	.
Walleye	.	0.6	.	0.1	0.4	0.4
Logperch	0.3	.	1.5	2.5	.	14.1
Freshwater Drum	0.1	0.3	0.4	.	3.0	.
Total	17.0	23.2	98.2	45.1	28.5	251.1
Number of samples	15	10	15	15	10	15
Number collected	256	232	256	678	285	678
Species collected	16	16	16	22	19	22

* - Indicates only Young of Year collected.

Table 11. Species listing and catch per unit effort at the forebay and transition during the fall electrofishing and gill netting on Fort Loudoun, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Longnose Gar	.	.	.	.	0.1	.
Skipjack Herring	.	9.9	.	.	15.6	.
Gizzard Shad	5.9	4.0	35.7	2.7	5.7	15.6
Threadfin Shad	.	1.4	.	*	0.1	*
Hybrid Shad	.	.	.	.	0.3	.
Mooneye	.	.	.	.	0.2	.
Common Carp	1.7	0.9	10.0	2.7	1.1	15.6
Golden Shiner	.	.	.	0.1	.	0.8
Emerald Shiner	.	.	.	0.1	.	0.8
Bluntnose Minnow	.	.	.	0.1	.	0.4
Spotfin Shiner	0.6	.	3.6	.	.	.
Steelcolor Shiner	0.1	.	0.4	.	.	.
Quillback	0.1	0.1	0.4	.	.	.
Carpsucker						
Northern Hog Sucker	0.1	.	0.8	0.7	.	4.2
Smallmouth Buffalo	0.7	0.9	4.4	0.7	0.8	3.8
Black Buffalo	0.1	0.2	0.4	.	.	.
Spotted Sucker	0.1	.	0.4	.	.	.
Blue Catfish	.	0.8	.	.	2.0	.
hannel Catfish	0.2	1.0	1.2	0.2	1.0	1.1
Flathead Catfish	0.1	0.4	0.4	.	0.7	.
Brook Silverside	0.1	.	0.4	0.1	.	0.8
White Bass	0.2	5.3	1.2	0.1	1.3	0.8
Yellow Bass	0.1	6.0	0.8	0.2	2.5	1.1
Striped Bass	.	0.4	.	.	.	.
Redbreast Sunfish	0.4	.	2.4	.	.	.
Green Sunfish	.	.	.	0.3	.	1.5
Warmouth	0.1	.	0.4	.	.	.
Bluegill	8.4	0.2	50.6	7.4	0.4	42.2
Redear Sunfish	0.2	.	1.2	0.1	.	0.4
Smallmouth Bass	0.5	.	2.8	0.6	.	3.4
Largemouth Bass	6.5	0.1	39.4	5.5	.	31.2
White Crappie	0.1	0.1	0.4	0.2	0.2	1.1
Black Crappie	1.0	0.5	6.0	0.1	0.4	0.4
Yellow Perch	0.2	.	1.2	.	.	.
Sauger	.	0.9	.	0.4	2.0	2.3
Walleye	.	0.1	.	.	0.1	.
Logperch	0.2	.	1.2	0.2	.	1.1
Freshwater Drum	0.2	0.4	1.2	0.1	1.0	0.8
Total	28.0	33.6	166.9	22.3	35.5	129.4
Number of samples	15	10	15	15	10	15
Number collected	415	336	415	340	355	340
Species collected	25	20	25	22	19	22

* - Indicates Only Young Of Year Collected

Table 12. Species listing and catch per unit effort at the inflow during the fall electrofishing and gill netting on Fort Loudoun, 1999 (electrofishing effort = 300 meters of shoreline).

Common name	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow
Chestnut Lamprey	0.1	0.4
Gizzard shad	6.0	35.2
Common carp	1.7	10.2
Emerald shiner	1.0	5.9
Spotfin shiner	4.7	27.3
Bigeye Chub	0.1	0.4
Northern Hog Sucker	0.1	0.4
White Sucker	0.1	0.4
Smallmouth buffalo	0.1	0.4
Black buffalo	0.1	0.4
Spotted sucker	0.2	1.2
Silver redhorse	0.1	0.8
Black Redhorse	0.3	1.6
Golden redhorse	0.9	5.5
Channel catfish	0.2	1.2
Rock Bass	0.1	0.4
Redbreast sunfish	0.7	4.3
Green Sunfish	0.1	0.4
Bluegill	2.5	14.8
Redear sunfish	0.3	1.6
Smallmouth bass	0.3	2.0
Spotted bass	1.1	6.3
Largemouth bass	0.5	3.1
White Crappie	0.1	0.4
Black Crappie	0.1	0.4
Yellow perch	0.1	0.8
Logperch	0.2	1.2
Snubnose Darter	0.1	0.4
Freshwater drum	0.3	1.6
Total	22.2	129.0
Number of samples	15	15
Number collected	329	329
Species collected	29	29

Table 13. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Fort Patrick Henry, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	8.7	3.1	50.0
Threadfin Shad	.	0.1	.
Common Carp	0.1	1.8	0.4
Spotfin Shiner	17.5	.	100.8
White Sucker	0.5	0.9	2.7
Blue Catfish	.	0.4	.
Channel Catfish	.	0.9	.
Striped Bass	.	0.4	.
Warmouth	0.1	.	0.8
Bluegill	0.2	.	1.2
Smallmouth Bass	1.1	0.8	6.2
Largemouth Bass	1.3	0.3	7.3
Black Crappie	.	0.1	.
Total	29.5	8.8	169.4
Number of samples	15	10	15
Number collected	440	88	440
Species collected	8	10	8

* - Indicates only Young of Year collected.

Table 14. Species listing and catch per unit effort at the Forebay and Big Sandy during the fall electrofishing and gill netting on Kentucky, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Big Sandy	Gill Netting Big Sandy	Electrofishing Catch Rate Per Hour Big Sandy
Skipjack Herring	0.8	16.1	4.8	*	1.8	*
Gizzard Shad	4.6	13.6	27.7	4.7	10.6	29.3
Threadfin Shad	1.7	.	10.0	*	0.2	*
Common Carp	0.4	0.3	2.4	0.1	1.0	0.4
Emerald Shiner	3.7	.	22.5	.	.	.
River Carpsucker	.	0.3	.	.	.	.
Smallmouth Buffalo	0.3	1.1	2.0	.	0.2	.
Bigmouth Buffalo	0.1	0.1	0.4	.	.	.
Spotted Sucker	0.1	0.4	0.4	.	0.2	.
Golden Redhorse	0.1	.	0.8	.	.	.
Blue Catfish	.	0.5	.	.	1.2	.
Channel Catfish	0.1	3.8	0.8	.	1.6	.
Flathead Catfish	0.2	0.2	1.2	.	.	.
White Bass	0.1	1.4	0.8	.	.	.
Yellow Bass	0.3	2.1	1.6	3.1	2.4	19.4
Striped x White Bass	.	0.2	.	.	0.1	.
Bluegill	0.6	.	3.6	1.4	0.1	8.7
Longear Sunfish	3.9	0.1	23.3	0.1	.	0.8
Redear Sunfish	0.4	0.2	2.4	0.1	.	0.4
Smallmouth Bass	0.3	.	1.6	.	.	.
Spotted Bass	0.1	0.1	0.8	0.1	.	0.8
Largemouth Bass	0.8	0.2	4.8	0.7	0.1	4.1
White Crappie	.	.	.	.	0.5	.
Black Crappie	.	0.1	.	0.1	0.2	0.4
Yellow Perch	0.1	0.1	0.8	0.1	0.1	0.4
Sauger	0.1	0.4	0.4	0.1	0.1	0.4
Logperch	0.1	.	0.4	0.3	.	1.7
Freshwater Drum	0.5	0.9	2.8	0.7	2.1	4.1
Total	19.4	42.2	116.3	11.6	22.6	70.9
Number of samples	15	10	15	15	10	15
Number collected	290	422	290	172	226	172
Species collected	23	21	23	15	17	15

* = Only Young Of The Year Collected

Table 15. Species listing and catch per unit effort at the inflow and transition during the fall electrofishing and gill netting on Kentucky, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Spotted Gar	0.1	0.8	0.1	.	0.8
Longnose Gar	0.3	1.7	.	.	.
Bowfin	0.1	0.8	.	.	.
Skipjack Herring	0.1	0.8	*	2.9	*
Gizzard Shad	3.5	22.0	2.5	4.9	15.5
Threadfin Shad	.	.	*	0.3	*
Mooneye	0.1	0.8	.	.	.
Common Carp	0.2	1.2	0.1	0.1	0.8
Emerald Shiner	.	.	0.2	.	1.3
Northern Hog Sucker	0.1	0.4	.	.	.
Smallmouth Buffalo	0.7	4.1	.	0.3	.
Spotted Sucker	.	.	1.0	0.2	6.3
Golden Redhorse	3.2	19.9	0.1	.	0.4
Blue Catfish	.	.	.	3.6	.
Channel Catfish	0.2	1.2	.	3.0	.
Flathead Catfish	0.3	1.7	.	0.4	.
White Bass	1.1	7.1	0.1	0.6	0.4
Yellow Bass	0.5	2.9	0.1	1.2	0.8
Striped Bass	0.3	1.7	.	.	.
Warmouth	.	.	0.1	.	0.4
Bluegill	0.9	5.4	0.3	.	1.7
Longear Sunfish	1.2	7.5	0.4	.	2.5
Redear Sunfish	1.3	8.3	1.1	0.1	7.1
Smallmouth Bass	0.1	0.8	0.2	.	1.3
Spotted Bass	1.6	10.0	.	0.1	.
Largemouth Bass	1.0	6.2	0.3	.	2.1
White Crappie	.	.	.	0.1	.
Black Crappie	.	.	0.4	0.2	2.5
Sauger	0.1	0.4	.	0.4	.
Logperch	0.1	0.4	0.1	.	0.4
Freshwater Drum	1.6	10.0	0.5	2.6	3.3
Total	18.7	116.1	7.6	21.0	47.6
Number of samples	15	15	15	10	15
Number collected	280	280	114	210	114
Species collected	24	24	19	17	19

* Only Young of Year Collected

Table 16. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Little Bear Creek, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

	Electrofishing	Gill Netting	Electrofishing Catch Rate Per Hour
Common name	Forebay	Forebay	Forebay
Gizzard Shad	.	1.2	.
Common Carp	.	0.4	.
Whitetail Shiner	1.1	.	6.3
Spotted Sucker	0.1	2.2	0.8
Black Redhorse	.	0.1	.
Golden Redhorse	0.4	0.4	2.4
Channel Catfish	0.4	1.1	2.4
Flathead Catfish	0.2	0.5	1.2
White Bass	.	1.4	.
Green Sunfish	0.1	.	0.4
Bluegill	0.7	.	4.3
Longear Sunfish	1.1	.	6.3
Redear Sunfish	0.1	.	0.4
Smallmouth Bass	0.6	0.3	3.5
Spotted Bass	0.6	1.3	3.5
Largemouth Bass	0.6	1.5	3.5
White Crappie	.	0.3	.
Logperch	1.6	.	9.4
Total	7.6	10.7	44.4
Number of samples	15	10	15
Number collected	113	107	113
Species collected	13	12	13

Table 17. Species listing and catch per unit effort at the forebay and inflow during the fall electrofishing and gill netting on Nickajack, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow
Spotted Gar	0.2	.	1.2	0.1	0.4
Longnose Gar	.	.	.	0.2	1.2
Skipjack Herring	.	1.7	.	.	.
Gizzard Shad	3.1	4.0	19.3	1.4	8.4
Threadfin Shad	*	0.2	*	.	.
Common Carp	0.1	0.2	0.4	0.1	0.8
Golden Shiner	0.1	.	0.4	.	.
Emerald Shiner	.	.	.	0.3	1.6
Spotfin Shiner	.	.	.	0.1	0.8
Smallmouth Buffalo	.	.	.	0.1	0.4
Spotted Sucker	0.1	.	0.4	0.2	1.2
Golden Redhorse	.	.	.	0.3	2.0
Blue Catfish	.	0.3	.	0.3	1.6
Channel Catfish	.	0.3	.	0.5	3.2
Flathead Catfish	0.5	0.7	2.9	0.2	1.2
White Bass	.	0.1	.	0.1	0.4
Yellow Bass	.	1.9	.	5.1	30.4
Striped Bass	.	0.1	.	.	.
Striped x White Bass	.	0.1	.	.	.
Rock Bass	.	0.1	.	.	.
Redbreast Sunfish	0.7	.	4.1	0.3	1.6
Green Sunfish	.	.	.	0.1	0.4
Warmouth	0.1	.	0.4	0.1	0.4
Bluegill	0.4	0.1	2.5	1.9	11.2
Longear Sunfish	.	.	.	0.1	0.8
Redear Sunfish	0.3	0.3	1.6	1.1	6.8
Smallmouth Bass	.	.	.	0.3	1.6
Spotted Bass	0.2	0.8	1.2	3.8	22.8
Largemouth Bass	1.8	.	11.1	0.3	2.0
Black Crappie	.	0.5	.	.	.
Sauger	.	0.3	.	.	.
Logperch	.	.	.	0.5	2.8
Freshwater Drum	0.1	0.7	0.4	0.5	3.2
Total	7.7	12.4	45.9	18.0	107.2
Number of samples	15	10	15	15	15
Number collected	112	124	112	268	268
Species collected	14	18	14	25	25

* - Indicates only Young of Year collected.

Table 18. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Norris, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

	Electrofishing	Gill Netting	Electrofishing Catch Rate Per Hour
Common name	Forebay	Forebay	Forebay
Gizzard Shad	0.3	2.0	1.6
Common Carp	.	0.2	.
Spotfin Shiner	3.2	.	18.6
Channel Catfish	.	0.4	.
Flathead Catfish	.	0.4	.
Brook Silverside	0.2	.	1.2
Striped Bass	.	0.3	.
Rock Bass	0.1	.	0.8
Bluegill	12.7	.	73.6
Longear Sunfish	0.1	.	0.4
Smallmouth Bass	0.2	0.6	1.2
Spotted Bass	2.1	0.2	12.4
Largemouth Bass	0.2	.	1.2
Walleye	.	5.3	.
Freshwater Drum	.	0.6	.
Total	19.1	10.2	111.0
Number of samples	15	10	15
Number collected	289	102	289
Species collected	9	10	9

Table 19. Species listing and catch per unit effort at the transition during the fall electrofishing and gill netting on Norris, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Transition Powell River	Gill Netting Transition Powell River	Electrofishing Catch Rate Per Hour Transition Powell River	Electrofishing Transition Clinch River	Gill Netting Transition Clinch River	Electrofishing Catch Rate Per Hour Transition Clinch River
Longnose Gar	.	1.3	.	.	0.4	.
Gizzard Shad	0.1	4.1	0.4	0.1	5.3	0.8
Common Carp	.	0.6	.	.	0.2	.
Spotfin Shiner	1.5	.	8.6	7.0	.	41.0
Quillback	.	2.1	.	0.1	1.2	0.4
Northern Hog Sucker	0.1	.	0.8	0.1	.	0.4
Silver Redhorse	.	1.1	.	.	0.1	.
Shorthead Redhorse	.	0.4	.	.	0.4	.
River Redhorse	0.8	.	4.7	0.1	0.1	0.8
Black Redhorse	0.7	0.1	4.3	0.3	.	1.6
Golden Redhorse	1.0	0.9	5.9	0.3	.	1.6
Channel Catfish	.	0.5	.	.	0.8	.
Flathead Catfish	0.2	0.4	1.2	0.1	0.6	0.4
Brook Silverside	.	.	.	0.6	.	3.5
White Bass	.	0.5	.	.	.	.
Striped Bass	.	.	.	.	1.3	.
Rock Bass	.	.	.	0.1	.	0.4
Green Sunfish	.	.	.	0.1	.	0.4
Warmouth	0.1	.	0.8	.	.	.
Bluegill	1.4	.	8.2	7.3	.	43.0
Redear Sunfish	.	.	.	0.1	.	0.4
Smallmouth Bass	1.1	.	6.7	1.2	.	7.0
Spotted Bass	1.3	1.0	7.8	1.1	0.7	6.6
Largemouth Bass	0.5	1.5	2.7	0.9	0.4	5.5
Black Crappie	0.5	0.8	3.1	1.6	1.8	9.4
Sauger	.	0.2	.	.	0.1	.
Walleye	.	2.8	.	0.1	1.8	0.4
Logperch	0.4	.	2.4	0.1	.	0.4
Tangerine Darter	0.1	.	0.4	.	.	.
Freshwater Drum	0.3	0.1	1.6	0.1	0.1	0.8
Total	10.1	18.4	59.6	21.4	15.3	124.8
Number of samples	15	10	15	15	10	15
Number collected	152	184	152	321	153	321
Species collected	16	17	16	20	16	20

* - Indicates only Young of Year collected.

Table 20. Species listing and catch per unit effort at the forebay and transitionduring the fall electrofishing and gill netting on Nottley, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Blueback Herring	.	.	.	6.1	.	35.2
Gizzard Shad	.	0.3	.	.	0.5	.
Threadfin Shad	.	.	.	1.2	.	6.9
Common Carp	0.4	0.6	2.4	0.8	1.2	4.6
Goldfish	.	.	.	.	0.7	.
Northern Hog Sucker	0.1	.	0.4	0.1	.	0.8
Silver Redhorse	.	0.1	.	.	.	.
River Redhorse	.	0.1	.	.	.	.
Golden Redhorse				0.1	.	0.8
Channel Catfish	0.1	0.5	0.8	0.1	0.4	0.4
Flathead Catfish				0.1	0.3	0.4
White Bass	.	0.4	.	.	1.2	.
Striped Bass	.	0.8	.	.	2.5	.
Redbreast Sunfish	0.3	.	2.0	0.3	.	1.5
Green Sunfish	0.5	.	2.8	1.4	.	8.0
Warmouth	.	.	.	0.3	.	1.5
Bluegill	1.2	.	7.1	28.7	.	164.8
Redear Sunfish				0.3	.	1.5
Smallmouth Bass	0.1	0.5	0.8	.	.	.
Spotted Bass	1.4	1.3	8.3	1.5	1.1	8.4
Largemouth Bass	0.6	0.2	3.5	2.3	0.3	13.0
Black Crappie	0.6	0.2	3.5	0.1	0.1	0.4
Walleye	* .	0.6	.	.	0.6	.
Total	5.3	5.6	31.6	43.4	8.9	248.2
Number of samples	15	10	15	15	10	15
Number collected	80	56	80	648	89	648
Species collected	10	12	10	15	11	15

* - Indicates only Young of Year collected.

Table 21. Species listing and catch per unit effort at the forebay during the fall electrofishing and gill netting on Ocoee, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	.	0.1	.
Common Carp	.	0.1	.
Channel Catfish	.	0.3	.
Redbreast Sunfish	0.1	.	0.4
Bluegill	0.5	.	2.8
Largemouth Bass	1.7	0.8	10.1
Black Crappie	.	0.1	.
Yellow Perch	0.1	.	0.8
Total	2.4	1.4	14.1
Number of samples	15	10	15
Number collected	35	14	35
Species collected	4	5	4

Table 22. Species listing and catch per unit effort at the forebay and transition during the fall electrofishing and gill netting on Tellico, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Longnose Gar	.	.	.	.	0.1	.
Skipjack Herring	.	4.0	.	.	0.8	.
Alewife	.	3.7	.	.	2.7	.
Gizzard Shad	3.2	3.1	18.1	0.5	2.0	2.9
Threadfin Shad	1.0	0.9	5.7	.	0.4	.
Common Carp	1.3	0.6	7.5	0.7	1.1	4.1
Spotfin Shiner	1.1	.	6.0	1.7	.	10.6
Smallmouth Buffalo	0.2	1.8	1.1	0.1	0.9	0.4
Black Buffalo	0.1	.	0.8	0.3	0.1	1.6
Spotted Sucker	.	0.1	.	.	0.5	.
River Redhorse	0.1	.	0.8	.	.	.
Black Redhorse	.	.	.	0.1	.	0.4
Blue Catfish	.	.	.	.	0.1	.
Channel Catfish	.	1.3	.	.	0.4	.
Flathead Catfish	0.1	0.4	0.4	.	0.1	.
Brook Silverside	1.1	.	6.0	3.0	.	18.4
White Bass	0.1	1.4	0.4	.	1.2	.
Yellow Bass	.	2.9	.	.	1.2	.
Striped Bass	.	0.1	.	.	0.1	.
Rock Bass	.	0.1	.	.	.	.
Redbreast Sunfish	0.4	.	2.3	0.1	.	0.8
Green Sunfish	0.5	.	2.6	.	.	.
Bluegill	6.0	0.1	34.0	1.7	.	10.2
Redear Sunfish	.	.	.	0.1	.	0.8
Smallmouth Bass	0.7	.	3.8	0.5	0.1	2.9
Spotted Bass	0.1	.	0.4	0.1	.	0.4
Largemouth Bass	1.5	0.1	8.7	0.3	.	1.6
White Crappie	.	0.1	.	0.1	.	0.4
Black Crappie	.	.	.	.	0.1	.
Yellow Perch	0.3	.	1.5	.	.	.
Sauger	.	1.1	.	.	0.6	.
Walleye	.	0.8	.	.	0.5	.
Logperch	0.3	.	1.5	.	.	.
Freshwater Drum	0.2	0.9	1.1	0.1	0.3	0.4
Total	18.3	23.5	102.7	9.4	13.3	55.9
Number of samples	15	10	15	15	10	15
Number collected	272	235	272	137	133	137
Species collected	19	19	19	15	20	15

* - Indicates only Young of Year collected.

Table 23. Species listing and catch per unit effort at the inflow and embayment during the fall electrofishing and gill netting on Wheeler, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow	Electrofishing Embayment	Gill Netting Embayment	Electrofishing Catch Rate Per Hour Embayment
Spotted Gar	.	.	0.3	0.5	1.6
Longnose Gar	0.3	2.0	.	.	.
Skipjack Herring	.	.	*	9.3	*
Gizzard Shad	2.5	15.1	2.3	14.5	14.1
Threadfin Shad	*	*	*	1.4	*
Common Carp	.	.	.	0.1	.
Golden Shiner	.	.	0.1	.	0.4
Emerald Shiner	.	.	.	.	.
River Carpsucker	0.1	0.8	.	.	.
Smallmouth Buffalo	0.1	0.4	0.5	0.2	3.2
Spotted Sucker	.	.	0.8	0.9	4.8
Silver Redhorse	.	.	.	0.1	.
Golden Redhorse	0.8	4.8	1.1	.	6.8
Blue Catfish	0.3	1.6	.	.	.
Channel Catfish	0.1	0.4	.	1.0	.
White Bass	1.3	7.5	0.5	0.6	3.2
Yellow Bass	0.1	0.8	*	1.3	*
Striped Bass	0.1	0.4	.	.	.
Striped x White Bass	.	.	.	0.7	.
Bluegill	.	.	2.7	.	16.5
Longear Sunfish	*	*	0.3	.	1.6
Redear Sunfish	0.1	0.8	0.7	.	4.0
Smallmouth Bass	0.1	0.8	0.3	.	1.6
Spotted Bass	3.4	20.2	.	.	.
Largemouth Bass	0.7	4.0	2.7	0.1	16.1
Sauger	0.1	0.4	0.1	0.1	0.4
Freshwater Drum	0.7	4.4	0.2	1.9	1.2
Total	10.9	64.8	12.6	32.7	75.5
Number of samples	15	15	15	10	15
Number collected	163	163	188	327	188
Species collected	19	19	17	15	17

* - Indicates only Young of Year collected.

Table 24. Species listing and catch per unit effort at the forebay and transition during the fall electrofishing and gill netting on Wheeler, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Spotted Gar	0.1	.	0.4	.	.	.
Skipjack Herring	.	11.3	.	*	7.1	*
Gizzard Shad	1.8	7.3	11.0	1.8	2.8	11.2
Threadfin Shad	*	0.9		*	0.2	*
Common Carp	.	.	.	0.1	.	0.8
Emerald Shiner	0.5	.	2.9	.	.	.
Smallmouth Buffalo	0.1	0.7	0.4	0.1	0.2	0.8
Spotted Sucker	0.1	0.1	0.4	0.1	.	0.8
Golden Redhorse	0.9	.	5.3	0.1	.	0.4
Blue Catfish	.	0.4	.	.	0.6	.
Channel Catfish	0.3	1.6	1.6	0.1	0.4	0.8
Flathead Catfish	0.1	0.3	0.4	.	0.2	.
White Bass	.	0.6	.	0.7	0.2	4.5
Yellow Bass	.	0.2	.	*	0.5	*
Striped Bass	.	.	.	.	0.3	.
Striped x White Bass	.	0.6	.	.	0.5	.
Warmouth	.	0.1	.	.	.	.
Bluegill	0.9	0.1	5.3	0.2	.	1.2
Longear Sunfish	0.3	0.2	1.6	.	.	.
Redear Sunfish	0.3	.	1.6	0.5	.	3.3
Smallmouth Bass	0.5	.	3.3	.	.	.
Spotted Bass	0.1	0.3	0.8	.	0.2	.
Largemouth Bass	0.3	1.4	2.0	0.7	.	4.1
White Crappie	.	0.3	.	.	.	.
Black Crappie	.	0.1	.	.	.	.
Yellow Perch	.	.	.	0.1	.	0.4
Sauger	.	0.6	.	0.2	0.3	1.2
Freshwater Drum	0.3	0.6	2.0	0.1	0.4	0.8
Total	6.6	27.7	39.0	4.8	13.9	30.3
Number of samples	15	10	15	15	10	15
Number collected	96	277	96	74	139	74
Species collected	16	20	16	16	14	16

* - Indicates only Young of Year collected.

Appendix E.

Mean Catch Per Effort by Species
For Electrofishing and Gill Netting Efforts
at Each Location in 1999 for Repeat QA Sampling

Table 1. Species listing and catch per unit effort for QA repeat samples at the forebay during the fall electrofishing and gill netting on Bear Creek, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Chestnut Lamprey	0.1	.	0.4
Longnose Gar	.	0.1	.
Gizzard Shad	1.1	0.2	6.2
Threadfin Shad	.	.	.
Hybrid Shad	.	0.4	.
Quillback	.	1.2	.
Northern Hogsucker	0.1	.	0.4
Smallmouth Buffalo	0.1	.	0.4
Black Buffalo	0.1	0.2	0.4
Spotted Sucker	1.1	0.9	6.5
Black Redhorse	1.6	.	9.2
Blue Catfish	.	0.3	.
Channel Catfish	0.3	0.5	1.9
Flathead Catfish	0.1	0.2	0.4
Blackspotted Topminnow	0.1	.	0.4
Redbreast Sunfish	0.1	.	0.4
Green Sunfish	2.5	.	14.2
Warmouth	0.1	.	0.4
Bluegill	4.6	.	26.5
Longear Sunfish	1.5	.	8.5
Redear Sunfish	0.5	.	2.7
Spotted Bass	1.7	.	9.6
Largemouth Bass	1.1	0.3	6.5
White Crappie	0.8	0.9	4.6
Logperch	0.4	.	2.3
Total	18.0	5.2	101.9
Number of samples	15	10	15
Number collected	265	52	265
Species collected	20	11	20

Table 2. Species listing and catch per unit effort for QA repeat samples at the transition during the fall electrofishing and gill netting on Chickamauga, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Chestnut Lamprey	0.1	.	0.4
Skipjack Herring	.	0.5	.
Gizzard Shad	6.3	2.3	35.8
Common Carp	0.1	.	0.8
Emerald Shiner	0.2	.	1.1
Spotfin Shiner	0.5	.	2.6
Spotted Sucker	0.8	1.4	4.5
Golden Redhorse	0.1	0.1	0.4
Channel Catfish	0.3	0.5	1.9
Flathead Catfish	.	0.1	.
White Bass	0.1	0.5	0.4
Yellow Bass	0.8	1.0	4.5
Striped Bass	.	0.3	.
Redbreast Sunfish	0.9	.	5.3
Warmouth	0.3	0.2	1.9
Bluegill	8.0	0.3	45.3
Longear Sunfish	0.9	.	5.3
Redear Sunfish	1.1	1.6	6.0
Hybrid Sunfish	0.1	.	0.4
Smallmouth Bass	0.4	.	2.3
Spotted Bass	1.0	0.7	5.7
Largemouth Bass	0.5	0.1	3.0
Black Crappie	0.3	0.4	1.5
Yellow Perch	0.3	.	1.9
Sauger	.	1.1	.
Logperch	0.3	.	1.9
Freshwater Drum	0.4	.	2.3
Total	23.8	11.1	135.2
Number of samples	15	10	15
Number collected	358	111	358
Species collected	23	16	23

Table 3. Species listing and catch per unit effort for QA repeat samples at the forebay during the fall electrofishing and gill netting on Douglas, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-night).

Common name	Electrofishing Forebay	Gill Netting Forebay	Electrofishing Catch Rate Per Hour Forebay
Gizzard Shad	3.5	16.7	21.2
Threadfin Shad	*	.	*
Common Carp	0.1	0.2	0.4
Northern Hog Sucker	0.1	.	0.4
Smallmouth Buffalo	.	1.0	.
Golden Redhorse	0.2	.	1.2
Channel Catfish	.	0.4	.
Flathead Catfish	.	0.2	.
White Bass	1.2	0.1	7.3
Bluegill	0.7	0.5	4.5
Largemouth Bass	1.3	0.6	7.8
White Crappie	.	0.4	.
Black Crappie	..	1.7	.
Sauger	.	0.7	.
Walleye	.	0.9	.
Logperch	0.1	.	0.4
Freshwater Drum	.	0.1	.
Total	7.2	23.5	43.2
Number of samples	15	10	15
Number collected	106	235	106
Species collected	9	13	9

* Only Young of Year Collected

Table 4. Species listing and catch per unit effort for QA repeat samples at the inflow during the fall electrofishing and gill netting on Nickajack, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Inflow	Electrofishing Catch Rate Per Hour Inflow
Chestnut Lamprey	0.1	0.4
Gizzard Shad	2.2	11.8
Threadfin Shad	1.8	9.7
Common Carp	0.8	4.3
Emerald Shiner	1.7	9.0
Spotfin Shiner	1.2	6.5
Central Stoneroller	0.1	0.4
Northern Hog Sucker	0.1	0.4
Spotted Sucker	0.2	1.1
Black Redhorse	0.3	1.4
Golden Redhorse	0.5	2.5
Blue Catfish	0.1	0.4
Channel Catfish	0.8	4.3
Flathead Catfish	0.1	0.7
Brook Silverside	0.3	1.8
White Bass	0.1	0.4
Yellow Bass	10.3	55.2
Rock Bass	0.7	3.6
Redbreast Sunfish	1.3	6.8
Green Sunfish	0.1	0.7
Bluegill	3.0	16.1
Longear Sunfish	0.2	1.1
Redear Sunfish	2.0	10.8
Smallmouth Bass	0.5	2.5
Spotted Bass	2.3	12.2
Largemouth Bass	0.9	5.0
Black Crappie	0.1	0.4
Sauger	0.1	0.7
Logperch	13.9	74.9
Snubnose Darter	0.1	0.4
Freshwater Drum	0.1	0.7
Total	46.0	246.2
Number of samples	15	15
Number collected	686	686
Species collected	31	31

* - Indicates only Young of Year collected.

Table 5. Species listing and catch per unit effort for QA repeat samples at the transition during the fall electrofishing and gill netting on Norris, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing	Gill Netting	Electrofishing Catch Rate Per Hour
	Transition Powell River	Transition Powell River	Transition Powell River
Longnose Gar	.	0.5	.
Gizzard Shad	0.3	2.7	2.1
Common Carp	0.1	0.5	0.4
Quillback	.	0.3	.
Silver Redhorse	.	1.3	.
Shorthead Redhorse	.	0.1	.
Black Redhorse	.	0.1	.
Golden Redhorse	0.5	0.9	2.9
Channel Catfish	.	0.1	.
Flathead Catfish	.	0.4	.
White Bass	.	0.1	.
Bluegill	0.3	.	1.6
Smallmouth Bass	0.2	0.1	1.2
Spotted Bass	0.5	0.4	3.3
Largemouth Bass	0.2	.	1.2
Sauger	.	0.9	.
Walleye	.	1.6	.
Logperch	0.1	.	0.4
Total	2.2	10.0	13.1
Number of samples	15	10	15
Number collected	32	100	32
Species collected	8	15	8

* - Indicates only Young of Year collected.

Table 6. Species listing and catch per unit effort for QA repeat samples at the transition during the fall electrofishing and gill netting on Wheeler, 1999 (electrofishing effort = 300 meters of shoreline and gill netting effort = net-nights).

Common name	Electrofishing Transition	Gill Netting Transition	Electrofishing Catch Rate Per Hour Transition
Skipjack Herring	0.2	1.3	1.1
Gizzard Shad	3.5	3.9	20.2
Mooneye	.	0.1	.
Common Carp	0.2	.	1.1
Silver Chub	0.1	.	0.4
Golden Shiner	0.6	.	3.4
Emerald Shiner	2.7	.	15.6
Bluntnose Minnow	0.1	.	0.4
Smallmouth Buffalo	0.1	.	0.8
Spotted Sucker	0.7	.	3.8
Black Redhorse	0.1	.	0.4
Golden Redhorse	.	0.1	.
Blue Catfish	.	0.2	.
Channel Catfish	0.7	1.8	4.2
Flathead Catfish	.	0.1	.
Inland Silverside	0.3	.	1.9
White Bass	0.3	0.5	1.9
Yellow Bass	0.7	0.8	3.8
Striped Bass	0.1	1.2	0.4
Redbreast Sunfish	0.1	.	0.4
Warmouth	0.1	.	0.4
Bluegill	1.2	0.2	6.8
Longear Sunfish	0.2	.	1.1
Redear Sunfish	0.5	0.4	3.0
Smallmouth Bass	0.2	.	1.1
Spotted Bass	0.1	0.4	0.4
Largemouth Bass	2.1	0.1	12.2
White Crappie	0.1	.	0.8
Black Crappie	0.2	0.1	1.1
Yellow Perch	0.1	.	0.4
Sauger	0.3	1.1	1.5
Logperch	0.2	.	1.1
Freshwater Drum	0.7	0.1	3.8
Total	16.5	12.4	93.5
Number of samples	15	10	15
Number collected	246	124	246
Species collected	30	17	30

* - Indicates only Young of Year collected.