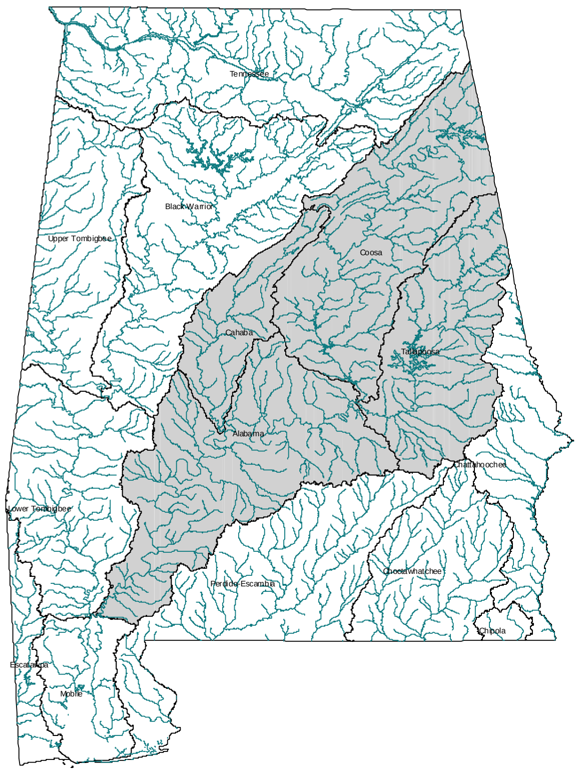
Intensive Water Quality Survey of Coosa, Tallapoosa, and Alabama River Reservoirs 2000



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Environmental Indicators Section
Field Operations Division
Alabama Department of Environmental Management

Intensive Water Quality Survey of Coosa, Tallapoosa, and Alabama River Reservoirs 2000

FINAL REPORT

Preface

This project was funded or partially funded by the Alabama Department of Environmental Management utilizing a Clean Water Act Section 319(h) nonpoint source demonstration grant provided by the U.S. Environmental Protection Agency - Region 4.

Comments or questions related to this report should be addressed to:

Alabama Department of Environmental Management
Field Operations Division
Environmental Indicators Section
P.O. Box 301463
Montgomery, AL 36130-1463

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INTRODUCTION

ADEM Reservoir Water Quality Monitoring Program

Section 314(a)(1) of the Water Quality Act of 1987 requires states to conduct assessments of the water quality of publicly-owned lakes and report the findings as part of their biennial 305(b) Water Quality Report To Congress. Prior to 1997, funding for the assessments was provided by Lake Water Quality Assessment (LWQA) grants administered through the Clean Lakes Program of the United States Environmental Protection Agency (EPA). Submittal to the EPA of approved lakes assessment information from states ensured continued eligibility for financial assistance under the Clean Lakes Program. With the discontinuation of Clean Lakes Program funding, water quality assessments are currently conducted using funding from a variety of sources, including Clean Water Act Section 319 funds.

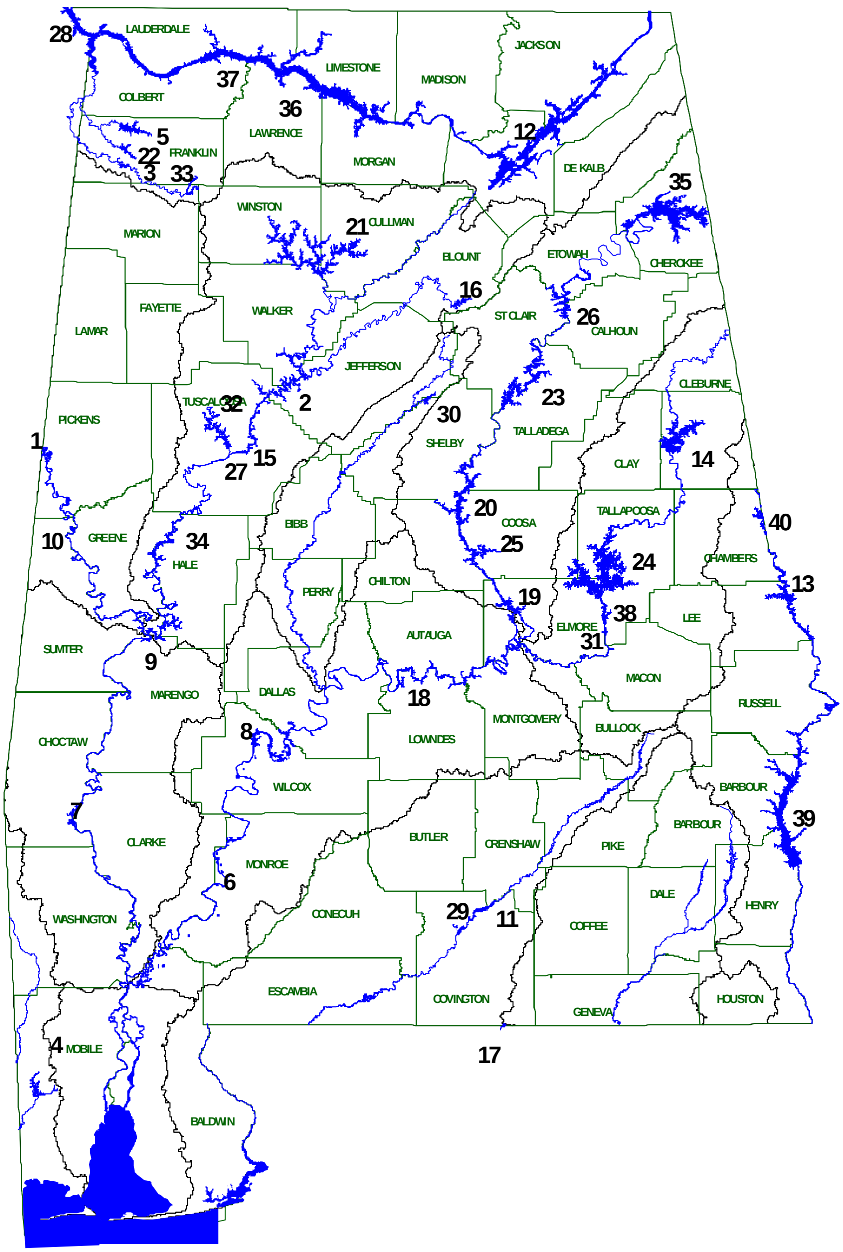
The Alabama Department of Environmental Management (ADEM) has defined publicly-owned lakes/reservoirs as those that are of a multiple-use nature, publicly-accessible, and exhibit physical/chemical characteristics typical of impounded waters. Lakes designated strictly for water supply, privately owned lakes, or lakes managed by the Alabama Department of Conservation and Natural Resources (ADCNR) strictly for fish production are not included in this definition. Lakes meeting the above definition are listed in Figure 1.

In 1985, the need for information on the trophic state of Alabama's publicly-owned lakes led to an initial survey conducted by ADEM with the assistance of the Environmental Protection Agency (EPA), Region IV. The survey established limited baseline information on the lakes and was used to rank them according to trophic condition.

In 1989, LWQA funds enabled the ADEM to conduct required water quality assessments of thirty-four publicly-owned lakes in the state and submit the collected information as part of the 1990 305(b) Water Quality Report to Congress (ADEM 1989). Trophic state index (TSI) values calculated from data gathered for the water quality

Figure 1.

Alabama Publicly Accessible Reservoirs



1) Aliceville
2) Bankhead
3) Bear Creek
4) Big Creek
5) Cedar Creek
6) Claiborne
7) Coffeeville
8) Dannelly
9) Demopolis
10) Gainesville
11) Gantt
12) Guntersville
13) Harding
14) Harris
15) Holt
16) Inland
17) Jackson
18) Jones Bluff
19) Jordan
20) Lay
21) Lewis Smith
22) Little Bear Creek
23) Logan-Martin
24) Martin
25) Mitchell
26) Neely Henry
27) Oliver
28) Pickwick
29) Point A
30) Purdy
31) Thurlow
32) Tuscaloosa
33) Upper Bear Creek
34) Warrior
35) Weiss
36) Wheeler
37) Wilson
38) Yates
39) W. F. George
40) West Point

assessments indicated potentially significant increases when compared to TSI values from the study conducted in 1985.

In 1990, the Reservoir Water Quality Monitoring (RWQM) Program was initiated by the Special Studies Section of the Field Operations Division of ADEM. Objectives of the program are as follows:

a) to develop an adequate water quality database for all publicly-owned lakes in the state;
b) to establish trends in lake trophic status that can only be established through long-term monitoring efforts; and,
c) to satisfy the requirement of Section 314(a)(1) of the Water Quality Act of 1987 that states conduct assessments of the water quality of publicly-owned lakes and report the findings as part of their biennial Water Quality Report to Congress.

Acquiring this information enables the ADEM to determine lake water quality and identify those in which water quality may be deteriorating. Should deterioration in lake water quality be indicated by collected data, more intensive study of the lake can be instituted to establish causes and extent of the deterioration.

Thirty-one publicly-owned lakes in the state were monitored at least once during the three-year period 1990-1992. In 1991, additional funding received through the Clean Lakes Program enabled the expansion of the RWQM Program to include all of the 31 publicly-owned lakes in the state, with the exception of those in the Tennessee River system. Expansion of the program allowed more extensive monitoring of certain lakes for which water quality concerns were greatest and the inclusion of Alabama/Georgia border lakes that were not included in earlier water quality assessments.

Beginning in 1994, the frequency of reservoir monitoring in the RWQM Program was increased to a minimum of once every two years so that the water quality database and trends in trophic status could be developed more rapidly. Lakes indicated to be use-threatened or impaired from previously collected data continued to be monitored annually. Realignment of the reservoir sampling schedule was also begun in 1994 so that reservoir sampling by basin could be instituted.

During 1997, intensive monitoring of reservoirs by basin was initiated with Coosa and Tallapoosa reservoirs sampled to gather water quality data prior to proposed water diversions in Georgia. Basins sampled to date are as follows:

a) 1997 - Coosa and Tallapoosa basins;

b) 1998 - Warrior basin;

c) 1999 - Chattahoochee and Conecuh basins;

During 2000, reservoirs of the Coosa and Tallapoosa River basins were intensively monitored for the second time with reservoirs from the Alabama basin monitored for the first time. Data collected from Coosa, Tallapoosa and Alabama basin reservoirs will be used to develop lake-specific nutrient criteria in an effort to address nutrient effects and to assist in development of total maximum daily loads as required by Section 303(d) of the Clean Water Act. Intensive monitoring of these reservoirs is increasingly important for a number of reasons including those listed below:

a) the Coosa and Tallapoosa basins are the primary basins involved in the water allocation negotiations between Alabama and Georgia. As such, intensive survey water quality data collected from these reservoirs will likely be useful in any determinations related to these negotiations;

b) high nutrient concentrations and the highly eutrophic state observed in certain Coosa reservoirs and increasing nutrient concentrations and trophic state in certain Tallapoosa reservoirs;

c) only a single year of intensive survey data (1997) has been collected from all Coosa and Tallapoosa reservoirs, with no intensive data collected from Alabama River reservoirs. Several years of data is typically needed to determine trends;

d) several years of intensive survey water quality data from these reservoirs would be necessary to any future development of lake-specific standards (criteria); and,

e) the year 2000 had below normal precipitation, in which case water quality data can provide an indication of the effects to water quality of reduced flows from the upper Coosa and Tallapoosa watersheds in Georgia.

MATERIALS AND METHODS

Sampling Locations. Reservoirs sampled during 2000 appear in Table 1. Locations of sampling sites appear in Table 2. All reservoirs were sampled in the dam forebay. Multiple sites were sampled on larger reservoirs. Tributary embayment sampling sites were as described in Table 2. Water quality measurements and water sample collections were conducted from boats positioned at the deepest point of the channel at each sampling site.

Sample Collection. Intensive monitoring of Coosa, Tallapoosa, and Alabama River mainstem reservoir locations were conducted monthly, April-October 2000. In addition, tributary embayment sites of Coosa, Tallapoosa, and Alabama River reservoirs were sampled during April, June, and August 2000. Each month, reservoirs within each basin were sampled within a one-week period to reduce weather-related variability in water quality conditions.

Monitoring and analyses were conducted in accordance with appropriate standard operating procedures. Water quality variables measured during 2000 appear in Table 3.

At each sampling site temperature, dissolved oxygen, specific conductance, and pH were measured in situ at multiple depths in the water column with Hydrolab Surveyor instruments.

A standard, 20 cm diameter Secchi disk with alternating black and white quadrants was used to measure visibility. Photic zone depth determinations were made by measuring the vertical illumination of the water column using an underwater photometer. The depth at which one percent of the surface illumination was measured by the photometer was considered the photic zone depth. A composite water sample of twenty liters was collected from the photic zone. The sample was collected by raising and lowering a plastic submersible pump and hose apparatus repeatedly through the photic zone while collecting the sample in a plastic container. Withdrawal of individual samples from the composite water sample occurred in the order presented in the following paragraphs.

Chlorophyll *a* samples were collected by filtering a minimum of 500 ml of the composite photic zone sample through glass fiber filters immediately after collection of

Table 1. Reservoirs sampled during the Intensive Water Quality Survey of the Coosa, Tallapoosa, and Alabama Reservoirs, 2000.

Year	River Basin	Reservoir	Surface Area (acres)	Drainage Area (mi^2)
2000				
	Coosa			
		Weiss	30,200	5,270
		Neely-Henry	11,235	6,600
		Logan-Martin	15,260	7,700
		Lay	12,000	9,087
		Mitchell	5,850	9,827
		Jordan	6,800	10,165
	Tallapoosa			
		Harris	10,660	1,453
		Martin	39,000	3,000
		Yates	1,980	3,250
		Thurlow	585	3,300
	Alabama			
		Woodruff	12,510	16,300
		Dannelly	17,200	20,700
		Claiborne	5,930	21,473

Table 2. Monitoring sites for the Intensive survey of Coosa, Tallapoosa and Alabama Reservoirs, 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Coosa					
	Weiss	1	34.1348	-85.7911	Deepest point, main river channel, power dam forebay.
		2	34.2057	-85.6105	Deepest point, main river channel, immediately upstream of causeway at Cedar Bluff.
		3	34.2103	-85.5468	Deepest point, main river channel, at power line crossing upstream of Spring Creek.
		4	34.1800	-85.4847	Deepest point, main river channel, immed. upstream of Mud Creek / Coosa River confluence, near stateline.
		5	34.2525	-85.6603	Deepest point, main river channel, Little River embayment, LRM 12.5.
		6	34.2443	-85.6120	Deepest point, main river channel, Chattooga River embayment, CRM 12.5
		7	34.1457	-85.5708	Deepest point, main creek channel, Spring Creek embayment, downstream of Cherokee Co. Hwy. 31 bridge.
		8	34.1440	-85.5943	Deepest point, main creek channel, Cowan Creek embayment, downstream of Cherokee Co. Hwy. 16 bridge.
		9	34.1780	-85.6824	Deepest point, main creek channel, Big Nose Creek embayment, approximately 0.5 miles upstream of lake confluence.
	Neely-Henry	1	33.8084	-86.0645	Deepest point, main river channel, dam forebay.
		2	33.9945	-86.0004	Deepest point, main river channel, immediately upstream of I-759 highway bridge.
		3	33.9476	-86.0202	Deepest point, main river channel, immediately upstream of Alabama Highway 77 bridge.
		5	34.1179	-85.8175	Deepest point, main creek channel, Ballplay Creek embayment, approximately 0.5 miles upstream of Coosa River confluence.
		6	33.9829	-86.0184	Deepest point, main creek channel, Big Wills Creek embayment, approximately 1.0 miles upstream of US Hwy. 411 bridge.
		7	33.9916	-86.0153	Deepest point, main creek channel, Black Creek embayment, immediately upstream of Interstate 759 bridge.
		8	33.8617	-86.0817	Deepest point, main creek channel, Big Canoe Creek embayment, downstream of Canoe Creek Campground.
		9	33.8529	-86.0474	Deepest point, main creek channel, Greens Creek embayment, immediately upstream of AL Hwy. 77 bridge.
		10	33.8425	-86.0797	Deepest point, main creek channel, Beaver Creek embayment, upstream of Greensport Marina.

Table 2. cont'd. Monitoring sites for the Intensive survey and tributary embayment sites for 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Coosa					
	Logan-Martin	1	33.4316	-86.3306	Deepest point, main river channel, dam forebay.
		2	33.5944	-86.2117	Deepest point, main river channel. Downstream of I-20 bridge, immediately upstream of Riverside Marina.
		3	33.4976	-86.2319	Deepest point, main river channel. Approximately 1.5 miles downstream of Alabama Highway 34 bridge.
		4	33.7306	-86.1023	Deepest point, main creek channel, Cane Creek embayment, approximately 0.25 miles upstream of Coosa River confluence.
		5	33.6014	-86.1711	Deepest point, main creek channel, Blue Eye Creek embayment, approximately 0.5 miles upstream of lake confluence.
		6	33.5582	-86.1754	Deepest point, main creek channel, Choccolocco Creek embayment, approximately 1.0 miles upstream of lake confluence.
		7	33.5709	-86.2227	Deepest point, main creek channel, Dye Creek embayment, approximately 0.5 miles upstream of lake confluence.
		8	33.5219	-86.2829	Deepest point, main creek channel, Cropwell Creek embayment, approximately 0.5 miles upstream of lake confluence.
		9	33.4468	-86.2877	Deepest point, main creek channel, Clear Creek embayment, immediately upstream of Talladega Co. Rd. 191 bridge.
	Lay	1	32.9683	-86.5189	Deepest point, main river channel, dam forebay .
		2	33.2217	-86.4665	Deepest point, main river channel, upstream of Bullock's Islands.
		3	33.1097	-86.4912	Deepest point, main river channel, immediately downstream of Peckerwood Creek/Coosa River confluence.
		6	33.4115	-86.3606	Deepest point, main creek channel, Kelly Creek embayment, approximately 0.5 miles upstream of lake confluence.
		7	33.3064	-86.3537	Deepest point, main creek channel, Talladega Creek embayment, immediately upstream of AL Hwy. 235 bridge.
		8	33.2923	-86.3528	Deepest point, main creek channel, Tallaseehatchee Creek embayment, immediately upstream of AL Hwy. 235 bridge.
		9	33.2476	-86.4570	Deepest point, main creek channel, Yellowleaf Creek embayment, upstream of Gaston Steam Plant discharge.
		10	33.1058	-86.4738	Deepest point, main creek channel, Peckerwood Creek embayment, approximately 0.5 miles upstream of lake confluence.
		11	33.0236	-86.5312	Deepest point, main creek channel, Waxahatchee Creek embayment, approximately 0.5 miles upstream of lake confluence.

Table 2. cont'd. Monitoring sites for the Intensive survey and tributary embayment sites for 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Coosa					
	Mitchell	1	32.8106	-86.4420	Deepest point, main river channel, dam forebay .
		2	32.8972	-86.4877	Deepest point, main river channel, downstream of Foshee Islands.
		3	32.8653	-86.4771	Deepest point, main creek channel, Walnut Creek embayment, approximately 0.5 miles upstream of lake confluence.
		4	32.8555	-86.4317	Deepest point, main creek channel, Hatchet Creek embayment, approximately 0.5 miles upstream of lake confluence.
	Jordan	1	32.6213	-86.2595	Deepest point, main river channel, dam forebay .
		2	32.6783	-86.3338	Deepest point, main river channel, upstream of Weoka Creek / Coosa River confluence.
		3	32.6542	-86.3277	Deepest point, main creek channel, Shoal Creek embayment, immediately upstream of Elmore County Rd. 23 bridge.
		4	32.6664	-86.3006	Deepest point, main creek channel, Weoka Creek embayment, approximately 0.5 miles upstream of lake confluence.
		5	32.6372	-86.2645	Deepest point, main creek channel, Sofkahatchee Creek embayment, approximately 0.5 miles upstream of lake confluence.
Tallapoosa					
	Harris	1	33.2641	-85.6127	Deepest point, main river channel, dam forebay .
		2	33.3184	-85.5811	Deepest point, main river channel, immediately upstream of Tallapoosa River / Little Tallapoosa River confluence.
		3	33.4100	-85.5939	Deepest point, main river channel, immediately downstream of Randolph County Highway 82 bridge.
		4	33.3431	-85.5444	Deepest point, Little Tallapoosa River channel, immediately downstream of Randolph County Highway 29.
		5	33.3408	-85.5097	Deepest point, main creek channel, Wedowee Creek embayment, approximately 0.5 miles upstream of lake confluence.
		6	33.3414	-85.6064	Deepest point, main creek channel, Mad Indian Creek embayment, approximately 0.5 miles upstream of lake confluence.

Table 2. cont'd. Monitoring sites for the Intensive survey and tributary embayment sites for 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Tallapoosa					
	Martin	1	32.6865	-85.9107	Deepest point, main river channel, dam forebay .
		2	32.7344	-85.8874	Deepest point, main river channel, immediately upstream of Blue Creek embayment.
		3	32.7428	-85.9649	Deepest point, main creek channel, immediately upstream of Alabama Highway 63 (Kowaliga) bridge.
		4	32.8775	-85.9013	Deepest point, main river channel, upstream of Wind Creek State Park.
		5	32.9336	-85.8669	Deepest point, main river channel, approximately 0.5 miles upstream of Coley Creek embayment.
		6	32.9650	-85.8444	Deepest point, main creek channel, Hillabee Creek embayment, approximately 0.5 miles upstream of lake confluence.
		7	32.9264	-85.8778	Deepest point, main creek channel, Coley Creek embayment, approximately 0.5 miles upstream of lake confluence.
		8	32.8781	-85.9436	Deepest point, main creek channel, Elkahatchee Creek embayment, approx. 0.5 miles downstream of Elkahatchee/Sugar Creek confluence.
		9	32.8339	-85.8414	Deepest point, main creek channel, Manoy Creek embayment, approximately 1.0 mile upstream of lake confluence.
		10	32.8039	-85.8539	Deepest point, main creek channel, Sandy Creek embayment, approximately 1.0 mile upstream of lake confluence.
		11	32.7419	-85.8531	Deepest point, main creek channel, Blue Creek embayment, approximately 2.0 miles upstream of lake confluence.
	Yates	1	32.5767	-85.8897	Deepest point, main river channel, dam forebay .
		2	32.6132	-85.8766	Deepest point, main creek channel, Sougahatchee Creek embayment. Approximately 1.6 miles upstream from the Tallapoosa River confluence
		3	32.6432	-85.8969	Deepest point, main creek channel, Channahatchee Creek embayment, approximately 0.5 miles upstream of lake confluence.
	Thurlow	1	32.5376	-85.8893	Deepest point, main river channel, dam forebay .

Table 2. cont'd. Monitoring sites for the Intensive survey and tributary embayment sites for 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Alabama					
	Woodruff	1	32.3273	-86.7820	Deepest point, main river channel, dam forebay.
		2	32.3443	-86.5397	Deepest point, main river channel, immediately downstream of Tallawassee Creek confluence.
		3	32.4414	-86.3251	Deepest point, main river channel, immediately downstream of Jackson Lake.
		4	32.3711	-86.4584	Deepest point, main creek channel, Catoma Creek embayment, approximately 0.5 miles upstream of lake confluence.
		5	32.3402	-86.4992	Deepest point, main creek channel, Pintlalla Creek embayment, approximately 0.5 miles upstream of lake confluence.
		6	32.4111	-86.6321	Deepest point, main creek channel, Swift Creek embayment, approximately 0.5 miles upstream of lake confluence.
		7	32.3512	-86.6734	Deepest point, main creek channel, Cypress Creek embayment, approximately 0.5 miles upstream of lake confluence.
	Dannelly	1	32.1035	-87.3986	Deepest point, main river channel, dam forebay.
		2	32.0619	-87.2457	Deepest point, main river channel, immediately upstream of Roland Cooper State Park.
		3	32.1680	-87.1136	Deepest point, main river channel, immediately upstream of Elm Bluff Park.
		4	32.4240	-86.8514	Deepest point, main river channel, upstream of Hammermill paper mill discharge. ARM 220.
		5	32.4386	-86.8655	Deepest point, main creek channel, Mulberry Creek embayment, approximately 0.5 miles upstream of lake confluence.
		6	32.3289	-87.0937	Deepest point, main river channel, Cahaba River embayment, approximately 0.5 miles upstream of lake confluence.
		7	32.1713	-87.2257	Deepest point, main creek channel, Bogue Chitto Creek embayment, approximately 0.5 miles upstream of lake confluence.
		8	32.1231	-87.2548	Deepest point, main creek channel, Pine Barrens Creek embayment, approximately 0.5 miles upstream of lake confluence.

Table 2. cont'd. Monitoring sites for the Intensive survey and tributary embayment sites for 2000.

Basin	Reservoir	Station #	Latitude	Longitude	Station Description
Alabama					
	Claiborne	1A	31.5413	-87.5260	Downstream of Claiborne Reservoir. Deepest point, main river channel, approx. 1 mile downstream of US Hwy. 84.
		1	31.6174	-87.5506	Deepest point, main river channel, dam forebay.
		2	32.0106	-87.4744	Deepest point, main river channel, approximately 0.5 miles upstream of Beaver Creek confluence.
		3	32.0028	-87.4806	Deepest point, main creek channel, Beaver Creek embayment, approximately 0.5 miles upstream of lake confluence.
		4	31.9155	-87.3705	Deepest point, main creek channel, Pursley Creek embayment, approximately 0.5 miles upstream of lake confluence.
		5	31.8029	-87.4253	Deepest point, main creek channel, Tallatchee Creek embayment, approximately 0.5 miles upstream of lake confluence.

Table 3. Water quality variables measured during the Intensive Water Quality Survey of Coosa, Tallapoosa, and Alabama River Reservoirs, 2000.

Variable	Method	Reference	Detection Limit
Physical			
Vertical illumination	Photometer, Secchi disk	Lind, 1979	---
Temperature	Thermistor	APHA et al. 1992	---
Turbidity	Nephelometer	APHA et al. 1992	---
Total dissolved solids	Filtration, drying	EPA-600/4-79-020	1 mg/l
Total suspended solids	Filtration, drying	EPA-600/4-79-020	1 mg/l
Specific conductance	Wheatstone bridge	APHA et al. 1992	---
Hardness	Titrametric, EDTA	EPA-600/4-79-020	1 mg/l
Alkalinity	Potentiometric titration	EPA-600/4-79-020	1 mg/l
Chemical			
Dissolved oxygen	Membrane electrode	APHA et al. 1992	---
pH	Glass electrode	APHA et al. 1992	---
Ammonia	Automated phenate	EPA-600/4-79-020	0.015 mg/l
Nitrate + Nitrite	Cadmium reduction	EPA-600/4-79-020	0.003 mg/l
Total Kjeldahl Nitrogen	Automated colorimetric	EPA-600/4-79-020	0.15 mg/l
Dissolved reactive phosphorus	Automated single reagent	EPA-600/4-79-020	0.004 mg/l
Total phosphorus	Persulfate digestion	EPA-600/4-79-020	0.004 mg/l
Total organic carbon	Persulfate-ultraviolet	EPA-600/4-79-020	0.50 mg/l
Biological			
Chlorophyll *a*	Spectrophotometeric	APHA et al. 1992	0.1 mg/l
Fecal coliform	Membrane filter	APHA et al. 1992	---
Algal growth potential test	Printz Algal Assay Test	ADEM 1993	---

the composite sample. Immediately after filtering, each filter was folded once and placed in a 50 mm petri dish. Each petri dish was wrapped in aluminum foil, sealed in a ziploc bag, and placed on ice for shipment to the Field Operations Division to be frozen until analyzed. Corrected chlorophyll *a* concentrations were used in calculating Carlson's trophic state index (TSI) for lakes. A more detailed discussion of Carlson's TSI appears later in this section.

Dissolved reactive phosphorus (formerly termed orthophosphate) samples were collected by vacuum filtering 125 ml of the composite sample through 0.45 micron Millipore membrane filters and collecting the filtrate in pre-cleaned plastic containers.

Finally, two half-gallon portions of the composite sample were collected in plastic containers and properly preserved for laboratory analysis of water quality variables. Subsurface grab samples were collected in properly prepared containers at each sampling site for fecal coliform analysis. During August, samples for Algal Growth Potential Tests (AGPT) were collected from the composite photic zone sample by filling a properly prepared plastic container and preserving on ice. A more detailed discussion of AGPT appears later in this section.

All samples were preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures and Quality Control Assurance Manual Volume I Physical/Chemical (1992).

Quality Control / Quality Assurance. For quality control/quality assurance purposes, field duplicates of each sample type were collected at ten percent of the sampling sites. Field duplicates were true duplicates of the complete collection process. Blanks were collected at the same frequency as duplicates by processing distilled water through the collection and filtration equipment in the same manner as regular samples. Measurements of water temperature, dissolved oxygen, specific conductance, and pH were replicated at sampling sites where duplicate samples were collected.

Trophic State Index. Corrected chlorophyll *a* concentrations were used in calculating Carlson's trophic state index (TSI) for lakes (Carlson 1977). Carlson's TSI provides limnologists and the public with a single number that serves as an indicator of a lake's trophic status. Corrected chlorophyll *a* is the parameter used in the RWQM Program to calculate TSI because it is considered to give the best estimate of the biotic response of lakes to nutrient enrichment when algae are the dominant plant community.

The trophic state classification scale used is as follows:

Oligotrophic:	TSI ≤39
Mesotrophic:	TSI 40-49
Eutrophic:	TSI 50-69
Hypereutrophic:	TSI ≥70

Algal Growth Potential Tests. The Algal Growth Potential Test (AGPT) determines the total quantity of algal biomass supportable by the test waters and provides a reliable estimate of the bioavailable and limiting nutrients (Raschke and Schultz 1987). In control samples, maximum algal standing crop (MSC) dry weights below 5.0 mg/l are thought to assure protection from nuisance algal blooms and fish-kills in southeastern lakes, with the exception of lakes in Florida (Raschke and Schultz 1987). In most freshwater lakes, phosphorus is the essential plant nutrient that limits growth and productivity of plankton algae (Wetzel 1983). Nitrogen usually becomes the limiting nutrient when bioavailable phosphorus increases relative to nitrogen, as in the case of waters receiving quantities of treated municipal waste (Raschke and Schultz 1987). The AGPT is helpful in identifying these common growth limiting nutrients.

RESULTS AND DISCUSSION

Data Selection. Material in this section is divided by basin and reservoir. Water quality data presented for further discussion consist of the following:

a) total nitrogen (TN) and total phosphorus (TP), used as indicators of nutrient content in the waterbody;
b) algal growth potential tests (AGPT), used as a determinant of the total quantity of algal biomass supportable by test waters and of the limiting nutrient;
c) corrected chlorophyll *a*, used as an indicator of algal biomass;
d) Carlson Trophic State Index (TSI), calculated from corrected chlorophyll *a* concentrations as a means of trophic state classification of the reservoir ; and,
e) dissolved oxygen (DO) concentrations, used as a more direct indicator of water quality because severe depletion can damage aquatic vertebrate and macroinvertebrate communities and interfere with water supply and recreational uses;

These data were selected because of their relationship to the process of eutrophication and their interest to the regulatory and scientific communities that stems from this relationship. The process of eutrophication and the effects on water quality will be discussed more fully in following paragraphs. Topics not selected for further discussion in this report were done so in the interests of time, space, or data availability.

Graphs. Bar graphs consist of means of the variables for all months depicted in the line graphs. Bar graphs with multiple reservoirs and reservoir stations are illustrated from upstream to downstream as the graph is read from left to right. Bar graphs of tributary embayments use the same color pattern as the receiving reservoir. Line graphs for each reservoir depict the monthly changes in the variables. Unless otherwise specified, reservoir location is referred to in the legends of graphs as **upper**, for the upper portion of each reservoir; **mid**, for the middle portion of the reservoir; and **lower,** for the dam forebay of each reservoir. Line graphs were not developed for tributary embayments since data were only collected during 3 months.

Line graphs of DO concentrations consist of measurements conducted at a depth of five feet because ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/l at this depth (ADEM 1997). Under extreme natural conditions such as drought the DO concentration may be as low as 4.0 mg/l.

Eutrophication. For those unfamiliar with the process of eutrophication, it may be useful to discuss the relationship of the topics to the process and how the process affects the water quality of lakes and reservoirs. Eutrophication is the process by which water bodies become more productive through increased input of nutrients, primarily nitrogen and phosphorus (Welch 1992). Normally, increased plant (algae and/or macrophyte) productivity and biomass are considered part of the eutrophication process though nutrients can increase without an increase in plant growth if available light in the water column is limited by high concentrations of suspended solids.

The classical trophic succession sequence that occurs in natural lakes is as follows:

Oligotrophy:	nutrient-poor, biologically unproductive;
Mesotrophy:	intermediate nutrient availability and productivity;
Eutrophy:	nutrient-rich, highly productive;
Hypereutrophy:	the extreme end of the eutrophic stage.

Depending on the nature of the watershed however, eutrophication of natural lakes may take thousands of years or they may never become eutrophic.

All waterbodies monitored during the intensive survey are reservoirs rather than natural lakes. Trophic succession in reservoirs does not occur in the classical form as in natural lakes. After filling of the reservoir basin, trophic upsurge occurs, resulting in high productivity of algae and fish. The trophic upsurge is fueled by nutrient inputs from the watershed, leaching of nutrients from the flooded soils of the basin, and decomposition of terrestrial vegetation and litter. Eventually a trophic depression takes place with a decline in the productivity of algae and fish as these initially available nutrient sources decline. In time, a less productive but more stable trophic state is established. The trophic state that the reservoir eventually settles into (oligotrophic, mesotrophic, or eutrophic) is determined by the combination of the natural fertility of the watershed and the effects of the point and nonpoint sources of pollution within the watershed.

The concern about eutrophication from a water quality standpoint is more likely due to cultural eutrophication. Cultural eutrophication can be defined as eutrophication brought about by the increase of nutrient, soil, and /or organic matter loads to a lake or reservoir as a result of anthropogenic activities (EPA 1990). Activities that contribute to cultural eutrophication include wastewater treatment discharges, agricultural and silvicultural activities, residential and urban development, and road building. Increased eutrophication in a waterbody occurring over a period of 10 to 50 years usually indicates cultural eutrophication (Welch 1992).

The effects of cultural eutrophication to a reservoir that is highly productive, or eutrophic, can lead to hypereutrophic conditions. Hypereutrophic conditions are characterized by the following:

a) dense algal populations;

b) low dissolved oxygen concentrations;

c) increased likelihood of fish kills; and,

d) interference with public water supply and recreational uses.

Regardless of whether a reservoir is oligotrophic, mesotrophic, or eutrophic, however, cultural eutrophication negatively affects biological communities of these waterbodies through sedimentation and changes in water quality variables such as dissolved oxygen, pH, water temperature, and light availability.

I. COOSA RIVER RESERVOIRS

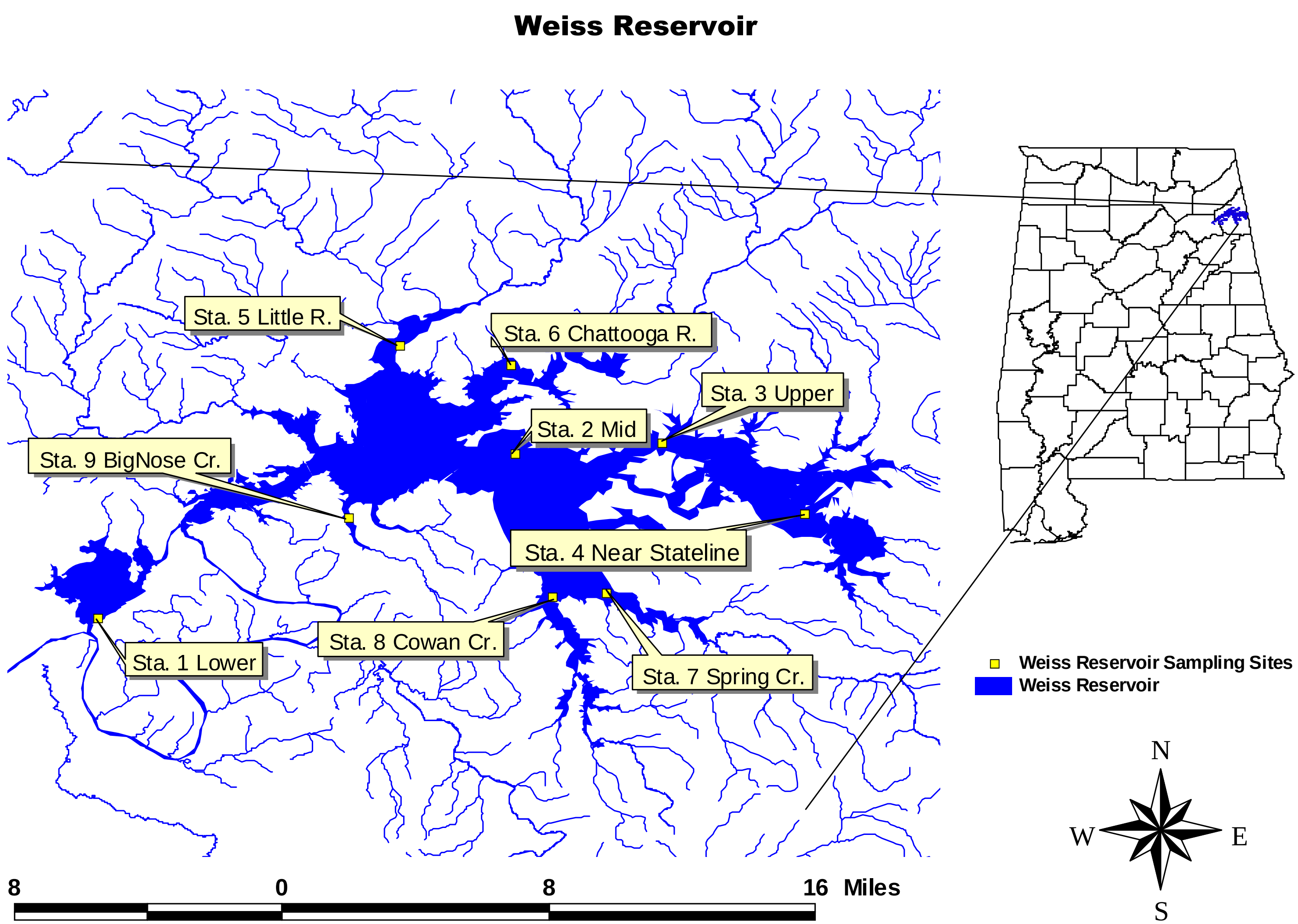


Figure I.1. Weiss Reservoir with 2000 sampling locations.

Weiss Reservoir

Nitrogen

Mainstem. Mean total nitrogen (TN) concentrations at Weiss reservoir locations were some of the highest observed in the Coosa River chain (Fig. I.7). Mean TN concentrations in Weiss ranged from 0.629 mg/l at the stateline site to 0.869 mg/l at the upper reservoir site. Graphs of mean TN data collected in 1992, 1997 and 2000 from comparable stations indicate that concentrations at the upper, mid, and lower reservoir locations decreased from 1992 to 1997 and then increased to higher concentrations in 2000 (Appendix Fig. I.1). No data were available in 1992 for near stateline, but concentrations did slightly increase from 1997 to 2000.

In 2000, TN concentrations varied among locations during the sampling season (Fig. I.15). By June, TN concentrations increased two to three times April concentrations. For July, the month with the greatest range in concentrations, TN concentrations at upper and lower reservoir continued to increase, while concentrations decreased at mid and near stateline reservoir locations. TN concentrations at three of four sampling locations decreased greatly from July to August. TN levels rebounded August to September for all sites except lower reservoir.

Lake mean TN concentration at Weiss reservoir slowly increased April-July (Fig. I.15). A decline in mean TN was exhibited July to August followed by a slight increase for September. Mean TN concentration declined to its lowest point in October. Lake mean discharge was approximately four times higher in April than May. Lake mean discharge rates slowly decreased throughout the sampling season. In general, lake mean TN concentration increased as discharge decreased through July. From July to October, lake mean TN and discharge exhibited similar trends.

Tributaries. Mean TN concentrations in Weiss Reservoir tributaries were similar to concentrations of the other upper Coosa basin tributaries (Fig. I.11). Concentrations ranged from 0.615 mg/l in the Little River to 1.145 in Cowan Creek.

Phosphorus

Mainstem. Mean total phosphorus (TP) concentrations at Weiss reservoir were higher than TP at most other Coosa River reservoirs (Fig. I.8). Mean TP at the near stateline location (0.117 mg/l) was higher than any other Coosa River location. Concentrations decreased from the near stateline reservoir to lower reservoir locations. Graphs of mean total phosphorus data collected in 1991, 1992, 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations increased from 1991 to 1992 and then decreased from 1992 to 2000 (Appendix Fig. I.1). No data were available in 1991 or 1992 for near stateline reservoir, but concentrations increased from 1997 to 2000.

Monthly TP concentrations at the four Weiss locations followed similar patterns throughout the sampling season (Fig. I.15). Monthly TP concentrations approximately doubled from April to October. TP concentrations peaked in June and September. Highest concentrations were observed at the near stateline site during June and September, and the lowest concentration occurred at lower reservoir during May. In general, TP concentrations were lowest at the lower reservoir site.

An overall increase in lake mean TP concentration was evident between April and October (Fig. I.15). Peaks in lake mean TP were observed in June and September. Lake mean discharge was four times higher in April than following months. Discharge rate continued to decrease until October. There was no apparent relationship between discharge and lake mean TP.

Tributaries. Mean TP concentrations for Weiss Reservoir tributaries were higher than other Coosa Reservoir tributaries (Fig. I.12). Mean TP concentrations in the Chattooga River were the third highest of all the tributaries. The tributaries ranged in concentrations from 0.051 mg/l in Little River to 0.190 mg/l in Chatooga River.

Algal Growth Potential Tests

Nitrogen was determined to be the limiting nutrient for each of the four Weiss Reservoir locations (Table I.1). Mean MSC values for all Weiss sampling locations were greater than the maximum 5.0 mg/l level suggested to assure protection from nuisance algal blooms and fish-kills in southeastern lakes. Mean MSC at upper reservoir was 28.32 mg/l, more than five times the maximum suggested level.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations at mid and lower reservoir sites were more than twice concentrations at the upper and stateline sites (Fig. I.9). Chlorophyll *a* concentration at mid Weiss was second highest of all Coosa locations. Graphs of mean chlorophyll *a* data collected in 1991, 1992, 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations generally increased from 1991 to

2000, with a decrease at all stations in 1992 (Appendix Fig. I.1). No data were available in 1991 and 1992 for near stateline, however, concentrations at this location increased from 1997 to 2000.

Monthly chlorophyll *a* concentrations followed two distinct patterns. Concentrations were nearly identical at the near stateline and upper reservoir locations. Chlorophyll *a* concentrations at mid reservoir and lower reservoir also were very similar (Fig. I.16). Chlorophyll *a* concentrations at the two uppermost locations differed greatly from the mid and lower reservoir stations. While chlorophyll *a* at mid and lower reservoir continued to increase after June, levels decreased at the near stateline and upper reservoir locations. By September, the chlorophyll *a* concentration was approximately five times higher at the two lower reservoir locations than the more upstream Weiss Reservoir stations.

Lake mean chlorophyll *a* concentrations at Weiss increased steadily from April through July and slowly declined from July to October (Fig. I.16). Lake mean discharge was four times higher during April than any other month of the sampling period. While not necessarily related, chlorophyll *a* concentration was lowest during the month of greatest discharge (April). As discharge decreased slowly until July, lake mean chlorophyll *a* increased.

Tributaries. Mean chlorophyll *a* concentrations for the tributaries of Weiss Reservoir were higher overall than other tributaries of the Coosa basin (Fig I.13). Spring Creek, Chattooga River, and Big Nose Creek, reported the three highest mean chlorophyll *a* concentrations of the 28 tributaries measured (44.31, 43.62, and 38.29 μg/l, respectively). Of the Weiss tributaries, Little River reported the lowest mean concentration (31.27 μg/L), which was still higher than most of the other reservoir tributaries.

Total Suspended Solids

Mainstem. Mean TSS concentrations at Weiss Reservoir were similar to other reservoirs in the upper Coosa basin (Fig. I.10). Unlike most other Coosa Reservoirs, concentrations increased from the upper to mid location. Mean TSS concentrations dropped at the lower reservoir. The mean concentration at the mid location (19.9 mg/l) was the highest of all Coosa basin locations. Graphs of mean TSS data collected in 1997 and 2000 from comparable stations indicate that concentrations at the near stateline site decreased from 1997 to 2000, while the upper and lower reservoir concentrations were nearly the same (Appendix Fig. I.1). Concentrations at mid reservoir nearly doubled from 1997 to 2000.

Monthly TSS concentrations were variable April through October (Fig. I.16). Concentrations were lowest near stateline in all months except May, while concentrations were highest in mid reservoir. Between July and October TSS concentrations at all sites except the upper reservoir location increased and decreased simultaneously. Concentrations from the upper and lower reservoir were similar.

Lake mean TSS concentrations generally decreased from April through October (Fig. I.16). Lake mean discharge was much higher in April than following months and continued to decrease until October. No obvious relationship existed between lake mean TSS and discharge. Concentrations fluctuated monthly as flow gradually decreased.

Tributaries. Mean TSS concentrations of the tributaries of Weiss Reservoir were less than those of tributaries of Neely Henry Reservoir and similar to those of Logan Martin (Fig. I.14). Concentrations ranged from 11.7 mg/l at Cowan Creek to 21.7 mg/l at Chattooga River.

Trophic State

Monthly TSI values at Weiss Reservoir locations remained near or within eutrophic status for the entire growing season (Fig. I.17). TSI values at mid-reservoir and lower reservoir steadily increased April through June and remained just below hypereutrophic status through October. TSI values at the Alabama/Georgia stateline and upper reservoir location increased through June as well, but TSI status decreased during the following months to near mesotrophic status by September. A slight increase in TSI value was observed at the two uppermost locations September to October.

Dissolved Oxygen/Temperature

Mainstem. Monthly dissolved oxygen (DO) concentrations at Weiss were similar at most locations during the sampling season (Fig. I.17). Greatest variability was observed during September when DO concentration at mid-reservoir was approximately 2 mg/l greater than DO at the stateline station. DO concentrations were higher during April, decreased to lowest values by August and recovered through October. Greatest DO concentrations were observed during October. From July to September, DO concentrations at certain locations remained just above the criterion limit of 5.0 mg/l.

Depth profiles of temperature and DO from near stateline and upper reservoir sites were essentially isothermal and isochemical from April-October (Fig. I.18 & I.19). Dissolved oxygen concentrations occasionally fell below 5.0 mg/l between June and September.

Depth profiles of temperature and DO from mid reservoir show only a weak thermocline in October (Fig. I.20). Relatively isothermal conditions existed in all other months. Highest temperatures occurred in June. Weak chemoclines existed in May and August, which strengthened in June and October. Deoxygenated conditions existed near the bottom in June.

Depth profiles of temperature and dissolved oxygen from the dam forebay of Weiss Reservoir indicated thermoclines did not occur in any months April through October (Fig. I.21). Highest temperatures occurred in June and July. Profiles in June suggest the development of two chemoclines. In August and October, weak chemoclines existed. Between June and August, deoxygenated conditions existed near the bottom.

Tributaries. Depth profiles of temperature and dissolved oxygen in Little River were isothermal and isochemical in April (Appendix Fig. I.2). Weak thermoclines existed in June and August when highest temperatures occurred. A chemocline developed in June and strengthened in August. Dissolved oxygen concentrations were below 5 mg/l for most of the water column in August.

Depth profiles of temperature in Chattooga River show essentially isothermal conditions throughout the sampling season (Appendix Fig. I.2). Highest temperatures occurred in June. A chemocline existed in all months with deoxygenated conditions near the bottom in June and August.

Depth profiles of temperature and dissolved oxygen in Spring, Cowan and Big Nose Creeks were isothermal and isochemical in April (Appendix Figs. I.2 & I.3). Weak thermoclines existed in June and August and highest temperatures occurred in June. Strong chemoclines in June resulted in deoxygenated conditions below 3 meters.

Summary and Discussion

Mean TN concentrations at Weiss reservoir locations were among the highest observed in the Coosa River reservoirs. TN concentrations increased two to three-fold from April to June. Mean total phosphorus concentrations at Weiss reservoir were higher than TP at most other Coosa River reservoirs. Mean chlorophyll *a* concentrations were more than two times higher at mid and lower reservoir than more upstream locations. During September, chlorophyll *a* concentration was approximately five times higher at the two lower locations than the more upstream stations of Weiss Reservoir. During April, discharge was very high compared to later months and lake mean chlorophyll *a* concentration was relatively low. As discharge decreased slowly until July, and retention time increased, lake mean chlorophyll *a* increased. Variation in monthly patterns in chlorophyll *a* among sites shows two distinct responses, one representing the upstream stations and the other representing the downstream stations. The downstream (mid and lower) sites have consistently elevated and similar chlorophyll *a* concentrations and near hypereutrophic TSI values, even though nutrient concentrations are similar for all sites.

Though similar to other Coosa reservoirs, the highest TSS concentrations were found in Weiss Reservoir, even though tributary concentrations were relatively low. Concentrations at mid reservoir were higher during most months. Monthly TSI values at Weiss Reservoir locations remained near or within eutrophic status for the entire growing season. From July to September, DO concentrations remained just above the criterion limit of 5.0 mg/l. Depth profiles of temperature indicated little to no thermal stratification at Weiss during the months sampled. A moderate chemocline existed May through June, August, and October at certain locations.

Between 1997 and 2000, both causative (nutrient) and response (chlorophyll *a*) values in Weiss Reservoir changed. There were increases in TN concentrations from 1997 at all sites while TP concentrations decreased. Higher chlorophyll *a* occurred indicating an increase in primary productivity in 2000. TN was identified as the limiting nutrient in AGPT analyses for all sites. An increase in TN concentrations in 2000 corresponded with an increase in chlorophyll *a* concentrations. TSI values from 1997 and 2000 were similar. In 1997 and 2000, TSS concentrations were similar at the near stateline, upper, and lower reservoir locations.

The five tributary embayments on Weiss monitored in 2000 included Little River, Chattooga River, Spring Creek, Cowan Creek, and Big Nose Creek. The Little River sub-watershed drains approximately 22 mi^2 in Cherokee and Dekalb Counties (ADEM 2002b). Percent land cover of the Little River sub-watershed was estimated as 34% deciduous forest, 29% evergreen forest, 32% mixed forest, 2% pasture/hay, and 2% row crops. No current stormwater authorizations or NPDES permits have been issued in the sub-watershed. The local Soil and Water Conservation District (SWCD) estimates of animal concentrations in the sub-watershed were *low* (0.00 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (2.0 tons/acre), mostly from erosion of woodlands. The overall potential for impairment from nonpoint sources was estimated as *low*. However, mean TN, TP, and TSS were slightly higher than other tributaries, with a higher mean chlorophyll *a* concentration also indicating nutrient inputs. DO concentrations remained above any critical levels through most of the water column. Further investigation is necessary to identify nutrient sources.

The Lower Chattooga River sub-watershed drains approximately 34 mi^2 in Cherokee County (ADEM 2002b). Percent land cover of the Lower Chattooga River sub-watershed as determined by EPA, was estimated as 24% deciduous forest, 21% evergreen forest, 22% mixed forest, 7% pasture/hay, 9% row crop, 1% wetlands, and 16% open water. Estimates of land-use by the local SWCD indicated a higher percent of row crops (33%) and urban land use (6%), and lower amount of open water (8%). One (1) current municipal NPDES permit, one (1) construction stormwater authorization, and one (1) CAFO registration have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle being the dominant animals. Sedimentation estimates indicated a *low* potential for NPS impairment (1.8 tons/acre) from erosion of cropland. The overall potential for impairment from nonpoint sources was estimated as *moderate*. Evidence of possible nonpoint source and point source impairment was evident in the Chattooga River embayment. Elevated concentrations of TN and TSS were reported. Chlorophyll *a* and TP concentrations were among the highest of the basin. DO concentrations in June may cause some concern as concentrations fell below 2.0 mg/l for half the water column.

The Spring Creek sub-watershed drains approximately 107 mi^2 in Cherokee County (ADEM 2002b). Cowan and Big Nose Creek are included in the Spring Creek sub-watershed. Percent land cover of the Spring Creek sub-watershed was estimated as 3% transitional forest, 16% deciduous forest, 19% evergreen forest, 19% mixed forest, 17% pasture/hay, 15% row crop, and 9% open water. Estimates of land-use by the local SWCDs were higher for row crops (25%), open water (14%), and urban (7%), and lower for forest (44%) and pasture (7%). One (1) current municipal NPDES permit and two (2) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.10 AU/acre), with broiler poultry and cattle being the dominant animal types (0.06 and 0.03 AU/acre, respectively). Sedimentation estimates indicated a *low* potential for NPS impairment (1.6 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. The highest two TN concentrations in Weiss Reservoir tributaries were those of Cowan and Big Nose Creeks. TP was elevated and similar in all three creeks. Mean chlorophyll *a* was highest in Spring Creek, but both Cowan and Big Nose Creeks had high levels. The combine effect of these point and nonpoint sources are likely contributors to elevated nutrient and chlorophyll *a* concentrations. DO concentrations were generally above any critical levels for all three creeks. However, in Cowan Creek, deoxygenated conditions existed in June for over half the water column. Continued monitoring is recommended to document water quality trends.

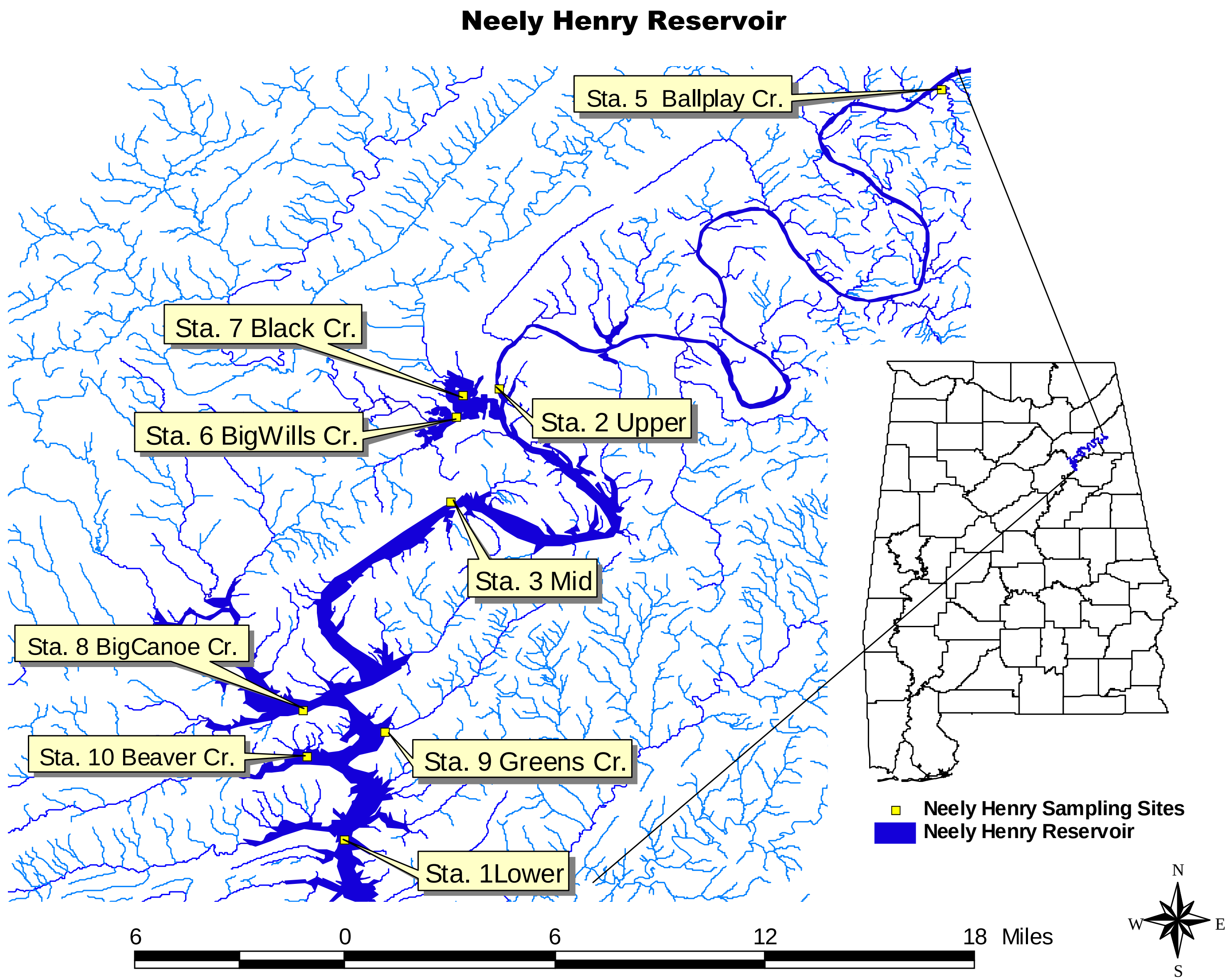


Figure I.2. Neely Henry Reservoir with 2000 sampling locations.

<u>Neely Henry Reservoir</u>

Nitrogen

Mainstem. Mean total nitrogen concentrations at mid and lower Neely Henry sites were highest of all Coosa River reservoir locations. Graphs of mean TN data collected in 1993, 1994, 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations slightly increased from 1993 to 1994 and decreased at all stations from 1994 to 1997 (Appendix Fig. I.4). In 2000, concentrations increased to the highest levels of any year sampled.

Monthly TN concentrations at upper and lower reservoir increased slowly April through July (Fig. I.22). TN concentration peaked at mid-reservoir in June, but at the other two stations in July. TN concentration at mid-reservoir was two times the concentration at the other stations in June. TN concentrations fell sharply at all Neely Henry locations July through August and remained relatively low through October.

Lake mean TN concentration was stable April to May, increased to a peak during June and July, and then fell in August (Fig. I.22). Lake mean TN was stable August through October. Mean discharge for April was nearly five times greater than any other month of sampling. Mean discharge changed little May through October. There is no obvious relationship between discharge and lake mean TN.

Tributaries. Overall, Neely Henry tributary concentrations were higher than the other Coosa reservoir tributaries (Fig. I.11). The mean TN concentration at Ballplay Creek was the highest of any tributaries in the Coosa basin.

Phosphorus

Mainstem. Mean TP concentrations at Neely Henry reservoir were higher than most other Coosa River reservoirs except Weiss (Fig. I.8). Mean TP at mid-reservoir (0.089 mg/l) was the highest of Neely Henry locations. Graphs of mean TP data collected in 1993, 1994, 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations increased from 1993 to 1994 (Appendix Fig. I.4). The mid and lower reservoir concentrations decreased in 1997 and remained similar in 2000.

Monthly TP concentrations fluctuated throughout the sampling season (Fig. I.22). TP concentrations were generally higher at mid-reservoir for each month, and TP was usually lowest at the upper reservoir location. July was the month of greatest variability with TP at mid-reservoir much higher than TP concentration at upper reservoir.

Lake mean concentration fluctuated with peaks in June and September (Fig. I.22). Discharge sharply fell from April-May then remained low throughout the remainder of season. No obvious relationships appeared to exist between lake mean TP and lake mean discharge.

Tributaries. The mean TP concentrations of most of the tributaries of Neely Henry Reservoir were similar to other Coosa basin reservoirs (Fig. I.12). However, Big Wills Creek reported the highest mean TP concentration (0.269 mg/l) of any tributary.

Algal Growth Potential Tests

Nitrogen was determined to be the limiting nutrient for upper Neely-Henry Reservoir (Table I.1). Mid reservoir was indicated to be nitrogen and phosphorus co-limited, and no limiting nutrient was identified for lower reservoir. Mean MSC for upper reservoir (8.1 mg/l) was the only exceedance of the suggested MSC of 5.0 mg/l.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentration was highest overall in Neely Henry (Fig. I.9). Lower reservoir was higher than any other Coosa mainstem reservoir location. Mean chlorophyll *a* increased with each downstream location. Graphs of mean chlorophyll *a* data collected in 1993, 1994, 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations, slightly decreased from 1993 to 1994 (Appendix Fig. I.4). Concentrations at all stations nearly doubled from 1994 to 1997 and then slightly increased or stayed the same in 2000.

Monthly chlorophyll *a* concentrations increased steadily April through July, and then fell slowly through October (Fig. I.23). The highest chlorophyll *a* concentration observed was greater than 60 μg/L at mid-reservoir during July.

Lake mean chlorophyll *a* concentration was lowest during April, and increased to a peak in July (Fig. I.23). Lake mean chlorophyll *a* concentration fell slowly July through October. Mean discharge at Neely Henry Reservoir was highest during April, then decreased the following months through October. No obvious relationship was observed between discharge and chlorophyll *a*.

Tributaries. Mean chlorophyll *a* concentrations in the tributaries of Neely Henry were lower than upstream Weiss and similar to other tributaries downstream (Fig. I.13). Concentrations ranged from 16.54 µg/l at Big Wills Creek to 32.22 µg/l at Greens Creek.

Total Suspended Solids

Mainstem. Mean TSS concentrations at Neely Henry Reservoir were similar to other reservoirs in the upper Coosa basin (Fig. I.10). Within the reservoir, concentrations decreased from the upper location to lower location. The mean concentration at upper location was the second highest of all Coosa basin locations. Graphs of mean TSS data collected in 1993, 1994, 1997, and 2000 from comparable stations indicate that concentrations at all reservoir stations increased from 1993 to 1997 (Appendix Fig. I.4). In 2000, the upper reservoir continued to increase while the mid and lower reservoirs decreased.

Monthly TSS concentrations increased and decreased simultaneously at all stations May through October (Fig. I.23). The extreme TSS values occurred in April with the highest value at the upper station and the lowest TSS at the lower site.

Lake mean TSS concentrations generally decreased from April through October with a slight increase in July (Fig. I.23). Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October. Lake mean TSS concentration, especially influenced by high concentrations in the upper reservoir, was greatest in April, the month of greatest discharge. There was likely a relationship between discharge and TSS at the upper site.***Tributaries.*** Mean TSS concentrations of the tributaries of Neely Henry Reservoir were variable and usually higher than other tributaries (Fig. I.14). The two highest concentrations were Big Wills (50.7 mg/l) and Greens Creek (49.7 mg/l).

Trophic State

Monthly Trophic State Index values at Neely Henry Reservoir increased from just above eutrophic status during April, to near hypereutrophic status May through October (Fig. I.24). Highest TSI values were observed during July.

Dissolved Oxygen/Temperature

Mainstem. DO concentrations at Neely Henry Reservoir locations remained above the criterion limit of 5.0 mg/l for each month except August (Fig. I.24). During August, DO concentrations at mid and upper reservoir fell below 5.0 mg/l.

Depth profiles of temperature and DO indicate the water column in upper and mid Neely Henry Reservoir was isothermal and isochemical for all months sampled except for July and October (Figs. I.25 & I.26). A weak chemocline developed in July. Highest temperatures were recorded in July. Anoxic conditions at the bottom of the reservoir were not recorded.

At lower Neely Henry, depth profiles of temperature indicated little thermal stratification during the sampling period. Highest water column temperatures occurred June through August (Fig. I.27). Chemical stratification existed from May to August with DO concentrations remaining below 5.0 mg/l for more than half the hypolimnion. A decrease in DO concentrations was also observed in October.

Tributaries. Depth profiles of temperature and dissolved oxygen for Ballplay, Big Wills and Black Creeks were essentially too shallow for the water column to be stratified (Appendix Fig. I.5.). Generally, isothermal and isochemical condition existed for all three creeks in all three months. A slight thermocline was evident in June in Black Creek when highest temperatures occurred. Deoxygenation did not occur.

In Big Canoe Creek in April, a weak thermocline and chemocline exited within the water column. In Greens and Beaver Creeks, depth profiles of temperature and dissolved oxygen were isothermal and isochemical in April (Appendix I.6). The water column was stratified in June and August for all three creeks. Strong chemoclines occurred in June and August for Big Canoe and Beaver Creek resulting in deoxygenated conditions near the bottom.

Summary and Discussion

Mean total nitrogen concentration at mid-reservoir and lower reservoir of Neely Henry was higher than any other Coosa River location. Mean total phosphorus concentrations at Neely Henry reservoir were higher than most other Coosa River reservoirs except Weiss. Mean TP at mid-reservoir (0.089mg/l) was the highest of Neely Henry locations. Mean chlorophyll *a* concentration was higher at lower Neely Henry than any other mainstem Coosa Reservoir location. Mean chlorophyll *a* increased with each location downstream. Monthly TSS concentrations were low and similar May through October. Monthly Trophic State Index values at Neely Henry Reservoir increased from just above eutrophic status during April, to hypereutrophic in July. During August, DO concentrations at mid-reservoir and upper reservoir fell just below the criterion limit of 5.0 mg/l. Depth profiles of temperature indicated little thermal stratification at lower Neely Henry during the sampling period. Chemical stratification existed from May to August with DO concentrations remaining below 5.0 mg/l for more than half the hypolimnion.

Overall, the status of Neely Henry is a cause for concern. TSI values indicate the reservoir is near or at hypereutrophic conditions. In 1997, the reservoir remained mid-eutrophic until August, while in 2000, near hypereutrophic conditions (TSI=69) occurred in mid reservoir in May. Mean TN concentrations have increased from previous studies. Chlorophyll *a* concentrations were much higher in 1997 and 2000 as compared to 1993 and 1994. Further study is recommended to identify nutrient sources and to monitor trophic status.

Six tributary embayments were monitored on Neely-Henry Reservoir. They included Ballplay, Big Wills, Black, Big Canoe, Greens, and Beaver Creeks. The Ballplay Creek sub-watershed drains approximately 73 mi^2 in Cherokee, Etowah and Calhoun Counties (ADEM 2002b). Percent land cover of the Ballplay Creek sub-watershed was estimated as 1% transitional forest, 26% deciduous forest, 21% evergreen forest, 23% mixed forest, 11% pasture/hay, 10% woody wetlands, and 6% row crop. Estimates of land-use by the local SWCDs were similar to EPA data. Three (3) current construction/stormwater authorizations, two (2) current mining/stormwater authorizations (non-coal <5 acres), and two (2) mining NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.06 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (3.5 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, the highest recorded TN concentration of any tributary was found in Ballplay Creek. Mean TP, chlorophyll *a*, and TSS concentrations were similar to other Coosa basin tributaries. Further investigation is necessary to determine the source of excess nitrogen within the system. DO concentrations remained well above (>2.0 mg/l) any minimum requirements necessary for fish survival.

The Lower Big Wills Creek - Little Wills Creek sub-watershed drains approximately 97 mi^2 in Dekalb and Etowah Counties (ADEM 2002b). Percent land cover of the Lower Big Wills Creek - Little Wills Creek sub-watershed was estimated as 35% deciduous forest, 15% evergreen forest, 24% mixed forest, 10% pasture/hay, and 5% row crop. Estimates of land-use by the local SWCDs were higher for pastureland (23%) and lower for forest (60%). One (1) mining and two (2) municipal NPDES permits, four (4) current construction/stormwater authorizations, and one (1) CAFO registration have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.12 AU/acre), with cattle and poultry being the dominant animal types. Sedimentation estimates indicated a *low* potential for NPS impairment (2.9 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Mean concentrations of TP and TSS in Big Wills Creek were the highest recorded of any tributary. This may be the result of both point and nonpoint sources. The entire water column was oxygenated during all months sampled.

The Black Creek sub-watershed drains approximately 64 mi^2 in Etowah, Dekalb, and Cherokee Counties (ADEM 2002b). A three mile segment of the downstream reach of Black Creek is included on the Alabama CWA §303(d) list of impaired waterbodies with a non-support status for priority organics, ammonia, and organic enrichment/dissolved oxygen from industrial, urban runoff/storm sewers, and contaminated sediments sources. Percent land cover of the Black Creek sub-watershed was estimated as 32% deciduous forest, 19% evergreen forest, 27% mixed forest, 5% pasture/hay, 6% row crop, 2% wetland, 1% open water, 4% low intensity residential, 1% high intensity residential, and 3% high intensity commercial/industrial/transportation. Estimates of land-use by the local SWCDs were higher for pasture (25%) and urban (15%), and lower for forest (45%). One (1) industrial and one (1) semi-public/private NPDES permit, two (2) current construction/stormwater authorizations, and one (1) current mining/stormwater authorization (non-coal <5 acres) have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.06 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *moderate* potential for NPS impairment (4.1 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Elevated concentrations of TN and TSS in Black Creek have been related to these point and nonpoint sources. Though a portion of Black Creek is on the 303(d) list for organic enrichment/dissolved oxygen problems, the embayment sampling location did not appear to have low DO. During the three months sampled, the entire water column was oxygenated, though temperatures exceeded 32°C near the surface in June.

The Lower Big Canoe Creek sub-watershed drains approximately 51 mi^2 in Etowah and St. Clair counties (ADEM 2002b). Percent land cover of the Lower Big Canoe Creek sub-watershed was estimated as 36% deciduous forest, 15% evergreen forest, 26% mixed forest, 11% pasture/hay, 4% row crop, 3% open water, and 2% wetland. Estimates of land-use by the local SWCDs were higher for pasture (17%) and lower for row crops (1%) and open water (1%). Three (3) current construction/stormwater authorizations and two (2) CAFO registrations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.16 AU/acre), with broiler-poultry and cattle being the dominant animal types (0.11 and 0.05 AU/acre, respectively). Sedimentation estimates indicated a *low* potential for NPS impairment (1.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, chlorophyll *a* concentrations were higher than several upper Coosa tributary embayments. DO concentrations may also be of concern. Deoxygenated conditions existed below 4 meters in June and August and water temperatures approached 30° C.

The Greens Creek sub-watershed drains approximately 42 mi^2 in Etowah and Calhoun Counties (ADEM 2002b). Percent land cover of the Greens Creek sub-watershed was estimated as 33% deciduous forest, 11% evergreen forest, 17% mixed forest, 14% pasture/hay, 8% row crop, 1% wetland, and 10% open water. Estimates of land-use by the local SWCDs were lower for forest (50%) and open water (1%) and higher for pasture (26%), row crops (16%), and urban (5%). Two (2) current construction/stormwater authorizations and two (2) current mining/stormwater authorizations (non-coal <5 acres) have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.07 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for NPS impairment (1.8 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, mean TSS and chlorophyll *a* concentrations were elevated when compared to other Coosa basin tributaries. Depth profiles of dissolved oxygen show very weak stratification in April intensifying through August. Low DO (<2.0 mg/l) occurred in August near the bottom.

The Beaver Creek sub-watershed drains approximately 36 mi^2 in St. Clair County (ADEM 2002b). Percent land cover of the Beaver Creek sub-watershed was estimated as 42% deciduous forest, 10% evergreen forest, 23% mixed forest, 17% pasture/hay, and 6% row crop.

Estimates of land-use by the local SWCDs were lower for forest (50%) and higher for pasture land-uses (36%). Five (5) current construction/stormwater authorizations, one (1) current mining/stormwater authorization (non-coal <5 acres), and three (3) mining NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.12 AU/acre), with cattle and swine being the dominant animal types (0.07 and 0.04 AU/acre, respectively). Sedimentation estimates indicated a *low* potential for NPS impairment (1.9 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, mean chlorophyll *a* and TSS concentrations of Beaver Creek were higher than those of many other upper Coosa tributary embayments. Depth profiles of temperature and dissolved oxygen were similar to other tributaries of Neely Henry Reservoir. Low DO (<2.0 mg/l) occurred in June and August only near the very bottom.

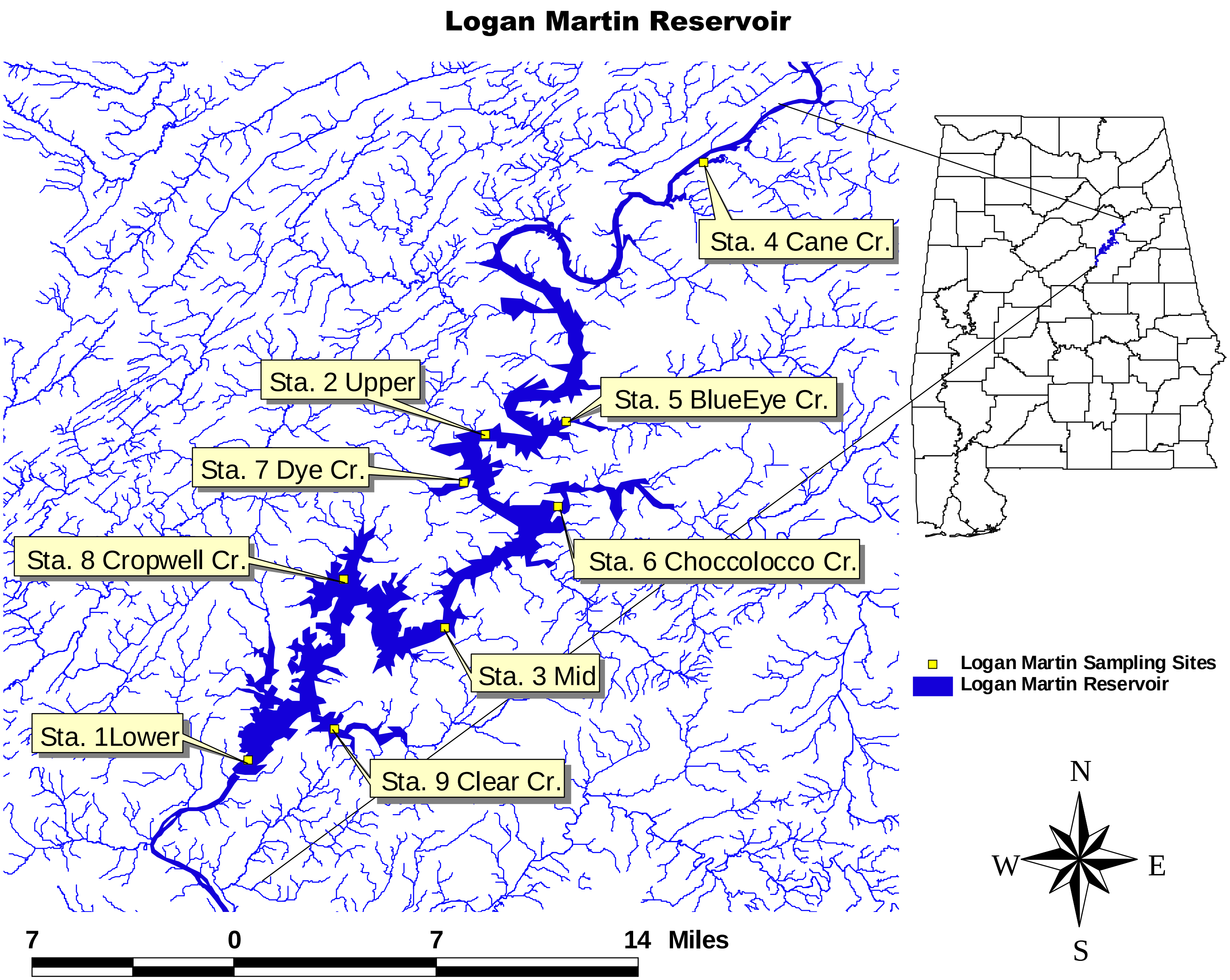


Figure I.3. Logan Martin Reservoir with 2000 sampling locations.

Logan Martin Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentrations were almost identical across Logan Martin Reservoir (Fig. I.7). Mean TN concentrations were lower than any observed at reservoirs located upstream of Logan Martin and higher than any downstream locations. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations nearly doubled from 1997 to 2000 (Appendix Fig. I.7).

Monthly total nitrogen concentrations increased April through July and decreased in August. Concentrations were similar at all three sites for each month except July and October (Fig. I.28). For July, TN was highest at upper reservoir. During October, TN was highest at lower-reservoir and approximately 50% less at upper Logan Martin.

Lake mean total nitrogen concentration increased from April to highest concentrations in July (Fig. I.28). Following a significant decrease between April and May, discharge was relatively stable through the remainder of the sampling season. There was no apparent relationship between TN and discharge.

Tributaries. Mean TN concentrations were similar to upstream reservoirs and higher than those downstream (Fig. I.11). The highest mean concentration for Logan Martin tributaries was at Blue Creek, which was the second highest of any tributary monitored in the Coosa basin. The lowest tributary concentration was 0.527 mg/l in Clear Creek.

Phosphorus

Mainstem. Mean TP concentrations were lower than any reservoir station located upstream of Logan Martin (Fig. I.8). Mean TP at lower reservoir (0.021 mg/l) was lower than any other Coosa River location. Mean TP concentrations decreased from upstream to downstream Logan Martin Reservoir. Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations decreased from 1997 to 2000 (Appendix Fig. I.7). The mean concentration at the lower station declined by over half.

Similar trends in monthly TP concentrations of mainstem locations were evident most of the sampling period with exception of September (Fig. I.28). From August to September, TP increased at all three locations, but TP was approximately two times higher at upper reservoir than at mid-reservoir. For most sampling months, TP concentrations were highest at the mid reservoir site and lowest at lower reservoir.

Lake mean TP concentration decreased April to May and remained stable through August (Fig. I.28). After August, lake mean TP increased slightly. Mean discharge was nearly four times higher during April than any other month of sampling. Discharge was stable from May to October. Lake mean TP was possibly related to discharge since both decreased April to May and then remained stable through August, however, an increase in TP occurred September through October although there was no change in discharge.

Tributaries. Mean TP concentrations were similar at all tributaries in Logan Martin, ranging from 0.055 mg/l at Cropwell Creek to 0.085 mg/l at Choccolocco Creek (Fig. I.12). Concentrations were generally higher than most other downstream tributaries.

Algal Growth Potential Tests

Algal growth potential tests indicated that upper Logan Martin Reservoir was nitrogen limited and lower reservoir was phosphorus limited (Table I.1). No limiting nutrient was determined for mid-reservoir. Mean MSC values for each of the Logan Martin locations were below the suggested level of 5.0 mg/l. The highest MSC was observed at mid-reservoir.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations were higher at upper and mid-reservoir than any location downstream of Logan Martin (Fig. I.9). Mean chlorophyll *a* at the two uppermost locations was approximately twice the chlorophyll *a* at lower reservoir. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper, mid, and lower reservoir locations decreased from 1997 to 2000 (Appendix Fig. I.7)

Monthly chlorophyll *a* concentrations were similar for the upper and mid reservoir locations of Logan Martin (Fig. I.29). Although chlorophyll *a* increased at each location through July, concentrations at lower reservoir remained almost half those of the other two stations. As chlorophyll *a* concentrations continued to increase through September at upper and mid-reservoir, chlorophyll *a* decreased at lower reservoir. Chlorophyll *a* decreased from September to October at upper and mid-reservoir, while levels increased at lower Logan Martin.

Lake mean chlorophyll *a* concentration increased steadily April through September and decreased slightly in October (Fig. I.29). Mean discharge was much higher during April than any other month. In general, lake mean chlorophyll *a* concentration increased during the sampling period as discharge remained constant.

Tributaries. Mean chlorophyll *a* concentrations of all Logan Martin tributaries were similar, ranging from 20.24 μg/l at Clear Creek to 29.44 μg/l at Blue Creek (Fig. I.13).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Logan Martin Reservoir were similar to other reservoirs in the upper Coosa basin (Fig. I.10). Within the reservoir, concentrations decreased from the upper location to lower location. The mean concentration at upper location was the fourth highest of all seventeen Coosa basin locations. Graphs of mean TSS data collected in 1997 and 2000 from comparable stations indicate that concentrations at the upper reservoir station just slightly decreased (Appendix Fig. I.7). In the mid and lower reservoirs, concentrations increased slightly from 1997 to 2000.

Monthly TSS concentrations varied among stations May through October (Fig. I.29). Concentrations were lowest in the lower reservoir for most months, while concentrations were highest in the upper reservoir.

Lake mean TSS concentrations decreased from April through June, increased through August, and then decreased through October (Fig. I.29). Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October. No obvious relationship existed between lake mean TSS concentration and discharge.

Tributaries. Mean TSS concentrations of the tributaries of Logan Martin Reservoir were similar to other Coosa basin tributaries (Fig. I.14). Concentrations generally decreased from upstream (Cane Creek: 21.0 mg/l) to downstream (Clear Creek: 6.3 mg/l) tributaries.

Trophic State

Monthly TSI values ranged from just above mesotrophic status to upper eutrophic status (Fig. I.30). The trophic status at lower reservoir remained near or below a TSI value of 60 for the entire sampling period. The trophic status at upper and mid-reservoir exceeded a TSI value of 60 by May and peaked near hypereutrophic status in September.

Dissolved Oxygen/Temperature

Mainstem. DO concentrations fell below the criterion limit of 5.0 mg/l on two occasions (Fig. I.30). During August, DO at mid-reservoir was just under 5.0 mg/l, but recovered in the following months. DO concentration at lower reservoir was below the criterion limit in September at 3.35 mg/l. DO concentrations at most locations decreased from April to August and increased to the highest levels during October.

Depth profiles of temperature and DO indicate the water column in the upper Logan Martin Reservoir was essentially isothermal and isochemical for all months sampled (Figs. I.31). A weak chemocline developed from May to August. Highest temperatures were recorded in July. Deoxygenation did not occur.

Depth profiles of temperature at mid reservoir and dam forebay of Logan Martin indicated mild thermal stratification May through July (Fig. I.32 & I.33). Highest water column temperatures occurred during July and August. Depth profiles of DO indicated chemical stratification of the hypolimnion during May through August and October. During these months DO concentrations were below 5.0 mg/l for more than half the water column.

Tributaries. Depth profiles of temperature and DO of Cane Creek were shallow and essentially isothermal and isochemical from April through October (Appendix I.8). The water column of Blue Eye Creek was essentially isothermal in all months sampled. Depth profiles of dissolved oxygen were stratified, with concentrations at or below 5.0 mg/l for more than half the water column (Appendix I.8). Depth profiles of temperature and dissolved oxygen of Choccolocco Creek showed weak thermoclines in June and weak chemoclines in June and August (Appendix I.8). Highest temperatures in all three creeks occurred in June.

Depth profiles of temperature in Dye, Cropwell, and Clear Creeks show weak thermoclines in all months sampled (Appendix I.9). Highest temperatures occurred in June and August. Weak chemoclines were evident in April in all three creeks and intensified in June and August. Deoxygenation occurred near the bottom in Dye and Cropwell Creek. In Clear Creek, anoxic conditions existed below 6 meters.

Summary and Discussion

Mean TN concentrations were lower than any observed at reservoirs located upstream of Logan Martin and higher than any downstream location. Lake mean TN concentration increased slowly from April to July, fell in August, and remained relatively low through October. Mean TP concentrations decreased as sampling progressed downstream on Logan Martin Reservoir. Mean TP and TSS at lower reservoir (0.021 mg/l) was less than any other Coosa River location. Mean TP increased in September with no change in discharge. This may be indicative of a turnover in September. Mean chlorophyll *a* at the two uppermost locations was approximately two times higher than chlorophyll *a* at lower reservoir. In general, lake mean chlorophyll *a* concentration increased during the sampling period. Monthly TSS concentrations were lowest in the lower reservoir for most months when concentrations were highest in the upper reservoir. Monthly TSI values ranged from just above mesotrophic status to upper eutrophic status. Depth profiles of temperature indicated mild thermal stratification May through July. Depth profiles of DO indicated chemical stratification of the hypolimnion during May through August and October.

Overall, the trophic status of Logan Martin has changed little from 1997 to 2000. TN increased and TP decreased. Chlorophyll *a* slightly decreased while TSS slightly increased. Given the highly eutrophic conditions, continued monitoring is advised to determine water quality trends in this reservoir.

Six tributary embayments were monitored in Logan Martin Reservoir including Cane, Blue Eye, Choccolocco, Dye, Cropwell, and Clear Creeks. The Cane Creek sub-watershed drains approximately 93 mi^2 in Calhoun County (ADEM 2002b). Percent land cover of the Cane Creek sub-watershed was estimated as 38% deciduous forest, 21% evergreen forest, 24% mixed forest, 4% pasture/hay, 4% row crop, 3% low intensity residential, 1% high intensity residential, and 2% high intensity commercial/ industrial/transportation. Estimates of land-use by the local SWCDs were higher for urban (25%) and lower for forest (60%).

Three (3) current construction/stormwater authorizations and one (1) municipal NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.13 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (0.4 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low.* However, slightly elevated chlorophyll *a* and TSS concentrations were found in Cane Creek. Depth profiles of temperature and DO show essentially isothermal and isochemical conditions in all months sampled. High DO concentrations were evident even during the highest water temperatures.

The Blue Eye Creek sub-watershed drains approximately 29 mi^2 in Talladega and Calhoun Counties (ADEM 2002b). Percent land cover of the Blue Eye Creek sub-watershed was estimated as 30% deciduous forest, 14% evergreen forest, 20% mixed forest, 17% pasture/hay, 13% row crop, 3% wetland, 2% urban, and 1% open water. Estimates of land-use by the local SWCDs were higher for forest (72%) and lower for pasture (10%) and row crop (4%) land-uses. Five (5) current construction/stormwater authorizations, one (1) municipal NPDES permit, and one (1) CAFO registration have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *high* (0.97 AU/acre), with broiler poultry (0.80 AU/acre) and cattle (0.17 AU/acre) being the dominant animal types. Sedimentation estimates indicated a *moderate* potential for NPS impairment (8.5 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *high*. TN concentrations in Blue Eye Creek were the second highest of any tributary. Depth profiles revealed good DO concentrations for at least half the water column in all months sampled.

The Lower Choccolocco Creek sub-watershed drains approximately 66 mi^2 in Talladega and Calhoun Counties (ADEM 2002b). Percent land cover of the Lower Choccolocco Creek sub-watershed was estimated 29% deciduous forest, 14% evergreen forest, 21% mixed forest, 15% pasture/hay, 10% row crop, 2% other grasses, 1% wetland, 3% urban and 3% open water. Estimates of land-use by the local SWCDs were higher for urban (17%) and open water (8%), and lower for forest (58%), pasture (9%), and row crop (3%) land-uses. Five (5) current construction/stormwater authorizations, two (2) current mining, one (1) municipal, one (1) semi-public/private, one (1) industrial NPDES permits, and one (1) CAFO registration have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.29 AU/acre), with broiler poultry and cattle being the dominant animals. Sedimentation estimates indicated a *low* potential for NPS impairment (3.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Concentrations of TN, TP, chlorophyll *a*, and TSS found in Choccolocco Creek were average for tributaries to Logan Martin. Depth profiles show essentially isothermal and isochemical conditions in April, June, and August. Concentrations were usually at or above 5 mg/l.

The Dye Creek sub-watershed drains approximately 125 mi^2 in St. Clair County (ADEM 2002b). Percent land cover of the Dye Creek sub-watershed was estimated as 40% deciduous forest, 15% evergreen forest, 28% mixed forest, 6% pasture/hay, 3% row crop, 1% wetland, 1% low intensity residential, 1% high intensity commercial/ industrial/transportation, and 3% open water. Estimates of land-use by the local SWCDs were similar. Five (5) current construction/stormwater authorizations, one (1) municipal and three (3) semi-public/private NPDES permits, and two (2) CAFO registrations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.09 AU/acre), with broiler-poultry being the dominant animal type. Sedimentation estimates indicated a *low* potential for NPS impairment (1.0 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Higher chlorophyll *a* concentrations were found in the embayment of Dye Creek. DO concentrations were not a concern for most of the water column all months sampled. Further research is suggested in the sub-watershed to more specifically determine origins of the high chlorophyll *a* values and effects to biological communities.

The Easonville Creek sub-watershed, which includes Cropwell Creek, drains approximately 38 mi^2 in St. Clair and Talladega Counties (ADEM 2002b). Percent land cover of the Easonville Creek sub-watershed was estimated as 20% deciduous forest, 16% evergreen forest, 21% mixed forest, 13% pasture/hay, 7% row crop, 1% wetland, 1% low intensity residential, and 21% open water. Estimates of land-use by the local SWCDs were higher for pasture (25%) and urban (4%), and lower for open water (1%). Three current construction/stormwater authorizations, and one (1) mining and one (1) semi-public/private NPDES permit has been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (0.8 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Only a slightly elevated mean chlorophyll *a* concentration was reported in Cropwell Creek. Other parameters appeared to be within tributary averages. High temperatures and low DO concentrations in June and August may cause some concern; however, concentrations in April were not a concern.

The Clear Creek sub-watershed drains approximately 71 mi^2 in Talladega County (ADEM 2002b). Percent land cover of the Clear Creek sub-watershed was estimated as 2% transitional forest, 34% deciduous forest, 20% evergreen forest, 25% mixed forest, 5% pasture/hay, 4% row crop, 2% wetland, and 8% open water. Estimates of land-use by the local SWCDs were somewhat higher for pasture land-use (10%) and lower for forest (60%). Three current construction/stormwater authorizations, one (1) current mining/stormwater authorization (non-coal <5 acres), and one (1) semi-public/private NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.29 AU/acre), with broiler poultry and cattle being the dominant animal types. Sedimentation estimates indicated a *low* potential for NPS impairment (2.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate.* However, mean concentrations for TN, TP, chlorophyll *a*, and TSS in Clear Creek were among the lowest of any tributary in the reservoir. Depth profiles reveal very low (<2.0 mg/l) DO concentrations below 6 and 7 meters in June and August.

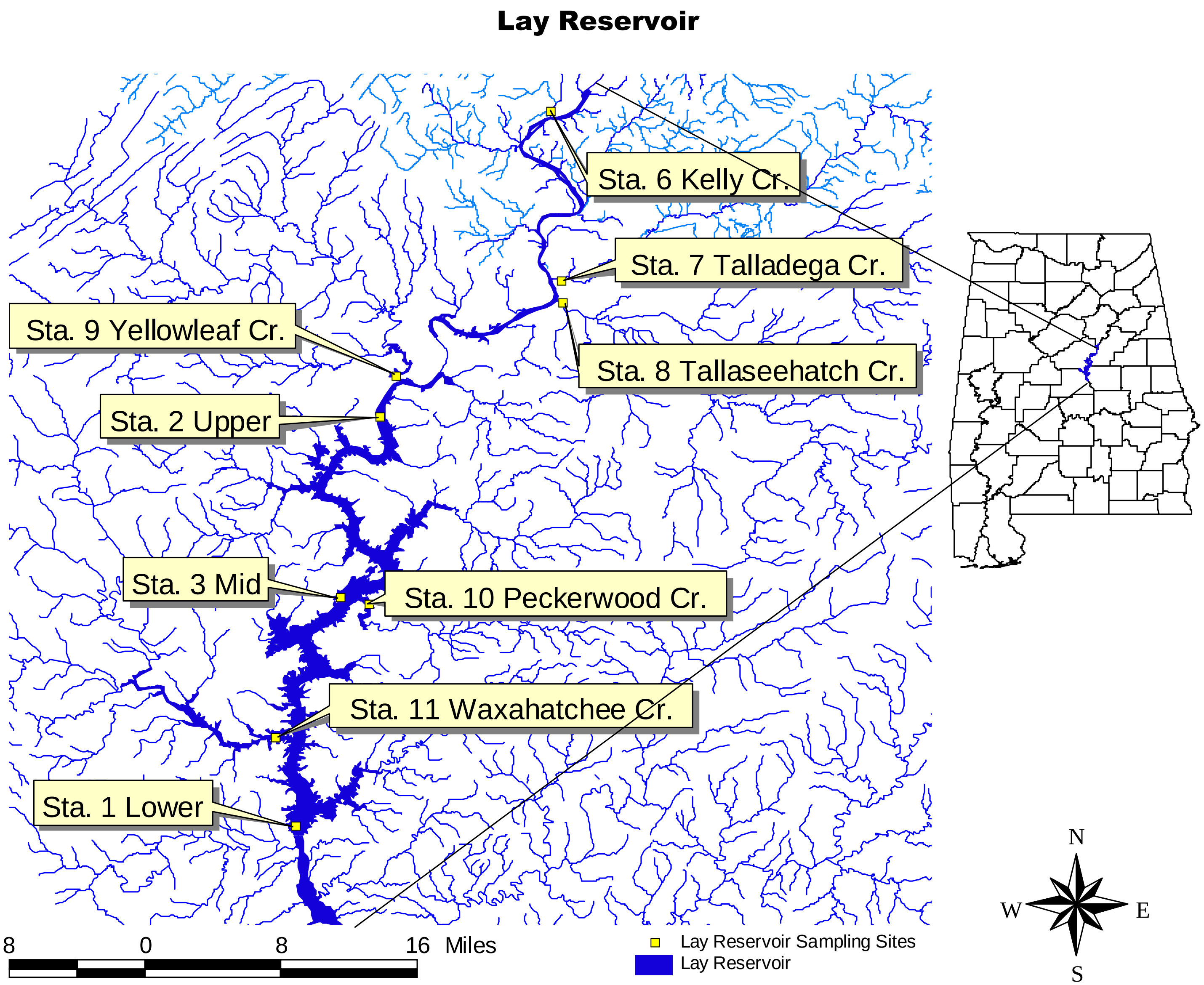


Figure I.4. Lay Reservoir with 2000 sampling locations.

Lay Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentrations were similar throughout Lay Reservoir (Fig. I.7). In general, mean TN at Lay Reservoir was lower than more upstream reservoirs and higher than reservoirs located downstream. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper and lower reservoir locations increased from 1997 to 2000 (Appendix Fig. I.10). Concentrations at mid reservoir in 2000 actually decreased from 1997.

Monthly total nitrogen concentrations were lower in April than October at all locations (Fig. I.34). Concentrations at mid-reservoir fluctuated more than concentrations at the other sites. Lowest concentrations were generally in April and August, with highest concentrations in May and October.

Lake mean TN fluctuated between approximately 0.400 mg/l in April to approximately 1.000 mg/l in October (Fig. I.34). Mean discharge was much higher during April than any other sampling month. Discharge fell slightly May to June, and then remained stable through October. There was no apparent relationship between lake mean TN concentration and discharge.

Tributaries. Mean TN concentrations for tributaries to Lay Reservoir were lower than any upstream tributary and similar to those downstream (Fig. I.11). The lowest concentration reported of any tributary in the Coosa basin was found in Yellowleaf Creek (0.202 mg/l).

Phosphorus

Mainstem. Mean total phosphorus concentrations ranged from 0.034 mg/l at lower reservoir to 0.045 mg/l at mid-reservoir (Fig. I.8). Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations in all three reservoir locations decreased by almost 50% from 1997 to 2000 (Appendix Fig. I.10).

Monthly total phosphorus values in Lay Reservoir were generally less at lower reservoir compared to the two uppermost locations (Fig. I.34). In April concentrations at all three locations were similar.

Lake mean TP concentration decreased from April to June and then fluctuated through October (Fig. I.34). Highest concentrations occurred in September, with lowest values occurring in June. Discharge dropped in May and continued to decline, though gradually, through September. There was no apparent relationship between discharge and TP concentration.

Tributaries. Mean TP concentrations for the tributaries of Lay Reservoir ranged from 0.018 mg/l at Kelly Creek to 0.191 mg/l at Tallasseehatchee Creek (Fig. I.12). TP at Kelly Creek was the lowest of any tributary and Tallasseehatchee Creek was the second highest.

Algal Growth Potential Tests

Algal growth potential tests determined that upper reservoir was nitrogen limited and mid-reservoir was nitrogen and phosphorus co-limited (Table I.1). There was no limiting nutrient evident for lower reservoir. Mean MSC at upper reservoir (5.55 mg/l) was greater than the 5.0 mg/l suggested for avoidance of nuisance algal blooms and fish kills in southeastern reservoirs.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentration at mid-reservoir was at least 4.5 μg/L higher than any other location on Lay Reservoir (Fig. I.9). Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from comparable stations indicate that concentrations were also higher at mid-reservoir in 1997. In general, concentrations in the upper, mid, and lower reservoir locations slightly decreased from 1997 to 2000 (Appendix Fig. I.10).

Monthly Chlorophyll *a* concentrations remained near 15 – 20 μg/L for the entire reservoir June through August and were variable in other months (Fig. I.35). Highest overall concentrations were measured in October and the lowest were measured in April. Concentrations at mid-reservoir were near 30 μg/l in May, September and October.

Lake mean chlorophyll *a* concentration increased between April and May, remained stable May through September, and increased to highest values in October. Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October.

Tributaries. Mean chlorophyll *a* concentrations were generally lower than other upper Coosa basin tributaries and similar to those of other lower Coosa basin tributaries (Fig.

I.13). The lowest concentration of any tributary was Kelly Creek (5.88 μg/l) in Lay Reservoir. Highest concentrations occurred in Yellowleaf Creek (24.39 μg/l).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Lay Reservoir were generally less than those of upper basin reservoirs and greater than other reservoirs in the lower Coosa basin (Fig. I.10). Within the reservoir, concentrations decreased from the upper location to lower location. Graphs of mean TSS data collected in 1997 and 2000 from comparable stations indicate that concentrations at all three reservoir stations were slightly greater in 2000 than 1997 (Appendix Fig. I.10).

Monthly TSS values were similar at all locations in all months except for June (Fig. I.35). Concentrations were generally highest in May and lowest in September and October.

Lake mean TSS fluctuated slightly each month between May and October (Fig. I.35). Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October. No obvious relationship existed between lake mean TSS concentration and discharge.

Tributaries. With the exception of Yellowleaf Creek, mean TSS concentrations of the tributaries of Lay Reservoir were generally less than those of the upper basin and similar to other lower Coosa basin tributaries (Fig. I.14). Concentrations in Yellowleaf Creek were the third highest of any tributary in the Coosa basin and at least three times greater than other tributaries to Lay Reservoir.

Trophic State

Trophic state index values at Lay Reservoir locations were within the eutrophic range for the entire sampling season (Fig. I. 36). Trophic status of Lay locations increased from April to May and remained near TSI of 60 through October. The mid-reservoir location exhibited the highest trophic condition for most months.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations were almost identical across mainstem Lay Reservoir during April (Fig. I.36). From April to May, DO concentration increased slightly at mid and lower reservoir, and decreased at the uppermost location. A steady decline in DO occurred at mid and lower reservoir sites until August. Concentrations of dissolved oxygen recovered by October. DO at mid-reservoir decreased below the criterion limit of 5.0 mg/l during August. DO was just below the criterion limit at the upper reservoir during September.

Depth profiles of temperature and DO from the upper Lay Reservoir indicated little to no thermal stratification April through October (Fig. I.37). A weak thermocline was detected in July at 3 meters. Highest water column temperatures occurred in July and August. A slight chemocline developed in June, July and October. DO concentrations dropped below 5.0 mg/l only in June and July.

Depth profiles of temperature in mid and lower Lay Reservoir indicated little to no thermal stratification during the growing season (Fig. I.38 & I.39). Highest water column temperatures occurred during July and August. A moderate chemocline existed in May and further developed June through October with dissolved oxygen concentrations below 5.0 mg/l for most of the water column.

Tributaries. Depth profiles of temperature and DO in April for Kelly, Talladega, and Tallaseehatchee Creeks, were isothermal and isochemical (Appendix I.11). Kelly Creek continued to be isothermal and isochemical in June and August. In both Talladega and Tallaseehatchee Creeks, weak thermoclines were evident in June and August during highest temperatures. Weak chemoclines were also evident, but DO concentrations remained above 5.0 mg/l.

Depth profiles of temperature and DO in Yellowleaf Creek were essentially isothermal and isochemical on all three sampling events (Appendix I.12). Highest temperatures occurred in August. Peckerwood and Waxahatchee Creeks had similar profiles to Yellowleaf in April, but distinct thermoclines occurred in June and chemoclines in June and August (Appendix I.12). Highest temperatures and deoxygenation near the bottom occurred in June.

Summary and Discussion

In general, mean TN at Lay Reservoir was lower than more upstream reservoirs and higher than reservoirs located downstream. Lake mean TN fluctuated from just under 0.40 mg/l in April to approximately 1.00 mg/l in October. Phosphorus values at Lay were less variable at lower reservoir compared to the two upstream locations. Mean chlorophyll *a* concentration at mid-reservoir was approximately 5.0 mg/l higher than any other location on Lay Reservoir. Lay Reservoir was classified as eutrophic throughout the sampling season. TSI values increased from April to May and remained near 60 through October. A steady decline in DO occurred throughout the reservoir until August. DO concentrations recovered by October. DO concentrations fell below the criterion limit of 5.0 mg/l on two occasions.

Although TP dropped from 1997 to 2000, mean TN concentrations increased at two sites. The decline in phosphorus may have contributed to the slight decrease in chlorophyll *a* concentrations. Any changes in chlorophyll *a* concentrations were not enough to cause a change in TSI. TSI values in 2000 were similar to those in 1997.

Six tributary embayments were monitored in Lay Reservoir including Kelly, Talladega, Tallaseehatchee, Yellowleaf, Peckerwood, and Waxahatchee Creeks. The Lower Kelly Creek sub-watershed drains approximately 69 mi^2 in Shelby and St. Clair Counties (ADEM 2002b). Percent land cover of the Lower Kelly Creek sub-watershed was estimated as 25% deciduous forest, 18% evergreen forest, 23% mixed forest, 16% pasture/hay, 10% row crop, 5% wetland, and 2% open water. Estimates of land-use by the local SWCDs were higher for row crop (15%) and urban (7%) land-uses. Six (6) current construction/stormwater authorizations and one (1) semi-public/private NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.05 AU/acre), with cattle and dairy being the dominant animal types. Sedimentation estimates indicated a *moderate* potential for NPS impairment (15.4 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Little impairment was detected in Kelly Creek, with concentrations of TN, TP, chlorophyll *a*, and TSS at the lowest or near lowest values of all the tributaries to Lay Reservoir. DO concentrations were also favorable throughout the entire water column in all months sampled.

The Talladega Creek sub-watershed drains approximately 173 mi^2 in Talladega and Clay Counties (ADEM 2002b). Percent land cover of the Talladega Creek sub-watershed was estimated as 43% deciduous forest, 16% evergreen forest, 25% mixed forest, 5% pasture/hay, 5% row crop, 1% other grasses, 2% wetland, and 1% low intensity residential. Estimates of land-use by the local SWCDs were higher for pasture (11%) and urban (11%), and lower for forest (62%) landuses. Five (5) current construction/ stormwater authorizations and three (3) municipal NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (3.4 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *high*. The mean TN concentration in Talladega Creek was the highest of the lower Coosa Reservoir tributaries. Depth profiles of DO did not indicate low concentrations in any portion of the water column.

The Tallaseehatchee Creek sub-watershed drains approximately 200 mi^2 in Clay and Talladega Counties (ADEM 2002b). Percent land cover of the Tallaseehatchee Creek sub-watershed was estimated as 33% deciduous forest, 17% evergreen forest, 27% mixed forest, 10% pasture/hay, 7% row crop, 3% urban, and less than 1% open water. Estimates by the local SWCDs were higher for urban land use (13%). Seven (7) current construction/stormwater authorizations, two (2) non-coal mining stormwater authorizations and four (4) mining NPDES permits, five (5) municipal NPDES permits, one (1) semi public/private NPDES permit, and one (1) industrial NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle and catfish being the dominant animals. Sedimentation estimates indicated a *low* potential for NPS impairment (2.8 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *high*. Mean TP concentration in Tallaseehatchee Creek was the second highest of any tributary of the Coosa basin. DO concentrations, however, were good and generally remained above 6 mg/l in April, June, and August.

The Yellowleaf Creek sub-watershed drains approximately 185 mi^2 in Shelby County (ADEM 2002b). Percent land cover of the Yellowleaf Creek sub-watershed was estimated as 34% transitional forest, 21% deciduous forest, 29% evergreen forest, 7% mixed forest, 4% pasture/hay, less than 1% row crop, less than 1% wetland, and 1% open water. Estimates of land-use by the local SWCDs were somewhat higher for pastureland (16%) and urban (6%), and for row crops (4%). Twenty-seven (27) current construction/stormwater authorizations, two (2) non-coal mining stormwater authorizations, one (1) semi public/private NPDES permit, and one (1) industrial NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.02 AU/Acre), with cattle being the dominant animal. Sedimentation estimates indicated a *moderate* potential for NPS impairment (5.9 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, Yellowleaf Creek was found to have the highest mean concentrations of chlorophyll *a* and TSS of any lower Coosa tributary. TP concentration was also elevated. DO concentrations remained good throughout the sampling season.

The Peckerwood Creek sub-watershed drains approximately 83 mi^2 in Coosa and Talladega Counties (ADEM 2002b). Percent land cover of the Peckerwood Creek sub-watershed was estimated as 35% deciduous forest, 24% evergreen forest, 29% mixed forest, 3% pasture/hay, 1% row crop, and 5% open water. Estimates of land-use by the local SWCDs were essentially the same. Two (2) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal. Sedimentation indicated a *low* potential for NPS impairment (1.8 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Concentrations of TN, TP, and TSS in Peckerwood Creek were found to be among the lowest of the Coosa basin tributaries. DO concentrations were good in April, but stratification in June caused low concentrations below a depth of 2 meters. In August, concentrations were generally lower than desired.

The Waxahatchee Creek sub-watershed drains approximately 137 mi^2 in Chilton and Shelby Counties (ADEM 2002b). Percent land cover of the Waxahatchee Creek sub-watershed was estimated as 2% transitional forest, 26% deciduous forest, 27% evergreen forest, 34% mixed forest, 5% pasture/hay, 2% row crop, and 2% open water. Estimates of land-use by the local SWCDs were essentially the same. Eleven (11) current construction/stormwater authorizations, one (1) non-coal mining stormwater authorization, one (1) mining and one (1) municipal NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *moderate* potential for NPS impairment (6.0 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Concentrations of TN, TP, and TSS in Waxahatchee Creek were found to be lower than upper basin tributaries and similar to other lower Coosa basin tributaries. The second highest chlorophyll *a* concentration of the lower Coosa basin tributaries occurred in Waxahatchee Creek. Depth profiles reveal good DO concentrations for April, but oxygen concentrations were below 5 mg/l for most of the water column in June and August. Anoxic conditions were evident in June only in the bottom 4 meters (total depth 10.6 m).

Mitchell Reservoir

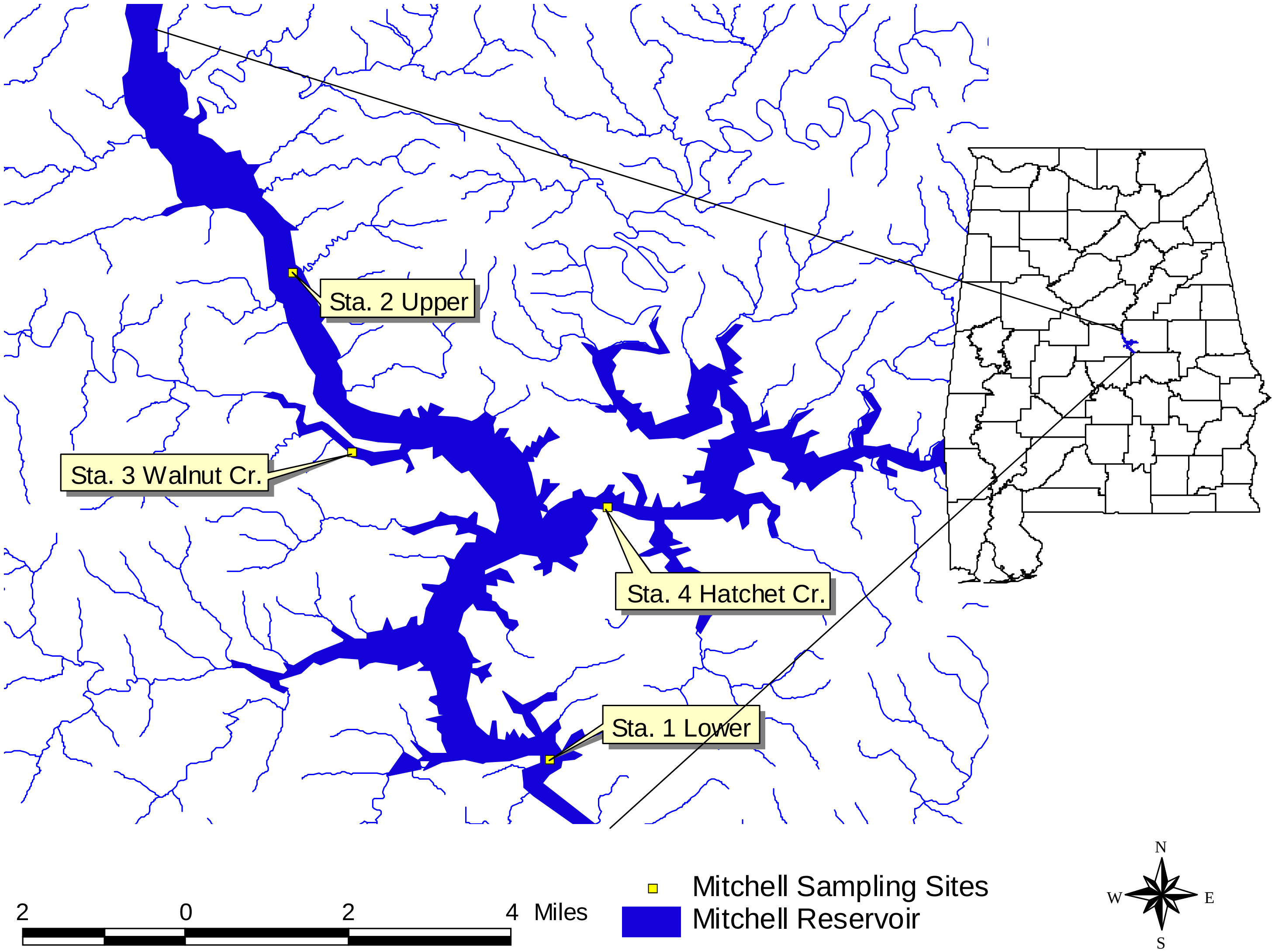


Figure I.5. Mitchell Reservoir with 2000 sampling locations.

Mitchell Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentrations at Mitchell Reservoir were less than those of Lay and greater than those of Jordan (Fig. I.7). The mean TN concentrations at the two sampling locations were similar. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations were higher in 2000 than in 1997 (Appendix Fig. I.13).

Monthly TN concentrations at Mitchell mainstem locations were similar for most months of the sampling period (Fig. I.40). Highest TN concentrations occurred during April and lowest TN concentrations occurred during June.

Lake mean TN declined sharply in June and increased in July. Only moderate changes occurred July through October (Fig. I.40). Mean discharge was much higher during April than the following months.

Tributaries. Mean TN concentration in both Mitchell Reservoir tributaries were similar to other lower Coosa tributaries (Fig. I.11). Walnut Creek TN concentration was second highest of the lower Coosa tributaries.

Phosphorus

Mainstem. Mean total phosphorus concentrations (0.035 mg/l) were uniform throughout the mainstem of Mitchell Reservoir (Fig. I.8). Mean TP levels at Mitchell were among the lowest of the Coosa River reservoirs. Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper and lower reservoir locations were much lower in 2000 than 1997 (Appendix Fig. I.13).

Monthly TP concentrations were similar through June at the two Mitchell sampling areas (Fig. I.40). TP concentration at lower reservoir was approximately two times that of upper reservoir during July. TP concentration at upper reservoir was approximately two times that of lower reservoir during September.

Lake mean TP concentrations fluctuated between 0.011 mg/l and 0.050 mg/l throughout the entire sampling season (Fig. I.40). Discharge in April was over four times greater than in any other month sampled. No obvious relationship exists between TP and discharge.

Tributaries. Mean TP concentrations of both tributaries of Mitchell Reservoir were among the lowest of the Coosa basin tributaries (Fig. I.12).

Algal Growth Potential Tests

Neither phosphorus nor nitrogen was indicated as a limiting nutrient for Mitchell sampling locations (Table I.1). The mean MSC of the upper and lower locations ranged from 4.17 to 2.01 mg/l, respectively. This was well below the maximum suggested level of 5.0 mg/l to avoid nuisance algal blooms in southeastern lakes.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentration at upper Mitchell was approximately 4 μg/l higher than the lower reservoir mean concentration (Fig. I.9). Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper reservoir remained similar, but the lower reservoir increased slightly from 1997 to 2000 (Appendix Fig. I.13).

Monthly sampling exhibited similar trends in chlorophyll *a* concentrations at both sites (Fig. I.41). Concentrations increased in June and remained elevated through October. Chlorophyll *a* was higher at the upper station than the lower station each month except May.

Lake mean chlorophyll *a* concentration was lowest during April and May (Fig. I.41). Lake mean chlorophyll *a* increased between May and June and remained relatively stable through October. Mean discharge was approximately four times higher in April than any other month. During April, the month of greatest discharge, lake mean chlorophyll *a* concentration was lowest. As monthly mean discharge rates reduced, monthly chlorophyll *a* concentrations increased. This may indicate a relationship between discharge and chlorophyll *a*, or it may be reflective of an increase in chlorophyll *a* concentrations due to increased photoperiod during the mid-summer months.

Tributaries. Chlorophyll *a* concentrations in tributaries of Mitchell Reservoir were similar to other lower Coosa tributaries (Fig. I.13). Overall, concentrations were low.

Total Suspended Solids

Mainstem. Mean TSS concentrations at Mitchell Reservoir were similar to other reservoirs in the lower Coosa basin (Fig. I.10). Concentrations decreased from upstream to downstream. Graphs of mean TSS data collected in 1997 and 2000 from comparable stations indicate that concentrations at both reservoir locations were higher in 2000 (Appendix Fig. I.13).

Monthly TSS concentrations at both locations were similar between April and August (Fig. I.41). Concentrations at the upper reservoir location were higher than the lower reservoir site in all months except September. At both sites, the highest concentrations occurred in April while lowest concentrations occurred in August.

Lake mean TSS concentrations decreased from April through May, increased through July, decreased in August and then increased again through October (Fig. I.41). Lake mean discharge was significantly higher in April than following months. Discharge continued to decrease until October. The highest discharge and TSS values occur in April and May.

Tributaries. Mean TSS concentrations of the tributaries of Mitchell Reservoir were among the lowest of the Coosa basin tributaries (Fig. I.14).

Trophic State

Trophic State Index values were just above eutrophic status for April and May (Fig. I.42). Both upper reservoir and lower reservoir locations increased to a TSI value of 60 by June and remained near 60 for the duration of the sampling period.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentration remained relatively high through August at lower reservoir (Fig. I.42). For the upper reservoir location, DO varied each month. Dissolved oxygen concentrations remained above the criterion limit of 5.0 mg/l throughout the sampling season.

Depth profiles of temperature and DO from the upper Mitchell Reservoir indicated little to no thermal stratification April through October (Fig. I.43). A weak thermocline was detected in May and June. Highest water column temperatures occurred between July and August. Chemoclines developed in May near the surface and intensified June through September. Dissolved oxygen concentrations dropped below 5.0 mg/l May through September. Anoxic conditions occurred near the bottom in June and July.

Depth profiles of temperature from lower Mitchell indicated thermal stratification May through August (Fig. I.44). Chemical stratification occurred May through October with more than half the water column having DO values less than 2.0 mg/l from June to August. Deoxygenation occurred May through September.

Tributaries. Depth profiles of temperature and dissolved oxygen of Walnut and Hatchet Creeks indicate essentially no thermal or chemical stratification in April (Appendix I.14). Weak thermoclines develop in June, but isothermal conditions return in August. Distinct chemoclines exist in June and August for both creeks with deoxygenation occurring near the bottom. In Hatchet Creek, more than half of the water column was oxygen depleted in June and August.

Summary and Discussion

Total nitrogen concentrations at Mitchell mainstem locations were similar for most months of the sampling period. Mean TP levels at Mitchell were some of the lowest of the Coosa River reservoirs. TP concentrations were similar at both Mitchell locations through June, but TP levels fluctuated in later months. Mean chlorophyll *a* concentration at upper Mitchell was more than 4 μg/l higher when compared to the lower reservoir location. Mean TSS were some of the lowest of the basin. Concentrations were similar in all months and were highest when discharge was highest. TSI values remained near 60, indicating eutrophic conditions, for most of the sampling period. Dissolved oxygen concentrations remained above the criterion limit of 5.0 mg/l from April to October. Depth profiles of temperature indicated thermal stratification May through August and chemical stratification occurred May through October. More than half of the water column in lower Mitchell had DO < 2.0 mg/l from June through August.

The trophic status of Mitchell Reservoir has not changed much overall, but conditions from July-September at lower reservoir increased from near eutrophic conditions to mid-eutrophic status. Mean TN increased at both stations while TP significantly decreased from 1997 to 2000. Little change was evident in chlorophyll *a* concentrations, with the lower reservoir increasing slightly.

Only two tributary embayments were monitored on Mitchell Reservoir, Walnut and Hatchet Creek. The Walnut Creek sub-watershed drains approximately 176 mi^2 in Chilton County (ADEM 2002b). Percent land cover of the Walnut Creek sub-watershed was estimated as 1% transitional forest, 29% deciduous forest, 15% evergreen forest, 28% mixed forest, 14% pasture/hay, 9% row crop, and 2% open water. Estimates of land-use by the local SWCDs were similar. Four (4) current construction/stormwater authorizations and two (2) municipal NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.07 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (2.0 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Concentrations of TN, TP, chlorophyll *a*, and TSS in Walnut Creek were similar to other lower Coosa basin tributaries. Depth profiles of temperature and dissolved oxygen indicate isothermal and isochemical conditions in April. Stratification is evident in June and August with deoxygenation occurring in the bottom 5 to 6 meters.

The Lower Hatchet Creek sub-watershed drains approximately 61 mi^2 in Coosa County (ADEM 2002b). Percent land cover of the Lower Hatchet Creek sub-watershed was estimated as 10% transitional forest, 28% deciduous forest, 26% evergreen forest, 25% mixed forest, 1% pasture/hay, less than 1% row crop, and 9% open water. Estimates of land-use by the local SWCDs were similar. One (1) current construction/stormwater authorization has been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.00 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (1.6 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Total nitrogen, TP, chlorophyll *a*, and TSS concentrations in Hatchet Creek were among the lowest of Coosa basin locations. Though DO concentrations in April are good, more than half of the water column in June and August was deoxygenated.

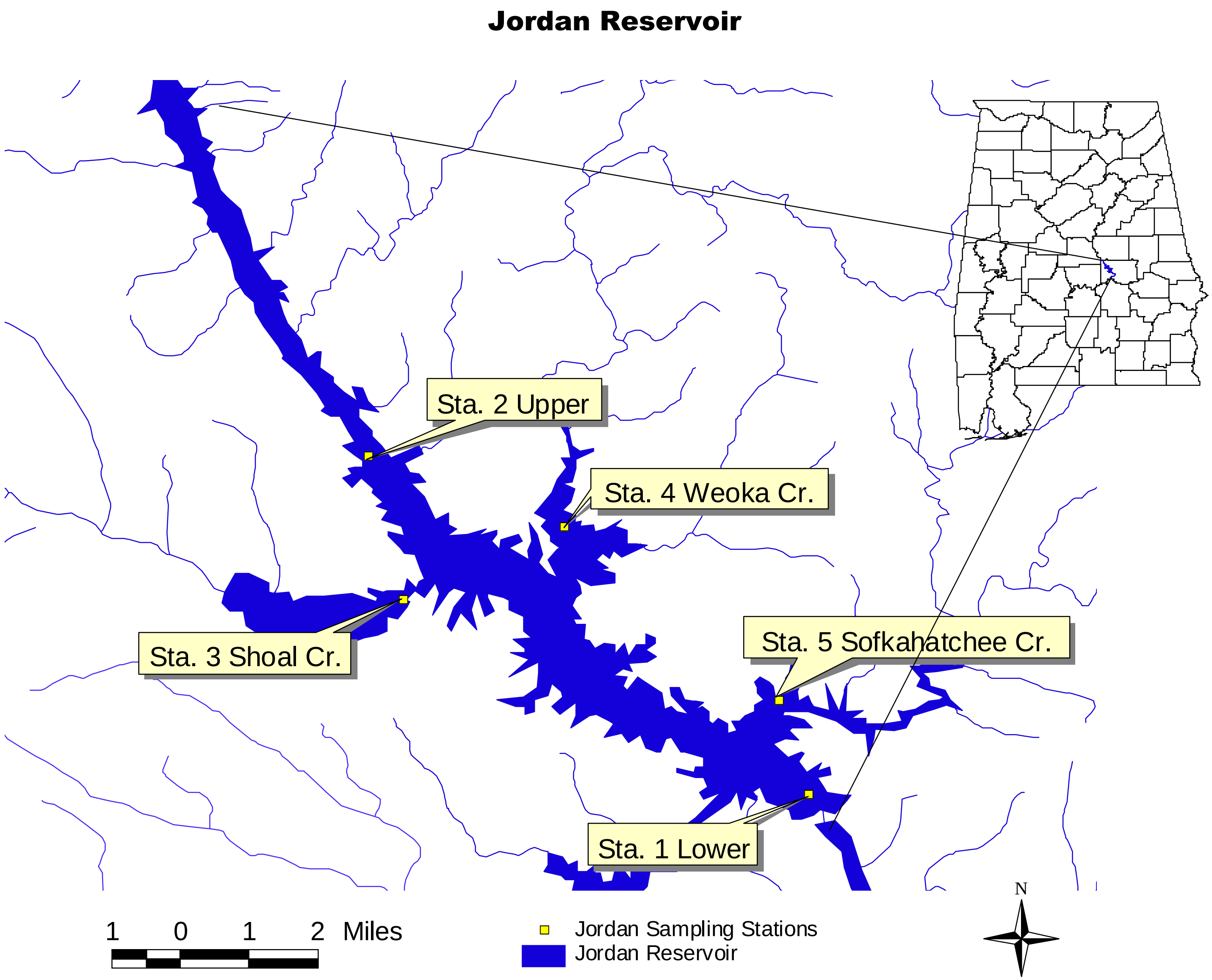


Figure I.6. Jordan Reservoir with 2000 sampling locations.

Jordan Reservoir

Nitrogen

Mainstem. Mean total nitrogen (TN) concentrations at Jordan Reservoir were lower than any other Coosa basin mainstem reservoir location (Fig. I.7). Concentrations were higher at the upper reservoir than at the lower reservoir. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations in the upper and lower reservoir locations were much higher in 2000 than 1997 (Appendix Fig. I.15).

Monthly TN concentrations at upper and lower Jordan Reservoir locations were similar each month except July (Fig. I.45). During July, TN concentration at upper reservoir was approximately 5 times higher than at lower reservoir.

Lake mean TN concentration was highest during April and May and lowest in June (Fig. I.45). Mean TN at Jordan decreased May to June and remained relatively low through October. Mean discharge was high during April (>24,000 cfs), but fell sharply in May and remained stable through October. Lake mean TN was highest during months of greatest discharge.

Tributaries. TN concentrations in all three tributaries monitored in Jordan Reservoir were similar to other lower Coosa basin tributaries. Weoka Creek was highest of the 3 Jordan Reservoir tributaries monitored (Fig. I.11). Overall TN concentrations were among the lowest of the basin.

Phosphorus

Mainstem. Mean total phosphorus concentrations at Jordan Reservoir were among the lowest of mainstem Coosa River locations (Fig. I.8). TP at the dam forebay was slightly lower than the TP concentration at upper reservoir. Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations at both stations were much lower in 2000 than 1997 (Appendix Fig. I.15).

Monthly TP concentrations were variable at both locations (Fig. I.45). Both locations followed similar patterns in all months except October.

Lake mean TP concentration decreased slowly April to June, increased slightly for July, and fell again in August (Fig. I.45). Highest lake mean TP concentrations were observed during September and October. Mean discharge was much higher during April than any other month. There was no apparent relationship between lake mean TP and discharge.

Tributaries. The mean TP concentrations of the tributaries of Jordan Reservoir were among the lowest of the Coosa basin tributaries (Fig. I.12).

Algal Growth Potential Tests

Algal growth potential tests conducted in August indicated both locations on Jordan reservoir were phosphorus limited (Table I.1). The mean MSC of the upper and lower reservoir ranged from 1.79 to 2.41 mg/l, respectively. The concentrations were below the maximum level of 5.0 mg/l that the EPA suggests for southeastern lakes.

Chlorophyll a

Mainstem. The mean chlorophyll *a* concentration at the dam forebay of Jordan Reservoir (14.53 μg/L) was among the lowest of Coosa River mainstem reservoir locations (Fig. I.9). The mean concentration was slightly higher at upper reservoir. Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from comparable stations indicate that concentrations were higher in 2000 (Appendix Fig. I.15).

Chlorophyll *a* concentrations were dissimilar at both locations and varied monthly (Fig. I.46). Chlorophyll *a* concentration peaked at lower reservoir during September and chlorophyll *a* was highest at upper reservoir during October. Chlorophyll *a* concentrations at both locations were lowest during April.

Lake mean chlorophyll *a* concentration increased April through September and declined slightly in October (Fig. I.46). Mean discharge was greatest during April and remained relatively low May through October.

Tributaries. Mean chlorophyll *a* concentrations of the tributaries of Jordan Reservoir were similar to other lower Coosa basin tributaries (Fig. I.13).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Jordan Reservoir were the lowest overall of reservoirs in the Coosa basin (Fig. I.10). Concentrations increased from the upper location to lower location. Graphs of mean TSS data collected in 1997 and 2000 from comparable stations indicate that concentrations were higher in 2000 than 1997 (Appendix Fig. I.15).

Monthly TSS concentrations at upper and lower sites followed similar patterns between April and August (Fig. I.46). Concentrations generally decreased in upper and lower reservoir April through August. Concentrations were lowest in August and highest in April.

Lake mean TSS concentrations generally decreased from April to August and then increased in September (Fig. I.46). Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October. TSS concentrations generally decreased with decreasing discharge.

Tributaries. Mean TSS concentrations of the tributaries of Jordan Reservoir were similar to those of other lower Coosa basin tributaries (Fig. I.14).

Trophic State

Trophic state index values were lowest during April and increased to mid-eutrophic status by May (Fig. I.47). TSI values changed little May through October.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentration fell slowly April through July for both Jordan Reservoir locations (Fig. I.47). For August, DO continued to fall at upper reservoir and DO recovered slightly at lower reservoir. DO concentration increased steadily at upper reservoir from August through October as DO fell consistently at the lower reservoir location.

Depth profiles of temperature for both upper and lower Jordan Reservoir, show essentially isothermal conditions existed April through October (Figs. I.48 & I.49). Weak thermoclines developed in May, June and August. Highest temperatures were in July and August. Depth profiles of dissolved oxygen were isochemical in April. Chemoclines developed in May and remained until October. The majority of the water column had DO levels of less than 2.0 mg/l from June to August. Deoxygenated conditions occurred near the bottom May to September.

Tributaries. Depth profiles of temperature of Shoal Creek indicate isothermal conditions in all three sampling events (Appendix I.16). The highest temperature occurred in August. Depth profiles of DO show a weak chemocline in April that intensified in June and August creating anoxic conditions near the bottom.

Depth profiles of temperature in Weoka and Sofkahatchee Creeks show essentially isothermal conditions in April, June and August (Appendix I.16 and I.17). A strong chemocline was detected in June and August in both creeks when more than half of the water column had DO levels of less than 2.0 mg/l.

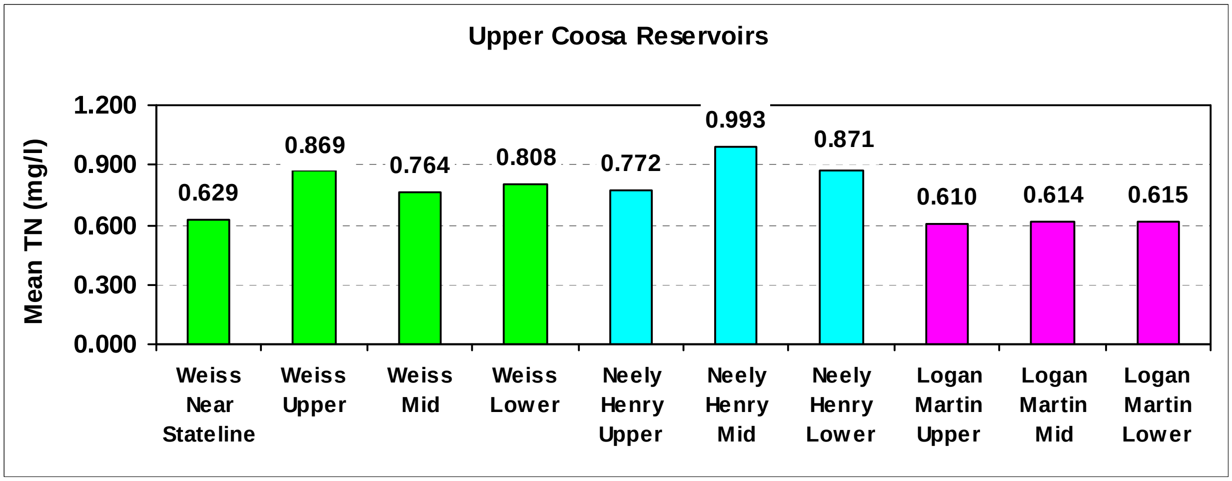
Summary and Discussion

Mean TN concentrations at Jordan Reservoir were lower than any other Coosa River locations. TP at Jordan Reservoir locations was lower than most other locations on the Coosa River. Mean chlorophyll *a* concentration at the dam forebay of Jordan Reservoir (14.53 mg/l) was one of the lowest of Coosa River locations sampled. Mean TSS concentrations were the lowest of all Coosa basin reservoirs. Trophic state index values were lowest during April and increased to mid-eutrophic status May through October. Dissolved oxygen concentration increased steadily at upper reservoir from August through October as DO fell consistently at the lower reservoir location.

Concentrations of TN and chlorophyll *a* increased from 1997 to 2000 in Jordan Reservoir, but TP decreased by nearly half. AGPT testing revealed the system was phosphorus limited. Any significant increase in the phosphorus loading into this reservoir may result in increases in trophic status.

Three tributary embayments were monitored in 2000 in Jordan Reservoir: Shoal, Weoka, and Sofkahatchee Creeks. Shoal Creek embayment, part of the Chestnut Creek sub-watershed, drains approximately 127 mi^2 in Autauga, Elmore, and Chilton Counties (ADEM 2002b). Percent land cover of the Chestnut Creek sub-watershed was estimated as 28% deciduous forest, 13% evergreen forest, 31% mixed forest, 10% pasture/hay, 12% row crop, 3% wetland, 3% open water, and urban less than 1%. Estimates of land-use by the local SWCDs were slightly higher for urban (6%) and row crop (12%). Six (6) current construction/stormwater authorizations and one (1) mining NPDES permit has been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.02 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (2.5 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Water quality concentrations at Shoal Creek were consistent with this assessment. All values were low and within range of other Jordan tributaries. Depth profiles of temperature and DO reveal stratification only existing in June and August with deoxygenated conditions only occurring near the very bottom.

The Weoka Creek sub-watershed, which includes both Weoka and Sofkahatchee Creek embayment sites, drains approximately 189 mi^2 in Coosa and Elmore Counties. Percent land cover of the Weoka Creek sub-watershed was estimated as 1% transitional forest, 36% deciduous forest, 17% evergreen forest, 34% mixed forest, 5% pasture/hay, 5% row crop, and 2% open water. Estimates of land-use by the local SWCDs were lower for row crops (1%) and higher for urban (3%) and pasture land-uses. Three (3) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (1.2 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Minimal apparent impairment was detected in Weoka or Sofkahatchee Creeks through water quality analysis. Although TN, TP, TSS and chlorophyll *a* were low and consistent with the other lower Coosa tributaries, DO was occasionally below recommended levels. Depth profiles of temperature and dissolved oxygen in Weoka Creek show isochemical conditions in April and a hypolimnion near the surface in June allowing much of the water column to have low DO. In August, the hypolimnion moved deeper into the water column allowing for more oxygenated water. Depth profiles of temperature and dissolved oxygen in Sofkahatchee Creek show a deep hypolimnion in June moving closer to the surface in August. More than half of the water column was deoxygenated. The DO levels of less than 2 mg/l are below levels recommended to sustain healthy aquatic life.



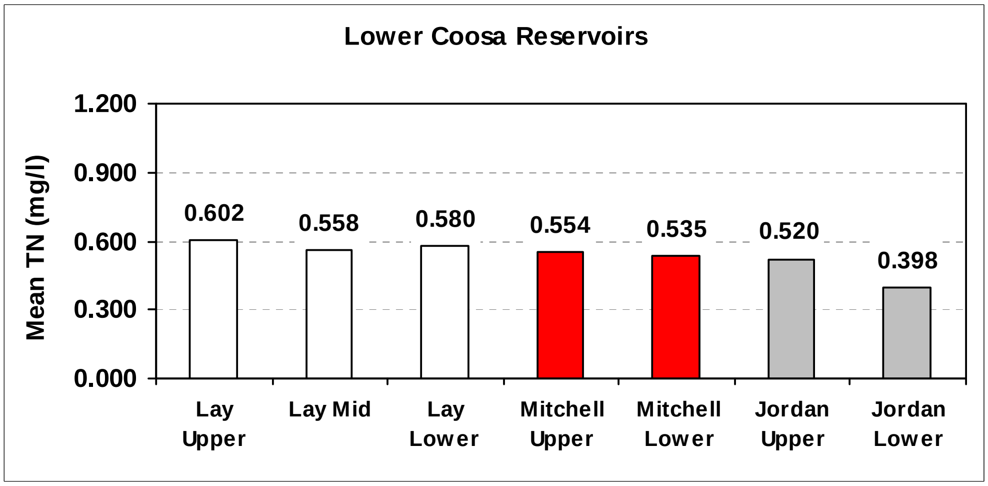


Figure I.7. Mean total nitrogen (TN) concentrations of Coosa reservoir locations, April-October 2000.

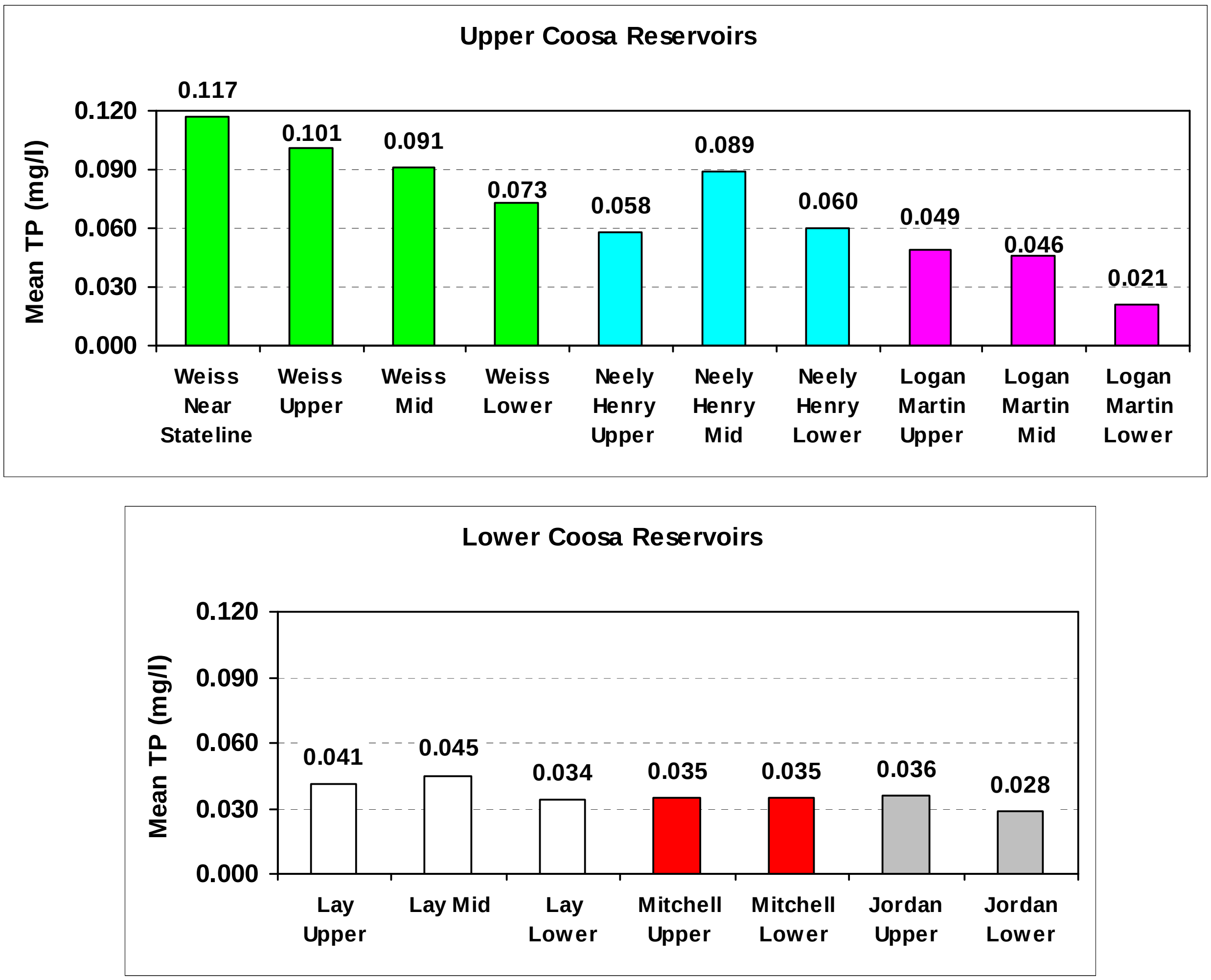
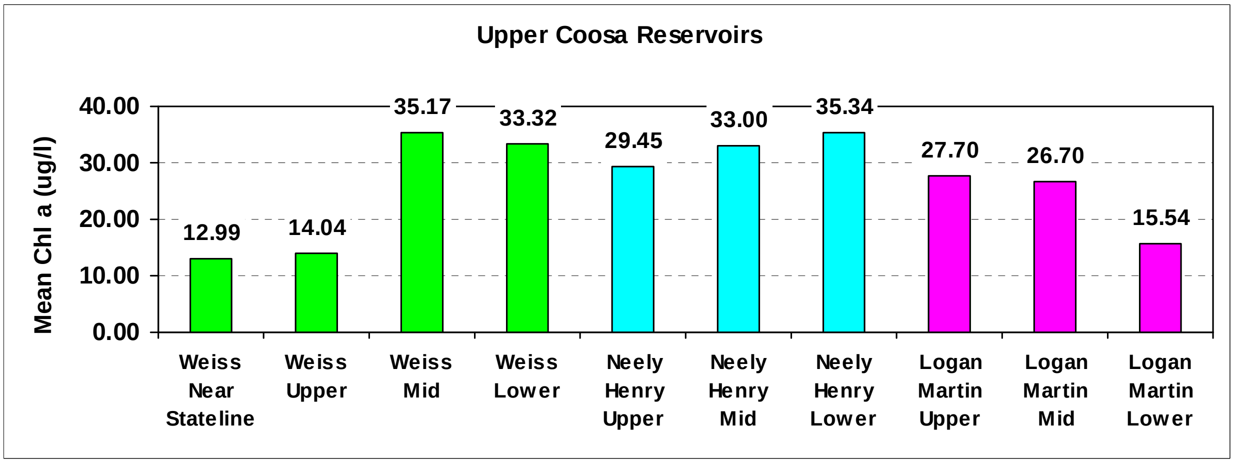


Figure I.8. Mean total phosphorus (TP) concentrations of Coosa reservoir locations April-October 2000.



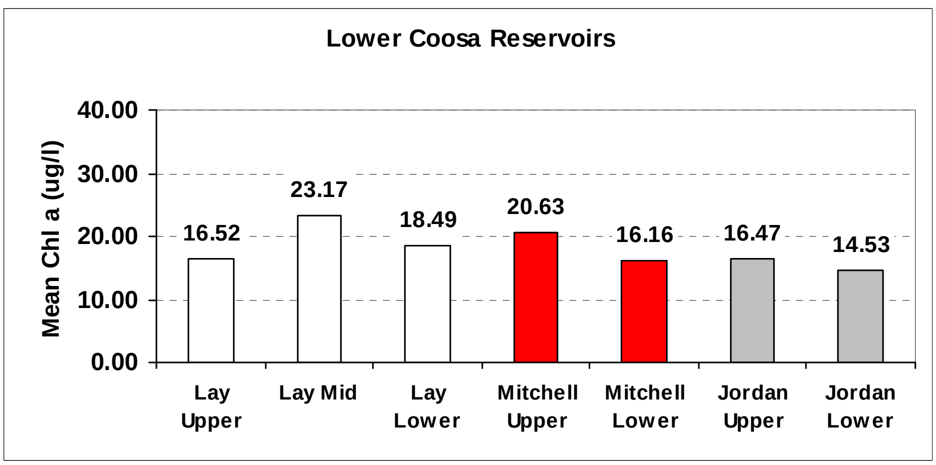


Figure I.9. Mean chlorophyll *a* concentrations of Coosa reservoir locations April-October 2000.

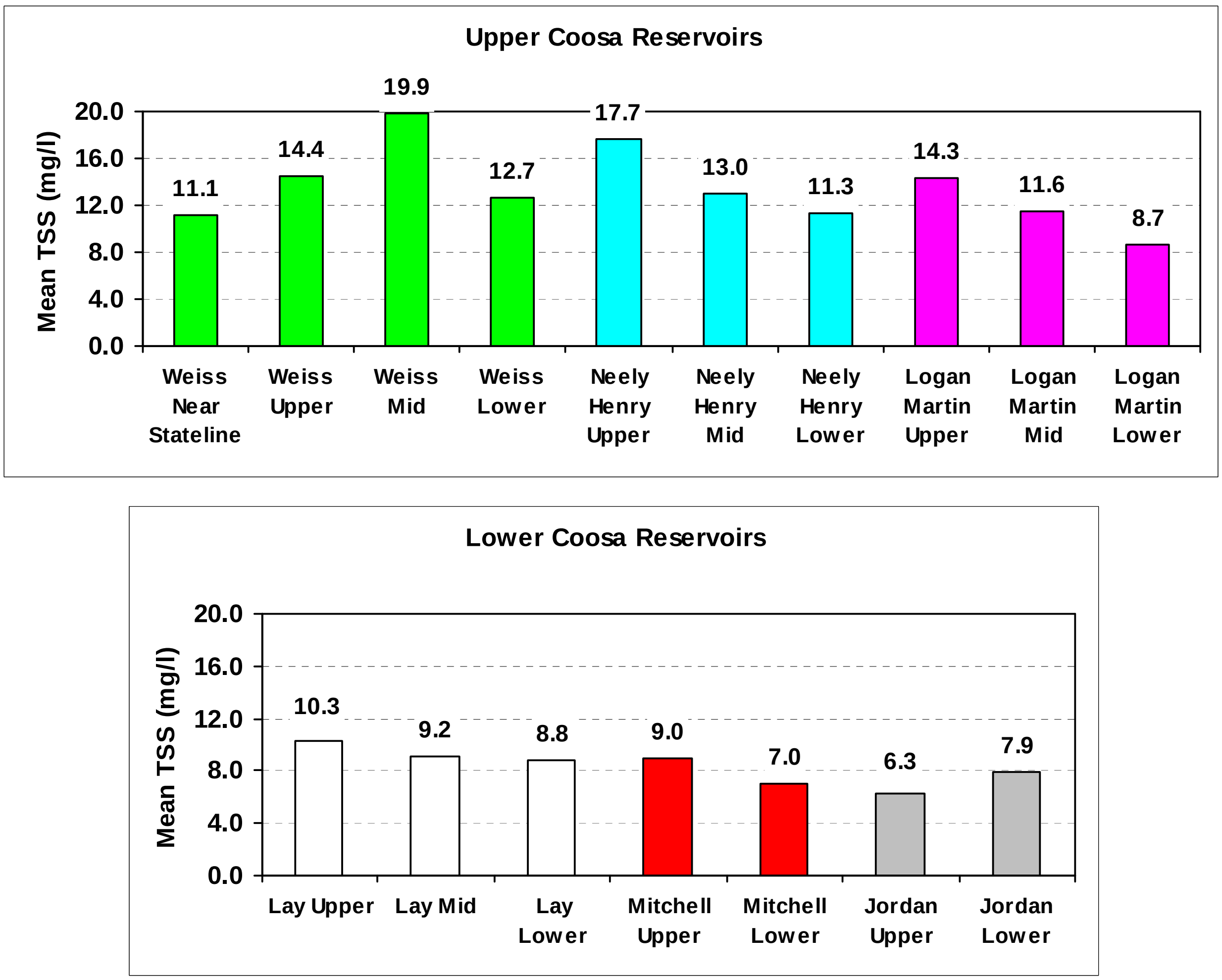
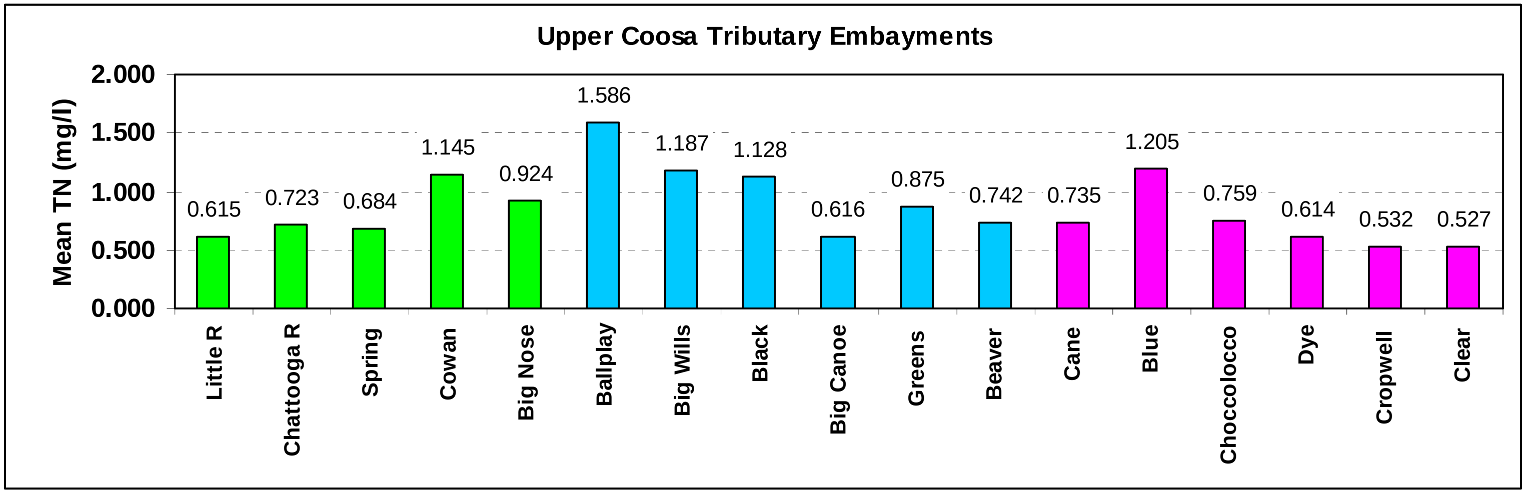


Figure I.10. Mean total suspended solids (TSS) concentrations of Coosa reservoir locations April-October 2000.



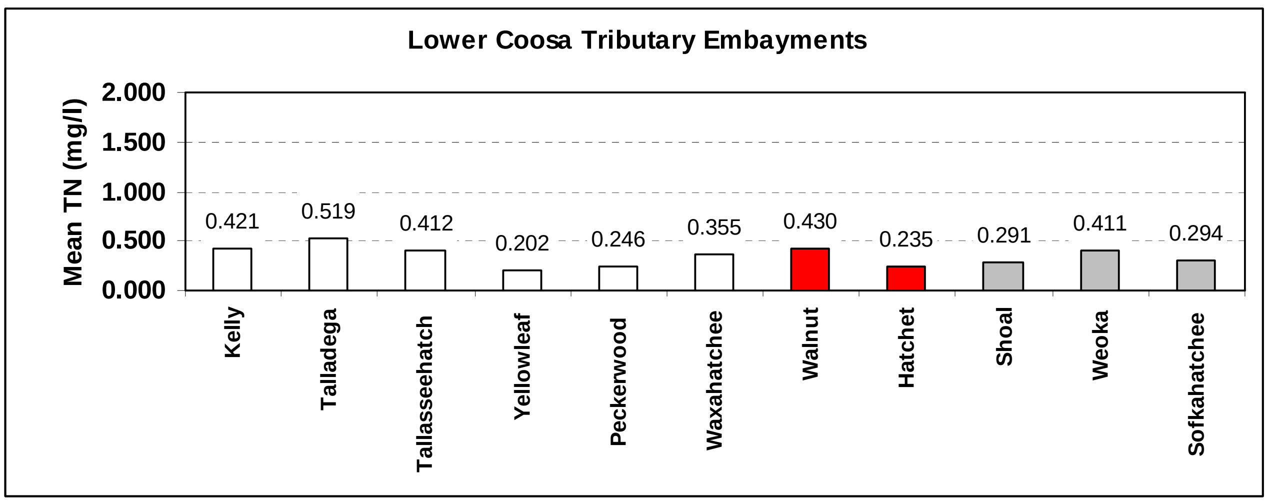


Figure I.11. Mean total nitrogen (TN) concentrations of Coosa Tributary Embayment locations, April-August, 2000.

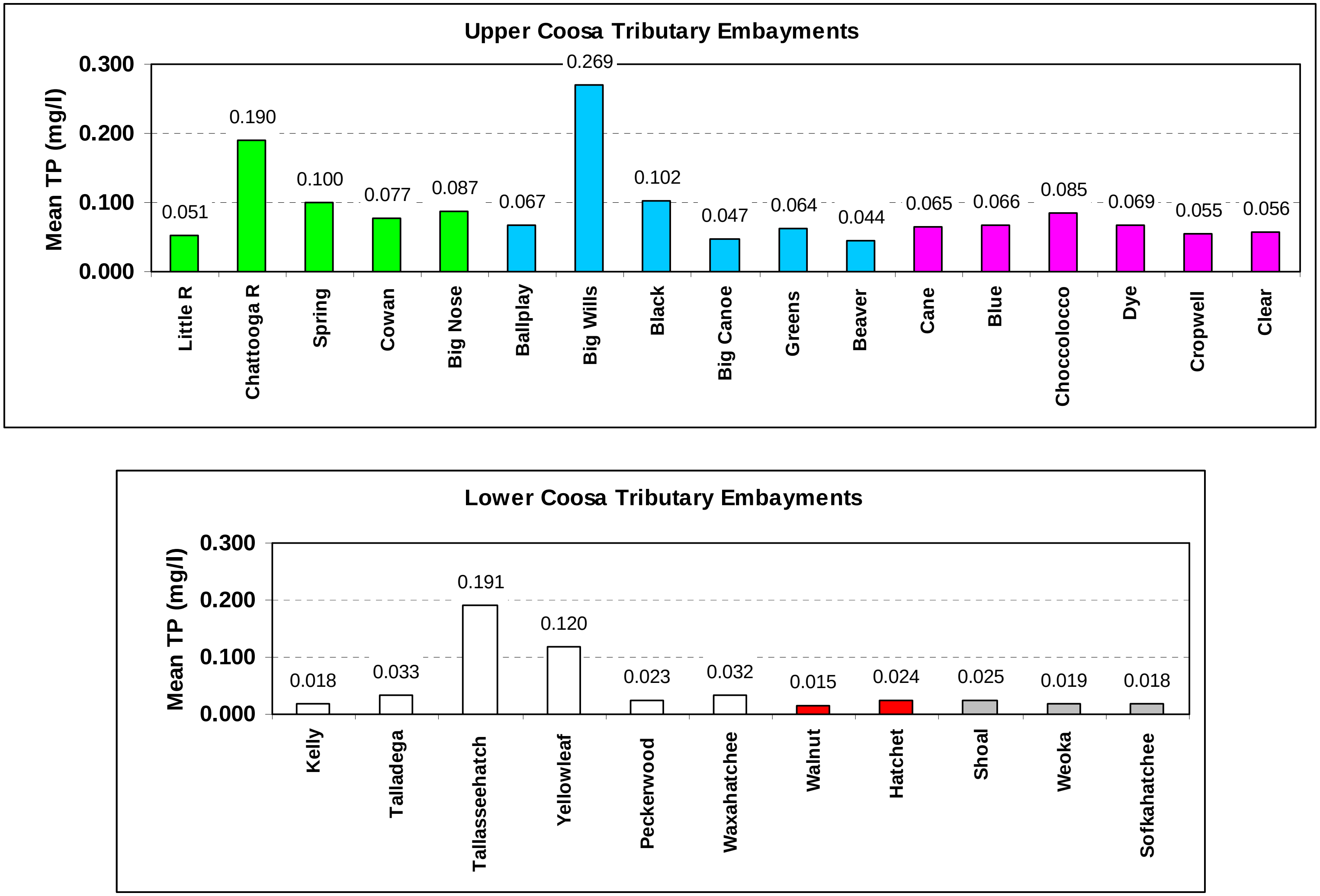


Figure I.12 Mean total phosphorus (TP) concentrations of Coosa Tributary Embayment locations, April-August, 2000.

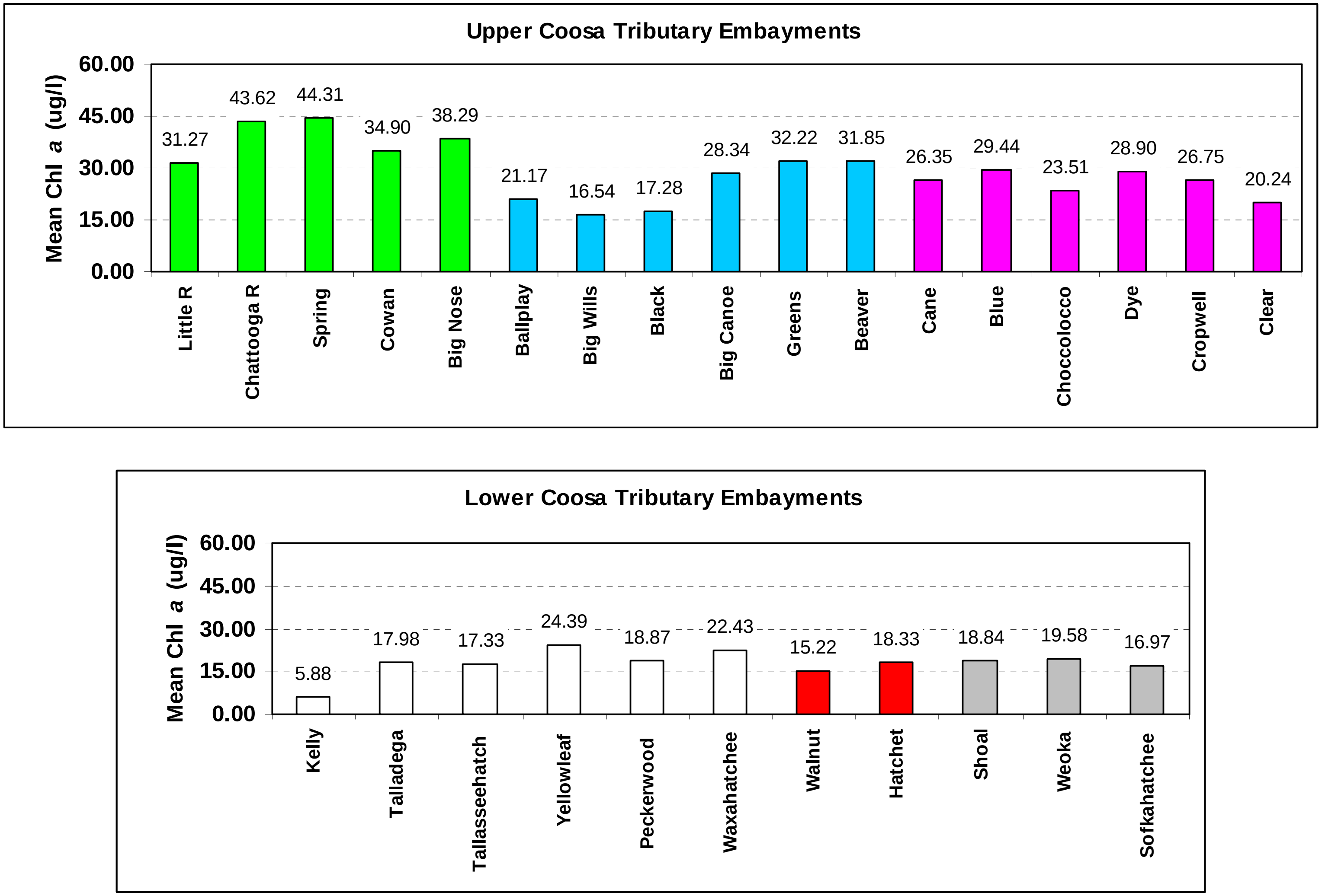


Figure I.13. Mean chlorophyll *a* concentrations of Coosa Tributary Embayment locations, April-August, 2000.

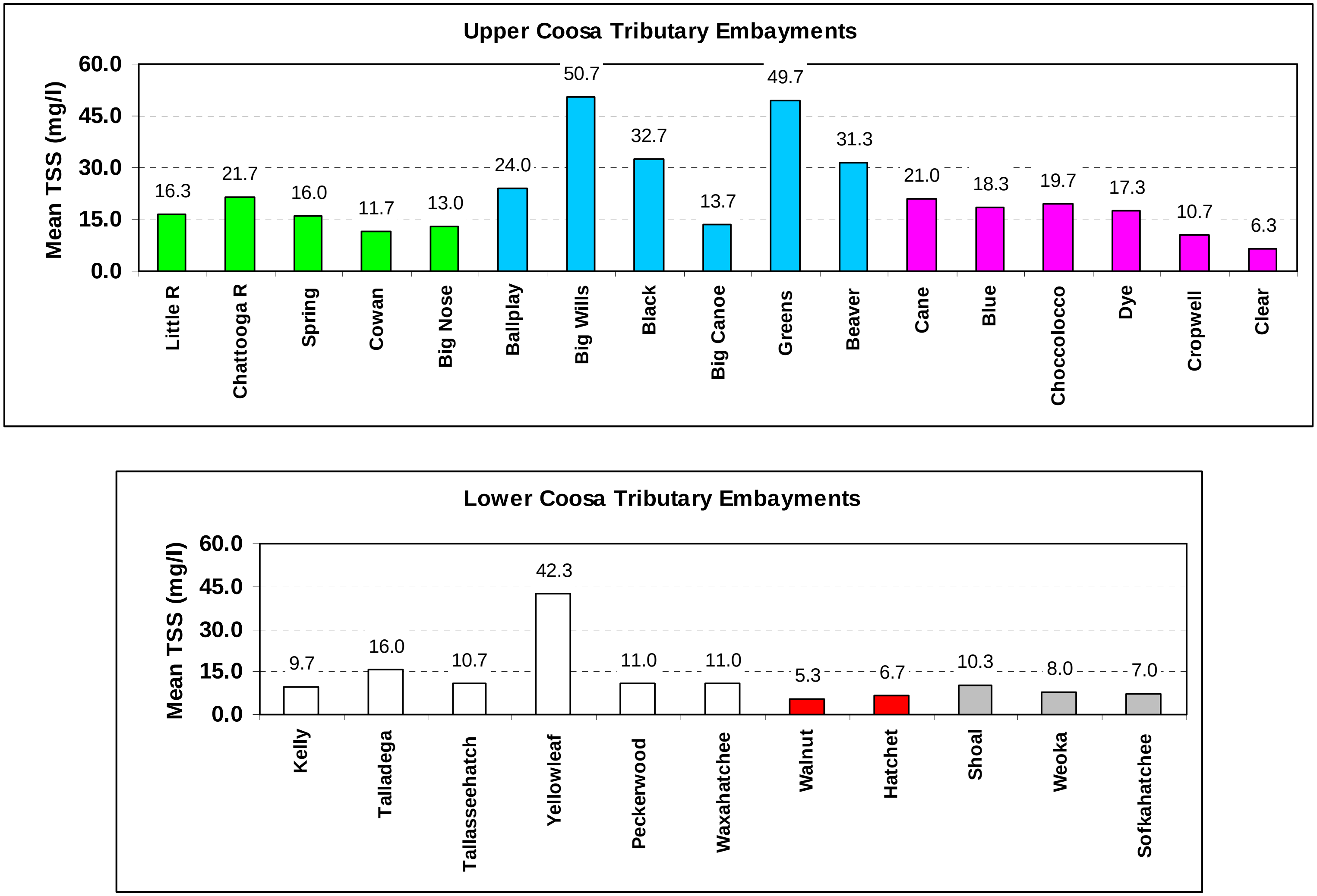


Figure I.14. Mean total suspended solids (TSS) concentrations of Coosa Tributary Embayment locations, April-August, 2000.

Table I.1. Algal growth potential testing (AGPT) of Coosa River reservoirs, August 2000.

Reservoir	Location	Collection Date	Mean MSC (mg/l) C	C+N	C+P	Limiting Nutrient
Weiss	Near Stateline	8/29/00	21.20	**64.45**	21.81	Nitrogen
	Upper	8/29/00	28.32	**66.16**	28.49	Nitrogen
	Mid	8/29/00	5.59	**44.65**	4.66	Nitrogen
	Lower	8/29/00	8.35	**33.22**	7.44	Nitrogen
Neely Henry	Upper	8/24/00	8.10	**30.79**	9.21	Nitrogen
	Mid	8/24/00	3.55	**4.24**	4.15	Co-Limit
	Lower	8/24/00	4.35	**2.58**	4.25	None
Logan Martin	Upper	8/23/00	3.70	**14.64**	2.79	Nitrogen
	Mid	8/23/00	4.23	3.26	4.01	None
	Lower	8/23/00	1.17	**1.13**	**2.87**	Phosphorus
Lay	Upper	8/22/00	5.55	**6.90**	**6.02**	Nitrogen
	Mid	8/22/00	3.04	**4.65**	5.11	Co-Limit
	Lower	8/22/00	2.67	**2.78**	3.32	None
Mitchell	Upper	8/21/00	4.17	**4.17**	3.73	None
	Lower	8/21/00	2.01	**2.01**	**2.68**	None
Jordan	Upper	8/21/00	1.79	**1.79**	2.74	Phosphorus
	Lower	8/21/00	2.41	2.41	**2.98**	Phosphorus

MSC = Maximum Standing Crop

C = Control; C+N = Control + Nitrogen; C+P = Control + Phosphorus

Values in **bold** print are significantly different from control.

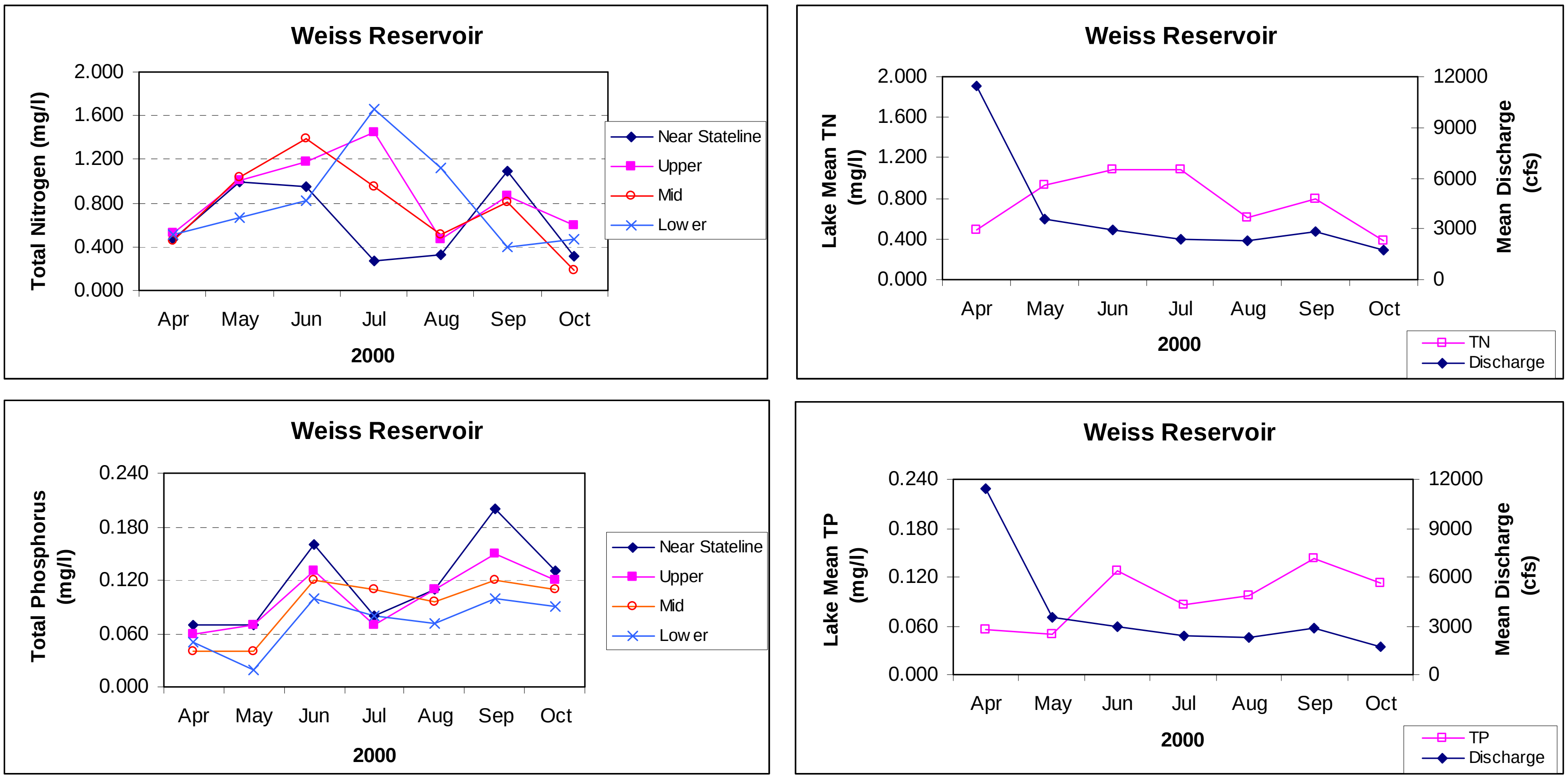


Figure I.15. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), and lake mean TP vs. discharge of Weiss Reservoir, April-October 2000.

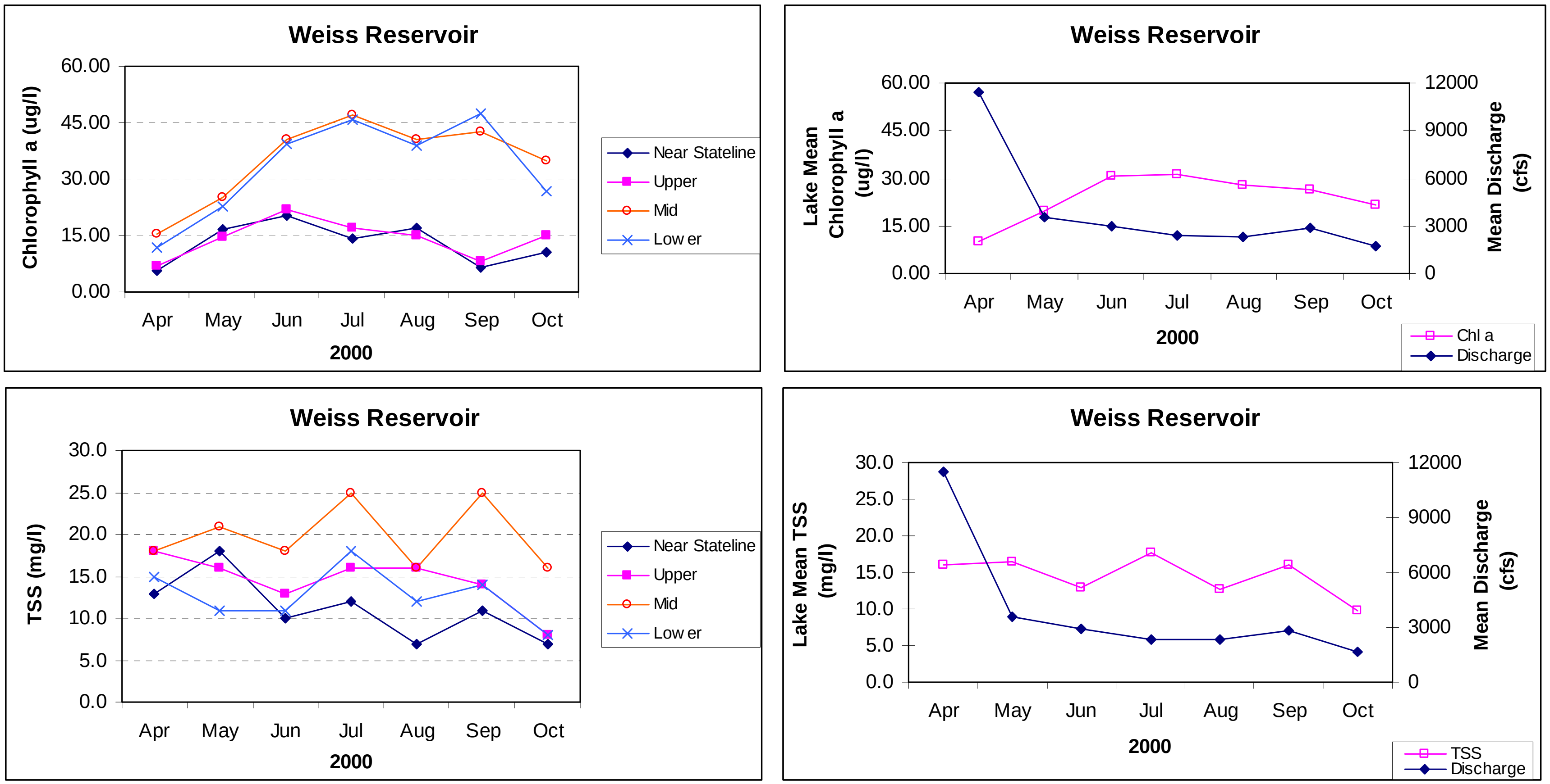


Figure I.16. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Weiss Reservoir, April-October 2000.

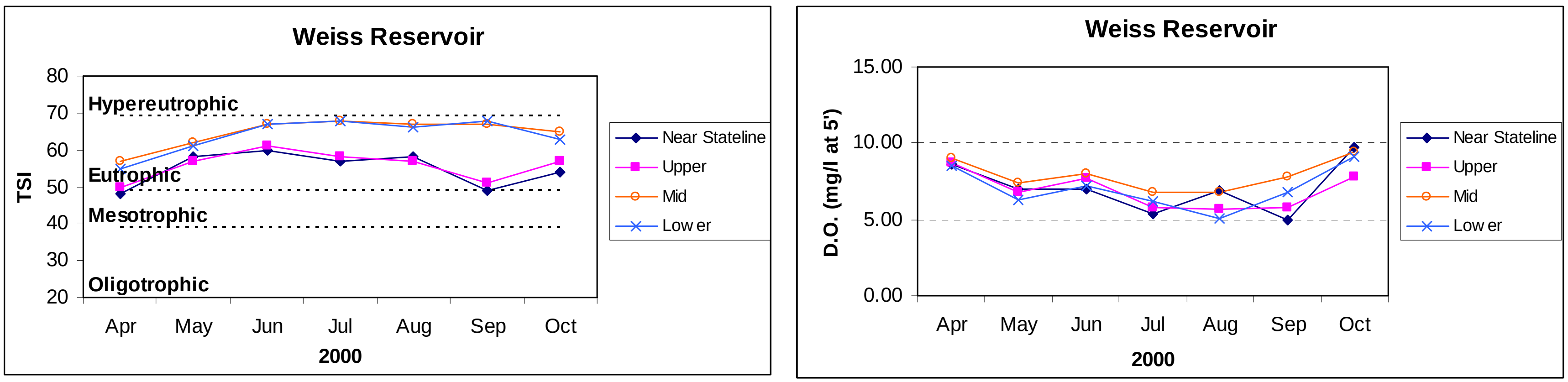


Figure I.17. Trophic state index (TSI), and dissolved oxygen (DO) of Weiss Reservoir, April-October 2000.

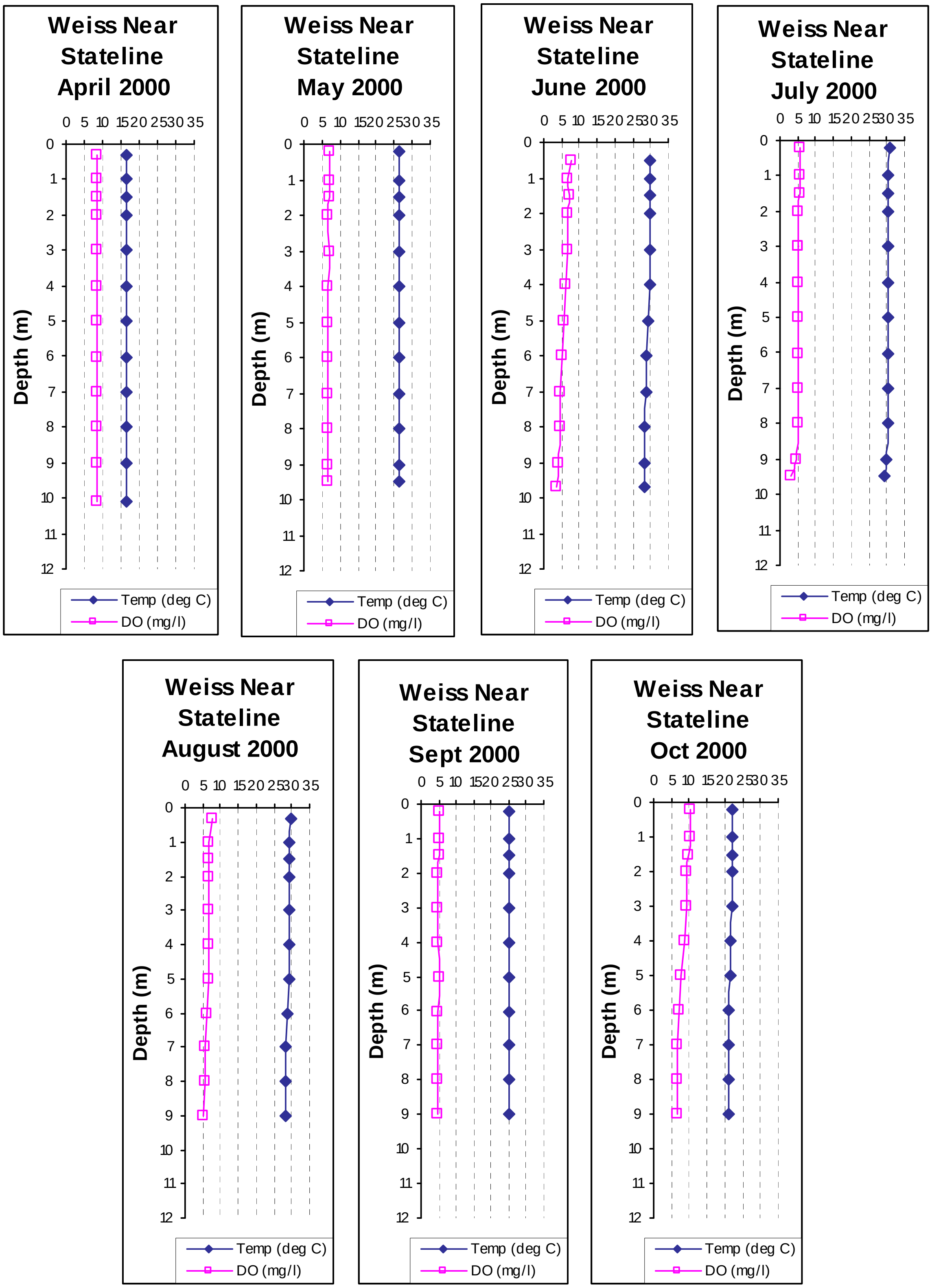


Figure I.18. Depth profiles of dissolved oxygen (DO) and temperature (Temp) near the stateline in Weiss Reservoir, April-October 2000.

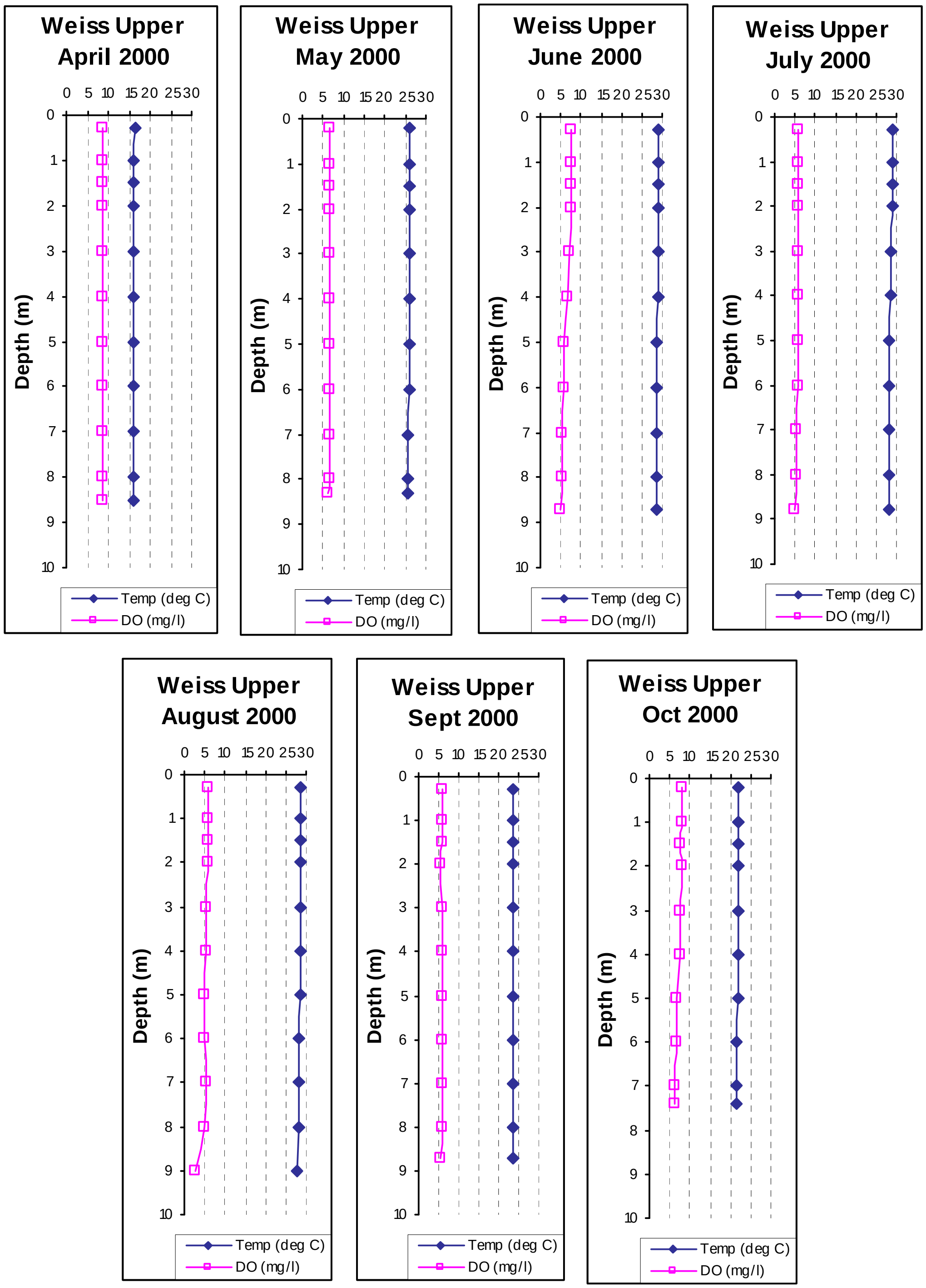


Figure I.19. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Weiss Reservoir, April-October 2000.

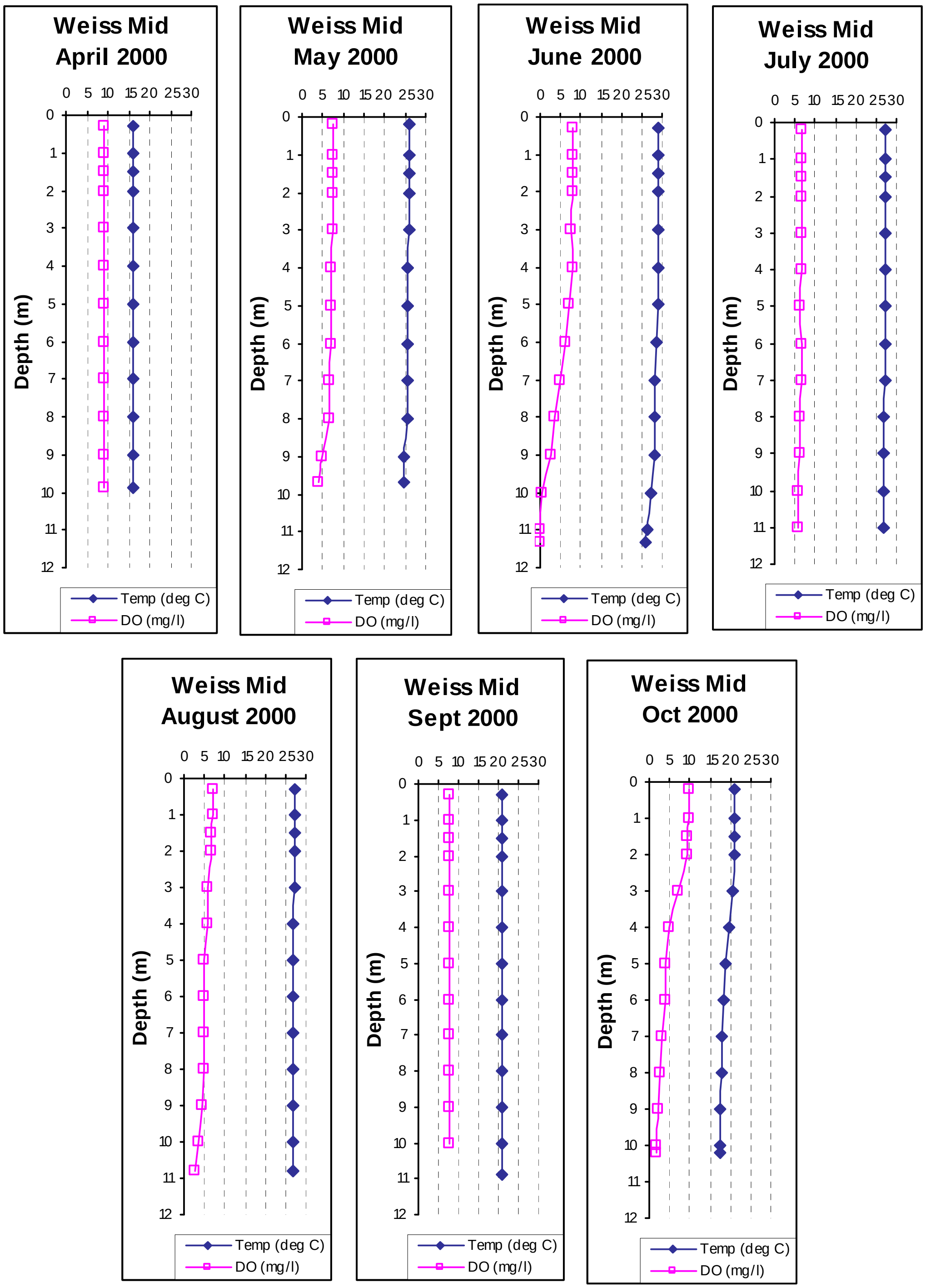


Figure I.20. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Weiss Reservoir, April-October 2000.

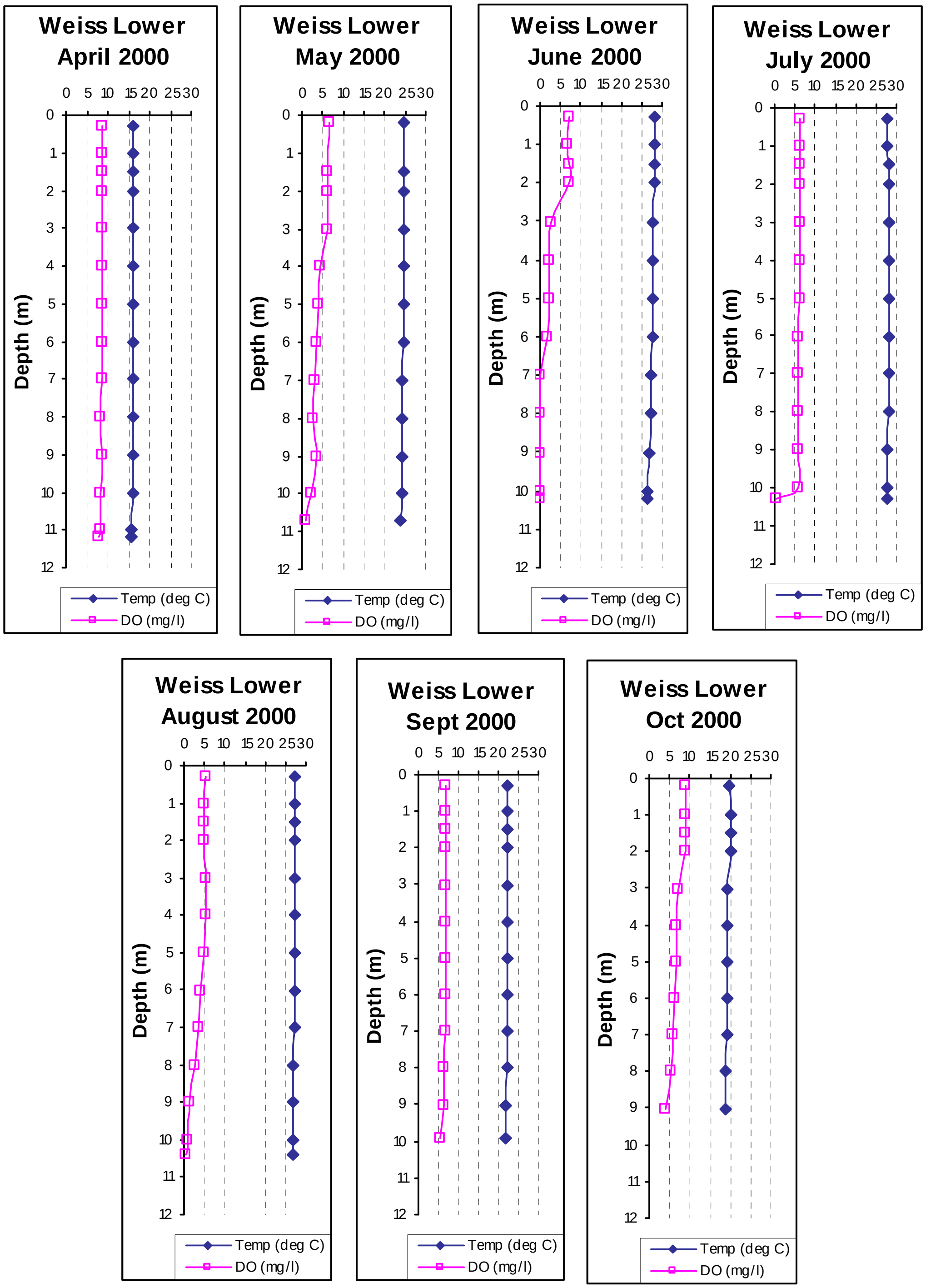


Figure I.21. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Weiss Reservoir, April-October 2000.

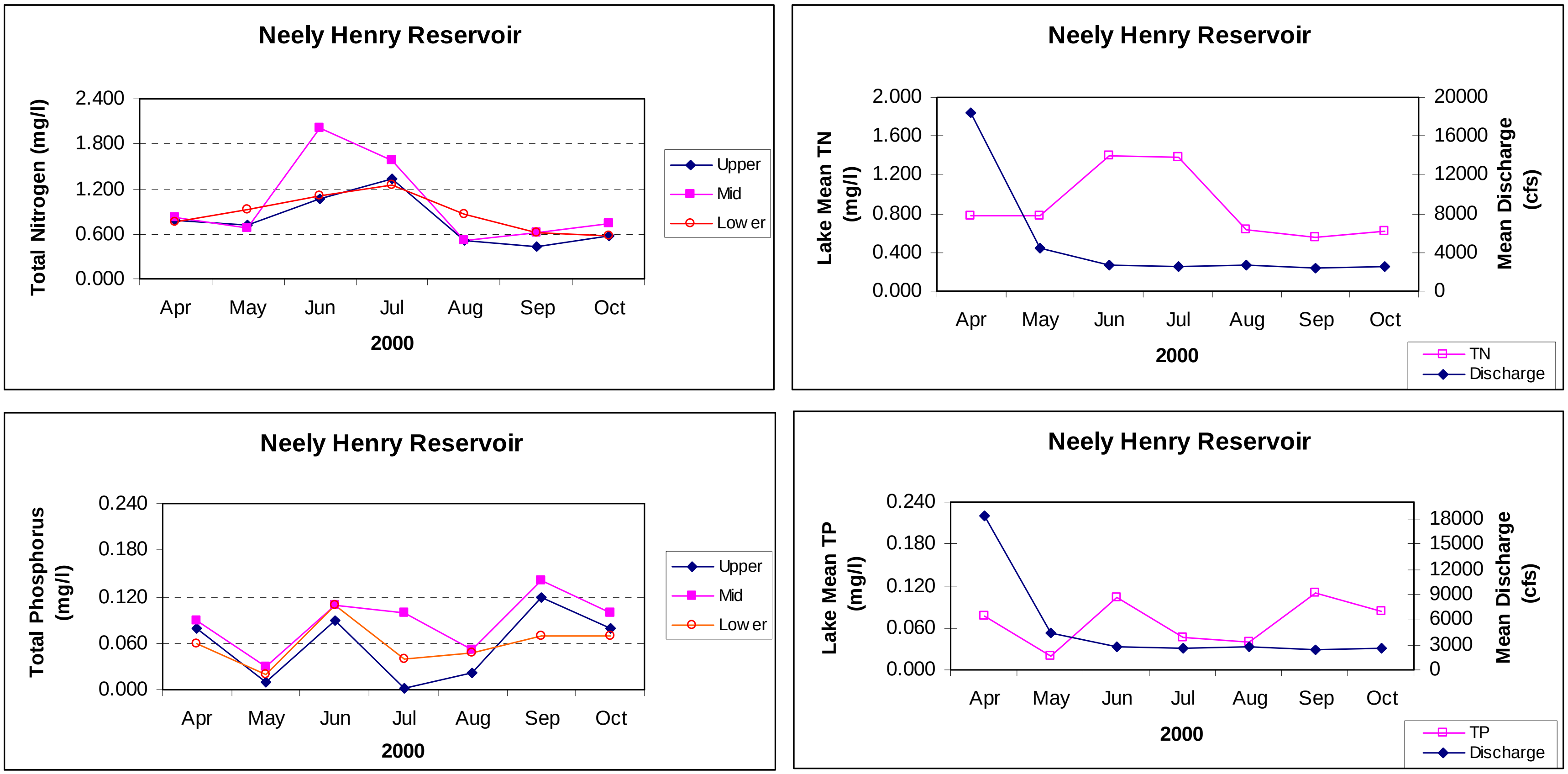


Figure I.22. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), and lake mean TP vs. discharge for Neely Henry Reservoir, April-October 2000.

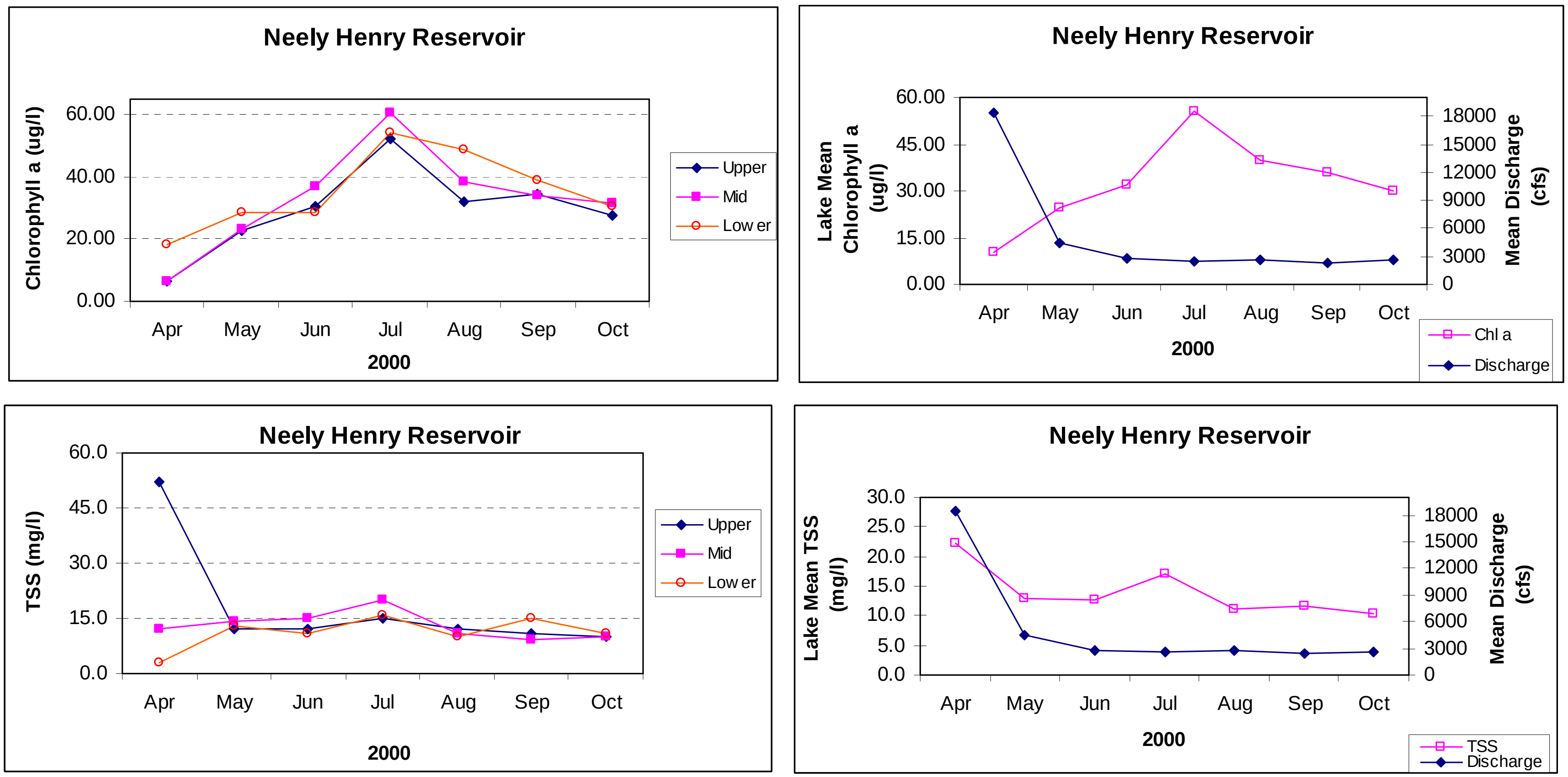
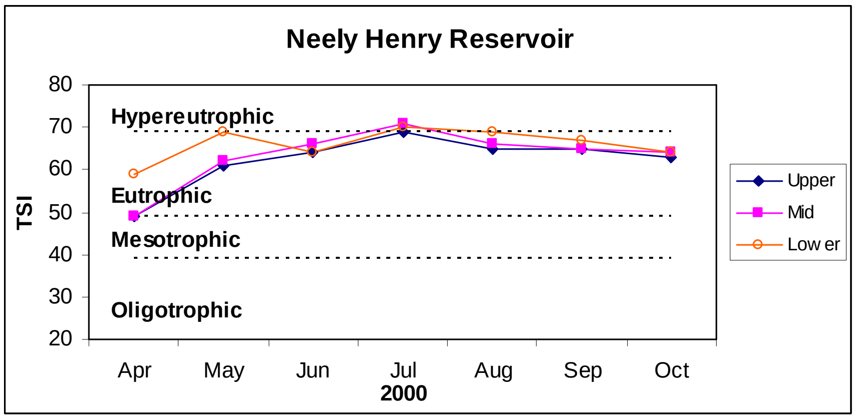


Figure I.23. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge for Neely Henry Reservoir, April-October 2000.



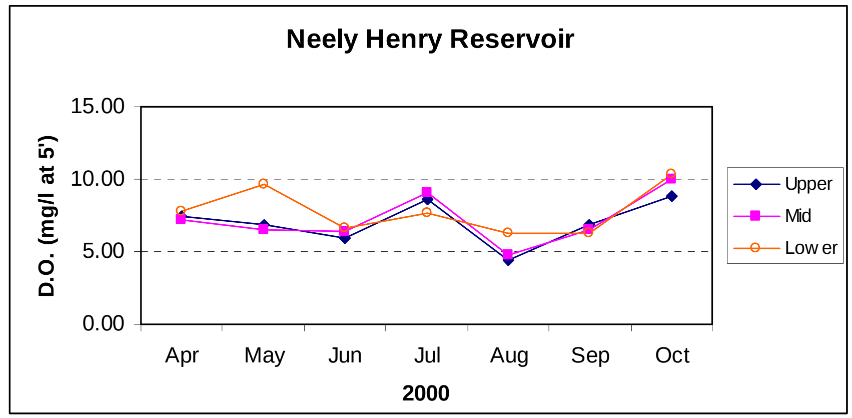


Figure I.24. Trophic state index (TSI), and dissolved oxygen (DO) of Neely-Henry Reservoir, April-October 2000

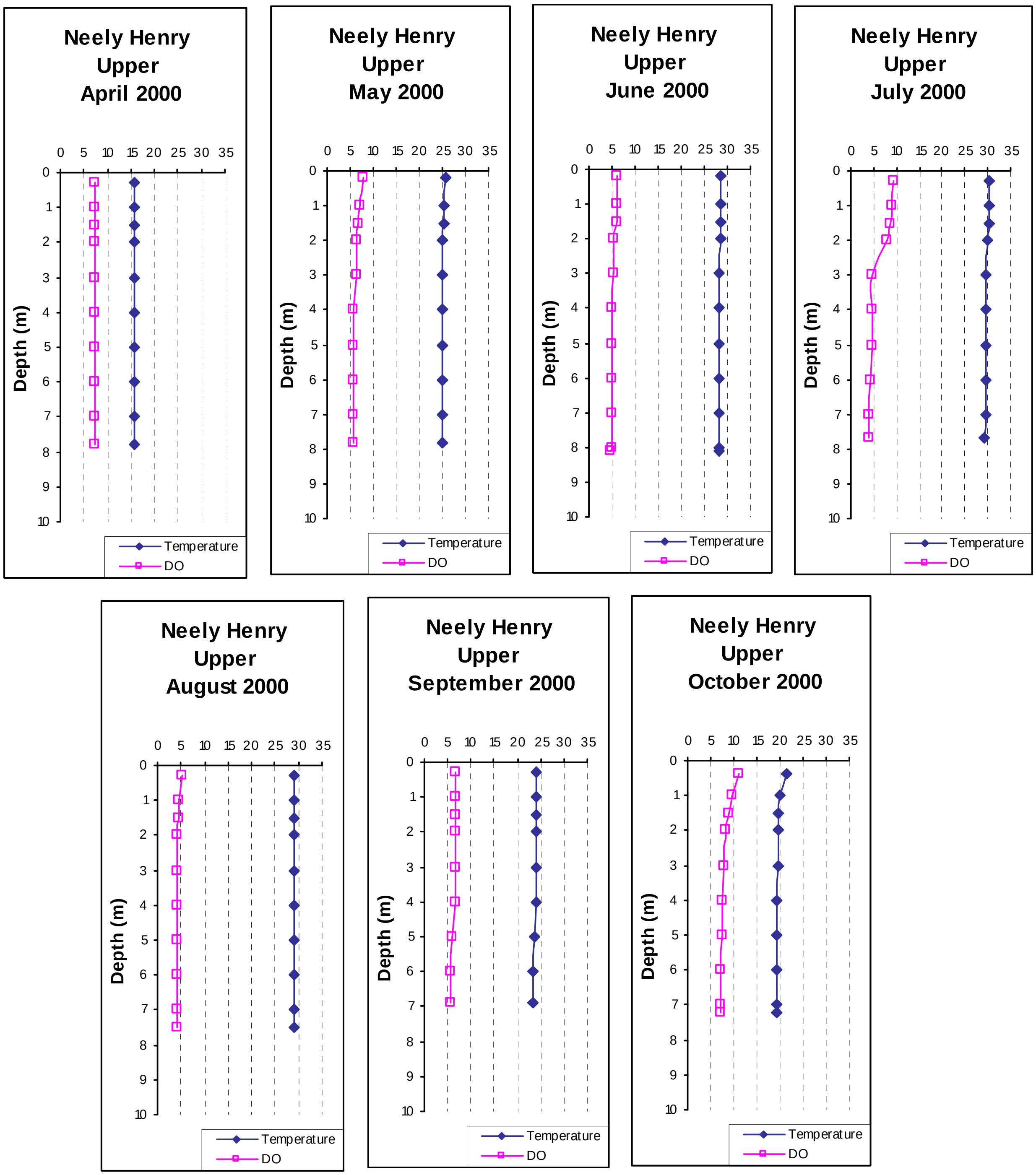


Figure I.25. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Neely-Henry Reservoir, April-October 2000.

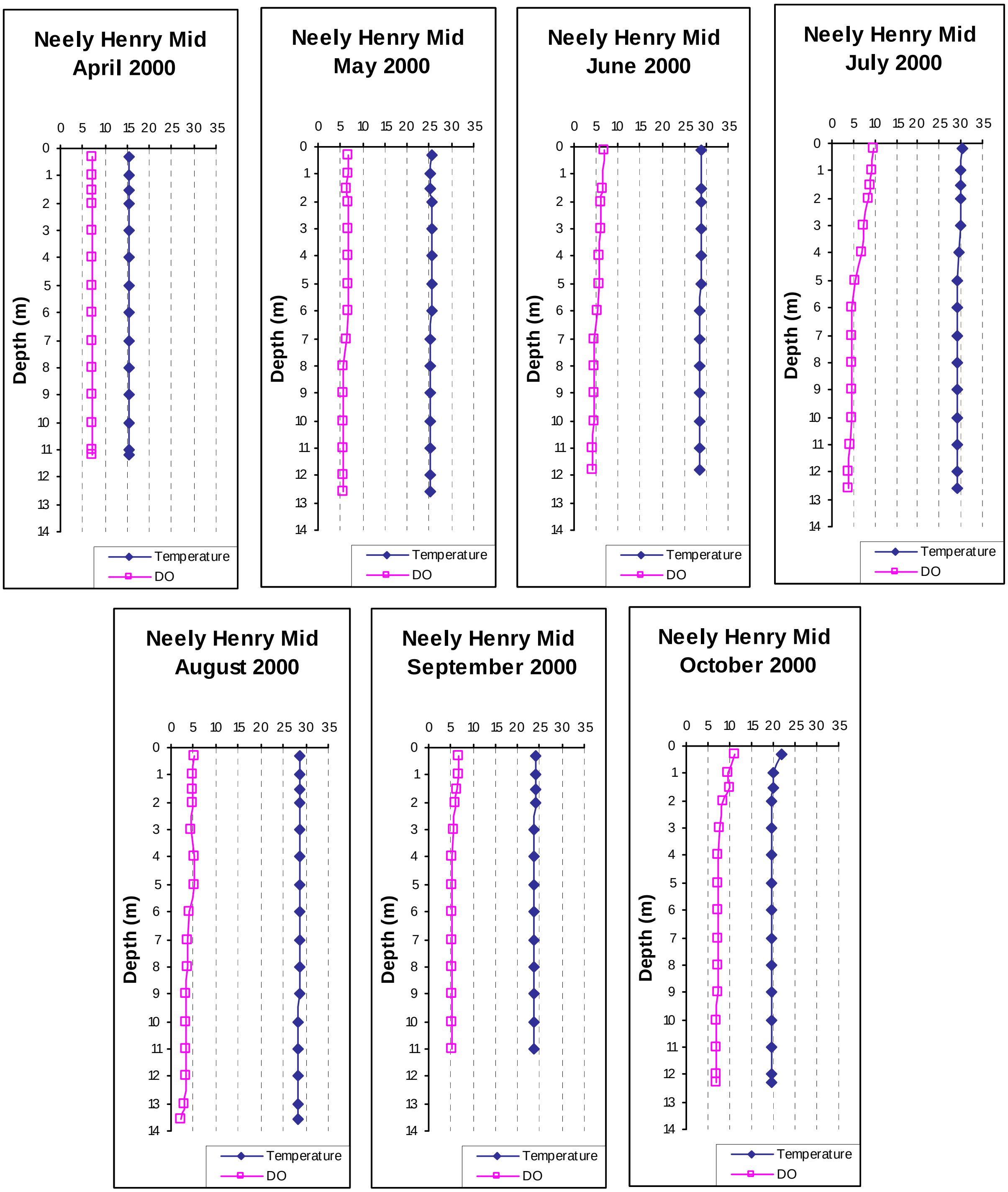


Figure I.26. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Neely-Henry Reservoir, April-October 2000.

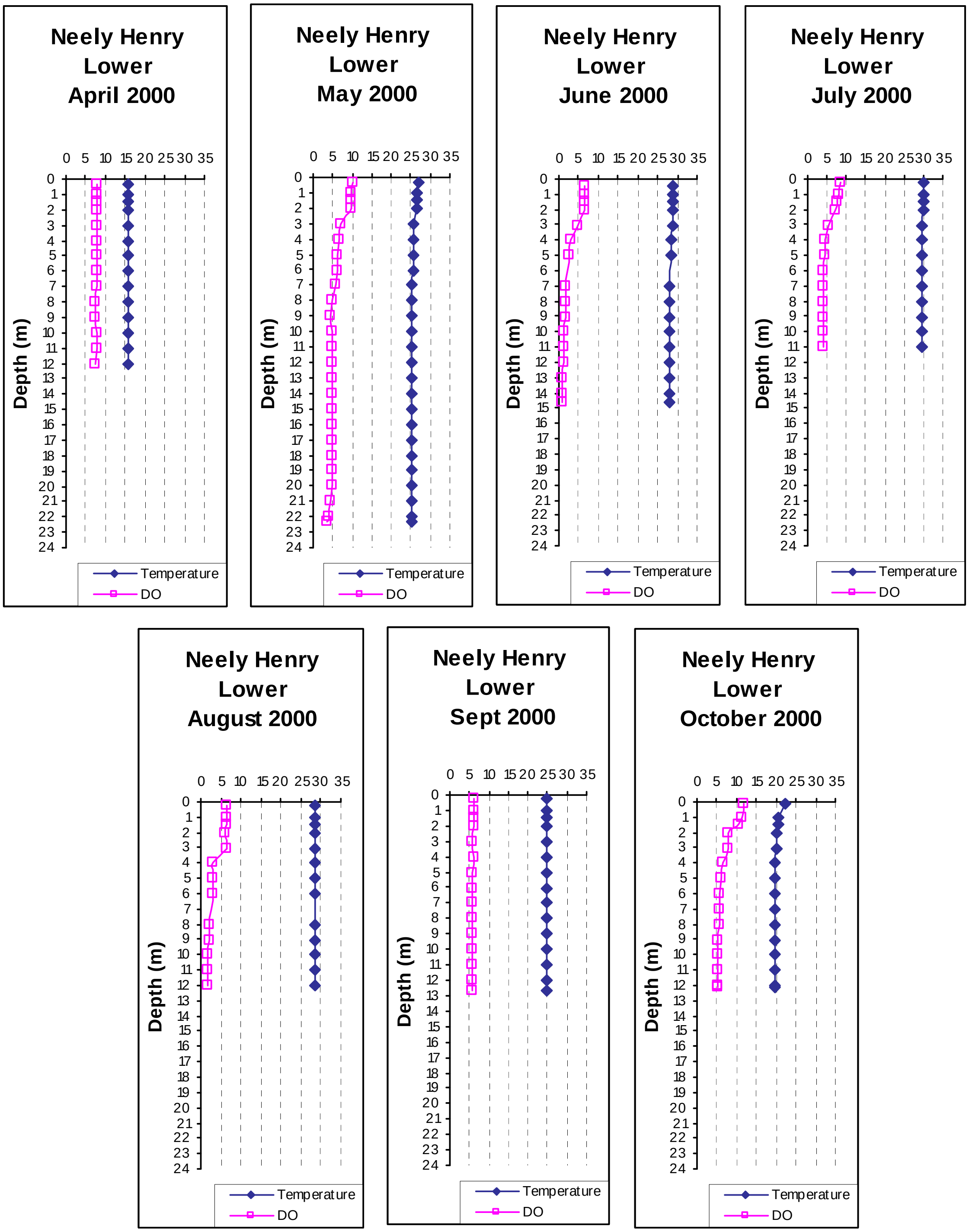


Figure I.27. Depth profiles of dissolved oxygen (DO) and temperature (Temp) of the dam forebay of Neely Henry Reservoir, April-October 2000.

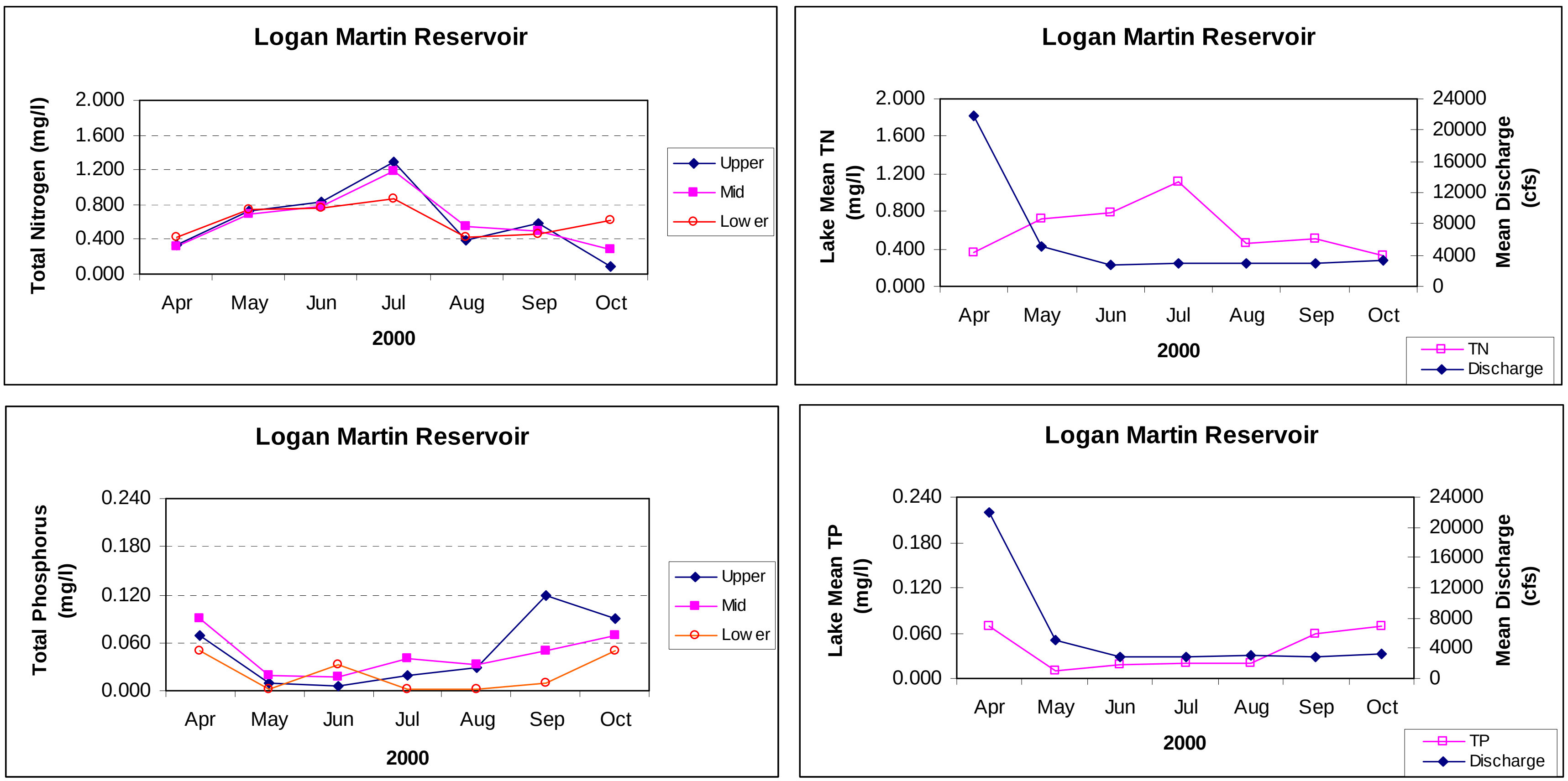


Figure I.28. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), and lake mean TP vs. discharge of Logan Martin Reservoir, April-October 2000.

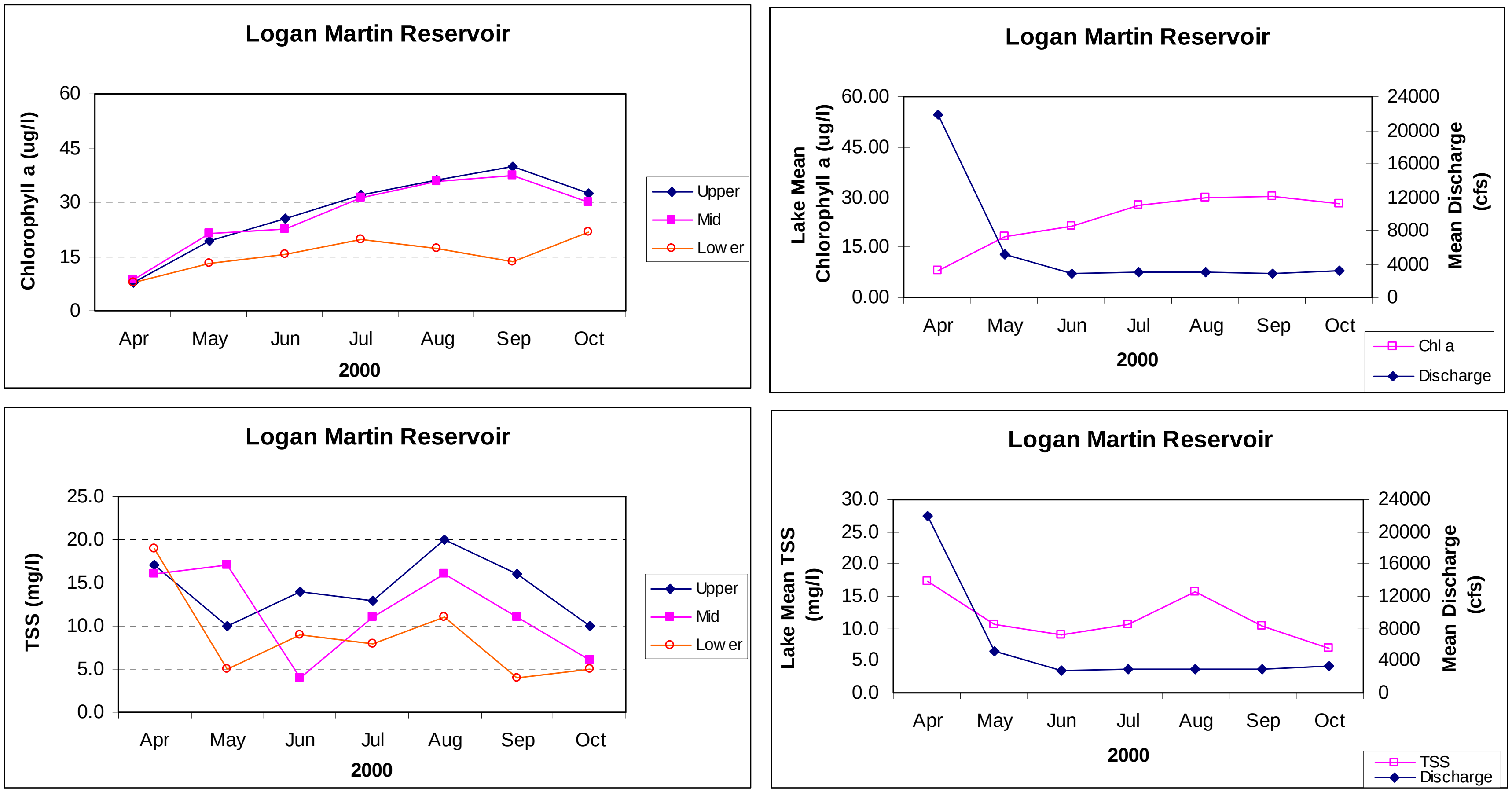
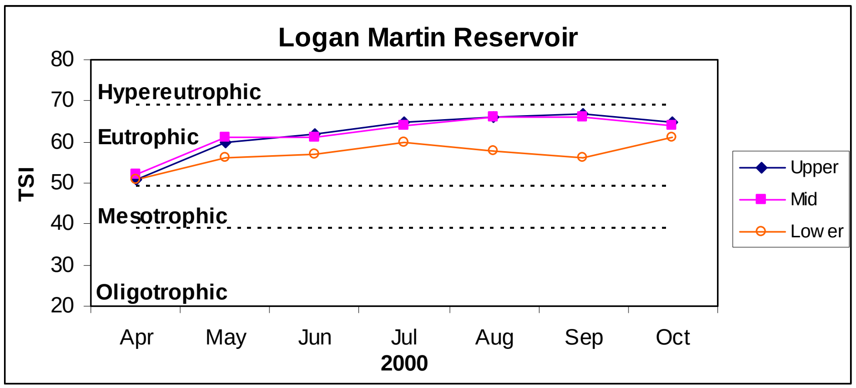


Figure I.29. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge total suspended solids (TSS), and TSS vs. discharge of Logan Martin Reservoir, April-October 2000.



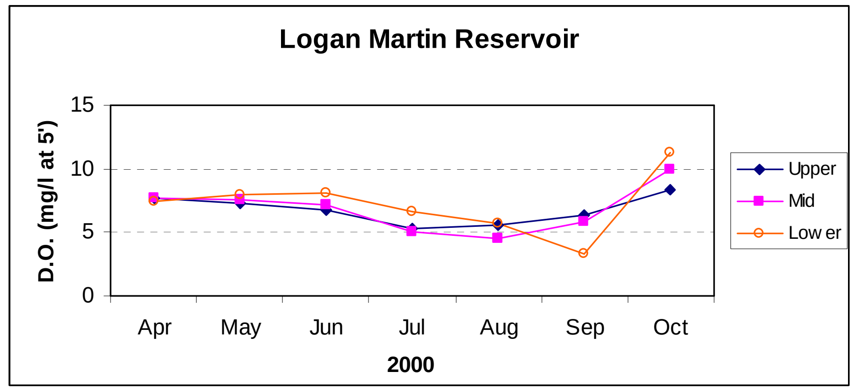


Figure I.30. Trophic state index (TSI), and dissolved oxygen (DO) of Logan-Martin Reservoir, April-October 2000.

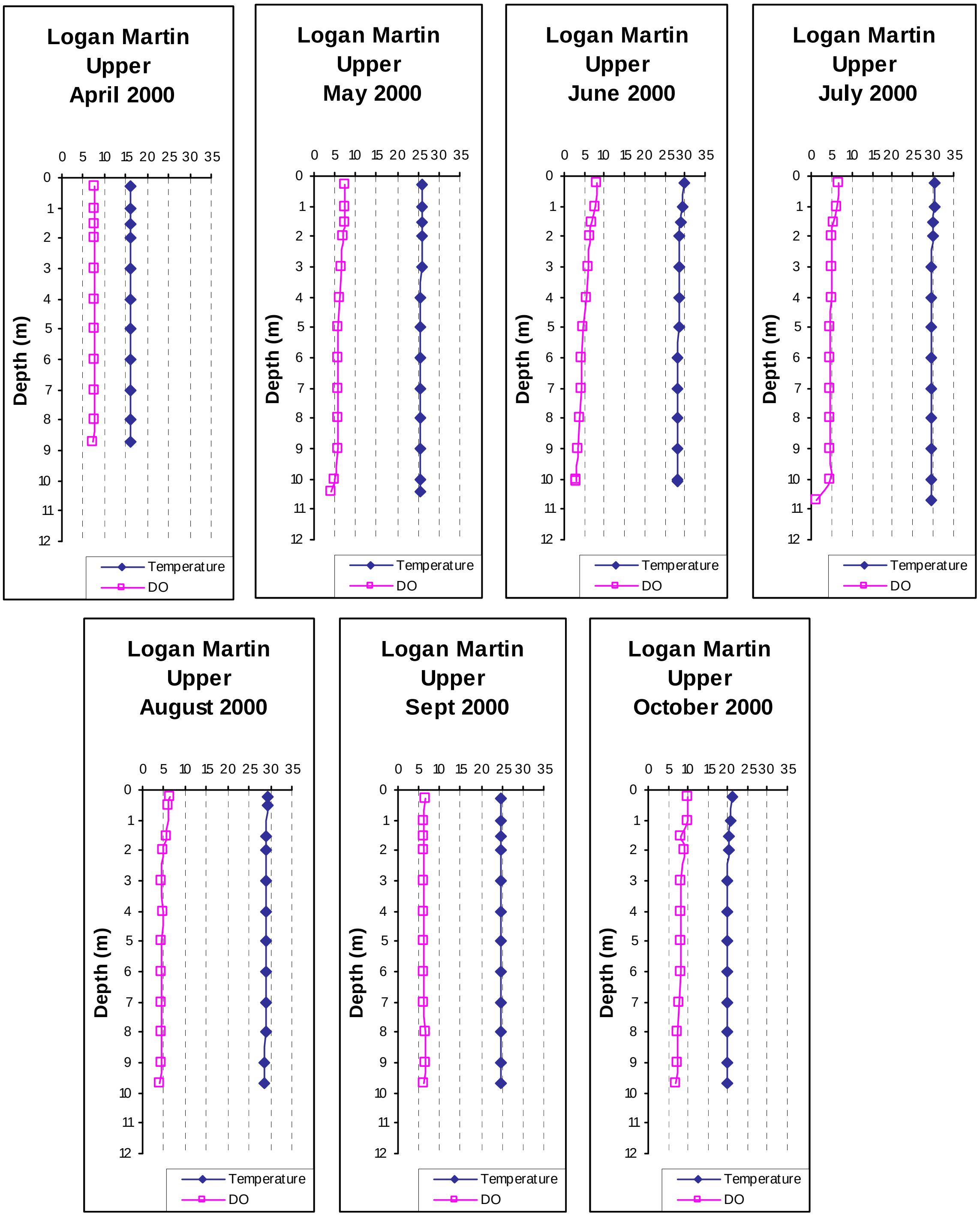


Figure I.31. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Logan-Martin Reservoir, April-October 2000.

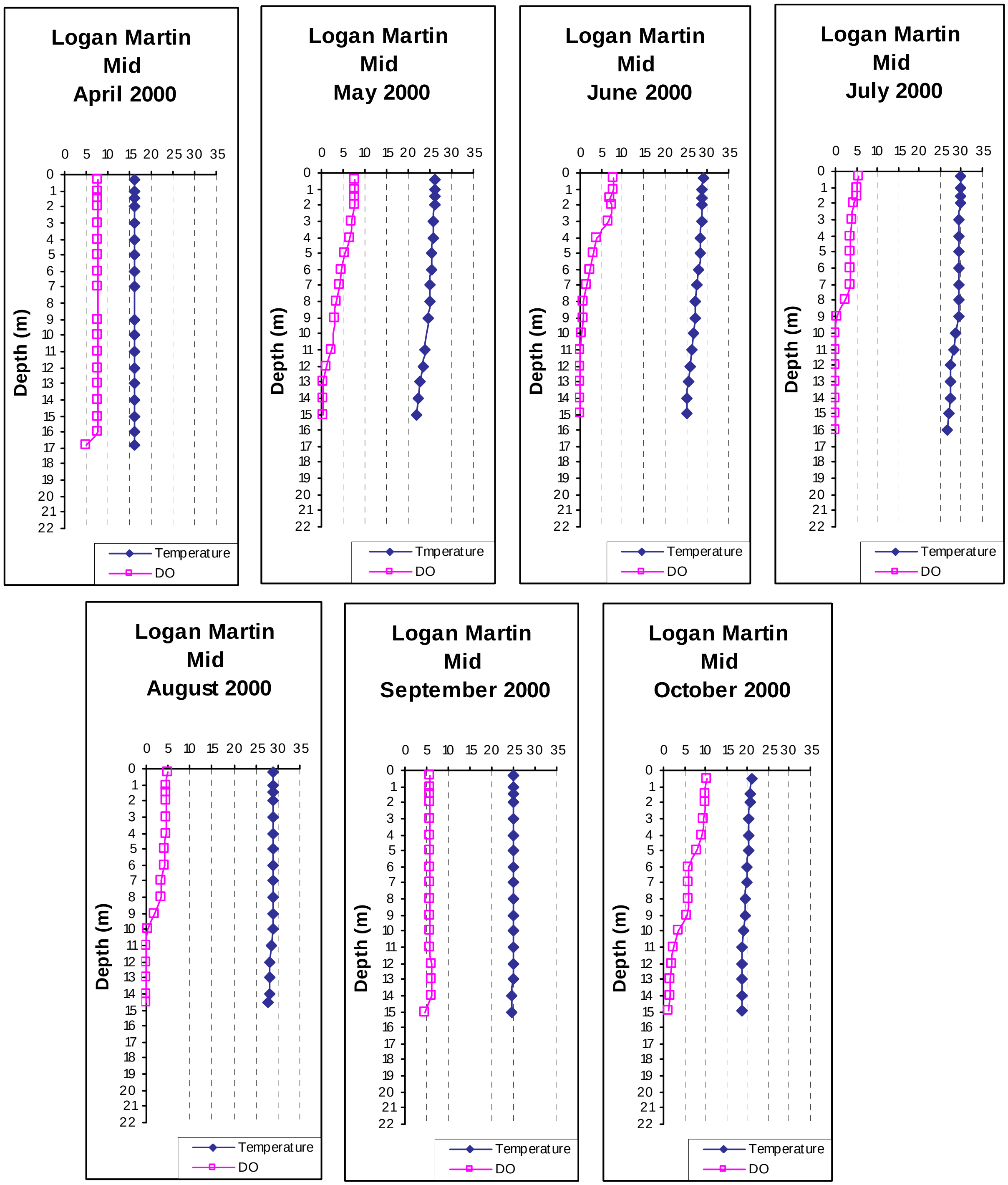


Figure I.32. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Logan-Martin Reservoir, April-October 2000.

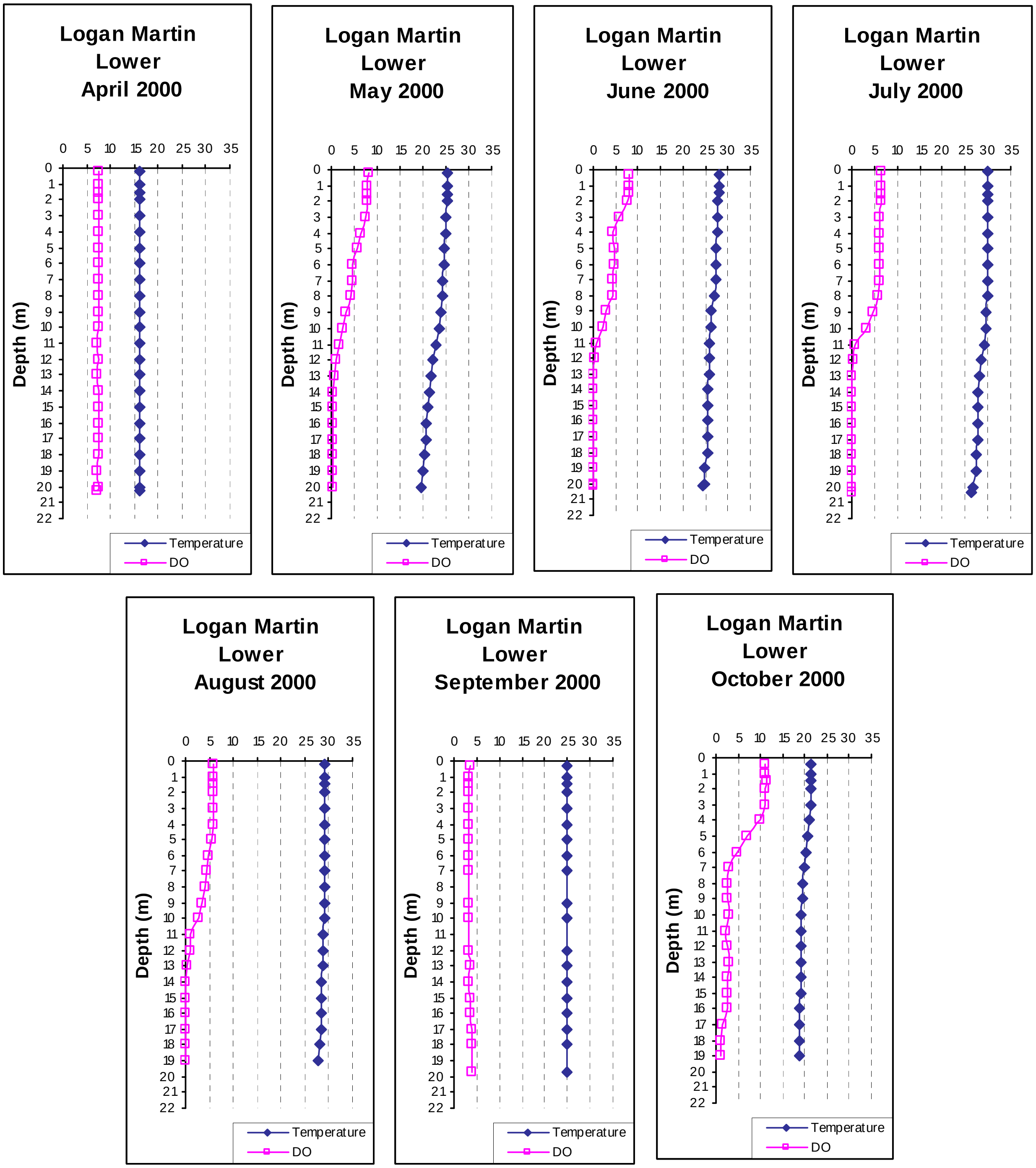


Figure I.33. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Logan Martin Reservoir, April-October 2000.

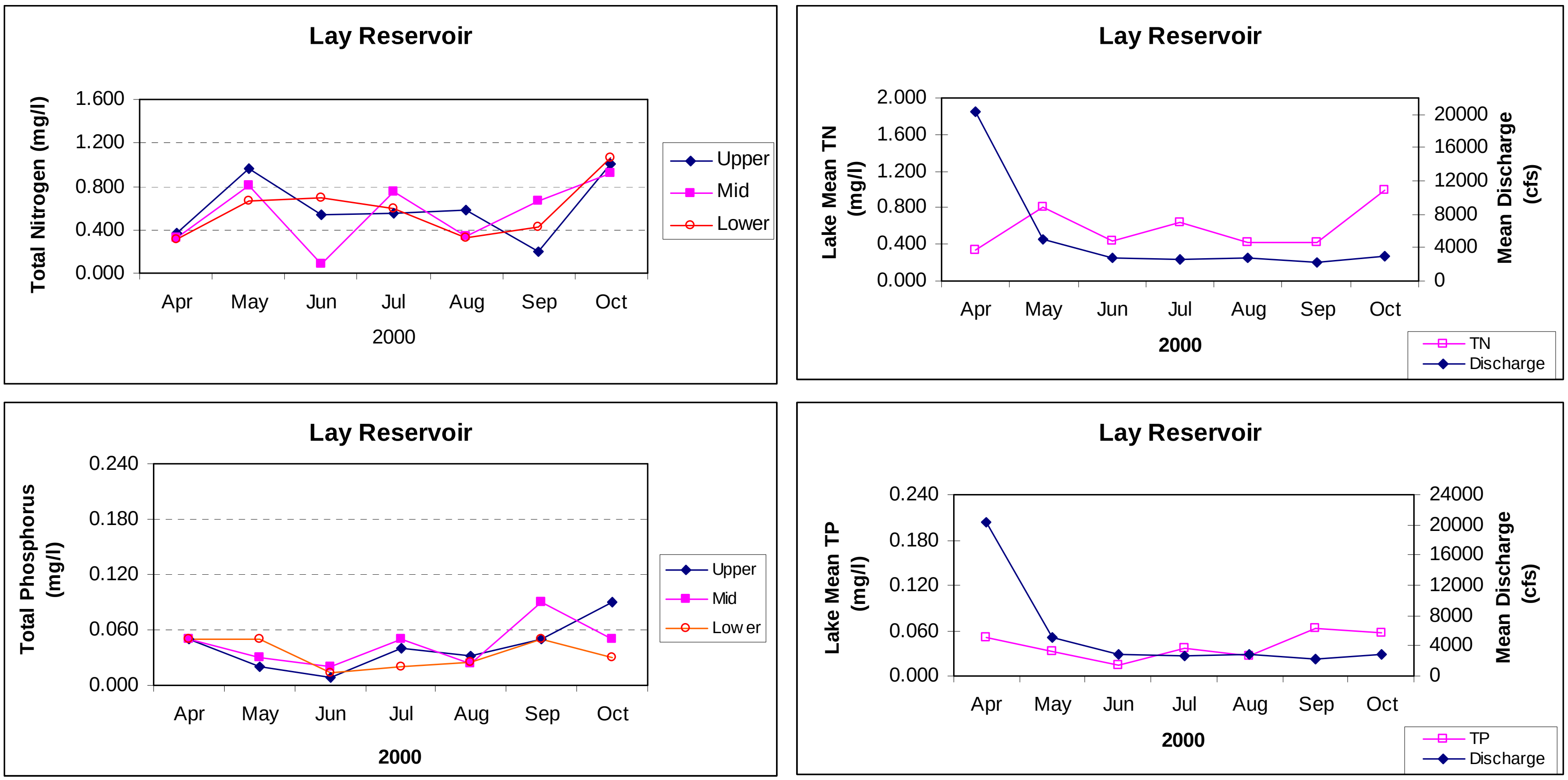


Figure I.34. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Lay Reservoir, April-October 2000.

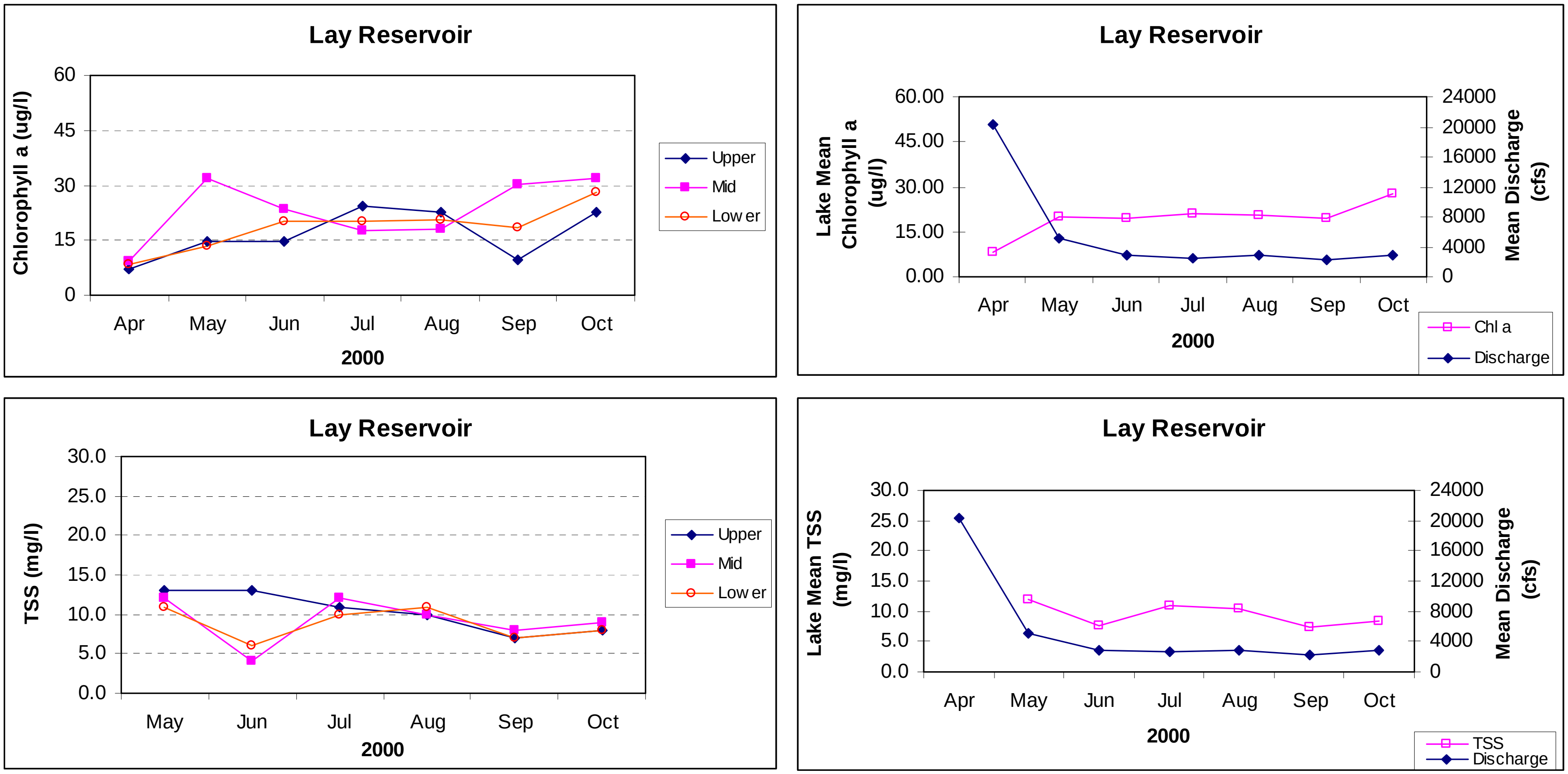


Figure I.35. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Lay Reservoir, April-October 2000.

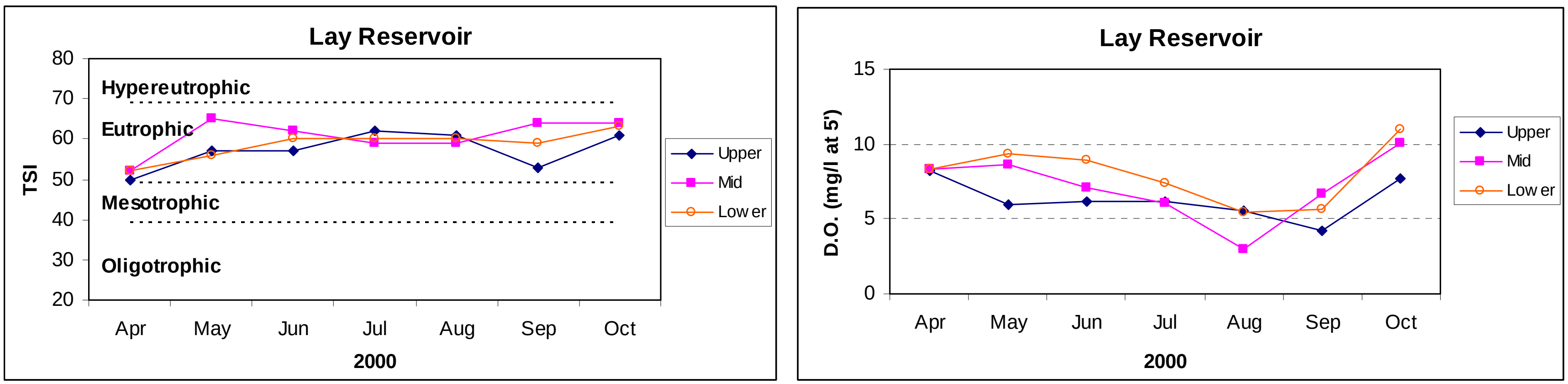


Figure I.36. Trophic state index (TSI), and dissolved oxygen (DO) of Lay Reservoir, April-October 2000.

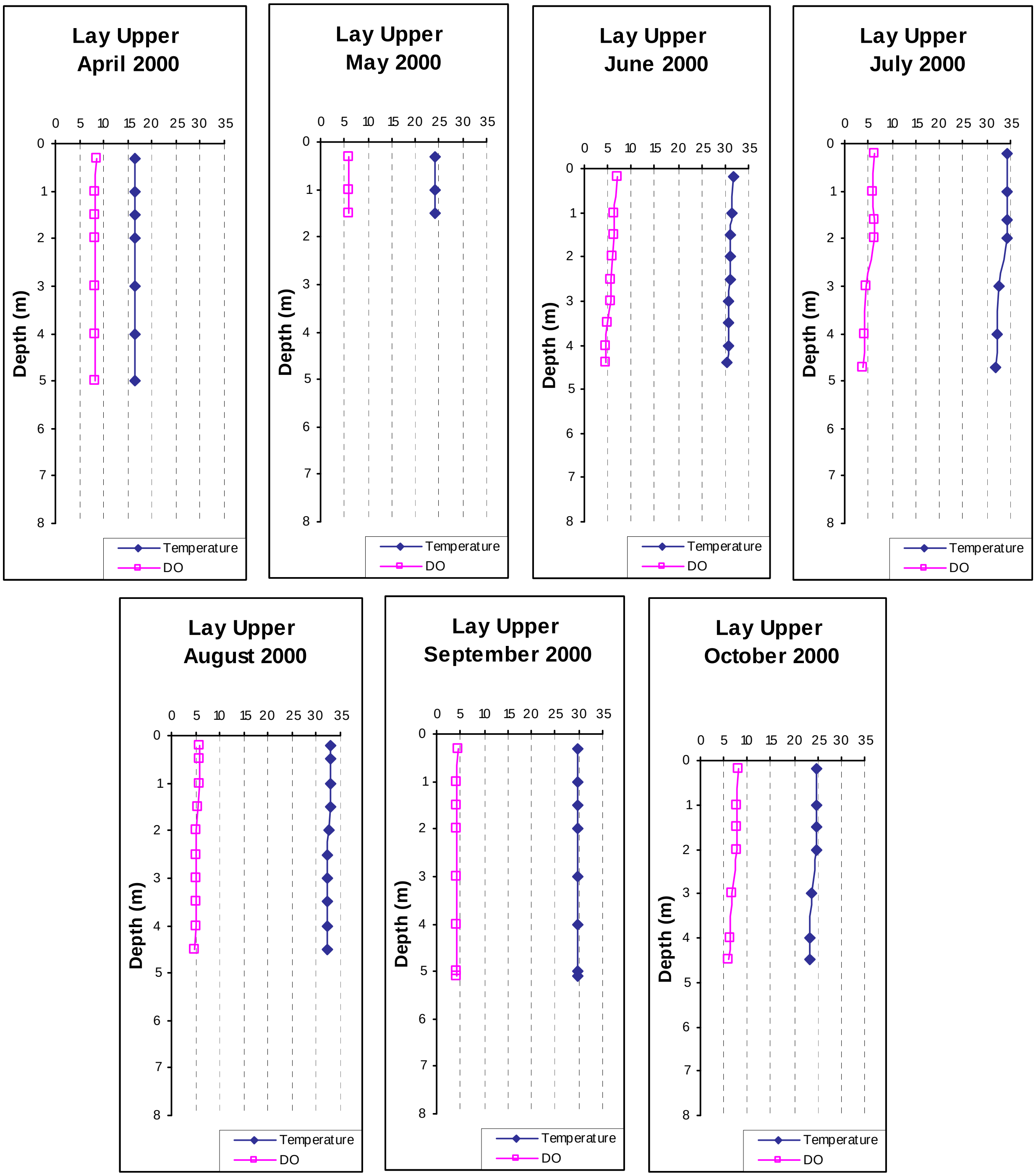


Figure I.37. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Lay Reservoir, April-October 2000.

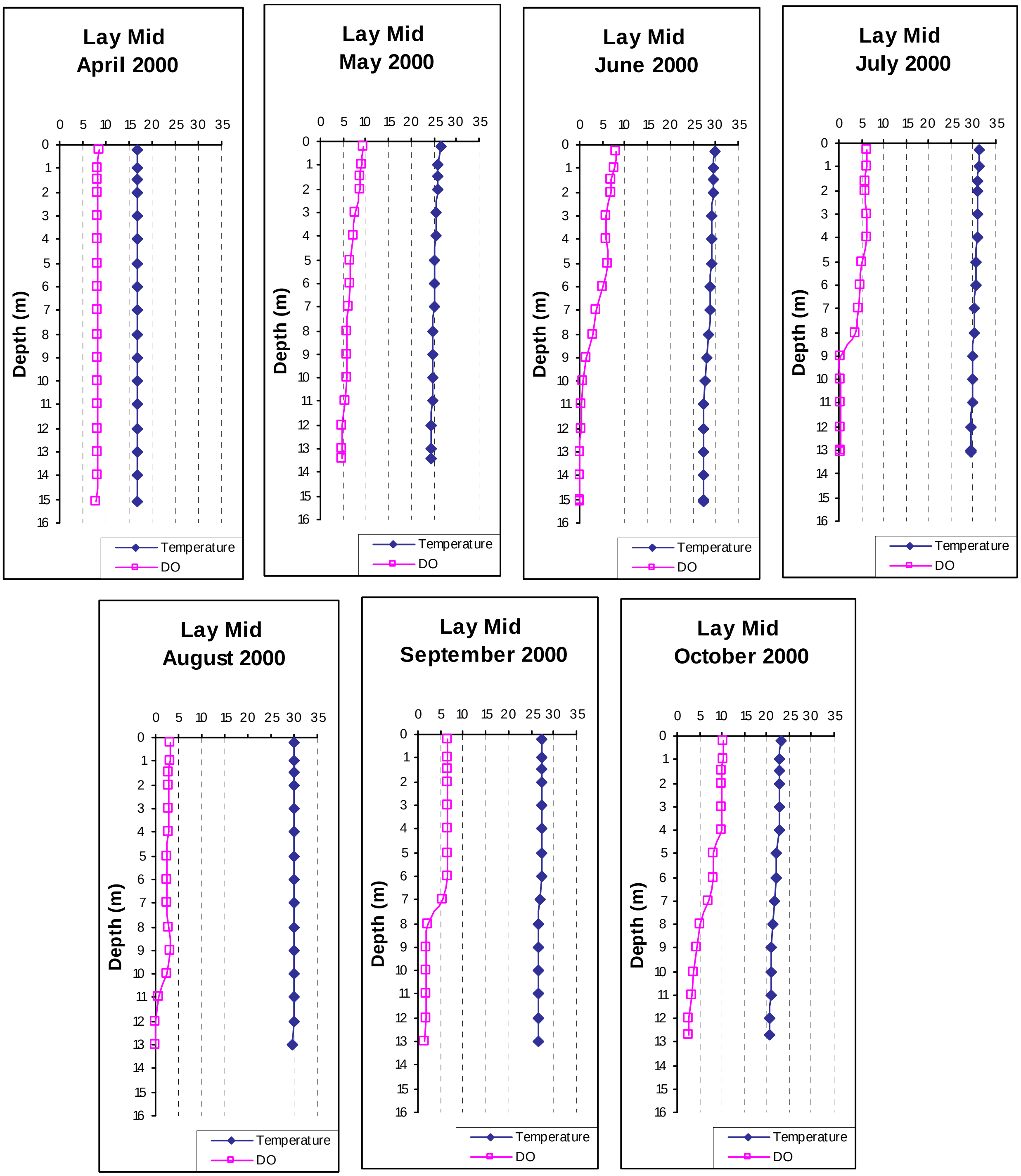


Figure I.38. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Lay Reservoir, April-October 2000.

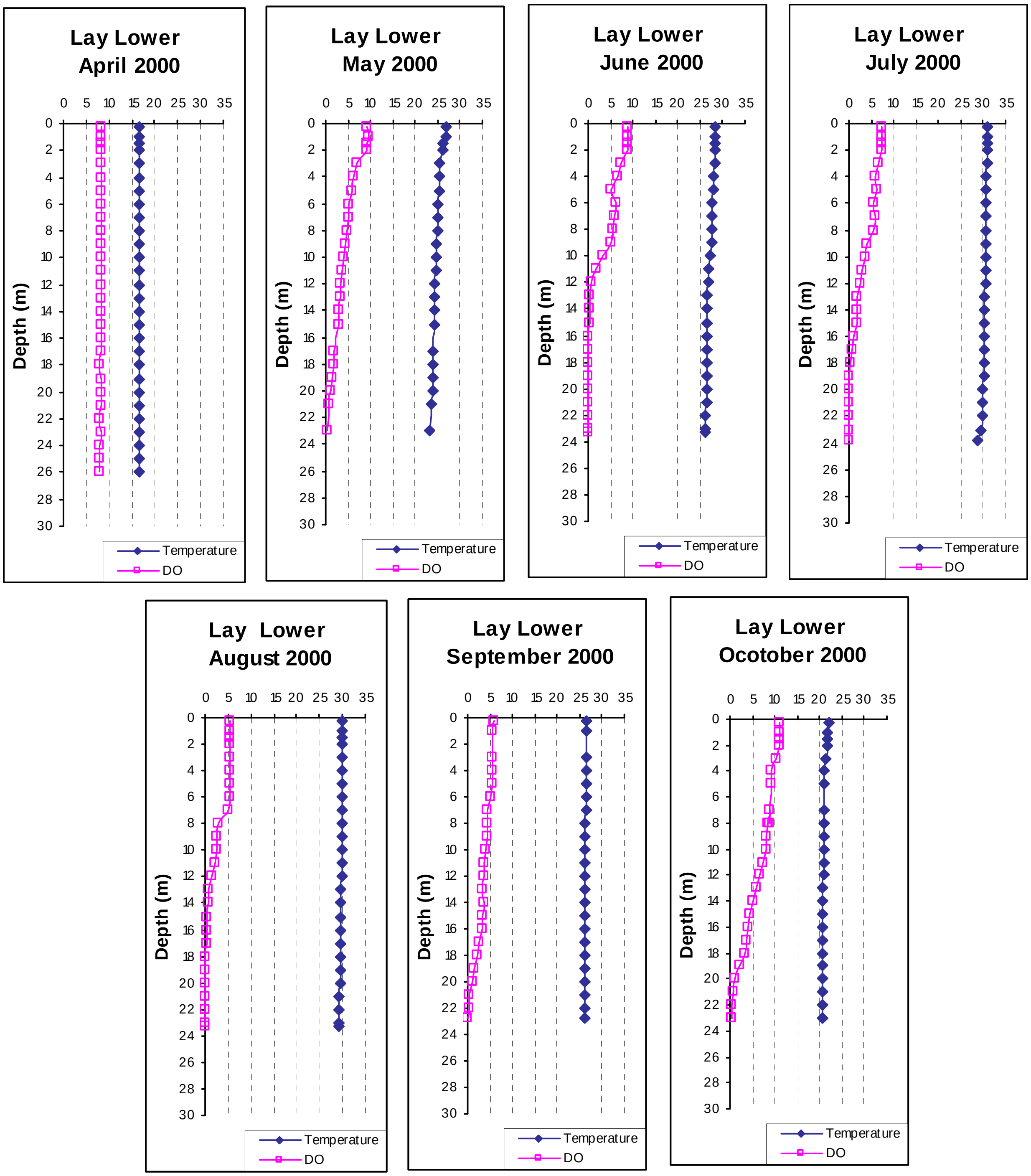


Figure I.39. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Lay Reservoir, April-October 2000.

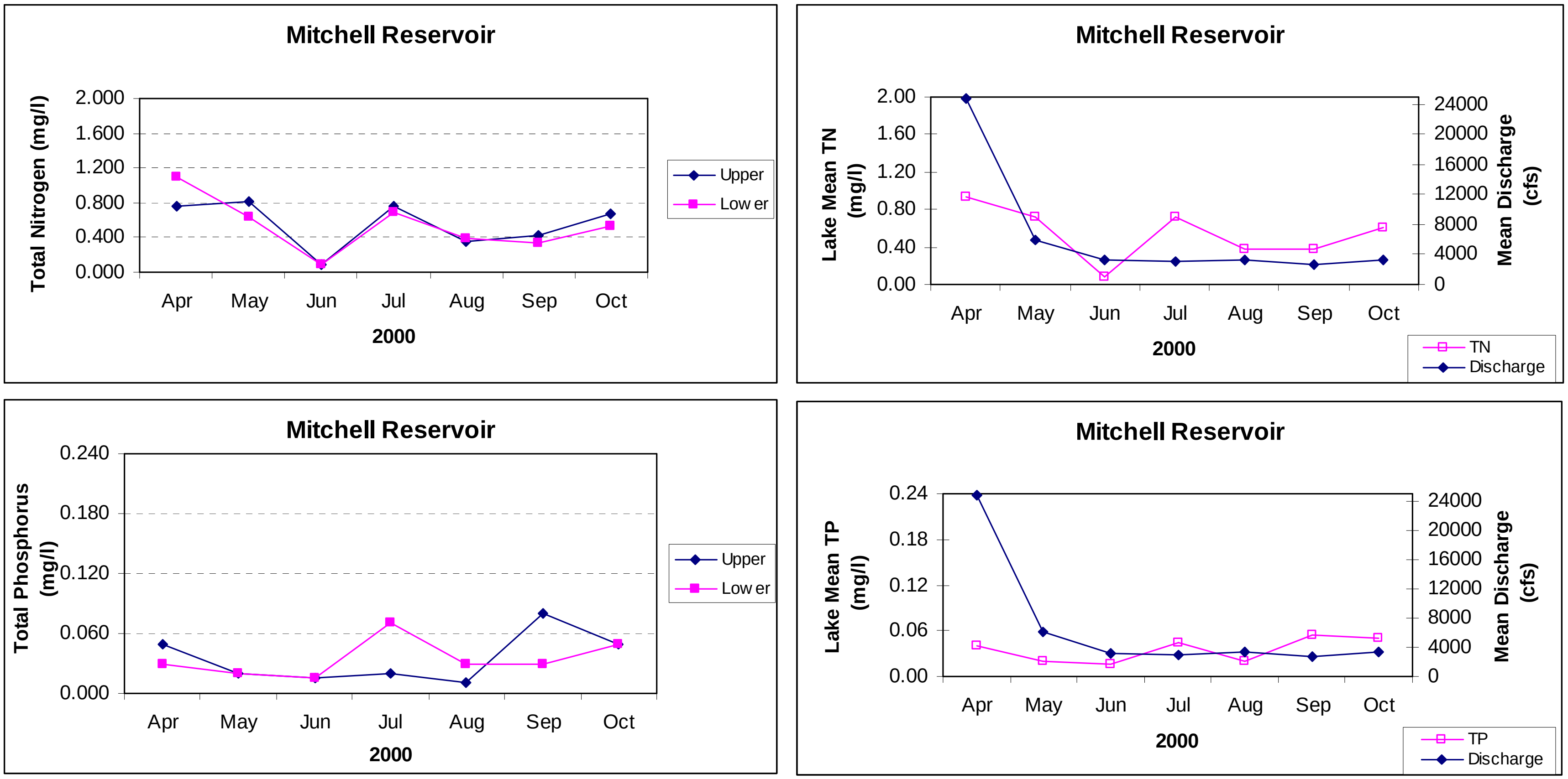


Figure I.40. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), and lake mean TP vs. discharge of Mitchell Reservoir, April-October 2000.

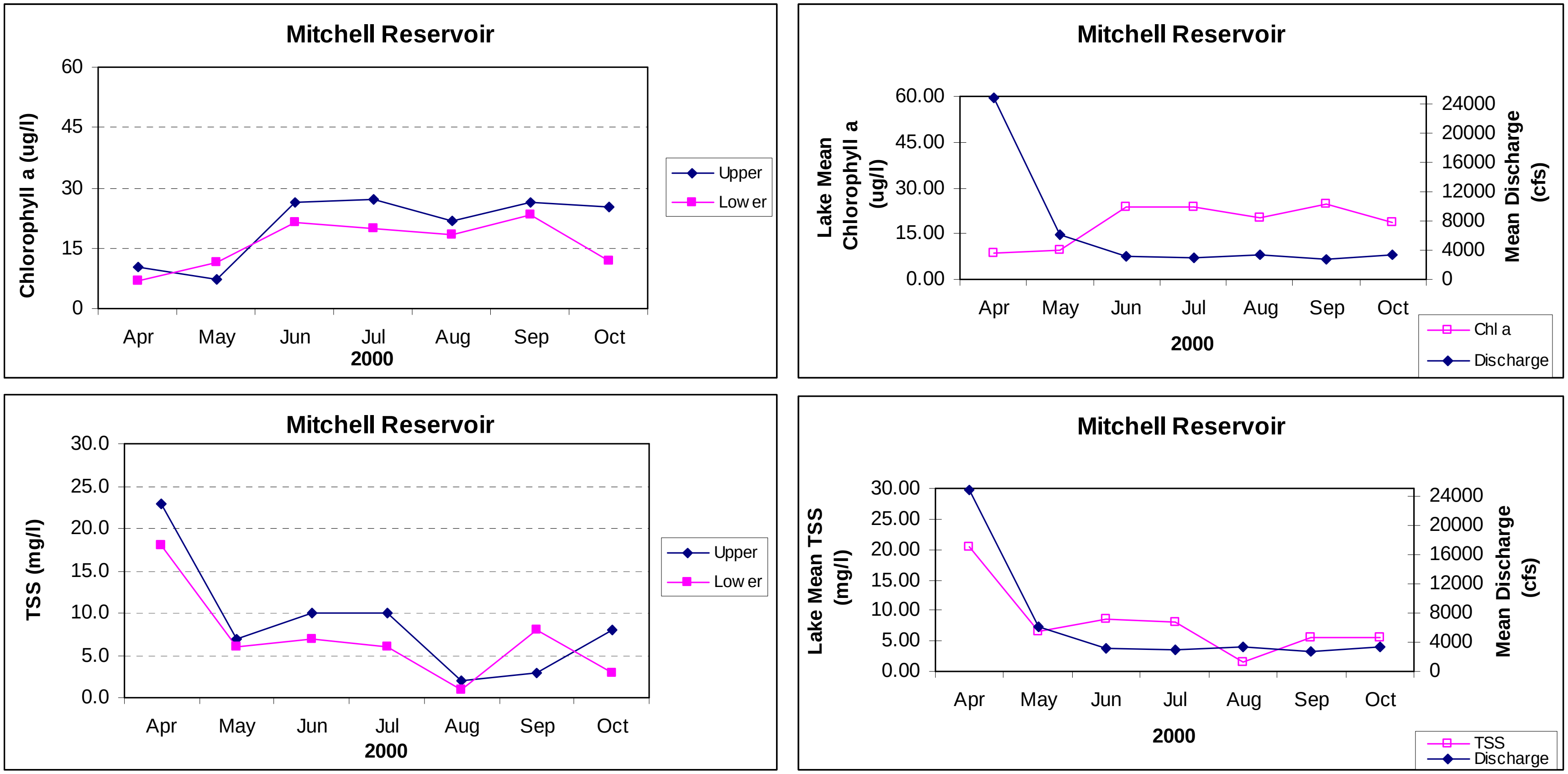


Figure I.41. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Mitchell Reservoir, April-October 2000.

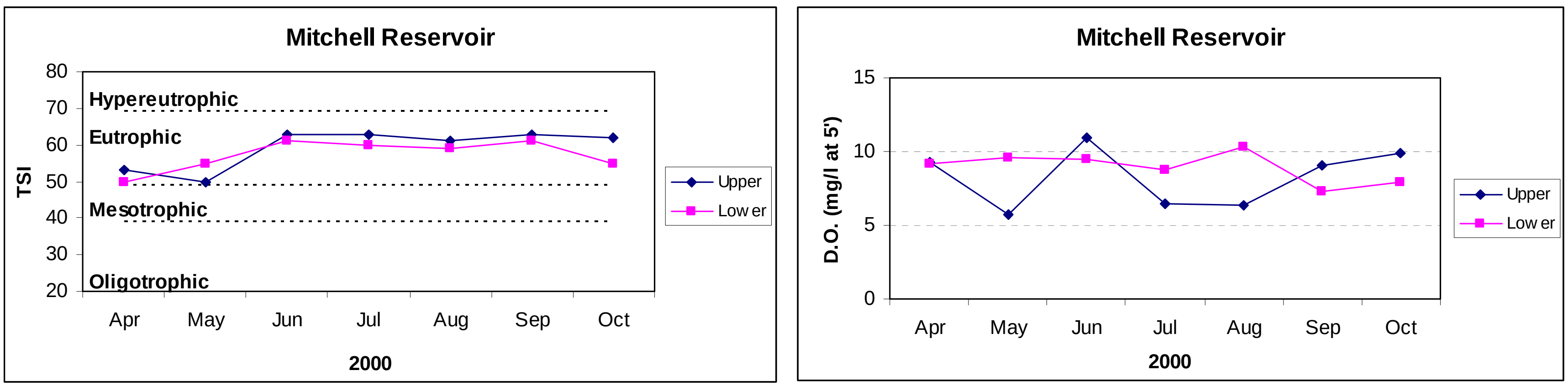


Figure I.42. Trophic state index (TSI), and dissolved oxygen (DO) of Mitchell Reservoir, April-October 2000.

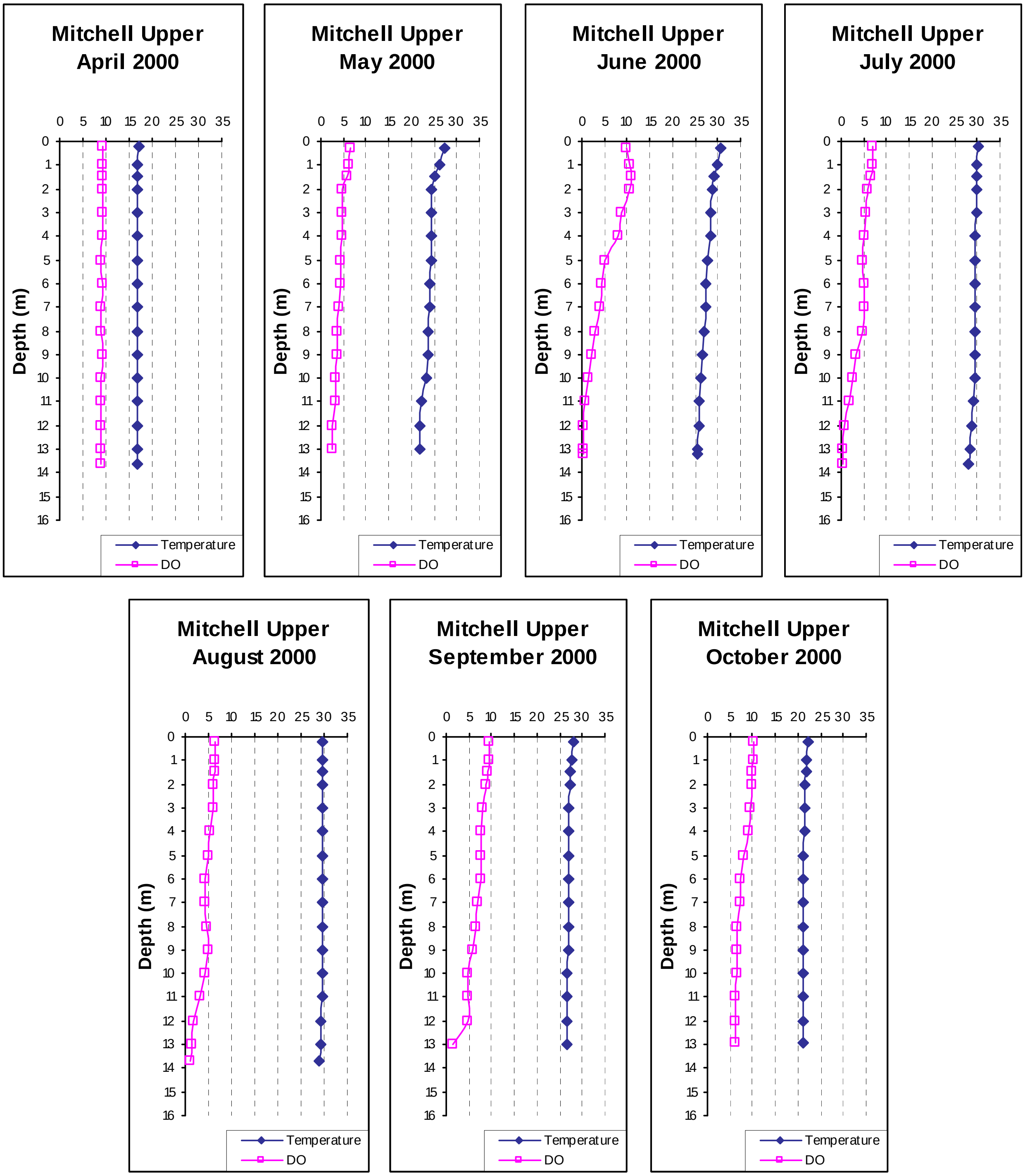


Figure I.43. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Mitchell Reservoir, April-October 2000.

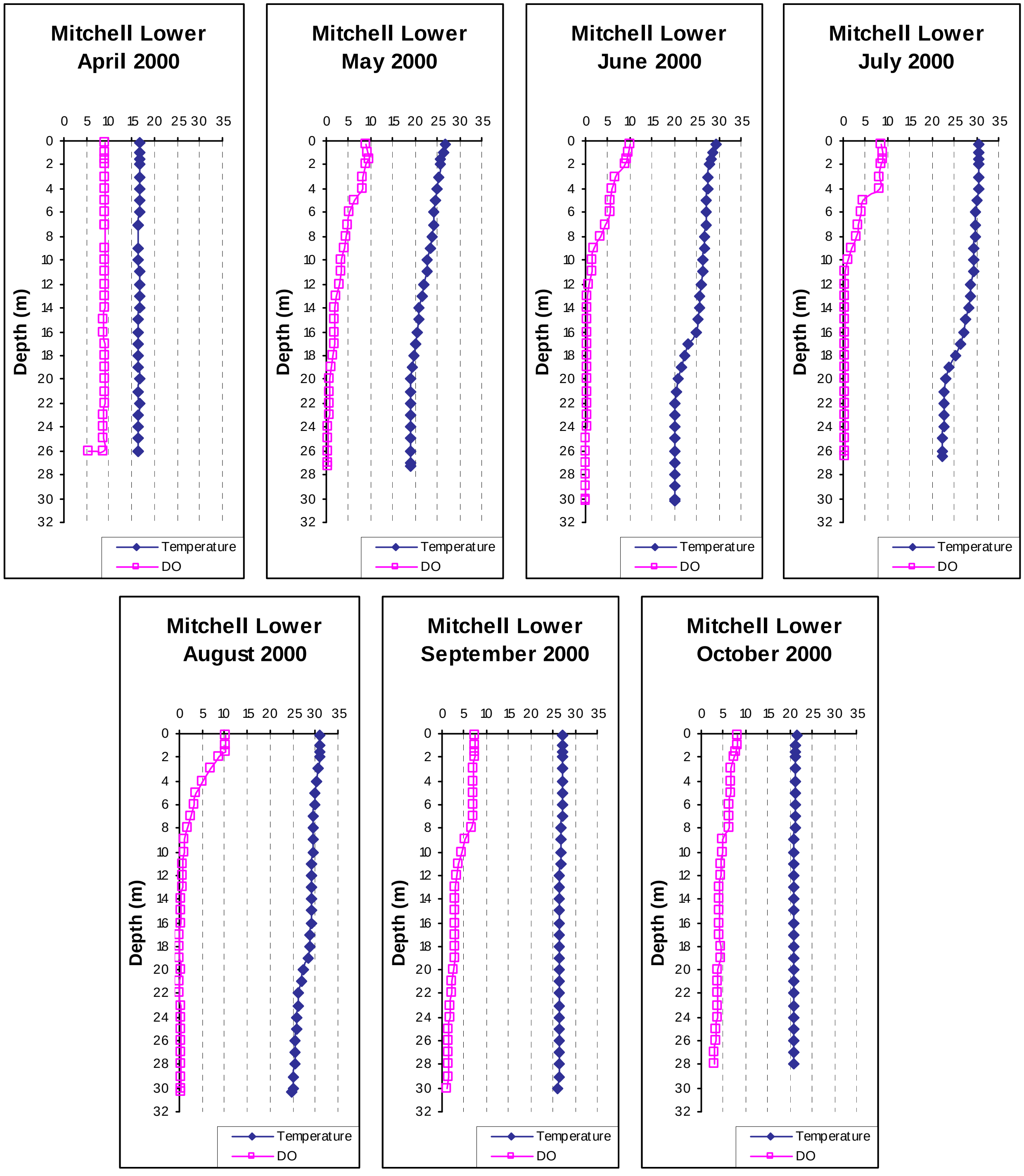


Figure I.44. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Mitchell Reservoir, April-October 2000.

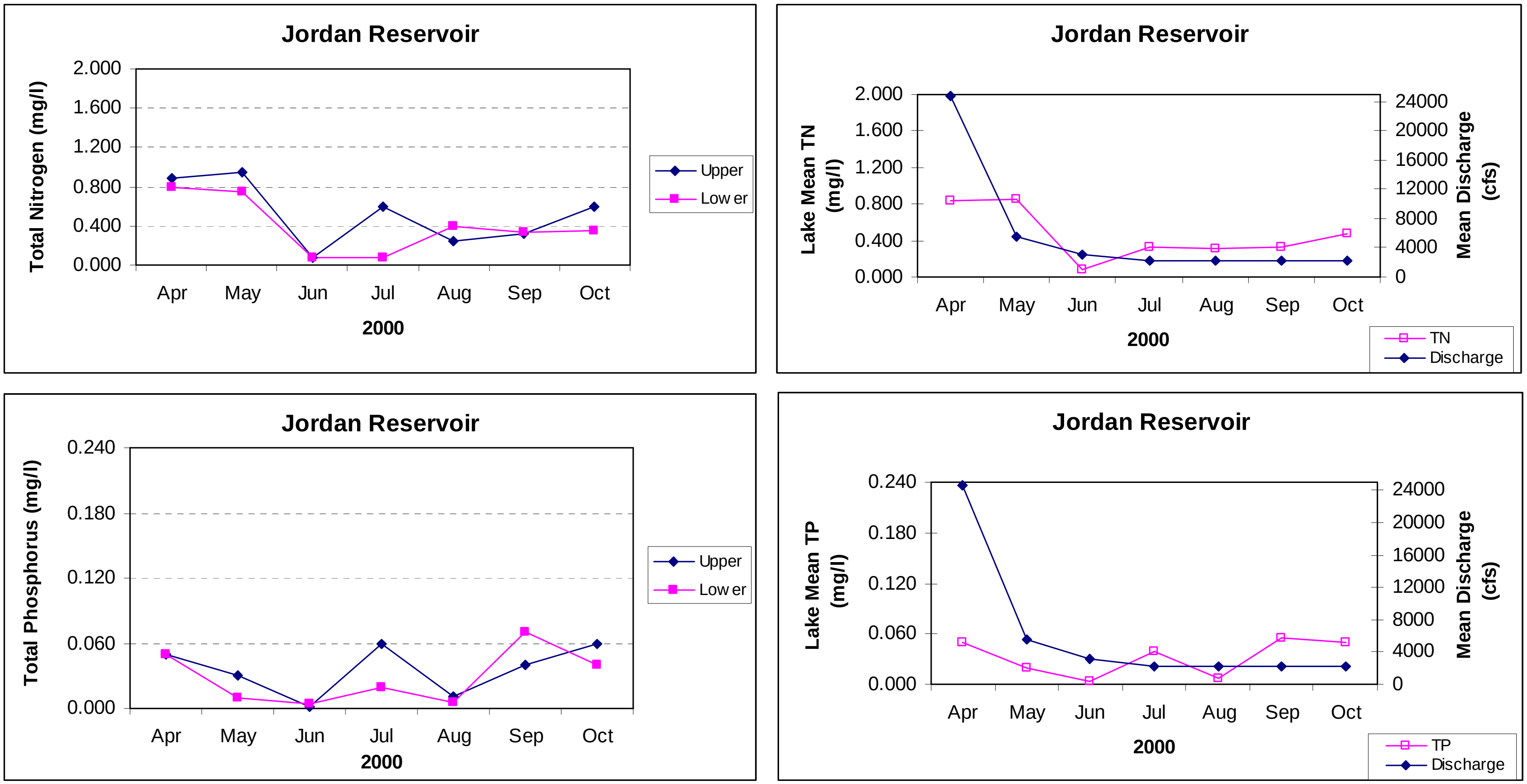


Figure I.45. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Jordan Reservoir, April-October 2000.

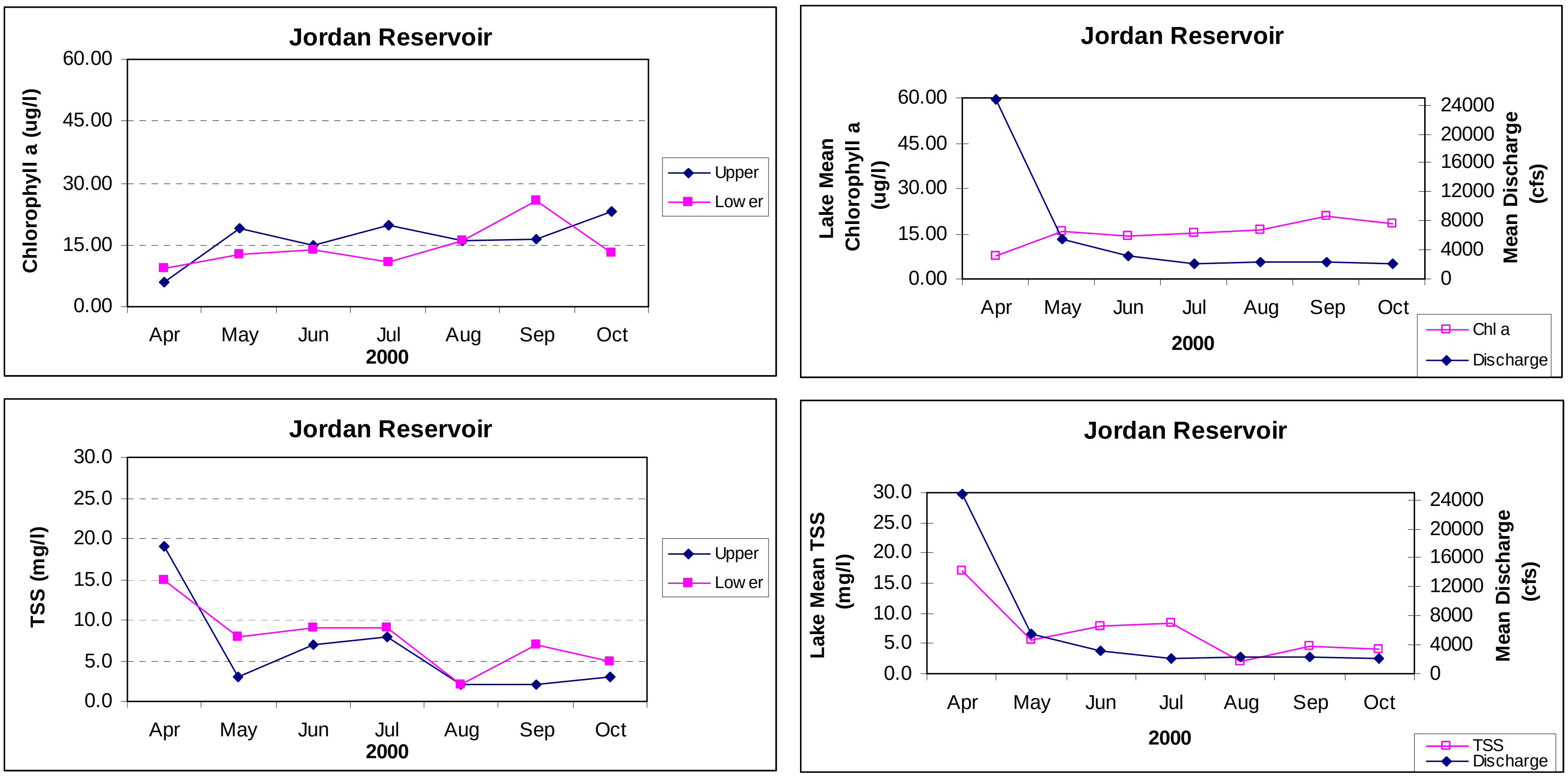


Figure I.46. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Jordan Reservoir, April-October 2000.

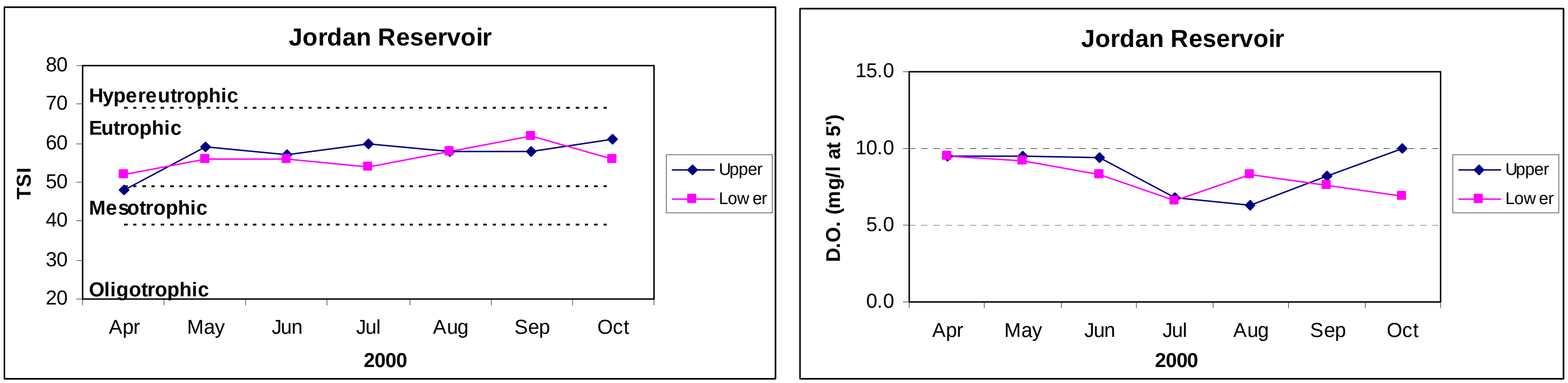


Figure I.47. Trophic state index (TSI), and dissolved oxygen (DO) of Jordan Reservoir, April-October 2000.

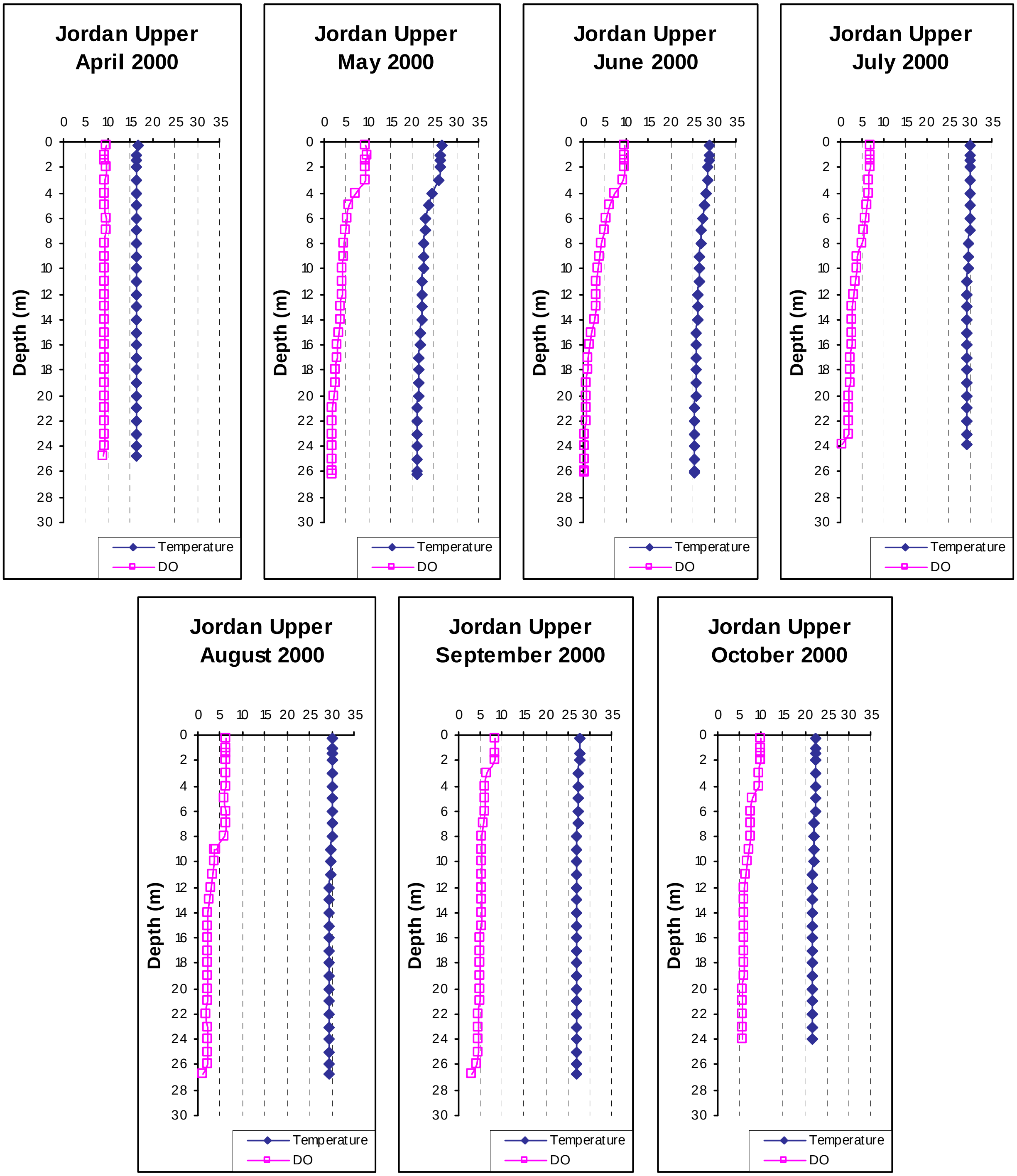


Figure I.48. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Jordan Reservoir, April-October 2000.

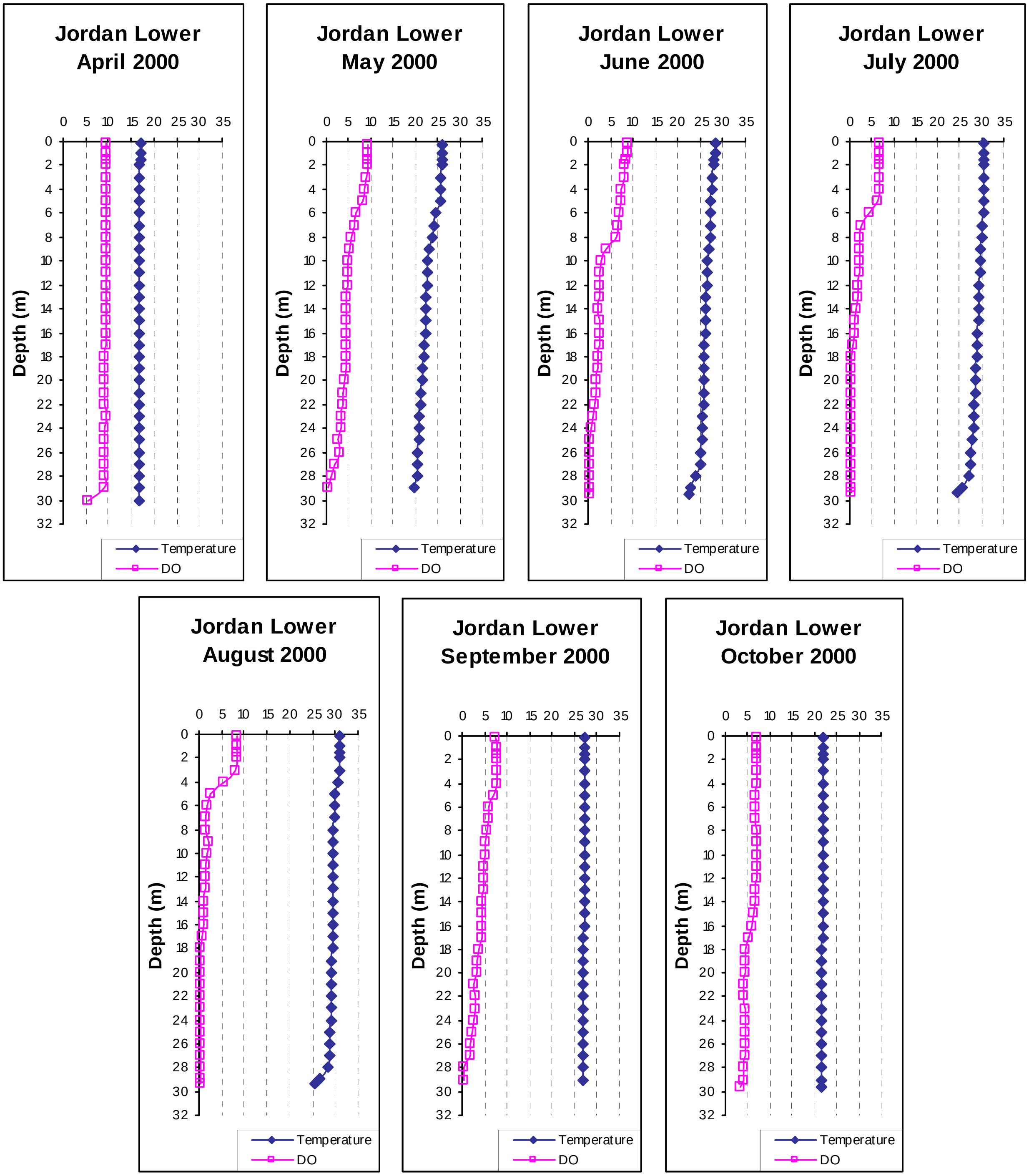


Figure I.49. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Jordan Reservoir, April-October 2000.

II. TALLAPOOSA RIVER RESERVOIRS

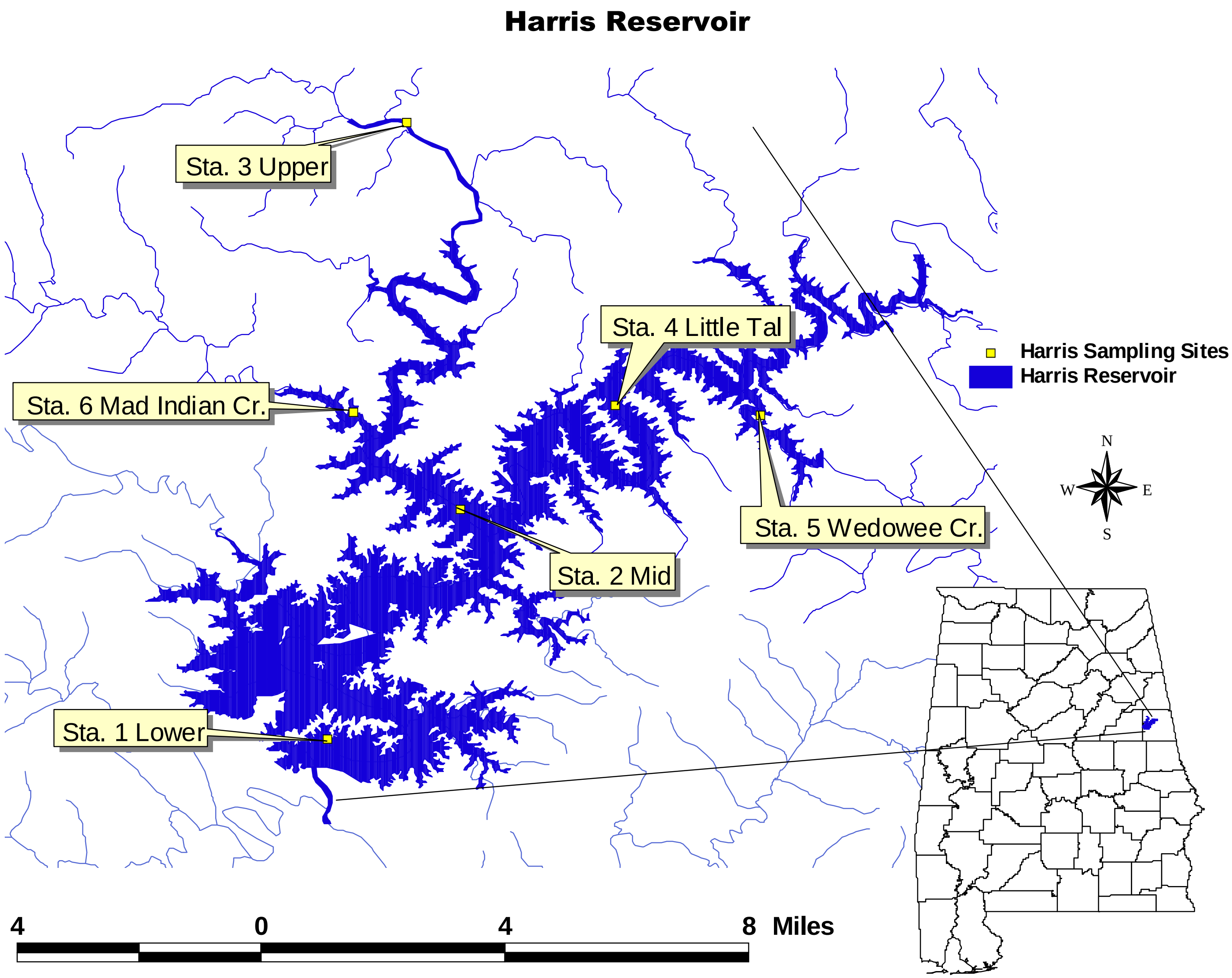


Figure II.1. Harris Reservoir with 2000 sampling locations.

Harris Reservoir

Nitrogen

Mainstem. Mean TN concentration at upper Harris was the highest of all Tallapoosa River reservoirs (Fig. II.5). Concentrations generally decreased from upstream to downstream locations. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations at all four stations were higher in 2000 than 1997 (Appendix Fig. II.1).

Monthly TN concentrations were similar for Harris Reservoir locations except for upper reservoir concentrations during July, September and October (Fig. II.9). Other locations exhibited a decrease in TN concentration for July sampling. TN levels were similar during August, but were followed by higher concentrations at upper reservoir during September and October.

Lake mean TN concentrations increased from April to June, decreased from June to August, and remained relatively low until sampling was completed in October (Fig. II.9). Following a decrease between April and May, discharge fluctuated very little throughout the sampling season. There was no apparent relationship between lake mean TN concentration and discharge.

Tributaries. The mean TN concentration in Wedowee Creek was the second highest of all tributaries in the basin (0.558 mg/l) (Fig. II.7). Mad Indian Creek had the lowest mean TN concentration of any tributary in the basin.

Phosphorus

Mainstem. Mean TP concentrations of Harris Reservoir locations were similar to most other Tallapoosa River sampling sites (Fig. II.5). Concentrations were similar at Little Tallapoosa, mid and lower reservoir and slightly higher at the upper station. Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations were lower in 2000 than 1997 (Appendix Fig. II.1).

Monthly TP concentrations were similar among Harris locations except for an increase at upper reservoir September and October (Fig. II.9). TP concentrations generally declined April to

June, then increased through October. During October, TP concentration at upper reservoir was approximately two times greater than other Harris Reservoir locations.

Lake mean TP concentrations declined April to June, then increased through October (Fig. II.9). Lake mean discharge declined sharply April to May, then slowly decreased through October. There was no apparent relationship between lake mean TP and discharge.

Tributaries. The mean TP concentration of Wedowee Creek was highest of the tributaries to Harris Reservoir, but near the mean of the other tributaries in the Tallapoosa Basin (Fig. II.7). Concentrations from Mad Indian Creek were among the lower values of Tallapoosa basin tributaries.

Algal Growth Potential Tests

Algal growth potential tests indicated that lower reservoir and the Little Tallapoosa locations of Harris were neither phosphorus nor nitrogen limited (Table II.1). Upper reservoir was nitrogen limited and mid-reservoir was phosphorus and nitrogen co-limited. Upper-reservoir was identified as having the highest mean MSC concentration of 3.62 mg/l.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations at upper Harris Reservoir were at least three times higher than any other Tallapoosa basin location (Fig. II.6). Concentrations decreased as sampling moved from upstream to downstream. Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from comparable stations indicate that concentrations at Little Tallapoosa, Mid and Lower reservoir stations were lower in 2000 (Appendix Fig. II.1). Mean chlorophyll *a* concentration at the upper station was three times greater in 2000 than in 1997.

Monthly mean chlorophyll *a* concentrations remained below 15 μg/l for all Harris locations with exception of upper reservoir (Fig. II.10). Chlorophyll *a* concentration at upper reservoir escalated to a peak concentration (>65 μg/l) in September, while concentrations remained relatively stable at other Harris locations.

Lake mean chlorophyll *a* concentration at Harris Reservoir remained below 15 μg/l through July, peaked in September, and decreased slightly in October (Fig. II.10). Discharge decreased sharply from April to May and declined slowly the remainder of the sampling season. There was no apparent relationship between discharge and chlorophyll *a*.

Tributaries. Both tributaries of Harris Reservoir were among the higher chlorophyll *a* concentrations (Fig. II.8). The second highest mean chlorophyll *a* concentration of Tallapoosa tributaries was from Wedowee Creek. Mad Indian Creek chlorophyll *a* concentration (9.99 µg/L) is slightly less than the mean value of all Tallapoosa tributaries combined.

Total Suspended Solids

Mainstem. Mean TSS concentrations in Harris Reservoir were slightly higher than other reservoirs in the Tallapoosa basin (Fig. II.6). Concentrations were similar across the reservoir (8.00 and 8.29 mg/l).

Monthly TSS concentrations were generally similar, with a typical range of less than 10 mg/l in each month sampled (Fig. II.10). TSS concentrations generally decreased from April to September and then increased in October.

Lake mean TSS concentrations steadily decreased April-September along with mean lake discharge (Fig. II.10).

Tributaries. Mean TSS concentrations in the tributaries to Harris Reservoir were similar to other tributaries in the Tallapoosa basin (Fig. II.8), with Mad Indian being the median concentration (7.7 mg/l) and Wedowee only slightly less (7.0 mg/l).

Trophic State

TSI values remained near the eutrophic range for all Harris reservoir stations April to June (Fig. II.11). TSI value for upper Harris steadily increased from June until reaching the hypereutrophic range during September and October. TSI value for Little Tallapoosa location remained just above eutrophic status throughout the growing season. TSI values for mid and lower reservoir locations decreased slowly from June and remained mesotrophic through October.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations at all Harris reservoir locations exhibited similar trends (Fig. II.11). DO concentrations were generally higher during April and October and lowest during September. DO concentrations were above the criterion limit of 5.0 mg/l at 5 feet on all dates sampled.

Depth profiles of temperature for upper Harris Reservoir, indicated thermal stratification May to July (Fig. II.12.). Chemical stratification occurred May to August with more than half the water column having a DO less than 5.0 mg/l. Deoxygenation occurred near the bottom May to October.

Depth profiles of temperature at the lower three stations (Little Tallapoosa, Mid and Lower) indicated thermal stratification April to September (Figs. II.13, II.14 & II.15). Highest water temperatures occurred between June and August. Chemical stratification existed May to October. In most months approximately two thirds of the water column had dissolved oxygen concentrations less than 5 mg/l. Anoxic conditions occurred in every month for every station with the exception of Lower Harris in April.

Tributaries. Depth profiles of temperature and DO indicate stratification near the surface in both Wedowee and Mad Indian Creeks in April (Appendix II.2). In June and August, the hypolimnion intensified and moved deeper as at least half of the water column had DO concentrations less than 2 mg/l. Highest temperatures occurred in June.

Summary and Discussion

Mean TN concentration in upper Harris Reservoir was higher than any other location within the basin. Mean TP concentrations for upper Harris was the highest of the basin. Mean chlorophyll *a* concentrations at upper Harris reservoir were three times higher than any other Tallapoosa basin location. Mean TSS concentrations were similar at all Harris Reservoir stations. TSI values remained near the eutrophic range for all Harris reservoir stations April to June. TSI value for upper Harris steadily increased from June until reaching the hypereutrophic range during September and October. DO concentrations were generally highest during April and October and lowest during September. Chemical stratification at the dam forebay existed May to October with approximately two thirds of the water column having a dissolved oxygen concentration less than 5 mg/l.

Between 1997 and 2000 concentrations of TN at the lower stations (Little Tallapoosa, Mid and Lower) increased, but both TP and chlorophyll *a* decreased. At the upper station, TN concentration more than doubled and the chlorophyll *a* concentration more than tripled from 1997 to 2000. Barely reaching mid-eutrophic status in 1997, the upper reservoir reached hypereutrophic conditions in September and October.

Two Harris Reservoir tributary embayments, Wedowee and Mad Indian Creek, were monitored in 2000. Wedowee Creek sub-watershed drains approximately 51 mi^2 in Randolph County (ADEM 2002c). Percent land cover of the Wedowee Creek sub-watershed was estimated as 40% deciduous forest, 14% evergreen forest, 22% mixed forest, 15% pasture/hay, 6% row crop, and wetland, open water, and urban less than 1%. Estimates of land-use by the local SWCDs were slightly higher for urban (10%) and open water (4%). Two (2) municipal NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.20 AU/acre), with poultry being the dominant animal. Sedimentation estimates indicated a *high* potential for NPS impairment (18.8 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Based upon mean TSS concentration, sedimentation does not appear to be a major issue in Wedowee Creek. Higher chlorophyll *a* concentrations may be due to runoff from poultry farms and urban development in addition to discharge from municipal sources. Mean TN, TP, and chlorophyll *a* concentrations from Wedowee Creek were among the highest of Tallapoosa tributary locations. DO concentrations were also of concern as more than half of the water column in June and August was deoxygenated.

The Mad Indian Creek sub-watershed drains approximately 61 mi^2 in Clay and Randolph Counties (ADEM 2002c). Percent land cover of the Mad Indian Creek sub-watershed was estimated as 1% transitional forest, 42% deciduous forest, 17% evergreen forest, 26% mixed forest, 9% pasture/hay, 2% row crop, and 2% open water. Estimates of land-use by the local SWCDs were similar to EPA data. One (1) current construction/stormwater authorization has been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.26 AU/acre), with poultry-broilers being the dominant animal. Sedimentation estimates indicated a *moderate* potential for NPS impairment (11.0 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Mean concentrations in Mad Indian Creek were typically near the mean values of tributaries in the Tallapoosa basin, with the exception of TN, which was the lowest in the basin. Much of the water column in June and August was oxygen depleted. Only the top 4-5 meters had high enough DO to sustain fish, but water temperatures at these depths were near 30° C.

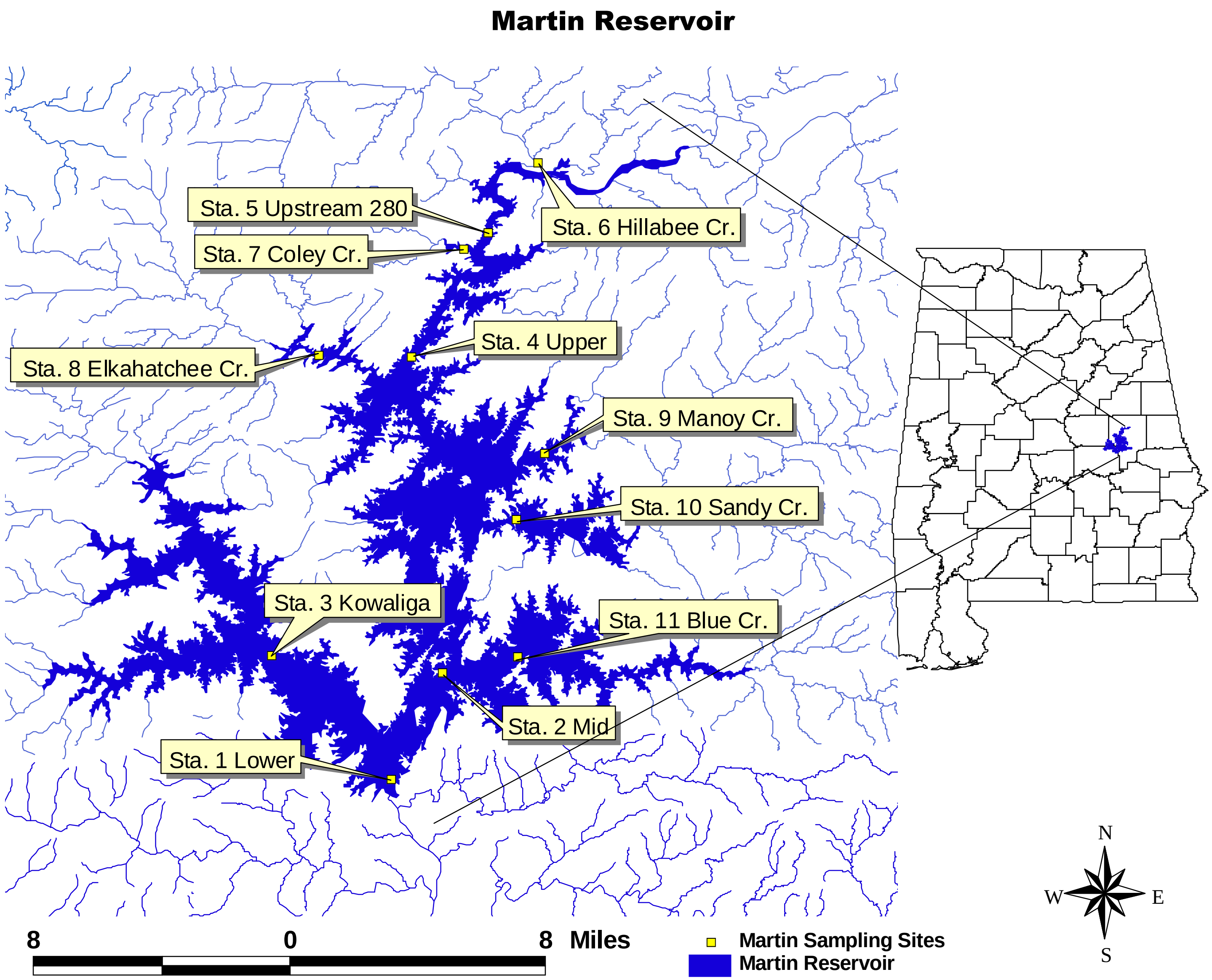


Figure II.2. Martin Reservoir with 2000 sampling locations.

Martin Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentrations were similar for all Martin mainstem reservoir locations (Fig. II.5). Highest mean TN concentration occurred at upstream 280 location with lowest concentrations occurring at mid reservoir. Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations at upper, Kowaliga, and lower reservoir stations were higher in 2000 (Appendix Fig. II.3). The concentration at the mid station decreased in 2000.

Monthly TN concentrations at all sampling locations decreased in June (Fig. II.16). TN concentrations were generally highest in May and lowest in June.

Lake mean TN concentration in Martin was highest during April to May and decreased to its lowest point in June (Fig. II.16). Lake mean TN fluctuated little July to October. Lake mean discharge was highest in April then dropped in May and remained stable June to October.

Tributaries. Mean TN concentrations for the tributaries of Martin Reservoir varied (Fig. II.7). The highest chlorophyll *a* concentration of any Tallapoosa tributary was found in Coley Creek (0.612 mg/l) while the second lowest concentration was in Sandy Creek (0.187 mg/l).

Phosphorus

Mainstem. Mean TP concentration remained below 0.031 mg/l for all Martin reservoir locations (Fig. II.5). Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations at all four reservoir stations were lower in 2000 (Appendix Fig. II.3).

Monthly TP concentrations fluctuated similarly for all Martin stations from April to August (Fig. II.16). TP concentration remained low for mid and lower reservoir locations through September. In contrast, TP levels increased to their highest concentrations at the other three Martin sampling locations during September.

Lake mean TP concentration was lowest in June and July and highest in April and September (Fig. II.16). Following a sharp decrease between April and May, discharge remained relatively stable. Concentrations decreased with discharge April to May, but there was no apparent relationship between TP and discharge from June through October.

Tributaries. The tributaries to Martin Reservoir exhibited the highest and lowest mean TP concentrations of the tributaries in the Tallapoosa basin (Fig. II.7). The highest two concentrations occurred in Coley (0.049 mg/l) and Elkahatchee Creeks (0.044 mg/l), while the lowest concentration occurred in Sandy Creek (0.011 mg/l).

Algal Growth Potential Tests

Phosphorus was the limiting nutrient for all locations in August algal growth potential tests at Martin reservoir (Table II.1). Mean MSC values ranged from 1.71 mg/l at Kowaliga location to 3.2 mg/l at upper reservoir. These concentrations were below the maximum 5.0 mg/l suggested by EPA to avoid nuisance algal blooms and to avoid fish kills in southeastern lakes.

Chlorophyll a

Mainstem. Mean Chlorophyll *a* concentrations were highest at the two upstream mainstem locations of Martin reservoir (Fig. II.6). At mid reservoir, lower reservoir and Kowaliga locations, concentrations were approximately three times lower than Chlorophyll *a* at upper reservoir locations. Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from comparable stations indicate that concentrations at all four stations were lower in 2000 (Appendix Fig. II.3).

Monthly chlorophyll *a* concentration was often 2-3 times higher for upper reservoir and upstream 280 locations for each month May – October (Fig. II.17). Chlorophyll *a* concentration at upstream 280 location was similar to concentrations at mid reservoir, lower reservoir and Kowaliga locations during April. The concentrations of the lowermost three locations remained below 3.0 μg/l for the entire sampling season.

Lake mean chlorophyll *a* concentration was lowest during April (Fig. II.17). Chlorophyll *a* concentrations increased April to June and remained stable the remainder of the sampling season. Following a decrease between April and May, discharge remained stable. Lake mean chlorophyll *a* concentration remained fairly stable from May through October.

Tributaries. Mean chlorophyll *a* concentrations of the tributaries of Martin Reservoir were variable (Fig. II.8). The highest concentration of any tributary in the Tallapoosa Basin was found in Coley Creek (31.15 μg/l) and the lowest concentration in Blue Creek (1.44 μg/l).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Martin Reservoir were similar to other mainstem reservoir locations in the Tallapoosa basin (Fig. II.6). Within the reservoir, concentrations ranged from 4.00 mg/l to 6.29 mg/l.

Monthly TSS values were variable at all stations May to September (Fig. II.17). Concentrations were lowest in the upper reservoir in June and Kowaliga in August. Concentrations were highest in the lower reservoir in June.

Lake mean TSS concentrations generally decreased from May-August, increased in September, and decreased in October (Fig. II.17). Lake mean discharge was higher in April than following months. No obvious relationship existed between lake mean TSS concentration and discharge.

Tributaries. Mean TSS concentrations of the tributaries of Martin Reservoir ranged from 2.0 mg/l to 15.3 mg/l (Fig. II.8). The highest concentration occurred in Coley Creek and the lowest concentration occurred in Blue Creek. In general, concentrations were higher in upstream tributaries than downstream tributaries.

Trophic State

TSI values for the two upstream locations of Martin Reservoir were near lower eutrophic status for each month with the exception of April (Fig. II.18). TSI values at mid to lower reservoir locations remained at or below mesotrophic status April to October. The Kowaliga location remained in oligotrophic status April to October. In general, TSI values were lowest for each station during April, except at lower reservoir. From June through October, TSI values remained fairly stable.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations were similar for all Martin Reservoir locations. DO concentrations were highest during April, fell slowly until September, and increased in October. DO concentrations consistently remained above the criterion limit of 5.0 mg/l.

Depth profiles of temperature at upstream 280 indicated thermal stratification in May, June and October (Figs. II.19). Highest water temperatures occurred between June and

August. Chemical stratification existed May to August and October with the bottom few meters having a DO concentration less than 2 mg/l. Anoxic conditions occurred near the bottom May to August.

Depth profiles of temperature and DO show thermoclines and chemoclines developing in upper reservoir from April through October, though very weak in April and October (Fig. II.20). Highest temperatures were in June through August. DO concentrations dropped below 2.0 mg/l in more than half of the water column between May and September.

Depth profiles of temperature for Kowaliga and mid reservoir, indicated thermal stratification April to October (Fig. II.21 & II.22). Chemical stratification occurred between June and October. More than half the water column in August to October had DO less than 2.0 mg/l. Anoxic conditions occurred between July and October.

Depth profiles of temperature at the dam forebay indicate thermal stratification for each month April through October (Figs. II.23). Water temperatures were highest during July and August. A moderate chemocline existed June through August and a more pronounced chemocline was observed during September and October.

Tributary. Depth profiles of temperature and dissolved oxygen in Hillabee and Coley Creeks indicate little to no stratification in April or August (Appendix II.4). Both locations were shallow and reached highest temperatures in June. Depth profiles of temperature in Elkahatchee Creek show weak stratification near the top in April and the bottom in June (Appendix II.4). Temperatures were highest in August. Chemical stratification occurred in April and June. Anoxic conditions occurred beneath 6 meters in June.

Depth profiles of temperature and DO show weak thermoclines and isochemical conditions in both Manoy and Sandy Creeks in April (Appendix II.5). Distinct thermal and chemical stratification was evident in June and August. Highest temperatures occurred in August when at least half of the water column was less than 2.0 mg/l. Deoxygenation occurred in August in both creeks.

Depth profiles of temperature in Blue Creek show thermal stratification in April, June and August (Fig. II.6). Highest temperatures were reached in June and August. A chemocline was apparent in August, with over half of the water column less than 2.0 mg/l.

Summary and Discussion

Mean total nitrogen concentrations were relatively similar for all Martin reservoir locations. Mean TP concentration remained near 0.03 mg/l for all Martin reservoir locations. Monthly TP concentrations fluctuated somewhat between August and October. At mid-reservoir and Kowaliga Creek locations, chlorophyll *a* concentrations were approximately one third those measured at upper reservoir. Chlorophyll *a* levels increased very little April to May and remained stable the remainder of the sampling season. Mean TSS concentrations were the lowest of any reservoir of the Tallapoosa basin. TSI values were generally higher (eutrophic) at upper reservoir locations and lower (mesotrophic) at mid – lower Martin locations. DO concentrations were highest during April, fell slowly until September, and increased in October. DO concentrations were above the criterion limit of 5.0 mg/l for each sampling event.

Martin Reservoir has remained oligotrophic or lower eutrophic during 1997 and 2000. AGPT results show the reservoir to be phosphorus limited. Slight increases in nitrogen concentrations in 2000 and large decreases in phosphorus concentrations have coincided with reduced chlorophyll *a* concentrations. Lower chlorophyll *a* concentrations indicate less productive conditions and result in lower TSI values representative of an oligotrophic reservoir.

Six tributary embayments were monitored on Martin Reservoir. They included Hillabee, Coley, Elkahatchee, Manoy, Sandy, and Blue Creeks. The Hillabee Creek sub-watershed drains approximately 94 mi^2 in Clay, Coosa, and Tallapoosa Counties. Percent land cover of the Hillabee Creek sub-watershed was estimated as 2% transitional forest, 37% deciduous forest, 22% evergreen forest, 32% mixed forest, 3% pasture/hay, 2% row crop, and less than 1% urban. Estimates of land-use by the local SWCDs were higher for urban (11%) and pasture (8%) (ADEM 2002c). Two (2) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animals in the sub-watershed were *low* (0.3 AU/acre). Sedimentation estimates indicated a *low* potential for nonpoint source impairment (3.5 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Elevated levels of TN and TP were found within Hillabee Creek, while chlorophyll *a* and TSS concentrations were similar to other

Tallapoosa basin tributaries. The water column was essentially isothermal and isochemical in April and August. June showed a slight decline in temperature and oxygen with depth.

The Elkahatchee Creek sub-watershed, which includes monitoring stations in both Coley and Elkahatchee Creeks, drains approximately 97 mi^2 in Coosa and Tallapoosa Counties. Percent land cover of the Elkahatchee Creek sub-watershed was estimated as 31% deciduous forest, 20% evergreen forest, 29% mixed forest, 10% open water, 3% pasture/hay, and 2% row crop and urban. Estimates of land-use by the local SWCDs were higher for urban (18%), open water (13%), and pasture (6%), and lower for forest (63%) (ADEM 2002c). Six (6) current construction/stormwater authorizations, two (2) municipal NPDES permits, and one (1) semi-public/private NPDES permit have been issued in the sub-watershed. The SWCD estimates of animals in the sub-watershed were *low* (0.12 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for nonpoint source impairment (0.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, the highest reported TN, TP, chlorophyll *a*, and TSS were found in Coley Creek. The second highest TP was found in Elkahatchee Creek. Further investigation is needed to isolate sources of excess nutrients and TSS. Since low concentrations of TN and TP are found in the main reservoir, loads from Coley and Elkahatchee Creeks could influence to the future status of the reservoir. DO concentrations in both creeks generally remained between 5-10 mg/l with the exception of Elkahatchee Creek in June, where deoxygenated conditions existed in the bottom 4 meters.

The Manoy Creek sub-watershed falls within the Tallapoosa River sub-watershed which drains approximately 61 mi^2 in Tallapoosa County. Percent land cover of the Tallapoosa River sub-watershed was estimated as 28% deciduous forest, 21% evergreen forest, 32% mixed forest, 12% open water, 2% pasture/hay and wetland, 1% row crop, and less than 1% urban. Estimates of land-use by the local SWCDs were higher for open water (20%) and urban (3%), and lower for forest (75%) (ADEM 2002c). Three (3) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animals in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for NPS impairment (0.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Concentrations of TN, TP, chlorophyll *a*, and TSS in Manoy Creek were among the lowest in the Tallapoosa basin. Depth profiles of temperature and dissolved oxygen show stratification in June and deoxygenation beneath the hypolimnion in August.

The Sandy Creek sub-watershed drains approximately 195 mi^2 in Lee and Tallapoosa counties. Percent land cover of the Sandy Creek sub-watershed was estimated as 24% deciduous forest, 29% evergreen forest, 31% mixed forest, 5% pasture/hay, 4% wetland, 3% open water and row crop, and 1% urban. Estimates of land-use by the local SWCDs were higher for pasture (10%) and lower for row crops (0%) (ADEM 2002c). Six (6) current construction/stormwater authorizations, three (3) mining/stormwater authorizations (non-coal <5acres), and two (2) municipal NPDES permits have been issued in the sub-watershed. The SWCD estimates of animals in the sub-watershed were *low* (0.03 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for NPS impairment (1.2 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. The lowest mean TP was found in Sandy Creek. TN, chlorophyll *a,* and TSS concentrations were the second lowest of any tributary in the Tallapoosa basin. Depth profiles of temperature and dissolved oxygen show a hypolimnion intensifying from April to August. Concentrations below 7 meters were nearly anoxic in August.

The Blue Creek sub-watershed drains approximately 73 mi^2 in Lee and Tallapoosa Counties. Percent land cover of the Blue Creek sub-watershed was estimated as 27% deciduous forest, 23% evergreen forest, 30% mixed forest, 15% open water, 2% pasture/hay and wetland, and 1% row crop. Estimates of land-use by the local SWCDs were similar to EPA data (ADEM 2002c). Four (4) current construction/stormwater authorizations, one (1) current mining/stormwater authorizations (non-coal <5 acres), and one (1) semi-public/private NPDES permit have been issued in the sub-watershed. The SWCD estimates of animals in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for nonpoint source impairment (0.5 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Elevated TN and TP concentrations were found in the waters at Blue Creek, along with the lowest mean chlorophyll *a* and TSS concentrations of any tributary studied in the Tallapoosa basin. Depth profiles of temperature and dissolved oxygen show thermal stratification April through August and near anoxic conditions in August.

Yates Reservoir

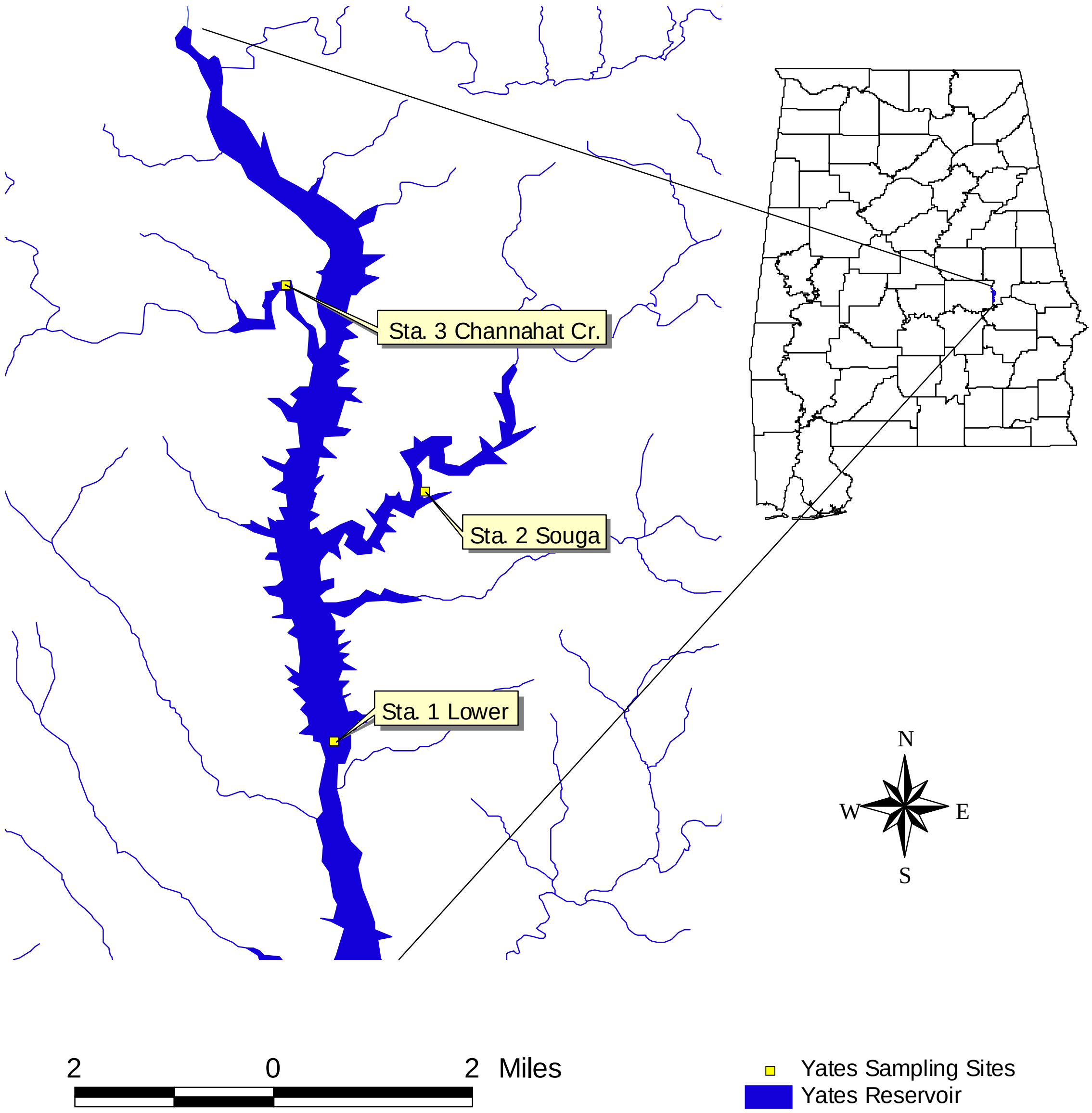


Figure II.3. Yates Reservoir with 2000 sampling locations.

Yates Reservoir

Nitrogen

Mainstem. Mean TN concentration at lower reservoir was the second highest of all Tallapoosa mainstem locations (Fig. II.5). Graphs of mean TN data collected in 1997 and 2000 from comparable stations indicate that concentrations at both Sougahatchee and lower reservoir stations were higher in 2000 (Appendix Fig. II.7).

TN concentration at lower reservoir peaked in June and steadily declined until October (Fig. II.24). Discharge was highest during April, fell slightly in May and remained relatively constant for the duration of the sampling season. There was no apparent relationship between TN concentration and discharge.

Tributary. The mean TN concentrations in tributaries to Yates Reservoir were similar to other Tallapoosa basin tributaries (Fig. II.7). The third highest mean TN concentration of any tributary in the Tallapoosa basin occurred in Sougahatchee Creek (0.538 mg/l).

Phosphorus

Mainstem. Mean total phosphorus concentration at Yates Reservoir was similar to other Tallapoosa River locations (Fig. II.5). Graphs of mean TP data collected in 1997 and 2000 from comparable stations indicate that concentrations at both Sougahatchee and lower reservoir stations were lower in 2000 than 1997 (Appendix Fig. II.7).

TP for lower reservoir decreased from April to May and remained below 0.03 mg/l through August (Fig. II.24). TP concentration steadily increased from August through October. Discharge was slightly higher in April than the following months. TP fluctuated similarly to discharge April through August.

Tributary. The mean TP concentration of the Channahatchee Creek embayment was among the lowest of any tributary of the Tallapoosa basin while the other, Sougahatchee Creek, was the third highest (Fig. II.7).

Algal Growth Potential Tests

Algal growth potential tests indicated lower Yates reservoir was phosphorus limited, and Sougahatchee creek was nitrogen limited (Table II.1). The mean MSC concentration was nearly three times higher at Sougahatchee Creek (7.14 mg/l) than at lower reservoir (2.52 mg/l). The mean MSC value for Sougahatchee Creek is above the maximum suggested level of 5.0 mg/l.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentration in Yates Reservoir was among the lowest concentrations of the Tallapoosa basin (Fig. II.6). Graphs of mean chlorophyll *a* data collected from comparable stations indicate that the concentration at Sougahatchee Creek increased between 1997 and 2000, but lower reservoir concentrations decreased in 2000 (Appendix Fig. II.7).

Chlorophyll *a* concentration at lower Yates Reservoir was less than 5.00 μg/l throughout the growing season (Fig. II.24). Discharge and lower reservoir chlorophyll a concentrations were highest during April, decreased in May and remained relatively constant through October.

Tributary. Mean chlorophyll *a* concentration in one Yates tributary was among the lowest, while the other was among the highest of the Tallapoosa basin tributaries (Fig. II.8).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Yates Reservoir were lower than Harris, but generally higher than Martin mainstem reservoir locations (Fig. II.6).

TSS concentrations were variable at lower reservoir April to October (Fig. II.24). Lowest concentrations occurred in August and September with highest concentrations occurring in July. Discharge was slightly higher in April than the following months. Discharge rate remained similar through October. No obvious relationship existed between lake mean TSS concentration and discharge.

Tributary. Mean TSS concentrations of the tributaries of Yates Reservoir were higher when compared with all Tallapoosa tributaries (Fig. II.8). Of the ten Tallapoosa basin tributaries monitored, Sougahatchee Creek and Channahatchee Creek had two of the three highest TSS concentrations.

Trophic State

TSI values for lower Yates indicated lower mesotrophic status April and June to October (Fig. II.25). TSI values in May decreased into the oligotrophic range.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations in Yates dam forebay at a depth of 5 feet were relatively similar April to October (Fig. II.25). At no time were DO concentrations below the criterion limit of 5.0 mg/l.

Depth profiles of temperature at lower Yates indicated thermal stratification May to September (Fig. II.26). Highest water column temperatures occurred during July and August. Depth profiles of oxygen indicated slight chemical stratification June to October. During April and May the water column at Yates dam forebay was essentially isochemical.

Tributary. Depth profiles of temperature and DO of Channahatchee and Sougahatchee Creeks indicated isothermal and isochemical conditions in April (Appendix Fig. II.8). Thermal stratification was evident in June and August. Highest temperatures occurred in June. Weak chemoclines existed in June and August, but anoxic conditions did not occur in Channahatchee Creek. Deoxygenation occurred in most of the water column in Sougahatchee Creek in both June and August.

Summary and Discussion

Mean total nitrogen concentration at lower reservoir was the third highest of all Tallapoosa River locations. Mean total phosphorus, mean chlorophyll *a*, and mean TSS concentrations were among the lowest of any Tallapoosa mainstem location. TSI values were mostly mesotrophic. DO concentrations were highest in April and October. Depth profiles of oxygen indicate that most of the water column was essentially isochemical for the months sampled.

Between 1997 and 2000, TN concentrations increased and TP concentrations decreased. AGPT testing shows nitrogen as the limiting nutrient at Sougahatchee Creek. The lower reservoir was limited by phosphorus and a decrease in TP from 1997 to 2000 likely caused a decline in chlorophyll *a* concentrations and resulting oligotrophic/mesotrophic conditions.

Two tributary embayments were monitored on Yates Reservoir, Channahatchee and Sougahatchee Creeks. The Channahahatchee Creek sub-watershed drains approximately 46 mi^2 in Elmore County. Percent land cover of the Channahahatchee Creek sub-watershed was estimated as 25% deciduous forest, 23% evergreen forest, 37% mixed forest, 7% pasture/hay, 4% row crop, and 2% open water and wetland. Estimates of land-use by the local SWCDs were higher for urban (6%) and pasture (24%) and lower for open water (1%), forest (70%), and row crops (0%) (ADEM 2002c). Three (3) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for nonpoint source impairment (1.2 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, the second highest TSS concentration was reported in Channahahatchee Creek, likely due to nonpoint sources not identified in the SWCD estimates. Concentrations of TN, TP and chlorophyll *a* were similar to other tributaries in the Tallapoosa basin. Depth profiles show few DO concerns as much of water column is well above 2.0 mg/l.

The Sougahatchee Creek sub-watershed drains Lee, Chambers and Tallapoosa Counties. Percent land cover of the Sougahatchee Creek sub-watershed was estimated as 31% deciduous forest, 23% evergreen forest, 31% mixed forest, 6% pasture/hay, 3% row crop and urban, and 1% open water and wetland. Estimates of land-use by the local SWCDs were higher for urban (7%) and pasture (8%) and lower for forest (83%) and row crops (1%) (ADEM 2002c). Twenty-one (21) current construction/stormwater authorizations, three (3) non-coal mining <5 acres/stormwater authorizations, and three (3) municipal, one (1) semi-public/private, and one (1) industrial process wastewater NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.02 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *moderate* potential for nonpoint source impairment (4.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, the third highest mean concentration of TN and TP along with the fourth highest mean chlorophyll *a* concentration occurred in Sougahatchee Creek. In addition, the highest mean TSS concentration of any tributary occurred in Sougahatchee Creek. DO profiles indicate that even in such shallow conditions over half of the water column has low DO in June and August. The combine effect of point and nonpoint sources are likely contributors to elevated nutrients and low DO.

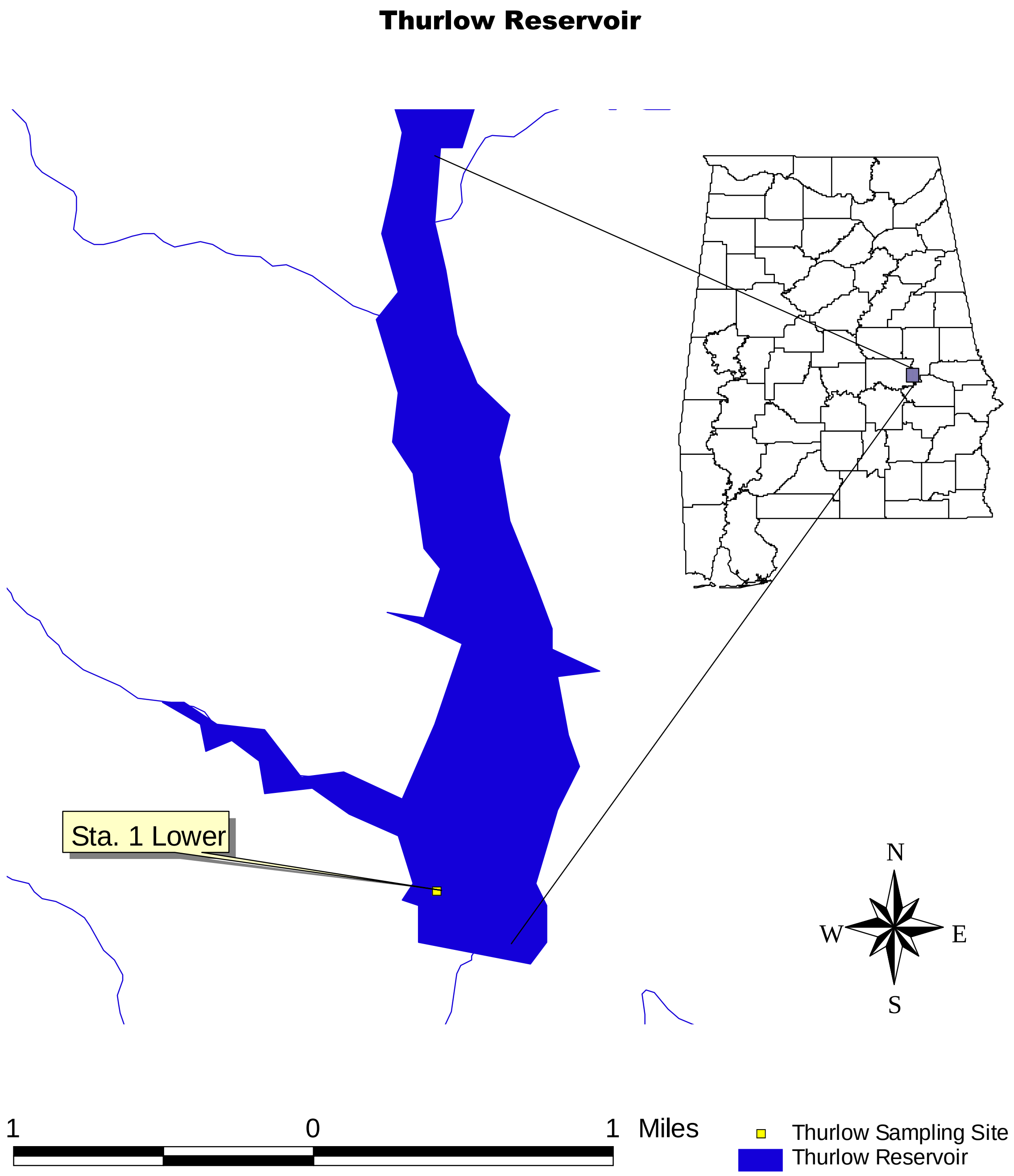


Figure II.4. Thurlow Reservoir with 2000 sampling locations.

Thurlow Reservoir

Nitrogen

Mean total nitrogen concentration at Thurlow reservoir was lower than lower Yates reservoir, but slightly higher than the mean (0.45 mg/l) of all 11 mainstem Tallapoosa reservoirs sampled (Fig. II.5). Graphs of mean TN data collected in 1997 and 2000 from a comparable station indicate that concentrations were higher in 2000 (Appendix Fig. II.9).

Total nitrogen concentration at Thurlow was highest during April and May (Fig. II.27). TN declined for June, increased in July and August and tapered between September and October. TN concentration was lowest during June and October. Following a decrease between April and May, lake mean discharge remained stable for the duration of the sampling period.

Phosphorus

Mean total phosphorus concentration at Thurlow reservoir was lowest (0.01 mg/l) of all Tallapoosa River reservoirs (Fig. II.5). Graphs of mean TP data collected in 1997 and 2000 from a comparable station indicate that concentrations were much lower in 2000 (Appendix Fig. II.9).

Total phosphorus was highest during April and fell to a less than detectable concentration (<0.004 mg/l) May to July (Fig. II.27). TP levels increased slightly during August and September and fell again in October. Following a decrease between April and May, discharge remained stable for the duration of the sampling period. There was no apparent relationship between mean TP and discharge.

Algal Growth Potential Tests

Algal growth potential tests conducted during August for Thurlow reservoir indicated that the reservoir was phosphorus limited (Table II.1). Mean MSC of Thurlow was 2.52 mg/l, well below the 5.0 mg/l level suggested for southeastern lakes.

Chlorophyll a

Chlorophyll *a* concentration was relatively low at Thurlow compared to other Tallapoosa River lakes (Fig. II.6). Graphs of mean chlorophyll *a* data collected in 1997 and 2000 from a comparable station indicate that concentrations were lower in 2000 than 1997 (Appendix Fig. II.9).

Monthly chlorophyll *a* concentration changed very little during the growing season (Fig. II.27). Chlorophyll *a* was constant April to September and increased slightly in October. Following a decrease between April and May, discharge remained stable for the duration of the sampling period. There was no apparent relationship between chlorophyll *a* and discharge.

Total Suspended Solids

The mean TSS concentration at Thurlow Reservoir was similar to lower Yates Reservoir (Fig. II.6).

TSS concentrations remained between 3 mg/l and 9 mg/l throughout the sampling season (Fig. II.27). Lake mean discharge decreased slightly in May and remained stable through October. There was no apparent relationship between concentration and discharge.

Trophic State

Monthly TSI values for Thurlow were within mesotrophic status for each month except October (Fig. II.25). TSI value increased slowly April to July, decreased slightly until September, and then peaked to highest values in October.

Dissolved Oxygen/Temperature

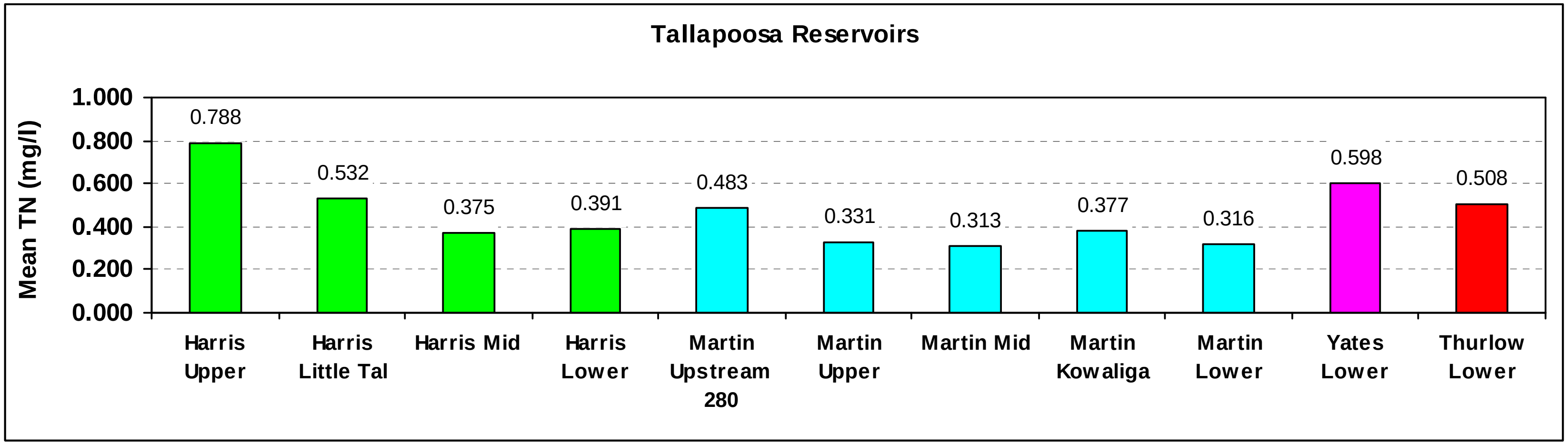
Dissolved oxygen concentration at Thurlow reservoir changed little during the sampling period (Fig. II.25). Monthly DO levels exceeded 7.5 mg/l, well above the criterion limit of 5.0 mg/l. DO concentration was lowest in July and highest in October.

Depth profiles of temperature indicated thermal stratification near the surface May to September, with the highest water column temperatures occurring during July and August (Fig. II.28). Depth profiles of oxygen indicate that the greater portion of the water column was essentially isochemical for the months sampled.

Summary and Discussion

Mean total nitrogen was near the mean when compared to other Tallapoosa reservoirs. Mean total phosphorus concentration at Thurlow reservoir was lowest (0.01 mg/l) of all Tallapoosa River reservoirs. Lake mean chlorophyll *a* concentration at Thurlow reservoir remained below 3.5 μg/l during the sampling period. TSS concentrations were low. Monthly TSI values for Thurlow were within oligotrophic status for each month except October. Monthly DO levels exceeded 7.5 mg/l each month; well above the criterion limit of 5.0 mg/l. Depth profiles of oxygen indicate that the greater portion of the water column was essentially isochemical for the months sampled.

Thurlow appears to have improved from 1997. Decreases in TP and chlorophyll *a* concentrations kept the TSI values in the oligotrophic range for a majority of the season. In 1997, TSI values reached eutrophic status. Increased TN concentrations were noted, however.



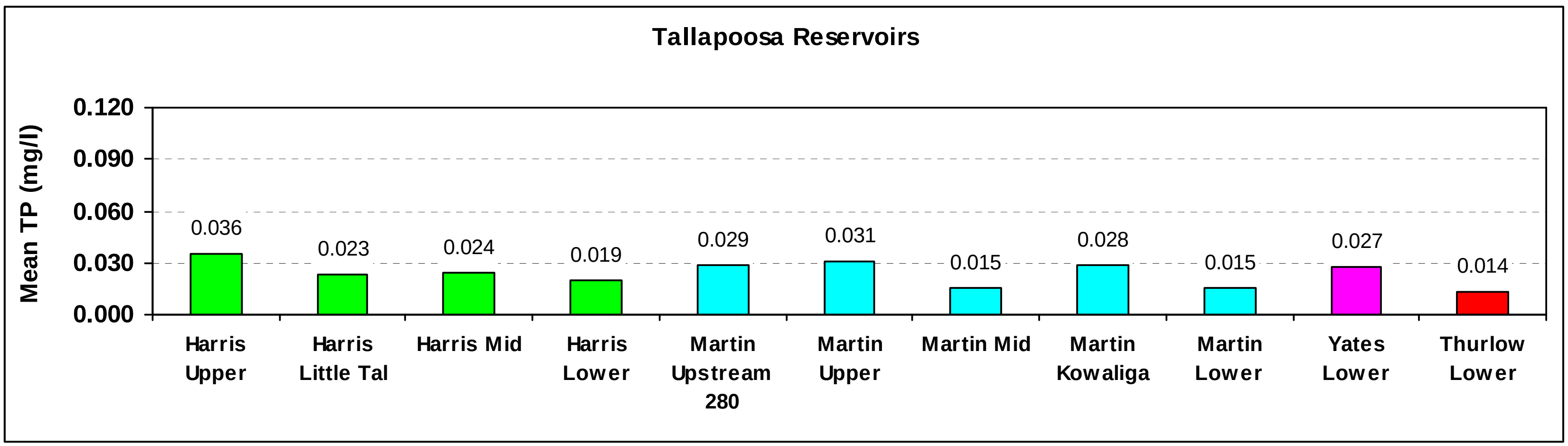
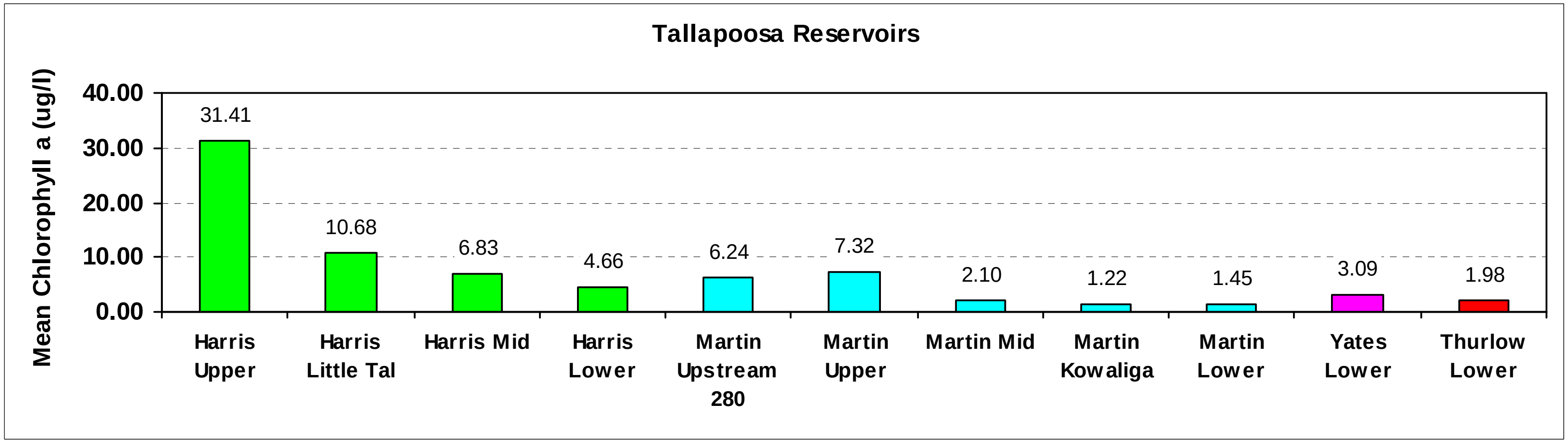


Figure II.5. Mean total nitrogen (TN) and mean total phosphorus (TP) concentrations of Tallapoosa reservoir locations, April-October 2000.



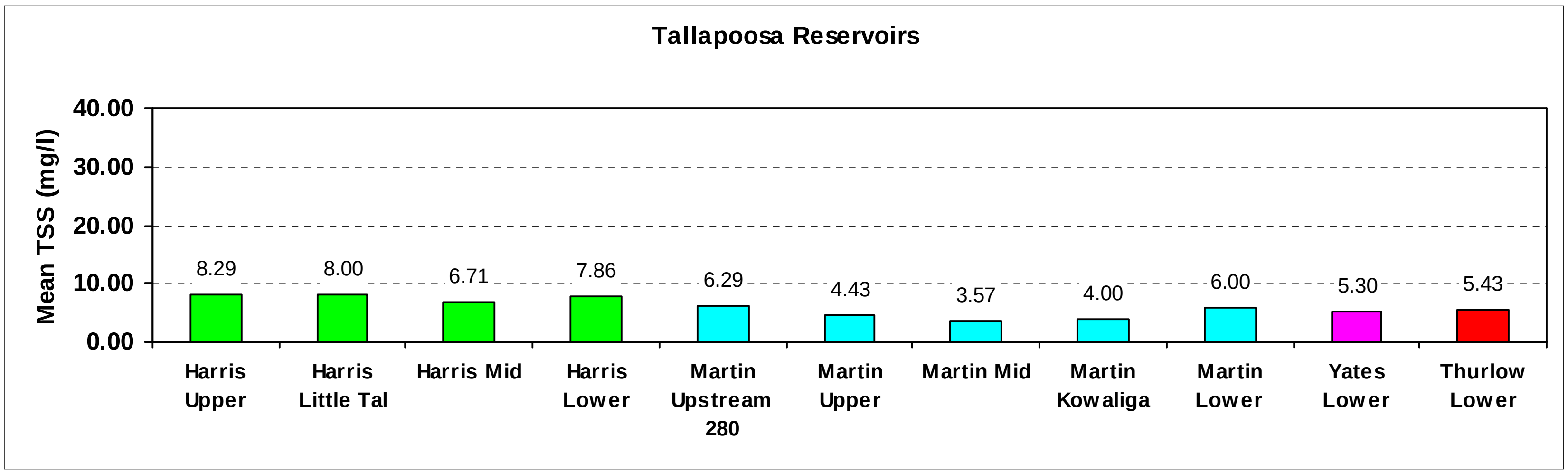
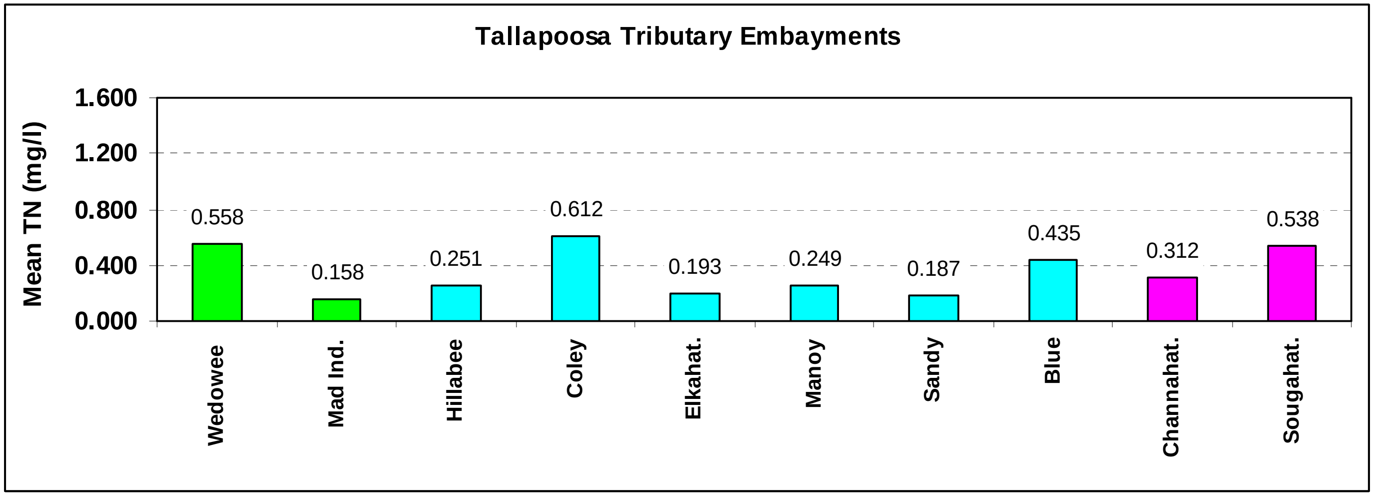


Figure II.6. Mean chlorophyll *a* and mean total suspended solids concentrations of Tallapoosa reservoir locations, April-October 2000.



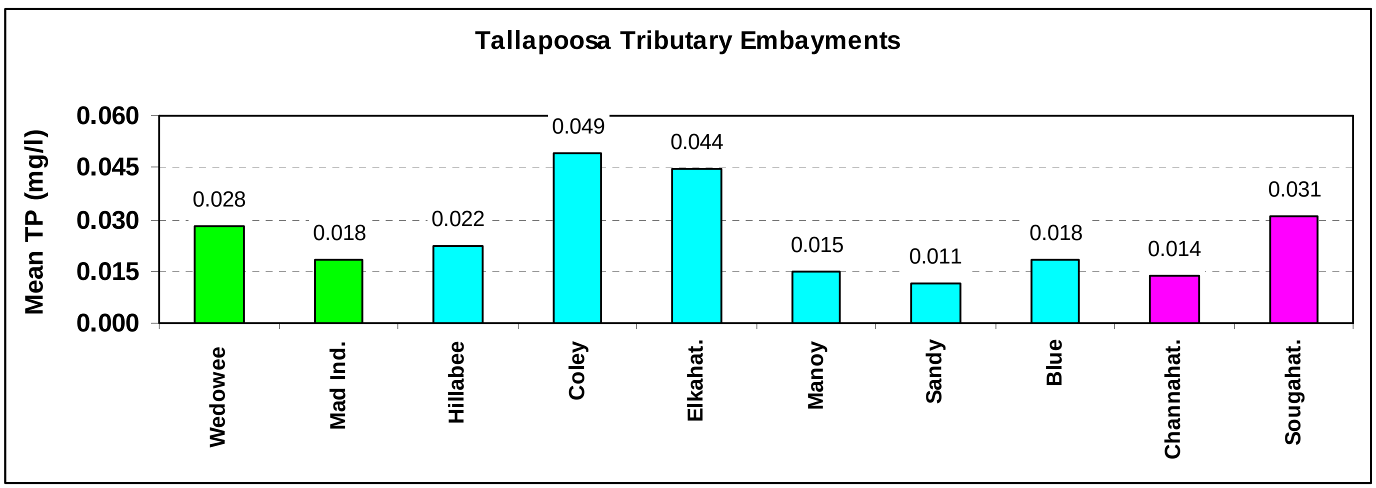
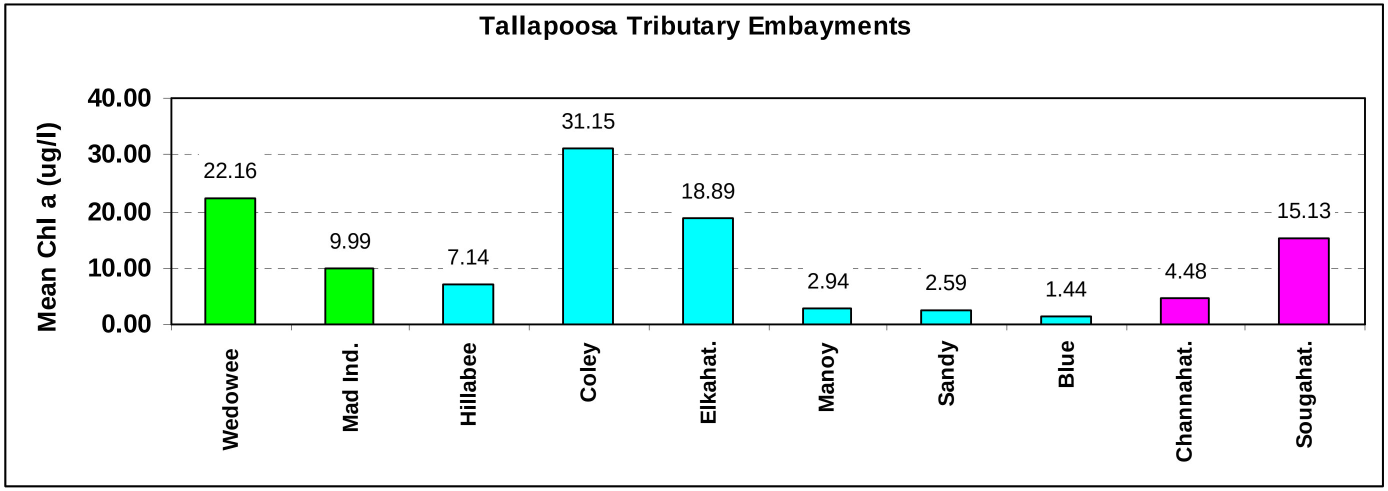


Figure II.7. Mean total nitrogen (TN) and mean total phosphorus (TP) concentrations of Tallapoosa Tributary embayment locations, April-August 2000.



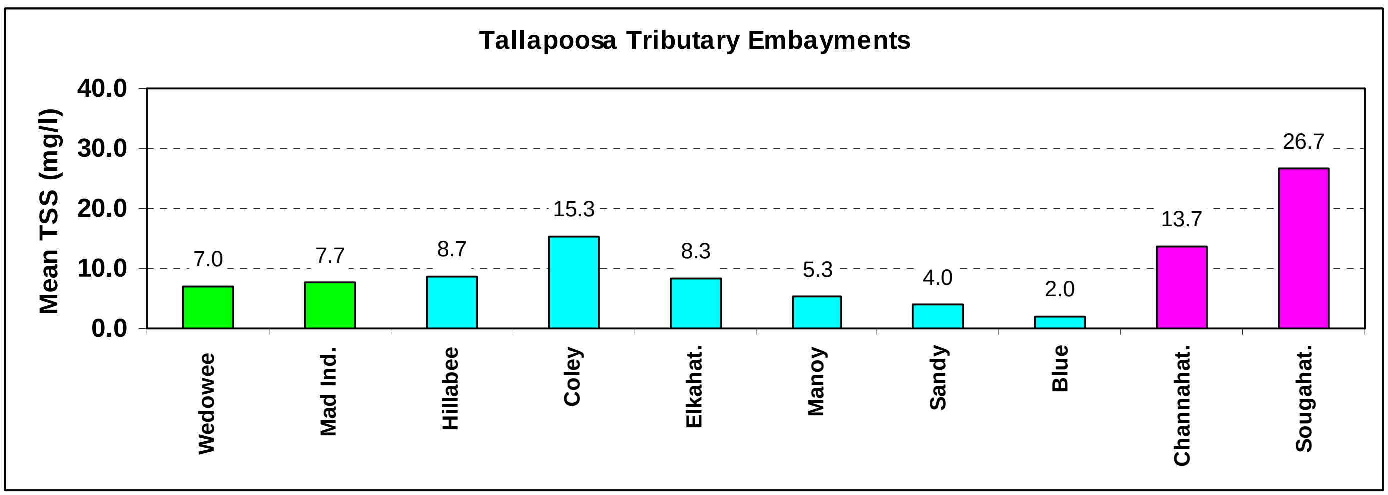


Figure II.8. Mean chlorophyll *a* and total suspended solids concentrations of Tallapoosa Tributary embayment locations, April-August 2000.

Table II.1. Algal growth potential testing (AGPT) of Tallapoosa River reservoirs, August 2000.

Reservoir	Location	Date	Mean MSC (mg/l) C	C+N	C+P	Limiting Nutrient
Harris	Little Tallapoosa	8/24/00	1.97	2.39	**2.15**	None
	Upper	8/24/00	3.62	10.04	**4.62**	Nitrogen
	Mid	8/24/00	1.59	1.88	**1.81**	Co-Limit
	Lower	8/24/00	1.74	1.75	**1.78**	None
Martin	Upper	8/22/00	3.2	3.5	**4.14**	Phosphorus
	*Mid	8/22/00				
	Kowaliga	8/22/00	1.63	**1.71**	**2.17**	Phosphorus
	Lower	8/22/00	1.73	2.03	**2.21**	Phosphorus
Yates	Sougahatchee	8/21/00	7.14	**18.72**	6.95	Nitrogen
	Lower	8/21/00	2.52	2.41	**10.37**	Phosphorus
Thurlow	Lower	8/21/00	2.53	2.23	**9.97**	Phosphorus

MSC = Maximum Standing Crop

C = Control; C+N = Control + Nitrogen; C+P = Control + Phosphorus

Values in **bold** print are significantly different from control.

*Lost/damaged sample.

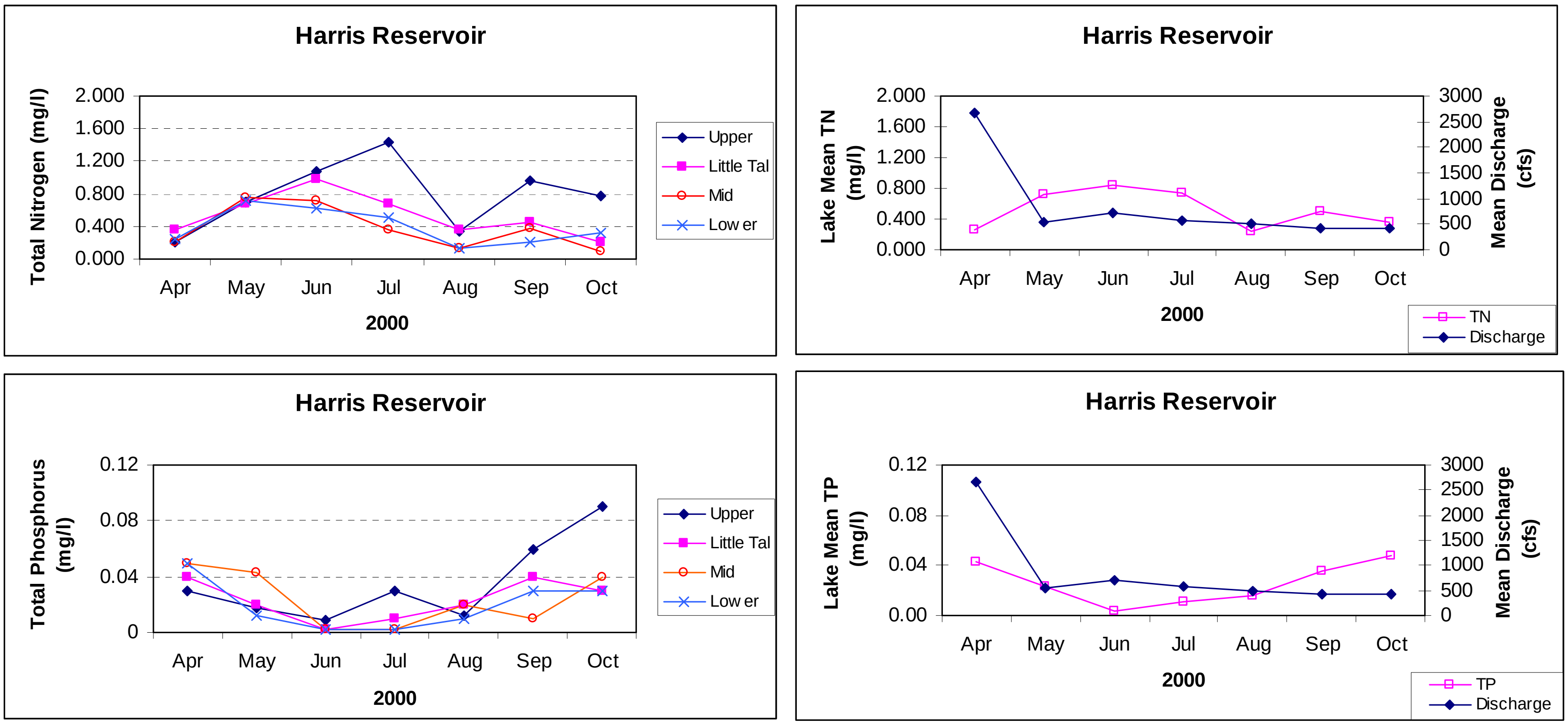


Figure II.9. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Harris Reservoir, April-October 2000.

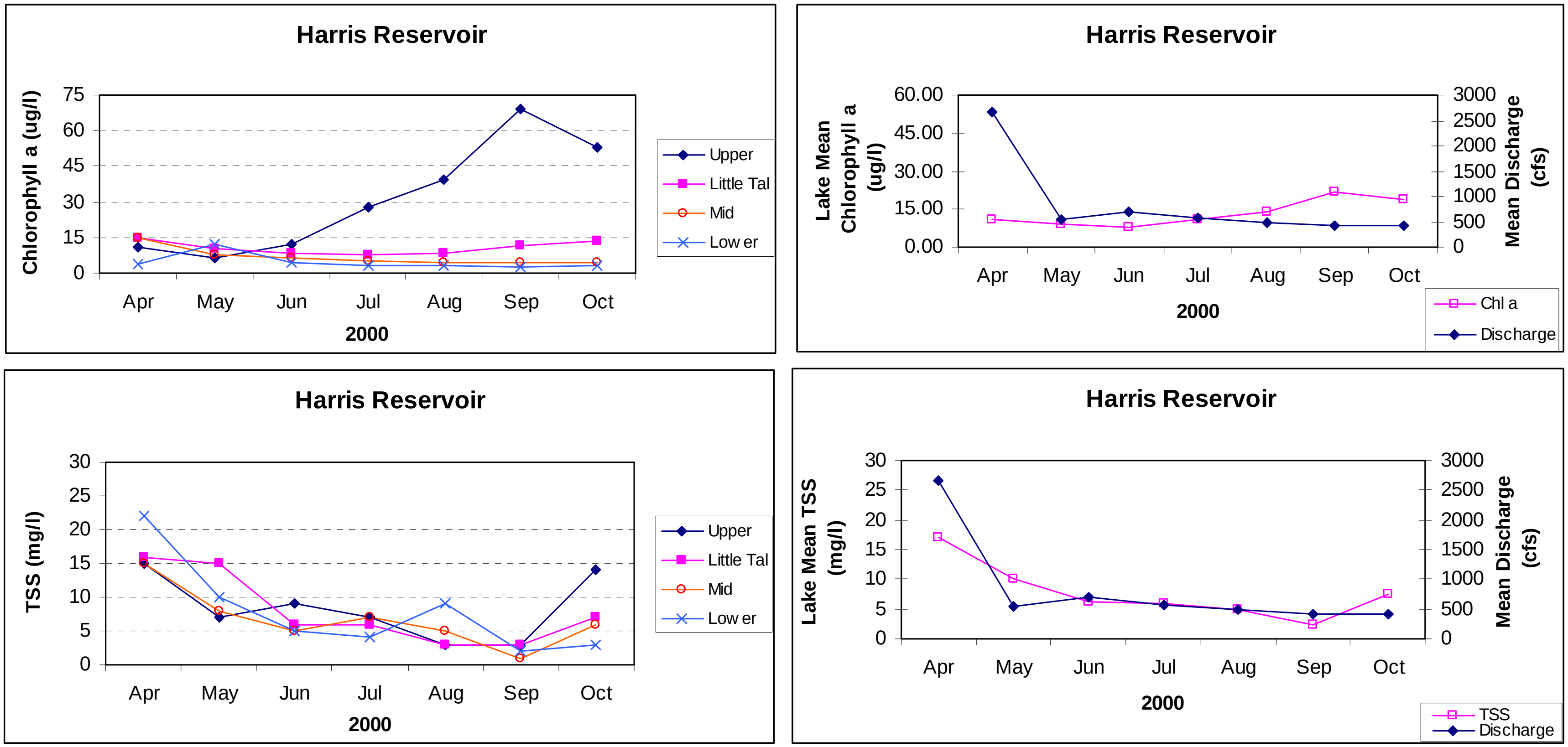


Figure II.10. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Harris Reservoir, April-October 2000.

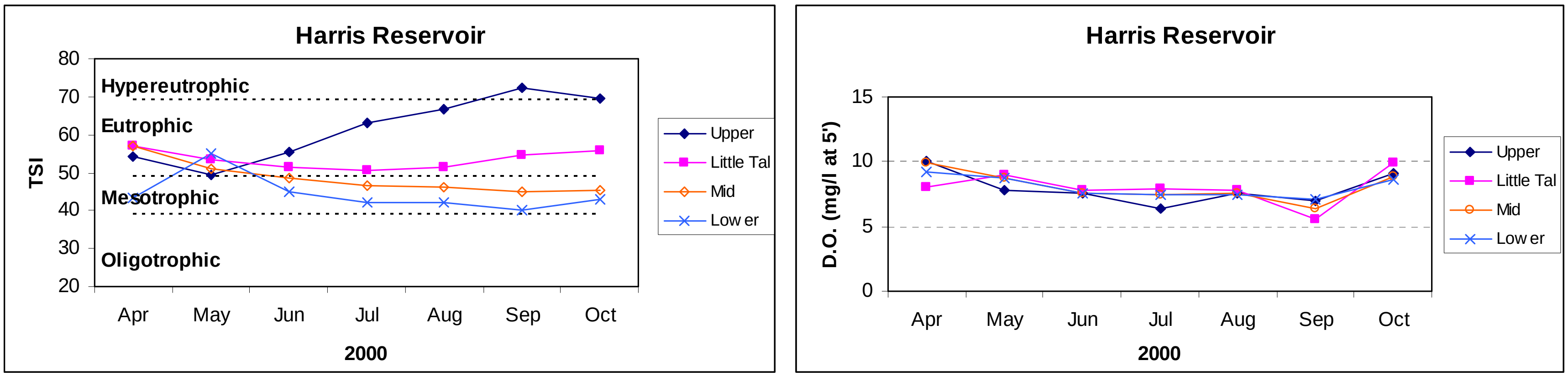


Figure II.11. Trophic state index (TSI), and dissolved oxygen (DO) of Harris Reservoir, April-October 2000.

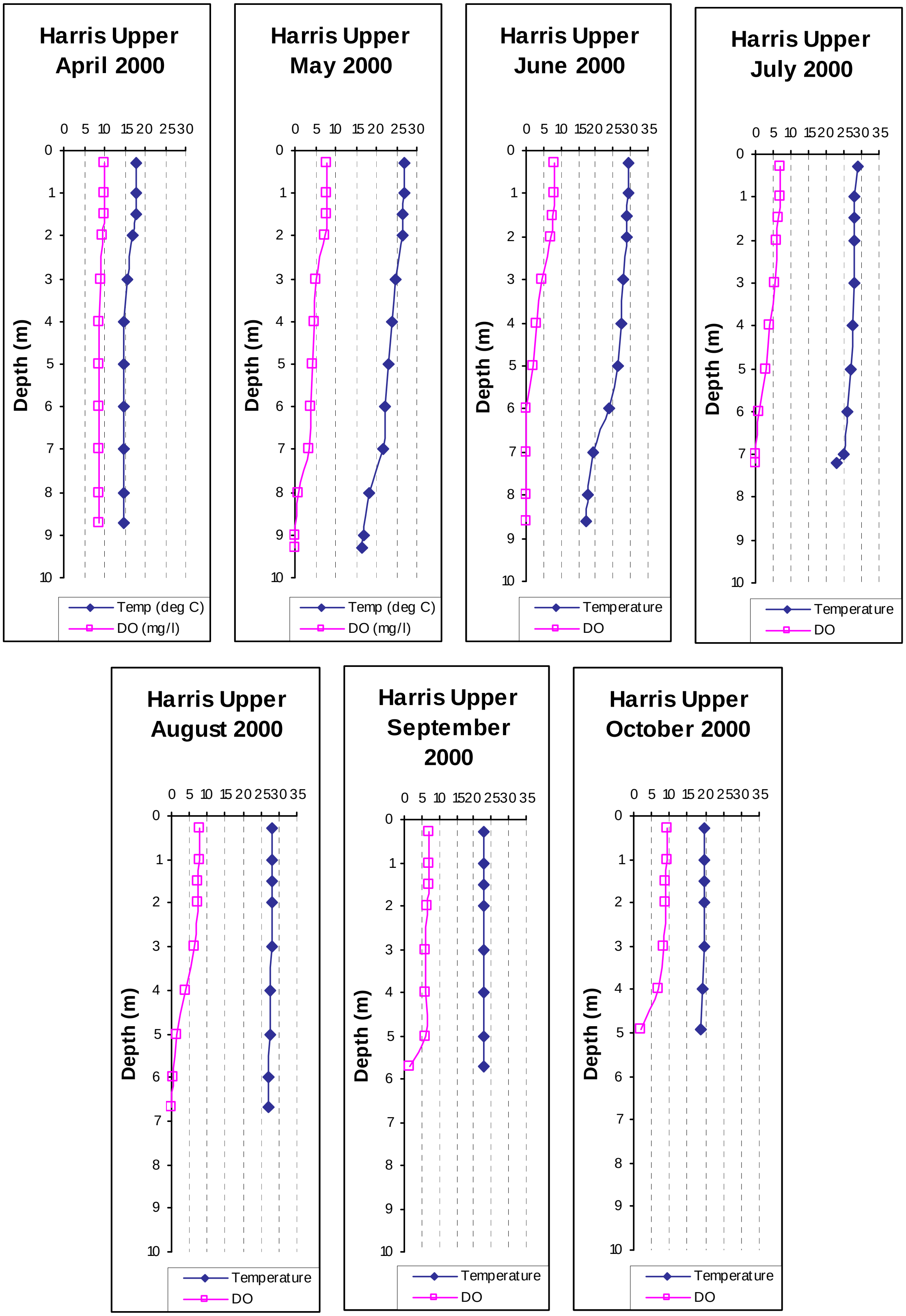


Figure II.12. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Harris Reservoir, April-October 2000.

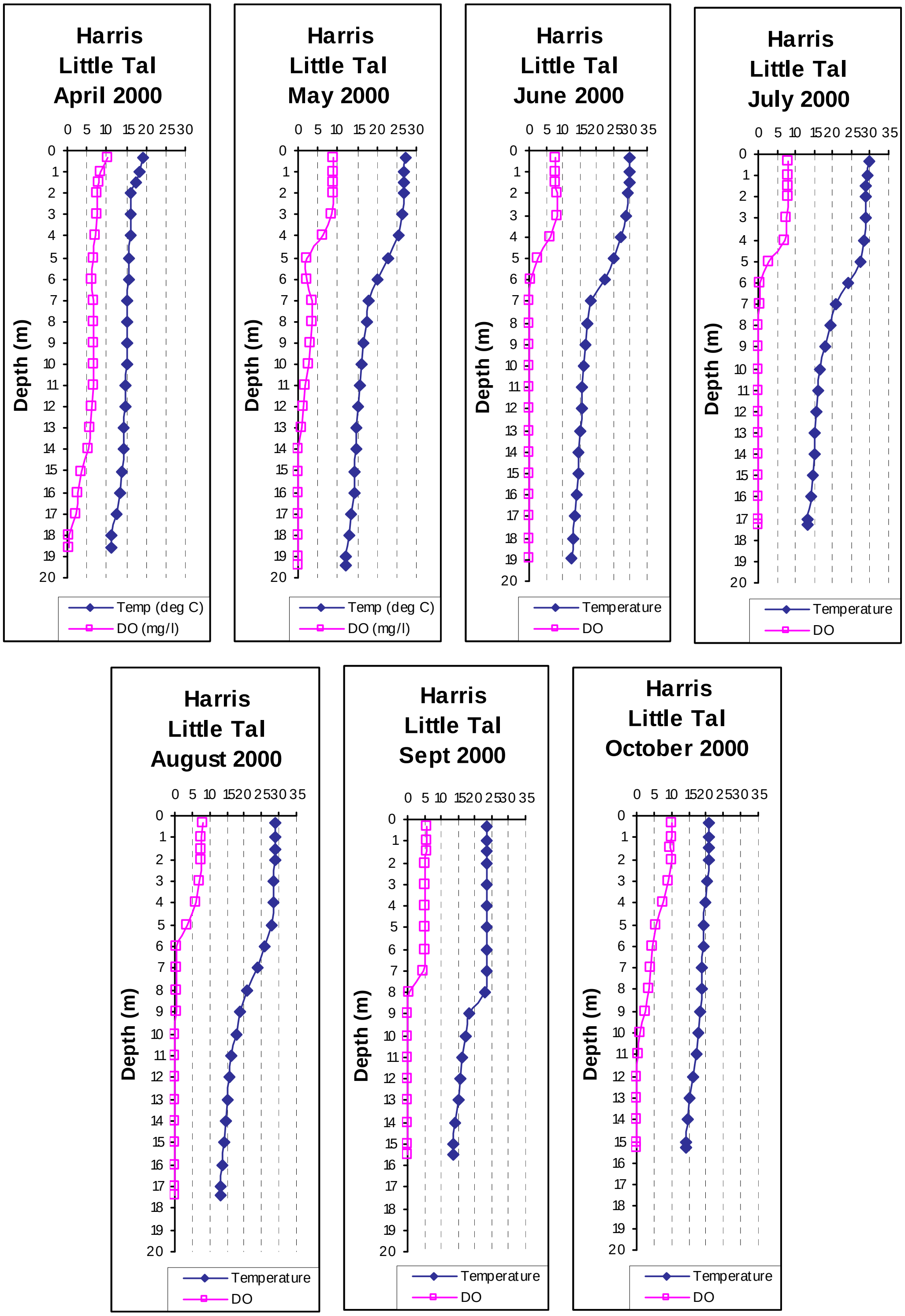


Figure II.13. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Little Tallapoosa river channel into Harris Reservoir, April-October 2000.

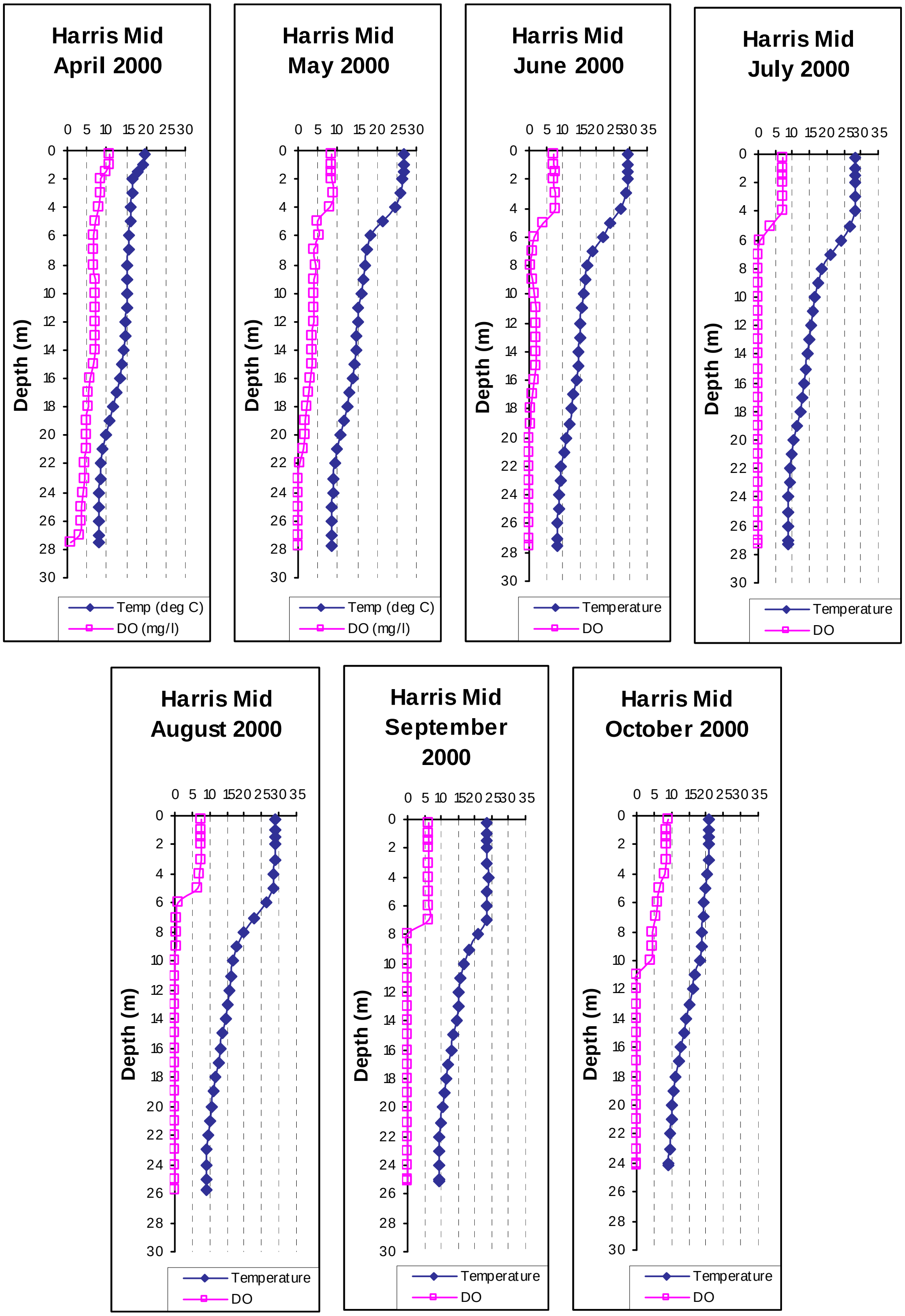


Figure II.14. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Harris Reservoir, April-October 2000.

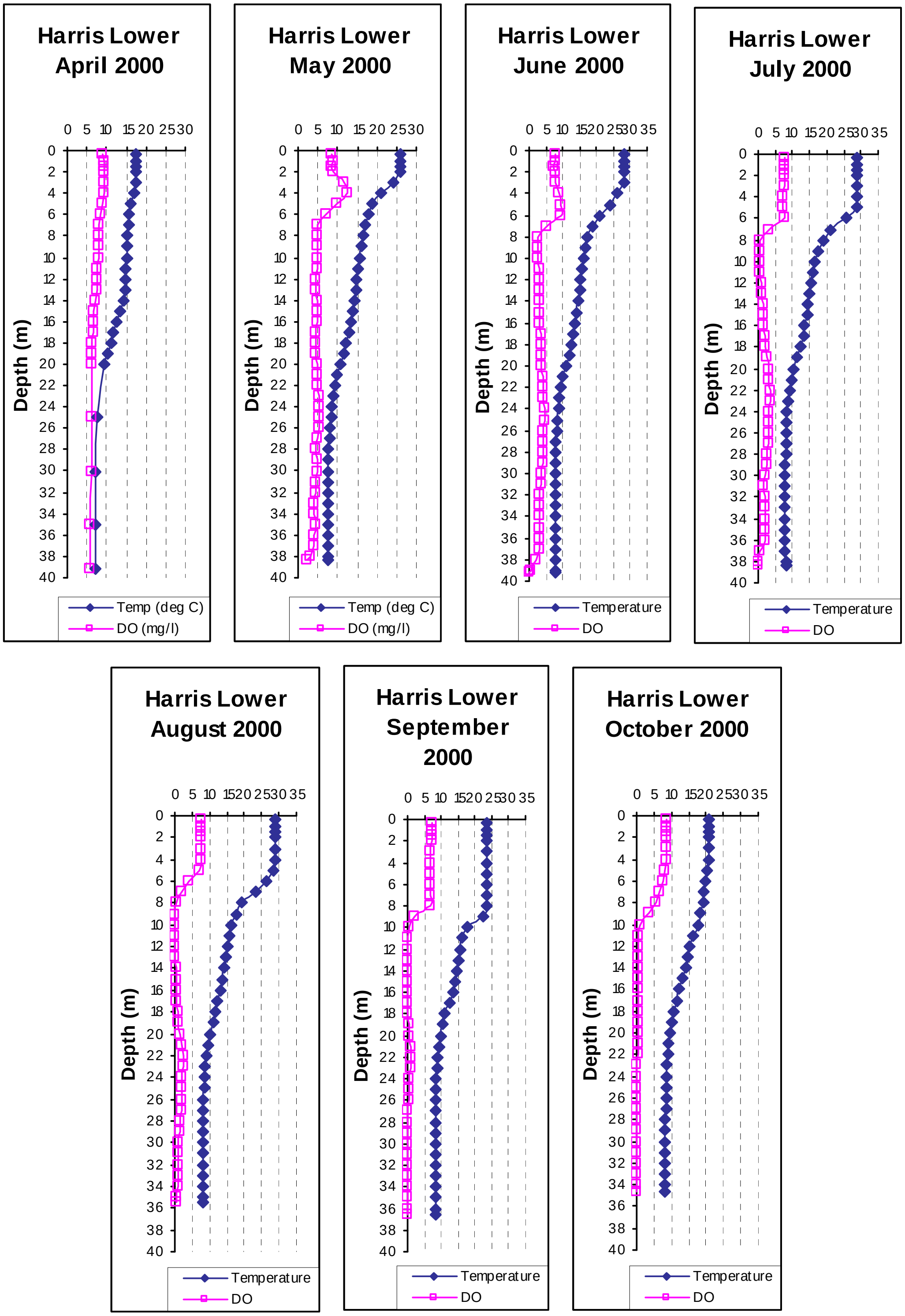


Figure II.15. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Harris Reservoir, April-October 2000.

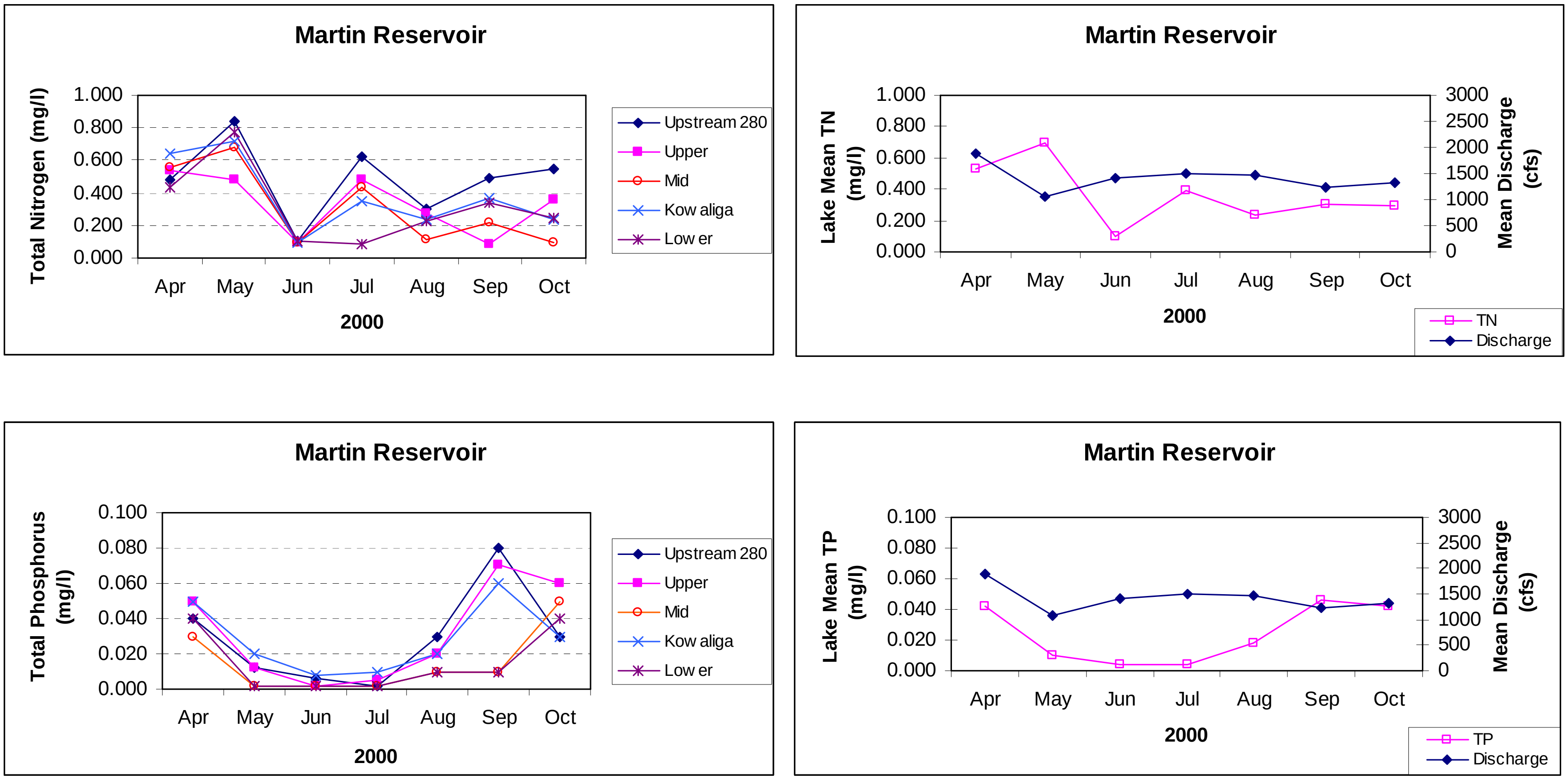


Figure II.16. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Martin Reservoir, April-October 2000.

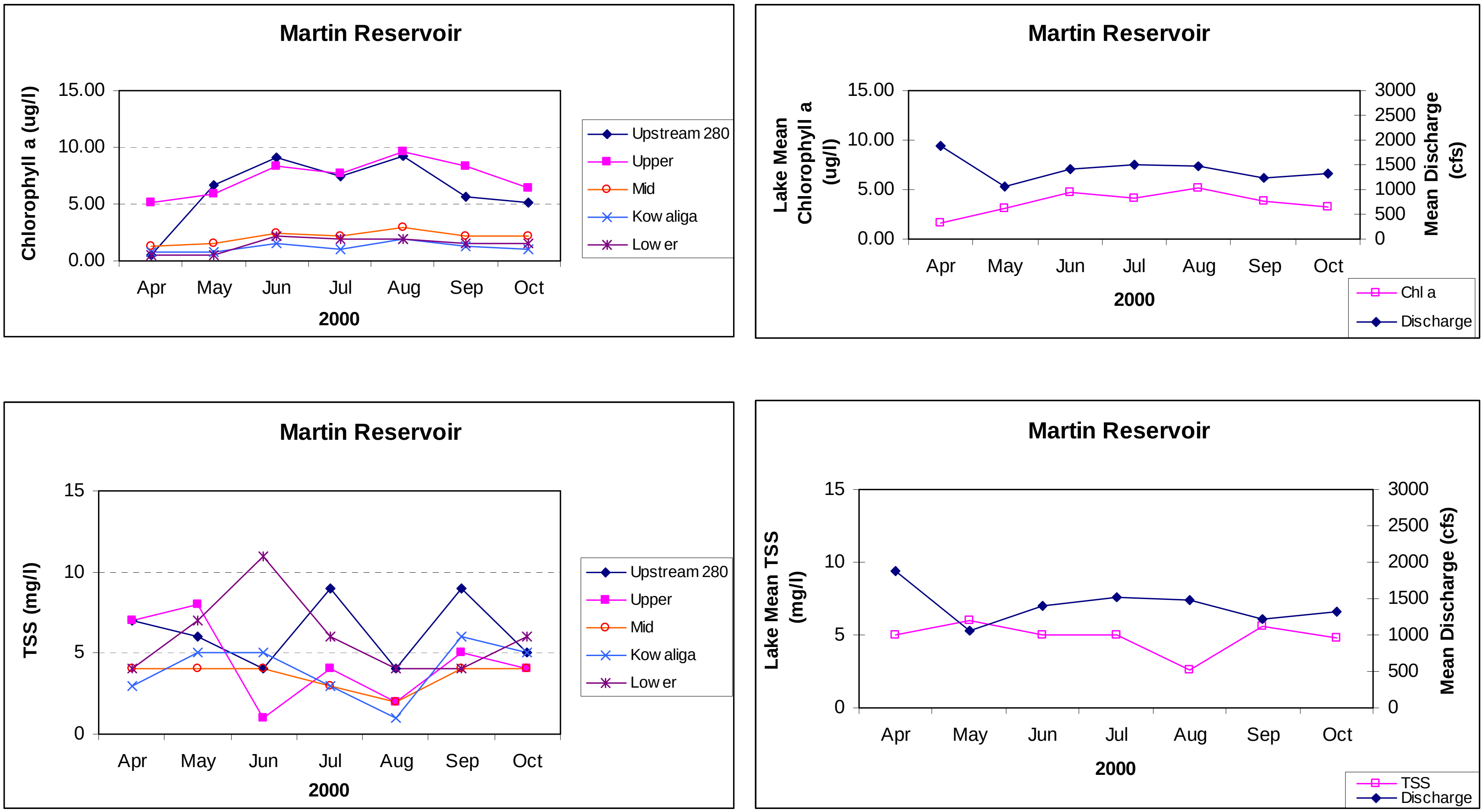
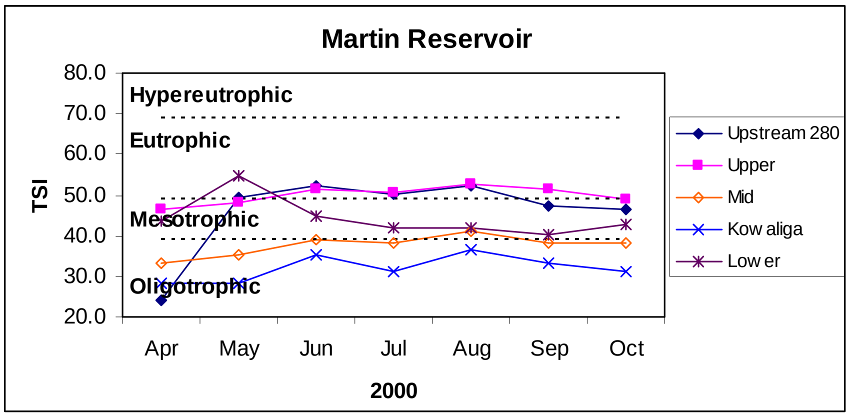


Figure II.17. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids (TSS), and TSS vs. discharge of Martin Reservoir, April-October 2000.



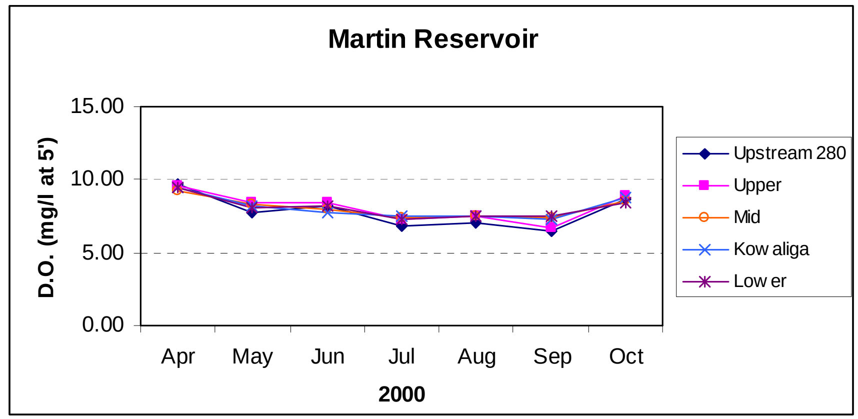


Figure II.18. Trophic state index (TSI), and dissolved oxygen (DO) of Martin Reservoir, April-October 2000.

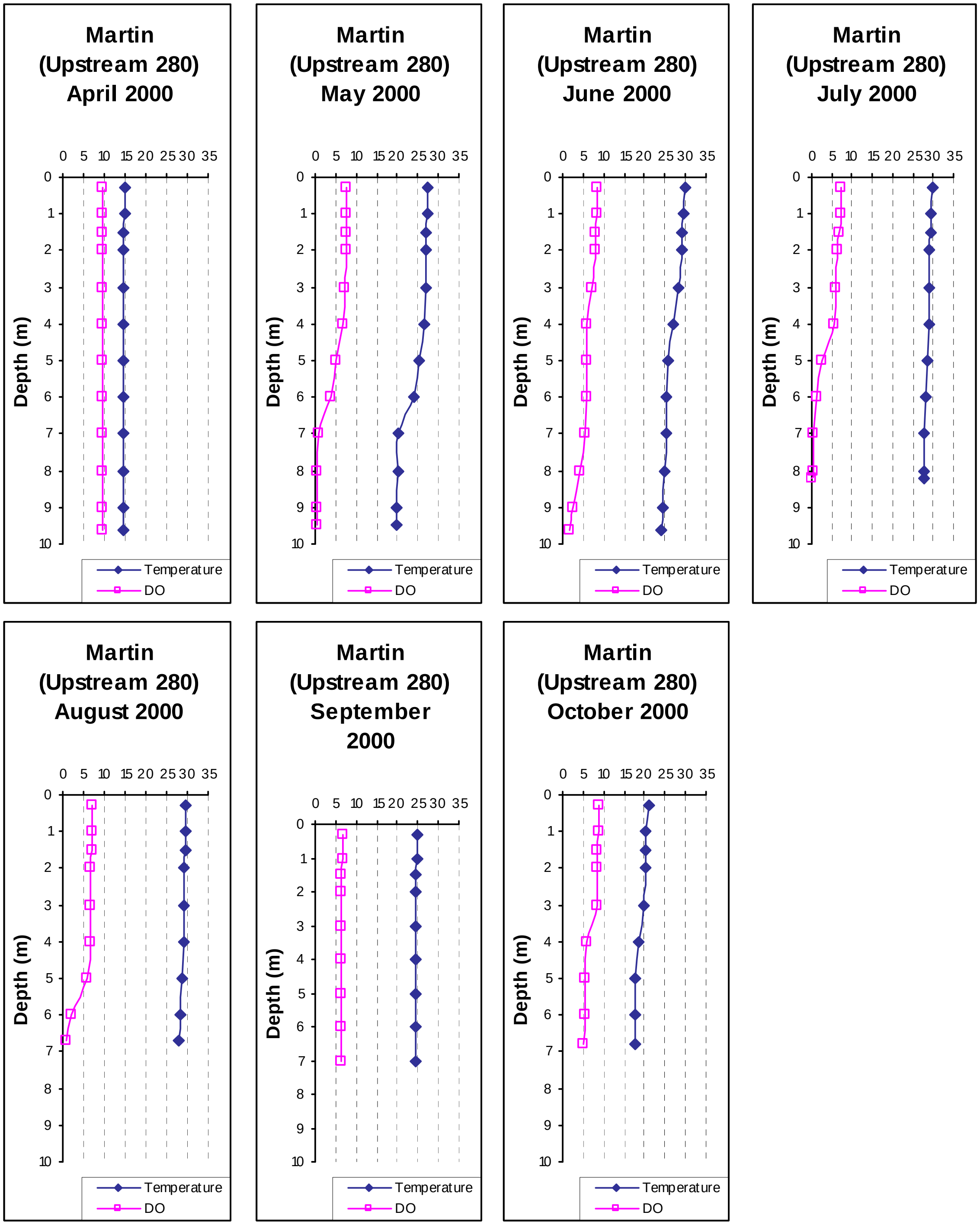


Figure II.19. Depth profiles of dissolved oxygen (DO) and temperature (Temp) upstream of 280 in Martin Reservoir, April-October 2000.

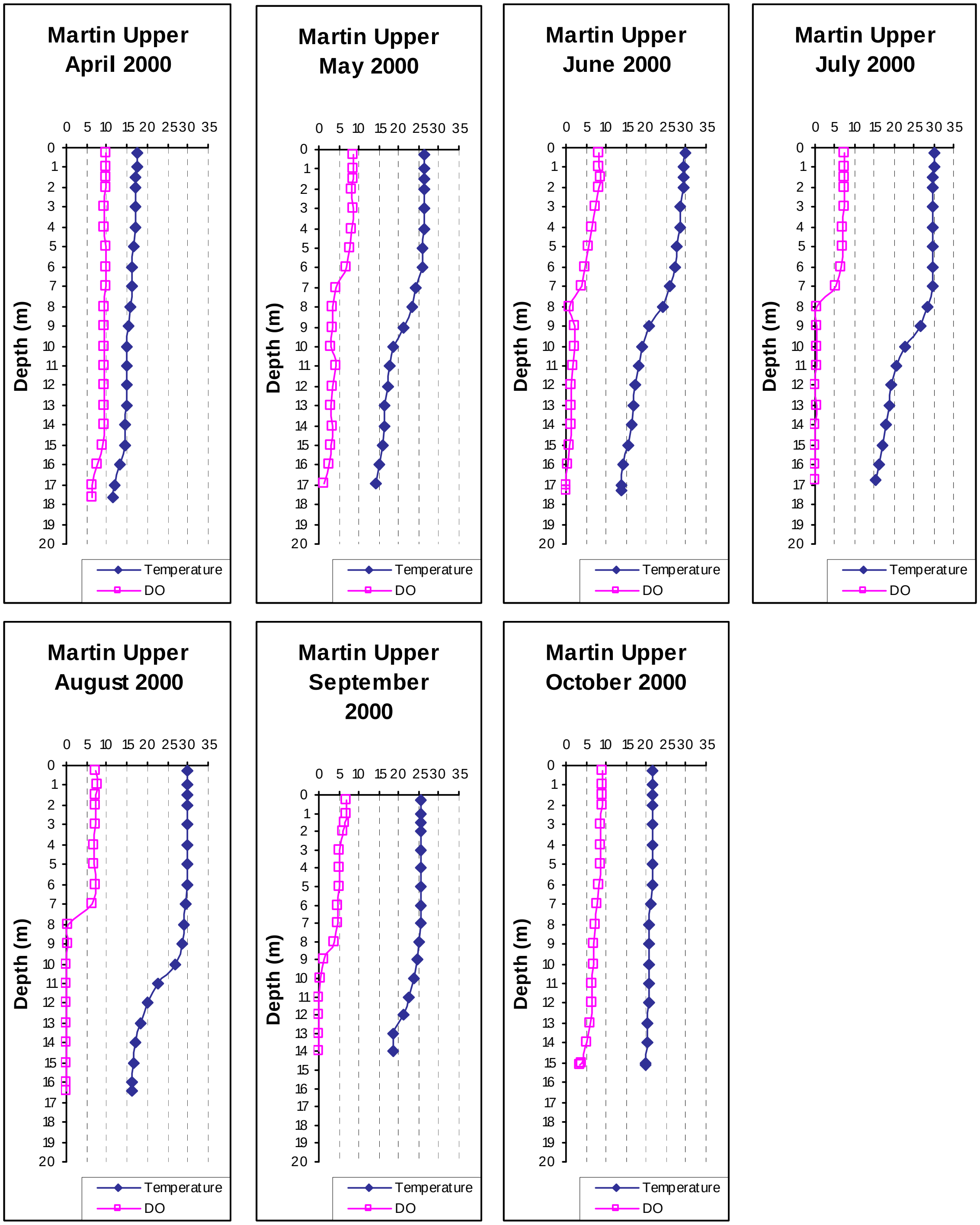


Figure II.20. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Martin Reservoir, April-October 2000.

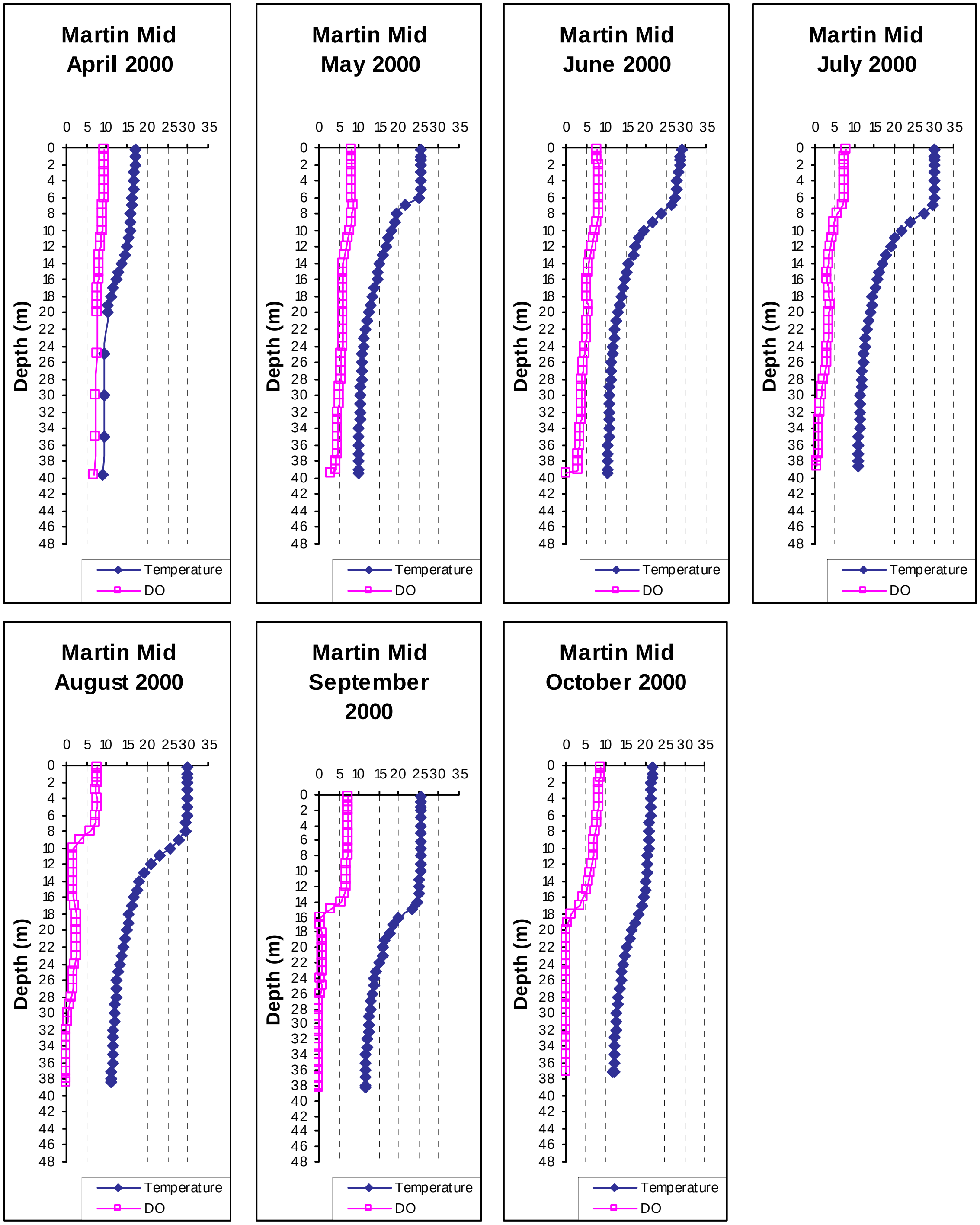


Figure II.21. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Martin Reservoir, April-October 2000.

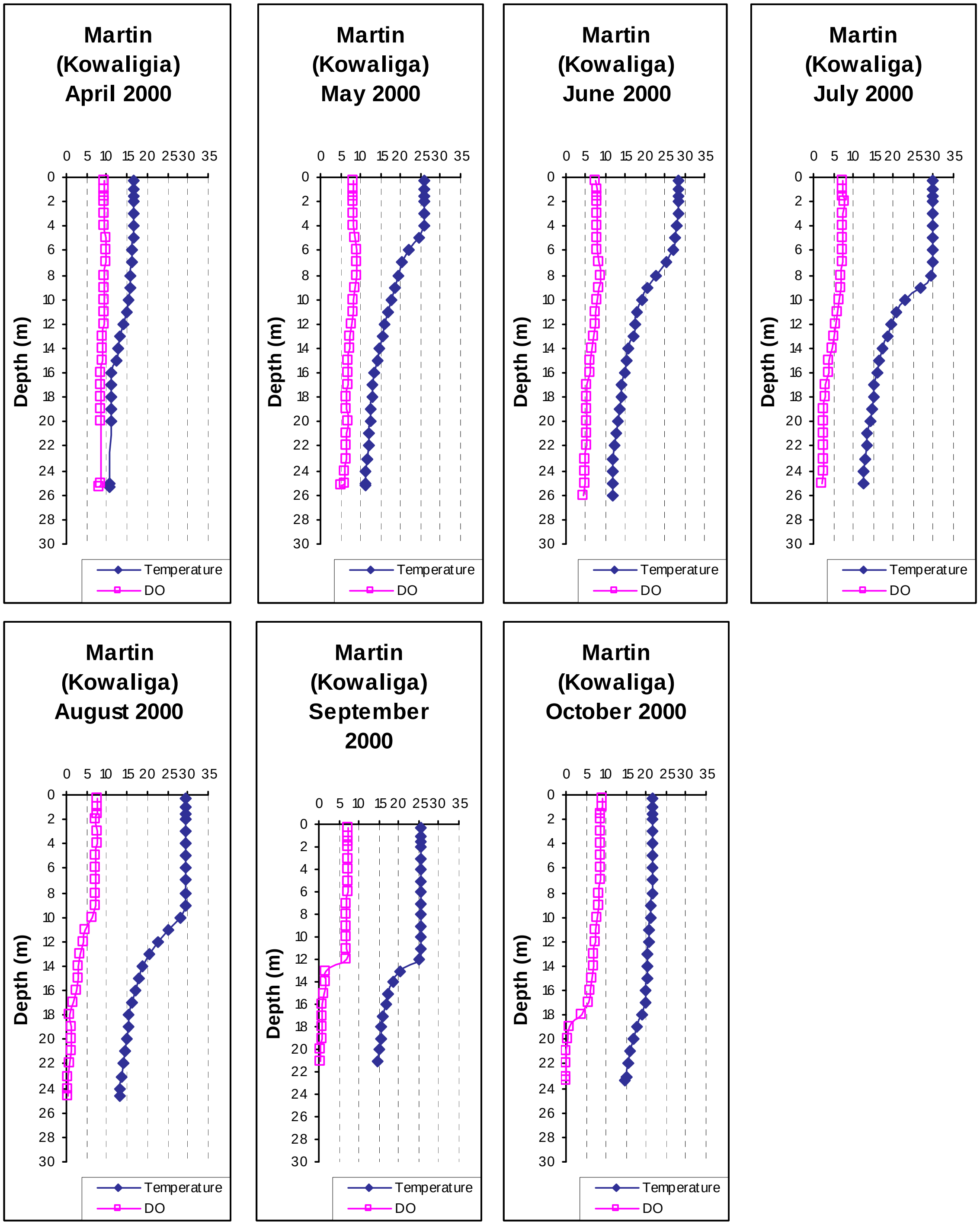


Figure II.22. Depth profiles of dissolved oxygen (DO) and temperature (Temp) at Kowaliga in Martin Reservoir, April-October 2000.

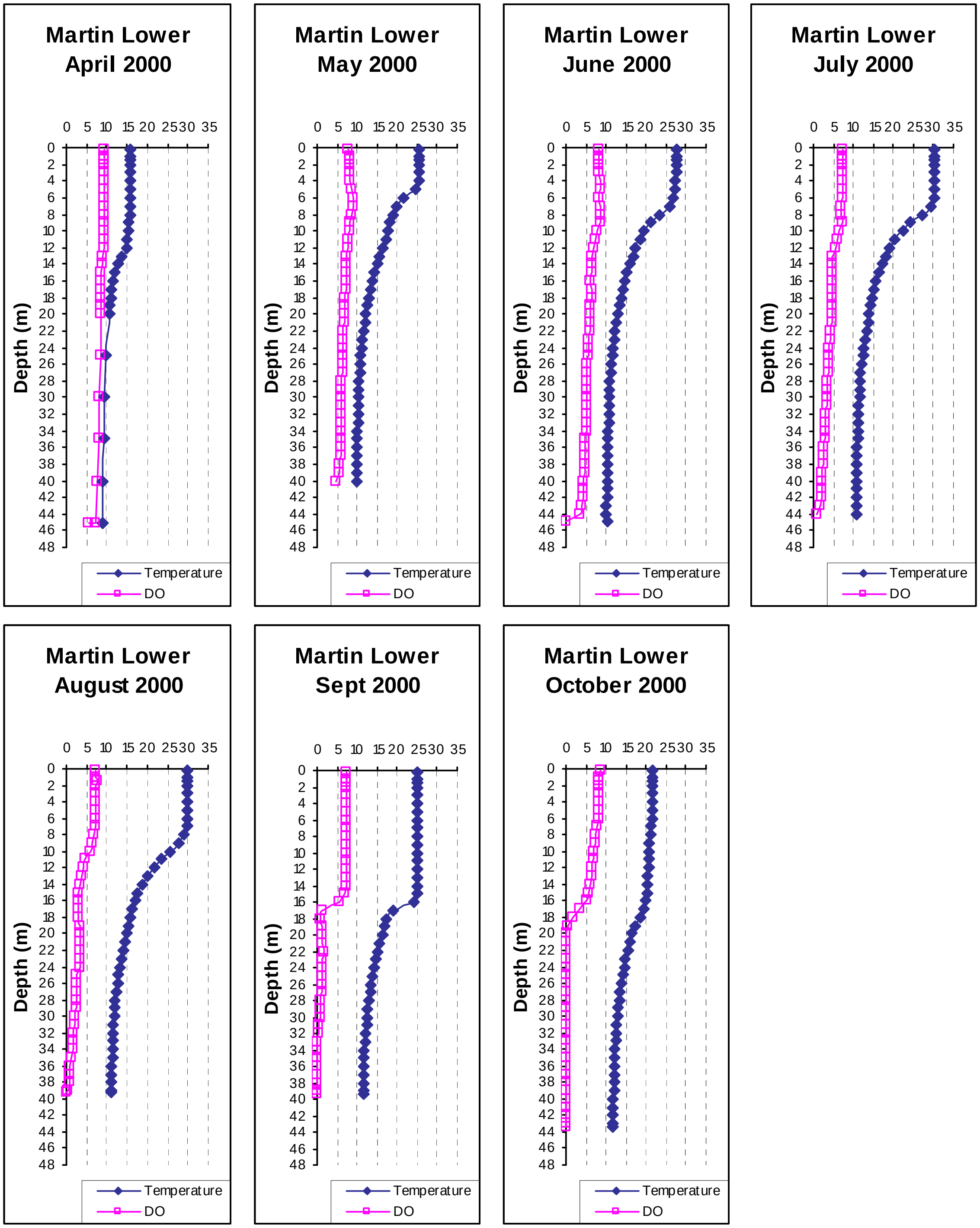


Figure II.23. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Martin Reservoir, April-October 2000.

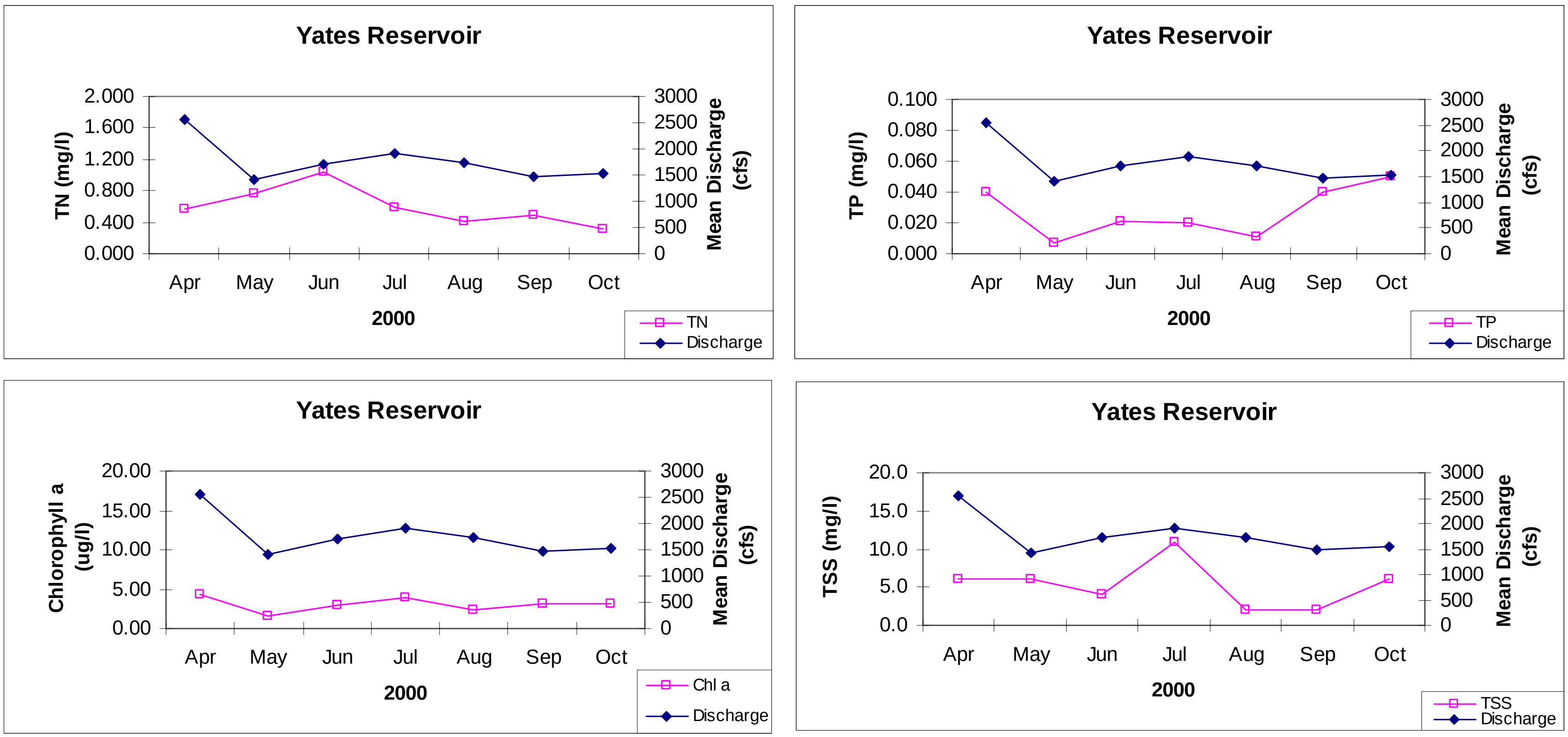
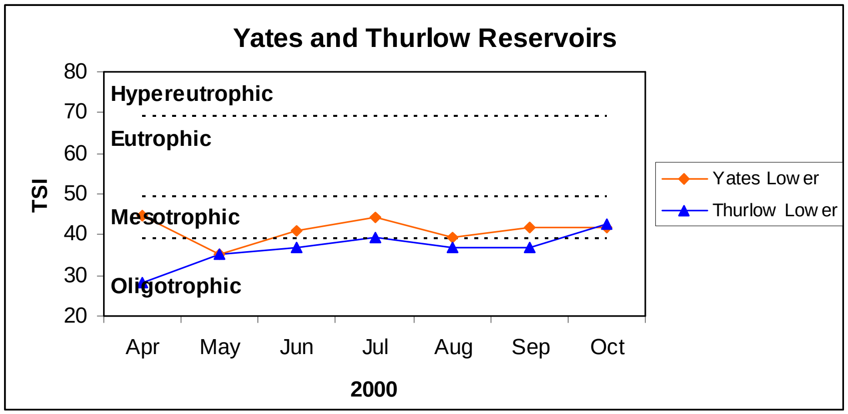


Figure II.24. Total nitrogen (TN) vs. discharge, total phosphorus (TP) vs. discharge, chlorophyll *a* vs. discharge, and total suspended solids vs. discharge of Yates Reservoir, April-October 2000.



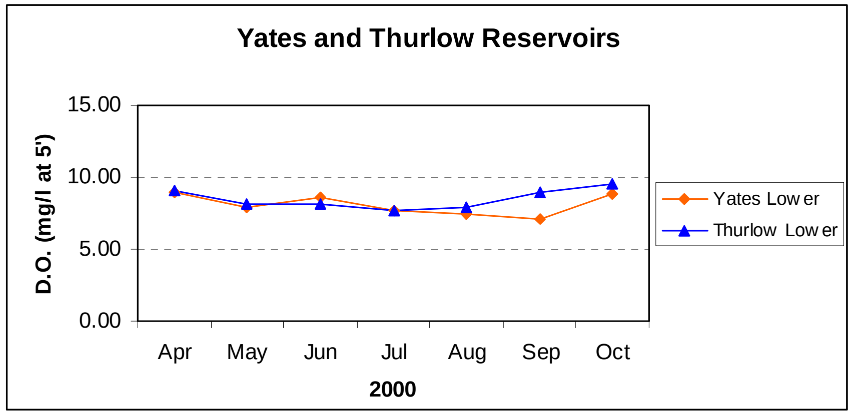


Figure II.25. Trophic state index (TSI) and dissolved oxygen (DO) of Yates and Thurlow Reservoirs, April-October 2000.

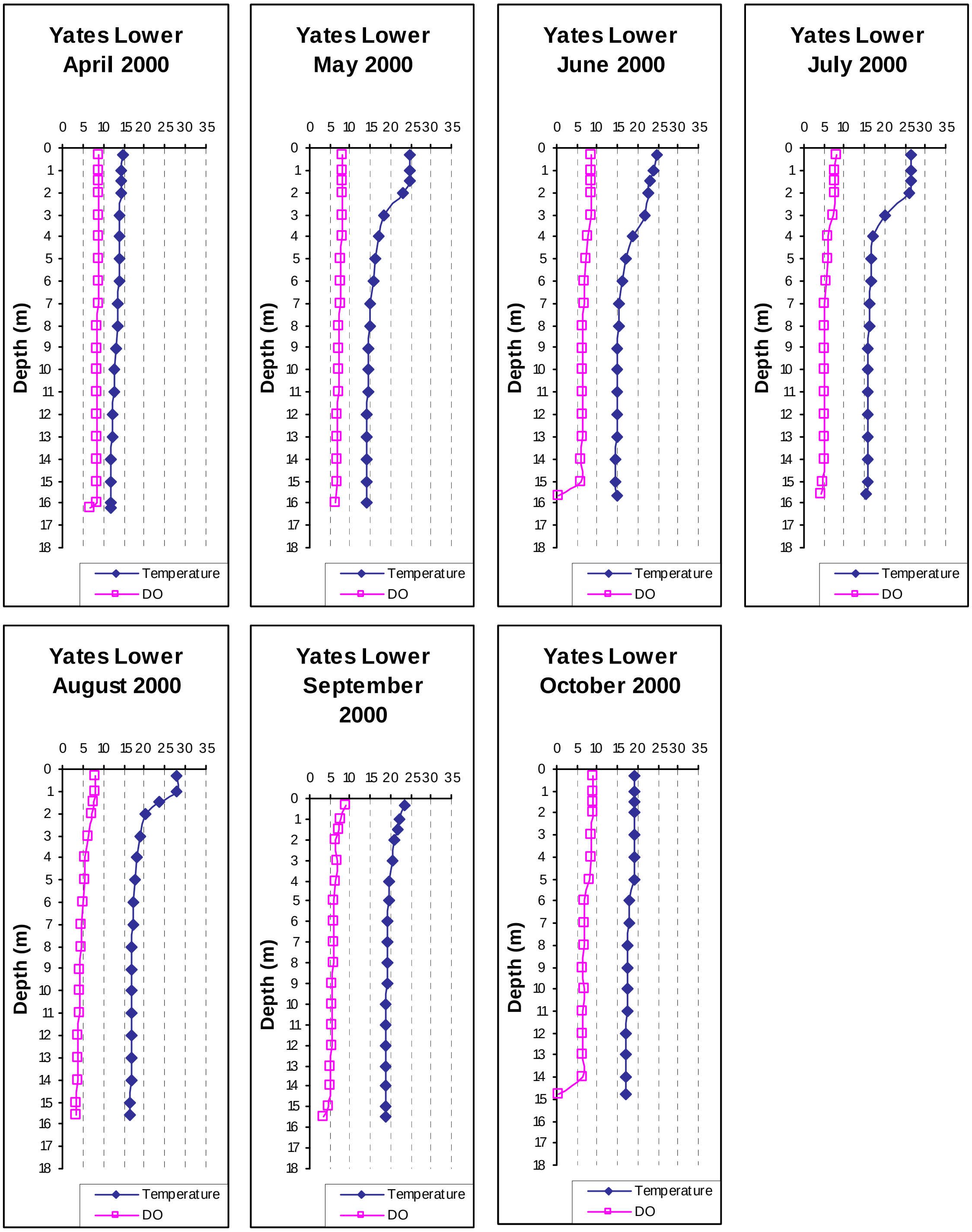


Figure II.26. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Yates Reservoir, April-October 2000.

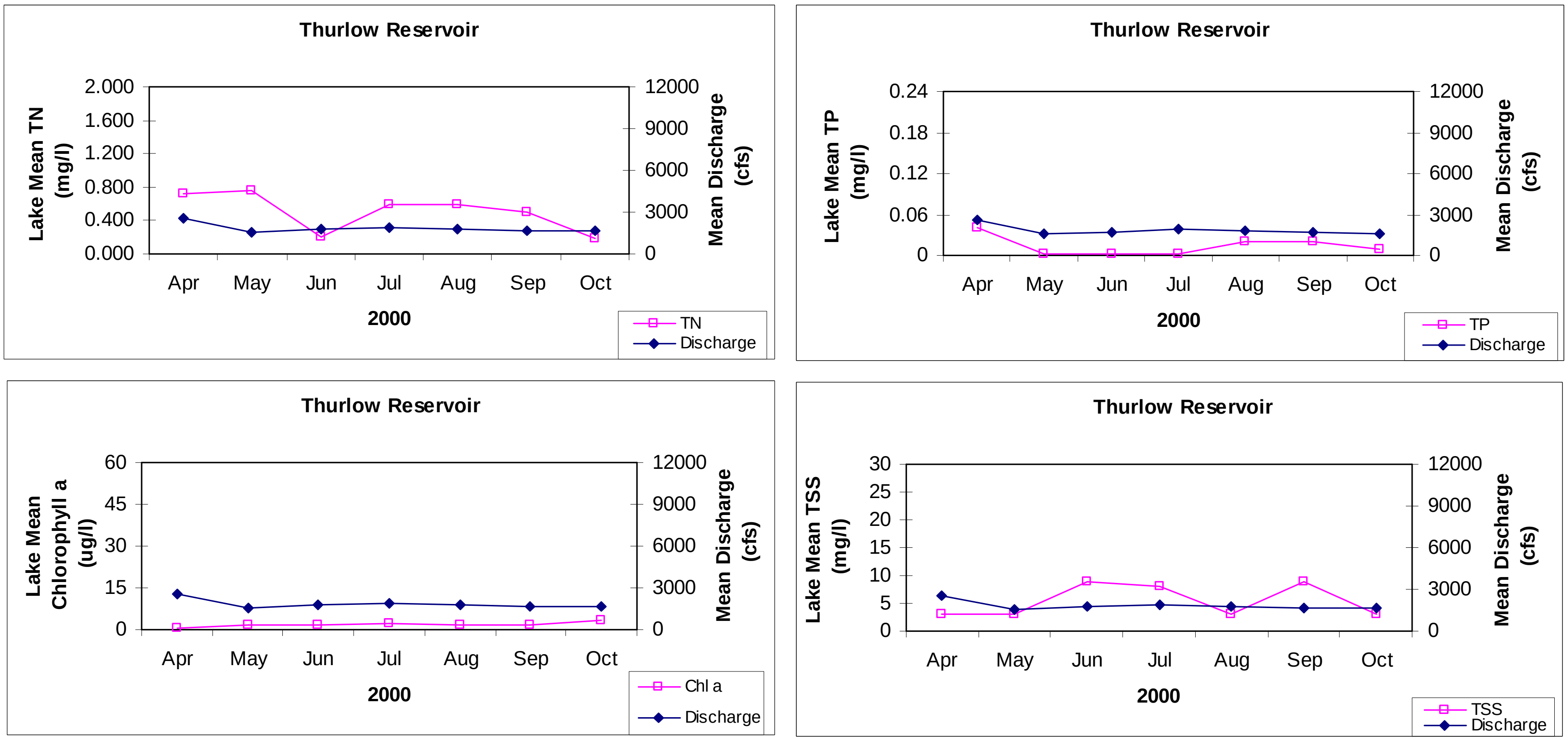


Figure II.27. Total nitrogen (TN) vs. discharge, total phosphorus (TP) vs. discharge, chlorophyll *a* vs. discharge, and total suspended solids vs. discharge of Thurlow Reservoir, April-October 2000.

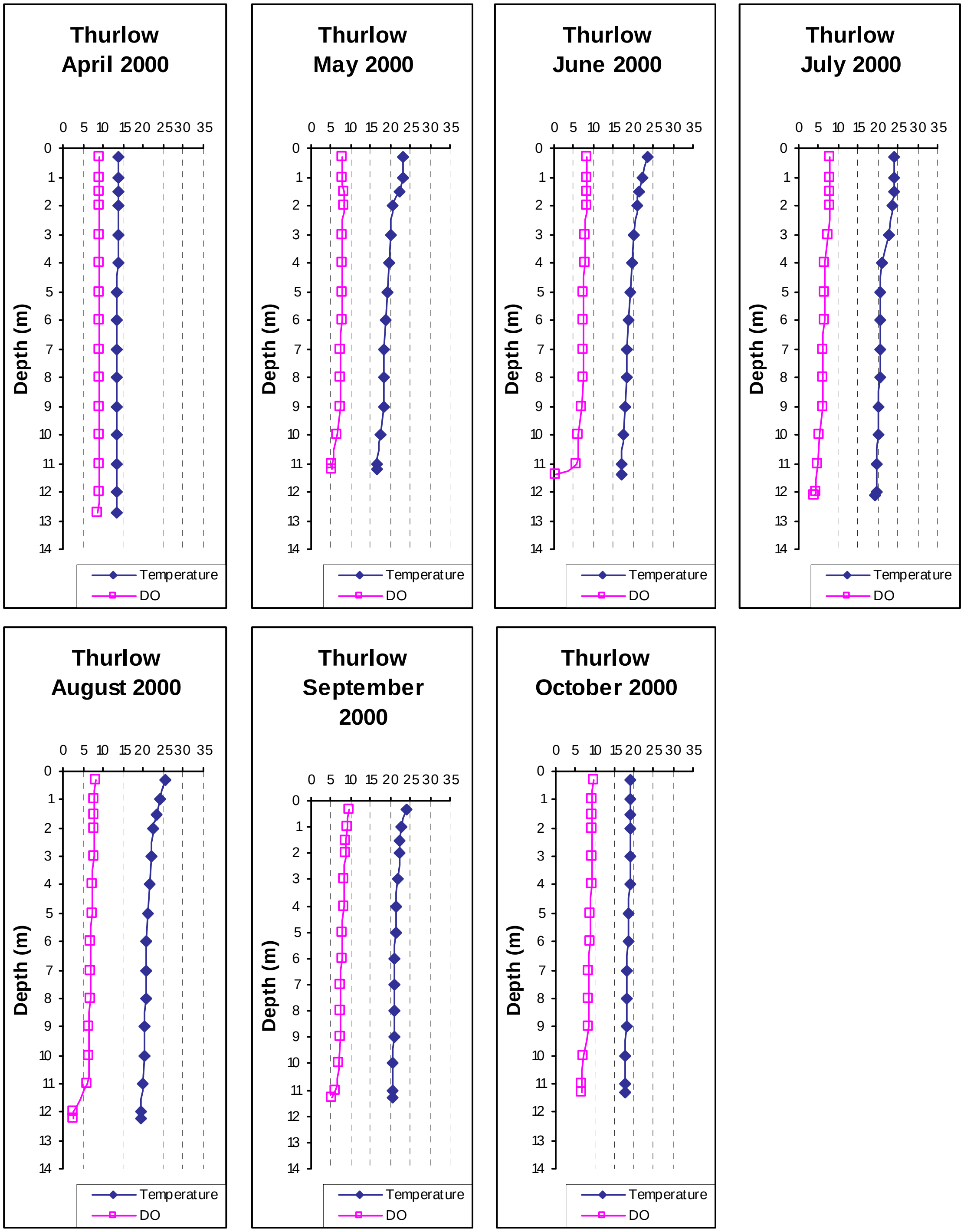


Figure II.28. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Thurlow Reservoir, April-October 2000.

III. ALABAMA RIVER RESERVOIRS

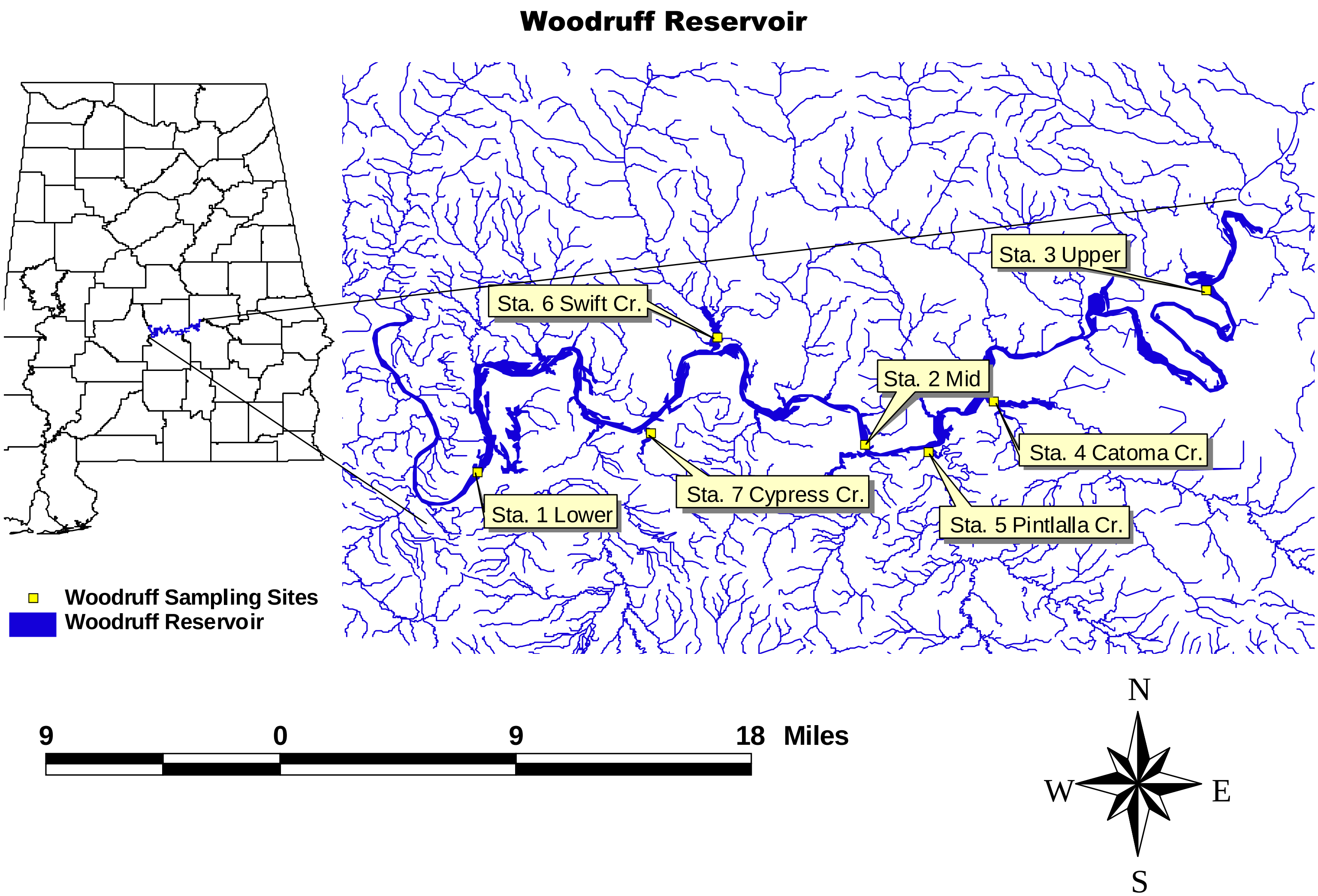


Figure III.1. Woodruff Reservoir with 2000 sampling locations.

Woodruff Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentrations at Woodruff Reservoir were higher than other Alabama basin mainstem reservoir locations (Fig. III.4). Concentrations increased slightly from upstream to downstream reservoir locations.

Monthly TN concentration more than doubled at each station from April to June and decreased back to initial concentrations by August (Fig. III.8). During May, TN concentration at upper reservoir was approximately 50% less than concentrations observed at other locations. Highest TN concentrations occurred during June.

Lake mean TN peaked in June, fell to lowest values in August, and remained low through October (Fig. III.8). Lake mean discharge was much higher during April than following months. There was no apparent relationship between lake mean TN and discharge.

Tributaries. Mean TN concentrations for the tributaries of Woodruff Reservoir were generally higher than other tributaries of the Alabama basin (Fig. III.6). The highest three concentrations were found in Pintlalla, Catoma, and Swift Creeks (0.971, 0.806, 0.802 mg/l, respectively).

Phosphorus

Mainstem. Mean total phosphorus concentrations were slightly higher overall than those downstream at Dannelly Reservoir (Fig. III.4). The mid-lake location (0.059 mg/l) was the highest of Woodruff Reservoir sampling stations.

Monthly TP concentrations at all Woodruff locations fluctuated similarly through July (Fig. III.8). From July to August, TP levels at upper and lower reservoir continued to increase. Concentrations at all locations peaked to highest values in September.

Lake mean TP concentration was variable throughout the sampling season (Fig. III.8). Highest lake mean TP concentration occurred in September. Discharge was approximately four times greater in April than any other month. There was no apparent relationship between lake mean TP concentration and mean discharge.

Tributaries. Overall, the tributaries of Woodruff Reservoir had higher mean TP concentrations overall than other tributaries in the Alabama basin (Fig. III.6). The highest TP concentration of any tributary sampled occurred in Catoma Creek (0.091 mg/l).

Algal Growth Potential Tests

Algal growth potential tests conducted for Woodruff Reservoir indicated that upper reservoir was phosphorus limited and middle and lower reservoir locations were nitrogen limited (Table III.1). Mean MSC values for middle and lower reservoir exceeded the 5.0 mg/l level suggested for avoidance of nuisance algal blooms and fish kills.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations were similar to the concentrations downstream at Dannelly Reservoir (Fig. III.5). Mean chlorophyll *a* at the upstream sampling area was approximately 3 μg/L lower than other Woodruff locations.

Monthly chlorophyll *a* concentrations were variable April to October (Fig. III.9). Highest chlorophyll *a* concentration for upper reservoir occurred during June. Chlorophyll *a* peaked at other sampling locations during September.

Lake mean chlorophyll *a* concentration fluctuated similar to lake mean TP concentration. Lake mean chlorophyll *a* peaked during September and was lowest during July (Fig. III.9). Following a decrease between April and May, lake mean discharge remained stable for the duration of the sampling period. There was no apparent relationship between lake mean chlorophyll *a* concentration and mean discharge.

Tributaries. Woodruff Reservoir tributaries had the highest overall mean chlorophyll *a* levels of the tributaries in the Alabama basin (Fig. III.7). Concentrations in Pintlalla and Catoma Creeks were the two highest of any Alabama basin tributary (27.77 and 25.99 μg/l, respectively).

Total Suspended Solids

Mainstem. Mean TSS concentrations in Woodruff Reservoir were similar to downstream Dannelly and less than those at Claiborne Reservoirs (Fig. III.5). Within the reservoir, mean concentrations in the upper reservoir were greater than those of the lower reservoir.

Monthly TSS concentrations were similar at all three reservoir locations May through September. The highest concentrations occurred in April at upper reservoir. Lowest concentrations were in August (Fig. III.9). The upper station concentration in April was two times greater than both the mid and lower stations.

In general, lake mean TSS concentrations decreased April to September with a slight increase occurring in July (Fig. III.9). Highest values occurred in April and lowest values occurred in September. Following a decrease between April and May, lake mean discharge remained stable for the duration of the sampling period.

Tributaries. Mean TSS concentration in the tributaries of Woodruff Reservoir were similar to other tributaries of the Alabama basin (Fig. III.7). The second highest overall mean chlorophyll *a* concentration was found in Catoma Creek (27.3 mg/l).

Trophic State

Trophic state index values at Woodruff Reservoir remained at eutrophic levels for all stations April to October, with one exception (Fig. III.10). Upper reservoir dropped into mesotrophic status in May, but returned to eutrophic status in June. TSI values peaked at all three locations to highest values during September.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations were highest during April and generally decreased until July (Fig. III.10). DO concentrations recovered slowly between July and October. DO concentrations remained above the criterion limit of 5.0 mg/l for all locations during the sampling period. In general, DO levels were higher at upper reservoir.

Depth profiles of temperature indicated little to no thermal stratification throughout the sampling period for all three mainstem reservoir stations (Figs. III.11, III.12 & III.13). DO concentrations were generally uniform and remained at or above 5.0 mg/l for the entire water column.

Tributaries. Depth profiles of temperature for Catoma and Pintlalla Creeks show little to no thermal stratification (Appendix Fig. III.1). Slightly elevated temperatures were evident at the surface. Highest temperatures were reached in June and August. Depth profiles of DO in both creeks show chemical stratification in all months.

Depth profiles of temperature and DO for Swift Creek were essentially isothermal and isochemical in August (Appendix Fig. III.2). Weak thermal and chemical stratification occurred in June. In Cypress Creek, depth profiles of temperature were isothermal in both April and August. A weak thermocline developed in June when highest temperatures occurred. Essentially isochemical conditions existed in April. A chemocline existed in June with DO concentrations below 2.0 mg/l near the bottom.

Summary and Discussion

Mean TN concentrations at Woodruff Reservoir were slightly higher than most other Alabama basin mainstem reservoir locations. TN concentration more than doubled at each station from April to June. Lake mean TP concentration fluctuated throughout the sampling season. Mean chlorophyll *a* concentration was highest at the mid-reservoir location of Woodruff. Highest chlorophyll *a* concentration for upper reservoir occurred during June. Chlorophyll *a* peaked at other sampling locations during September. The upper reservoir location was less productive than the lower two locations, potentially due to the influence of downstream tributaries. Mean TSS concentrations were relatively low, with the lowest mean TSS occurring in lower Woodruff Reservoir. Trophic state index values at Woodruff Reservoir were within eutrophic status. Dissolved oxygen concentrations were highest during April and fell slowly until July. Depth profiles of temperature indicated little to no thermal stratification during the sampling period.

Four tributaries to Woodruff Reservoir were monitored: Catoma, Pintlalla, Swift, and Cypress Creek. The Lower Catoma Creek sub-watershed drains approximately 98 mi^2 in Montgomery County, including most of the City of Montgomery (ADEM 2002a). Percent land cover of the Catoma Creek sub-watershed was estimated as 18% deciduous forest, 2% evergreen forest, 10% mixed forest, 22% pasture/hay, 14% row crop, 12% wetlands, 11% low intensity residential, 4% high intensity residential, 3% high intensity commercial/ industrial/transportation, and 1% open water. Estimates of land-use by the local SWCDs were higher for urban (40%), and lower for row crop (2%). Twenty-two (22) current construction/stormwater authorizations and one (1) municipal and one (1) mining NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.06 AU/acre). Sedimentation estimates indicated a *low* potential for nonpoint source impairment (2.4 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Water quality testing indicated high concentrations of TN, TP, chlorophyll *a*, and TSS within the system. The highest TP concentration occurred in Catoma Creek, as well as the second highest concentrations for all other parameters. Further monitoring is recommended to document nutrient levels and investigate any further nutrient loading. Depth profiles of dissolved oxygen show concentrations >5 mg/l through most of the water column in all months sampled.

The lower Pintlalla Creek sub-watershed drains approximately 91 mi^2 in Lowndes and Montgomery Counties (ADEM 2002a). Percent land cover of the lower Pintlalla Creek sub-watershed was estimated as 17% deciduous forest, 4% evergreen forest, 12% mixed forest, 35% pasture/hay, 20% row crop, 10% wetland, and 1% open water. Estimates of land-use by the local SWCDs were higher for pasture (64%) and open water (3%) and lower for row crop (5%) land-uses. Four (4) current construction/stormwater authorizations, and one (1) semi-public/private NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.29 AU/acre), with cattle (0.19 AU/acre) and broiler poultry (0.08 AU/acre) being the dominant animal types. Sedimentation estimates indicated a *low* potential for NPS impairment (3.1 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. Mean TN and mean chlorophyll *a* concentrations were the highest of any tributary. Mean TP concentration was the third highest. Depth profiles of dissolved oxygen show distinct chemical stratification in all months. Deoxygenation did not occur.

The Swift Creek sub-watershed drains approximately 161 mi^2 in Chilton and Autauga Counties (ADEM 2002a). Percent land cover of the Swift Creek sub-watershed was estimated 2% transitional forest, 23% deciduous forest, 18% evergreen forest, 26% mixed forest, 7% pasture/hay, 14% row crop, 11% wetland, and less than 1% open water. Estimates of land-use by the local SWCDs were higher for forest (73%) and pasture (12%), and lower for row crop (10%) land-uses. Four (4) current construction/stormwater authorizations, two (2) mining NPDES permits, and one (1) municipal NPDES permit have been issued in the sub-watershed The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle and swine being the dominant animals. Sedimentation estimates indicated a *low* potential for NPS impairment (1.2 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *moderate*. The third highest TN concentration occurred at Swift Creek along with the lowest mean TSS concentration. Mean TP and mean chlorophyll *a* concentrations were within range of other tributaries in this basin. Depth profiles do not indicate any DO concentration concerns.

The Cypress Creek sub-watershed drains approximately 45 mi^2 in Lowndes County (ADEM 2002a). Percent land cover of the Cypress Creek sub-watershed was estimated as 20%

deciduous forest, 2% evergreen forest, 14% mixed forest, 19% pasture/hay, 24% row crop, 15% wetland, 1% low intensity residential, 1% high intensity commercial/ industrial/transportation, and 6% open water. Estimates of land-use by the local SWCDs were lower for forest (30%) and open water (3%) and higher for row crop (32%) and pasture (29%). Two (2) current construction/stormwater authorizations and one (1) CAFO registration have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.09 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for nonpoint source impairment (3.6 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *high.* Only slightly elevated levels of TN, TP, and chlorophyll *a* were assessed at this station. Cypress Creek had the second lowest mean TSS concentration. Depth profiles of dissolved oxygen show stratification in June near the top and in August near the bottom of the water column. Deoxygenation did not occur.

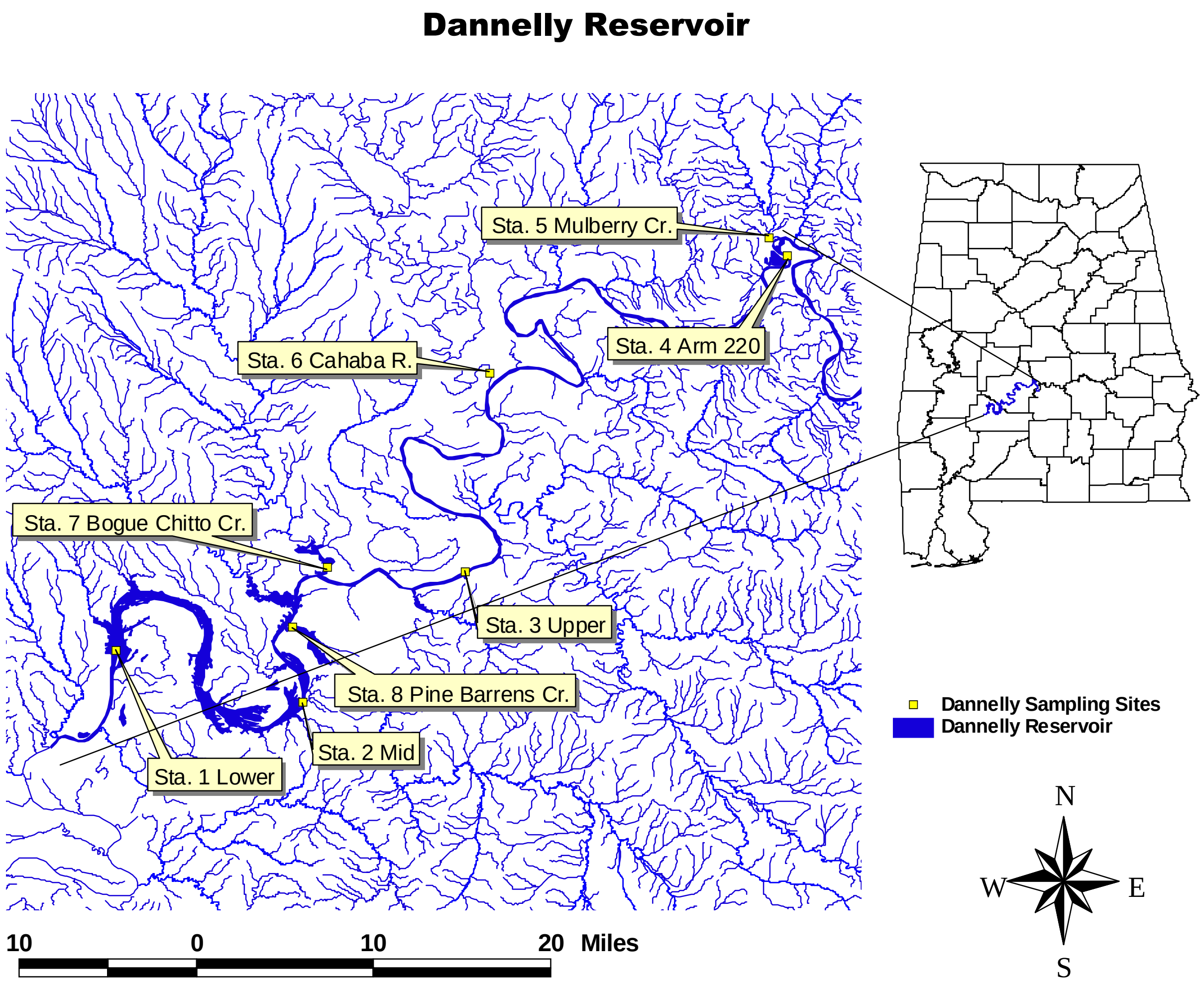


Figure III.2. Dannelly Reservoir with 2000 sampling locations.

Dannelly Reservoir

Nitrogen

Mainstem. Mean TN concentration at ARM 220 location of Dannelly Reservoir was below any other Alabama basin mainstem reservoir sampling station (Fig. III.4). Mid-reservoir exhibited the highest mean TN concentrations of the Dannelly mainstem locations.

Monthly TN concentrations generally increased to highest concentrations by July (Fig. III.14). TN concentration at mid-reservoir was approximately three times higher in July than the previous month. TN levels sharply declined from July to August, especially at the three uppermost locations.

Lake mean TN concentration increased April to May, decreased slightly in June, and peaked in July (Fig. III.14). Following the July peak, lake mean TN fell quickly to a lowest concentration in August. Lake mean TN remained relatively stable August to October. Mean discharge was approximately four times higher in April than any other month. There was no apparent relationship between lake mean TN and discharge.

Tributaries. The three lowest mean TN concentrations of the tributaries of the Alabama basin flow into Dannelly Reservoir (Fig. III.6). The lowest reported TN concentration for the basin was found in Mulberry Creek (0.172 mg/l).

Phosphorus

Mainstem. Mean TP concentrations at Dannelly Reservoir were generally lower than upstream and downstream reservoirs (Woodruff and Claiborne) (Fig. III.4). Mid-Dannelly Reservoir was lower than any other Alabama basin mainstem reservoir station sampled (0.027 mg/l).

Monthly TP concentrations varied throughout the sampling period. For July, TP concentration was approximately four times higher at the ARM 220 (Selma) location than TP at other Dannelly locations (Fig. III.14). TP concentrations were relatively low at all locations during August. TP concentrations increased August to September with exception of the mid-reservoir location. For October sampling, TP concentration fell to lowest values at upper reservoir, but increased to highest values at mid-reservoir.

Lake mean TP concentration was lowest during August, but concentrations were highest during September (Fig. III.14). Mean discharge fell sharply April to May and remained stable until October. There was no apparent relationship between lake mean TP and mean discharge.

Tributaries. Overall, mean TP concentrations of the tributaries of Woodruff Reservoir were variable from the lowest of the Alabama tributaries to the second highest (Fig. III.6).

Algal Growth Potential Tests

Algal growth potential tests conducted for Dannelly indicated the entire reservoir was nitrogen limited (Table III.1). Mean MSC values ranged from 2.01 mg/l at ARM 220 location to 4.34 mg/l at mid-reservoir. All mean MSC values were below the maximum 5.0 mg/l level suggested to avoid nuisance algal blooms and fish kills.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations at Dannelly Reservoir were higher than downstream Claiborne Reservoir (Fig. III.5). Within the reservoir, concentrations were highest at the upper two stations and decreased to lowest levels at the dam forebay.

Monthly chlorophyll *a* concentrations increased similarly April to June at the three upper stations of Dannelly Reservoir (Fig. III.15). The lowest concentration was at lower reservoir in May. Concentrations of chlorophyll *a* generally decreased between June and September at the upper, mid, and lower locations, while concentrations at the ARM 220 station more than doubled from July to September. By October, chlorophyll *a* at all locations returned to similar concentrations.

Lake mean chlorophyll *a* concentration for Dannelly Reservoir increased slightly from April to October (Fig. III.15). Mean discharge fell sharply April to May and remained relatively stable through October. There was no apparent relationship between lake mean chlorophyll *a* concentration and mean discharge.

Tributaries. Mean chlorophyll *a* concentrations of the tributaries of Dannelly Reservoir were among the lowest of the basin (Fig. III.7). Mulberry Creek and the Cahaba River had the lowest two chlorophyll *a* concentrations of any tributary in the Alabama basin. Bogue Chitto concentrations were higher and similar to those found in Woodruff tributaries.

Total Suspended Solids.

Mainstem. Mean TSS concentrations in Dannelly Reservoir were similar to upstream Woodruff reservoir locations and lower than downstream Claiborne reservoir locations (Fig. III.5). Mean concentrations was highest at ARM 220.

Monthly TSS values fluctuated, but generally decreased from highest values in April to lowest values in September (Fig. III.15). In June, ARM 220 had TSS values almost twice the values at the other three stations. In August, the upper reservoir station had concentrations that were three times less than the other three stations.

Lake mean TSS concentrations decreased from April through September, with a slight increase in August (Fig. III.15). Concentrations increased again in October. At the beginning of the season, higher concentrations were observed with higher flows and lower concentrations during lower flows. However, the decrease in TSS in September was not associated with a change in flow.

Tributaries. Mean TSS concentrations were similar to other Alabama basin tributaries, with the exception of the Cahaba River (Fig. III.7). The highest reported mean TSS concentration was found in the Cahaba River (38.3 mg/l), over 10 mg/l higher than any other value.

Trophic State

Monthly trophic state index values remained above eutrophic status (Fig. III.16). The lowest TSI value occurred at lower reservoir during May. During September, the TSI value at ARM 220 location was near Hypereutrophic status and was the highest for the sampling period.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations decreased steadily across Dannelly Reservoir from April to July (Fig. III.16). During July, DO concentrations were just below the criterion limit of 5.0 mg/l at the middle and lower reservoir stations. DO concentrations increased from July to October at all locations, but a more rapid recovery occurred at the ARM 220 location.

Depth profiles of temperature indicated little or no thermal stratification at all four Dannelly Reservoir locations April to October (Figs. III.17, III.18, III.19 & III.20). Temperatures for the entire water column were above 30° C during July and August. Little or no chemical stratification occurred from April to October.

Tributaries. No depth profiles of temperature and dissolved oxygen exist for Mulberry Creek due to very shallow conditions in June and August (Appendix Fig. III.3). Surface samples show favorable dissolved oxygen, but temperatures above 30°C.

Depth profiles of temperature and dissolved oxygen show essentially isothermal and isochemical conditions in the Cahaba River in April, June, and August (Appendix Fig. III.3).

In Bogue Chitto Creek, depth profiles of temperature and dissolved oxygen show weak stratification in April (Appendix Fig. III.3). Isothermal conditions existed in June and August while weak chemical stratification was evident. Deoxygenation occurred near the bottom in June.

Depth profiles of temperature and dissolved oxygen in Pine Barren Creek show stratification in April followed by isothermal and isochemical condition in June and August (Appendix Fig. III.3). Temperatures were above 30° C in both June and August. DO remained at or above 5 mg/l for the entire water column.

Summary and Discussion

Although the mean TN concentration at the ARM 200 sampling location of Dannelly Reservoir was below any other Alabama basin mainstem reservoir station, mean TP was highest. Lake mean TP concentration was lowest during August and peaked to highest concentrations in September. Mean chlorophyll *a* concentration was highest at the upper reservoir location. Lake mean chlorophyll *a* concentration for Dannelly Reservoir increased slightly from April to October. Unlike other Dannelly locations, chlorophyll *a* concentration at the ARM 220 station peaked in September. Monthly trophic state index values remained above eutrophic status (TSI = 50). Depth profiles of temperature indicated little or no thermal or chemical stratification at lower Dannelly Reservoir April through October. Dissolved oxygen concentration was below 5.0 mg/l for the majority of the water column during June and July at all locations except ARM 220.

The four tributary embayments monitored in Dannelly Reservoir included Mulberry Creek, Cahaba River, Bogue Chitto Creek, and Pine Barrens Creek. The Lower Mulberry Creek sub-watershed drains approximately 168 mi^2 in Autauga, Chilton, and Dallas Counties (ADEM 2002a). Percent land cover of the Lower Kelly Creek sub-watershed was estimated as 2% transitional forest, 21% deciduous forest, 26% evergreen forest, 34% mixed forest, 5% pasture/hay, 6% row crop, 5% wetland, and 2% open water. Estimates of land-use by the local SWCDs were similar. Two (2) current construction/stormwater authorizations, two (2) mining NPDES permits, and one (1) semi-public/private NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.02 AU/acre), with cattle being the dominant animal type. Sedimentation estimates indicated a *low* potential for NPS impairment (1.4 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. The water quality assessment agrees with this estimation as the lowest TN, TP, and chlorophyll *a* concentrations of any tributary in the Alabama basin occurred in Mulberry Creek. TSS concentration at Mulberry Creek was also among the lowest.

The Cahaba River sub-watershed drains approximately 78 mi^2 in Dallas and Perry Counties. Percent land cover of the Cahaba River sub-watershed was estimated as 65% forest, 29% pasture/hay, 3% row crop, 2% urban, and 1% open water. The sub-watershed was not analyzed as part of the 2000 Surface Water Quality Screening Assessment. Depth profiles of temperature and dissolved oxygen were not stratified in any month sampled. The highest mean TSS concentrations of any tributary were found in the Cahaba River embayment. Further investigation is recommended to determine if the additional sediment loading influences Dannelly Reservoir and to search for potential sources.

The Lower Bogue Chitto Creek sub-watershed drains approximately 114 mi^2 in Dallas and Perry Counties (ADEM 2002a). Percent land cover of the Talladega Creek sub-watershed was estimated as 14% deciduous forest, 7% evergreen forest, 12% mixed forest, 26% pasture/hay, 22% row crop, 17% wetland, and 1% open water. Estimates of land-use by the local SWCDs were higher for pasture (40%), open water (2%) and row crop (29%), and lower for forest (25%) landuses. One (1) current construction/stormwater authorization and two (2) semi-public/private NPDES permits have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *moderate* (0.17 AU/acre). Sedimentation estimates indicated a *low* potential for NPS impairment (1.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *high*. The second highest TP concentration occurred in Bogue Chitto Creek. TN, chlorophyll *a* and TSS concentrations were among the highest of the Alabama basin tributaries. DO concentrations were good throughout the entire water column in all months sampled.

The Lower Pine Barren Creek sub-watershed drains approximately 129 mi^2 in Wilcox and Dallas Counties (ADEM 2002a). Percent land cover of the Lower Pine Barren Creek sub-watershed was estimated as 20% deciduous forest, 23% evergreen forest, 28% mixed forest, 8% pasture/hay, 6% row crop, 11% wetland, and 1% open water. Estimates by the local SWCDs were higher for forest (83%) and pasture (15%) and lower for row crop (1%) and open water (<1%). Two (2) current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.03 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (0.7 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. Water quality assessment within this sub-watershed indicated concentrations of all variables were among the lowest. DO concentrations were essentially isochemical in April, June, and August.

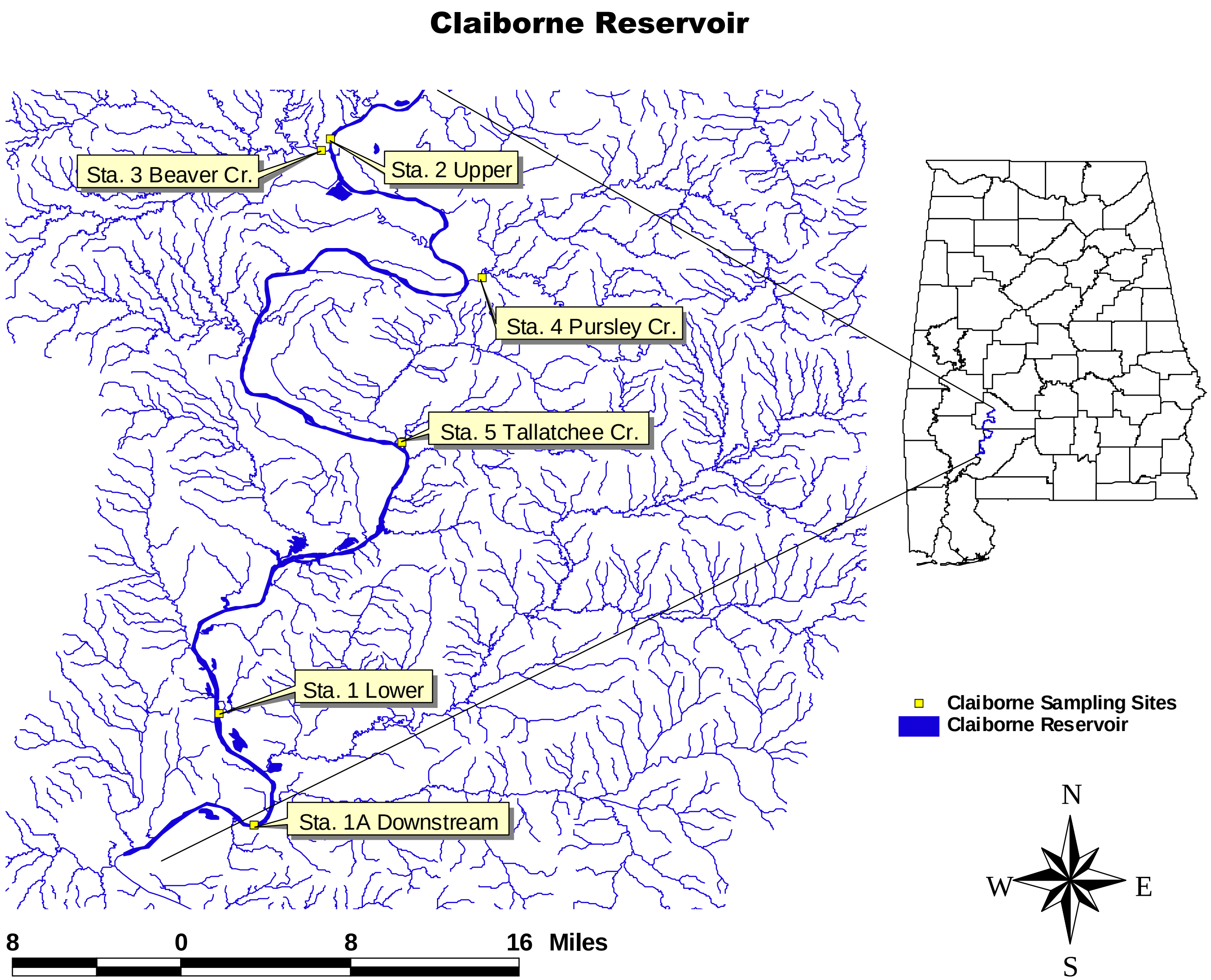


Figure III.3. Claiborne Reservoir with 2000 sampling locations.

Claiborne Reservoir

Nitrogen

Mainstem. Mean total nitrogen concentration downstream of Claiborne Reservoir was higher than any other Alabama basin mainstem reservoir location (Fig. III.4). Within the reservoir, TN increased from the upper station to the dam forebay.

TN concentration decreased April through June at all three locations (Fig. III.21) TN concentrations increased at all Claiborne locations during July, including a more than five fold increase at the downstream location. TN concentrations were lowest during August for all three Claiborne locations. From August to September, TN values increased once again, followed by a slight decline in October.

Lake mean TN concentration (mean of upper and lower stations only) decreased steadily April through June. Lake mean TN increased to highest concentrations in July followed lowest concentrations in August (Fig. III.21). Mean discharge was much higher in April than any of the following months. There was no apparent relationship between lake mean TN and discharge.

Tributaries. Mean TN concentrations of the tributaries of Claiborne Reservoir were generally lower than the tributaries of Woodruff, but higher than Dannelly Reservoir tributaries (Fig. III.6).

Phosphorus

Mainstem. The mean TP concentration for the downstream location was higher than any other Alabama basin mainstem reservoir location (Fig. III.4). Mean TP concentration below the Claiborne dam was nearly two times greater than mean TP at the upper reservoir location. Mean TP at the dam forebay was slightly higher than the mean TP at upper reservoir.

At Claiborne reservoir locations, monthly TP concentration downstream was highest each month of sampling except April (Fig. III.21). TP concentration at the downstream location increased sharply May to June as other Claiborne locations remained stable. TP concentrations at upper and lower reservoir changed little May through August. TP concentration at the downstream location was highest in September and October.

Lake mean TP concentration (mean of upper and lower stations only) sharply decreased April to May, remained stable through August, and then peaked in September (Fig. III.21). Mean discharge decreased between April and May and remained low through October.

Tributaries. The mean TP concentrations of all three tributaries of Claiborne reservoir were similar to other Alabama basin tributaries (Fig. III.6).

Algal Growth Potential Tests

Algal growth potential tests conducted for Claiborne Reservoir indicated upper reservoir to be phosphorus limited and lower reservoir was nitrogen limited (Table III.1). Nitrogen was also the limiting nutrient downstream of Claiborne dam. All mean MSC levels were below 5.0 mg/l. Highest mean MSC for Claiborne locations was observed downstream of Claiborne dam.

Chlorophyll a

Mainstem. Mean chlorophyll *a* concentrations at Claiborne sampling areas were lower than other locations on the Alabama basin mainstem reservoir (Fig. III.5). Mean chlorophyll *a* concentration downstream of Claiborne was lower than any other Alabama basin mainstem reservoir sampling location

Monthly chlorophyll *a* concentrations were similar at all three Claiborne locations from April to October (Fig. III.22). Highest concentrations occurred between June and August with lowest concentrations occurring in May.

Lake mean chlorophyll *a* concentration (mean of upper and lower stations only) increased slowly through July and declined at a similar rate through September (Fig. III.22). Mean discharge was more than five times higher during April than the following month. Discharge remained relatively stable from June through October. There was no apparent relationship between lake mean chlorophyll *a* and mean discharge.

Tributaries. Mean chlorophyll *a* concentrations increased from upstream to downstream locations.(Fig. III.7). Tallatchee Creek had the third highest chlorophyll *a* concentration of any tributary in the Alabama basin (25.73 µg/l).

Total Suspended Solids

Mainstem. Mean TSS concentrations at Claiborne Reservoir were the highest of all reservoir locations in the Alabama basin (Fig. III.5). Concentrations were similar at the upper and lower locations. The highest overall concentration recorded was at the downstream location (20.6 mg/l).

Monthly TSS concentrations were generally similar in all months April through June (Fig. III.22). Concentrations gradually increased in lower and downstream reservoir June through August. Upper reservoir was higher than the other sites in July and August and dropped to the lowest concentration in September. Concentrations were lowest in September and highest in April.

Lake mean TSS concentrations (mean of upper and lower stations only) decreased from April to June, increased through August, and decreased in September (Fig. III.22). Lake mean discharge was significantly higher in April than following months. Discharge rate continued to decrease until October. There was no apparent relationship between TSS and discharge.

Tributaries. Mean TSS concentrations ranged from 16.3 to 20.7 mg/l in the tributaries of Claiborne Reservoir (Fig. III.7).

Trophic State

Trophic state index values ranged from mesotrophic status to near mid-eutrophic status (Fig. III.23). TSI values exceeded mesotrophic status at all three Claiborne locations by June and remained above a TSI of 50 through October.

Dissolved Oxygen/Temperature

Mainstem. Dissolved oxygen concentrations declined at all three Claiborne locations April to May (Fig. III.23). DO concentration at lower reservoir was generally less and remained just above the criterion limit of 5.0 mg/l between May and September. Dissolved oxygen concentrations recovered to initial levels September to October.

Depth profiles of temperature and DO indicated minimal thermal and chemical stratification from May to October (Figs. III.24, III.25, & III.26). High flow conditions prevented temperature and dissolved oxygen measurements in April. Highest water column temperatures occurred during July and August. DO concentrations were at or above 5.0 mg/l throughout the water column May through September.

Tributaries. Depth profiles of temperature and dissolved oxygen in Beaver and Pursley Creeks show little to no stratification in April, June, and August (Appendix Fig. III.4). Tallatchee Creek profiles show both thermal and chemical stratification in all months sampled. Depths in June and August were too shallow for a hypolimnion to develop, however concentrations and temperatures were distinctly different from the surface to the bottom. Temperatures above 30°C occurred in August for Beaver Creek and June and August for both Pursley and Tallatchee Creeks. Deoxygenation did not occur.

Summary and Discussion

Mean total nitrogen concentration downstream of Claiborne Reservoir was higher than any other Alabama basin mainstem reservoir location. Mean total phosphorus concentration below the Claiborne dam was nearly two times greater than mean TP at the upper reservoir location. There was no apparent relationship between mean TN, mean TP, and discharge. Despite high mean TN and mean TP concentrations, mean chlorophyll *a* concentration downstream of Claiborne was lower than any other Alabama basin mainstem reservoir sampling location. Lake mean chlorophyll increased slowly through July and declined at a similar rate through September. Mean TSS at Claiborne was higher than any other mainstem station. Concentrations in April ranged from 45 μg/l to 54 μg/l, over two times higher than May. Trophic state index values ranged from just above mesotrophic status (TSI = 40) to near mid-eutrophic (TSI = 60) status. Dissolved oxygen concentrations remained above the criterion limit of 5.0 mg/l for the entire sampling season.

The three tributary embayments of Claiborne reservoir monitored in 2000 included Beaver, Pursley, and Tallatchee Creeks. The Beaver Creek sub-watershed drains approximately 218 mi^2 in Wilcox, Clarke, and Marengo Counties (ADEM 2002a). Percent land cover of the Beaver Creek sub-watershed was estimated as 3% transitional forest, 17% deciduous forest, 32% evergreen forest, 32% mixed forest, 4% pasture/hay, 4% row crop, 7% wetland, and 1% open water. Estimates of land-use by the local SWCDs were similar to EPA data. Six (6) current construction/stormwater authorizations, two (2) non-coal mining <5 acres/stormwater authorizations, and one (1) municipal NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (2.0 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. The third highest TSS concentration of any tributary occurred at Beaver Creek. Mean TN and mean TP were slightly elevated while chlorophyll *a* concentrations were low. DO concentrations remained at or above 5 mg/l throughout the water column.

The Pursley Creek sub-watershed drains approximately 106 mi^2 in Wilcox County (ADEM 2002a). Percent land cover of the Pursley Creek sub-watershed was estimated as 5% transitional forest, 17% deciduous forest, 32% evergreen forest, 34% mixed forest, 5% pasture/hay, 4% row crop, and less than 1% urban. Estimates of land-use by the local SWCDs were higher for pasture (8%) and urban (1%) and lower for row crop (1%) land uses. One (1) current construction/ stormwater authorization, one (1) non-coal mining <5 acres/stormwater authorization, and one (1) municipal NPDES permit have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (<0.01 AU/acre). Sedimentation indicated a *low* potential for NPS impairment (0.6 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. This was consistent with the water quality assessment results. Pursley Creek had the forth lowest concentration of TN, TP, chlorophyll *a*, and TSS of all 11 tributaries sampled. DO concentration at 5 feet in April was slightly below the criterion limit of 5.0 mg/l, however, concentrations within the entire column in June and August remained above 5 mg/l.

The Tallatchee Creek sub-watershed drains approximately 85 mi^2 in Clarke, Monroe, and Wilcox Counties (ADEM 2002a). Percent land cover of the Tallatchee Creek sub-watershed was estimated as 3% transitional forest, 9% deciduous forest, 35% evergreen forest, 36% mixed forest, 3% pasture/hay, 2% row crop,10% wetland, and 2% open water. Estimates of land-use by the local SWCDs were essentially the same. Two current construction/stormwater authorizations have been issued in the sub-watershed. The SWCD estimates of animal concentrations in the sub-watershed were *low* (0.01 AU/acre), with cattle being the dominant animal. Sedimentation estimates indicated a *low* potential for NPS impairment (0.3 tons/acre). The overall potential for impairment from nonpoint sources was estimated as *low*. However, elevated levels of TP, chlorophyll *a*, and TSS were found in Tallatchee Creek. DO concentrations of less than 5 mg/l were evident in April, June, or August. Further monitoring is recommended to identify sources of pollution.

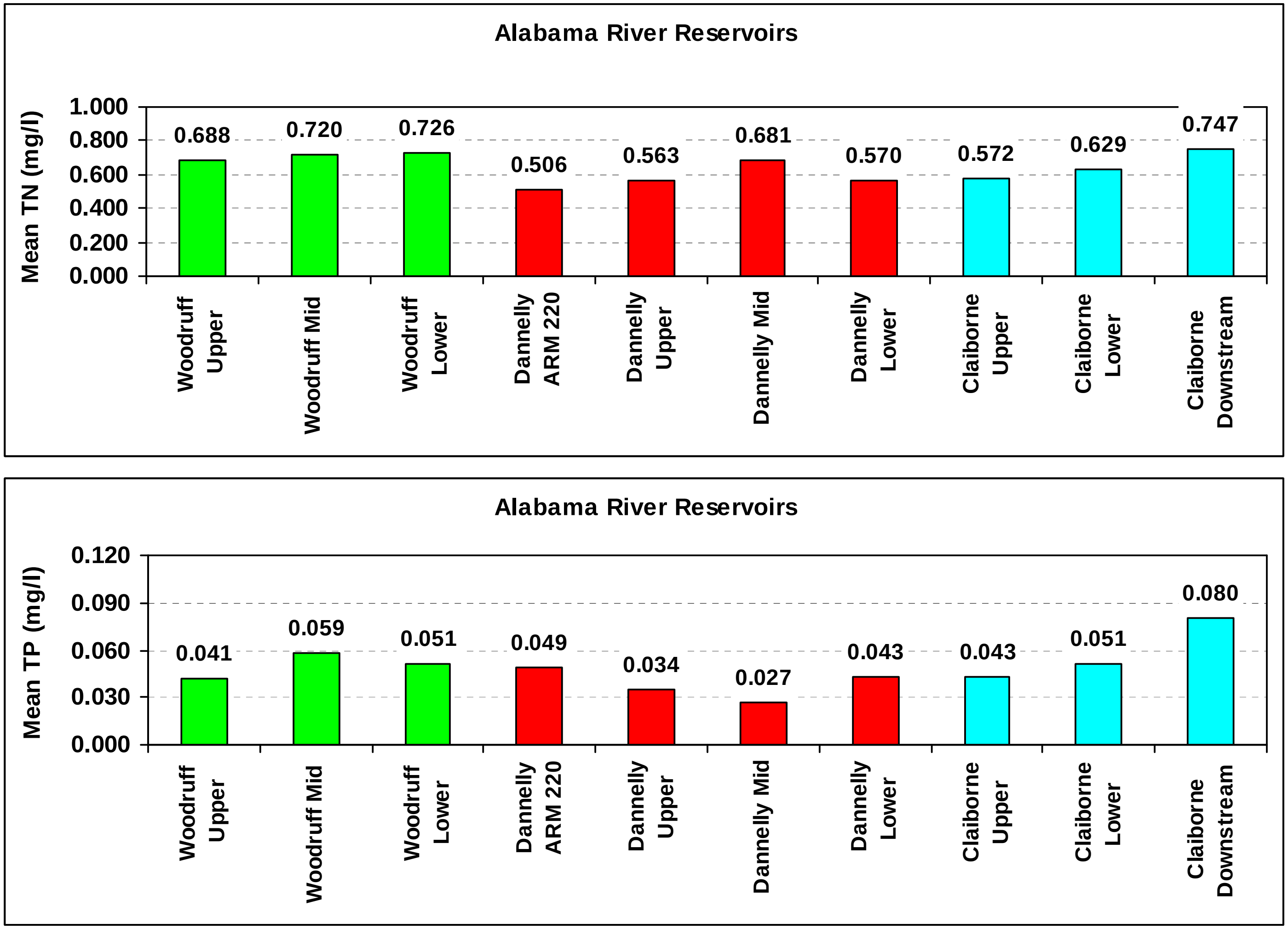


Figure III.4. Mean total nitrogen (TN) and mean total phosphorus (TP) concentrations of Alabama reservoir locations, April-October 2000.

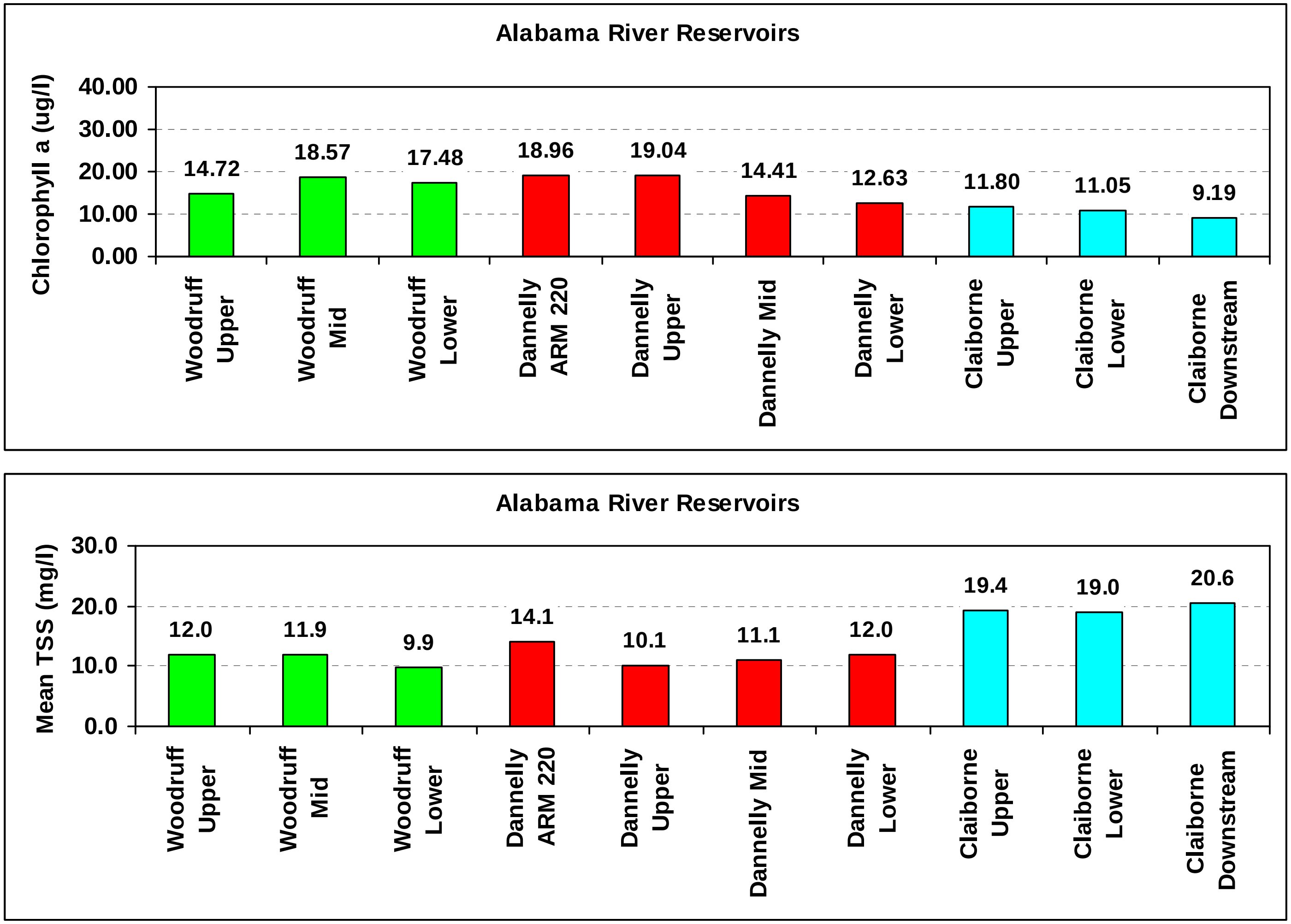
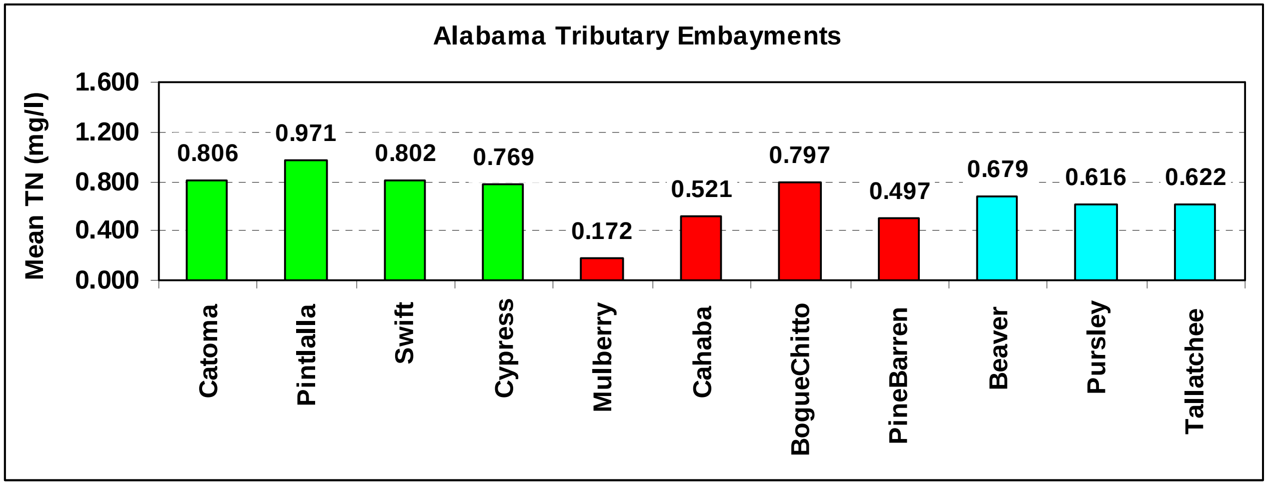


Figure III.5. Mean chlorophyll *a* (chlorophyll *a*) and mean total suspended solids (TSS) concentrations of Alabama reservoir locations, April-October 2000.



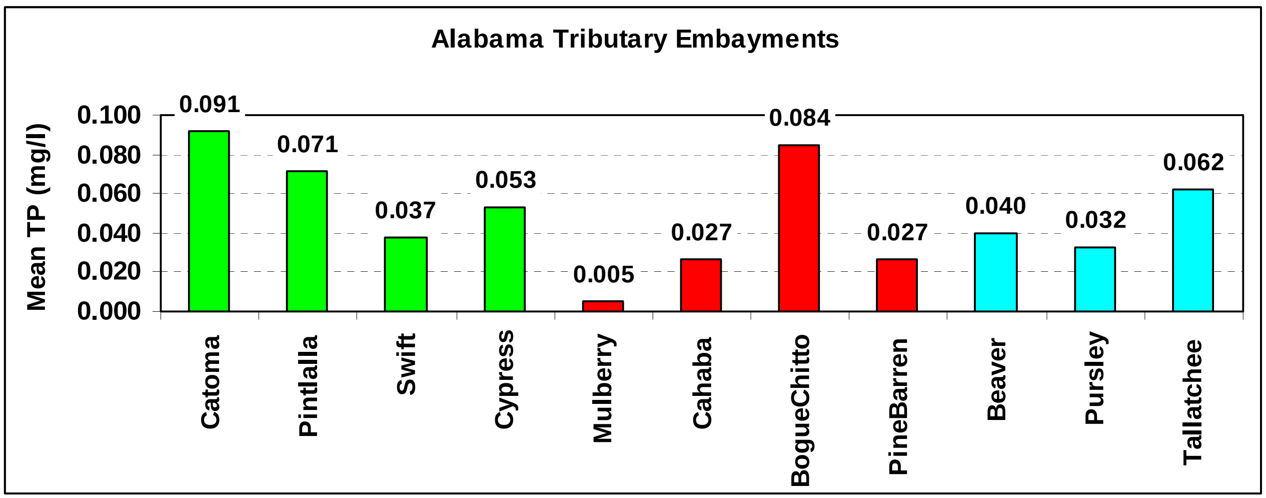
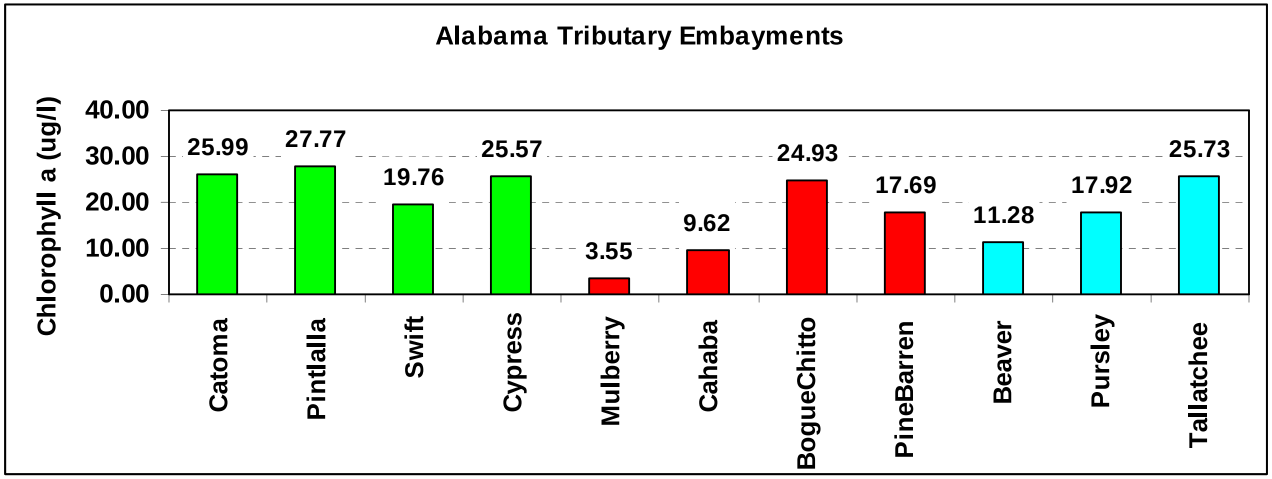


Figure III.6. Mean total nitrogen (TN) and mean total phosphorus (TP) concentrations of Alabama Tributary embayment locations, April-August 2000.



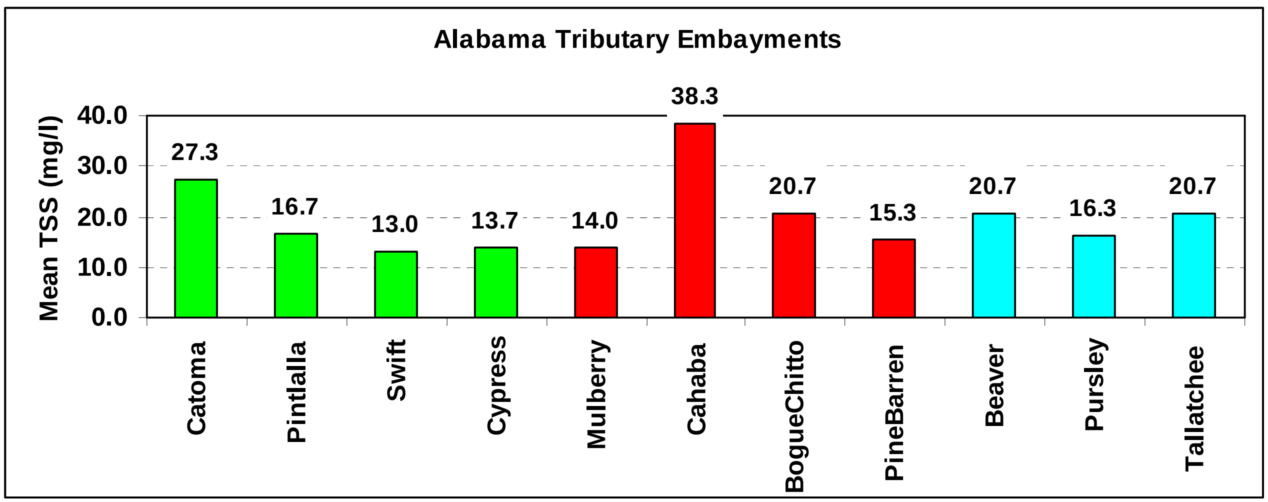


Figure III.7. Mean chlorophyll *a* (chlorophyll *a*) and mean total suspended solids (TSS) concentrations of Alabama Tributary embayment locations, April-August 2000.

Table III.1. Algal growth potential testing (AGPT) of Alabama River reservoirs, August 2000.

Reservoir	Location	Date	Mean MSC (mg/l)			Limiting
			C	C+N	C+P	Nutrient
Woodruff	Upper	8/24/00	4.36	4.23	**7.79**	Phosphorus
	Mid	8/24/00	6.79	20.33	**5.8**	Nitrogen
	Lower	8/24/00	5.22	13.74	**5.8**	Nitrogen
Dannelly	Arm 220	8/23/00	2.01	7.16	**1.96**	Nitrogen
	Upper	8/23/00	2.82	**11.33**	**3.04**	Nitrogen
	Mid	8/23/00	4.34	**9.75**	**4.25**	Nitrogen
	Lower	8/23/00	2.94	9.33	**3.27**	Nitrogen
Claiborne	Upper	8/22/00	3.3	**3.66**	5.77	Phosphorus
	Lower	8/22/00	2.81	11.55	**5.07**	Nitrogen
	Downstream	8/22/00	3.75	37.06	**3.55**	Nitrogen

MSC = Maximum Standing Crop

C = Control; C+N = Control + Nitrogen; C+P = Control + Phosphorus

Values in **bold** print are significantly different from control.

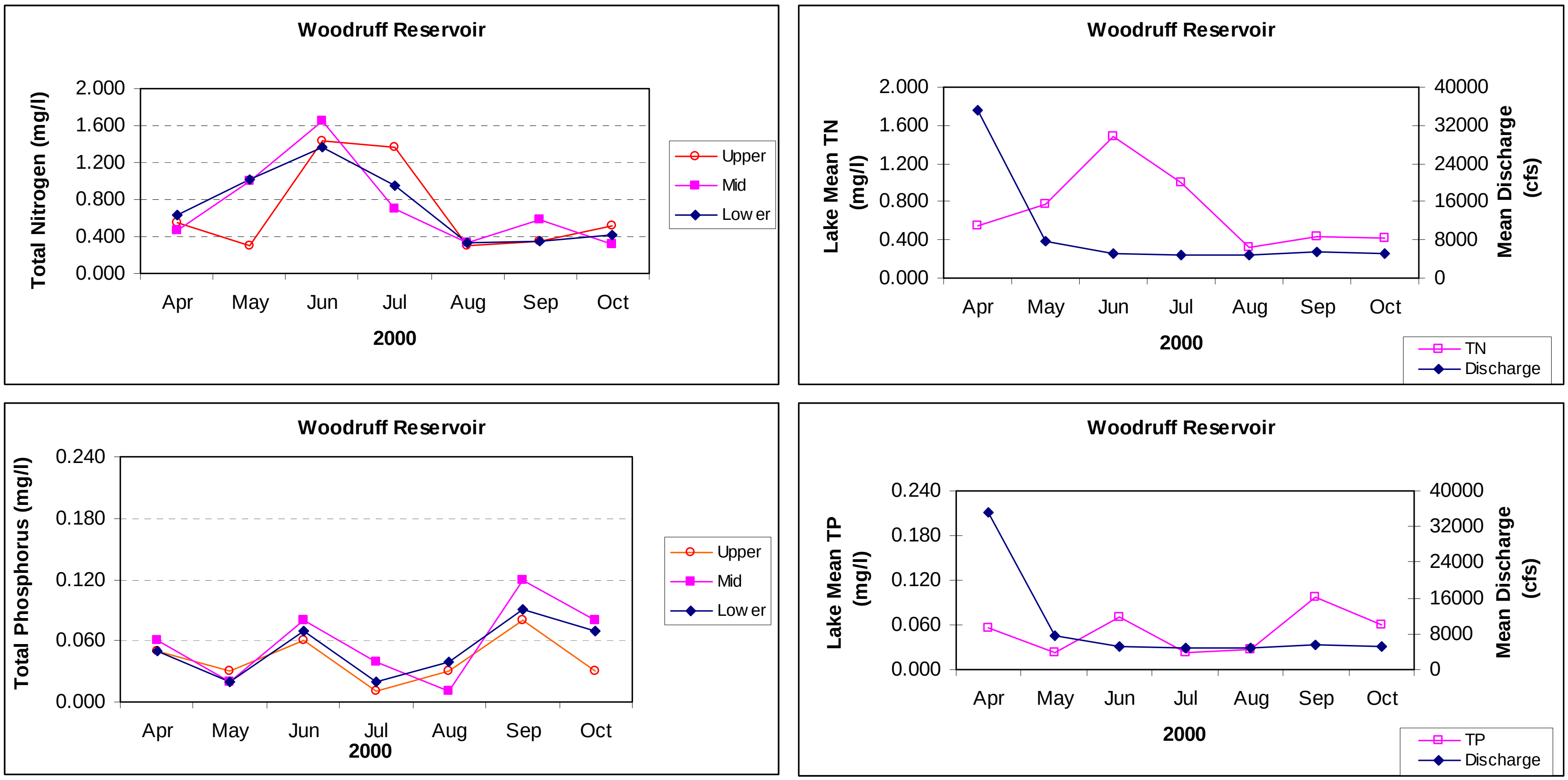


Figure III.8. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Woodruff Reservoir, April-October 2000.

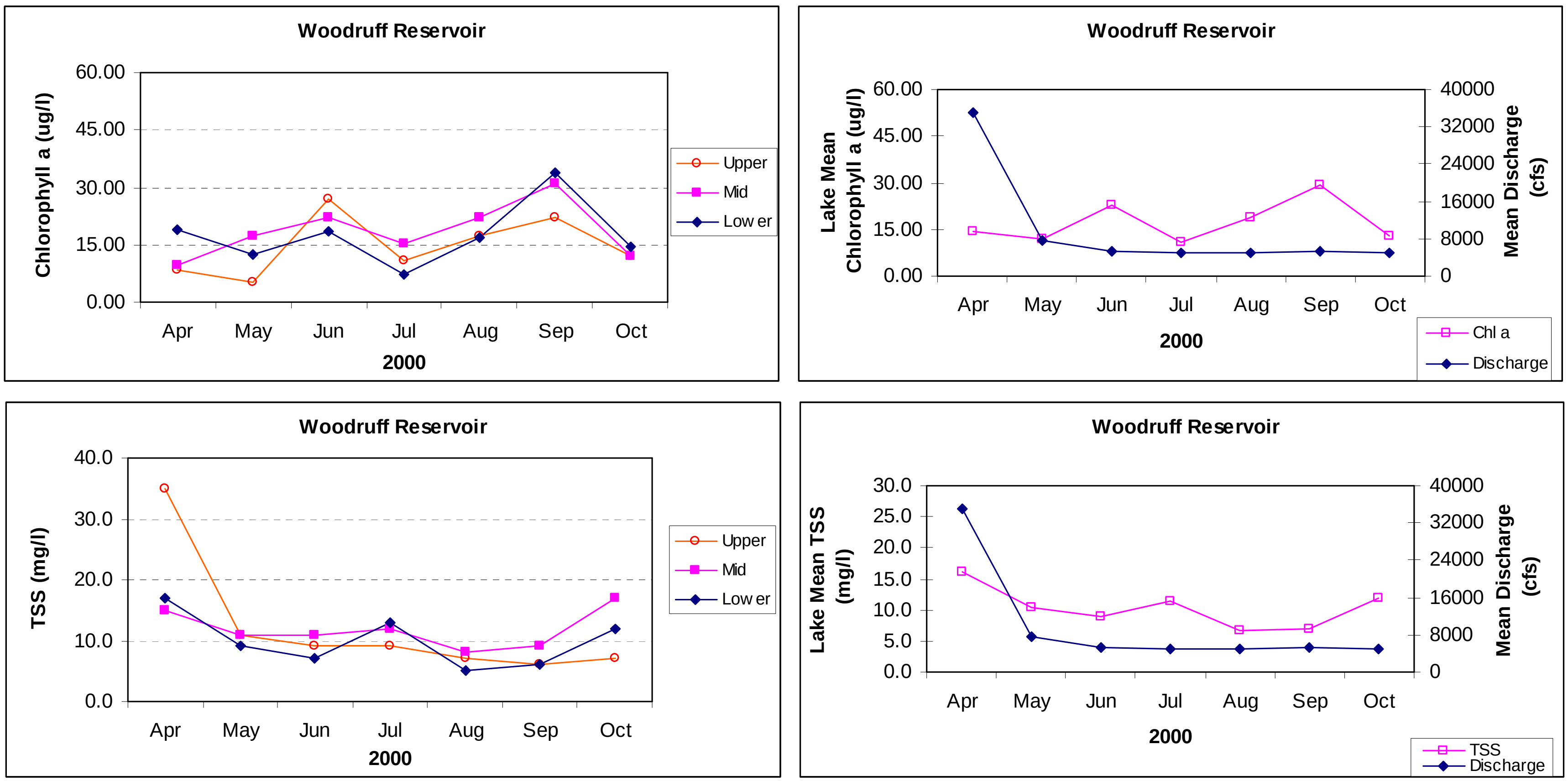
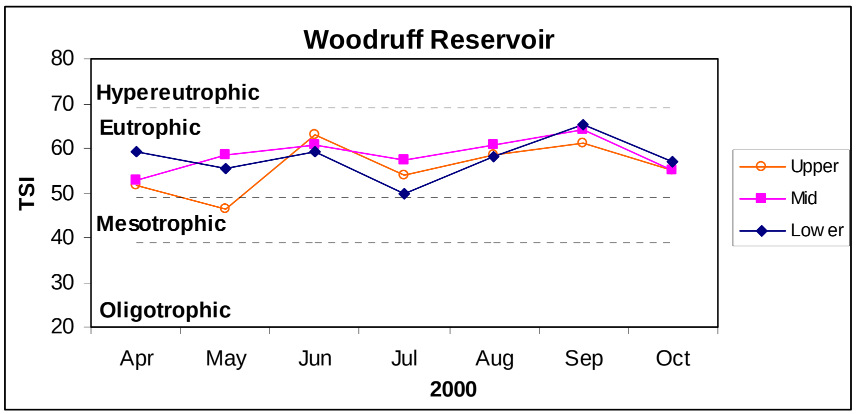


Figure III.9. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids, lake mean total suspended solids vs. discharge of Woodruff Reservoir, April-October 2000.



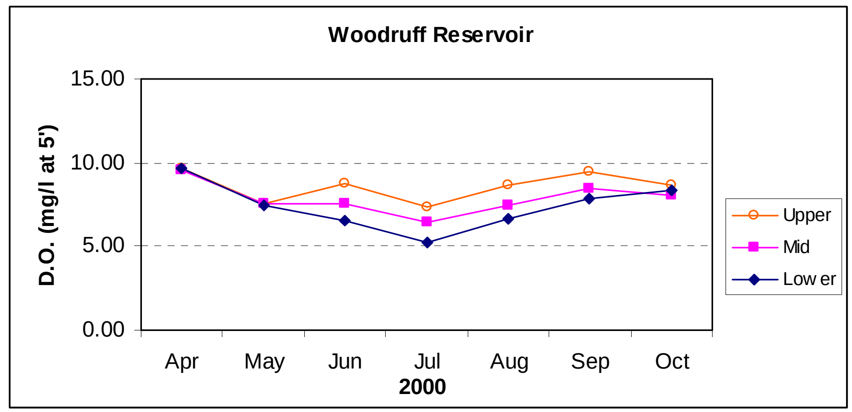


Figure III.10. Trophic state index (TSI) and dissolved oxygen (DO) of Woodruff Reservoir, April-October 2000.

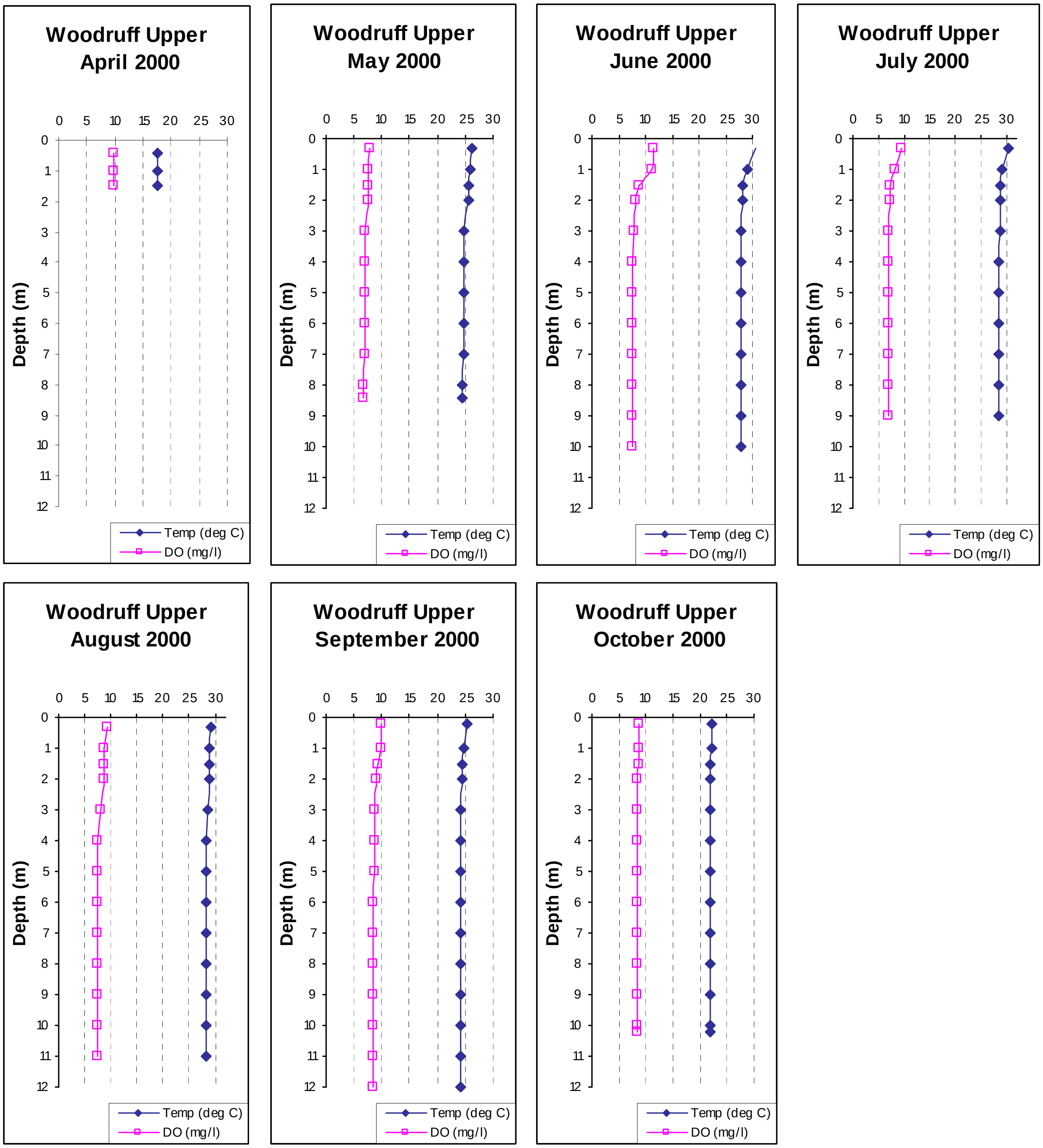


Figure III.11. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Woodruff Reservoir, April-October 2000.

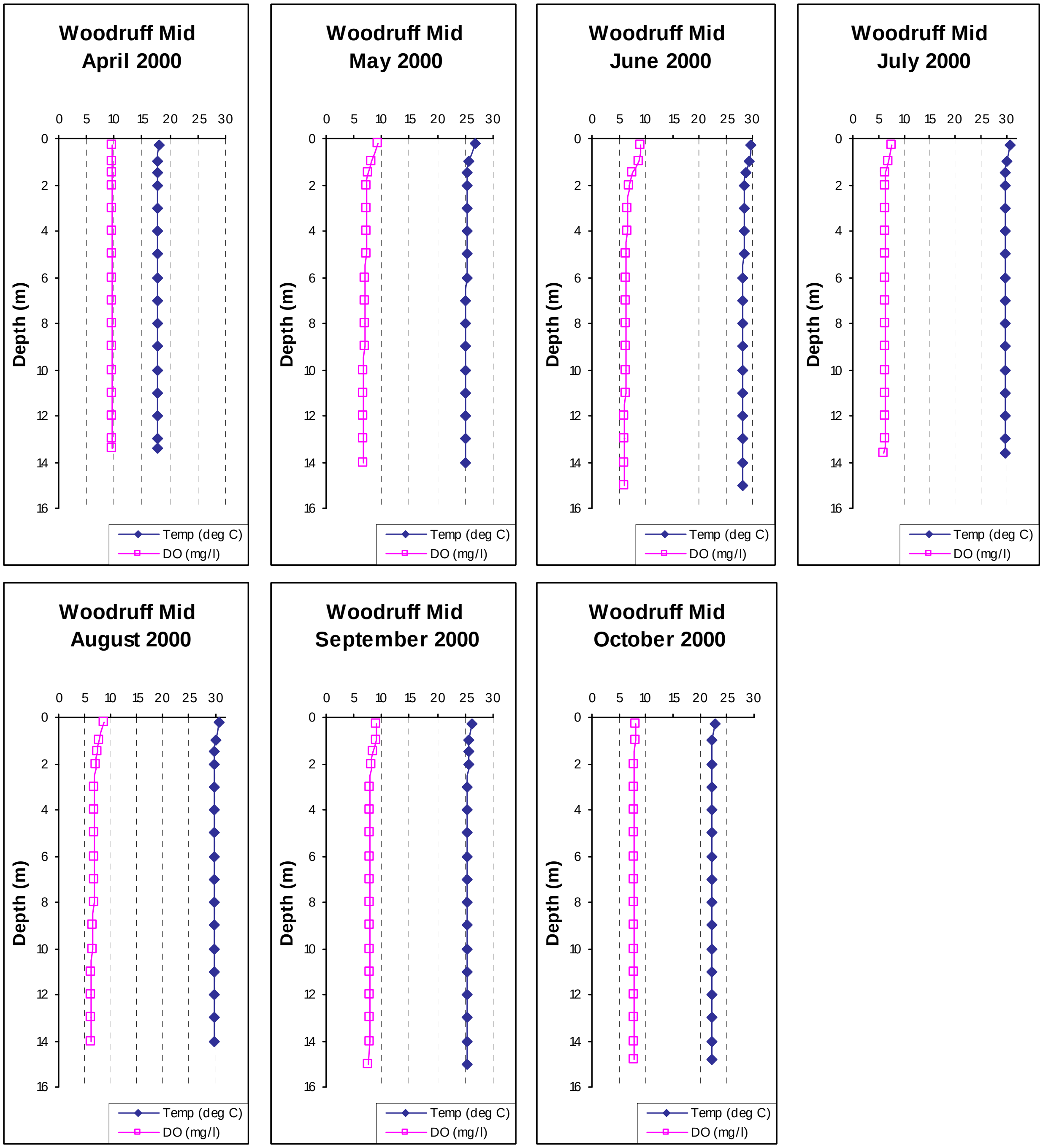


Figure III.12. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid of Woodruff Reservoir, April-October 2000.

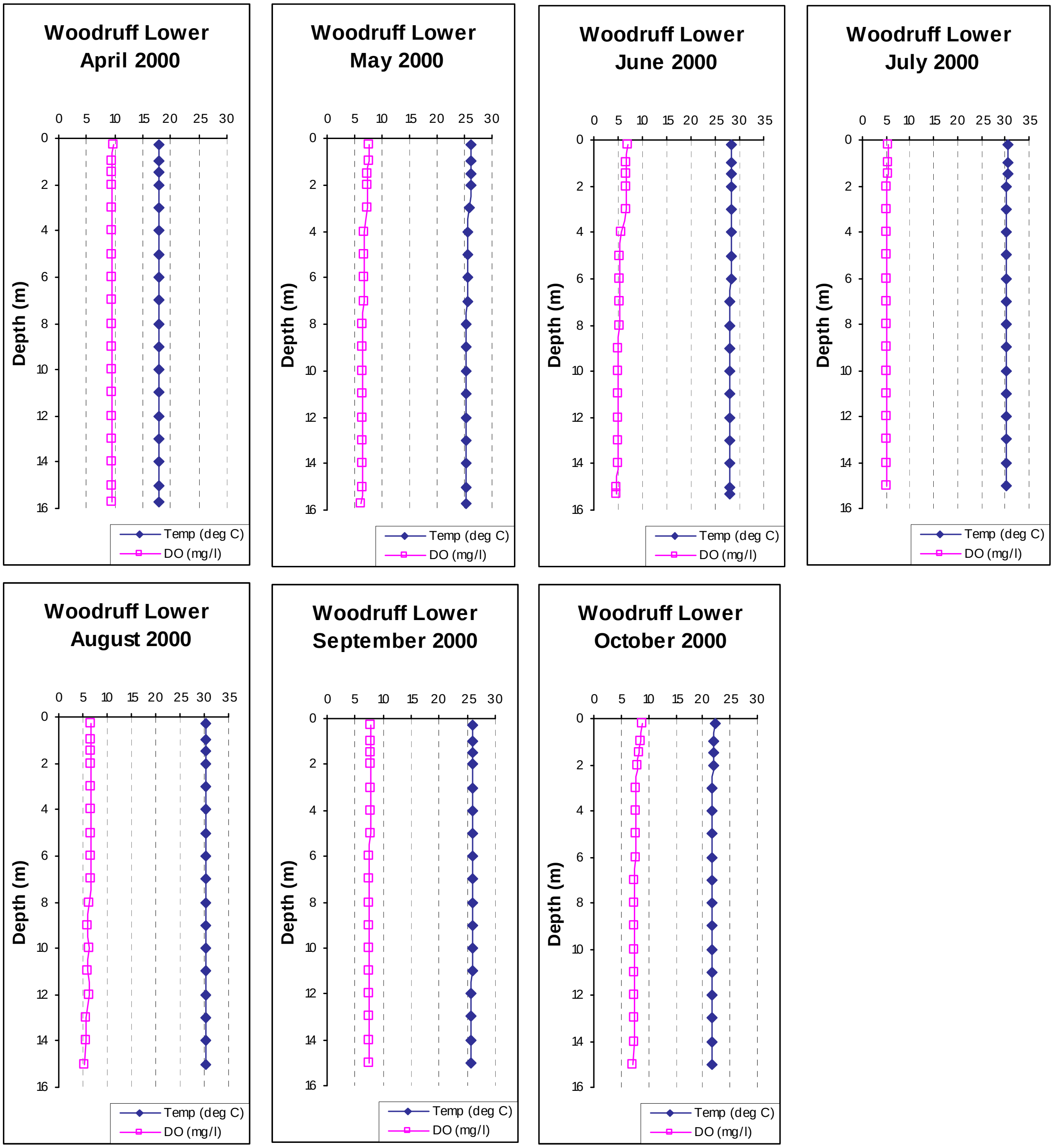


Figure III.13. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Woodruff Reservoir, April-October 2000.

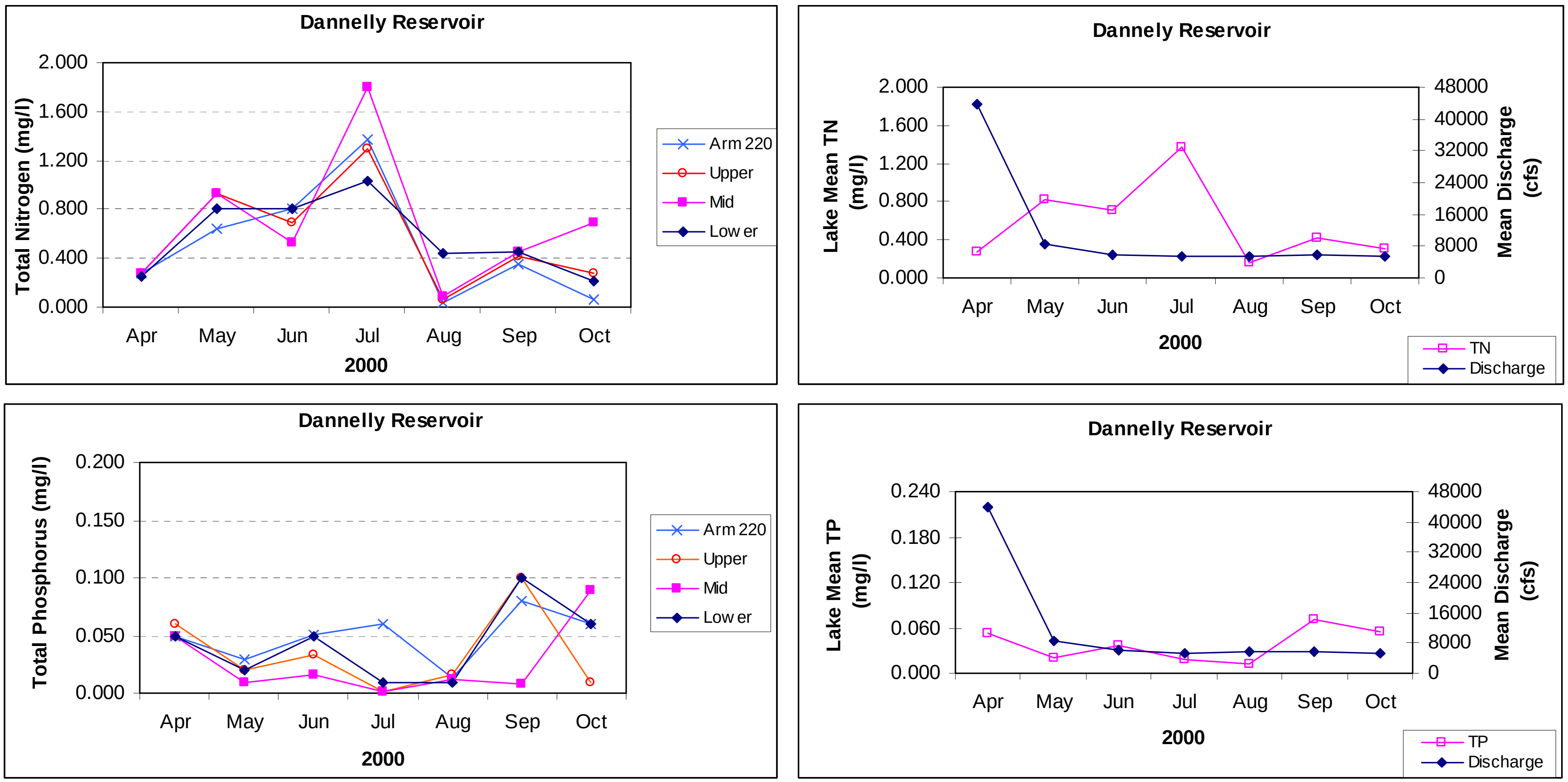


Figure III.14. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Dannelly Reservoir, April-October 2000.

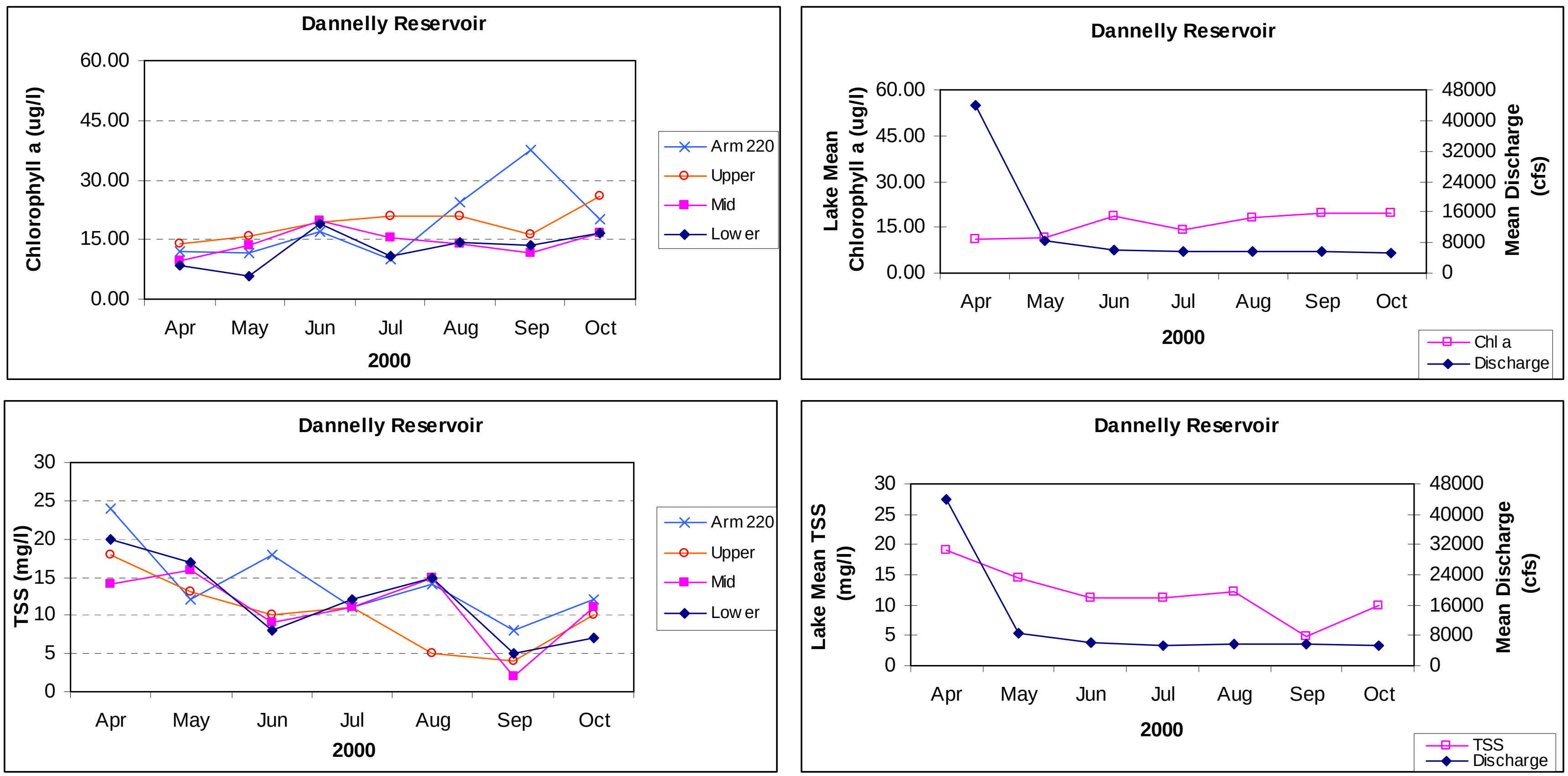
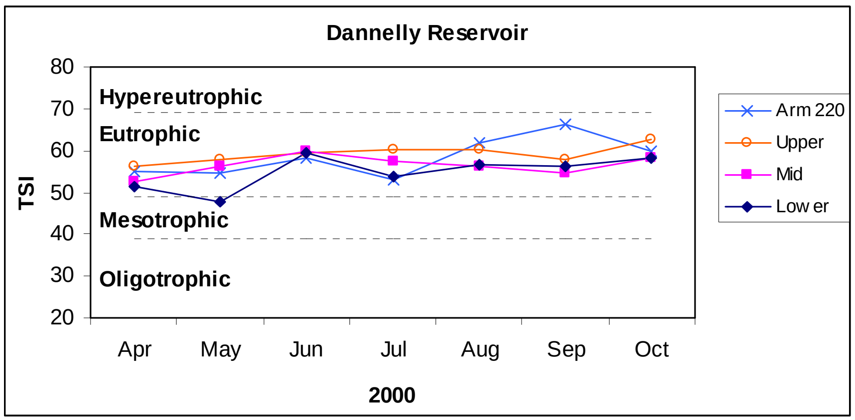


Figure III.15. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids, lake mean total suspended solids vs. discharge of Dannelly Reservoir, April-October 2000.



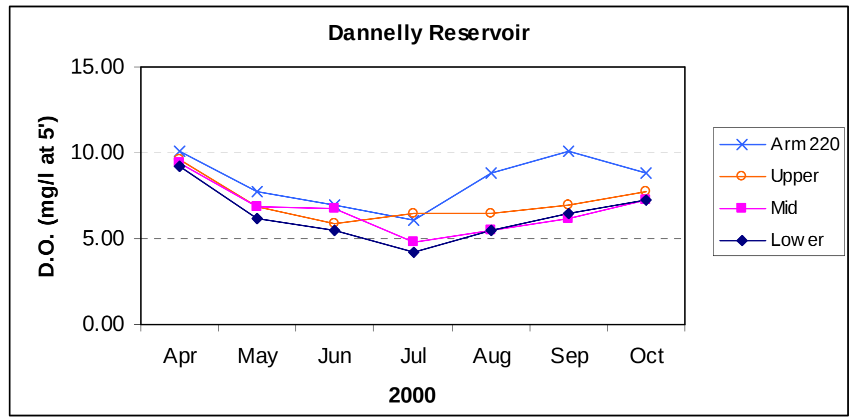


Figure III.16. Trophic state index (TSI) and dissolved oxygen (DO) of Dannelly Reservoir, April-October 2000.

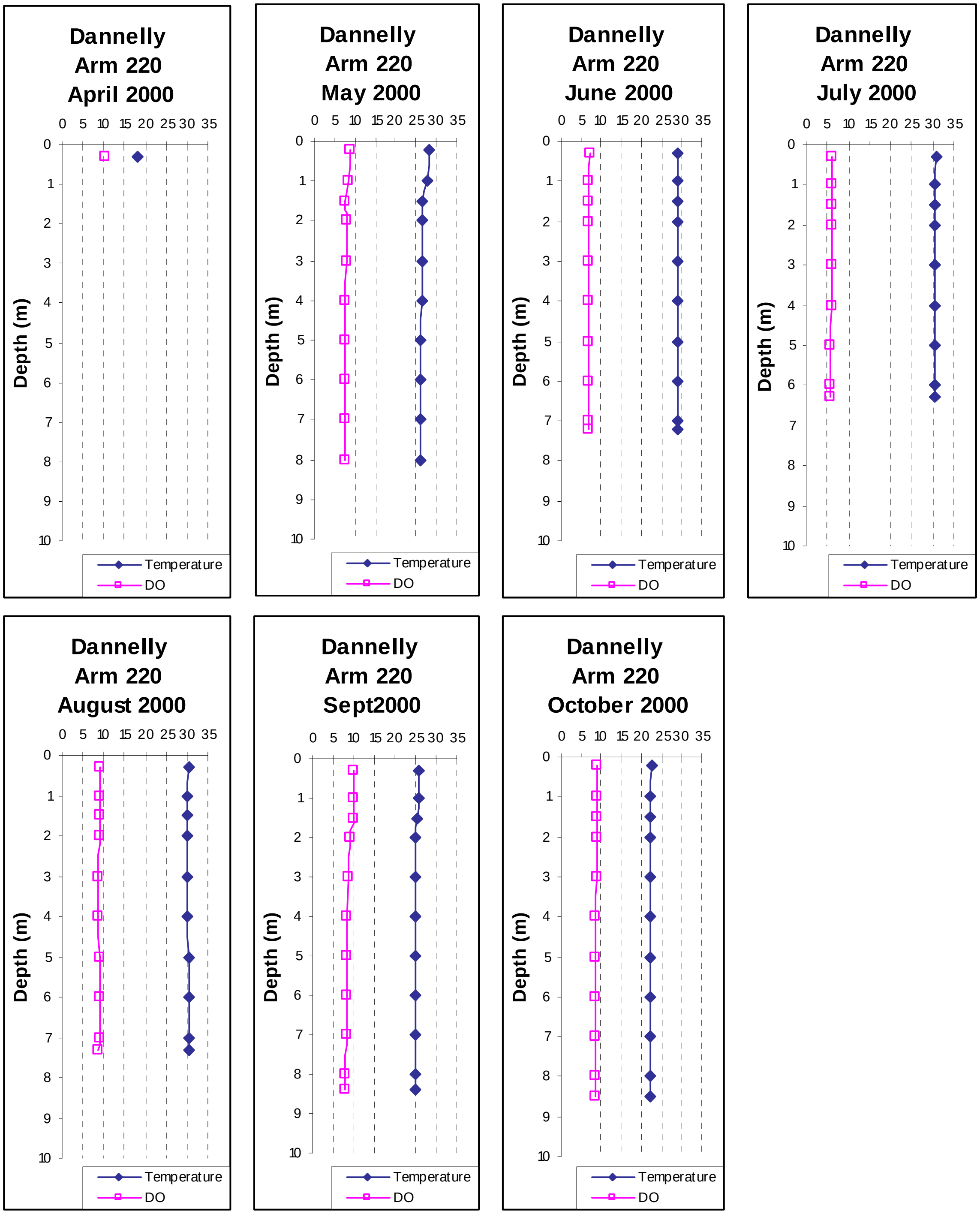


Figure III.17. Depth profiles of dissolved oxygen (DO) and temperature (Temp) at ARM 220, near Selma, upstream of Dannelly Reservoir, April-October 2000.

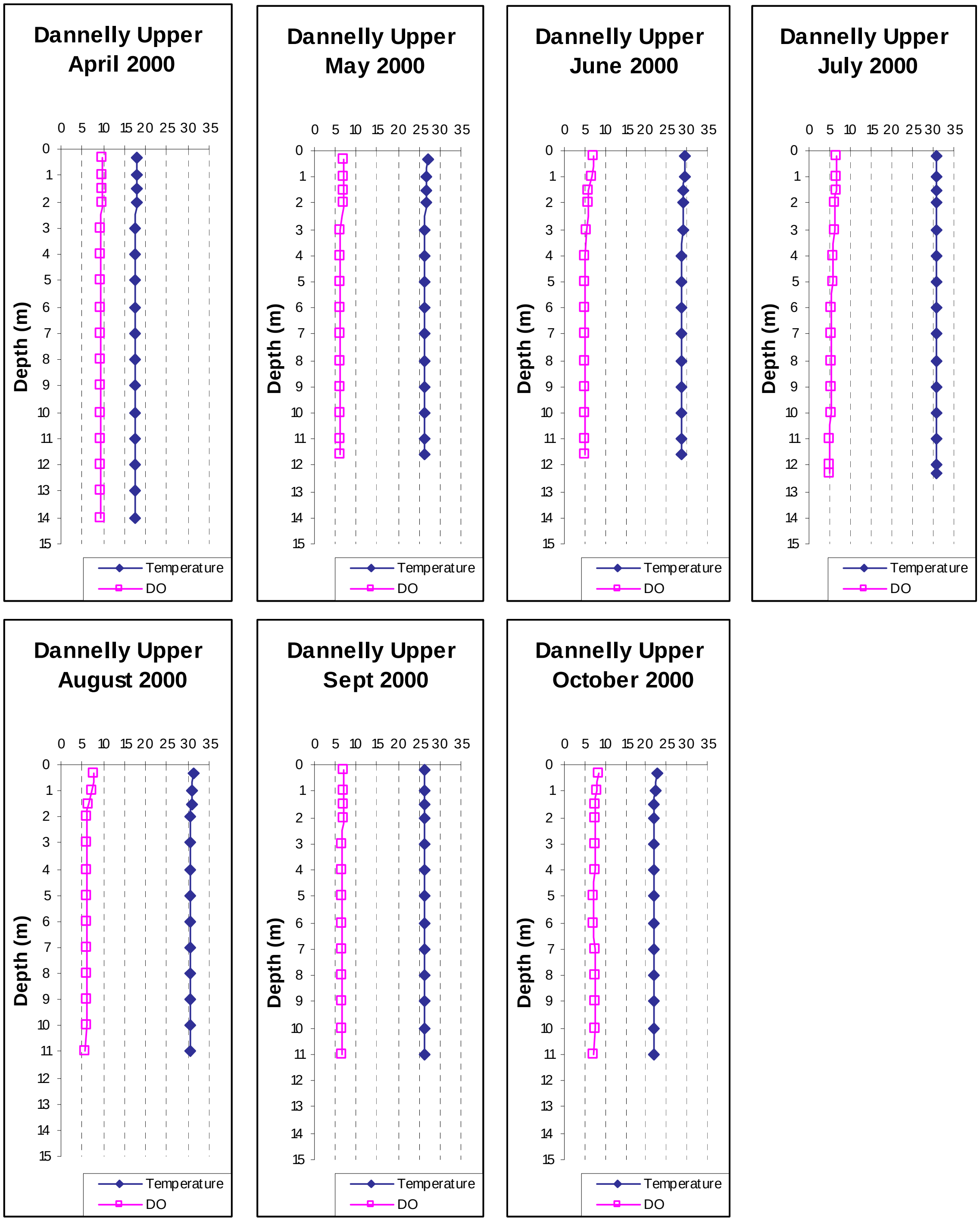


Figure III.18. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Dannelly Reservoir, April-October 2000.

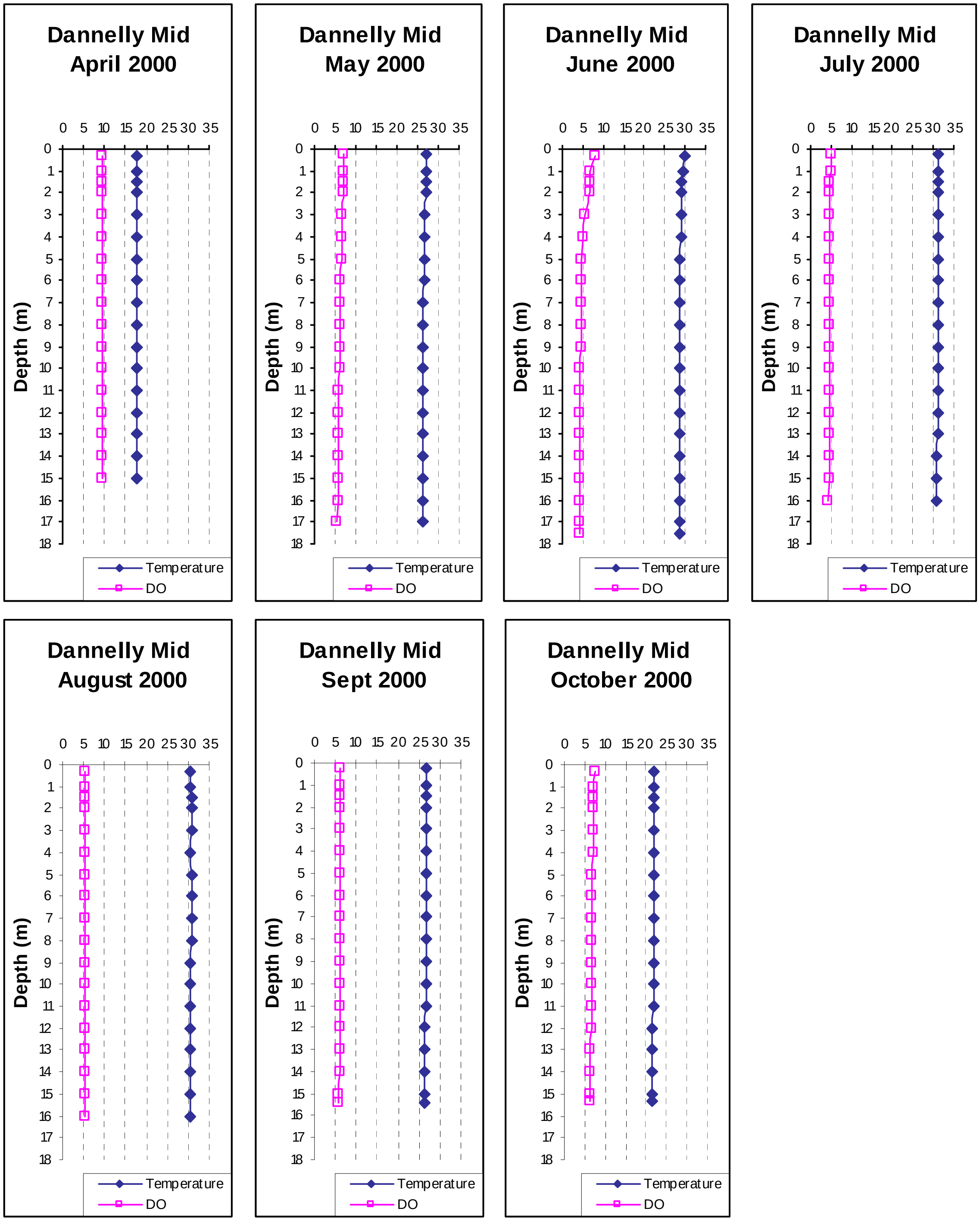


Figure III.19. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in mid Dannelly Reservoir, April-October 2000.

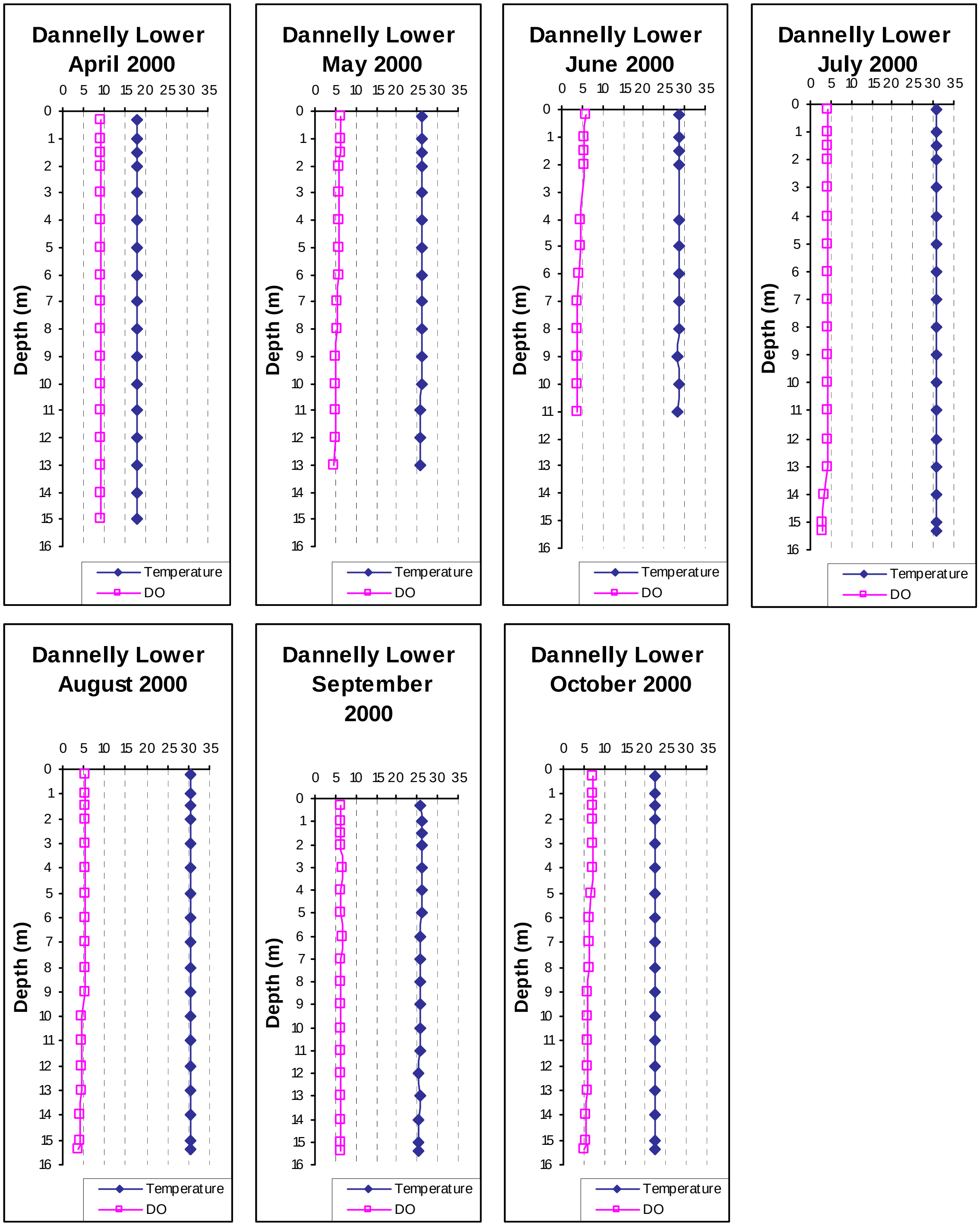


Figure III.20. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Dannelly Reservoir, April-October 2000.

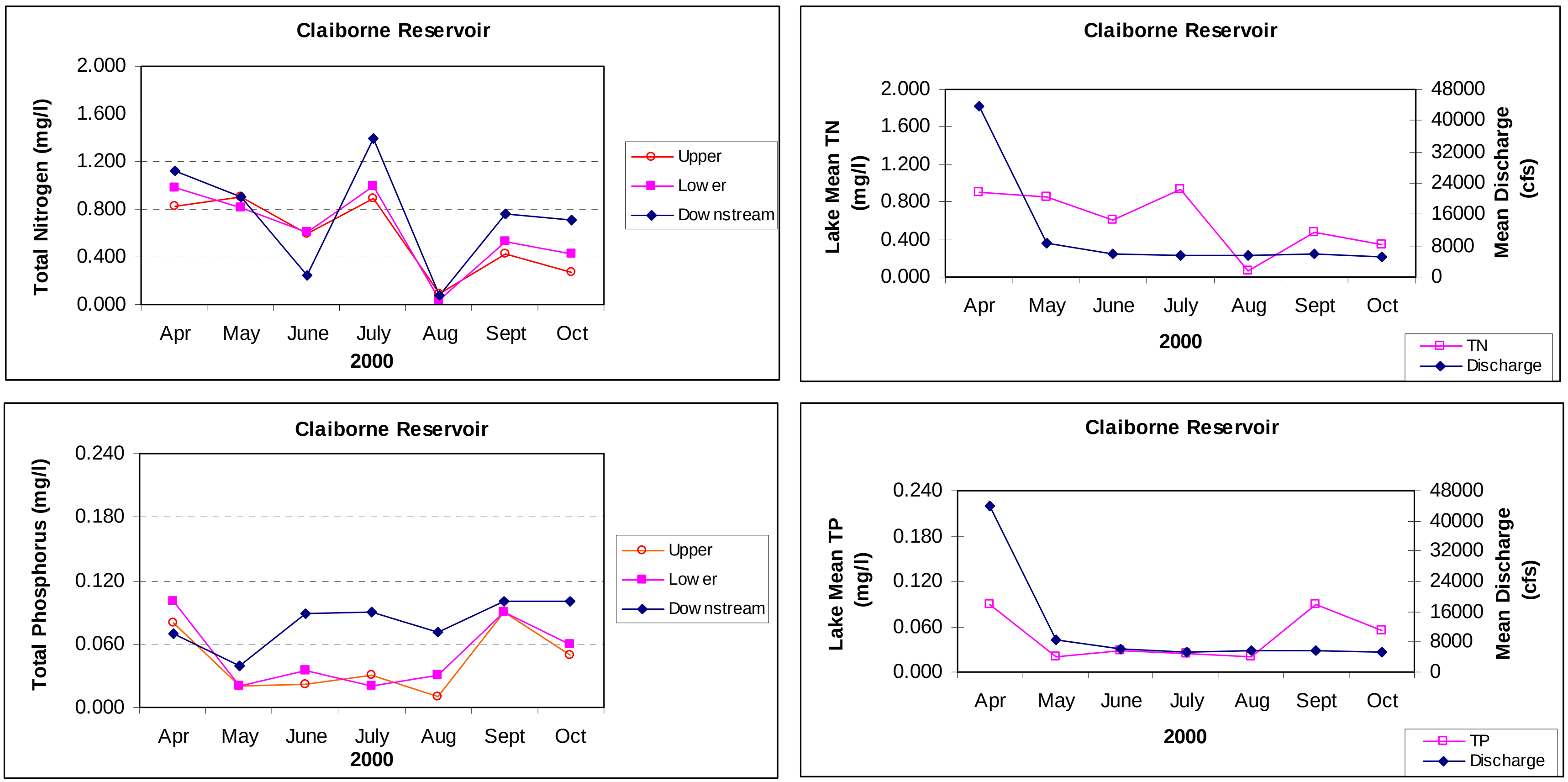


Figure III.21. Total nitrogen (TN), lake mean TN vs. discharge, total phosphorus (TP), lake mean TP vs. discharge of Claiborne Reservoir, April-October 2000.

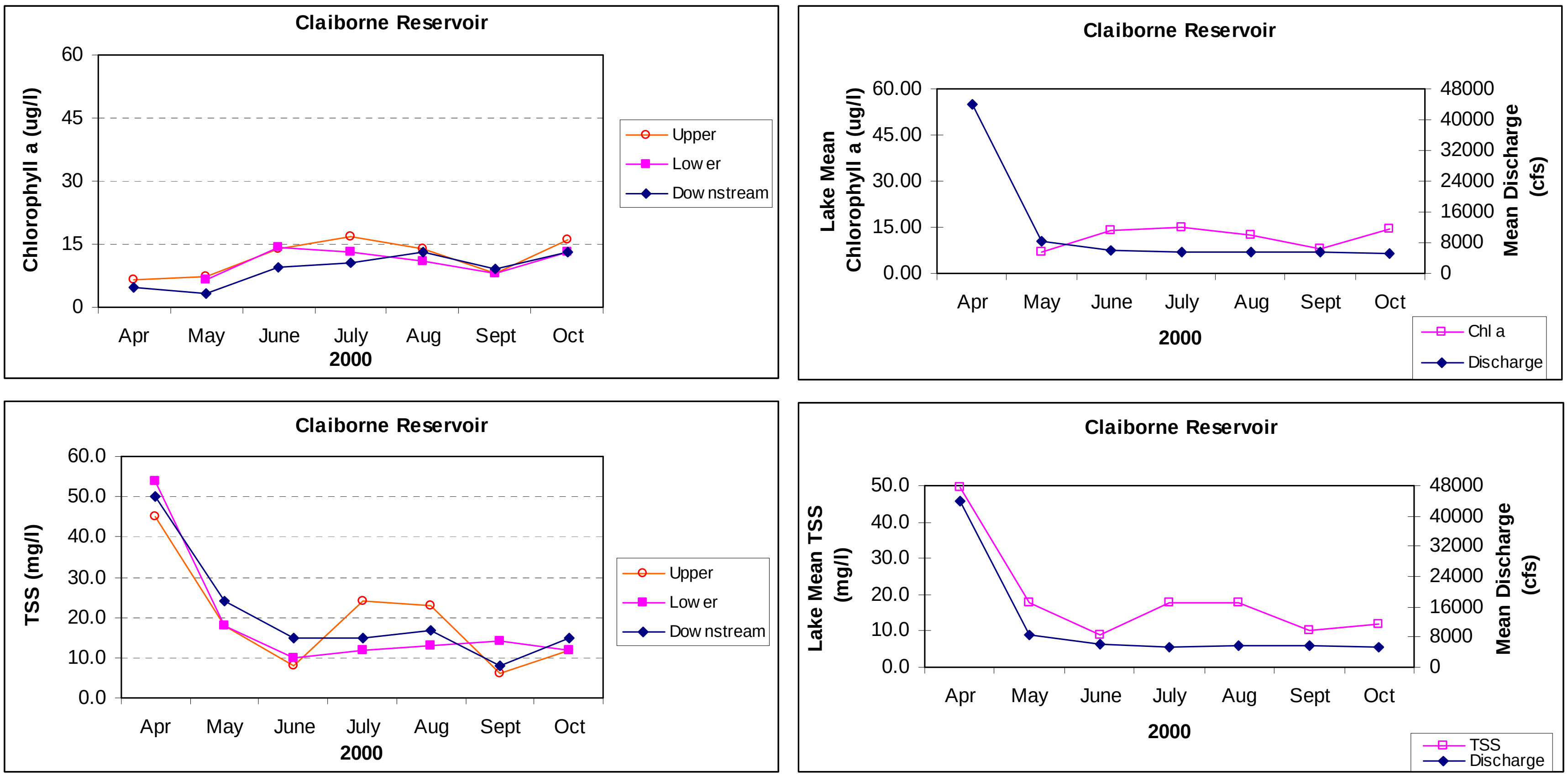


Figure III.22. Chlorophyll *a*, lake mean chlorophyll *a* vs. discharge, total suspended solids, lake mean total suspended solids vs. discharge of Claiborne Reservoir, April-October 2000.

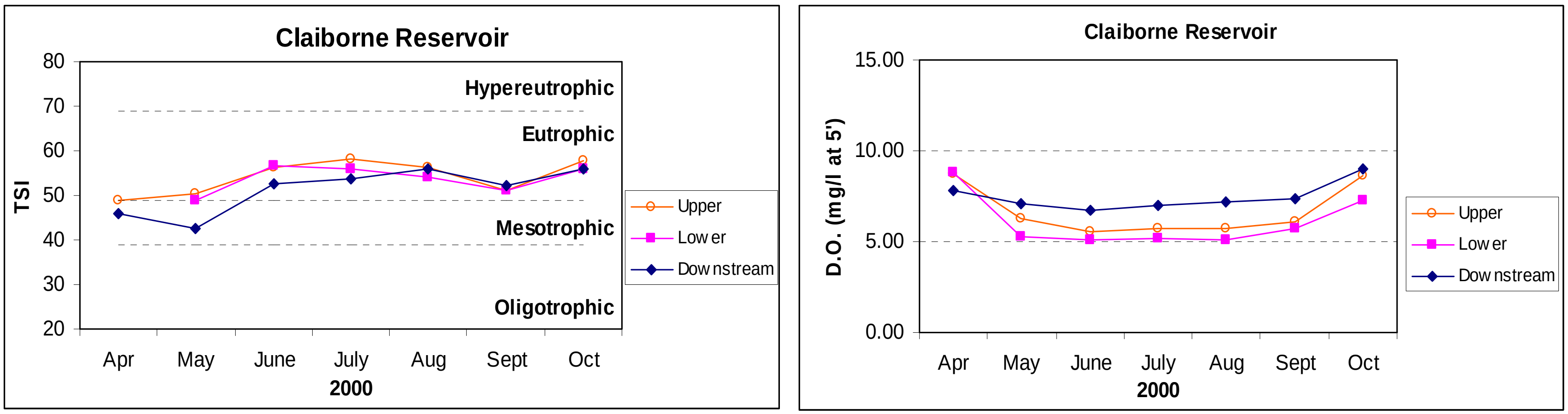


Figure III.23. Trophic state index (TSI) and dissolved oxygen (DO) of Claiborne Reservoir, April-October 2000.

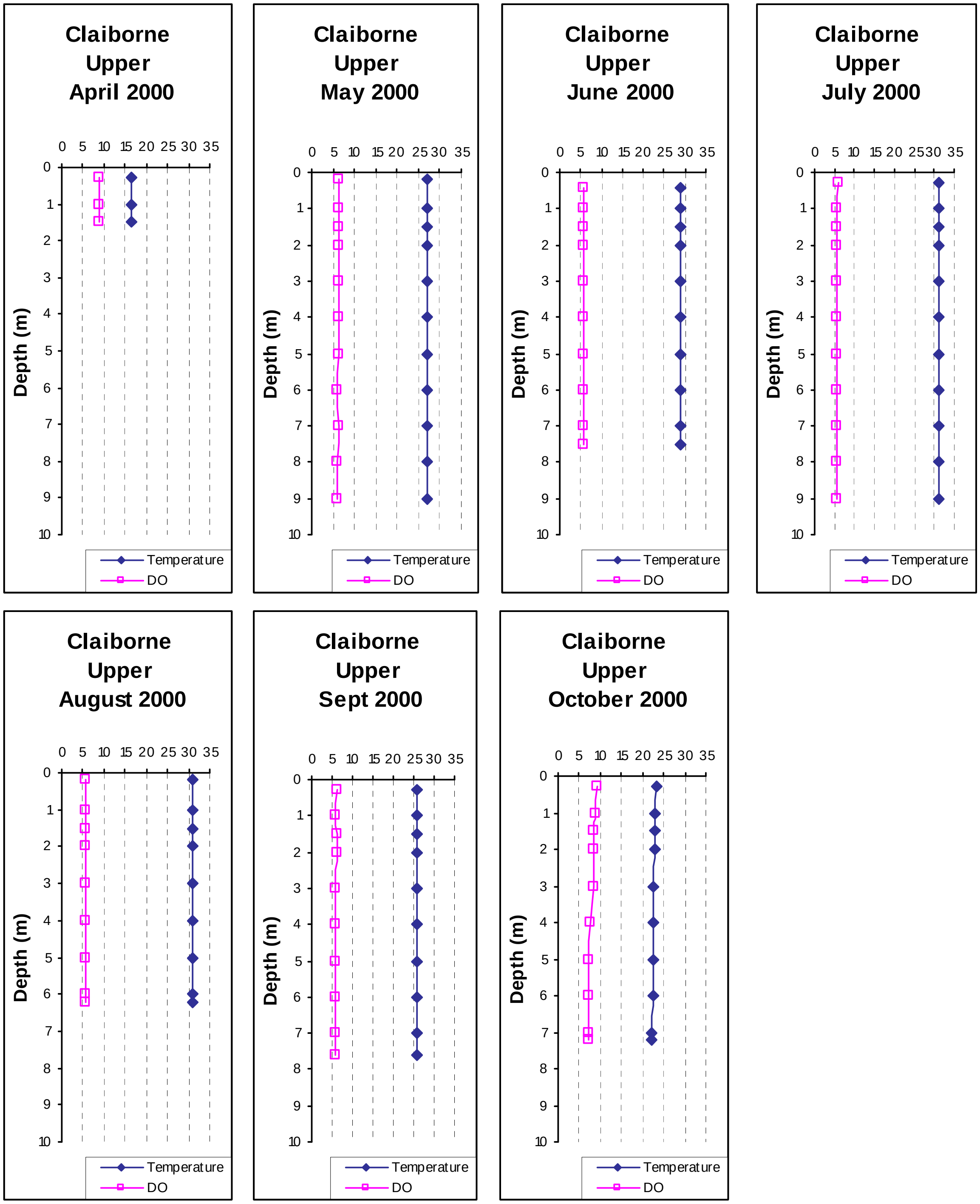


Figure III.24. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in upper Claiborne Reservoir, April-October 2000.

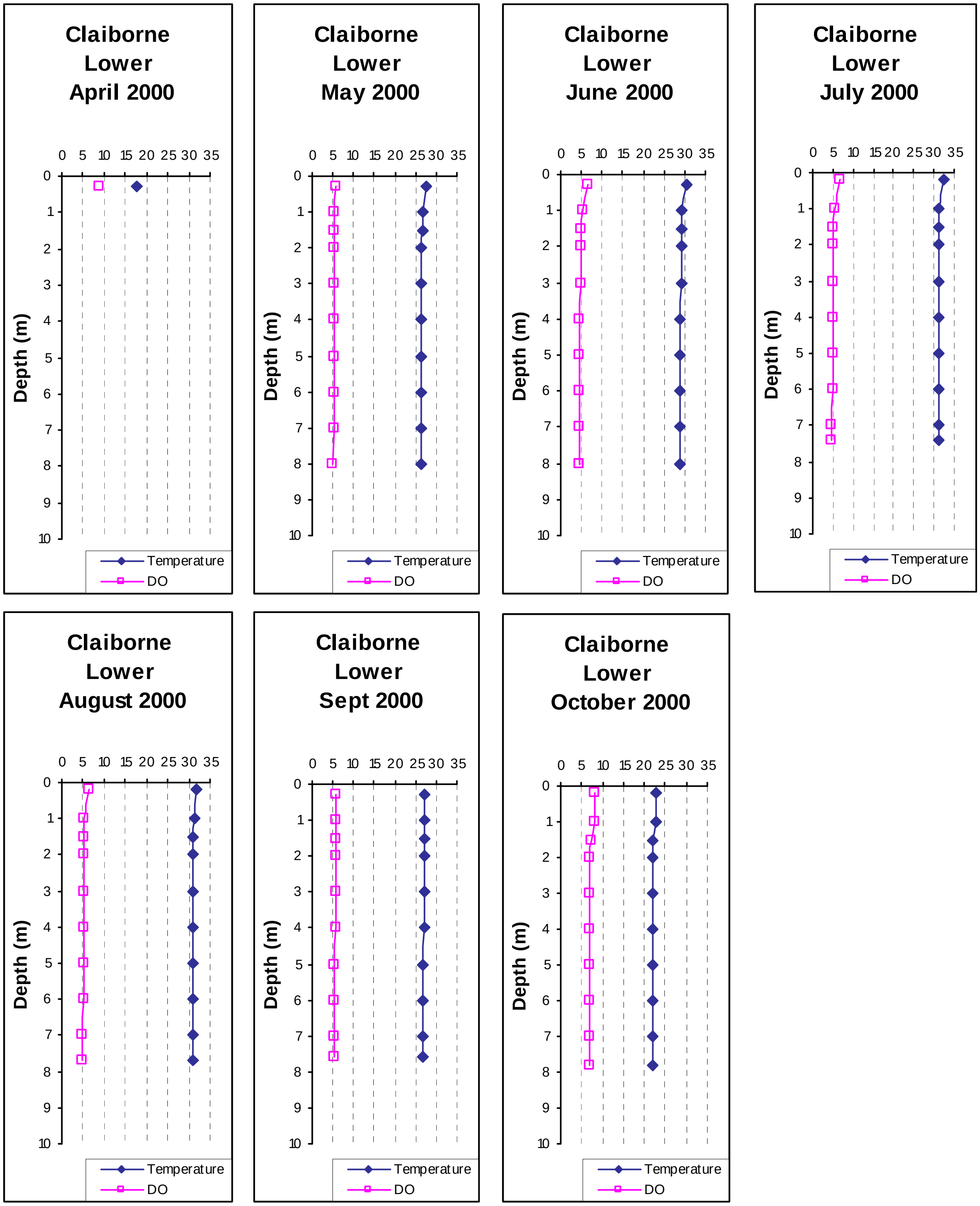


Figure III.25. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in the dam forebay of Claiborne Reservoir, April-October 2000.

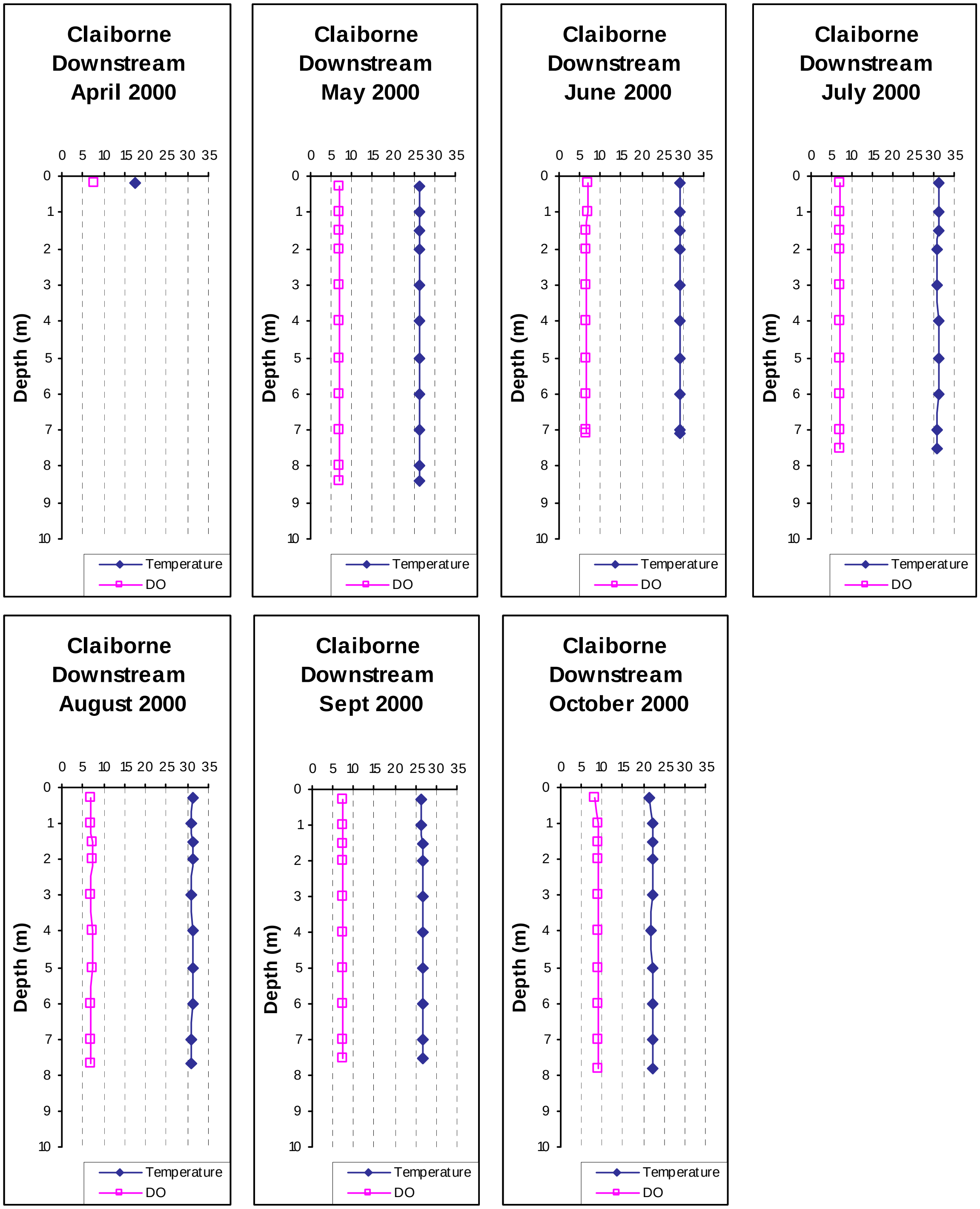


Figure III.26. Depth profiles of dissolved oxygen (DO) and temperature (Temp) downstream of Claiborne Reservoir, April-October 2000.

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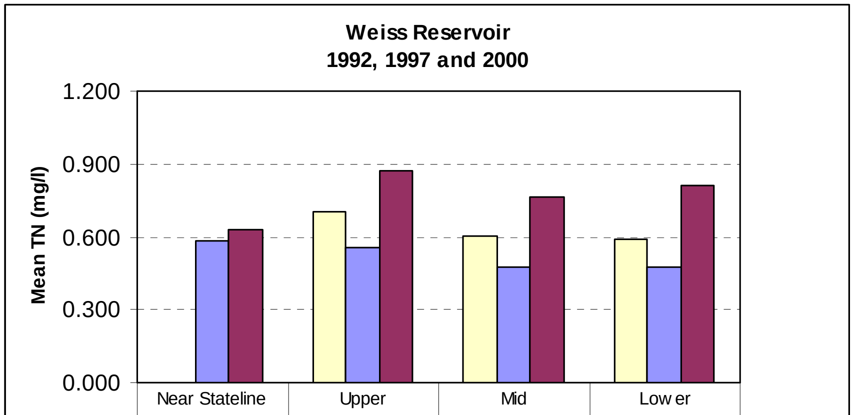
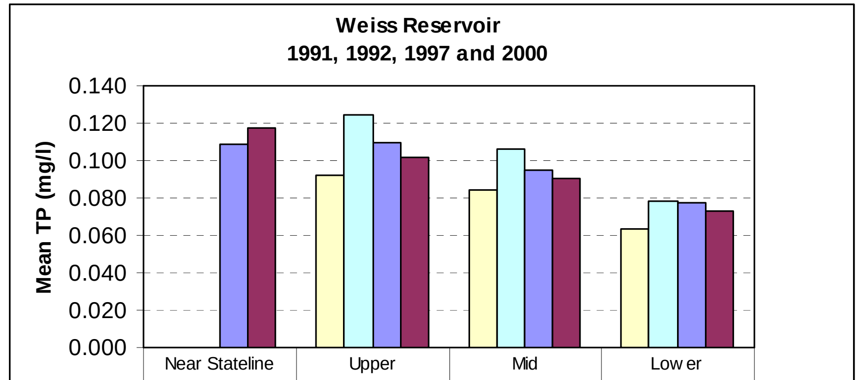
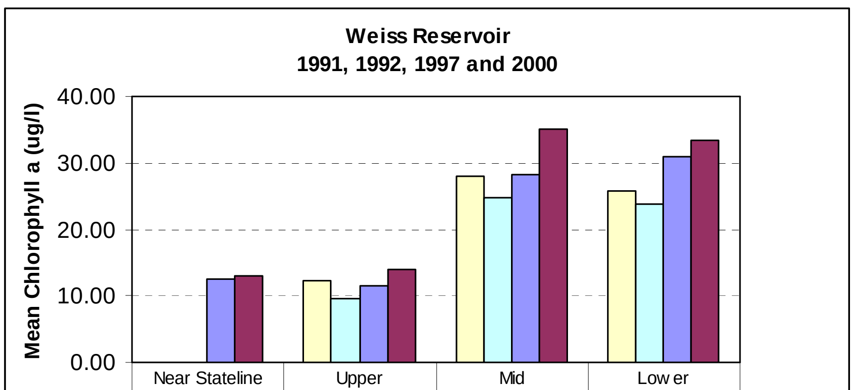
APPENDIX



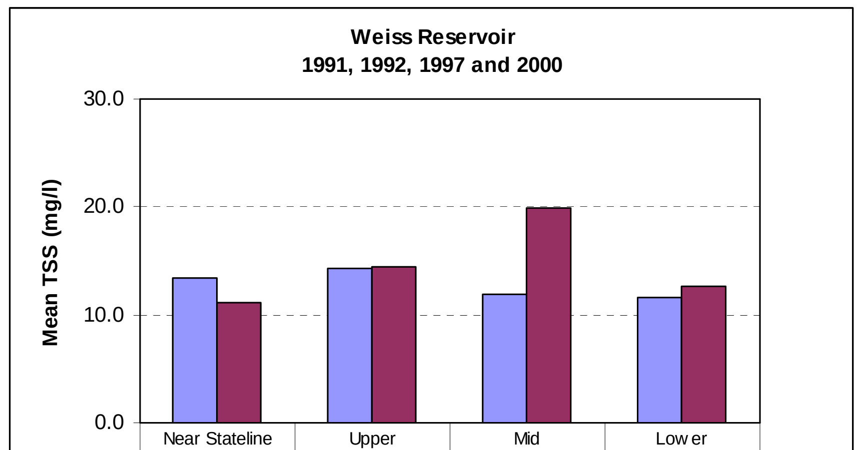
	Near Stateline	Upper	Mid	Lower
1992		0.704	0.604	0.588
1997	0.585	0.555	0.475	0.477
2000	0.629	0.869	0.764	0.808



	Near Stateline	Upper	Mid	Lower
1991		0.093	0.084	0.063
1992		0.124	0.106	0.078
1997	0.109	0.110	0.095	0.077
2000	0.117	0.101	0.091	0.073

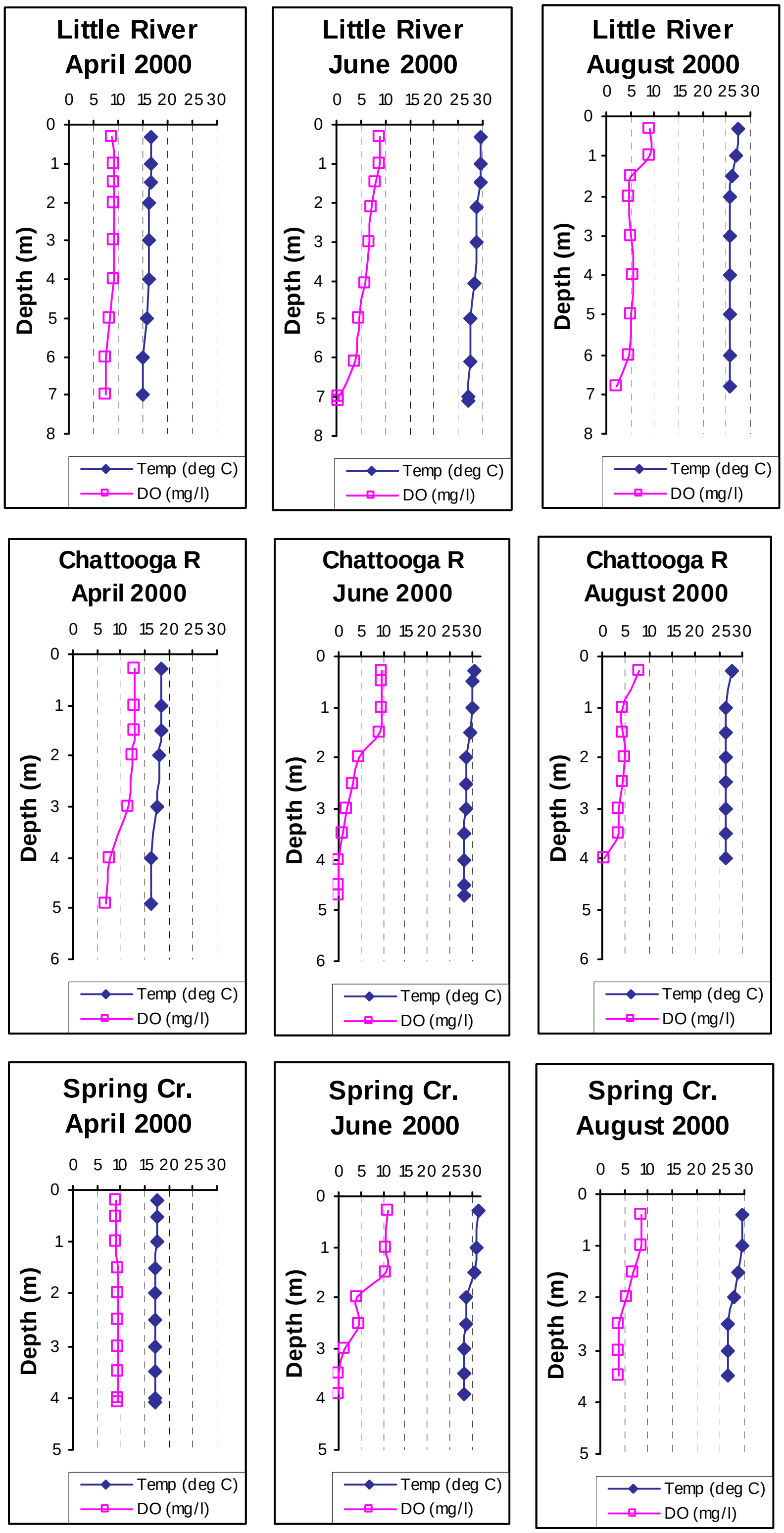


	Near Stateline	Upper	Mid	Lower
1991		12.33	27.88	25.65
1992		9.50	24.86	23.90
1997	12.39	11.51	28.23	30.81
2000	12.99	14.04	35.17	33.32

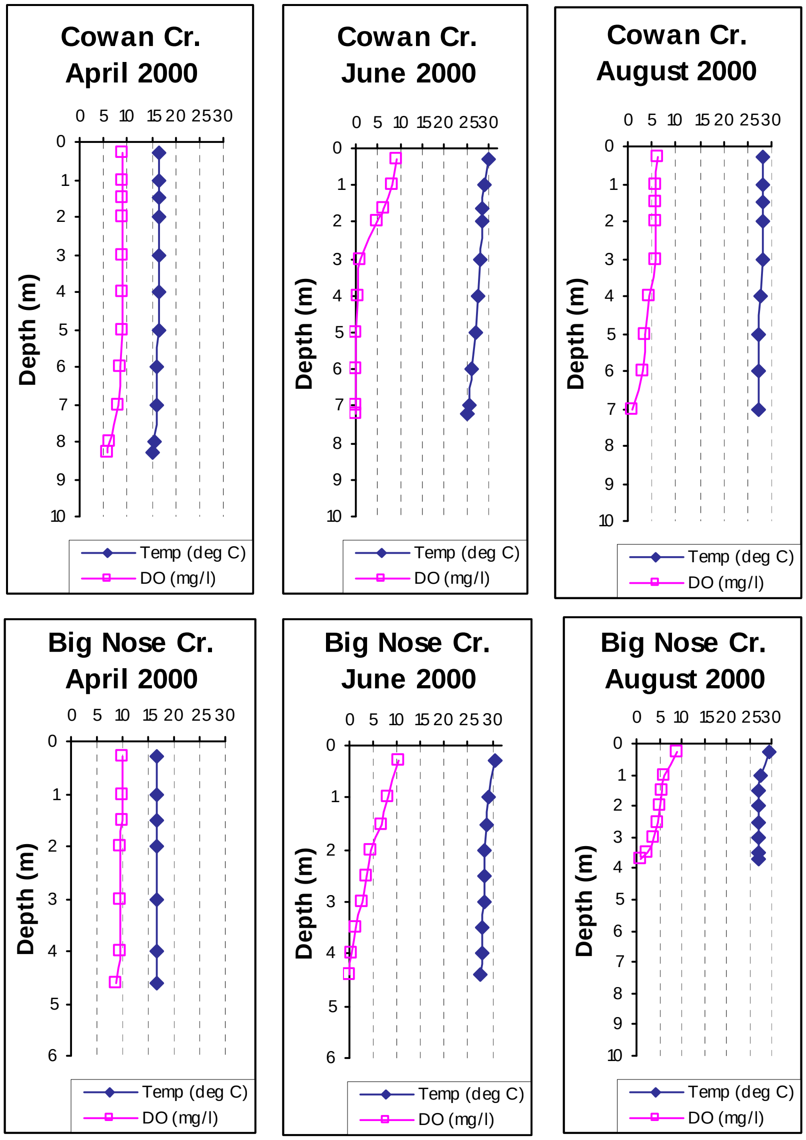


	Near Stateline	Upper	Mid	Lower
1997	13.4	14.3	11.9	11.6
2000	11.1	14.4	19.9	12.7

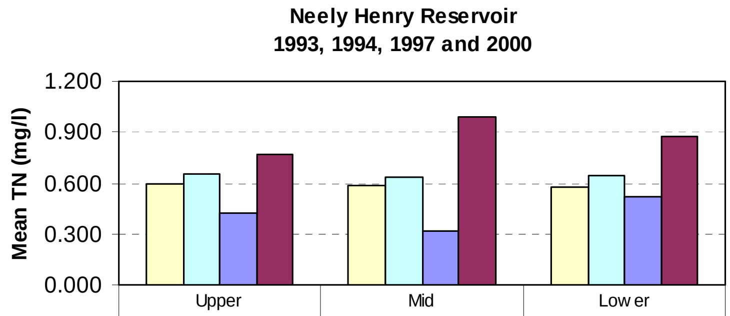
Appendix Figure I.1. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Weiss Reservoir, 1991, 1992, 1997 and 2000.



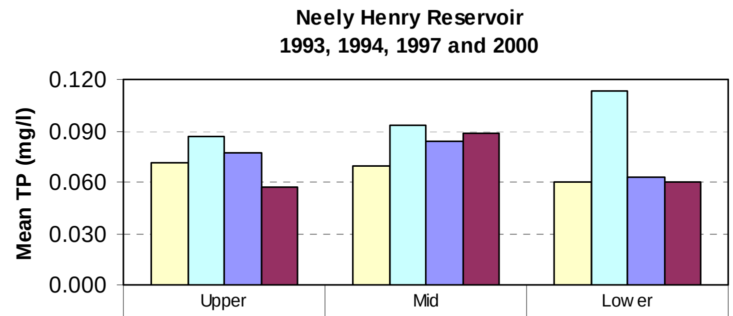
Appendix Figure I.2. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Little Chattooga Rivers and Spring Creek, Weiss Reservoir tributary embayments, April, June and August 2000.



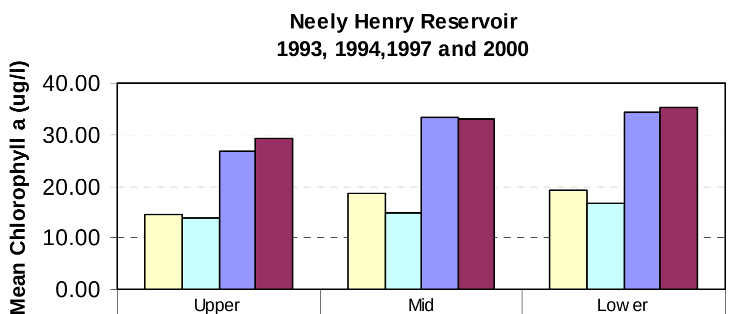
Appendix Figure I.3. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Cowan and Big Nose Creeks, Weiss Reservoir tributary embayments, April, June and August 2000.



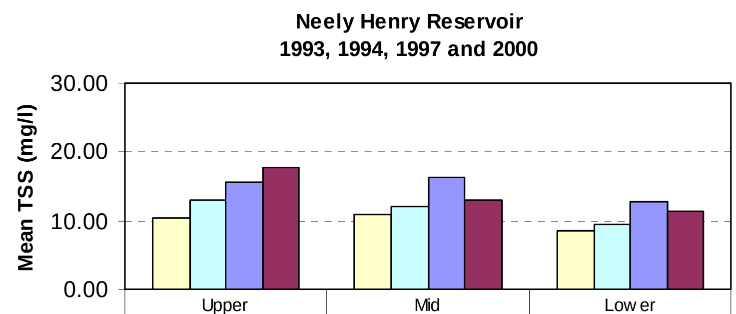
	Upper	Mid	Lower
1993	0.600	0.583	0.574
1994	0.652	0.637	0.648
1997	0.418	0.314	0.522
2000	0.772	0.993	0.871



	Upper	Mid	Lower
1993	0.072	0.070	0.060
1994	0.087	0.094	0.113
1997	0.077	0.084	0.063
2000	0.058	0.089	0.060

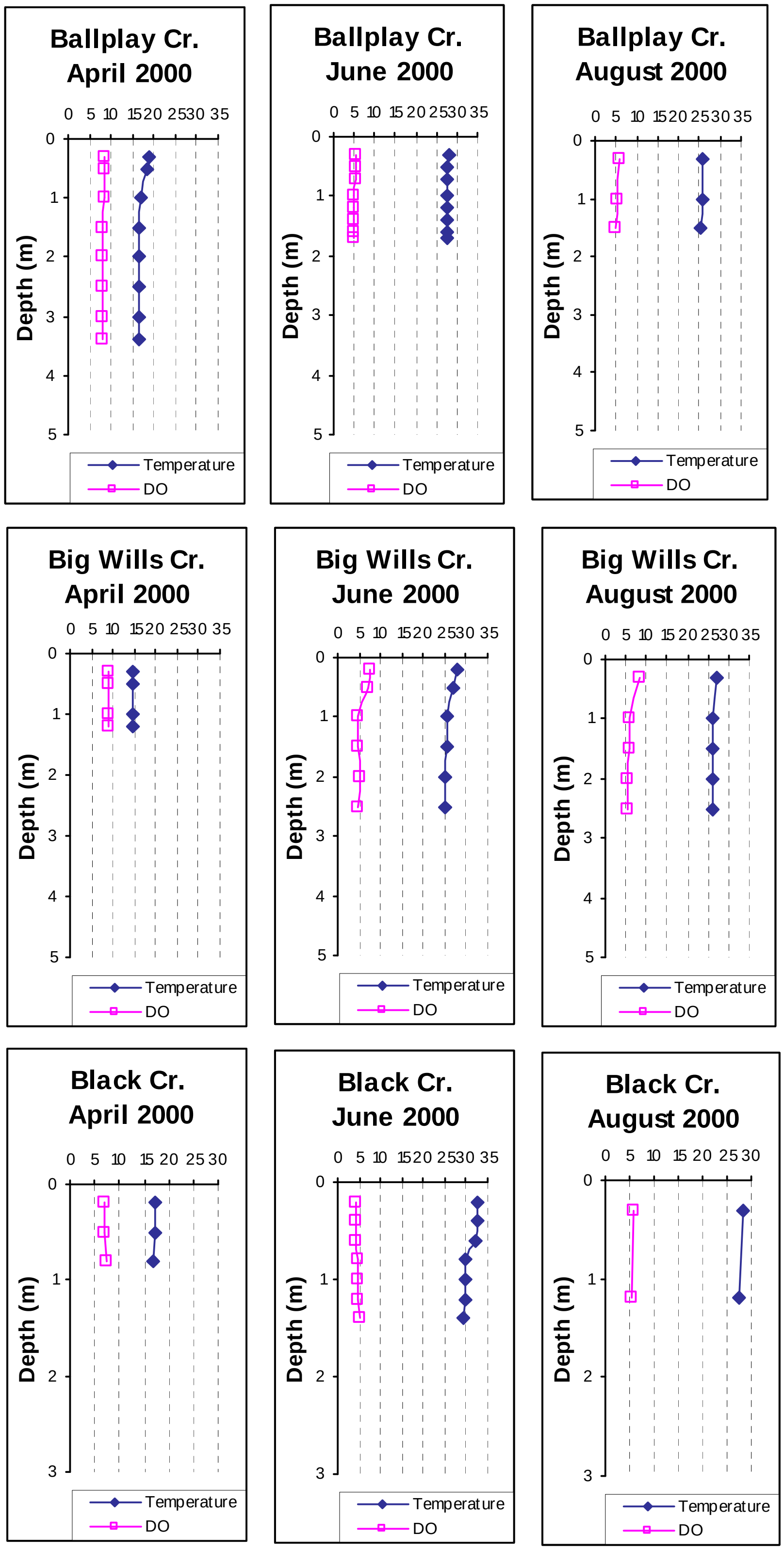


	Upper	Mid	Lower
1993	14.47	18.43	19.19
1994	13.73	14.67	16.59
1997	26.75	33.42	34.33
2000	29.45	33.00	35.34

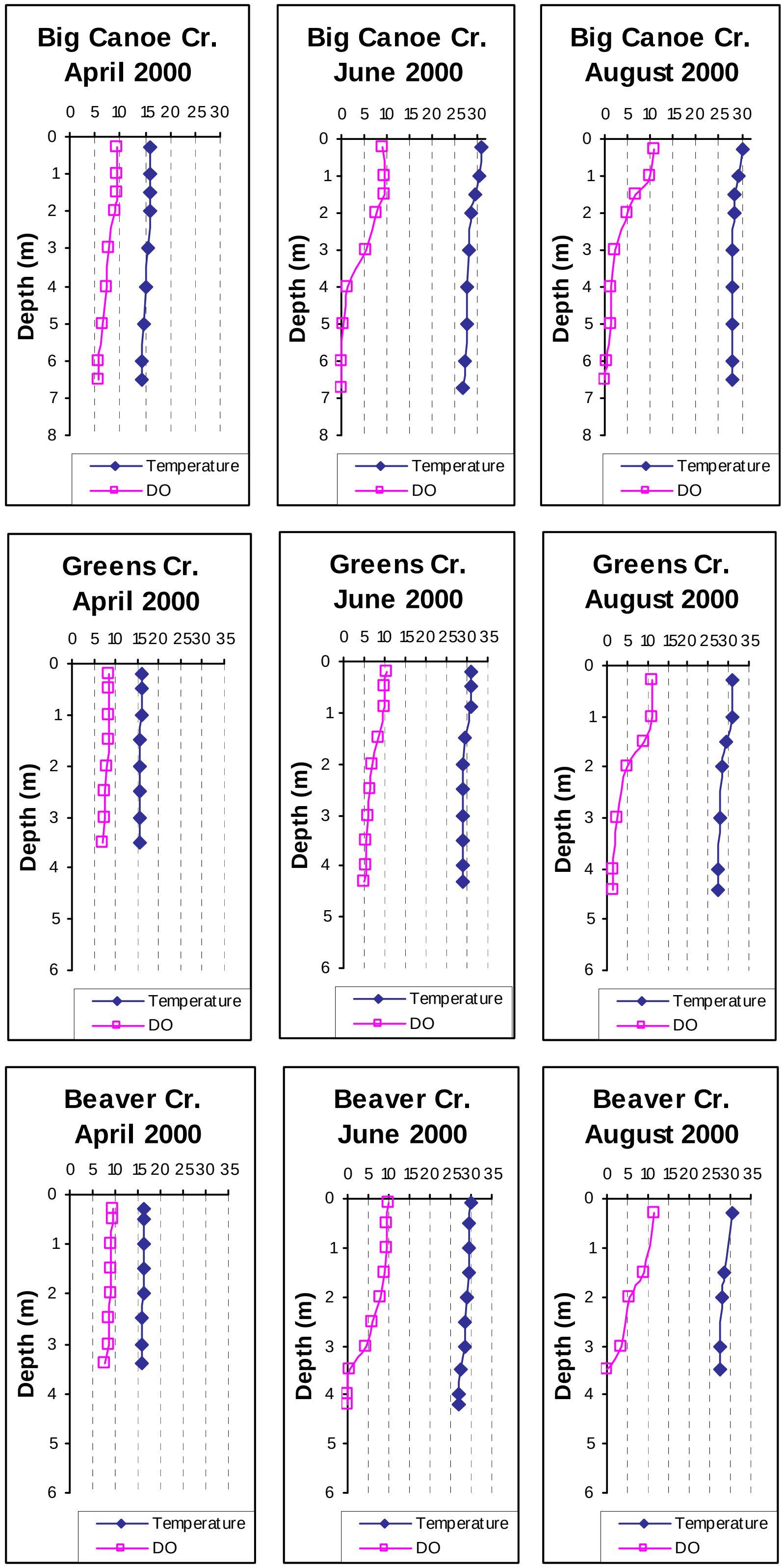


	Upper	Mid	Lower
1993	10.44	10.84	8.62
1994	12.92	12.14	9.37
1997	15.6	16.3	12.7
2000	17.7	13.0	11.3

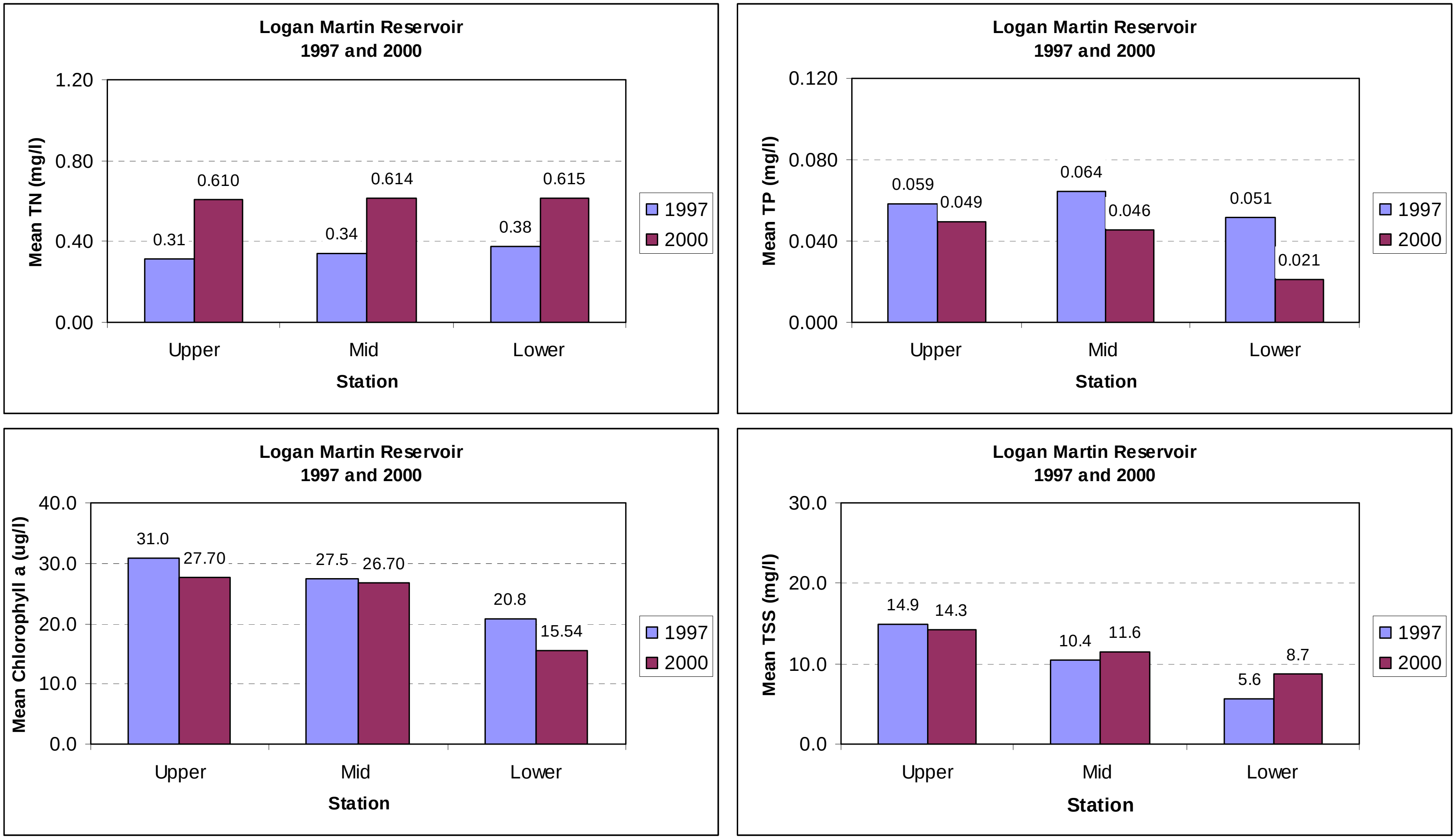
Appendix Figure I.4. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Neely-Henry Reservoir, 1992, 1993, 1997 and 2000.



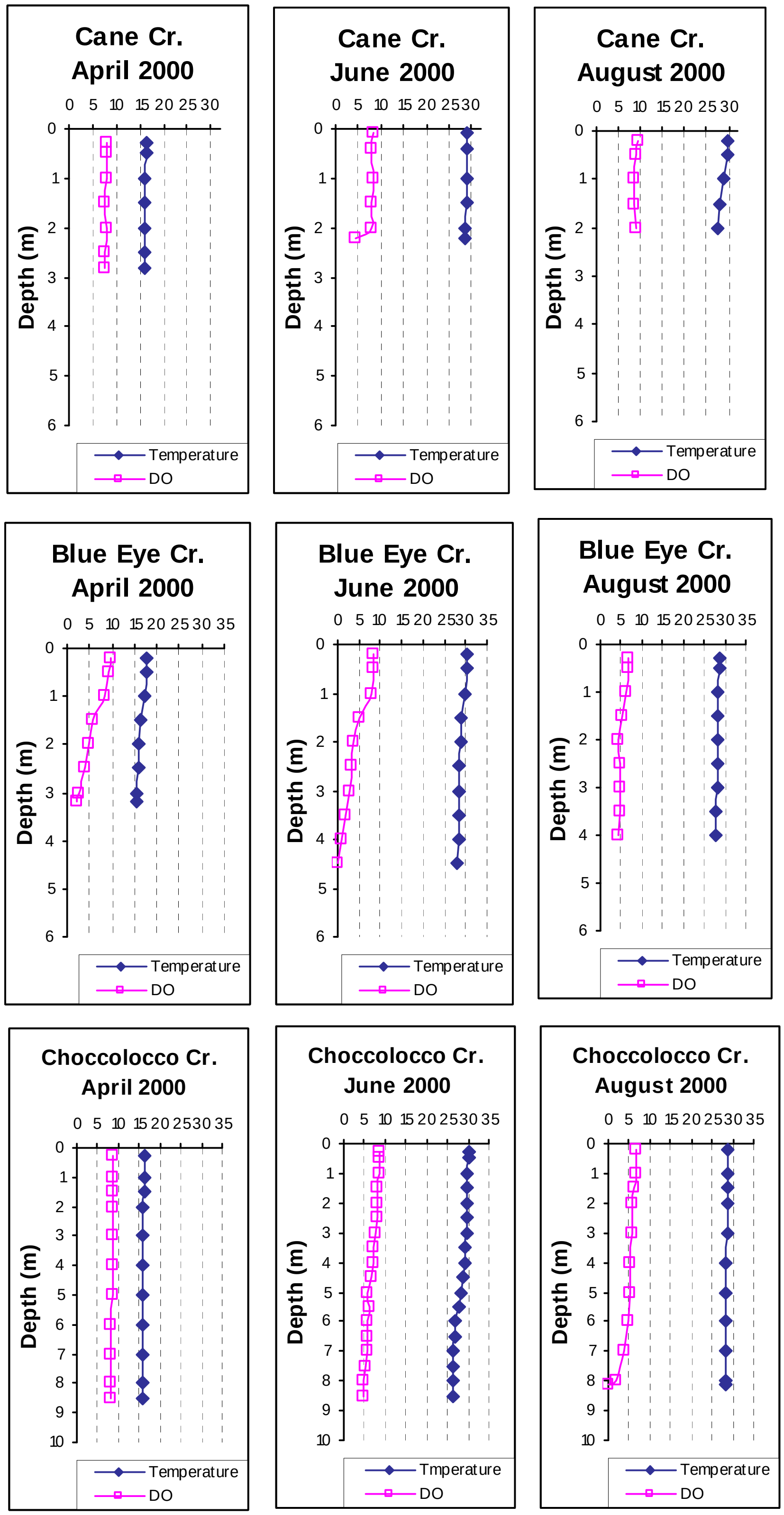
Appendix Figure I.5. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Ballplay, Big Wills and Black Creeks, Neely Henry Reservoir tributary embayments, April, June and August 2000.



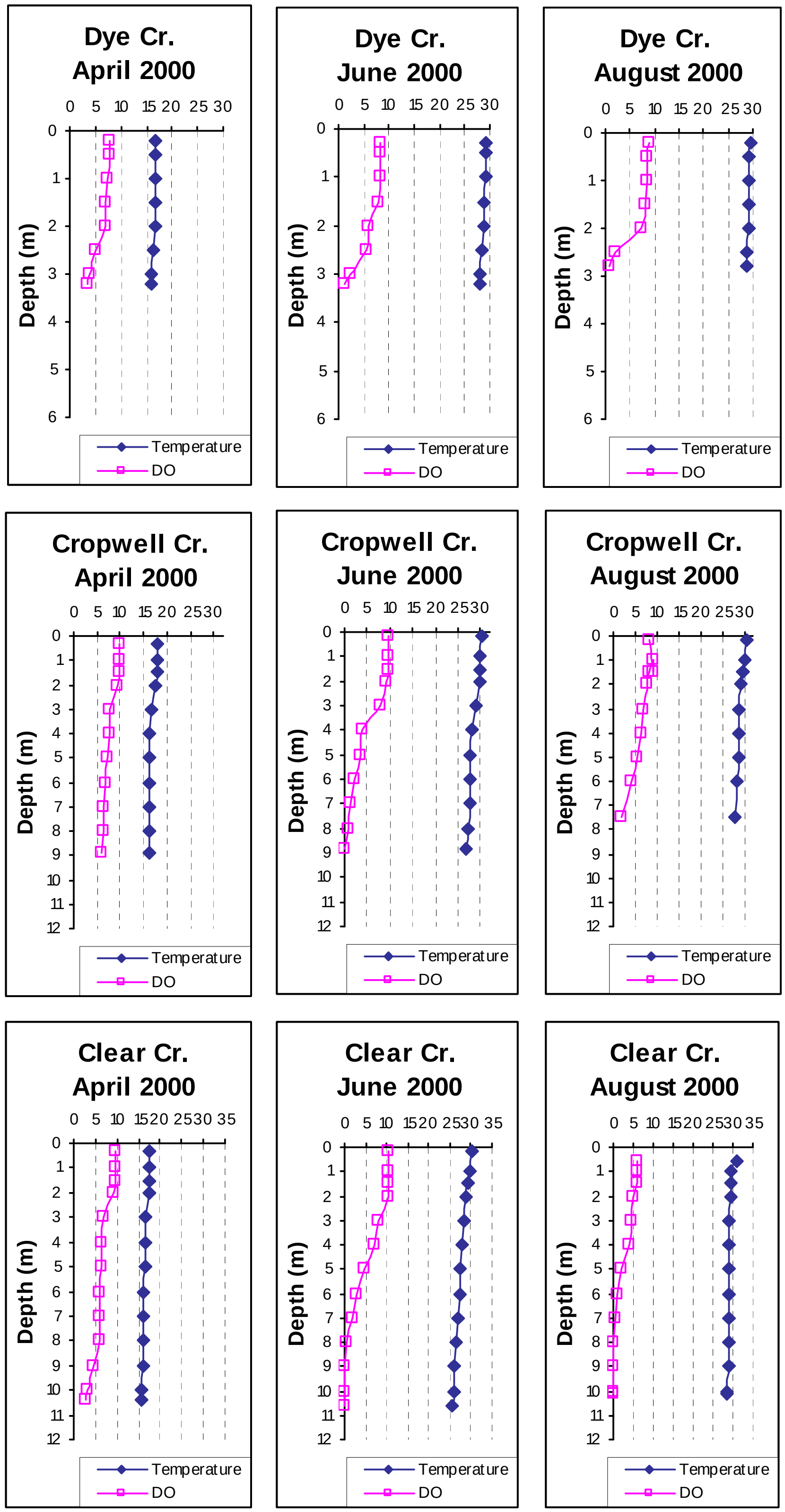
Appendix Figure I.6. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Big Canoe, Greens, and Beaver Creeks, Neely Henry Reservoir tributary embayments, April, June and August 2000.



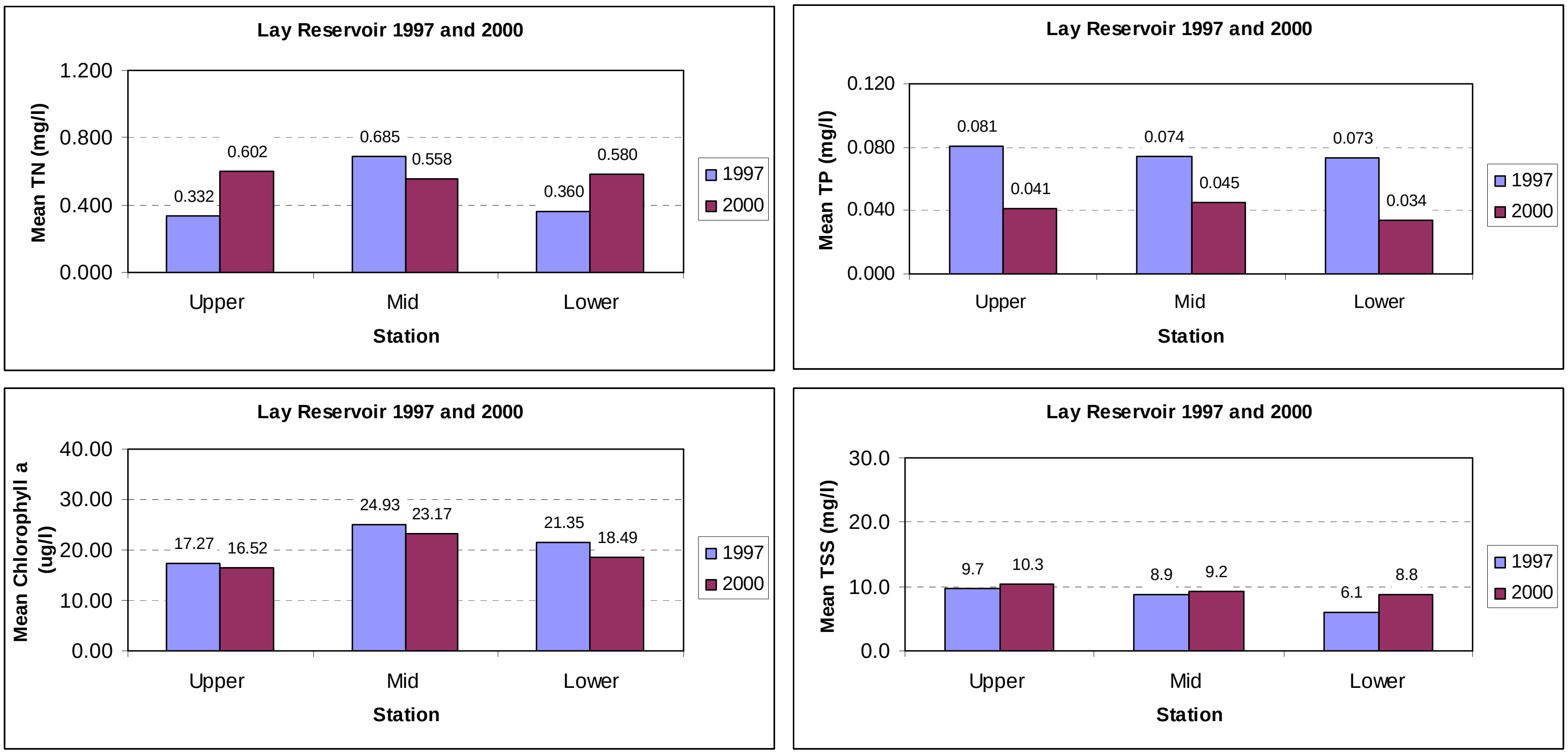
Appendix Figure I.7. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Logan-Martin Reservoir, 1997 and 2000.



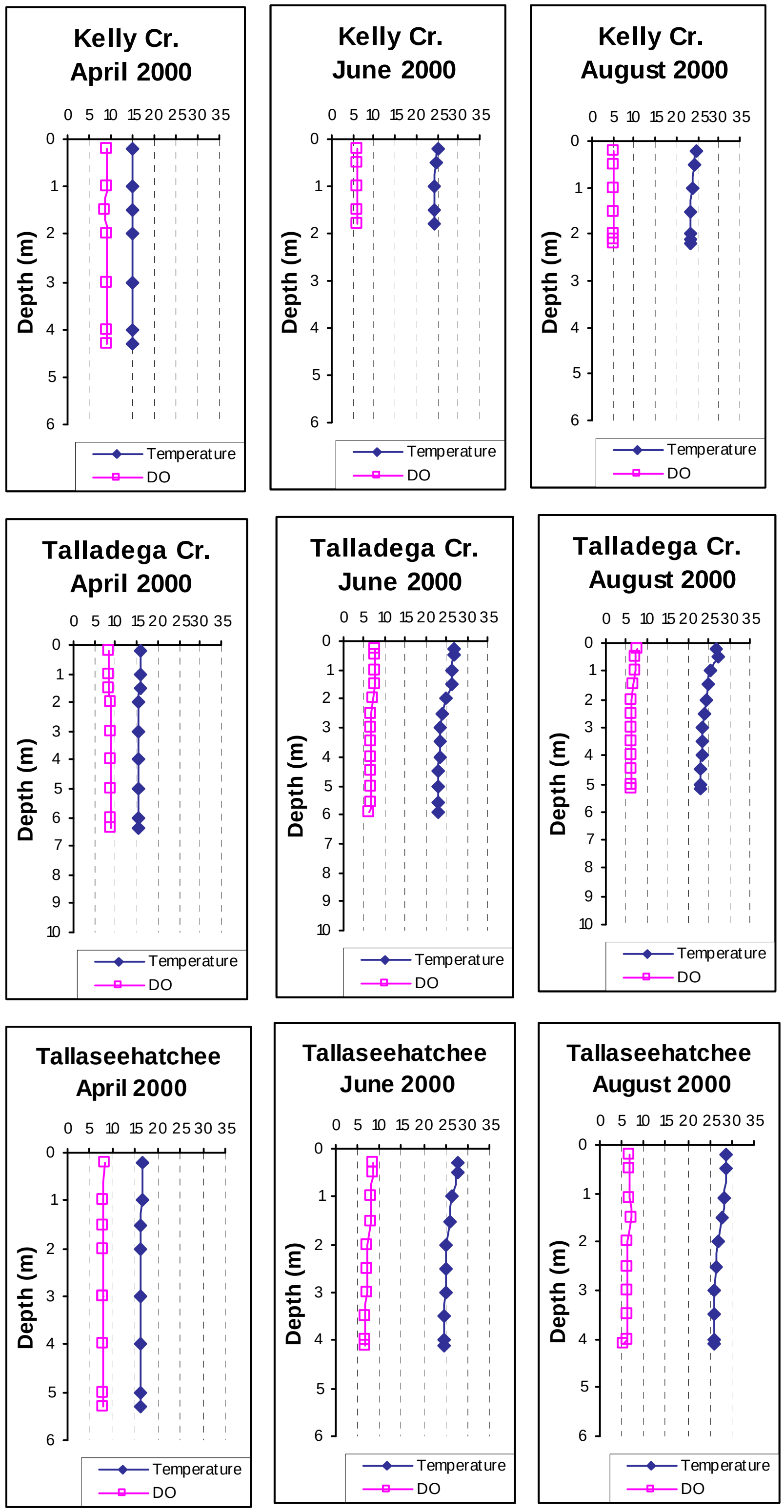
Appendix Figure I.8. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Cane, Blue Eye, and Choccolocco Creeks, Logan Martin Reservoir tributary embayments, April, June and August 2000.



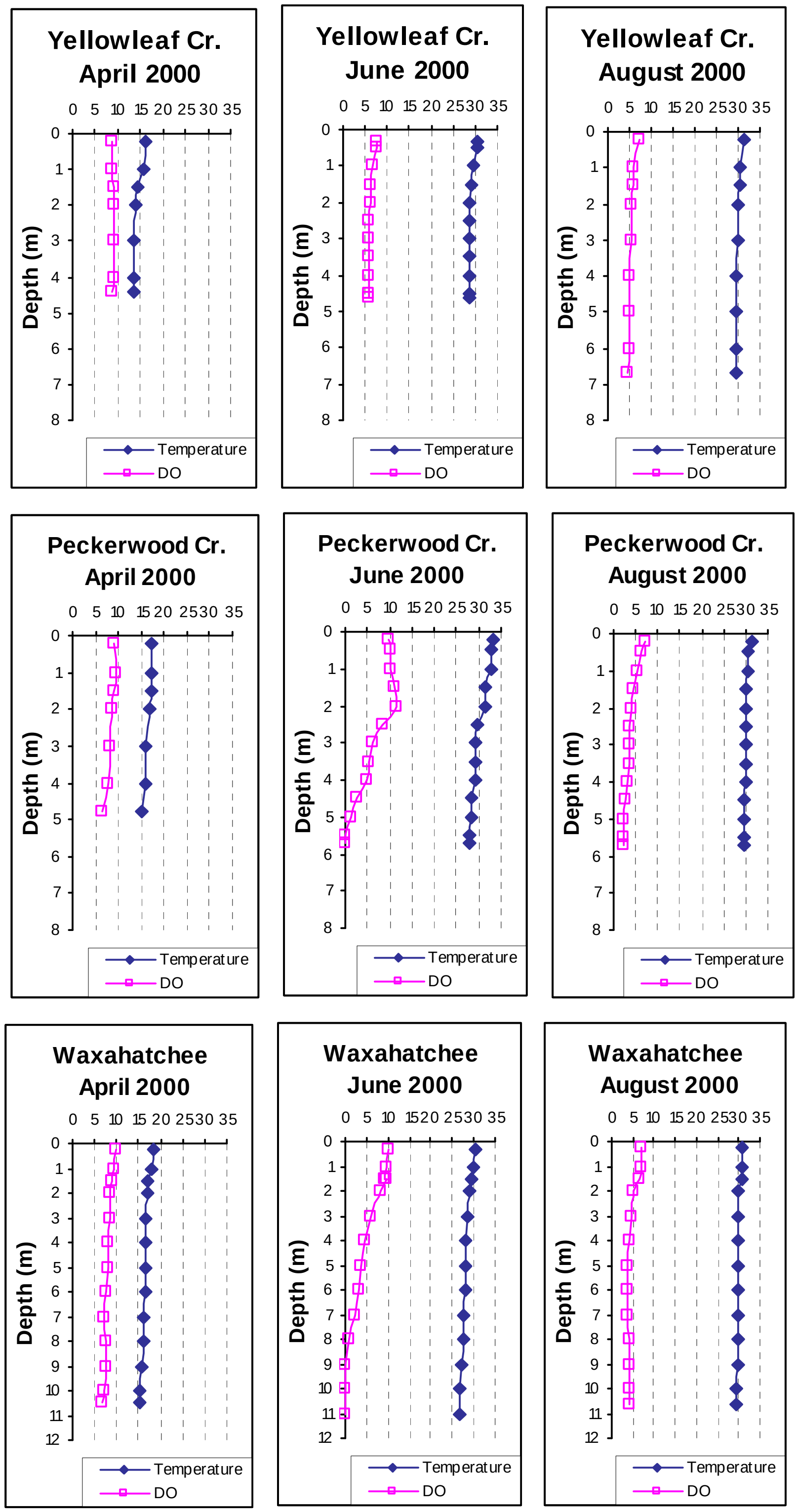
Appendix Figure I.9. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Dye, Cropwell, and Clear Creeks, Logan Martin Reservoir tributary embayments, April, June and August 2000.



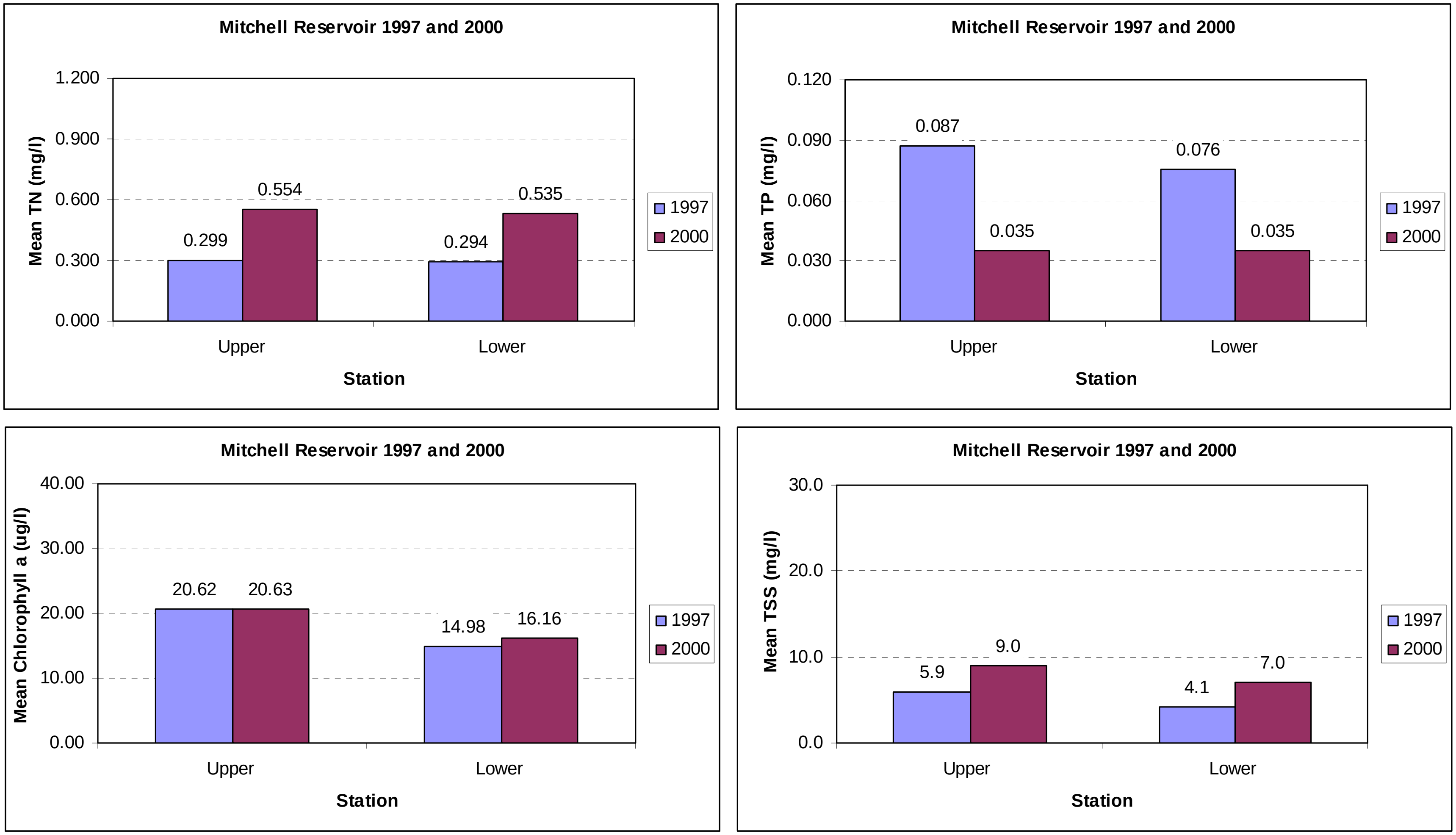
Appendix Figure I.10. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Lay Reservoir, 1997 and 2000.



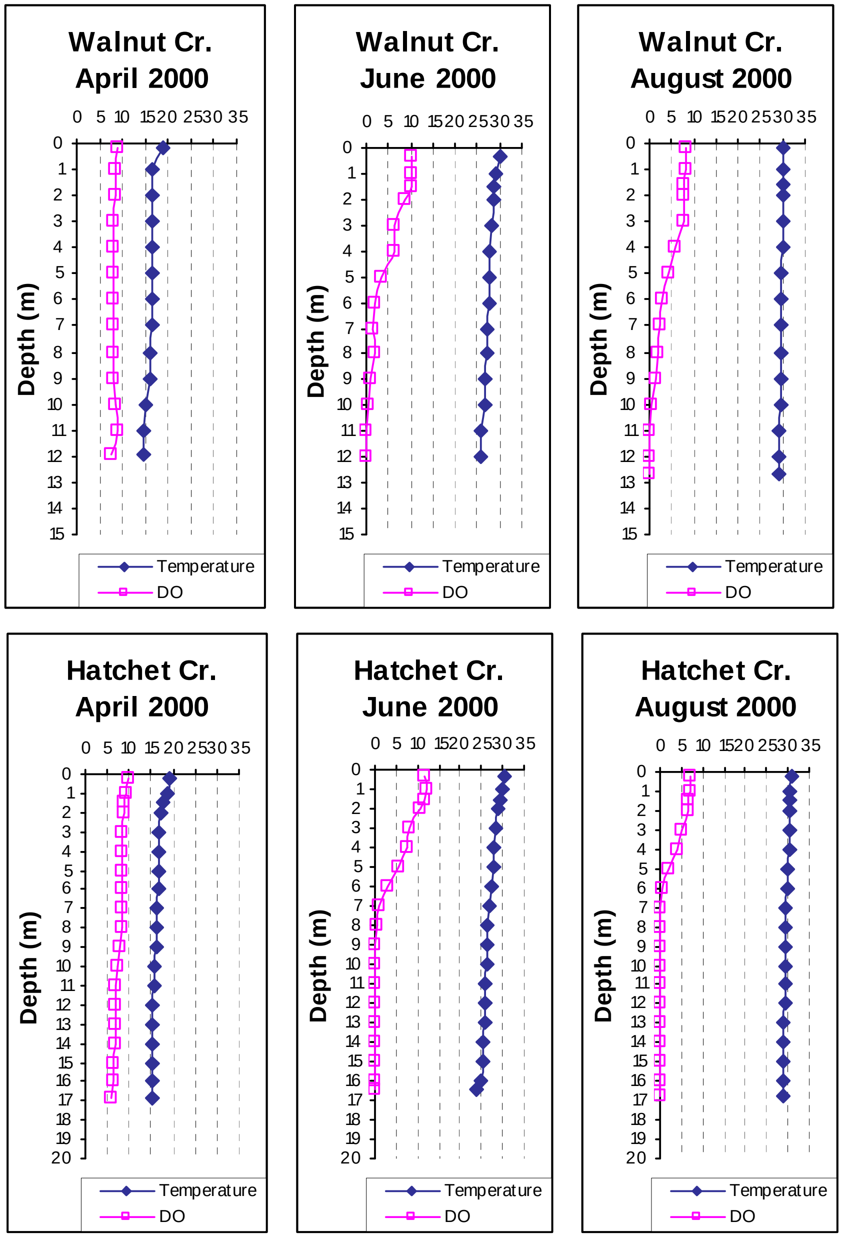
Appendix Figure I.11. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Kelly, Talladega, and Tallaseehatchee Creeks, Lay Reservoir tributary embayments, April, June and August 2000.



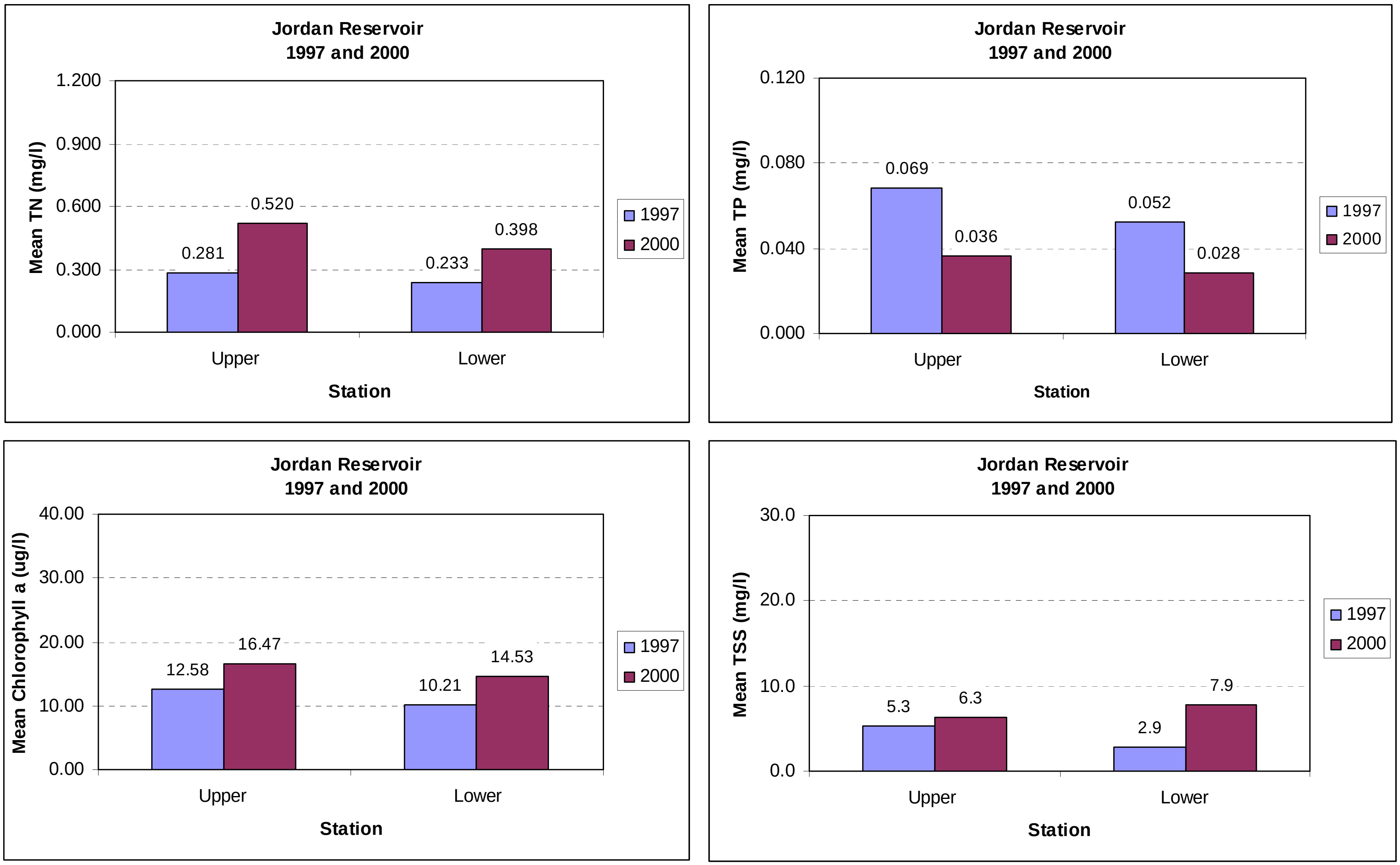
Appendix Figure I.12. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Yellowleaf, Peckerwood, and Waxahatchee Creeks, Lay Reservoir tributary embayments, April, June and August 2000.



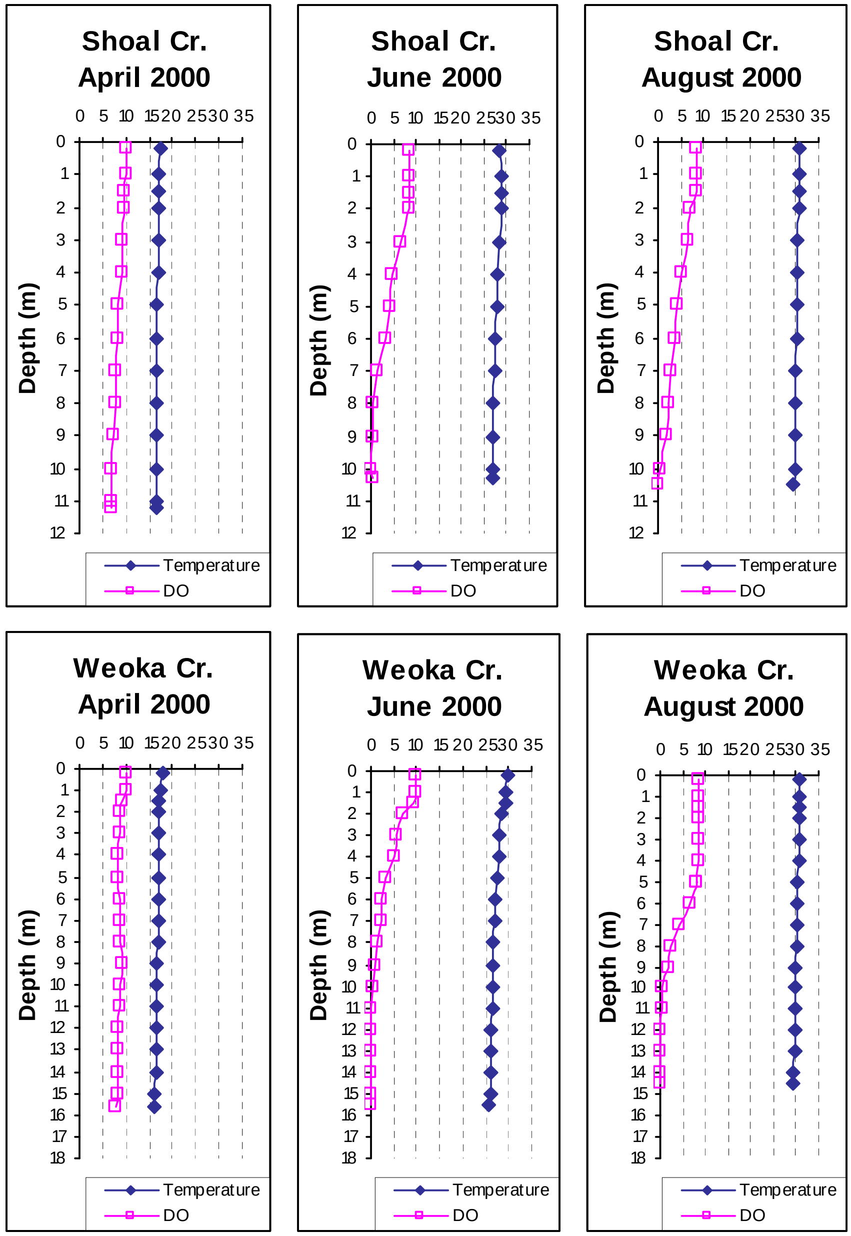
Appendix Figure I.13. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Mitchell Reservoir, 1997 and 2000.



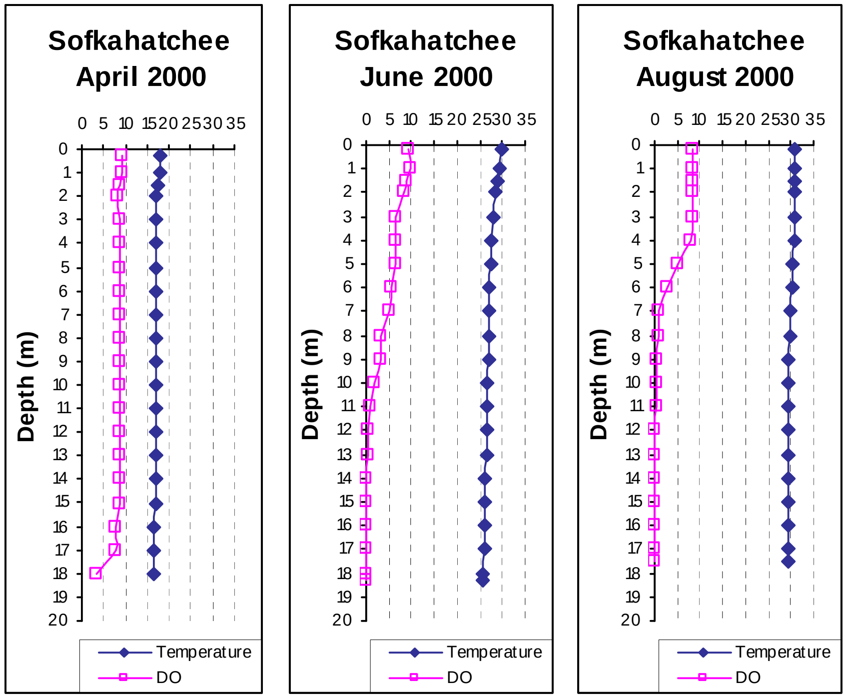
Appendix Figure I.14. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Walnut and Hatchet Creeks, Mitchell Reservoir tributary embayments, April, June and August 2000.



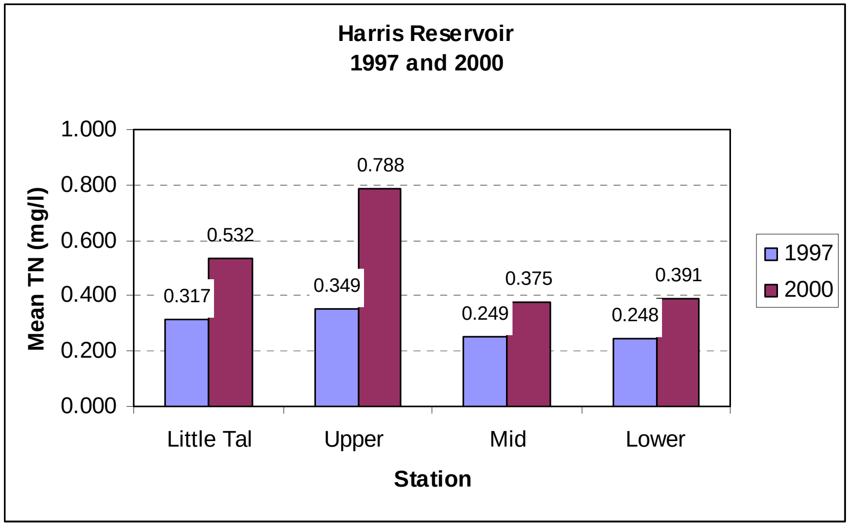
Appendix Figure I.15. Mean TN, TP, chlorophyll *a*, and TSS concentrations from Jordan Reservoir, 1997 and 2000.

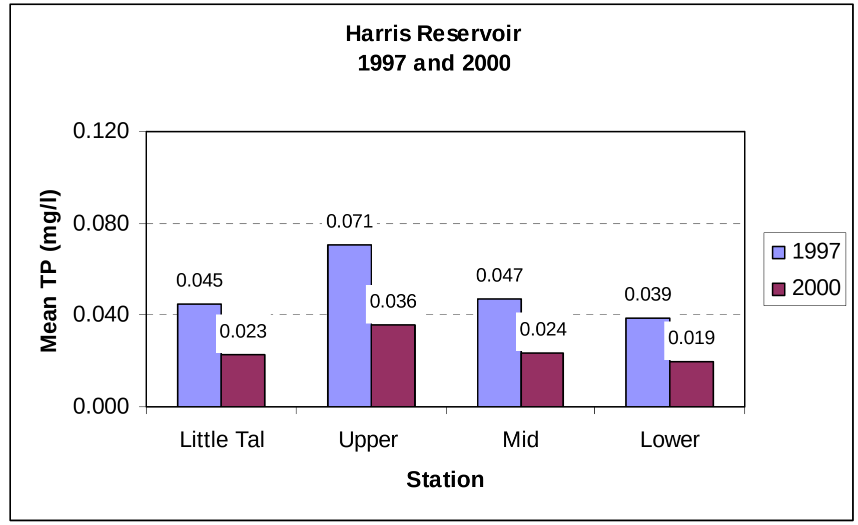


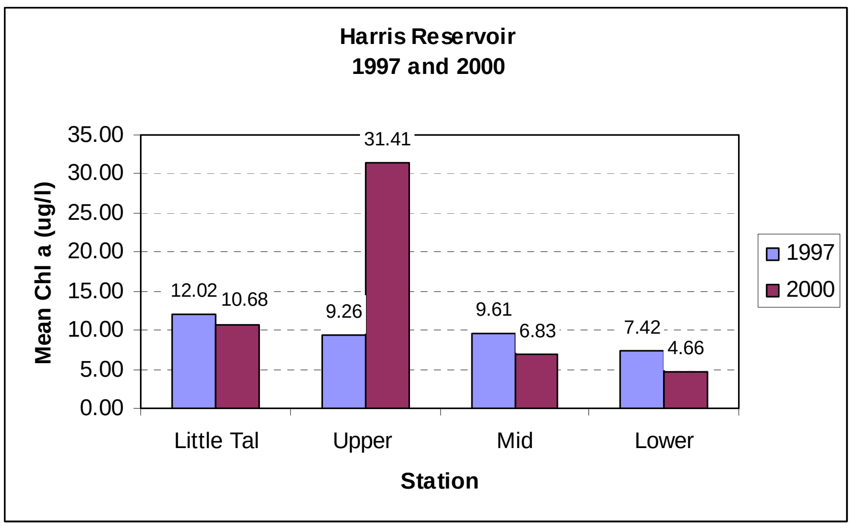
Appendix Figure I.16. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Shoal and Weoka Creeks, Jordan Reservoir tributary embayments, April, June and August 2000.



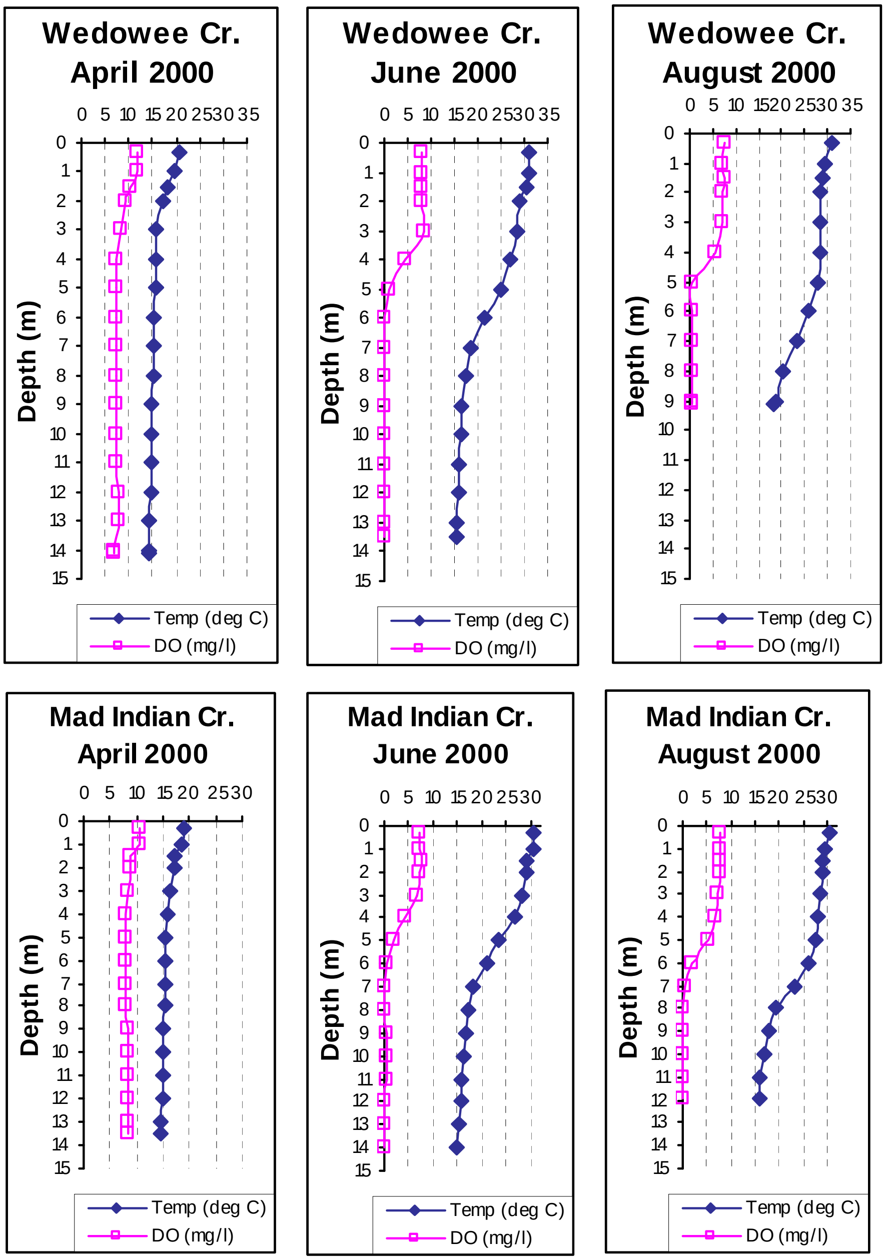
Appendix Figure I.17. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Sofkahatchee Creek, Jordan Reservoir tributary embayment, April, June and August 2000.



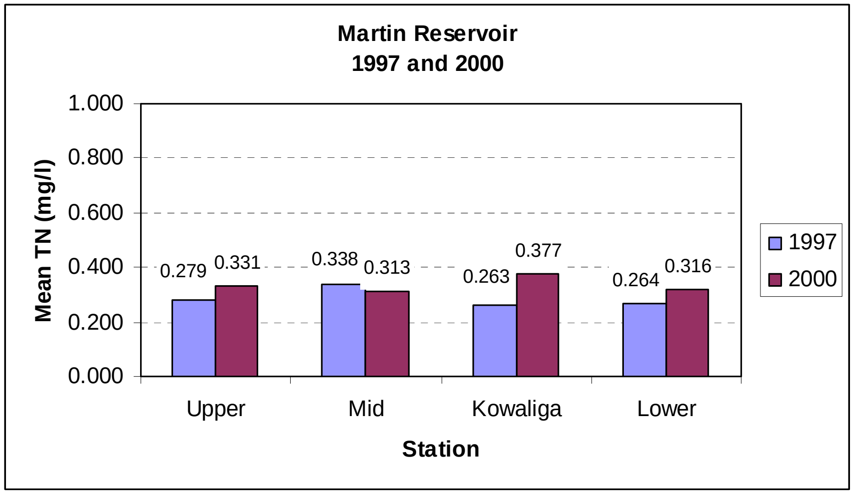


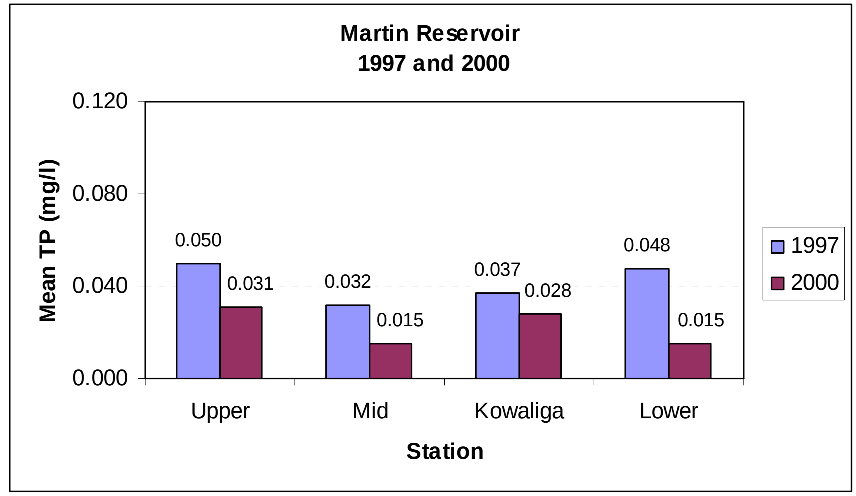


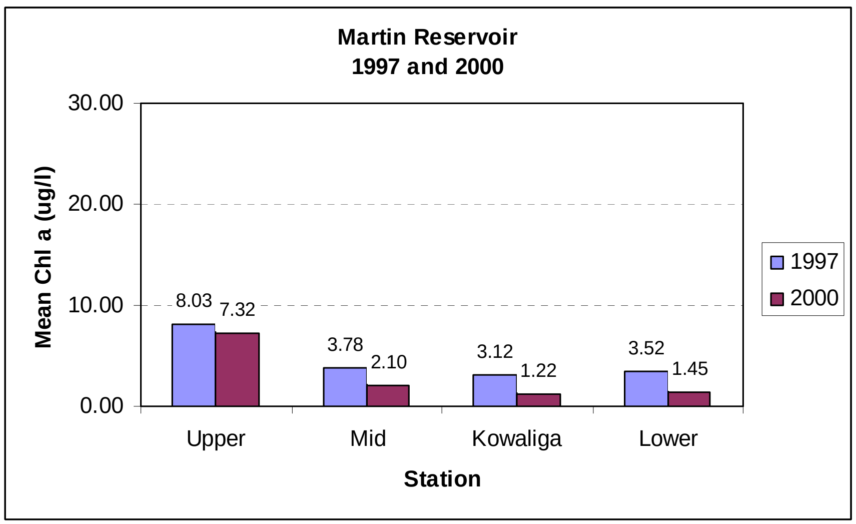
Appendix Figure II.1. Mean TN, TP, and Chl *a* from Harris Reservoir, 1997 and 2000.



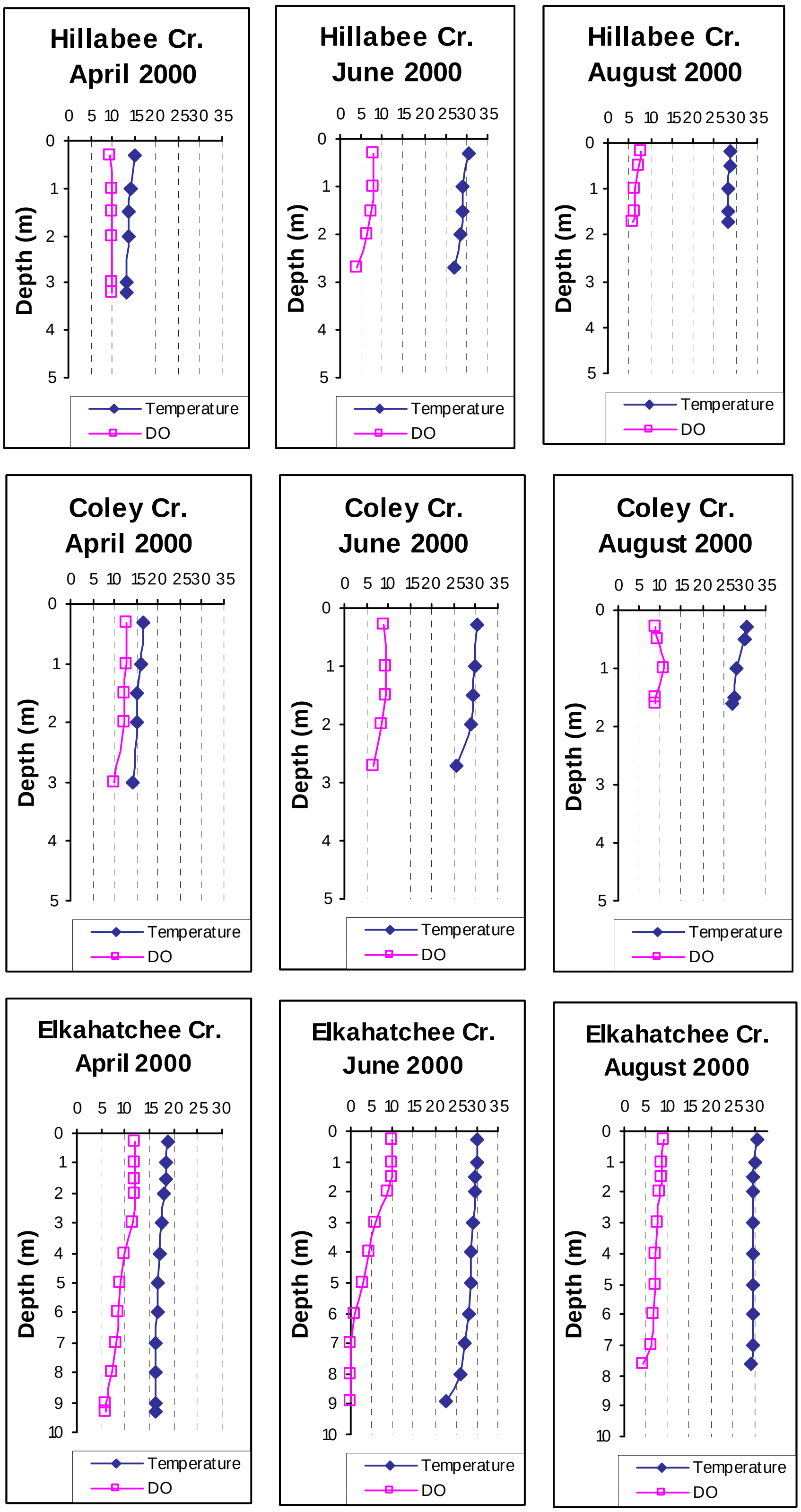
Appendix Figure II.2. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Wedowee and Mad Indian Creeks, Harris Reservoir tributary embayments, April, June and August 2000.



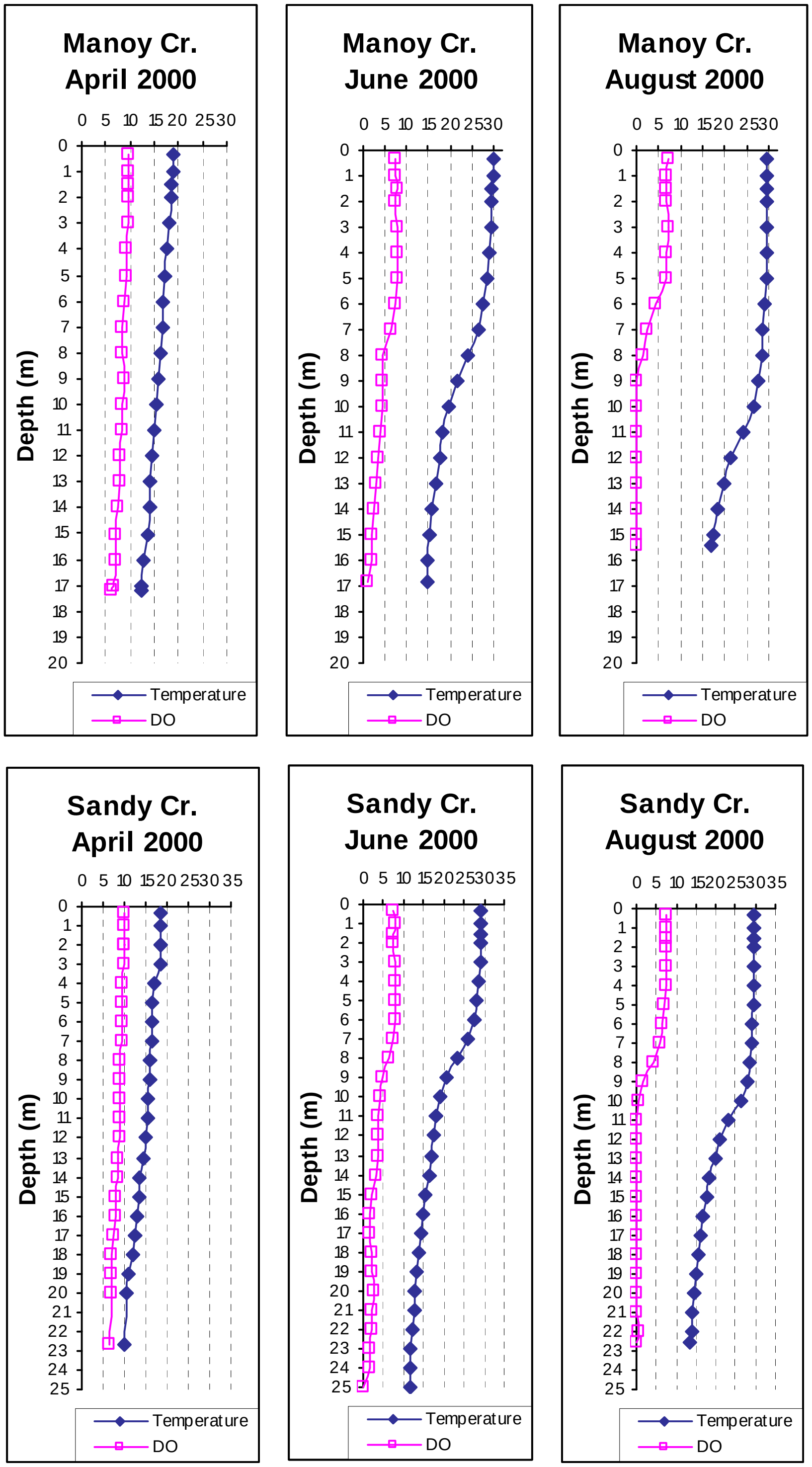




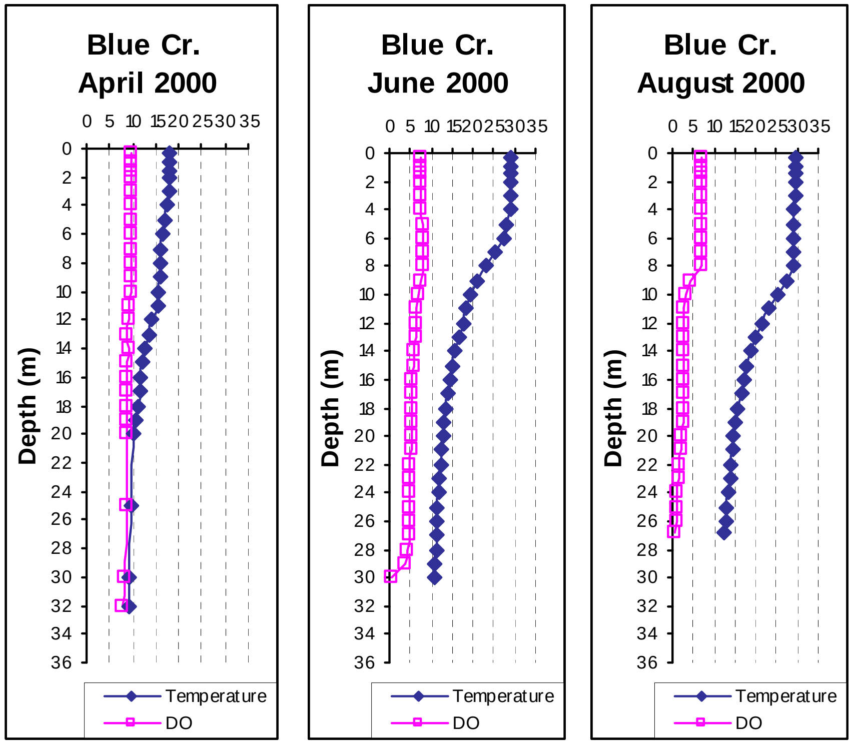
Appendix Figure II.3. Mean TN, TP, and Chl *a* from Martin Reservoir, 1997 and 2000.



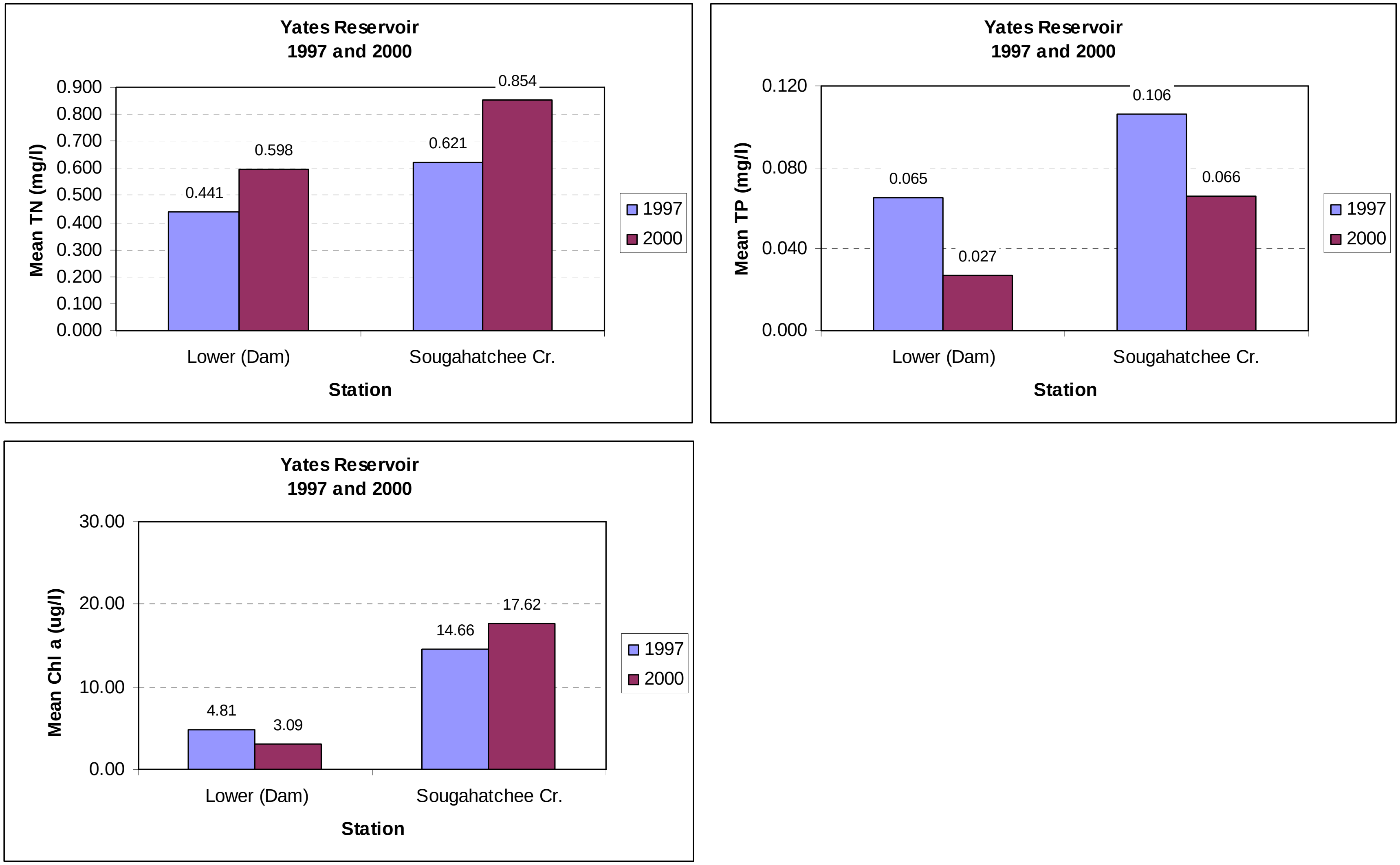
Appendix Figure II.4. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Hillabee, Coley, and Elkahatchee Creeks, Martin Reservoir tributary embayments, April, June and August 2000.



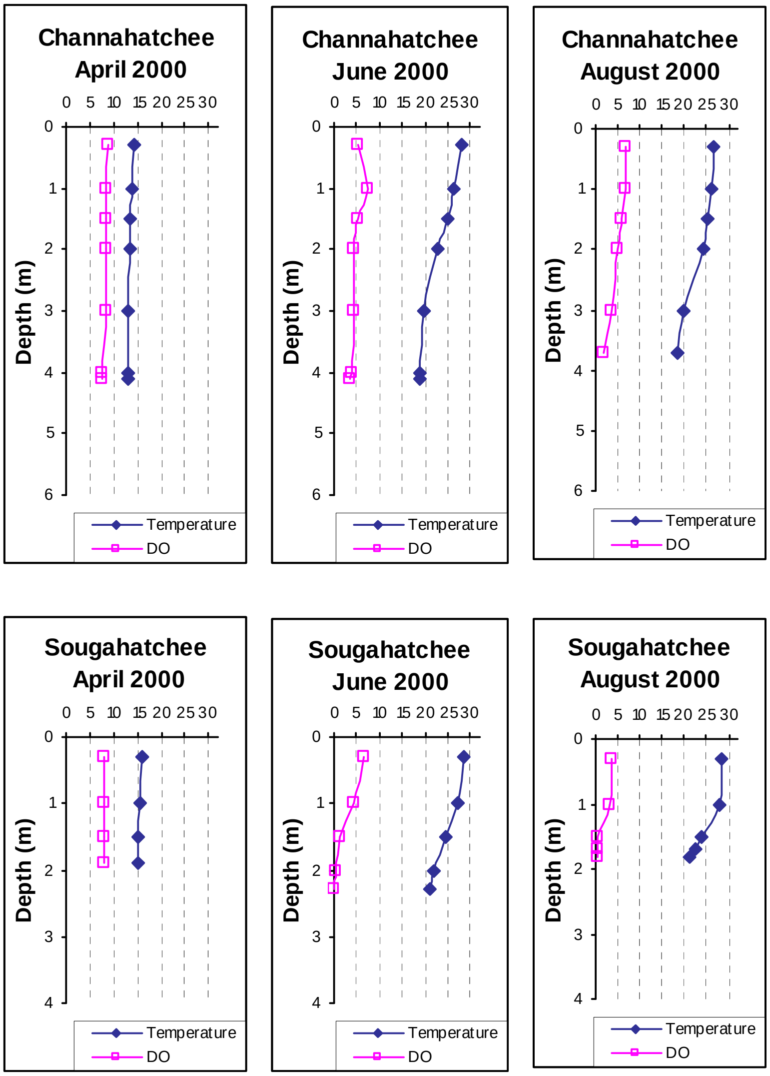
Appendix Figure II.5. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Manoy and Sandy Creeks, Martin Reservoir tributary embayments, April, June and August 2000.



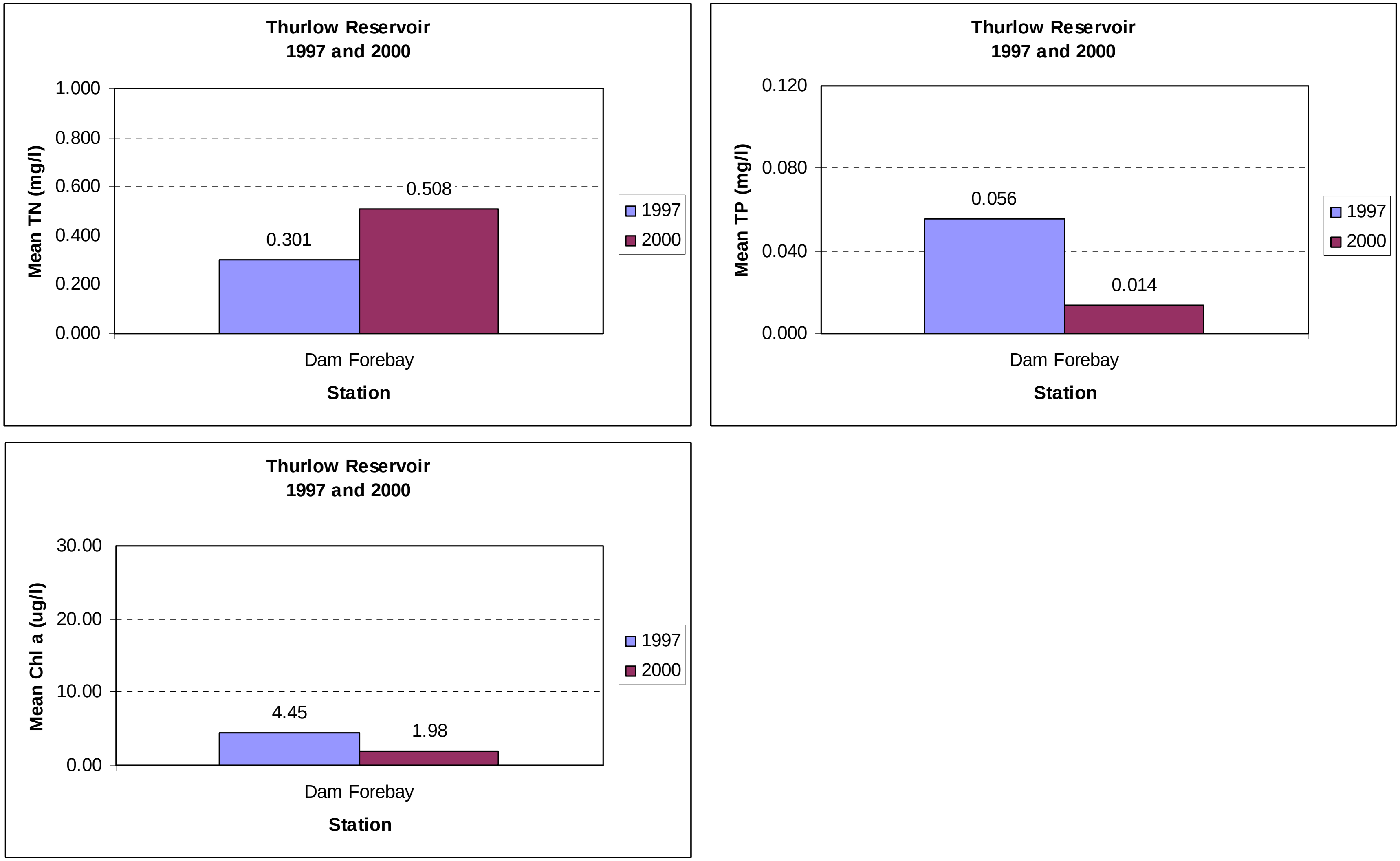
Appendix Figure II.6. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Blue Creek, Martin Reservoir tributary embayment, April, June and August 2000.



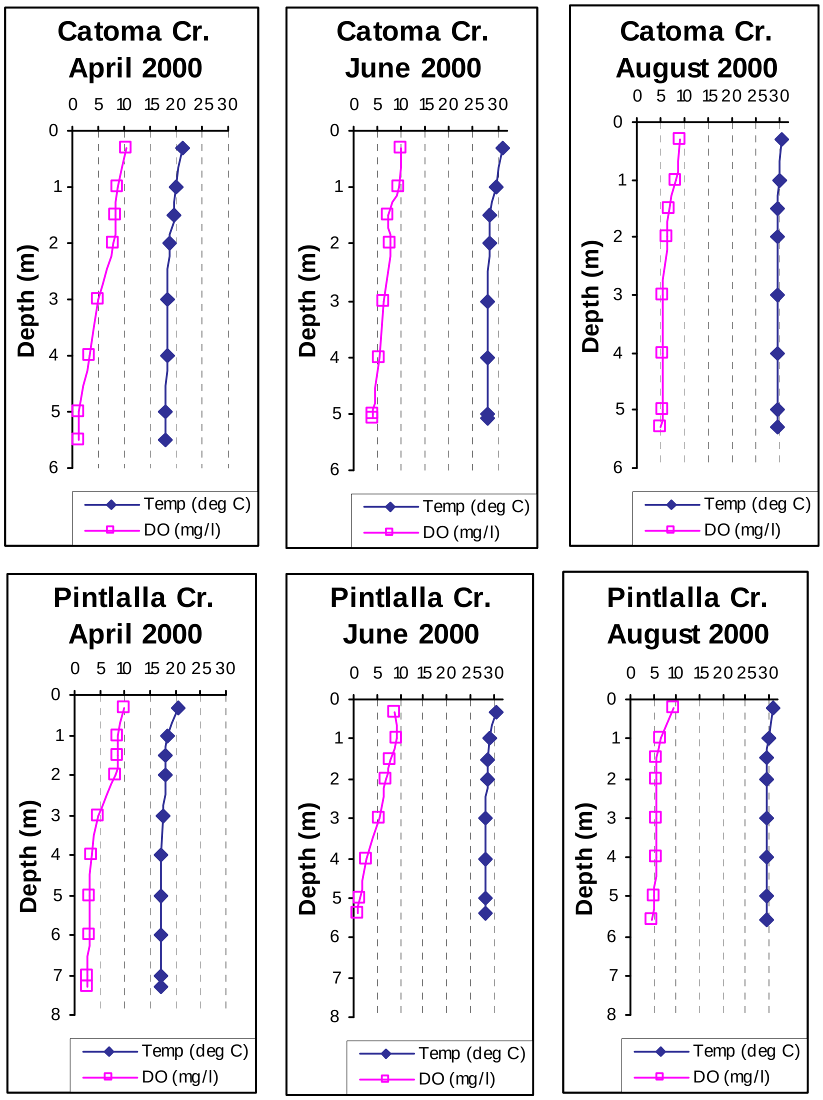
Appendix Figure II.7. Mean TN, TP, and Chl *a* from Yates Reservoir, 1997 and 2000.



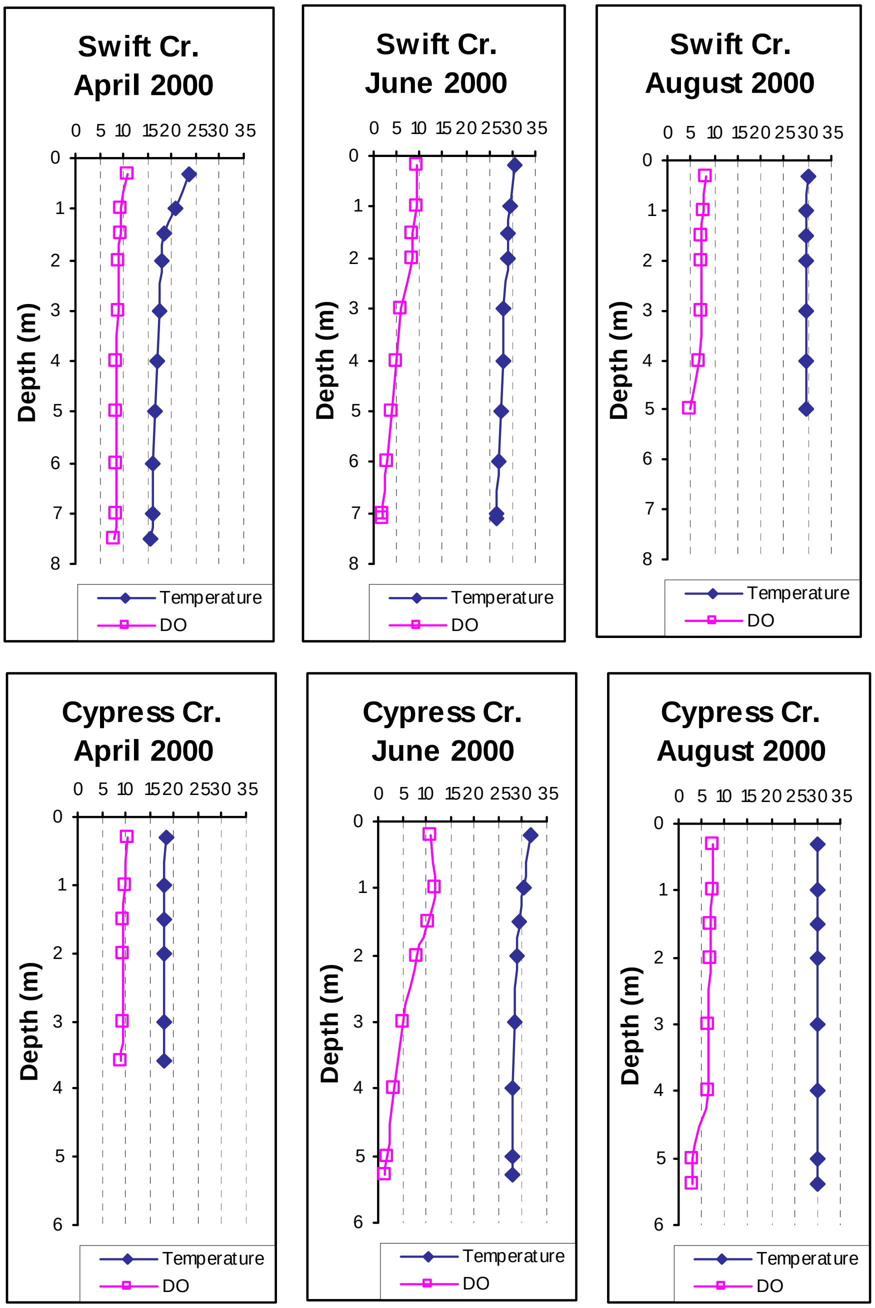
Appendix Figure II.8. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Channahatchee and Sougahatchee Creeks, Yates Reservoir tributary embayments, April, June and August 2000.



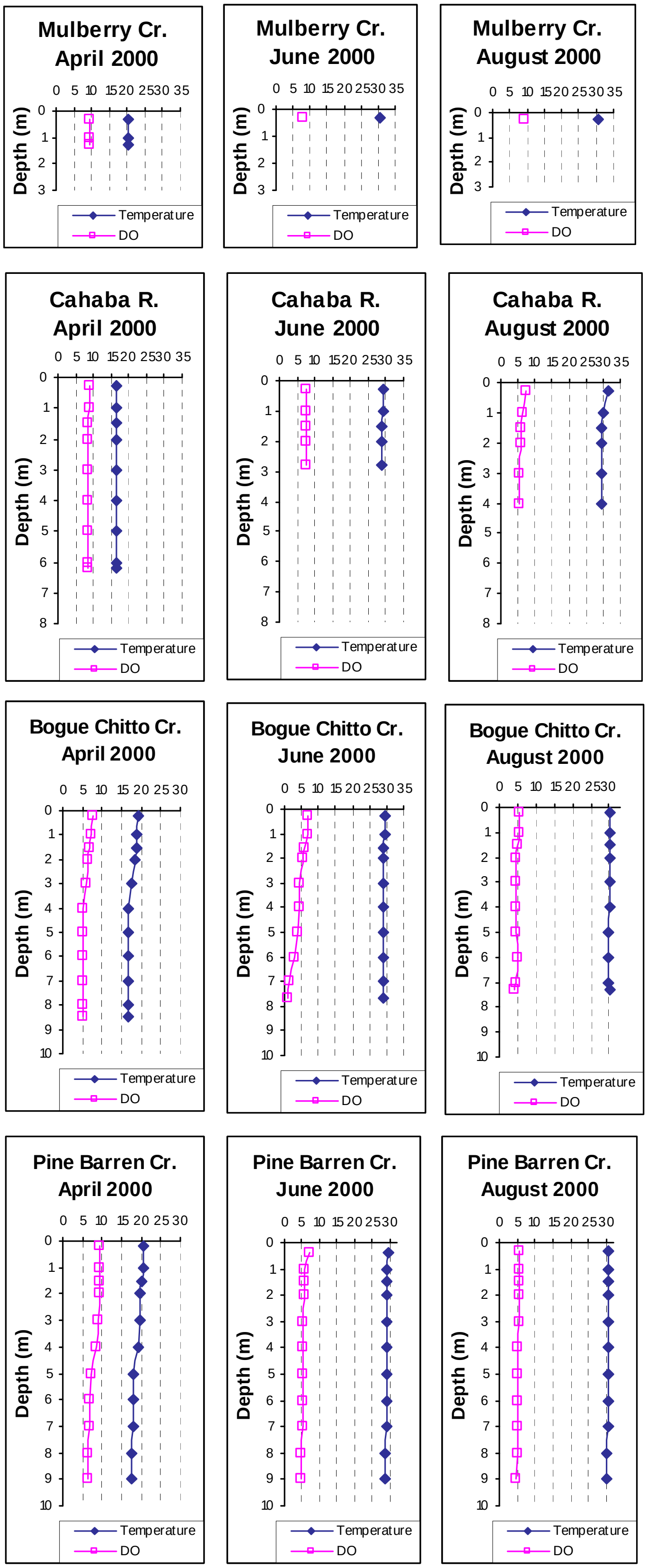
Appendix Figure II.9. Mean TN, TP, and Chl *a* from Thurlow Reservoir, 1997 and 2000.



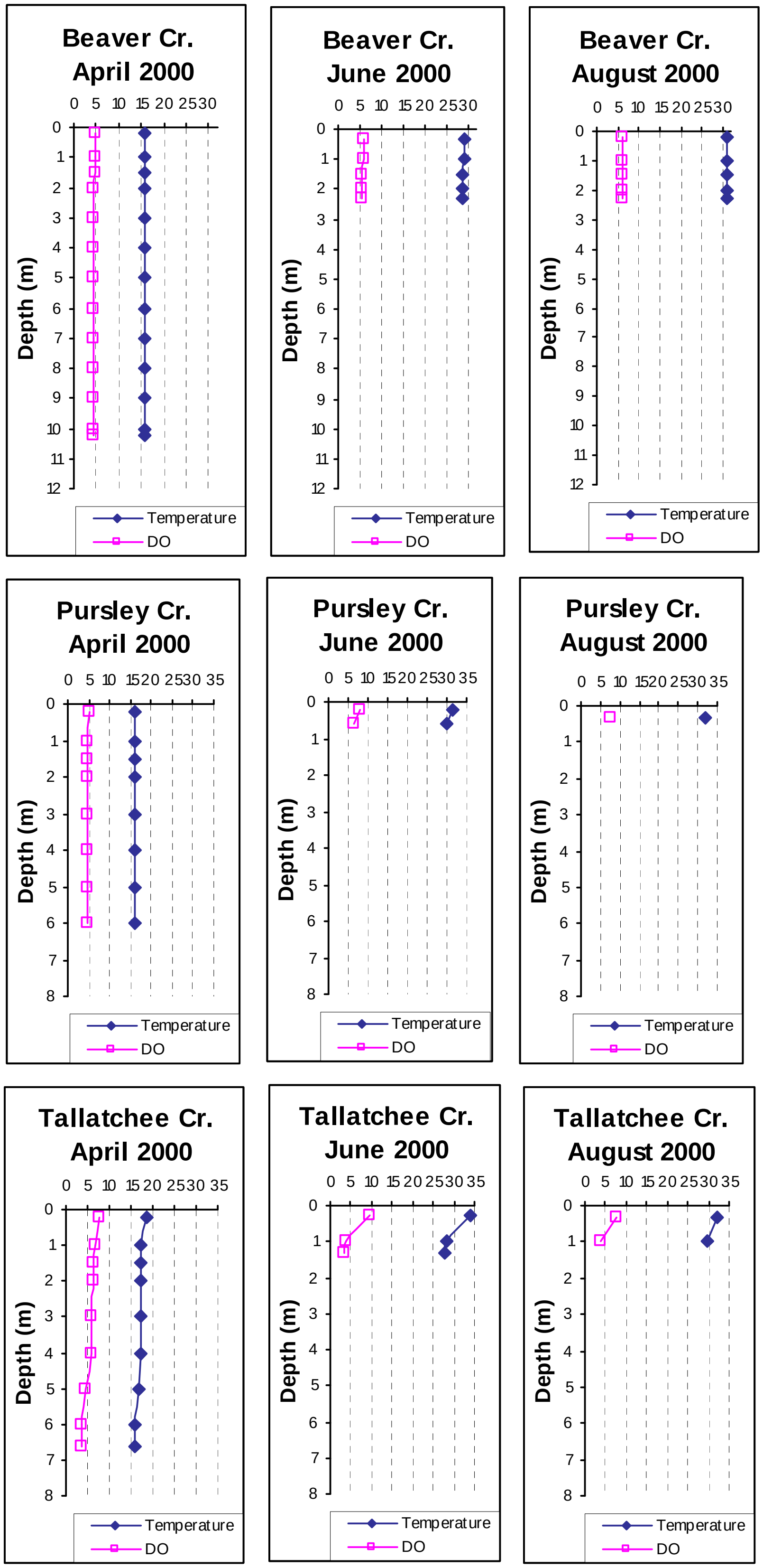
Appendix Figure III.1. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Catoma and Pintlalla Creeks, Woodruff Reservoir tributary embayments, April, June and August 2000.



Appendix Figure III.2. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Swift and Cypress Creeks, Woodruff Reservoir tributary embayments, April, June and August 2000.



Appendix Figure III.3. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Mulberry Creek, Cahaba River, Bogue Chitto and Pine Barren Creeks, Dannelly Reservoir tributary embayments, April, June and August 2000.



Appendix Figure III.4. Depth profiles of dissolved oxygen (DO) and temperature (Temp) in Beaver, Pursley, and Tallatchee Creeks, Claiborne Reservoir tributary embayments, April, June and August 2000.