U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

REELFOOT LAKE

OBION COUNTY

TENNESSEE

EPA REGION IV

WORKING PAPER No. 453

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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REPORT
ON
REELFOOT LAKE
OBION COUNTY
TENNESSEE
EPA REGION IV
WORKING PAPER NO. 453

WITH THE COOPERATION OF THE
TENNESSEE DEPARTMENT OF PUBLIC HEALTH
AND THE
TENNESSEE NATIONAL GUARD

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Tennessee Department of Public Health for professional involvement, to the Tennessee National Guard for conducting the tributary sampling phase of the Survey, and to those Tennessee wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Division of Water Quality Control, Tennessee Department of Public Health; the Division of Environmental Planning, Tennessee Valley Authority; and the Nashville District Corps of Engineers provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

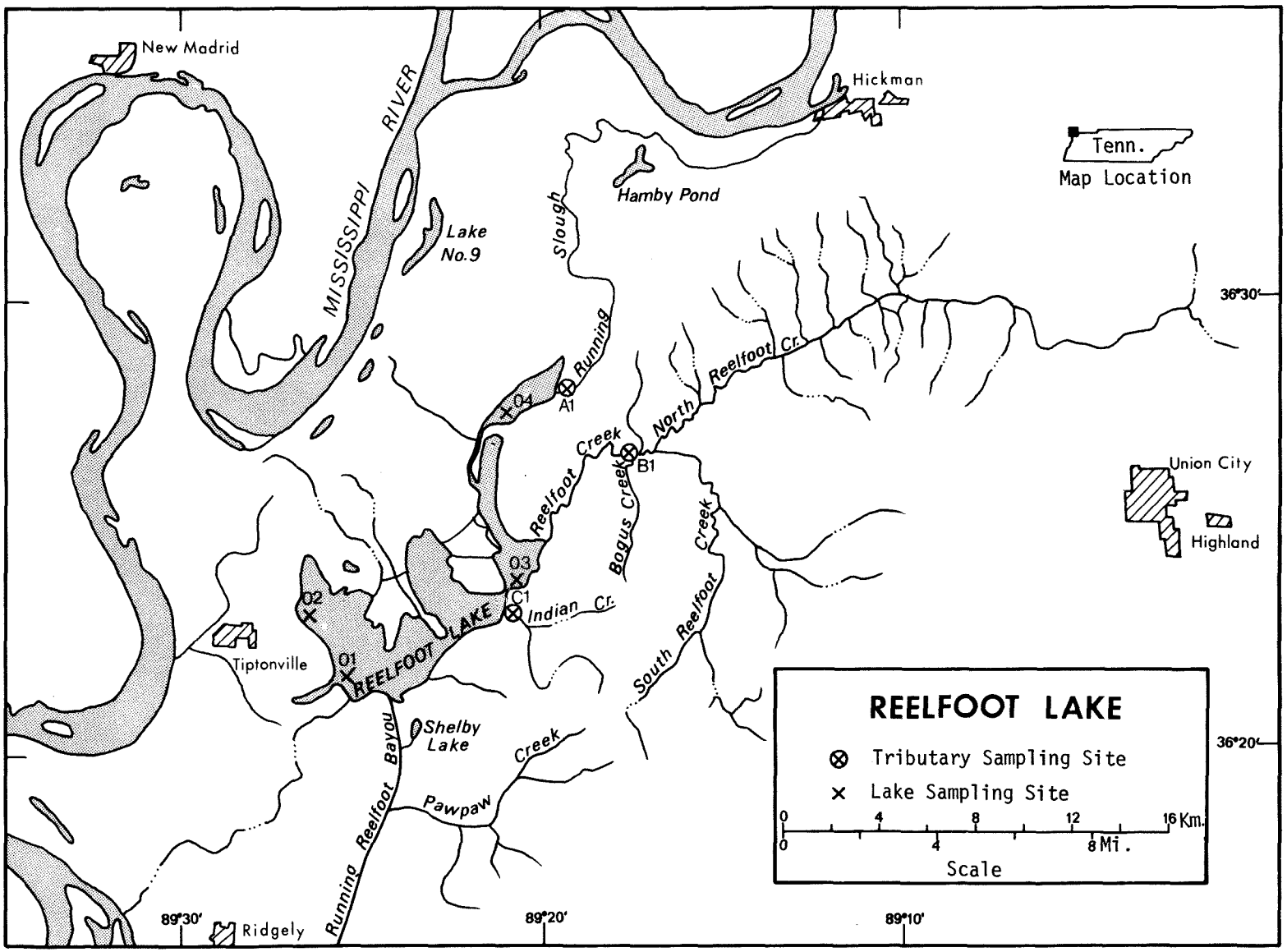
Major General William C. Smith, former Adjutant General of Tennessee, and Project Officer Colonel Wilburn C. Johnson, who directed the volunteer efforts of the Tennessee National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF TENNESSEE

LAKE NAME	COUNTY
Barkley	Stewart, Montgomery (Trigg, Lyon in KY)
Boone	Washington, Sullivan, Carter
Cheatham	Cheatham, Davidson
Cherokee	Jefferson, Hamblen, Grainger, Hawkins
Chickamauga	Hamilton, Rhea, Meigs, McMinn
Douglas	Sevier, Jefferson, Cocke
Fort Loudon	Loudon, Knox, Blount
Great Falls	White, Van Buren
Nickajack	Marion, Hamilton
Old Hickory	Sumner, Davidson, Wilson, Smith, Trousdale
Percy Priest	Davidson, Rutherford
Reelfoot	Obion
South Holston	Sullivan (Washington in VA)
Tims Ford	Moore, Franklin
Watts Bar	Rhea, Meigs, Cumberland, Roane, Loudon
Woods (Elk River)	Franklin, Coffee


New Madrid
MISSISSIPPI RIVER
Hickman
Tenn.
Map Location
Hamby Pond
Slough
Lake No.9
Running
A1
O4
North Reelfoot Cr.
36°30'
Reelfoot Creek
B1
Bogus Creek
Union City
Highland
O3
C1
Indian Cr.
O2
Tiptonville
O1
REELFOOT LAKE
South Reelfoot Creek
Shelby Lake
Running Reelfoot Bayou
Pawpaw Creek
36°20'
REELFOOT LAKE
Tributary Sampling Site
Lake Sampling Site
0 4 8 12 16 Km.
0 4 8 Mi.
Scale
89°30'
Ridgely
89°20'
89°10'

REPORT ON REELFOOT LAKE, TENNESSEE

STORET NO. 4727

I. CONCLUSIONS

A. Trophic Condition:*

On the basis of Survey data and field observations, Reelfoot Lake is considered hypereutrophic. The lake is characterized by extremely high nutrient levels and phytoplankton concentrations, low Secchi disc transparency (mean 60.3 cm) and high potential for primary production as measured by algal assay control yield. Chlorophyll a values ranged from a low of 16.2 µg/l in the spring to a high of 161.9 µg/l in the summer. Of the 16 lakes sampled in Tennessee, none had greater median total phosphorus, 14 had greater median inorganic nitrogen, and 1 had greater median dissolved phosphorus than Reelfoot Lake.

Survey limnologists reported visible algal blooms and floating duckweed, water hyacinths, and water lilies. The Tennessee Soil Conservation Service has a program proposed for alleviating the sedimentation problem in Reelfoot Lake by damming up several tributaries to the lake (Martin, personal communication).

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Reelfoot Lake was limited by available nitrogen levels. The ratios of available nitrogen to orthophosphorus (N/P) in sampled waters (5/1 or less on all sampling occasions) further indicate nitrogen limitation.

C. Nutrient Controllability:

1. Point sources -

There are no known municipal or industrial point sources contributing to Reelfoot Lake. Septic tanks were estimated to have contributed only 0.1% of the total load to the lake, while the Reelfoot Creek Packaging Company Feedlot contributed 52.5% of the total phosphorus load.

2. Nonpoint sources -

Major tributaries contributed 21.8% of the total phosphorus load to Reelfoot Lake, while minor tributaries were estimated to have contributed 9.0% of the load.

Reelfoot Lake is a combined National Wildlife Refuge Area and a State Wildlife Management Area. Considerable numbers of resident and migratory ducks and geese utilize the reservoir. On the basis of the numbers provided by the Tennessee Wildlife Resources Authority and certain assumptions (see page 12), it is estimated that wild ducks and geese contributed 18,715 kg of total phosphorus (16.1% of the total load) to the reservoir during the sampling year.

According to the U.S. Geological Survey (USGS) there is no continuous discharge from the lake, only seepage, and it is assumed that the lake is a sink. The Jackson Office of the Department of Public Health has indicated that there is an intermittent flow which is lake-level dependent from Reelfoot Lake into Running Reelfoot Bayou (W. Max, personal communication). Nevertheless, this periodic outlet was not gaged in this Survey and no statements can be made as to its effect on the nutrient budget of the lake.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry values are estimated based on information provided by the Tennessee State Department of Wildlife Resources. Tributary flow data were provided by the Tennessee District Office of USGS. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 36.42 km^2.
2. Mean depth: 1.37 meters.
3. Maximum depth: 4.88 meters.
4. Volume: 49.895 x 10^6 m^3.

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

Name	Drainage area(km^2)	Mean flow (m^3/sec)
A(1) Running Slough (Bayou Du Chien)	77.2	0.87
B(1) Reelfoot Creek	297.8	3.36
C(1) Indian Creek	21.9	0.25
Minor tributaries and immediate drainage -	170.9	1.93
Totals	567.8	6.41

2. Outlet - None known (see discussion, page 3).

C. Precipitation:

1. Year of sampling: 125.1 cm.
2. Mean annual: 105.5 cm.

III. LAKE WATER QUALITY SUMMARY

Reelfoot Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from four stations on the lake and from one or more depths at each station (see map, page). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first visit, an 18.9-liter depth-integrated sample was composited for algal assays. Maximum depths sampled were 3.0 meters at Station 1, 2.7 meters at Station 2, 0.9 meters at Station 3, and 1.5 meters at Station 4. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

REELFOOT LAKE
STORET CODE 4727

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	N*	(5/15/73) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(8/11/73) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(10/19/73) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	18.0- 37.0	27.6	0.0- 1.5	7	12.0- 29.1	24.0	0.0- 1.5	5	14.0- 20.2	18.0	0.0- 1.5
MAX DEPTH**	4	19.9- 22.3	21.3	0.9- 3.0	4	12.0- 29.1	28.7	0.0- 2.4	4	14.0- 20.2	18.8	0.0- 2.1
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	2	7.3- 10.4	8.8	0.9- 1.5	5	1.8- 5.8	3.2	0.0- 1.5	3	7.8- 10.4	9.0	0.0- 1.5
MAX DEPTH**	4	7.3- 10.4	7.6	0.9- 3.0	4	1.8- 4.2	2.7	0.0- 2.4	4	5.6- 10.4	8.4	0.0- 2.1
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	160.- 210.	195.	0.0- 1.5	7	200.- 274.	207.	0.0- 1.5	5	170.- 203.	172.	0.0- 1.5
MAX DEPTH**	4	160.- 210.	190.	0.9- 3.0	4	206.- 274.	233.	0.0- 2.4	4	170.- 203.	186.	0.0- 2.1
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	7.6- 8.5	8.0	0.0- 1.5	7	7.9- 9.5	8.9	0.0- 1.5	5	8.2- 8.9	8.7	0.0- 1.5
MAX DEPTH**	4	7.9- 8.4	7.9	0.9- 3.0	4	7.9- 8.6	8.1	0.0- 2.4	4	8.2- 8.9	8.5	0.0- 2.1
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	73.- 99.	86.	0.0- 1.5	7	88.- 115.	92.	0.0- 1.5	5	95.- 109.	98.	0.0- 1.5
MAX DEPTH**	4	74.- 99.	88.	0.9- 3.0	4	89.- 115.	101.	0.0- 2.4	4	95.- 109.	103.	0.0- 2.1
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.086-0.227	0.169	0.0- 1.5	7	0.233-0.471	0.430	0.0- 1.5	5	0.144-0.269	0.238	0.0- 1.5
MAX DEPTH**	4	0.101-0.201	0.138	0.9- 3.0	4	0.233-0.452	0.433	0.0- 2.4	4	0.144-0.269	0.248	0.0- 2.1
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.021-0.051	0.029	0.0- 1.5	7	0.060-0.273	0.240	0.0- 1.5	5	0.043-0.063	0.059	0.0- 1.5
MAX DEPTH**	4	0.026-0.050	0.031	0.9- 3.0	4	0.060-0.254	0.195	0.0- 2.4	4	0.043-0.082	0.061	0.0- 2.1
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.040-0.110	0.065	0.0- 1.5	7	0.110-0.200	0.170	0.0- 1.5	5	0.050-0.100	0.080	0.0- 1.5
MAX DEPTH**	4	0.040-0.080	0.070	0.9- 3.0	4	0.110-0.220	0.140	0.0- 2.4	4	0.050-0.100	0.080	0.0- 2.1
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.040-0.120	0.065	0.0- 1.5	7	0.130-0.280	0.150	0.0- 1.5	5	0.060-0.080	0.070	0.0- 1.5
MAX DEPTH**	4	0.040-0.090	0.070	0.9- 3.0	4	0.130-0.280	0.215	0.0- 2.4	4	0.060-0.090	0.080	0.0- 2.1
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.500-1.000	0.650	0.0- 1.5	7	2.300-3.500	3.000	0.0- 1.5	5	1.000-2.700	2.100	0.0- 1.5
MAX DEPTH**	4	0.400-1.000	0.550	0.9- 3.0	4	2.300-3.200	2.950	0.0- 2.4	4	1.000-2.700	2.200	0.0- 2.1
SECCHI DISC (METERS)												
	0	*****-*****	*****		0	*****-*****	*****		0	*****-*****	*****	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/15/73	1. Melosira	4,354
	2. Flagellates	3,886
	3. Nitzschia	2,387
	4. Stephanodiscus	1,966
	5. Oscillatoria	796
	Other genera	2,155
	Total	15,544
08/11/73	1. Melosira	24,631
	2. Merismopedia	5,437
	3. Nitzschia	3,107
	4. Raphidiopsis	2,774
	5. Stephanodiscus	2,663
	Other genera	15,754
	Total	54,366
10/19/73	1. Melosira	20,683
	2. Merismopedia	4,573
	3. Stephanodiscus	3,949
	4. Microcystis	3,845
	5. Flagellates	2,910
	Other genera	22,555
	Total	58,515

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
05/15/73	1	17.9
	2	32.7
	3	52.0
	4	16.2
08/11/73	1	138.7
	2	161.9
	3	70.4
	4	143.1
10/19/73	1	106.3
	2	133.0
	3	21.7
	4	77.6

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum Yield (mg/l-dry wt.)
Control	M*	0.152	6.4
0.05 P	M	0.152	7.4
0.05 P + 1.0 N	M	1.152	27.5
1.00 N	M	1.152	19.5

2. Filtered and nutrient spiked -

Control	0.025	0.219	3.4
0.05 P	0.075	0.219	6.4
0.05 P + 1.0 N	0.075	1.219	24.2
1.00 N	0.025	1.219	4.0

3. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production was high in Reelfoot Lake at the time of sampling. The response to the addition of nitrogen to the autoclaved sample, as well as the lack of response to the addition of phosphorus, indicates nitrogen limitation. Maximum yield was achieved with the simultaneous addition of both phosphorus and nitrogen.

The mean N/P ratios for the spring, summer, and fall lake sampling were respectively 5/1, 2/1, and 3/1, all indicating nitrogen limitation.

*Missing.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Tennessee National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page i), except for the high runoff months of February and March when two samples were collected. Sampling was begun in April 1973, and was completed in March 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Tennessee District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries, except for Reelfoot Creek, B(1), were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) and Reelfoot Creek, B(1), were estimated by using the mean annual nutrient loads, in $kg/km^2/yr$, for Running Slough and Indian Creek at Stations A(1) and C(1), respectively, and by multiplying the means by the ZZ area in km^2.

Estimates on nutrient contributions by Reelfoot Creek Packing Company Feedlot were calculated at 17.60 kg P and 57.49 kg N/animal/yr (Omernik 1976).

Estimates of nutrient contributions by wild ducks and geese were based on the following number of waterfowl using Reelfoot Lake as provided by the Tennessee Wildlife Resources Authority (Fox 1976):

Summer resident mallard ducks	1,000
Year round wood ducks	3,500
Winter resident mallard ducks	175,000
Migratory Canada geese	25,000

In calculating the nutrient loads the following assumptions were made:

1. Each wild duck contributes 0.45 kg total nitrogen and 0.20 kg phosphorus per year (Paloumpis and Starrett 1960).

2. Each wild goose contributes the same amount as one duck since geese typically feed in fields away from the lake several hours each day.

3. Summer resident waterfowl are at the lake for six months of the year.

4. Migratory waterfowl spend a total of one month per year at the lake, i.e., 15 days during spring migration and 15 days during fall migration.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A(1) Running Slough (Bayou Du Chien)	6,210	5.3
B(1) Reelfoot Creek	18,465	15.7
C(1) Indian Creek	990	0.8
b. Minor tributaries and immediate drainage (nonpoint load) -	10,595	9.0
c. Known municipal STP's - None		
d. Septic tanks* -	75	0.1
e. Known industrial - None		
f. Reelfoot Creek Packing Company Feedlot -	61,600	52.5
g. Wild ducks and geese -	18,715	16.1
h. Direct precipitation** -	635	0.5
Totals	117,285	100.0

2. Outputs - None known, see discussion, page 3.

*Estimate based on 1 State park, 1 camp, and 257 lakeside residences.
**Estimated (see NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A(1) Running Slough (Bayou Du Chien)	34,750	7.3
B(1) Reelfoot Creek	96,485	20.3
C(1) Indian Creek	4,345	0.9
b. Minor tributaries and immediate drainage (nonpoint load) -	55,370	11.6
c. Known municipal STP's - None		
d. Septic tanks* -	2,845	0.6
e. Known industrial - None		
f. Reelfoot Creek Packing Company Feedlot -	201,215	42.2
g. Wild ducks and geese -	42,110	8.8
h. Direct precipitation** -	39,320	8.3
Totals	476,440	100.0

2. Outputs - None known, see discussion, page 3.

*Estimate based on 1 State park, 1 camp, and 257 lakeside residences.
**Estimated (see NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
A(1) Running Slough	80	450
B(1) Reelfoot Creek	62	324
C(1) Indian Creek	45	198

E. Yearly Loading:

	Total Yearly Phosphorus Loading (g/m^2/yr)
Estimated loading for Reelfoot Lake	3.22

V. LITERATURE REVIEWED

Fox, Ron. 1976. Personal communication (ducks). Tennessee Wildlife Resources Authority.

Martin, W. H. 1975. Personal communication (sedimentation problem in Reelfoot Lake). Tennessee Department of Public Health, Division of Water Quality Control, Nashville, Tennessee.

Max, Wayne. 1976. Personal communication (lake outlet). Jackson Division of Water Quality Control, Tennessee Department of Public Health.

Omernik, James N. 1976. The Influence of Land Use on Stream Nutrient Levels. Ecological Research Series, Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Corvallis, Oregon.

Paloumpis, A. A. and W. C. Starrett. 1960. An Ecological Study of the Benthic Organisms in Three Illinois River Flood Plain Lakes. Amer. Midl. Natl. 64(2):406-435.

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.

VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR TENNESSEE 09/13/76

LAKE CODE 4727 REELFOOT LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 567.2

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4727A1	77.2	1.27	1.69	1.97	1.19	1.42	0.34	0.47	0.19	0.35	0.11	0.63	0.85	0.87
4727B1	297.8	4.93	6.51	7.62	4.59	5.47	1.30	1.82	0.75	1.37	0.42	2.44	3.28	3.36
4727C1	21.9	0.360	0.479	0.558	0.337	0.402	0.096	0.133	0.054	0.099	0.031	0.178	0.241	0.246
4727ZZ	170.9	2.82	3.74	4.36	2.64	3.14	0.75	1.05	0.43	0.78	0.24	1.40	1.89	1.93

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 567.2
SUM OF SUB-DRAINAGE AREAS = 567.8
TOTAL FLOW IN = 77.21
TOTAL FLOW OUT = 0.0

NOTE *** LAKE IS A NUTRIENT SINK--NO SIGNIFICANT OUTFLOW UNDER NORMAL CONDITIONS

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4727A1	4	73	4.870	15	0.422				
	5	73	2.945	11	0.422				
	6	73	0.269	9	0.218				
	7	73	0.235	29	0.102				
	8	73	0.354	11	0.102				
	9	73	0.252	11	0.153				
	10	73	0.269	14	0.278				
	11	73	6.060	11	0.320				
	12	73	4.446	9	0.345				
	1	74	5.352	12	15.178				
	2	74	1.048	10	0.371	28	0.396		
	3	74	1.645	9	0.490	22	1.427		
4727B1	4	73	18.831	15	1.628				
	5	73	11.327	11	1.628				
	6	73	1.042	9	0.847				
	7	73	0.912	29	0.391				
	8	73	1.368	11	0.391				
	9	73	1.107	11	0.586				
	10	73	1.042	14	1.076				
	11	73	23.390	11	1.237				
	12	73	17.188	9	1.337				
	1	74	20.615	12	58.616	28	45.590		
	2	74	4.049	10	1.433				
	3	74	6.343	9	1.889	22	5.493		

TRIBUTARY FLOW INFORMATION FOR TENNESSEE 09/13/76

LAKE CODE 4727 REELFOOT LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4727C1	4	73	1.382	15	0.119				
	5	73	0.833	11	0.119				
	6	73	0.076	9	0.062				
	7	73	0.071	29	0.028				
	8	73	0.099	11	0.028				
	9	73	0.082	11	0.042				
	10	73	0.076	14	0.079				
	11	73	1.716	11	0.091				
	12	73	1.263	9	0.099				
	1	74	1.512	12	4.304				
	2	74	0.297	10	0.105	28	0.113		
	3	74	0.467	9	0.139	22	0.405		
4727ZZ	4	73	10.789						
	5	73	6.513						
	6	73	0.597						
	7	73	0.317						
	8	73	0.634						
	9	73	0.634						
	10	73	0.597						
	11	73	13.422						
	12	73	9.854						
	1	74	11.836						
	2	74	2.316						
	3	74	3.653						

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/09/10

472701
36 21 41.0 089 25 35.0 3
REELFOOT LAKE
47095 TENNESSEE

100691

11EPALES 2111202
0013 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/15	12	35 0000	21.0		36	200	7.60	85	0.070	0.700	0.070	0.028
	12	35 0006	20.8	8.0		190	7.90	87	0.070	0.500	0.080	0.026
	12	35 0010	20.7	7.8		190	7.90	88	0.080	0.400	0.080	0.026
73/08/11	14	25 0000	29.1	5.0	24	200	9.50	88	0.150	2.900	0.170	0.240
	14	25 0004	28.7	5.8		207	8.70	92	0.170	2.700	0.200	0.252
	14	25 0008	28.6	4.2		211	8.60	91	0.200	2.900	0.220	0.251
73/10/19	14	15 0000	20.5		18	170	8.70	97	0.070	2.100	0.090	0.059
	14	15 0007	19.7	5.6		170	8.40	95	0.090	1.800	0.080	0.082

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/15	12	35 0000	0.086	17.9
	12	35 0006	0.089	
	12	35 0010	0.101	
73/08/11	14	25 0000	0.402	138.7
	14	25 0004	0.436	
	14	25 0008	0.437	
73/10/19	14	15 0000	0.238	106.3
	14	15 0007	0.247	

STORET RETRIEVAL DATE 76/09/10

472702
36 23 10.0 089 26 38.0 3
REELFOOT LAKE
47095 TENNESSEE

100691

11EPALES 2111202
0011 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/15	13 15	0000	20.5		33	190	8.00	87	0.080	0.500	0.070	0.030
	13 15	0006	19.9	8.1		190	8.00	87	0.070	0.400	0.060	0.028
	13 15	0009	19.9	7.5		190	8.00	87	0.090	0.600	0.080	0.033
73/08/11	14 00	0000	29.1		21	204	9.40	89	0.150	3.400	0.170	0.265
	14 00	0005	28.9	3.2		205	8.90	90	0.230	3.000	0.180	0.273
	14 00	0008	28.9	3.0		206	8.20	89	0.230	3.200	0.130	0.254
73/10/19	14 00	0000	20.8		18	172	8.90	95	0.070	2.100	0.070	0.052
	14 00	0005	20.2	7.8		172	8.60	98	0.080	2.600	0.100	0.059

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/15	13 15	0000	0.092	32.7
	13 15	0006	0.111	
	13 15	0009	0.126	
73/08/11	14 00	0000	0.458	161.9
	14 00	0005	0.471	
	14 00	0008	0.452	
73/10/19	14 00	0000	0.223	133.0
	14 00	0005	0.269	

STORET RETRIEVAL DATE 76/09/10

472703
36 23 48.0 089 20 32.0 3
REELFOOT LAKE
47131 TENNESSEE

100691

11EPALES 2111202
0005 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/15	13 50	0000	22.4		18	160	8.50	73	0.120	0.800	0.110	0.021
	13 50	0003	22.3	10.4		160	8.40	74	0.060	1.000	0.060	0.029
73/08/11	13 45	0000	29.2	2.4	12	254	8.10	111	0.130	2.300	0.110	0.060
73/10/19	13 50	0000	19.8	9.0	18	200	8.20	108	0.060	1.000	0.050	0.043

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/15	13 50	0000	0.227	52.0
	13 50	0003	0.201	
73/08/11	13 45	0000	0.233	70.4
73/10/19	13 50	0000	0.144	21.7

STORET RETRIEVAL DATE 76/09/10

472704
36 27 17.0 089 21 14.0 3
REELFOOT LAKE
47131 TENNESSEE

100691

11EPALES 2111202
0007 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/15	14 00	0000	22.0		37	205	8.00	99	0.050	0.600	0.040	0.051
	14 00	0005	21.9	7.3		210	7.90	99	0.040	0.500	0.040	0.050
73/08/11	13 25	0000	29.1		16	273	8.90	115	0.140	3.500	0.160	0.136
	13 25	0004	29.1	1.8		274	7.90	115	0.280	3.000	0.150	0.140
73/10/19	13 40	0000	19.8	10.4	14	203	8.90	109	0.080	2.700	0.080	0.063

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/15	14 00	0000	0.188	16.2
	14 00	0005	0.150	
73/08/11	13 25	0000	0.362	143.1
	13 25	0004	0.430	
73/10/19	13 40	0000	0.249	77.6

APPENDIX D

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/09/09

4727A1
36 28 00.0 089 19 10.0 4
RUNNING SLOUGH
47 OLIN TN CO MAP
T/REELFOOT LAKE 100691
BANK NEAR SEC RD IN WALNUT LOG
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/04/15	15 20		0.154	0.680	0.020	0.038	0.155
73/05/11	08 55		0.160	0.880	0.105	0.115	0.310
73/06/09			0.252	1.540	0.168	0.058	0.230
73/07/29	14 10		0.039	1.600	0.042	0.042	0.250
73/08/11			0.012	1.500		0.042	0.220
73/09/11	10 05		0.056	1.180	0.210	0.029	0.230
73/10/14	10 00		0.052	1.000	0.140	0.027	0.180
73/11/11	09 15		0.076	0.700	0.052	0.018	0.105
73/12/09	09 43		0.830	0.600	0.040	0.120	0.315
74/01/12	11 27		0.720	0.900	0.048	0.100	0.290
74/02/10	09 50		0.232	0.300	0.010	0.040	0.080
74/02/25			0.440	1.350	0.055	0.055	0.348
74/02/28	09 35		0.340	0.900	0.030	0.050	0.250
74/03/09	10 18		0.300	0.800	0.075	0.045	0.170

STORET RETRIEVAL DATE 76/09/09

472781
36 26 27.0 089 17 50.0 4
REELFOOT CREEK
47 OLIN TN CO MAP
I/REELFOOT LAKE 100691
ST RT 22 BRDG JUST SW JCT WITH ST RT 157
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/04/15	15	40	0.350	0.540	0.018	0.018	0.100
73/05/11	09	20	0.310	0.460	0.115	0.120	1.050
73/06/09	14	15	0.450	0.780	0.040	0.048	0.160
73/07/29	14	25	0.011	0.900	0.021	0.024	0.120
73/08/11			0.092	0.420	0.034	0.088	0.320
73/09/11	09	50	0.017	0.690	0.064	0.039	0.125
73/10/14	10	30	0.044	1.030	0.054	0.040	0.295
73/11/11	10	10	0.380	1.050	0.098	0.180	0.680
73/12/09	10	09	0.320	0.850	0.088	0.072	0.355
74/01/12	10	00	0.480	1.400	0.104	0.112	0.420
74/01/28	09	10	0.400		0.040	0.070	
74/02/10	10	20	0.510	0.800	0.060	0.020	0.065
74/02/25			0.560	1.300	0.075	0.040	0.360
74/03/09	11	00	0.528	1.500	0.090		0.380

STORET RETRIEVAL DATE 76/09/09

4727C1
36 23 03.0 089 20 34.0 4
INDIAN CREEK
47 OLIN TN CO MAP
T/REELFOOT LAKE 100691
ST RT 22 BRDG JUST NE OF SAMBURG
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/04/15	15 50		0.011	0.195	0.012	0.012	0.060
73/05/11	09 45		0.200	1.050	0.067	0.075	
73/06/09	14 25		0.099	0.340	0.056	0.042	0.120
73/07/29	14 40		0.014	0.480	0.016	0.050	0.125
73/08/11			0.037	0.200	0.034	0.105	0.195
73/09/11	09 30		0.037	0.360	0.064	0.072	0.200
73/10/14	10 15		0.046	0.650	0.034	0.100	0.270
73/11/11	09 45		0.015	0.650	0.020	0.061	0.140
73/12/09	10 00		0.132	0.300	0.040		0.080
74/01/12	09 50		0.232	0.400	0.044	0.032	0.115
74/02/10	10 10		0.036	0.200	0.020	0.015	0.045
74/02/25			0.100	0.400	0.030	0.020	0.080
74/02/28	10 15		0.260	0.900	0.045	0.115	0.140
74/03/09	10 45		0.140	0.300	0.040		0.080

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1974

STATE OF TENNESSEE

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INO-G N	500-MEAN SEC	MEAN CHLORA	15-MIN SD	MEDIAN DISS ORTHO P
4701	LAKE BARKLEY	0.128	0.480	473.381	12.723	10.400	0.047
4704	BOONE RESERVOIR	0.052	0.995	442.071	11.415	14.600	0.029
4706	CHEATHAM RESERVOIR	0.142	0.460	473.800	8.160	9.600	0.084
4707	CHEROKEE LAKE	0.051	0.780	448.667	12.162	15.000	0.022
4708	CHICKAMAUGA LAKE	0.031	0.440	463.833	3.111	9.600	0.012
4711	DOUGLAS LAKE	0.026	0.440	442.823	4.553	15.000	0.014
4712	FORT LOUDON RESERVOIR	0.054	0.550	465.571	4.776	12.600	0.025
4713	GREAT FALLS LAKE	0.020	0.405	444.417	3.983	14.800	0.007
4717	NICKAJACK RESERVOIR	0.051	0.495	459.833	2.742	9.700	0.025
4720	OLD HICKORY LAKE	0.058	0.330	469.769	8.931	9.400	0.019
4722	WATTS BAR RESERVOIR	0.032	0.510	462.250	5.550	11.000	0.012
4723	J. PERCY PRIEST RESERVOI	0.056	0.155	430.200	9.993	15.000	0.021
4724	TIM'S FORD RESERVOIR	0.021	0.445	398.167	6.739	14.900	0.009
4725	SOUTH HOLSTON LAKE	0.014	0.570	404.750	7.667	15.000	0.008
4727	REELFOOT LAKE	0.233	0.170	477.917	80.958	13.200	0.059
4728	WOODS RESERVOIR	0.017	0.320	429.083	7.392	15.000	0.005

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P	INDEX NO
4701	LAKE BARKLEY	13 (2)	40 (6)	13 (2)	7 (1)	73 (11)	13 (2)	159
4704	BOONE RESERVOIR	40 (6)	0 (0)	73 (11)	20 (3)	47 (7)	20 (3)	200
4706	CHEATHAM RESERVOIR	7 (1)	47 (7)	7 (1)	40 (6)	90 (13)	0 (0)	191
4707	CHEROKEE LAKE	50 (7)	7 (1)	53 (8)	13 (2)	13 (0)	40 (6)	176
4708	CHICKAMAUGA LAKE	67 (10)	63 (9)	33 (5)	93 (14)	90 (13)	70 (10)	416
4711	DOUGLAS LAKE	73 (11)	63 (9)	67 (10)	80 (12)	13 (0)	60 (9)	356
4712	FORT LOUDON RESERVOIR	33 (5)	20 (3)	27 (4)	73 (11)	60 (9)	27 (4)	240
4713	GREAT FALLS LAKE	87 (13)	73 (11)	60 (9)	87 (13)	40 (6)	93 (14)	440
4717	NICKAJACK RESERVOIR	50 (7)	33 (5)	47 (7)	100 (15)	80 (12)	33 (5)	343
4720	OLD HICKORY LAKE	20 (3)	80 (12)	20 (3)	33 (5)	100 (15)	53 (8)	306
4722	WATTS BAR RESERVOIR	60 (9)	27 (4)	40 (6)	67 (10)	67 (10)	70 (10)	331
4723	J. PERCY PRIEST RESERVOI	27 (4)	100 (15)	80 (12)	27 (4)	13 (0)	47 (7)	294
4724	TIM'S FORD RESERVOIR	80 (12)	53 (8)	100 (15)	60 (9)	33 (5)	80 (12)	406
4725	SOUTH HOLSTON LAKE	100 (15)	13 (2)	93 (14)	47 (7)	13 (0)	87 (13)	353
4727	REELFOOT LAKE	0 (0)	93 (14)	0 (0)	0 (0)	53 (8)	7 (1)	153
4728	WOODS RESERVOIR	93 (14)	87 (13)	87 (13)	53 (8)	13 (0)	100 (15)	433