

PHYSICOCHEMICAL CONDITIONS OF 14

SMALL MISSISSIPPI IMPOUNDMENTS,

1973-1976

by

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INTRODUCTION

Physicochemical data on small Mississippi impoundments was practically nonexistent prior to the 1970's. Several investigators have studied the large reservoirs in Mississippi. McGaha (1966) and his students have published numerous papers on the four large flood control reservoirs in north Mississippi. Barkley (1971), McGaha and Knight (1969), and Knight (1972) have published similar works on Ross Barnett Reservoir. Water quality data on small Mississippi impoundments is limited to Grantham's (1958) study of plankton in a south Mississippi impoundment and a survey of two Game and Fish Commission impoundments near Starkville by Lorio, Teels and Norwood (1972).

The Game and Fish Commission initiated a program of upgrading the state lakes in 1972. Cotton and Herring (1972) found 23 Park Commission and Game and Fish Commission Lakes to be free of mercury and pesticide pollution. Basic water quality data was then obtained so that an effective fisheries management program could be undertaken.

METHODS

Water samples for chemical determinations were taken at one meter intervals with a Kemmerer water sampler. One station, in deep water near the dam, was sampled in each lake four times during the year. Samples were collected from March, 1973 through January, 1976. Temperature, free CO₂, pH, dissolved oxygen, and Secchi Disc readings were determined in the field. Conductivity and total hardness samples were run in the lab the following day. Air temperatures were taken with a standard mercury thermometer and water temperatures were taken at one meter intervals with a Whitney underwater thermometer. Dissolved oxygen was measured at one meter intervals with a Yellow Springs, Model 54, oxygen meter. The standard titrimetric method was used to determine free CO₂. A colormetric method was used

for pH. A Beckman conductivity bridge was used for conductivity, and total hardness was analyzed by the standard titrimetric procedure as outlined in Standard Methods (1965).

FINDINGS

Physicochemical analysis of small Mississippi impoundments indicates that they are rather stable, except for climatic conditions. Ranges of water quality parameters are given in Table 1.

Secchi Disc readings ranged from a low of 10 inches in Tom Bailey during spring floods to 119 inches during late summer in Lake Columbia. Secchi Disc transparency was usually from 24 inches to 48 inches in most impoundments.

Water temperatures of the impoundments varied from a low of 39.8°F in Tippah during January, 1976 to a high of 92.4°F in Monroe and Mary Crawford during the summer of 1974. The deepest and smallest impoundment studied was Tishomingo, 10 meters and 40 surface acres; and the largest was Lamar Bruce, 330 acres.

Severe oxygen depletions occurred in the hypolimnion in all impoundments each summer and often water deeper than two meters contained less than one ppm oxygen; thus, large volumes of water were often unfit for fish habitation. Dissolved oxygen ranged from 0.0 in bottom waters on numerous occasions to a high of 12.2 ppm one meter deep in Mary Crawford during the summer of 1974.

Free CO₂ was normally low in surface waters but was often very high in oxygen devoid waters during the summer months. During summer stagnation period free CO₂ exceeded 50 ppm in the hypolimnion of nine of 14 impoundments.

Normally pH was 6 to 7 in most impoundments but considerable variations did exist. Lake Perry normally had a pH of 6.0 or less and in March, 1973, the pH was 5.6. The highest pH recorded was 9.4 during September, 1973 on Lake Monroe. A dense plankton bloom was evident at the time and evidently contributed to the high pH.

Conductivity of surface waters ranged from 8 μ mho/cm in Jeff Davis to 124 in Claude Bennett, but was generally 20 to 40 in most impoundments.

Total hardness ranged from a low of 4 ppm, observed in five impoundments, to a high of 84 ppm in Claude Bennett.

Of the 14 impoundments, Claude Bennett, Monroe and Tippah showed the best water quality for productivity. Total hardness of surface waters in Claude Bennett, Monroe and Tippah County averaged 43 ppm, 20 ppm and 21 ppm respectively. The average conductivity of these same three impoundments was 90 μ mho/cm, 59 and 58. Lake Tom Bailey waters were fairly productive with surface total hardness averaging 17 ppm and surface conductivity averaging 51 μ mho/cm. Lake Claude Bennett and Monroe are the only impoundments in this study which contained limestone in their watersheds. The remaining impoundments often exhibited water quality parameters not conducive to good fish growth.

Average total hardness of surface waters in six south Mississippi impoundments, Ross Barnett, Columbia, Mary Crawford, Jeff Davis, Perry and Walthall, was less than 10 ppm. Lorio, et. al. (1972) considered the two Mississippi impoundments he studied to be rather infertile, poorly buffered and generally of low productivity. By comparison, 11 of 14 impoundments in this study could be classified infertile.

Variations in water quality from year to year was mostly confined to temperature, and fall and winter oxygen levels. Water temperatures during the fall and winter of 1974 were approximately 10°F colder than 1973. Colder water temperatures occurred again in 1975 as lakes were 2 to 4°F colder than in 1974. The cooler weather during 1974 and 1975 caused destratification to occur earlier in the fall than in 1973. The cooler weather also caused destratification to be complete and not partial as had occurred on several impoundments in 1973.

McGaha (1966) stated that low pH values and low total hardness may be limiting the biological productivity of the flood control reservoirs in north Mississippi. This seems to be the case in at least of 11 of the 14 impoundments in this study.

Table 1. Range of water quality parameters recorded during 1973-1975 in small Mississippi impoundments.

Lake, acreage & years studied	Secchi Disc	Depth (m)	Temp. °F	D. O. ppm	Free CO ₂ ppm	pH	Cond. u mho/cm	Total Hardness ppm
Tom Bailey 234 A 1973-1974	10"-57"	5	47.9-85.5	0.1-10.8	0-47	5.9-8.2	12-167	12-32
Ross Barnett 87 A 1973-1974	30"-57"	9	49.0-84.2	0.0-9.6	1-80	5.8-7.0	19-106	4-12
Claude Bennett 71 A 1973-1974	12"-57"	6	50.3-84.8	0.0-10.7	0-80	6.2-8.8	21-310	8-84
Lamar Bruce 330 A 1973-1974	18"-90"	9	47.0-90.5	0.0-10.8	0-80	5.8-9.0	32-400	12-28
Columbia 90A 1973, 74, 75	31"-119"	5	47.4-89.8	0.1-10.5	1-46	5.8-7.1	17-81	4-16
Mike Conner 88 A 1973, 74, 75	32"-84"	7	46.4-92.0	0.1-9.4	0-110	5.5-8.4	17-180	8-24
Mary Crawford 134 A 1973-1974	20"-40"	5	53.3-92.4	0.1-12.2	0-31	5.5-9.1	20-154	4-20
Jeff Davis 164 A 1973-1974	24"-48"	9	51.8-88.4	0.1-10.5	0-48	5.5-8.6	8-108	4-12
Monroe 111 A 1973-1974	12"-54"	6	47.3-92.4	0.0-11.9	0-100	6.0-9.4	44-350	12-52
Perry 125 A 1973, 74, 75	23"-92"	6	49.6-88.0	0.1-9.6	0-38	5.5-8.8	17-62	8-24
Simpson Co. 94 A 1973, 74, 75	17"-91"	6	46.9-88.1	0.1-10.0	1-130	5.8-8.6	16-165	8-16
Tippah Co. 150 A 1974-1975	42"-55"	8	39.8-88.0	0.1-11.4	1-122	5.9-7.1	50-250	16-40
Tishomingo 40 A 1973	24"-52"	10	44.8-84.8	0.2-11.4	0-55	5.7-8.7	22-108	8-24
Walthall 62 A 1973-1974	32"-85"	8	54.3-90.8	0.1-9.5	0-90	5.7-8.4	20-185	4-20

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