SOME LIMNOLOGICAL ASPECTS OF BENBROOK LAKE, TARRANT COUNTY, TEXAS

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INTRODUCTION

Early limnological investigations in this country centered around the Great Lakes and smaller bodies of water in the surrounding glaciated region. Only relatively recently has interest in such work extended to the Southwest and more specifically, North Central Texas. Since water is a limiting factor for agriculture, industry and urban expansion in the Southwest, impoundments of various sizes increased in number and with them, interest in scientific study of these habitats.

Benbrook Lake is in the same general region of those lakes investigated by Jones (1939), Harris and Silvey (1940), Gunn (1953) and Murphy (1962). Harris and Silvey have probably done the most complete work on large reservoirs in Texas. Murphy (1962) investigated a small impoundment near Decatur, Texas soon after construction was completed and throughout the next five years.

During October, 1963, the first long range research program on limnology and fishery ecology of Benbrook Lake was begun. This report is limited to the limnological aspect of the investigation. Gratitude is extended to Texas Christian University and the Sport Fishing Institute for research funds and to Mrs. Helen Oujesky, Mr. James Lawrence and Mr. Howard Kerby for their assistance on various phases of the project.

DESCRIPTION

Benbrook Lake is located five miles southwest of the Fort Worth, Texas city limits. Construction of the lake was completed in 1952 by the closure of a dam across the Clear Fork of the Trinity River which is the lake's chief source of water. Trinity River and Bear Creek from the southwest, Mustang Creek and Rocky Creek from the southeast and Dutch Branch from the northwest flow into the lake. Benbrook Lake has a surface area of 3,769 acres providing 170,350 acre feet of storage capacity and is part of the Trinity River flood control system. The major part of the south shoreline slopes gradually. The north shoreline is very steep over most of its course. The south third of the lake is characterized by dead trees emerging from the water. Because of its close proximity to Fort Worth, Benbrook Lake has a high recreational value. It is heavily utilized for boating, swimming, angling and other outdoor sports (Fig. 1).

PHYSICAL AND CHEMICAL

The long axis of the lake parallels the course of the prevailing southerly winds which keep it in a constant state of holomixis. Temperature measurements indicate that Benbrook Lake does not stratify thermally anytime during the year except in some submerged depressions near the dam. In the Rocky Creek area at a depth of 18 feet, a seasonal temperature average expressed in Fahrenheit is as follows:

	Winter	Spring	Summer	Fall
Surface	44	47	80	68
Bottom	42	47	78	68

Near the dam in over 60 feet of water, no temperature variations greater than 3° F. from surface to bottom have been recorded. In other parts of the lake and in more shallow water, the temperature pattern is basically the same as in the Rocky Creek area.

Results of chemical analyses reflect the same pattern of variation from surface to bottom as temperature. Dissolved oxygen measurements reveal a 1 to 2 ppm range even in water over 60 feet deep. Methyl

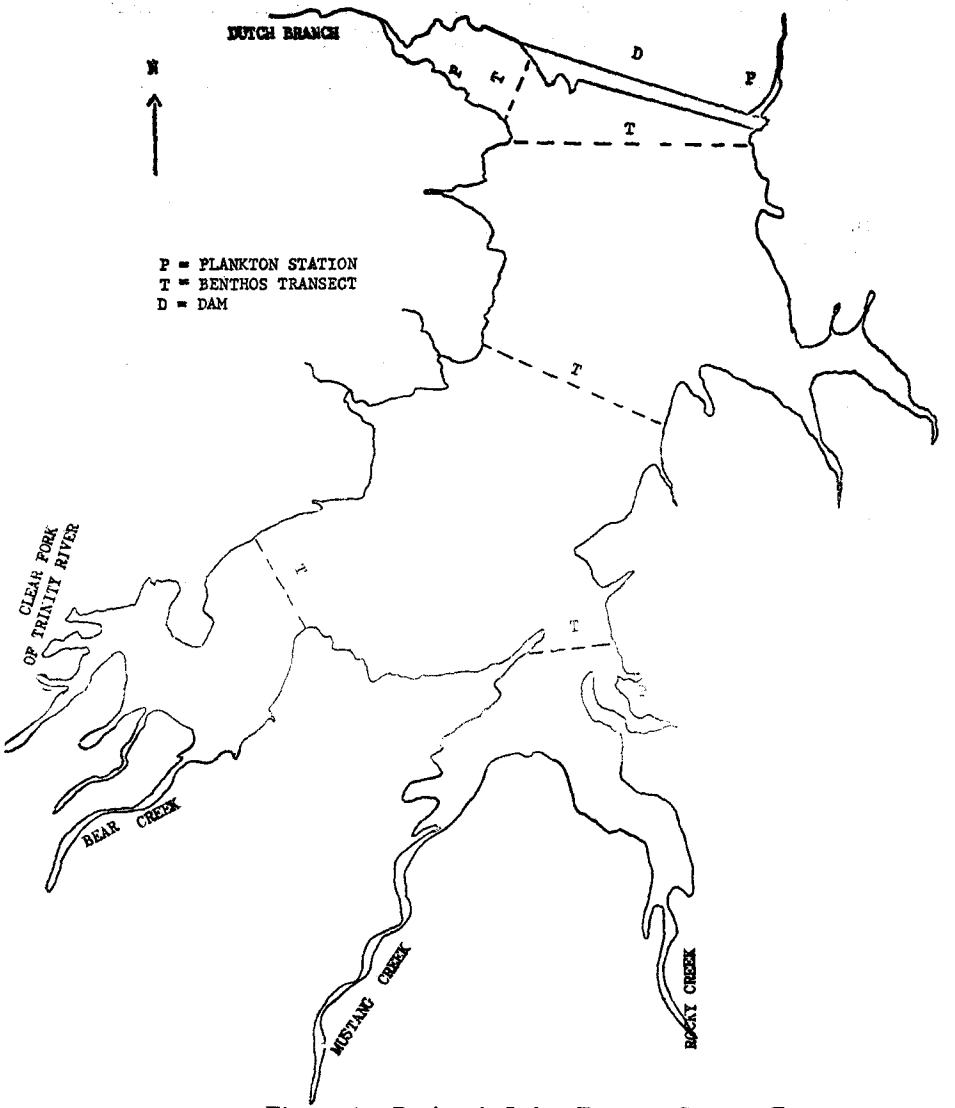

Figure 1. Benbrook Lake, Tarrant County, Texas

orange alkalinity values were 116 ppm in the surface, middle and bottom waters at the south, north and central portions of the lake during early October, 1965.

PLANKTON

In an attempt to detect trends in the plankton population pattern, three collecting stations were established. Station I was near the Bloxom Marina in the Dutch Branch inlet. Even though this was in a somewhat protected area, wind activity usually kept the water rather agitated. Station II, at the outlet below the dam, was formed by a concrete wall on either side about 50 feet apart and with a bottom contour such that a large pool of water is always maintained. Only once during the investigation was the outlet open at the time of collecting. Station III was located in the Rocky Creek region near

a boat pier. This is a more open area than Station I but receives greater protection because of morphometry in that particular part of the lake.

Forty-seven collections were made at the various stations. Collections at Station II were made throughout the investigation but to detect population trends in another area, Station I was abandoned in favor of Station III.

Two samples of not less than eight liters were poured through a plankton net of No. 25 bolting silk and the concentrate was preserved in 5% formalin. Using a Sedgwick-Rafter counting chamber, total qualitative and quantitative counts were made of 1 ml. aliquots from each sample. The number of organisms per liter was computed.

A total of 84 genera were collected during the investigation. Of this total, 47 genera were phytoplankters and 37 genera were zooplankters. Not all genera were collected during any one month or at any one station.

At Station I the number of genera per month ranged from 20 in December to 37 in October. At Station II the range was from 20 genera in December to 35 genera in April. At Station III the range was from 28 genera in April to 36 genera in March (Table I.)

Table I. Total Number of Genera Collected Each Month

Station	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	Range
I	37	31	20	33	21			20-37
II	31	25	20	26	25	34	35	20-35
III						36	28	28-36

Station II, with what appears to be a fall and spring peak in genera, suggests a more specific pattern than Stations I and III. It would be difficult to offer conclusive statements about the other two stations because of the sampling period.

Eleven plankters were collected in sufficient quantities to be considered predominant forms (highest number per liter) (Table II). Diatoms, *Pediastrum* and *Scenedesmus* appeared in all collections and *Keratella* was present in all but two.

Table II. Phytoplankton and Zooplankton Predominants

Number of Collections	Organism	Position of Rank 1st	2nd
19	*Ankistrodesmus*	1	3*
21	*Bosmina*	0	1
26	*Brachionus*	1	1
47	*Diatoms*	12	2*
40	*Difflugia*	4	3
45	*Keratella*	7	8
19	*Mesocyclops*	1	0
35	Nauplii	0	2
47	*Pediastrum*	1	5*
28	*Polyarthra*	1	2
47	*Scenedesmus*	0	4*

* Phytoplankton

Phytoplankton per liter reached its peak in abundance at Stations I and II in late February and at Station III in early March. A peak appeared at both Stations I and II in January but not of the magnitude exhibited at the former date. The difference in these two peaks is attributed to a definite increase in diatoms and *Ankistrodesmus*. October through December and late March and April yielded the lowest phytoplankton counts.

Zooplankton per liter reached its peak at Station II in late February and at Station III in early March. The peak for Station I was in January but it in no way compared in magnitude with the high peaks of the other stations. The abrupt increase in number of organisms

at Station II and the high count in the inital sample at Station III is attributed to the prominence of *Difflugia.*

The highest number of organisms, total plankton per liter, occurred in late February and early March.

In general, the population components observed in this study parallel relatively closely those recorded by Jones (1939), Harris and Silvey (1940), Cheatum, et al. (1942), and Murphy (1962) who worked in this region and Pennak (1949) who worked in Colorado.

The majority of predominants collected during this study were cosmopolitan forms of wide distribution. Results of this study indicate that Benbrook Lake possesses qualities similar to not only those bodies of water in this general area but also to those in other geographical locations.

The plankton population picture as exhibited by this preliminary study should in no way be construed to be the ultimate. Through continued study at the present and additional stations, we hope to substantiate results already obtained and establish more clearly the plankton trends in Benbrook Lake.

BENTHOS

A study of the benthos of Benbrook Lake was conducted during the summer of 1964 to determine the types of benthic organisms present and their concentrations at different stations throughout the lake.

A total of 15 samples were taken from five transects (Fig. 1) across Benbrook Lake by a scuba diver using an Ekman dredge to completely clean an area of 1764 sq. cm. The area was kept constant by sampling within a bottomless tub which was pushed into the lake bottom by the diver.

Organisms present in the samples (Table III) indicated that the dipteran family Chironomidae probably represented the predominant benthic organism. Chaoboridae (Diptera), Nematoda, and Copepoda also represented major portions of the population, but were present in lesser numbers than chironomids. Bryozoan statoblasts and Ostracoda were present in each sample.

The largest benthic populations occurred in the protected arms of the lake rather than in the main body. It was further demonstrated that the largest numbers were present in deeper waters along the middle of the transects.

Table III. Phylogenetic List of Organisms Collected in Bottom Samples from Benbrook Lake.

Phylum Nematoda	Phylum Arthropoda	Class Insecta
Phylum Bryozoa	Class Crustacea	Order Ephemeroptera
Phylum Mollusca	Subclass Ostracoda	Family Ephemeridae
Class Pelecypoda		*Hexagenia sp.*
Order Heterodonta	Subclass Copepoda	
Family Sphaeriidaoe	Order Eucopepoda	Order Diptera
	Suborder Cyclopoida	Family Chaoboridae
	Family Cyclopidae	Family Chironomidae
	Mesocyclops edax	

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