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The Physico-Chemical and Biological Features of Lake Texoma (Denison Reservoir), Oklahoma and Texas: A Preliminary Study

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INTRODUCTION

ACCORDING to Ellis' (1941) classification of impoundments based on size and depth, Lake Texoma is grouped with the larger and deeper types such as Elephant Butte Reservoir and Norris Lake. The knowledge of such large reservoirs is very slight, particularly those of the southwestern United States, when compared to the limnological standards of natural lakes of the United States and North Europe.

This study presents the physical and chemical limnological features of the impoundment together with lists of the planktonic and macroscopic benthic organisms. The physico-chemical data presented here were taken to supplement the bottom faunal data which constituted the main objective of the study.

The literature pertinent to southwestern impoundment limnology has been presented as a resumé in the author's manuscript dissertation which is on file at the University of Oklahoma Library.

This report embodies part of the material presented as a dissertation to the Graduate College of the University of Oklahoma in partial fulfillment of the requirements for the Doctor of Philosophy degree. It was made possible by a research fellowship from the Oklahoma Game and Fish Council and was subsidized by the U. S. Army, Corps of Engineers, a member agency of the Council. Appreciation is expressed to that organization. Dr. A. O. Weese, Department of Zoology, University of Oklahoma, directed the research. His invaluable assistance is gratefully acknowledged. The Department of Zoology, University of Oklahoma, the University of Oklahoma Biological Station, and the U. S. Army, Corps of Engineers, contributed much needed equipment and supplies. The author wishes to express his thanks to Dr. Carl D. Riggs, who made available the facilities of the Biological Station during the latter part of the study. Thanks and appreciations are expressed to the following specialists: Dr. Henry Van der Schalie, University of Michigan, determination of Pelecypoda; Mr. R. Tucker Abbott, U. S. National Museum, determination of Gastropoda; Dr. Herbert H. Ross, Illinois Natural History Survey, confirmation of most of the Trichoptera determinations; Dr. G. H. Bick, Tulane University, and Mrs. L. K. Gloyd, Illinois Natural History Survey, Odonata (Anisoptera) determinations; Dr. Leslie Ellis, Mississippi State College, Hemiptera determinations; Dr. Lewis Berner, University of Florida, Ephemeroptera determinations. To Mr. H. Francis Timmons grateful acknowledgment is made for assistance in taking samples. To my wife, Mary Smith Sublette, especial thanks are due for indispensable aid in many features of the investigation, Dr. Harold M. Hefley, Mississippi Southern College, read the manuscript and made helpful suggestions.

GENERAL FEATURES OF LAKE TEXOMA

Lake Texoma is utilized primarily for flood control and hydroelectric power. The reservoir, an impoundment of the Red River, is formed by Denison Dam five miles northwest of Denison, Texas, and lies in Love, Marshall, Johnson, and Bryan Counties, Oklahoma, and Cooke and Grayson Counties, Texas. The impounding project was completed in July, 1942, by the Denison District, Corps of Engineers (consolidated with the Tulsa District on April 1, 1945). The reservoir was first filled to the top of power pool, elevation 617 (feet above mean sea level), on March 15, 1942. Denison Dam is the largest earth-fill dam in the world. It consists of a main rolled earth-fill embankment 19,200 feet long, a 6,000 foot dike extension, a concrete spillway, outlet works and a powerhouse. Maximum base width of the main embankment is 1,145 feet, maximum height is 165 feet, and crest width 40 feet at elevation 670. At the spillway crest the reservoir would extend up the Red River Arm about 80 miles and the Washita River Arm, 65 miles. Maximum water depth at this elevation (spillway crest elevation 640) would be 120 feet, the surface area would be 144,000 acres and the total capacity would be 5,718,900 acre-feet. To date the reservoir has never reached the spillway crest. Normally, the water level is maintained near the elevation 617. At this elevation the surface is 94,874 acres, the capacity is 3,005,000 acre-feet and the shore line is 580 miles.

Lake Texoma ranks ninth among the reservoirs of the United States in capacity and sixth in area (including reservoirs under construction).

The drainage basin[1] upstream from the reservoir comprises the watersheds of both the Red and Washita Rivers, and is roughly diamond-shaped. The source of Red River is a number of intermittent streams in the semi-arid Staked Plains region of the Texas Panhandle near the New Mexico border. The total drainage area above the dam is 38,291 square miles.

The drainage basin of Lake Texoma lies within areas which vary considerably in climatic conditions. Normal rainfall for the watershed varies from 16.81 inches at Hereford, Texas (semi-arid steppe) to 42.52 inches at Sulphur, Oklahoma (sub-humid grassland). The normal average rainfall for the watershed above the dam site is 26.93 inches.

APPARATUS AND METHODS

A preliminary study was made during June and July, 1949, and constitutes the source of most of the distributional data on the benthic species. It was followed by a seasonal study from June, 1950, to May, 1951. During the preliminary two-month period eight stations were sampled (Fig. 1). A six-inch square Ekman dredge was used as a bottom sampler, except for six dredgings taken with a nine-inch square Ekman dredge. During the preliminary study only one dredging was taken per sample, with samples taken at random at each location. A total of 83 samples was taken during this period of the study. Each dredging sample was placed in a two-gallon pail and transferred to shore for screening. Three screens were utilized at first, a U. S. Sieve series size number 16, a number 30, and a number 50. The number 16 and 50 screens were soon discarded when it was found that the number 16 did not improve the efficiency of the method and that only organisms approaching microscopic size passed through the number 30 screen. Early in the investigation the organisms were removed from the screening residue while alive. Later, all samples were first preserved in formalin before any attempt was made to separate organisms from debris. By proper manipulation of light and dark backgrounds as large a recovery was obtained as with the live removal method and in a shorter time. After removal from debris the organisms were sorted, counted and then preserved in seventy per cent alcohol for specific determination and volumetric measurement according to a method described by Ball (1948).

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[1] Summarized from *Report of Sedimentation Survey, Denison Dam and Reservoir (Lake Texoma) Red River Basin* Annon. Rept., Corps of Engineers, U.S. Army, Tulsa District, Tulsa, Oklahoma. June, 1950.

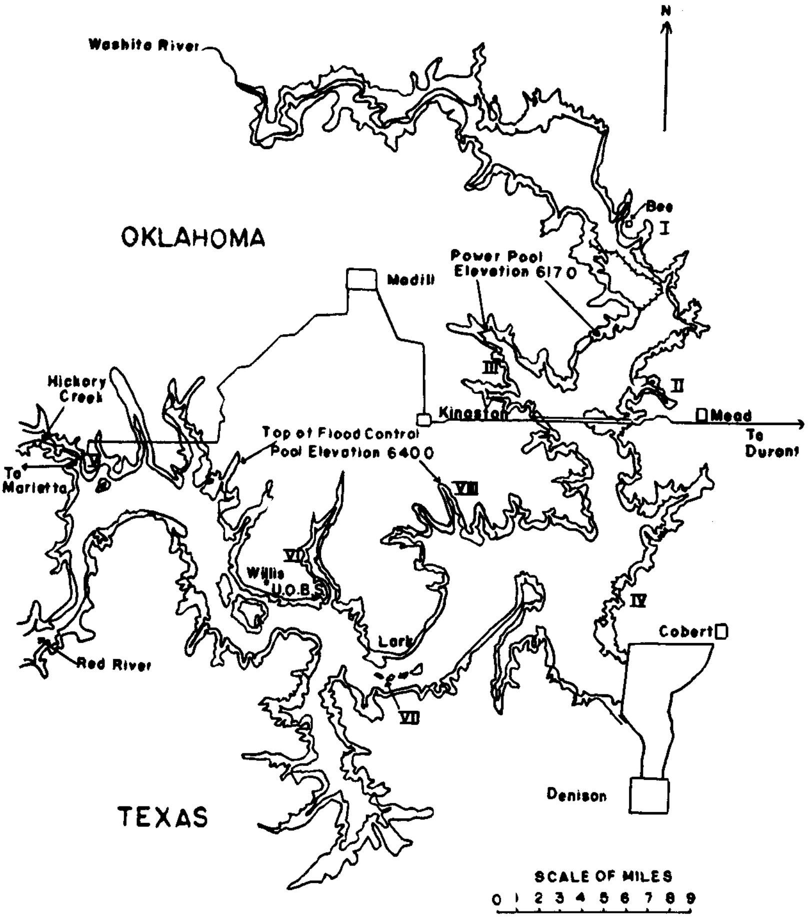

Fig. 1. Lake Texoma, showing the top of the flood control pool (M.S.L. 640) and the conservation pool level (M.S.L. 617). The location of the University of Oklahoma Biological Station is shown by the abbreviation U.O.B.S. The 1949 collecting stations are shown by Roman numerals.

In addition to the bottom samples certain other limnological data were taken.[2] These were obtained from analyses for dissolved oxygen, carbon dioxide, carbonates, pH, temperature, and light penetration. All water samples were taken with a two liter modified Kemmerer water sampler. Temperature was measured by a Negretti and Zambra reversing thermometer. Chemical analyses were conducted according

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[2] These analyses were made for the research unit by Mr. Jackson Hill, assisted in part by the author.

to the procedures outlined by Welch (1948). After comparing data for carbon dioxide with a graph plotted from the data given by Moore (1939) it appeared that the error in the analytical procedure was too large. The figures for carbon dioxide used in this paper were therefore calculated from the pH values and total alkalinity (Moore, 1939). Hydrogen ion concentration was obtained with a Hellige disc comparator. Light penetration was measured with a Secchi disc.

Aquatic vegetation was sampled in two ways: (1) rapid seining through clumps of vegetation with a fry seine; (2) removing the vegetation *in toto* in five gallon cans to the laboratory for examination.

Seasonal succession was studied by sampling along a transect near the mouth of Buncombe Creek Bay (Station VI, Fig. 1) located a few hundred yards up the bay from the University of Oklahoma Biological Station (U.O.B.S., Fig. 1). In June and July, 1950, to determine the nature of the substratum for a seasonal study, the Buncombe Creek transect was sampled and the dredgings analyzed for sediments (Bouyoucus method, Bouyoucus, 1936), for organic carbon (Walkley and Black method, Piper, 1942), and for bottom organisms. On the basis of preliminary findings three stations were selected along the transect, one on the west bank near the limits of the aquatic vegetation at a depth of 2.5 to 4.5 meters, one in the main channel at 12 meters and one on the east bank at 3 to 6 meters. These stations were sampled regularly at approximately two-week intervals during the first half of the seasonal study and monthly during the latter half. In addition, two other situations were sampled at irregular intervals; the 4 to 10 meter zone on the west shore, and the 1 to 3 meter zone on the east shore. All quantitative determinations of the benthic organisms during the seasonal study (June, 1950–May, 1951) were made using samples obtained with the six-inch square Ekman dredge. For the shallow water stations each sample consisted of 4 dredgings while the deep water sample consisted of only 3. A total of 267 dredgings making up 75 samples was utilized for the seasonal study.

The water level of Lake Texoma has rather wide seasonal fluctuations (Fig. 2). To offset this, sampling at marginal stations was done by depth and not by location. For example, the west shore would first be sounded. When the 2½ to 3 meter contour was located, the sample would be taken. It was assumed that most of the fauna migrated with a change in water level. This was later verified by observations and by the substantiating work of Moon (1940).

In order to identify the insect components of bottom fauna it is usually necessary to have the adults at hand since, in many instances,

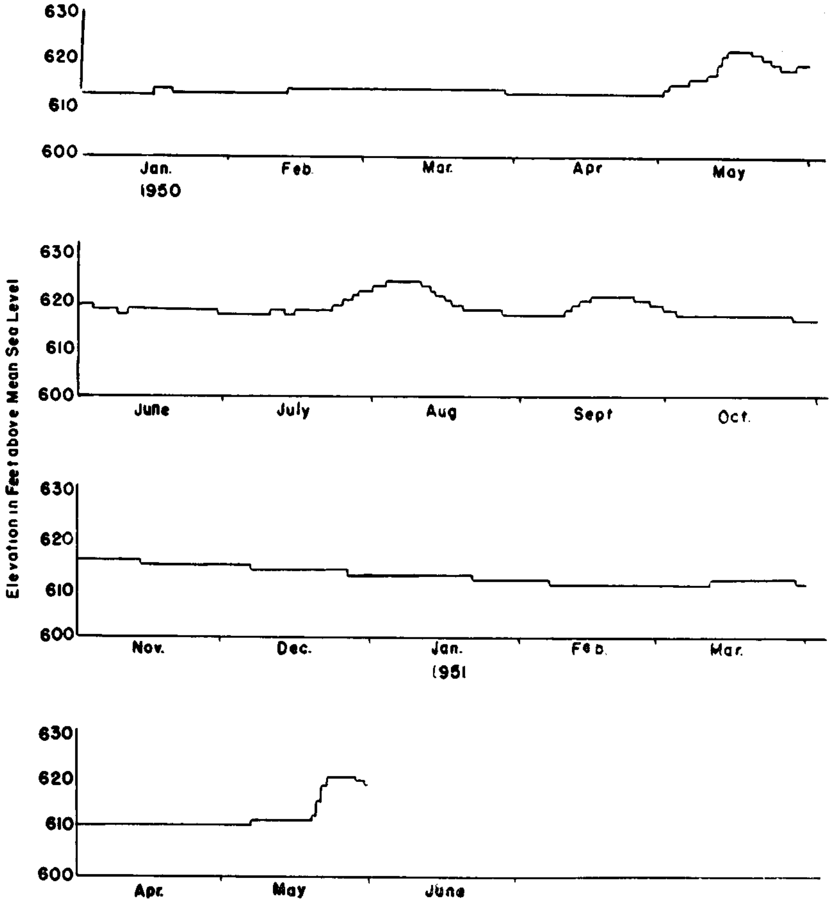

Fig. 2. Seasonal fluctuation of water level, January, 1950, to June, 1951.

specific identification is impossible from immature stages. Two procedures have been reported: the immature stages have been reared; and the tent-trap method has been used (Needham, 1908; Adamstone and Harkness, 1923; Ide, 1940; Scott and Opdyke, 1941; and Miller, 1941).

During the present study adult insects were caught by light traps and in sweep net collections. Light trap samples were obtained with nine Public Health Service Mosquito light traps (New Jersey type) operated at hourly intervals in sequence from 8 P.M. to 5 A.M. nightly from July 6 to September 1, 1950. From September to November 15, all the light traps were operated at hourly intervals one night a week.

During February, March, April, and May, one trap was operated from 8 P.M. to 5 AM. once a month. Pupal exuviae were taken at the water's edge by straining the surface with a very fine screen. The adults were then associated with the immature stages collected by dredging, and the pupal exuviae taken at the water's edge.

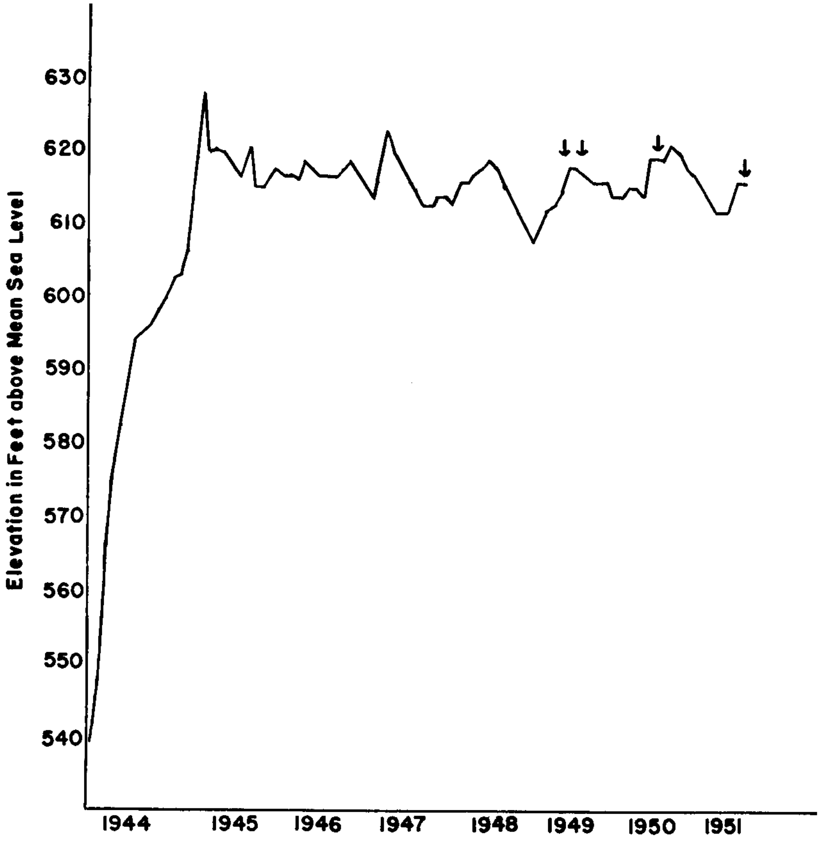

Fig. 3. Water levels since impoundment through June, 1951. The periods of study are indicated by arrows. Monthly means are plotted to give seasonal levels.

PHYSICO-CHEMICAL CHARACTERISTICS

Physical Features. Lake Texoma has a very irregular shore line, produced by the inundation of the many small ravines and valleys that formed the margins of the Red and Washita River Valleys. This irregularity is reflected in the lengthy shore line (580 miles at 617 M.S.L.). Texoma is rather shallow compared to many large reservoirs. The maximum depth of the reservoir (29 meters) is at the main pool just above the dam with deeper portions extending up the old drowned river channels, which are about 18 meters deep in most places. The area covered by these is very small, and most of the lake is less than 13 meters deep.

Normally the flood control pool (surface elevation, 640 M.S.L.)[3] is kept empty to be available for temporary storage and control of floods. The power draw down (conservation) pool (surface elevation, 617 M.S.L.) is the usual operating level of the reservoir. The surface level fluctuates as necessary to produce power. Water levels for the period of seasonal study are given in Figs. 2 and 3.[4] The water level was highest in the late spring and summer, with the low level occurring in winter and early spring. This sequence is fairly typical as is shown in Fig. 3, where monthly means were used to plot the annual fluctuations since impoundment. Discharge from the reservoir to date has been accomplished entirely by the power and flood control conduits. The water level has never reached the spillway level.

The normal sequence of transportation and deposition of sediments in reservoirs is well exemplified in Lake Texoma. Heavier sediments are accumulating and forming delta deposits near the point of inflow of the two major streams and lighter sediments are being carried farther downstream, distance of transportation being directly related to density and particle size. During the sedimentation survey conducted by the Corps of Engineers, 53 samples were taken and analyzed for particle size and weight. Of these samples, those taken in the deeper parts of the Red River channel are shown in Fig. 4, which indicates that most of the heavier sediments are deposited in the upper third of the reservoir. This figure was modified from Plate 31 of the Engineers' sedimentation report previously cited.

In addition to this sedimentation type, another one was noted during this investigation. In a series of samples taken along a transect across the Buncombe Creek bay near its mouth and analyzed as described under Apparatus and Methods, the following deposition characteristics are noted: at a depth of .2 meter the percentage composition was sand, 81; silt, 14; and clay, 5. At depths progressing outward from the shore, the amount of sand decreased while that of the silt and clay increased until, at a point somewhere between 11 and 13 meters, the sediments were about equally composed of sand, silt, and

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[3] These figures are in feet above mean sea level because of customary usage. All other measurements used here are in metric units.

[4] Data for these computations were kindly provided by Mr. Richard C. Pyle, Resident Engineer, Denison Dam.

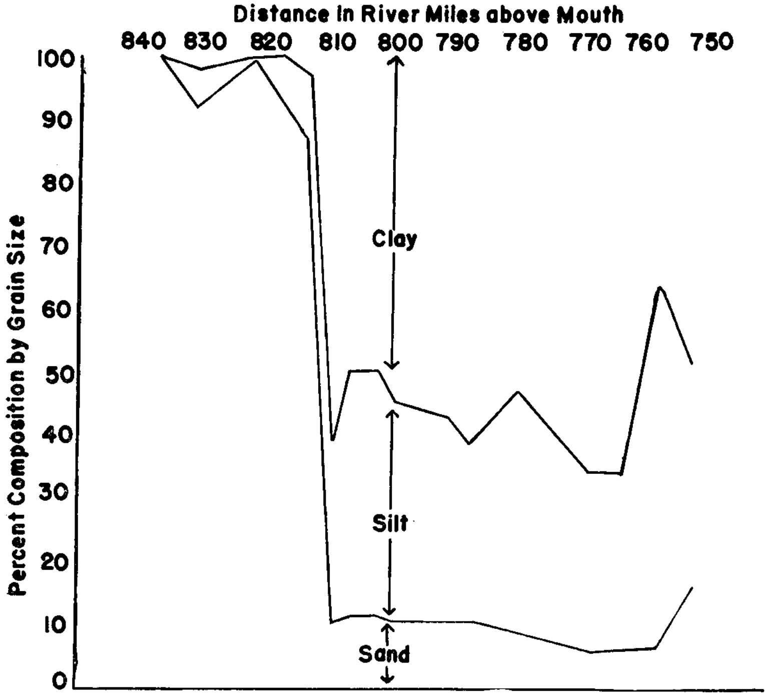

Fig. 4. Sedimentation pattern in Lake Texoma, Red River arm.

clay. Beyond this point, the amount of sand decreased considerably while clay and silt predominated. The apparent discrepancy in this pattern is near the old creek channel where the residual sand and silt is found in a greater proportion than is normally found at this depth. This deposition sequence is illustrated in Fig. 5. Since the sediment particles are arranged in size order at right angles to the main axis of Buncombe Creek, it is assumed that the sediments are deposited in this pattern by wave action and currents as described by Adamstone (1924). Another possibility, that of sheet wash from the immediate watershed, is unlikely since the watershed at this point is of very small area and has a thick cover of underbrush and blackjack oak forest.

The distribution of organic matter (as indicated by amounts of organic carbon present) was complementary to the distribution of fine particulate matter, *i.e.*, silt and clay. In general the organic matter was highest in the deep water, intermediate between the littoral zone and the profundal, and least in the shore region (littoral zone).

Wind direction is of considerable importance in the ecology of a lake or impoundment through its effect on such things as wave action,

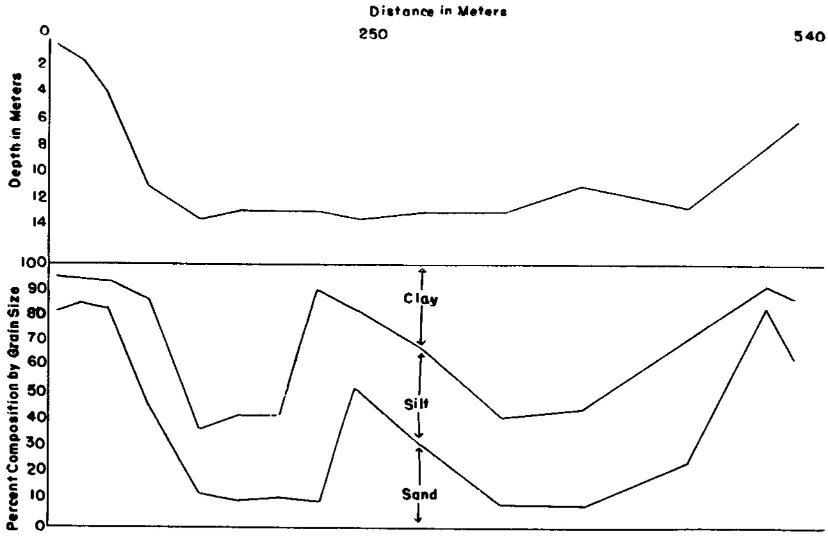

Fig. 5. Sediment deposition pattern, transect near the mouth of Buncombe Creek bay. These samples show that density and particle size are related to distance from shore (and wave action).

currents, and turbidity. At Texoma two patterns of wind movement are discernible. In the summer the winds are prevailingly from the south, while in the fall, winter, and spring the wind direction is highly variable. As a result of a maximum effective width of about 36,960 feet (7 miles) immediately opposite the mouth of Buncombe Creek (see Fig. 1), the wave activity at this point is of considerable magnitude and exerts much force. Welch (1952) states, "the greater the expanse of water over which the wind blows the greater the potential wave height, wave length, and wave velocity." The following formula from Hawksley (vide Whipple, 1927) expresses the condition as existing in large reservoirs: $h = 0.025\sqrt{f}$, where h equals height in feet of wave, f equals "fetch" of clear distance expressed in feet over which the wind blows. When computed, the value for h is equal to 4.8 feet.

In northern lakes an important environmental factor is low winter water temperature resulting in a surface ice cover. This cover is detrimental to bottom fauna by producing stagnation and secondarily by causing marginal bottom scouring where ice jams occur. A more important effect of low water temperature is the cessation of reproductive function of most benthic animals.

None of these temperature effects are operative at Texoma with the exception of the cessation of reproduction. At this latitude the nonreproductive period is very short (as demonstrated by light trap samples) or non-existent during mild winters. Surface ice did not form on the lake during the period of study, although local inhabitants report an incomplete cover during past winters.

Temperature records for the June and July period of 1949 indicated that many bay areas showed incipient or well developed stratification. However, most thermoclines were near or extending to the surface; and in some instances where the area sampled was relatively shallow, the thermocline occurred from surface to bottom. Other sampling stations showed complete top to bottom mixing. In all instances it was observed that stratification occurred in deep embayments or behind high headlands that afforded protection from the prevailing south winds. It is the author's opinion that complete stratification will rarely, if ever, occur in Texoma. With this assumption, Lake Texoma is best classified as a temperate lake (surface temperature varying above and below 4° C.) of the third order (temperature of bottom water very similar to that of surface water; circulation practically continuous throughout year) on the basis of Whipple's modification of Forel's classification of lakes based on temperature characteristics (vide Welch, 1952, pp. 63, 64).

The normal sequence of inflowing water was such that on the upper river arms Secchi disc readings were low but increased as the water moved toward the main pool above the dam. They ranged between a few centimeters on the upper river arms to 2.3 meters at Station IV. During flood periods this sequence was entirely obliterated because muddy water reached the main pool above the dam.

Chemical Features. From results of oxygen determinations of samples taken during the summer of 1949 it was observed that in no instance was there a complete depletion of oxygen from bottom waters. The least amount recorded was at Station IV where a reading of 0.4 p.p.m. was obtained at a depth of twenty-one meters. The hypolimnion showed a gradual rather than an abrupt or complete reduction in dissolved oxygen at this time (July 7). It is the author's opinion that complete stagnation rarely if ever occurs in Lake Texoma.

Alkalinity was determined by using phenolphthalein and methyl orange as indicators. Phenolphthalein alkalinity was present at three sampling stations with 14 p.p.m. recorded as a maximum. Total alkalinity (almost entirely as bicarbonates) varied between 81 and 118 p.p.m. for the surface waters, with an average of 101 p.p.m. The greatest vertical range recorded was at Station II, with a difference of 19 p.p.m. from surface to bottom.

The waters of Lake Texoma invariably tested positive for free carbon dioxide using standard reagents. Since the results seemed questionable, CO_2 content was calculated as previously described (Moore, 1939).

Calculated CO_2 for the bottom waters ranged from 2.0 to 15.3 p.p.m., with an average of 5.1 p.p.m. The greatest range of CO_2 values was at Station IV where a difference between surface and bottom of 11.1 p.p.m. was recorded.

The hydrogen ion concentration in the waters of Lake Texoma did not show such an extreme range as found for other Oklahoma waters. Surface pH values ranged from 7.4 to 8.2, while the bottom values ranged from 7.2 to 8.0, which are considerably lower than those reported for impoundments in central and northern Oklahoma (Irwin, 1942; Ophel, 1950).

BIOLOGICAL CHARACTERISTICS

Aquatic Vegetation. Lake Texoma is similar to other reservoirs in the southwestern United States in that there are few aquatic plants. The absence of most species can be directly attributed to the large annual fluctuation of surface level. The only submerged plant collected during the period of study was one of the broad-leaved pond weeds, *Potamogeton americanus* Chamisso and Schlechtendal. Several emergent aquatics were observed only in the inlets of streams (e.g., Newberry Creek), and had not become established in the lake proper.

Plankton. The following list is submitted, not as a complete listing of all the species present, but only as representative of two seasons of collecting (November, 1949; July, 1950). The list was prepared by Mr. Ivan L. Ophel, formerly a graduate student of the Department of Plant Sciences, University of Oklahoma, now Limnologist, Health Physics Branch, Atomic Energy of Canada, Ltd., Chalk River, Ontario. The collection of these samples was done by Mr. Ophel, assisted in part by the author.

Chlorophyceae
- *Ankistrodesmus falcatus*
- *Chlamydomonas* sp.
- *Closterium aciculare*
- *Coelastrum microporum*
- *Cosmarium* sp.
- *Kirchneriella lunaris*
- *Oocystis* sp.

Pediastrum duplex
Pediastrum simplex
Phacotus lenticularis
Staurastrum chaetoceros

Bacillariophyceae

Cyclotella kuetzingiana
Cymbella sp.
Gyrosigma sp.
Melosira granulata
Navicula spp.
Surirella robusta var. *splendida*
Synedra sp.

Dinophyceae

Ceratium hirundinella

Cryptophyceae

Cryptomonas sp.

Myxophyceae

Anabaena sp.
Aphanizomenon flos-aquae
Aphanocapsa sp.
Polycystis (=Microcystis) aeruginosa

Protozoa

Codonella cratera

Rotifera

Asplanchna sp.
Brachionus militaris
Conochiloides natans
Filinia longiseta
Keratella cochlearis var. *macrocantha*
Pedalion mirum

Cladocera

Diaphanosoma brachyurum
Diaphanosoma brachyurum var. *leuchtenbergianum*
Bosmina longirostris
Bosmina obtusirostris
Daphnia pulex var. *obtusa*

Daphnia longispina elongata
Ceriodaphnia reticulata
Ceriodaphnia lacustris

Copepoda

Diaptomus clavipes
Diaptomus siciloides
Cyclops leuckarti
Cyclops sp.
Ergasilum n. sp.
Attheyella sp.

From these scant samples no attempt was made to obtain quantitative results. However, Mr. Ophel (personal communication) concluded from his examination ". . . the predominance of certain diotoms, blue-greens and the Chlorococcales of the green algae." He further indicated the key organisms to be *Melosira granulata* (November and July) and *Polycystis aeruginosa* (summer).

Following the lake types of Thienemann and Naumann (Fritsch, 1931) this would indicate that Texoma had many eutrophic characteristics. This contention was further supported by the fact that two zooplankters *(Daphnia pulex* var. *obtusa, Diaptomus siciloides)* which were found in Texoma also commonly occurred in Lake Overholser (central Oklahoma), which undoubtedly had eutrophic characteristics (Ophel, 1950).

Benthic Invertebrates. The following is a list of all benthic invertebrates collected during the fifteen-month study. One addition has been made by Professor W. J. Harmon of Louisiana Polytechnic Institute, Ruston, Louisiana. This was the sponge, *Asteromeromeyenia radiospiculata* (Mills) identified by Dr. Minna E. Jewell of Thornton Junior College, Harvey, Illinois. In the list one asterisk to the left of a species indicates that the species is a new record for Texas; two asterisks, a new record for Oklahoma; and three asterisks, new for both Texas and Oklahoma.

Phylum Porifera

Spongilla lacustris (Linné)
****Asteromeromeyenia radiospiculata* (Mills)

Phylum Nematoda

Undetermined spp.

Phylum Bryozoa

Plumatella repens (Linné)

Phylum Annelida
  Class Oligochaeta
    Undetermined spp.

Phylum Mollusca
  Class Pelycepoda
    Quadrula quadrula apiculata (Say)
    Truncilla donaciformis (Lea)
    Leptodea laevissima (Lea)
    Anodonta corpulenta (Cooper)
    Anodonta imbecillis Say

  Class Gastropoda
    Physa halei Lea
    Lymnaea (=Fossaria) modicella (Say)
    Ancylus sp.

Phylum Arthropoda
  Class Crustacea
    Palaemonetes (Palaemonetes) paludosus (Gibbes)
    Argulus lepidostei (Kellicott)

  Class Arachnoidea
    Order Hydracarina
      Undetermined spp.

  Class Insecta
    Order Ephemeroptera
      Hexagenia munda elegans Traver
      Hexagenia limbata venusta Eaton
      ***Callibaetis montanus* (Eaton)?
      Stenonema femoratum tripunctatum Banks
      ****Brachycercus lacustris* Needham
      Siphlonurus sp.
      Caenis sp.

    Order Odonata
      Pantala hymenea Say
      Erpetogomphus sp.
      Gomphus plagiatus Selys
      Enallagma civile (Hagen)
      Ischnura sp.

Argia moesta (Hagen)?
Argia spp.

Order Trichoptera

***Cyrnellus marginalis* (Banks)
Oecetis inconspicua (Walker)
Oecetis cinerascens (Hagen)
Hydroptila sp.
Orthotricha sp.

Order Diptera

Chaoborus punctipennis (Say)
Chrysops sp.
Tabanus sp.
Stratiomyia sp.
Hydrellia sp.
Culicoides sp.
****Pentaneura basalis* (Walley)?
****Pentaneura annulata* (Say)
***Pelopia stellatus* Coq.
****Procladius bellus* (Loew)
****Procladius culiciformis* (Linné)
****Coelotanypus tricolor* (Loew)
****Coelotanypus concinnus* (Coq.)
****Coelotanypus scapularis* (Loew)
****Hydrobaenus (Psectrocladius)* sp.
****Hydrobaenus (Hydrobaenus)* sp.
****Hydrobaenus (Smittia)* sp.
****Hydrobaenus (Eukiefferiella)* sp.
****Cricotopus tricinctus* (Meig.)
****Calopsectra (Calopsectra) neoflavellus* (Mall.)
****Calopsectra (Calopsectra) dissimilis* (Joh.)
****Calopsectra (Stempellina) bausei* (Kief.)?
**Pseudochironomus pseudoviridis* (Mall.)
Polypedilum (Tripodura) digitifer Townes
Polypedilum (Polypedilum) illinoense (Mall.)
**Tanytarsus (Tribelos) fuscicornis* (Mall.)
Tanytarsus (Stictochironomus) palliatus (Coq.)
**Stenochironomus macateei* (Mall.)
**Xenochironomus festivus* (Say)
**Cryptochironomus fulvus* (Joh.)
****Cryptochironomus blarina* Townes

******Cryptochironomus sorex*** Townes
Cryptochironomus sp.
****Cryptochironomus*, sen. lat. sp. b. Johannsen
****Tendipes (Limnochironomus) neomodestus* (Mall.)
Tendipes (Limnochironomus) nervosus (Staeger)
Tendipes (Tendipes) decorus (Joh.)
***Tendipes (Tendipes) plumosus* (Linné)
****Glyptotendipes (Phytotendipes) paripes* (Edw.)
**Harnischia (Harnischia) incidata* Townes
****Harnischia (Harnischia) carinata* Townes
****Harnischia (Harnischia) nigrovittata* (Mall.)
****Harnischia (Harnischia) monochromus* (Van der Wulp)

Order Hemiptera

Ranatra sp.
Belostoma testaceum (Leidy)
Rheumatobates hungerfordii Wiley
Corixidae, undetermined sp.

Order Megaloptera

Sialis sp.

Order Coleoptera

Dineutus sp.
Haliplus sp.
Berosus pugnax (LeC.)
Tropisternus sp.

The ecology of the benthic organisms listed above is to be described in a later paper.

SUMMARY

The physico-chemical limnology of Lake Texoma, Oklahoma and Texas, is presented together with lists of planktonic and macrobenthic organisms. The study period was June and July, 1949, and June, 1950 to May, 1951. Most of the physico-chemical data were taken in 1949.

It was observed that the impoundment is relatively shallow compared to its area and that the water circulates almost continuously throughout the year. Normally, oxygen, carbon dioxide, carbonates, and pH values are fairly uniform in distribution; however, there is some tendency for stratification to occur, at least in areas that have some protection from the prevailing winds.

There was only one species of higher aquatic vegetation, *Potamogeton americanus,* present in the lake proper. Its distribution was rather spotty. The absence of other macrophytic species can be attributed to rather wide seasonal fluctuation of water levels (13.74 feet, July, 1950–June, 1951).

A list of forty-five species of net plankters is presented. The species composition and relative abundance shows that Texoma has an indication of eutrophy, at least in this respect.

A total of eighty-seven species (or groups) of macroscopic benthic invertebrates was collected. Of this number, the insects predominated with seventy-one species. Of the eighty-seven species or groups thirty-two are reported from Texas and twenty-eight from Oklahoma for the first time.

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