QUALITATIVE ANALYSIS

of

DIATOMS FROM TORCH LAKE

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INTRODUCTION

A diatom study, "Qualitative Analysis of Diatoms from Torch Lake" was undertaken in conjunction with a graduate student, William Houston. His study of Torch Lake includes an investigation of the vertical distribution of diatoms. He hopes to establish a basis of control using Torch Lake as a determinant for polluted waters. A norm has been established by Dr. Ruth Patrick and her associates from the Philadelphia Academy of Natural Science who pioneered in the use of sampling diatom population as a means of water quality. According to her, water may be classified as "healthy", "semi-healthy", "polluted" or "very polluted". Many studies have been made of polluted waters, but few have been made in collecting data of healthy waters to be used as a basis of control in future research. Data of this study includes two samplings obtained on July 5, 1964 by William Houston, and another on July 11, 1964 by the author. The first sampling was used for experimental purposes.

METHODS AND MATERIALS

Sampling began on July 5 followed by another a week later, July 11. The first sampling was taken at a station located at the northern end and in the middle of the lake at the depth of 55 meters. The others were taken every ten meters.

The apparatus employed to collect samples was a two liter Kemmerer water sampler. Refer to Welsh (1948) Fig. 59. The Kemmerer was attached to a crane and carefully lowered by means of a graduated rope with markers for one meters and a larger marker for the ten meters. When the Kemmerer was lowered at the desired depth of 55 meters, the messenger was sent with force to release and close both the upper and lower valves. Upon its return, the water sampler was emptied into a one-half gallon jar or 1.9 liters. The remaining water was discarded. Further samplings were taken every 10 meters. That of July 11 began with samplings at 65m, 63m, 59m (to make up the deficit of one meter) 56m, and every 3 meters to the surface.

For quantitive purposes a 500 ml of each sample was filtered through a 47mm grid Millipore filter. The process was speeded up with a power motor to which a hose was attached (Fig. 1). The water was siphoned and as it passed through the hose it created a vacuum. It is easier to use a vacuum pump. It is not as time consuming. The filter paper was removed, air-dried and labeled with date and depth (Fig. 2). It was then placed in a vial of 10 ml and capped to prevent the entrance of dirt. Further work ón quantitative study was intended to be undertaken, but a limiting time factor prevented it.

Qualitative analysis began with the addition of Potassium iodide to the remaining water sample in the jars to produce quick killing and the settling of organisms. The jars were capped to prevent evaporation, and set in the dark for a two

day period. Actually this settling period should last about two weeks. After this time most of the plankton had settled to the bottom. Water was carefully siphoned off until all of the upper sixths or more of the water column was removed. The remaining one-sixth was transferred to vials of 25 ml.

This sample of July 5th was used for experimental purposes in order to learn the techniques. Vials were labeled 5m to 55m for every 10 meters. Four drops of nitric acid were added to each of the seven vials. It was left to settle for 24 hours, after which time the supernatant was removed. The procedure for making burnt mount slides involved the following steps: cover slips were placed on a flat surface in a definite square with a number so as not to confuse them. The size of the cover slips was 25mm x 25mm. To determine the concentration of diatoms the number of drops placed on each cover slip is designated below(Fig. 3). Numbers below the square indicate depth. The number in the square indicates the number of drops taken from the bottom of the vials. Seven glass slides, 77mm x 25mm x 1mm, were placed on a warm hot plate. With a dropper cover on the hyrax bottle, one drop of hyrax was centrally placed on each of three slides (since three persons were working together at this point). This drop of hyrax was brought to a slow boil after 30 minutes heating. Each slide was removed with forceps from the hot plate and placed on a wooded area to retain the heat. The cover slip, labeled 0 depth, was inverted and placed on the hyrax drop, pressed with a pointed object, such as a dissecting needle, until the hyrax drop was distributed to all corners of the

cover slip. It was then dried. Excess hyrax around the cover slip was removed with a razor blade and zylene was used as the final cleansing agent. One source suggests returning the glass slide to the hot plate after the cover slip had been added (1).

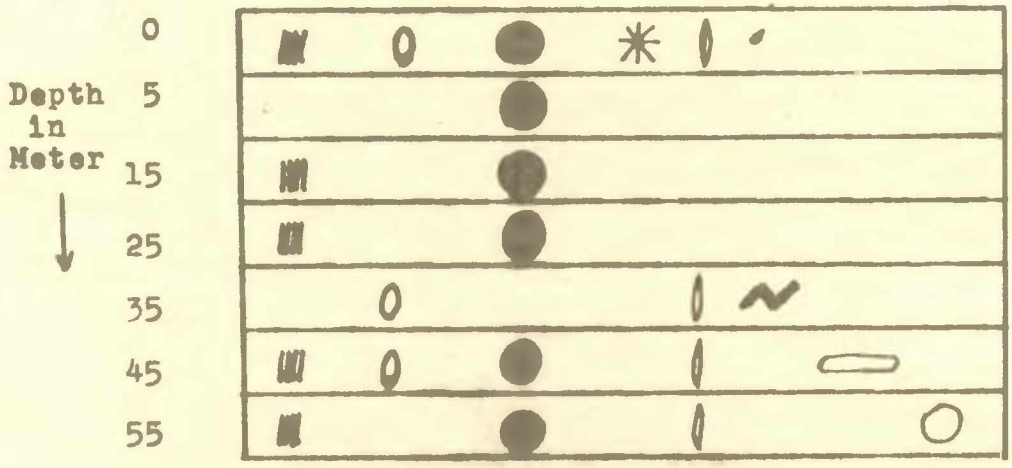
Observations were made with a compound microscope using a 10 power ocular with objectives of 10 power, 43 power, and 97 power (oil immersion) for the purpose of identification of diatoms.

RESULTS

VERTICAL DISTRIBUTION

of

DIATOMS IN TORCH LAKE



Fragilaria crotonensis
Cymbella
Cyclotella
Asterionella
Navicula
Nitzschia
Stephanodiscus
Diatoma

DISCUSSIONS

The organisms most abundant at any sampling station at any given time are the most reliable key to conditions of the environment (2). Studies in recent years have shown that unpolluted natural waters contain a wide variety of organisms, none, of which, usually occurs in overwhelming numbers (3). The four most abundant diatom species reflect in most situations the environmental conditions in streams and lakes. They are also a good source in determining difference in water quality and other conditions (4). The samples of diatoms collected at one station show a distribution of depth from 0 to 55 meters. On the graph the four most abundant genera of diatoms are in evidence: Fragilaria, Cymbella, Cyclotella, and Navicula. Many will admit that identification of diatoms can be most difficult. The above four were most numerous. However, even these have levels where they were not seen. Cyclotella, the most numerous fresh water species, was found at all levels except at 35m, yet the rare Diatoma was present. Cyclotella favors cold waters. Perhaps the thermocline was at this level. According to Welch (1952) species of diatoms vary in diurnal movement, with variations even within species. Some will migrate to the surface at night; others do so in the daytime. In other species, adults ascent both day and night, while the young remain in deep waters continuously. Another point to consider is the unseen number of micro-microscopic members. Those we normally see range in size from 10-20 microns. In 1962 during experimental studies some diatoms were collected that were 0.75 microns in diameter. "Both in total population

and number of species they (diatoms) constitute the largest planktonic group in the rivers and Great Lakes"

Navicula, belonging to the order Pennales, is characteristic of the diatoms found in the sea. Note, therefore, its presence in the colder and deeper waters, 35-45m, which is equivalent in temperature and light density to parts of the ocean. Most research indicates the concentration of numerous diatoms at the surface. The results here confirm this statement. Gessner F. (1948) speaks of the upper water layers as having light of sufficient intensity for photosynthesis and a continuous multiplication of cells takes place and causes flow of phytoplankton.

Nitzschia was found in 45m. It is a type reported to indicate a high nitrogen content, and, therefore, found in great numbers in waters that are polluted. Excessive enrichment or eutrophication of receiving waters by rich wastes is emerging as a major water pollution problem, according to Bogan (1961).

SUMMARY

Though this contribution is small in scope to the overall question of what factors, such as temperature, pH, density, depth, are necessary to constitute a healthy lake, this report may establish one fact, that diatoms are present in great numbers at all levels, with Cyclotella as the most numerous. The vertical distribution is essential to know basic plankton to determine food web. High quality of water establishes more or less a basis for water control. This is one of the perimeters

for good quality of water. The presence of diatoms in such great numbers is indicative of the "healthy" aspect. If all the other facets to this problem are solved, then the Torch of Torch Lake can again be a guide to clean water and clean living.

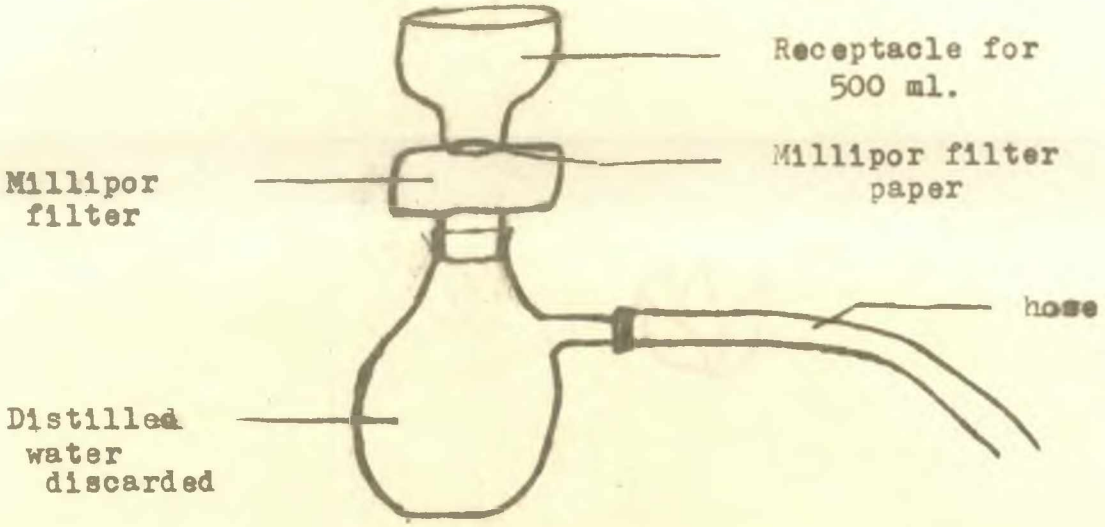


Fig. 1. Millipor Filter Set-up

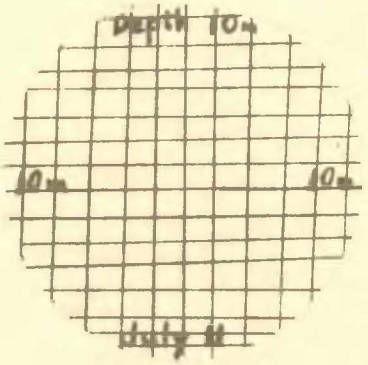


Fig. 2. Millipor Filter Paper

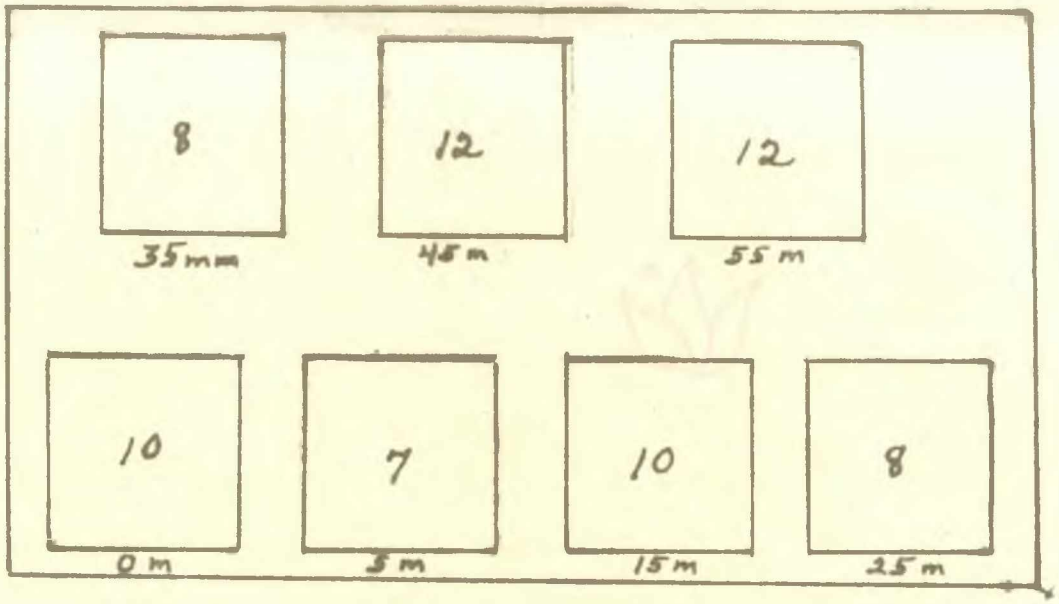


Fig. 3. Cover slips aerated

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