A Study of the Winter Diatoms (Bacillariophyceae) Flora in Fall Creek, Indiana

Robert G. Lipscomb

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Edited by

J. E. Potzger
The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana’s vegetation in past decades. Authors were Butler faculty, current and former master’s degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler’s first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal’s publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor’s degrees and 75 master’s degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner, included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master’s students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

Requests for use of materials, especially figures and tables for use in ecology text books, from the *Butler University Botanical Studies* continue to be granted. For more information, visit www.butler.edu/herbarium.
A STUDY OF THE WINTER DIATOMS (BACILLARIOPHYCEAE) FLORA IN FALL CREEK, INDIANA

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ABSTRACT

Lipscomb, Robert G. (U.S. Geological Survey, c/o Ind. Institute of Technology, Ft. Wayne, Indiana) A Study of the Winter Diatoms (Bacillariophyceae) Flora in Fall Creek, Indiana. Butler U. Bot. Studies 14(2) :41-52. Illus. 1964.—The diatom flora was studied at four stations on Fall Creek upstream from its confluence with White River at Tenth Street, Indianapolis, Indiana, over a three month period, December through February 1961-2. The entire course of the Creek studied was classified (Table 2) as fairly clean water. Pollution was due largely to contamination by sanitary wastes. The water had an average temperature of 2.5°C and an average of slightly alkaline reaction. The communities were composed of a few species well represented and many species sparsely represented.

Twenty-five species not previously reported from Marion County, twenty-two of which had not previously been reported from the State, were identified. *Dialoma hiemale* and *Gomphorhiza olivacea* were markedly sensitive to pollution, whereas *Meridion circulare* displayed a significant resistance. The presence of *Navicula gracilis* at all stations was not correlated with pollution. Although the study was conducted over a short period, the results tend generally to be in agreement with the findings of other workers.

Natural waters display a variety of environments. The seasonal and diurnal variation in light and temperature, the change in chemical characteristics, and the fluctuation in velocity are limiting factors to which all life forms present must adapt.

Appreciation is expressed to Dr. Rex N. Webster for his supervision of this research and the suggestions, guidance, and assistance in preparation of the manuscript; to Dr. M. T. Hall for his critical reading of the manuscript; to Mr. Robert Black and Miss Mildred Campbell of the Department of Biology, Shortridge High School, for making available the Hodge Diatom Collection; and to my wife, Jeanette Lipscomb, for typing the manuscript and for her assistance and encouragement during its preparation.

1 Appreciation is expressed to Dr. Rex N. Webster for his supervision of this research and the suggestions, guidance, and assistance in preparation of the manuscript; to Dr. M. T. Hall for his critical reading of the manuscript; to Mr. Robert Black and Miss Mildred Campbell of the Department of Biology, Shortridge High School, for making available the Hodge Diatom Collection; and to my wife, Jeanette Lipscomb, for typing the manuscript and for her assistance and encouragement during its preparation.

The resulting complex is normally in biological balance. The introduction, however, of industrial and sanitary wastes by continual and uncontrolled dumping into the aquatic environment tends to inhibit these important controls and pollution occurs.

To ascertain the conditions of a body of water or stream it is a common practice to make three determinations, namely a chemical analysis, a determination of the biochemical oxygen demand (B.O.D., sometimes used singly as an indicator of pollution), and a count of the viable coliform bacteria. These tests, however, may not always present a true picture of the conditions or quality of the water because the analyses can only be considered applicable at the time the water is tested and will not reflect the degree of balance between the biological components. Therefore, since all the organisms of a particular body of water express a tolerance to changes in environmental conditions, other groups may be also very helpful in the study of aquatic habitats.

Studies by Patrick (9) indicate that the Bacillariophyceae, or diatoms, are of particular value as possible indicators of industrial and sanitary wastes in the measure of stream conditions.

LOCATION AND PHYSIOGRAPHY

Fall Creek has its source in Madison County, Indiana. It flows southwestwardly through the southeast corner of Hamilton County, then into Marion County where it empties into the White River at Indianapolis. Fall Creek, as it runs through the City of Indianapolis, is polluted by both industrial and sanitary wastes. Flow is through Wisconsin glacial drift where bank physiography today is of medium relief at the uppermost limits. Although the streambank becomes quite abrupt at some points in northeastern Indianapolis, it again becomes less dissected as the stream approaches its confluence with the White River in northwest Indianapolis. Geist Reservoir, with a capacity of 6,900,000,000 gallons and a surface area of 1,800 acres, is located on Fall Creek at the junction of Hamilton, Marion and Hancock Counties and controls low flow into White River.

MATERIALS AND METHODS

The method employed to collect the diatoms in this study was developed by Patrick and her co-workers (10). Although the "Catherwood Diatometer" was not duplicated precisely it did serve as a guide to the construction of a similar device to be used in this study.

A piece of wood 2 x 4 x 30 inches was pointed at one end to form a bow. A 4 inch slit was cut with a saw at the opposite end, into which a stabilizer was fitted. The latter consisted of a small tin can flattened double.
A slide container was made by removing the top and bottom from a small wooden slide box to which a narrow strip of wood was glued across each slide track on one side to retain the slides against moving water. For added strength, the container was then wrapped well with electrician's tape and coated with paraffin. It was mounted by a bolt and nut 13 inches from the bow and designed to hold six slides in a vertical position, one in every other slot.

To protect the slides from the direct current and debris in the stream, a deflector was made from a No. 2 tin can by removing one end and the seam and spreading the sides to the width of the slide container. The curved deflector was mounted by screws 9 inches from the bow.

A common window lift was fastened on top just behind the slides for ease in handling and retrieving from the water.

Just forward from the deflector was placed an eye bolt to which one end of a six foot nylon line with swivel snap-hooks was attached and extended to an anchor. The anchor consisted of a cement-filled, one pound coffee can with extended eye bolt. If additional line or anchor were needed, it was a simple matter to snap them into place.

All surfaces were painted. Cracks were sealed with mastic cement and aluminum screws and bolts were used for greater protection against weathering (see Plate 1).

Four sites were selected for study along an approximate fifteen mile course of Fall Creek beginning with its confluence with White River, just a few hundred feet upstream from Tenth Street in Indianapolis. In downstream order, they were:

1. 79th Street, 100 feet below the bridge.
2. Woollens Garden, 600 feet below Highway 100.
3. Citizens Gas & Coke Utility, 1,000 feet below Northwestern Avenue.
4. Marion County General Hospital, 400 feet above the mouth of the Creek.

A diatometer was placed at each site in flowing water and allowed to remain for a period of seven days at four intervals through December, 1961, and January and February, 1962.

At the time of collection, the temperature of the water was taken adjacent to each diatometer and the container of slides was taken to the laboratory together with two water samples for standard B.O.D. determination, using the Winkler method (14).

At the laboratory, the material from two slides was scraped into a beaker, cleaned by use of the sulfuric-bichromate method described by Hohn (6) and strews were made for mounting in Hyrax. The remaining slides were flamed over a bunsen burner and filed for a permanent record.

An average of ten areas, each 32,400 square microns, from each slide,
PLATE 1. A. Top view. B. Bottom view. C. Top, bottom, and side views in detail. Numbered items are: 1. slide container. 2. deflector. 3. anchor. 4. anchor line. 5. lift. 6. stabilizer.
was studied to establish the percent composition of all the forms. Patrick and Strawbridge (11) emphasized the importance of studying a similar segment of the diatom community. If communities are compared by always counting the same number of specimens in each community, the results may not be reliable because the number of species identified in this manner varies greatly, depending upon the degree of dominance of species. In this study, the segment was computed in terms of area selected at random.

The diatoms were examined, using a Spencer binocular research microscope fitted with a 2 mm. apochromatic oil immersion objective, N.A. 1.30. Both 10x and 15x compensating ocular lenses were used. A photomicrograph was made of each diatom identified by using a Voigtlander Avus double extension bellows camera fitted over a monocular body. The front and back lenses were removed from the camera and the bellows was extended to approximately 25 cm. Kodak Tri-X Pan 2 1/4 x 3 1/4 film pack was used with light provided by a Bausch and Lomb research lamp fitted with a 3 inch No. 10 filter.

Species were determined with the aid of Boyer (2), (3), (4), Wolle (18), Van Heurck (17), Hustedt in Schmidt (12), Pascher (8), Hohn (6), and Tiffany and Britton (15). In addition, comparisons were made with type specimens contained in The Hodge Diatom Collection of the Department of Biology, Shortridge High School, Indianapolis, Indiana. The Van Heurck slides of this collection, which would have provided most of the type specimens, were on loan at this time and were not available for comparison.

Prepared slides of the species reported in this study have been placed in the Botany Department Herbarium, Butler University, Indianapolis, Indiana.

RESULTS

The winter distribution of diatoms in Fall Creek represented by those adhering to the slides of the diatometer consisted of members of one family and three genera of the Centrales and nine families and thirteen genera of the Pennales (Table 1).

A total of 39 identified species were identified. Twenty-five are species which have not previously been reported from the County, twenty-two of which have not previously been reported from the State, according to the file of the State Algal Flora being maintained by Mr. William A. Daily, Butler University. A photographic illustration of each is presented in PLATE 2.

Of all the forms appearing on the slides, four genera were represented at 15% or more in distribution. Either *Diatoma bidentale* (Lyngbye) Heidberg, or *Navicula gracilis* Ehrenberg, represented the predominant species at the four sites; *Diatoma bidentale* at the 79th Street station and the Marion County
General Hospital Citizens Gas station, these Diatoms: not to be co-dominant.

Garden station, Diatoms: not to be co-dominant.

County Garden station: Diatoms: not to be co-dominant.

Ehrenberg, 10% distribution: not to be co-dominant.

The maxim:

\[ \text{PLATE 2. Figs.:} \]

meneghiniana, Mueller, 1:

borealis var.

Heidelberg, Figs.

spatulifera Ehrenberg, 1:

pediculus Ehrenberg, 1:

lanesolata (Ehrenberg, 1):

Grunow, 1:

Fig. 16. Navicula popula Kuetz.

N. minuta manati (Gregory) A. M.

Gomphonema bicapitata Kuetz.

Fig. 15. Gomphonema amphiibium Kuetz.

Van Heurck, 2:

G. ovata Kuetz.

* —— 10

1 Species of

2 Species of

3 Not complete

4 Work done graphs 1 and 2
General Hospital station, and *Navicula gracilis* at the Woollens Garden and Citizens Gas & Coke Utility stations. With the exception of the 79th Street station, these two species were co-dominant. At the 79th Street station, *Gomphonema olsivaceum* (Lyngbye) Kuetzing replaced *Navicula gracilis* as the co-dominant, although it was still represented at 9%. At the Woollens Garden station, although listed as a co-dominant with *Navicula gracilis*, *Diatoma biemae* was found to be represented at only 2%. At the Marion County General Hospital station, *Cyclotella meneghiniana* Kuetzing, *Melosira italica* var. *tenaissima* (Grunow) Mueller, and *Synedra ulna* (Nitzsch) Ehrenberg, were represented in almost equal abundance, though less than 10% distribution. All other forms listed in Table 1 were found at only 1% distribution.

The maximum average B.O.D. determination of 5.9 ppm at the Citizens

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**PLATE 2.** Fig. 1. *Stephanodiscus atraea* (Ehrenberg) Grunow. ² Fig. 2. *Cyclotella meneghiniana* Kuetzing. Fig. 3. *Melosira italica* var. *tenaissima* (Grunow) Mueller. ³ Fig. 4. *Meridion circulare* (Greville) C. A. Agardh. Fig. 5. *Diatoma biemae* var. *meziodor* (Ehrenberg) Grunow. ² Fig. 6. *Diatoma biemae* (Lyngbye) Heidberg. Fig. 7. *Synedra ulna* (Nitzsch) Ehrenberg. Fig. 8. *Synedra ulna* var. *spartilifera* Grunow. ² ³ Fig. 9. *Synedra rampens* Kuetzing. ² ³ Fig. 10. *Coconetes pediculatus* Ehrenberg. Fig. 11. *Coconetes plicatula* Ehrenberg. ² Fig. 12. *Achnanthes lanceolata* (Trebsisson) Grunow. ² Fig. 13. *Rhiosiphonia curvata* (Kuetzing) Grunow. ² Fig. 14. *Navicula gracilis* Ehrenberg. ² Fig. 15. *Navicula radiata* Kuetzing. ² Fig. 16. *Navicula hungarica* var. *cypatita* (Ehrenberg) Cleve. ² Fig. 17. *Navicula papula* Kuetzing. ² Fig. 18. *Navicula confusae* (Kuetzing) Grunow. ² Fig. 19. *Navicula marica* Kuetzing. ² Fig. 20. *Navicula capillifera* Kuetzing. Fig. 21. *Navicula bicapillala* Husted. ² ³ Fig. 22. *Navicula anglica* Ralfs. ² Fig. 23. *Navicula exigua* (Gregory) Mueller. ² ³ Fig. 24. *Gyrosigma kuetzingii* (Grunow) Cleve. ² Fig. 25. *Gomphonema gracile* Ehrenberg var. *dichotoma* (Kuetzing) Grunow. ² Fig. 26. *Gomphonema lanceolatum* Ehrenberg. ² Fig. 27. *Gomphonema olsivaceum* (Lyngbye) Kuetzing. Fig. 28. *Gomphonema constrictum* var. *capilitum* forma *turgidum* (Ehrenberg) A. Mayer. Fig. 29. *Gomphonema parvulum* (Kuetzing) Grunow. Fig. 30. *Gomphonema angustatum* (Kuetzing) Grunow. ² Fig. 31. *Anaphora ovalis* Kuetzing. Fig. 32. *Cymbella protrusa* (Beckeley) Cleve. ² Fig. 33. *Cymbella tenuis* (Trebsisson) Van Heurck. ² Fig. 34. *Nitzschia angustata* (W. Smith) Grunow. ² Fig. 35. *Nitzschia amphibia* Grunow. ² Fig. 36. *Nitzschia hungarica* Grunow. ² Fig. 37. *Nitzschia ditiopita* (Kuetzing) Grunow. ² Fig. 38. *Sarrella angusta* Kuetzing. ² Fig. 39. *Sarrella ovata* Kuetzing.

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1 Species not previously reported from the County.
2 Species not previously reported from the State.
3 Not compared with type slides.
4 Work done subsequent to the completion of this manuscript indicates that photograph 1 and 15 are not representative of the species indicated.

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TABLE 1
Percent distribution of orders, families and genera of diatoms (Bacillariophyceae)
in Fall Creek, Indiana, collected through December, 1961, and January and February, 1962.

<table>
<thead>
<tr>
<th>Centrales</th>
<th>79th Street</th>
<th>Woolens Garden</th>
<th>Citizens Gas &amp; Coke Utility</th>
<th>Marion County General Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coscinodiscaceae</td>
<td>Cyclotella</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Melosira</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Stephanodiscus</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>pennales</td>
<td>Diatomaceae</td>
<td>Diatoma</td>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Naviculaceae</td>
<td>Nitzschia</td>
<td>9</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Navicula</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Nitzschia</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gomphonemataceae</td>
<td>Gomphonema</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Fragilaria</td>
<td>Synechococcus</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Meridionaceae</td>
<td>Meridion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Achnanthaceae</td>
<td>Achnanthes</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Rhoicosphenia</td>
<td>Cocconis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Acrocosmus</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cymbellaceae</td>
<td>Cymbella</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Amphora</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Surirellaceae</td>
<td>Surirella</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Gas & Coke Utility station and the minimum average of 3.7 ppm at the 79th Street station, were correlated with averaged pH values of 8.09 and 8.00 respectively. Average water temperatures varied only 0.5°C; 2.7°C for the high and 2.2°C for the low. See Table 2 for total averages.

Based on the classification of stream conditions adapted from Suckling (13), Table 3, the results in Table 2 show that some degree of pollution was present; the great majority of the waters in the Fall Creek were classified as 'borderline','waters of marginal quality', or 'polluted'.
TABLE 2

Averages of four determinations made of water samples collected from Fall Creek during December, 1961, and January and February, 1962.

<table>
<thead>
<tr>
<th>Station</th>
<th>B.O.D.</th>
<th>pH</th>
<th>Water Temperature (Centigrade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>79th Street</td>
<td>3.7 ppm</td>
<td>8.00</td>
<td>2.2</td>
</tr>
<tr>
<td>Woolens Garden</td>
<td>4.6 ppm</td>
<td>8.06</td>
<td>2.5</td>
</tr>
<tr>
<td>Citizens Gas &amp; Coke Utility</td>
<td>5.9 ppm</td>
<td>8.09</td>
<td>2.5</td>
</tr>
<tr>
<td>Marion County General Hospital</td>
<td>4.2 ppm</td>
<td>7.98</td>
<td>2.7</td>
</tr>
</tbody>
</table>

was present at all sites; the 79th Street station being the least affected while the greatest absorption of oxygen occurred at the Citizens Gas & Coke Utility station.

TABLE 3

Stream classification based on O₂ absorption, after Suckling (13).

<table>
<thead>
<tr>
<th>Water not absorbing more than:</th>
<th>ppm in 5 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very clean waters</td>
<td>1.0</td>
</tr>
<tr>
<td>Clean waters</td>
<td>2.0</td>
</tr>
<tr>
<td>Fairly clean waters</td>
<td>3.0</td>
</tr>
<tr>
<td>Waters of doubtful purity</td>
<td>5.0</td>
</tr>
<tr>
<td>Bad or polluted water</td>
<td>10.0</td>
</tr>
</tbody>
</table>

DISCUSSION AND CONCLUSIONS

Patrick, Hohn and Wallace (10) compared samples collected in the surrounding water at the time a diatometer slide was removed and found that slides exposed in this manner permitted the growth of diatoms which are representative of the species present in the stream. For this reason, and also since occasional or daily plankton net collections might actually miss a pulse, it was decided that the diatometer method of collecting samples would be used in this study.

It would be expected that the 79th Street station would be the least polluted since it lies in the outer edge of the City. The Woolens Garden station is not only nearer the City and in an area of considerable recent building, but is also downstream from a military reservation, Ft. Benjamin Harrison, through which flows affluent from a suburb of Indianapolis via Lawrence Creek. By the time flow reaches the Citizens Gas & Coke Utility station, sufficient pollutants have been added from numerous small inlets including...
housing, small businesses and St. Vincent’s Hospital, that the water is somewhat polluted. There are many riffles in the remainder of the Creek and, in part at least, are probably responsible for the slightly reduced absorbed oxygen at the Marion County General Hospital station. Fall Creek from 79th Street to White River, therefore, can be classified as one of not better than fairly clean water.

Suckling (13) states that trade wastes are often acid, while waters of suspected sewage and sewage affluent contamination are generally neutral or fairly alkaline in reaction. Since the amount of industrial waste being discharged is proportionately small as compared to sanitary wastes in Fall Creek, the slightly alkaline readings between 7.98 and 8.09 can probably be largely attributed to sanitary contamination.

It is not an easy matter to determine if pollution is the only factor in the environment affecting the structure of a diatom community. Natural pulses of species or associations of species rule invalid what might otherwise be a simple solution to the problem; that is, a designated reliable indicator which would be unaffected by changes in the environment that are not related to pollution. The emphasis placed upon the problem currently by some workers, therefore, has not been in this direction, but rather in that of defining the limits in variation of natural populations and how they vary with kinds or amounts of pollution.

Patrick and Strawbridge (11) recently concluded that changes in the structure of the population, that is, number of species and percent of population composed of all dominant species and total growth, are more generally reliable for indicating changes in the pollution load. The kinds of species must also be considered.

The community structure at each site as determined by this investigation was characterized by Patrick, et al, in 1949. From the comprehensive biota study of the Conestoga Basin, it was concluded that polluted channels generally would support a diatom flora in which the community was composed of a few species with a large number of specimens, and with many species of only a few specimens. It would be expected, of course, that certain species would be substituted by others in different regions, but the general pattern would be the same.

The procedures employed on Fall Creek were not so detailed as were Patrick’s, although the results from only a short study appear to be in general agreement with her findings.

The association of dominants at the 79th Street station appear to be similar in some respects to the *Diatoma-Gomphonema* community described by Blum (1) for unpolluted riffles in the Saline River, Michigan. He reported that *Gomphonema olsaeceum* was a subordinate associate until late February at which time it replaced an abundant growth of *Diatoma vulgare* Basy.
it is not known if such a replacement occurred at the 79th Street station, but
the relationship of the two species suggests that it might have. It is probable
that *Diatoma ascendens* and *Diatoma vulgare* are similar ecologically.
It is interesting to note another similarity reported by Blum (1). *Gomphonema
olivaceum* and *Diatoma vulgare* in greatly reduced numbers were present in
winter in polluted portions of the Saline River. In Fall Creek, like areas
supported a reduced *Gomphonema olivaceum* and *Diatoma ascendens*
association. It was also found that although *Diatoma vulgare* was not dominant on
 riffles above Saline Pond, it was very abundant immediately below a tributary
where relatively high concentrations of nitrate were maintained throughout
the winter months. Such departures as those demonstrated by *Navicula
gracilis* at the Woollens Garden station, *Diatoma ascendens* and *Gomphonema
olivaceum* at the 79th Street station, and *Meridion circulare* (Greville) C. A.
Agardh at the Citizens Gas & Coke Utility station appear to be the result of
factors related to pollution similar to that found by Blum (1).
On the basis of their seasonal maximum, algae may be grouped as sum-
mer, fall, winter or spring forms, as shown by Transeau (16). Although they
occur in all waters, the diatoms are probably more widely distributed in cold
waters than any other group. Hupp (7) and Coffing (5) observed vernal
and autumnal maxima in the White River Canal, Indianapolis, Indiana, and
Coffing (5) reported an abundant winter minimum in which *Synedra* and
*Nitzchia* displayed a weak rise in January when the water temperature was
at about 3°C. In his investigation on the Saline River, Blum (1) found
that *Diatoma vulgare* rose to dominance only after the water temperature had
fallen below 15°C.
Although maxima were not considered, the presence of *Diatoma, Navicula*
and *Gomphonema* (Table 1) at the water temperature shown in Table 2
is in agreement with the winter forms reported by Coffing (5) and, with the
exception of *Navicula*, the winter forms by Blum (1).
Insofar as the data permits, there appears to be a relationship in Fall
Creek between pollution and the diatoms that is generally in agreement with
the findings of workers elsewhere. Populations were composed of the same
characteristic winter forms reported by Coffing (5) and Blum (1) and
conformed closely with the standard developed by Patrick (9) for polluted
areas.
It is significant to note also, that the largest representation of *Meridion
circulare* was at the Citizens Gas & Coke Utility station, the most polluted
of the stations studied. Although a correlation is apparent, further study is
warranted.
With temperatures constant and pH nearly so, pollution appeared to have
to been the major significant variable in causing variations of the diatom com-

community along the section of Fall Creek studied.
LITERATURE CITED