# STUDIES ON THE TURBELLARIAN FAUNA OF THE MOUNTAIN LAKE BIOLOGICAL STATION. I. ECOLOGY AND DISTRIBUTION

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With 12 Text-Figures and One Chart

During the latter part of the 1938 summer session of the Mountain Lake Biological Station, extensive collections were made in the streams, ponds, and springs of the region in order to list the Turbellaria.

Our object is not only to list for the convenience of future workers the turbellarian fauna thus far found in the Mountain Lake region, either by ourselves or others, but also to add our bit to the small amount of information now available treating of the ecology and geographical distribution of these forms.

Thirty-eight species and varieties of twenty-three genera were studied. Three investigators have published descriptions of one or more species of Triclads or Rhabdocoeles for the vicinity of the Mountain Lake Biological Station: Kenk, 1935; Gilbert, 1935; Nuttycombe and Waters, 1938.

The Mountain Lake Biological Station was established by the University of Virginia as a summer biological station in 1930. The station is about eight miles from Pembroke, in Giles County, Virginia, and about one mile from Mountain Lake. This lake is said to be the only natural lake in the southern Appalachians and one of the highest in the East. The station is at an elevation of approximately 4,000 feet on the divide between the Mississippi and Atlantic drainage areas.

Because of an abundance of rain and the presence of many springs and small mountain streams, it is an excellent collecting place. Because of the altitude factor, collections may be made representing life of both the Canadian and Austral Zones within a radius of five miles of the station.

Since the establishment of the Mountain Lake Biological Station by the University of Virginia, nineteen zoologists have worked on the Turbellaria in this region. Only three of these investigators have published material of an ecological nature on this particular region. The

others have, whenever possible, generously contributed notes for the preparation of this paper. The list of investigators includes Dr. William A. Kepner, Dr. Bruce D. Reynolds, Dr. Chauncey M. Gilbert, and Mr. Robert Brumfield of the University of Virginia; Dr. Paul R. Burch of Radford State Teachers College; Dr. Margaret Hess of Judson College; Dr. Ruffin Jones of William and Mary College (Norfolk); Dr. Trenton K. Ruebush of Yale University; Dr. Roman Kenk of the University of Puerto Rico; Dr. John W. Nuttycombe of the University of Georgia; Dr. Raymond L. Taylor of William and Mary College; Mr. Robert I. Bosman of Johns Hopkins University; Mr. Richard J. Porter of the University of Chicago; Col. Robert P. Carroll of Virginia Military Institute, and the authors.

## TAXONOMIC LIST OF SPECIES REPORTED

Order 2: Rhabdocoelida
- Suborder 1: Notandropora
  - Family 1: Catenulidae
    - *Rhynchoscolex simplex* Leidy 1851.
    - *Catenula virginiana* Kepner and Carter 1930.
    - *Stenostomum arevaloi* Gieysztor 1931.
    - *Stenostomum grande* Child 1902.
    - *Stenostomum kepneri* Nuttycombe and Waters 1938.
    - *Stenostomum pegephylum* Nuttycombe and Waters 1938.
    - *Stenostomum saliens* Kepner and Carter 1931.
    - *Stenostomum tenuicaudatum* Graff 1911.
    - *Stenostomum tuberculosum* Nuttycombe and Waters 1938.
    - *Stenostomum ventronephrium* Nuttycombe 1932.
    - *Stenostomum virginianum* Nuttycombe 1931.
    - *Stenostomum* sp.
    - *Fuhrmannia* sp.
- Suborder 2: Opisthandropora
  - Family 2: Macrostomidae
    - *Macrostomum bulbostylum* Ferguson 1939
    - *Macrostomum riedeli* Ferguson 1939
    - *Macrostomum reynoldsi* Ferguson 1939
    - *Macrostomum ruebushi* Ferguson 1939
  - Family 3: Microstomidae
    - *Microstomum lineare* Schmidt 1848
- Suborder 3: Lecithophora
  - *Section* 1: Dalyellioida
  - Family 4: Provorticidae
    - *Provortex affinis* (Jensen) Graff 1882.
  - Family 5: Dalyelliidae
    - *Dalyellia* sp.
    - *Castrella truncata* Hofsten 1910.

*Section* 2: Typhloplanoida
Family 6: Typhloplanidae
Subfamily 2: Typhloplaninae
*Typhloplana* sp.
*Castrada* sp.
Subfamily 3: Rhynchomesostominae
*Rhynchomesostoma rostratum* (Müller) Luther 1904
Subfamily 4: Phaenocorinae
*Phaenocora kepneri* Gilbert 1935.
*Phaenocora virginiana* Gilbert 1935.
Subfamily 7: Mesostominae
*Mesostoma* sp.
*Section* 3: Kalyptorhynchia
Subsection 1: Eucalyptorhynchia
Family 18: Gyratricidae
*Gyratrix hermaphroditus* Ehrenberg 1831
Family 19: Polycystidae
*Klattia virginiensis* Kepner, Stirewalt, Ferguson 1939.
Order 3: Alloeocoela
Suborder 1: Lecithoepitheliata
Family 3: Prorhynchidae
*Prorhynchus stagnalis* Schultze 1851
*Geocentrophora baltica* (Kennel) Steinböck 1923*
*Geocentrophora* sp.
Suborder 3: Seriata
Family 11: Bothrioplanidae
*Bothrioplana semperi* Braun 1881.
Order 4: Tricladida
Family Planariidae
*Curtisia foremani* (Girard) Graff 1916.
*Euplanaria trigrina* (Girard) Kenk 1935.
*Fonticola gracilis* (Haldeman) Kenk 1935.
*Fonticola morgani* (Stevens and Boring) Kenk 1935.
*Planaria dactyligera* Kenk 1935.

## STATIONS

### *Natural Lake*

Mountain Lake (Fig. 1) is located between Salt Pond Mountain and Doe Mountain at an altitude of 3,873 feet. It is situated on what was for many years the main highway between Virginia and West Virginia. The interstate boundary line is about ten miles north of the lake. The first survey of this body of water was made in 1753 by Christopher Gist and is apparently valid today, the dimensions being about nine-tenths

* *Prorhynchus balticus* Kennel 1883.

*Distribution Chart (Summer, 1938)*

| ANIMAL | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mountain Lake | Hoge's Pond | Farrier's Pond | Kessinger's Pond | McClarity's Pond | Evans' Pond | V.P.I. Pond I | V.P.I. Pond II | "Lake Rana" | Water Supply Spring | Arsenic Spring | Twin Springs | Dividing Spring | Little Stony Creek | Mud Branch | Hunter's Branch | Sinking Creek | Big Stony Creek | Cascades and Bluffs | Little Cascades |
| *Bothrioplana semperi* | x | | | | | | | | | | | | | | | | | | | |
| *Catenula virginiana* | | z | | y | x | y | | x | x | x | y | | | | | | x | x | | |
| *Castrada* sp. | x | | | | | | | | | | | | | | | | | | | |
| *Castrella truncata* | | | | | | | | | | | | | | | | | | | x | |
| *Curtisia foremani* | | | | | | | x | | | y | | | | | | | | | | |
| *Dalyellia* sp. | x | | | | | | x | | | z | y | | | | | | | | y | |
| *Euplanaria trigrina* | x | | | | | | | | x | y | | | | | | | | | | |
| *Fonticola gracilis* | x | | | | | | | | | | | | | | | | | | | |
| *Fonticola morgani* | x | | | | | | | | | x | | | | x | | | | | | |
| *Fuhrmannia* sp. | x | | | | | | | | | x | x | | | | | | | | x | |
| *Geocentrophora baltica* | | | | | | | | | | | | | | | | | | | y | |
| *Geocentrophora* sp. | | | | | | | | | | x | | | | | | | | | | |
| *Gyratrix hemaphroditus* | | | | | | | | | x | y | z | | | | x | | | | | |
| *Klattia virginiensis* | | | | | | x | y | | | | | | | | | | | | | |
| *Macrostomum bulbostylum* | | | z | | | | x | | | | | | | | | | | | | |
| *Macrostomum riedeli* | | | | | | | | | | | y | | | | | | | | | |
| *Macrostomum reynoldsi* | | | | | | | | | | | | | | x | | | | | z | x |
| *Macrostomum ruebushi* | | | | | | | y | | | | | | | | | | | | | |
| *Mesostoma* sp. | | | | | | | x | | | | | | | | | | | | | |
| *Microstomum lineare* | y | | | | | | x | | | | | | | | | | | | | |
| *Phaenocora kepneri* | | | | | | | x | | | | | | | | | | | | | |
| *Phaenocora virginiana* | | | | | | y | | | | | | | | | | | | | | |
| *Planaria dactyligera* | y | | | | | | | | | | | | | | | | | | | |
| *Prorhynchus stagnalis* | y | | | | | | | | | y | x | | | | | | | | y | |
| *Provortex affinis* | | | | | | | | | | x | | | | | | | | | | |
| *Rhynchomesostoma rostratum* | x | | | | | | | | | | | | | | | | | | | |
| *Rhynchoscolex simplex* | x | | | | | | | | | x | | | | | | | | | x | x |
| *Stenostomum arevaloi* | | | | | | | | | | | | | | | | | | | x | |
| *Stenostomum grande* | x | x | | | | | x | | | | | | | | | | | | | |
| *Stenostomum kepneri* | x | | | | | | | | | | | | | | | x | | | x | |
| *Stenostomum pegephylum* | | | | | | | | | | x | | | | | | | | | | |
| *Stenostomum saliens* | x | | | | | | | | | | | | | | | | | | | |
| *Stenostomum tenuicaudatum* | x | | | x | x | x | x | | | x | | x | x | | x | | x | x | x | |
| *Stenostomum tuberculosum* | x | | | | | | | | | | | | | | | | | | | |
| *Stenostomum ventronephrium* | | | | | | | | | | | | | | | | | | | x | |
| *Stenostomum virginianum* | x | | | | | | | | | | | | | | | | | | x | |
| *Stenostomum* sp. | | | | | | | | | | | x | | | | | | | | | |
| *Typhloplana* sp. | y | | | | | | | x | | | | | | | | | | | | |

x—few specimens; y—many specimens; z—very abundant specimens.

of a mile by about one-fourth of a mile. The surface is about one hundred acres and the greatest depth is about eighty-five feet. According to several geologists the lake is a natural solution collapse basin. The underlying formation is of Martinsburg Shale (Ordovician). This shale is very high in lime content. On the east and north sides of the lake, large boulders of hard sandstone (Clinton formation) (Silurian) have broken away from overlying formations and come to lie on the bottom of the lake so that they project from the water. The lake is supplied by several springs and a very abundant rainfall. The water is usually transparent to the extent that a standard Secchi disc may be

FIG. 1. Mountain Lake—looking northward

seen to the depth of eighteen feet. After very heavy rains the transparency may not be more than three or four feet. Analysis of the water shows the following solutes to be present as indicated in parts per million: mineral residue, 6.4; organic and volatile residue, 19.2; iron and aluminum oxides, none; bicarbonates ($HCO_3$), 30; free carbon dioxide ($CO_2$), 9; dissolved silica, 1.4; calcium, trace; magnesium, trace; nitrates, none. Dr. Edwin Powers and Miss Theresa Hickman, working in the summer of 1934, found the pH to change from 6.8 to 5.9 as the depth increased to seventy-five feet. They found that the oxygen content decreased from 5.32 to 5.15 cc. per liter between the surface and

a depth of 30 feet and decreased thereafter to 2.48 cc. per liter at a depth of 75 feet. In summer the temperature is slightly over 22°C at the surface. It decreases about one degree between the surface and the thermocline. Between about 15 feet and 30 feet of depth (the thermocline) the temperature drops rapidly from 21°C to 11°C and thereafter drops gradually to 9°C at the bottom. The physical and chemical properties of the water and mud of the lake are well described by Hutchinson and Pickford (1932). The water contains *Elodea, Isoetes, Chara,* unicellular and filamentous algae, and other plants. The lake shore is overgrown with evergreens—mainly mountain laurel, rhododendron, and hemlock.

Collections were made at depths of from six inches to thirty feet. Study showed that the most abundant turbellarian fauna lived in the more shallow water, while only *Euplanaria* and *Rhynchomesostoma* were taken at the deepest point of collection.* Collections at the shallow southern end where several springs are found, proved to be the best. A more extensive study of depth collections will be made in the near future.

### *Artificial Ponds*

Collections were made in several artificial ponds varying in length from twenty-five feet to four hundred yards.

Hoge's Pond (Fig. 2) is located in Giles County on U. S. Route 23, approximately two miles east of Pembroke, at an elevation of 2,035 feet, in a fairly rich limestone valley (Stone River formation) (Ordovician). This pond is about seventy-five yards long and not over eight feet deep. It is about sixty years old. It is fed by the overflow from a watering trough, which receives water piped from a mountain spring two miles away. The pond is bordered on different sides by pasture, cultivated land, and a patch of weeds and willow trees.

Farrier's Pond (Fig. 3), is on U. S. Route 23, two miles west of Newport. It is about two hundred yards long and its greatest depth is about 15 feet. A swampy place produced by a small mountain stream and including a large spring was dammed up more than eight years ago to form this pond. It is located at an elevation of 1,850 feet, on limestone soil (Stone River formation). The water contains large quantities of *Chara* and other algae. The greater part of the pond is unshaded, though there are several large willow trees at one end. The shore is in lawn grass.

* These depth studies were made by means of an automatic collecting dredge (Ekman dredge, Foerst Company).

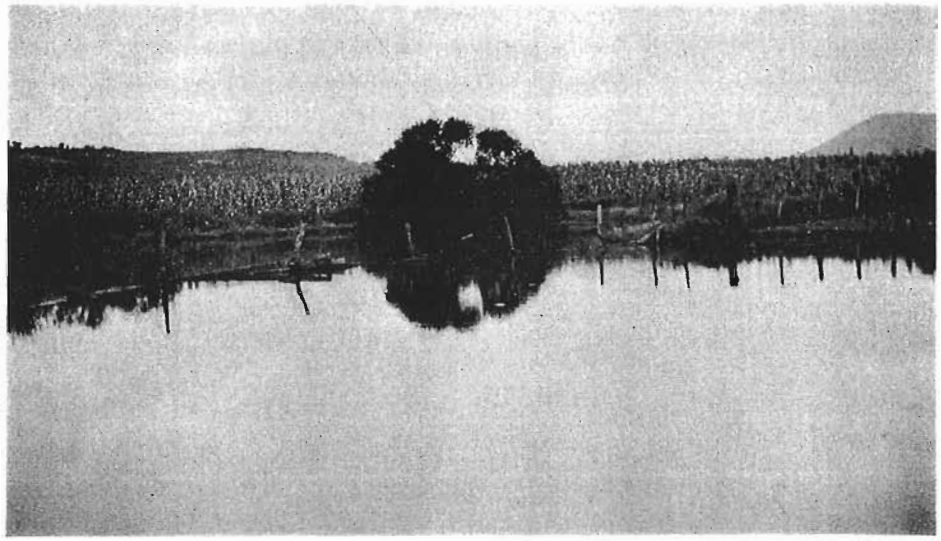

FIG. 2. Hoge's Pond

FIG. 3. Farrier's Pond

Kessinger's Pond (Fig. 4) was formed about twelve years ago by damming a small mountain stream in a swampy meadow. It is located in Giles County, Virginia, about two miles southwest of Newport at an

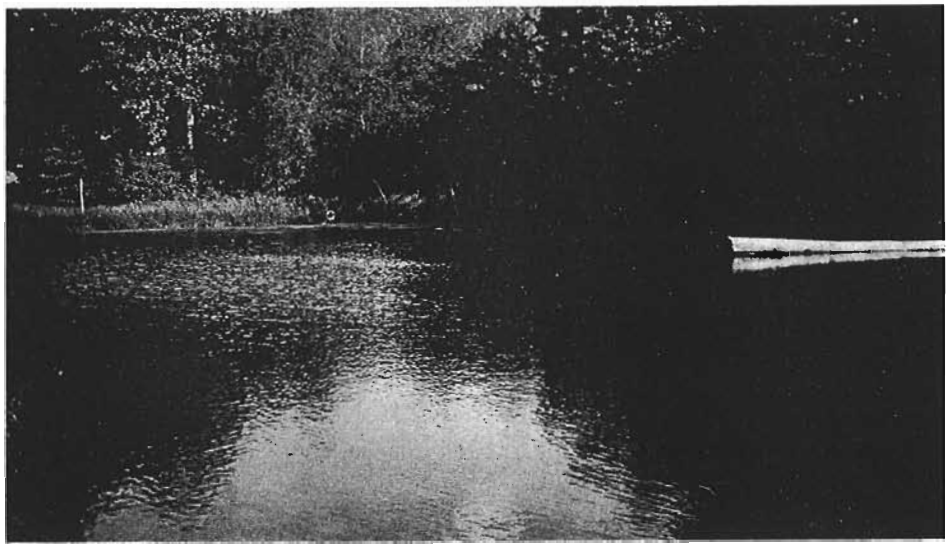

FIG. 4. Kessinger's Pond

FIG. 5. McClarity's Pond

elevation of 2,100 feet. The pond is about fifty yards long and contains an abundant growth of green algae. Aquatic insects are very numerous. The surrounding soil (Martinsburg Shale) is in grass on one side, and wooded on the other.

McClarity's Pond (Fig. 5) is located between Kire and Interior, Giles County, Virginia, about two miles from Kire. It was formed about ten years ago by damming a small swamp fed by a mountain stream. The pond is more than fifty yards long and is ten feet at the deepest point. Plant and animal life is not abundant. *Juncus*-like plants are growing in the northern end of the pond. The entire pond is surrounded by grass-land. It is located at an altitude of 2,690 feet in Black Devonian Shale.

FIG. 6. Evan's Pond

Evan's Pond (Fig. 6), about two miles south of Blacksburg (between Blacksburg and Price's Fork), is apparently a small sink hole. It is located at an elevation of 2,200 feet in the Rome formation (Cambrian). It is fed by a small spring and has no outlet. Though the pond is only about fifteen yards long and only knee deep, local residents say that it has never been dry. The center of the pond which is in open water has a bottom composed of bluish gray mud. A lush growth of rushes and saw grass separates the open water from a weed-grown field.

On the campus of Virginia Polytechnic Institute, in Blacksburg, are

two artificial ponds. One, located between the Faculty Apartments and the University Club (Pond I) (Fig. 7), is about three hundred yards

FIG. 7. V. P. I. Pond I

FIG. 8. V. P. I. Pond II

long. Pond I was formed about five years ago and contains abundant animal life and large quantities of *Spirogyra*. Pond II (Fig. 8) was formed about twenty-five years ago but was enlarged about a year ago

and contains almost no animal life but does contain abundant *Chara*. Both ponds are located at an elevation of 2,150 feet in Rome formation. Neither pond is shaded.

"Lake Rana" as it is known by the biologists of the Mountain Lake Station, is a small stream-fed pool on the grounds. It is a veritable catch-all for any aquatic plant or animal which may be brought for study. Many Turbellaria have been "planted" here for future study.

*Springs*

Collections were made in three large springs and many smaller springs on Salt Pond Mountain, Bear Cliff Mountain, Doe Mountain, and vicinity.

The Water Supply Spring of Mountain Lake Biological Station is located three-fourths of a mile southeast of the Station on Bear Cliff Mountain. It is at an elevation of 4,100 feet, and is located in Clinton formation (Silurian). The average summer temperature is 11°C. The spring is surrounded by mountain laurel and rhododendron. The border of the spring is over-grown with sphagnum moss. The bottom of the spring is covered with a layer of vegetable debris, principally dead leaves.

Arsenic Spring is a large spring on the banks of Big Stony Creek, two miles west of Kire, Virginia, between Interior and Kire. It is at an elevation of 2,689 feet in Black Shale (Devonian). This spring has proven very interesting because of its low summer temperature (11°C) and the large number of Turbellaria taken from it. The spring gushes from a bank, passes through a swampy area, and enters Big Stony Creek. It is in the swampy area of soft mud rich in organic matter and plant growth that the best collecting may be done. The spring and the swampy area are heavily shaded by deciduous trees.

Twin Springs are located one-half mile northwest of the Mountain Lake Biological Station, at an elevation of 3,680 feet. The springs form an alga-filled pool four yards long, surrounded by large hemlocks and mountain laurel.

On the road leading from the Biological Station toward the Virginia-West Virginia boundary line, approximately two miles from the Station, is Dividing Spring. This small spring is unique among those studied in that it has drainage partly to the Missippi and partly to the Atlantic coast. It is partially shaded and is filled with a rank growth of green algae.

*Streams*

Besides the many large and small springs, in the vicinity of the Biological Station, there are many typical, small mountain streams. Ex-

FIG. 9. Tributary stream to Little Stony Creek near Cascades

FIG. 10. Big Stony Creek

tensive collections were made in the small streams which unite with the Mountain Lake drainage to form Little Stony Creek. The streams

(Fig. 9) tributary to Little Stony Creek, from which collections were made, are called Mud Branch and Hunter's Branch. Collections were also made in Sinking Creek and Big Stony Creek (Fig. 10). Unlike the ponds whose locations have been pointed out, these streams are easily found by use of a map (U. S. Geological Survey topographical map, Dublin, Va.-W. Va. quadrangle).

FIG. 11. Little Cascades

*Falls*

Excellent collections were made in and near the cascades on Little Stony Creek. These are about four miles (six miles by road) west of the Lake. There are two falls—one called Little Cascades (Fig. 11) which has a twenty foot drop, and the second called The Cascades (Fig. 12) which has an eighty foot drop. They are located at an elevation of about 3,050 feet in the Clinton formation (Cacapon member) (Silurian). These cascades are surrounded by large hemlocks, rhododendrons, and deciduous trees. Excellent collections may be made by scraping the moss and algae from the rocks in the heavy spray of the falls. Surrounding the falls are high bluffs down which numerous spring-fed streams flow. These streams also offer good collecting places.

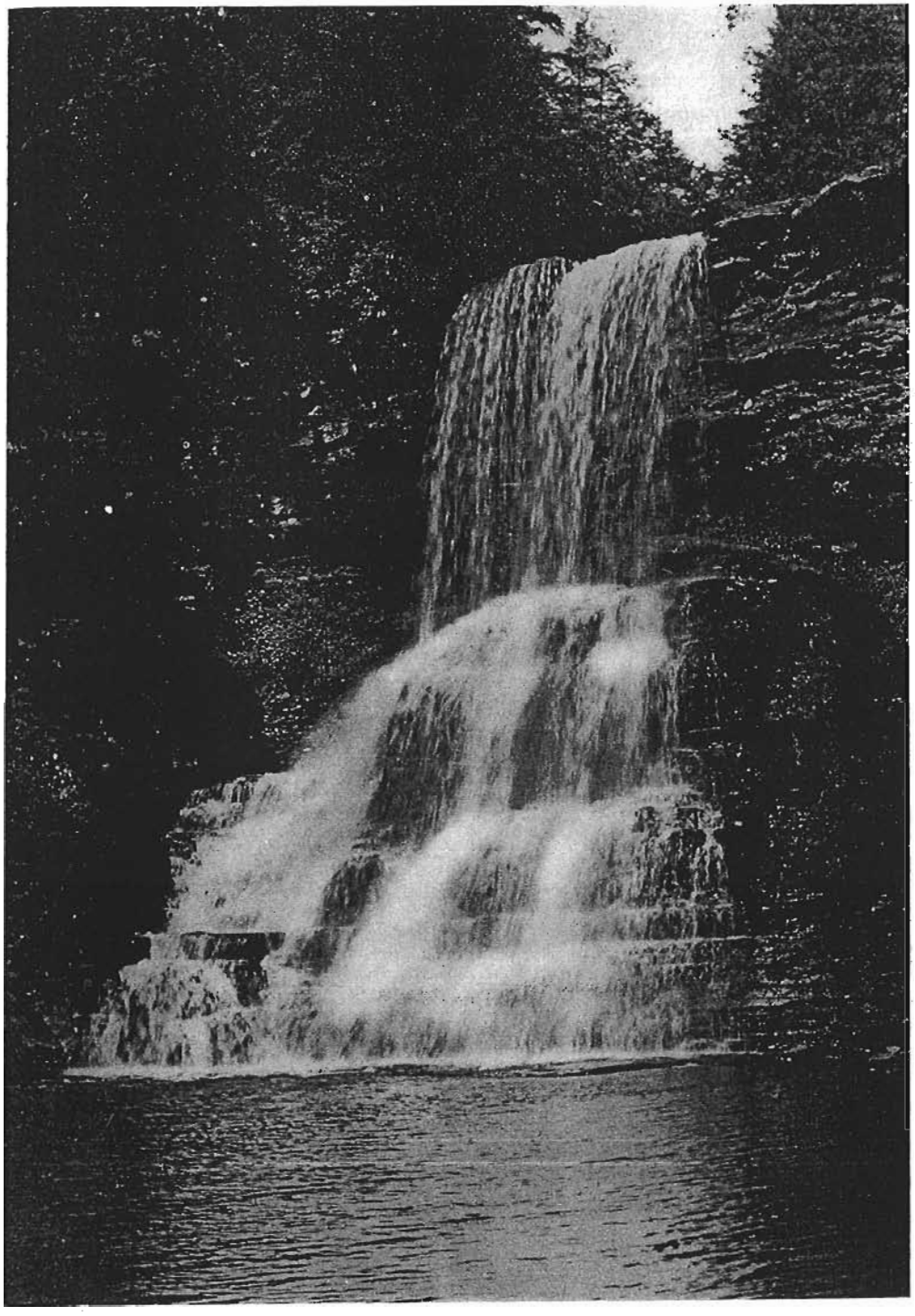

FIG. 12. The Cascades (Little Stony Creek)

## DISCUSSION

The occurrence of *Macrostomum bulbostylum* to the exclusion of other Turbellaria in Farrier's Pond is of significance. This is a carnivorous, hardy species which is able to live under conditions which would destroy many other turbellarian forms. On the other hand, the pond is relatively new. We intend to "plant" several of the more hardy turbellarian species in Farrier's Pond in order to test whether only *Macrostomum bulbostylum* has been able to establish itself in the pond or whether it (or some other factor) has prevented other species from establishing themselves.

While the authors are cognizant of the fact that turbellarian species may not always be found in the same place from year to year, they are convinced that such a survey as this will aid in understanding the variable nature of these bodies of water. The Mountain Lake Biological Station presents an ideal environment for the completion of such an ecological study. A vast amount of such work awaits the students of Turbellaria here in America as well as elsewhere.

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