The Ecology, Periodicity, and Taxonomy of the Algae of an Intermittent Stream in Hutcheson Forest

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Abstract: The intermittent stream which flows through Hutcheson Memorial Forest was observed for thirteen months. Filamentous Chlorophyta were the dominant algae of the more open sites. *Tetraspora* and *Draparnaldia* shared dominance in the spring; *Hydrodictyon* was the dominant in summer; *Draparnaldia, Spirogyra,* and *Tribonema* shared dominance in the fall; and *Drapernaldia* and *Spirogyra* shared dominance in the winter. In shaded areas diatoms were the dominants throughout the year. They had their greatest abundance during the colder months, when species of *Pinnularia* and *Surirella* were dominant.

A study of the small intermittent stream known as Spooky Brook, which flows through the Hutcheson Memorial Forest, was made between March 1962 and March 1963 (Roff 1963). Observations were confined to the 450 m of the stream within the borders of the forest property.

The purpose of the study was three-fold: (1) to observe the ecology of the freshwater algae of an intermittent stream; (2) to observe the periodicity of the algal flora; (3) to record the species present during the period of observation. Periodicity may be defined as the growth of different species of algae occurring at different times of the year.

Methods

The stream, which has a total length of about 3.2 km, rises approximately 400 m east of the forest in a small woods with a seepage area and a spring, and is fed by run-off and seepage on its course through cultivated fields. The eastern end of the forest, as well as some of the fields of the forest property, are drained by the stream. During occasional summers with high rainfall, the portion of the stream within the forest flows continuously, while during the years of extreme drought it dries completely.

Fig. 1 shows the locations of the four collecting stations which were established. Station 1 was the marsh and thicket area nearet Amwell Road. Stations 2, 3, and 4 were in the wooded area, the last being about 5 m inside the forest boundary. Since these three stations were dry the latter part of the summer, there are few records for them after August, especially at station 4. Station 1 was subdivided into three substations (Fig. 1, inset): 1a, marsh region; 1b, midzone between marsh and thicket area; 1c, thicket area. Significant features of the collecting sites are summarized in Table 1.

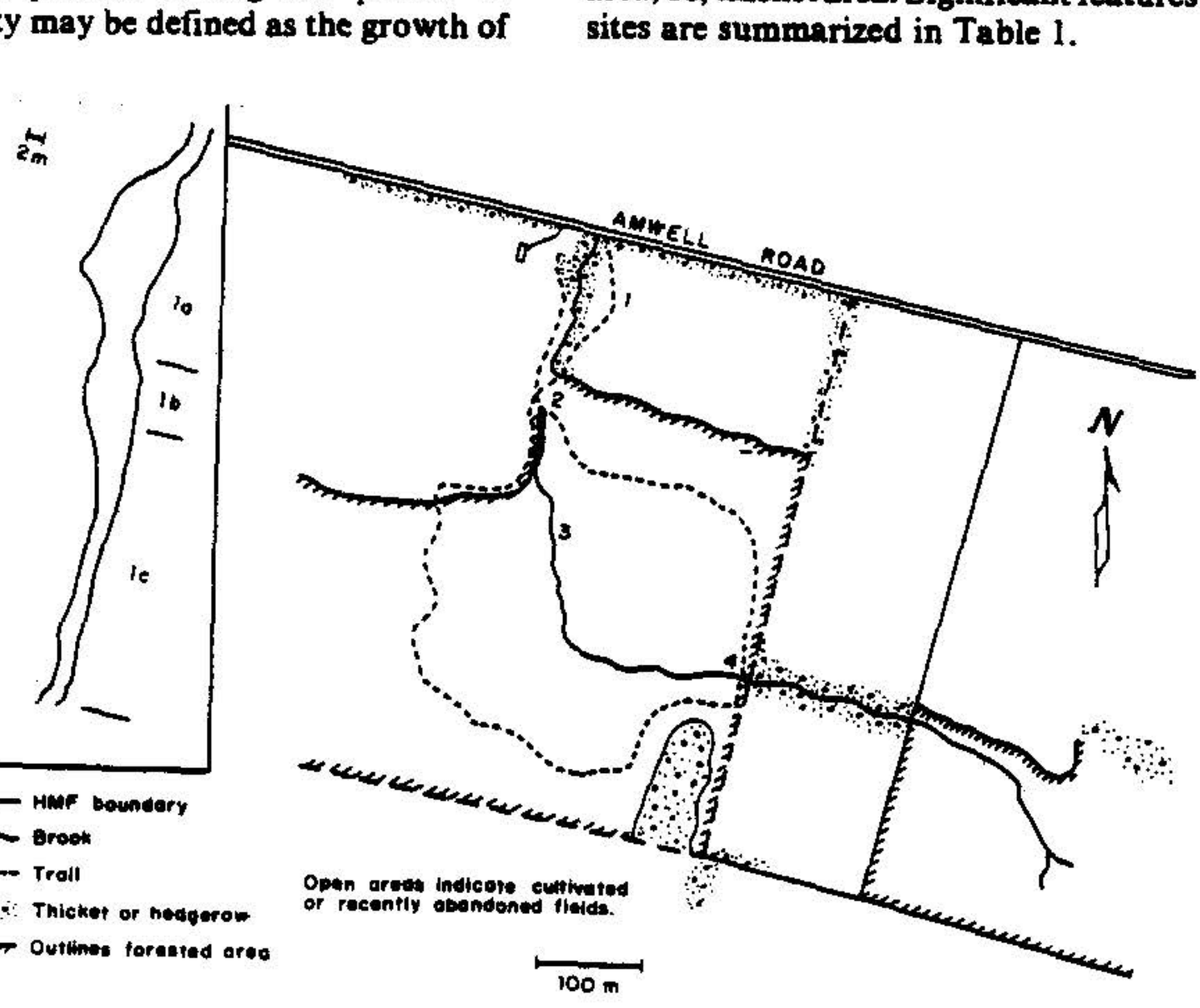

Fig. 1. Drainage basin of Spooky Brook. Drainage divide lies about 200 m west of the portion shown on the map. This area continues as forest and plowed or recently abandoned fields. Numbers 1-4 show locations of collecting stations. Inset shows collecting Station 1, with its subdivisions.

Table 1. Summary of the principal features of the collecting stations.

Station	Light	Water	Other
1a-marsh	good, winter; shaded summer	wet all year	flowing channel east side; marsh flooded to dry (mud); perennial macrophytes, summer
1b-intermediate zone	shaded by clump of trees	reduced to pool, summer	a channel; ≤ 0.5 m deep
1c-thicket	lightly shaded	wet all year; slow; slight flow, Aug.	principally a channel; ≤ 0.5 m deep
2-forest	shaded	wet all year; little flow, summer[1]	foot bridge; channel, with narrow flood plain west; dense macrophytes[2], summer
3-forest	less canopy & more open than 2, 4	dry, summer; swift, winter	channel through narrow flood plain; dense macrophytes[2], summer
4-forest	shaded	dry, summer; swift, winter	foot bridge; channel; no flood plain; macrophytes[3], summer

[1]Seepage, ≈ 30 m upstream, supplied some water
[2]Mostly *Impatiens capensis*
[3]Mostly *Sagittaria* sp.

Water temperatures were measured at regular collection periods with a stem thermometer. During the first four months of the study pH was determined with Fisher's pH indicator solution. During five consecutive weeks in April and May, 1962, dissolved oxygen was measured using the modified Winkler method.

Algal collections were made at regular monthly intervals, with frequent bi-monthly and weekly collections. Collections were preserved in 5% formalin.

Prescott (1951) was the authority used for algal nomenclature except for *Spirogyra* and the diatoms. Randhawa (1959) was used for *Spirogyra* identification and Husted (1930) for diatoms. A number of diatom identifications were supplied by Dr. Joan Hellerman.

Results

From mid-April to July diurnal water temperatures were above 17.5° C, with the maximum recorded being 24°. Because of the shallowness of the water, its temperature fluctuated with that of the air. During the winter months ice, and sometimes snow, covered the pond areas. With the low (7.4 cm) rainfall of July 1962, the stream became dry in most of its length leaving only limited seepage spools in the marsh and thicket areas. The pH of the water remained constant at 7.0 in the open area and at 6.0 in the thicket areas, the difference probably being due to a difference in photosynthetic activity. Oxygen tests showed the water to be saturated or even supersaturated, losing some oxygen in the riffle area at the lower end of Station 1.

All taxa which were recorded during the course of study are listed in Table 2, which also shows the stations at which they were collected.

Station 1, with its three subdivisions, provided the most diverse habitats and the greatest diversity of algae. Twenty-seven taxa were recorded from this station. The location and periodicity of the most abundant forms are summarized in Fig. 2, showing the dominance of the filamentous green algae. Of the thirteen genera of Chrysophyta found, only *Tribonema* attained any abundance. Cyanophyta, though shown in Fig. 2, were not important. *Batrachospermum* was found only once, at location 1b, in the spring. As no reproductive structures were found, the species was not determined.

Fig. 2 shows the shifting dominance of forms through the year at Station 1. The early spring community was dominated by *Tetraspora* sp. and *Draparnaldia plumosa*, both of which are considered cold-water forms. *Draparnaldia* continued dominant into the late spring.

The dominant of the summer community, and continuing into late fall, was *Hydrodictyon reticulatum*. (*Oscillatoria* spp. and numerous diatom species were present, but in such small numbers they are omitted from Fig. 2.) *Hydrodictyon* has been shown to be an alga of warm waters (Keller 1954, Moul, New Jersey Collection Records). The abundance of *Hydrodictyon* is noteworthy in view of Prescott's (1951) statement that, "It is so definitely confined to hard water that it may be used as an index organism for a high pH."

In the autumn community *Draparnaldia plumosa* again becomes dominant, with *Spirogyra* spp. and *Tribonema bombycinum* as co-dominants. The two filamentous green algae *Draparnaldia* and *Spirogyra* spp. continued as dominants of the winter community.

Stations 2, 3, and 4, in wooded areas of the forest, were in marked contrast to Station 1. Diatoms were consistently dominant throughout the study year. The mud along the edge of the brook was frequently covered with a brown scum of living diatoms. Sixteen genera of Chrysophyta were recorded, three of Chlorophyta and one of Cyanophyta.

The diatoms being present throughout the year in the wooded areas, periodicity was less striking than at Station 1. However the autumn community showed a heavy growth of diatoms, dominated by species of *Pinnularia* and *Surirella*. Pearsall (1923) proposed that

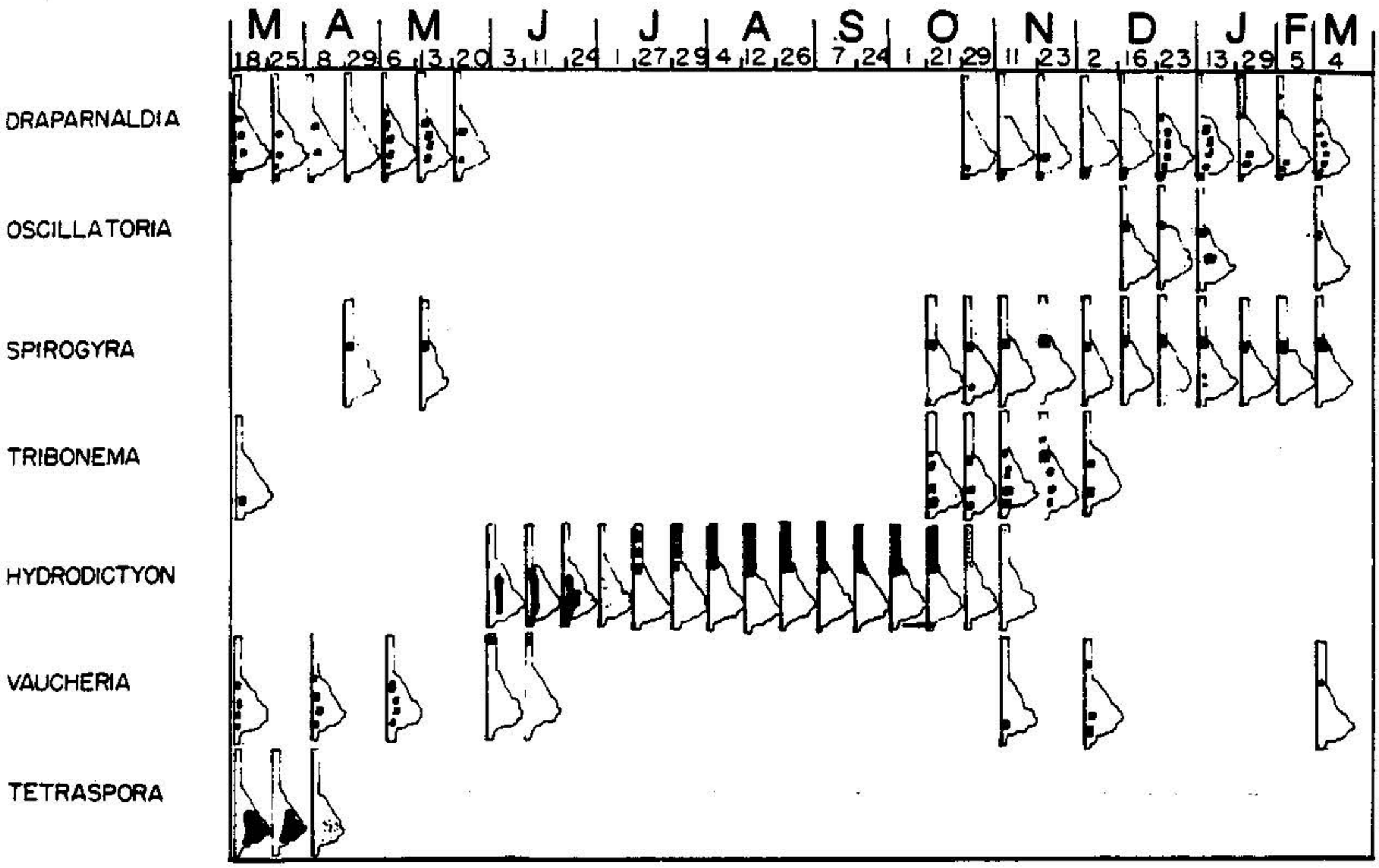

Fig. 2. Maps of locations 1a, 1b, and 1c, showing growth and distribution of seven genera of algae for a period of 13 months. See Fig. 1 for reference map.

flooding is a prime cause of diatom blooms, since minerals and other nutrients are being washed downstream and replenishing nutrient supply to the algae. The bloom of diatoms observed in this study occurred in October and November, when there was a considerable volume of water following fall rains.

Only one algal species was found at all seasons—the diatom *Meridion circulare*. It was most abundant during the cold season.

A more adequate study over a longer period of time could be made of the algae of Spooky Brook. This study was of too short duration and was further handicapped by the drying of most of the brook.

Table 2. Taxa of algae recorded and the stations from which they were collected. Many specimens were identified only to genus, and in some cases there may have been more than one species present.

Taxon	Stations	Taxon	Stations
		CHLOROPHYTA	
Closterium	1, 2, 4	*Mougeotia*	1, 3
Cosmarium		1 *Spirogyra crassivallicularis*	
Chaetophora elegans	1	*Spirogyra*	1
Draparnaldia plumosa	1, 2, 3	*Tetraspora*	1
Hydrodictyon reticulatum	1	*Zygnema*	1
		CHRYSOPHYTA	
Achnanthes	1, 2, 3, 4	*Pinnularia gibba* v.	
Caloneis	2	*mesogongyla*	2
Cymbella	1, 2, 4	*P. interrupta*	2
Diatoma	2	*P. obscura*	2

Eunotia lunaris	1, 2	*Pinnularia*	1, 2, 3, 4	2
E. lunaris v. *sub-arcuata*	3	*Stauroneis*		
Eunotia	4	*Surirella angusta*	2, 3	
Fragilaria	1, 2, 3, 4	*S. elegans*	3	
Frustulia	3	*S. robusta*	4	
Gomphonema	1, 2, 3, 4	*S. robusta* v. *splendida*	3	
Meridion circulare	1, 2, 3, 4	*Surirella*	1, 3, 4	
Navicula	1, 2, 3, 4	*Tabellaria*	1, 2	
Neidium	2, 3	*Vaucheria*	1	
Nitzschia	1, 2, 3, 4	*Tribonema bombycinum*	1	

CYANOPHTYA

Oscillatoria limosa	1, 2, 3, 4	*Oscillatoria sub-brevis*	1, 3
O. splendida	1, 3, 4	*Spirulina*	1

RHODOPHYTA

Batrachospermum

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