BIOLOGICAL SURVEY OF THE SPEED-ERAMOSA RIVER

1970 -71

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Ministry
of the
Environment

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by

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Previously

Biology Branch

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SUMMARY

On the basis of a study of biological, bacteriological and chemical parameters on the Speed-Eramosa River in 1970, some improvement of water quality has occurred since 1965 although the major problem of excessive growth of aquatic vegetation from Guelph to the Grand River remains.

Upstream of Guelph, water was generally of excellent quality on both the Speed and Eramosa Rivers although below Eden Mills limited contamination by domestic wastes was evident. Within Guelph, conditions had generally improved since 1965 but some water quality deterioration was still evident. Major increases in nutrient concentrations below the Guelph Sewage Treatment Plant resulted in extremely heavy growth of aquatic vegetation which in turn caused *severe* reductions in night-time concentrations of dissolved oxygen. Fish and benthic life was seriously impaired. Below Hespeler, the physical, biological and chemical quality of the river was further degraded as a result of additional discharges of municipal and industrial wastes.

Most important, this study indicates that levels of nutrients increase with progress downstream and observations of algal and aquatic plant growths indicated a concomitant increase in biomass production. Furthermore, the limited data indicate that substantial algal production may be present where concentrations of soluble phosphorus between 0.01 and 0.02 ppm and inorganic nitrogen values approximating 5 ppm exist.These figures correspond closely with those advanced for standing waters by Sawyer (1947) which indicate that, with a 0.3 mg/L concentration of inorganic nitrogen and a 0.01 mg/L concentration of soluble phosphorus at the start of the active growing season, algal blooms could be expected.

RECOMMENDATIONS

On the Eramosa River, two areas should receive attention. Below Eden Mills, the cause of elevations in levels of bacteriological parameters and luxuriant growth of the alga *Cladophora* should be ascertained. To explain localized conditions apparently toxic to benthic organisms, possible discharges and/or seepage from the property of Hart Chemicals Limited in Guelph should be investigated and eliminated.

Bacteriological quality of river water in the wading-swimming area on the Upper Speed River in north Guelph should be monitored regularly to insure that bacteriological water quality conforms with the permissible criteria for body contact recreation.

Inadequately treated wastes from the temporary municipal treatment facility at Hespeler should receive more effective chlorination to safeguard public health downstream.

Action should be taken to eliminate waste discharges which discolour the river from at least one of the woollen mills in Hespeler.

Specific studies are required to determine the interrelationships between phosphorus, nitrogen and possibly other nutrients in regulating the production of algae and aquatic macrophytes in the Speed River system. Such studies are mandatory for the establishment of a sound watershed management program on the Speed-Eramosa drainage basin.

Biological Survey of the Speed-Eramosa River

(May & June 1970 and August 1971)

INTRODUCTION

In light of changes in industrial and municipal waste discharges to the Speed River since an earlier biological survey of 1965, a repeat survey in 1970 was deemed useful to illustrate potential changes in benthic and fish communities.

Alterations in industrial waste discharges to the Speed since 1965 include the rerouting of wastes from Hart Chemicals Limited and Fiberglas Canada Limited to the Guelph municipal sanitary sewerage system. Matthews-Wells Limited and Standard Brands Limited have both ceased operations, thus eliminating two major sources of industrial waste discharges to the Speed in Guelph. A municipal plant planned for Hespeler will receive wastes from several industries located there. Treated wastes from Dominion Woollens & Worsted Limited and Stamped & Enamelled Ware Limited are discharged to the river.

Municipalities on the Speed-Eramosa have grown rapidly since 1965 necessitating the construction or expansion of sewage treatment facilities. At Rockwood, a 100,000 g.p.d.contact stabilization OWRC plant has been scheduled for completion in the summer of 1972. The City of Guelph increasedthe design capacity of its conventional secondary plant from 6 to 10 m.g.p.d. in early 1971. Average flow in 1970 was 7.78 m.g.p.d. A quarter of the flow at the Guelph plant will be treated experimentally for phosphorus removal for an 8-week period commencing in October

1971. At Hespeler, construction began this fall on a 2 m.g.p.d. capacity activated sludge plant which is expected to be completed in the fall of 1972. This OWRC-operated plant will replace the septic tank-sand filtration system currently in use at Hespeler. According to OWRC's schedule, phosphorus removal will be incorporated in 1973 at each of these plants.

During May 1970 a biological survey of the Speed-Eramosa River was conducted. Benthos and fish sampling wassupplemented by information on chemical, physical and bacteriological parameters collected in May, June, August and November. In August 1971, an algal bioassay study was conducted at seven of the sixteen stations.

WATER USES

As a result of discussions among representatives of the Grand River Conservation Authority, the Departments of Lands and Forests, Tourism and Information, Agriculture, Health and the Ontario Water Resources Commission, a water use inventory report for the Grand River Basin was prepared in early 1971. From this report, the most obvious uses catalogued for the Speed-Eramosa were abstracted.

Water for livestock watering and irrigation is utilized extensively on the entire Speed-Eramosa system. The use of river water for industrial supply is limited to the textile industry in Hespeler.

Use of the Speed for waste assimilation is of major proportions. The river below Guelph and Hespeler experiences severe demands in this respect and ranks second on a list of eight over-taxed receiving streams in the entire Grand River watershed.

Approximately thirty (30) recreation areas, most of which will be located on the headwaters of the Speed and Eramosa Rivers have been planned for the watershed. Activities will include hiking, picnicking and fishing. In 1954 a total of eighteen (18) cottages had been established on the Eramosa. Sections of both the Speed and Eramosa above Guelph are of major significance for total body contact recreation.

The upper Speed and the Eramosa support the major cold-water sports fishery in the Grand River Basin. The Eramosa subwatershed provides approximately 2,200 man-days of recreational fishing annually, while the Speed River affords roughly five hundred (500) man-days per year. In 1969, the Speed watershed was stocked with 4,380 brook trout by the Department of Lands and Forests.

Waterfowl production and staging areas are present mainly upstream of Guelph, although the Kortright Waterfowl Park at the mouth of Hanlon's Creek below Guelph, is perhaps the best known. Deer yarding areas in the Grand River Basin are concentrated mainly in the Speed-Eramosa watershed. Two deer yards at Everton and Hespeler support a population of about one hundred (100) animals and provide between three hundred (300) to six hundred (600) man-days of hunting recreation annually.

METHODS

Aside from the personnel involved in the survey and the addition of an algae growth potential study in 1971, methods were identical to those employed during a biological survey conducted in 1965 by Owen and Johnson. Sampling sites and timing were also the same.

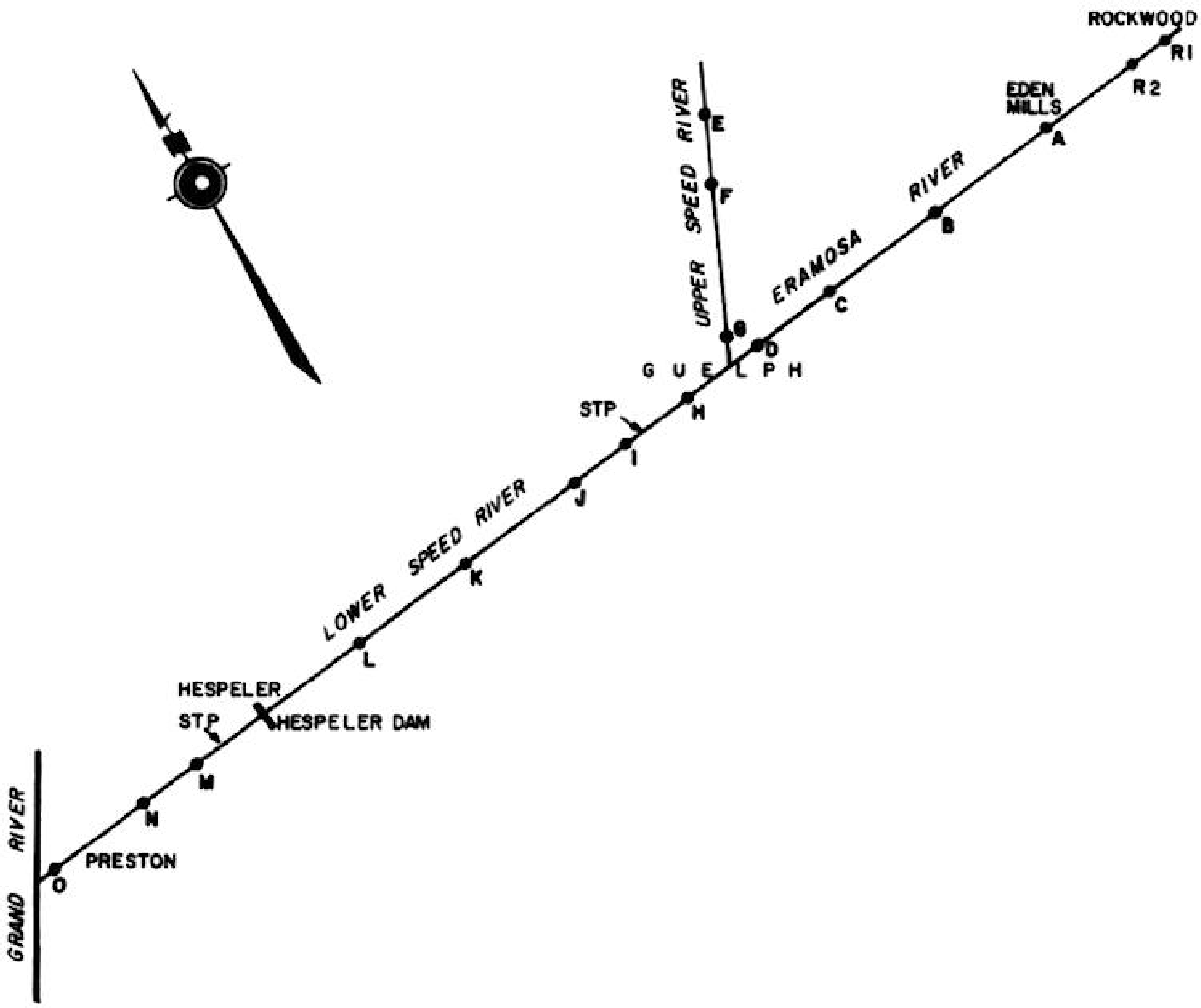

FIGURE 1. Sketch Of Station Locations On The Speed-Eramosa River Watershed. (Scale: 1 inch = 3 miles).

In May, benthic samples were collected at 16 stations (Figure 1) using hand sieves. At each station, two 10-minute timed collections were made and the organisms separated from debris and preserved in 95% ethanol. Samples were returned to the laboratory where they received a somewhat less detailed identification than those collected in 1965. Fish were collected with uniform effort at each station using a 30 ft. bag seine. At each location, observations regarding presence and relative abundance of aquatic vegetation were reported along with remarks on the general appearance and odour of the water.

On June 28 and August 9, diurnal oxygen determinations were conducted at six four-hour intervals at 10 of the sampling sites. Samples for routine chemical analyses were collected on May 27 and November 5. Bacteriological samples for total coliform, fecal coliform and fecal streptococcus determinations were collected on June 7 and 29, July 30 and November 5.

On August 17, 1971, water samples (32 ounce) were collected from seven stations for an algae growth potential study. Samples were kept cool and in the dark during transit to the OWRC Toronto Laboratory. At the laboratory each sample was split into two aliquots and both were inoculated with a culture of *Selenastrum capricornutum*. The inoculum culture and sample preparation were modified from an algal growth potential procedure from P.A.A.P. (1969) and Skulberg (1964, 1966). Numbers (algae cells/ml) were enumerated daily and averaged for each station. The test terminated with cessation of new growth in the flasks.

RESULTS

Bottom Fauna

An inventory of types and numbers of organisms collected from each station during 1970 is listed in Table 1 of the Appendix. A graphic representation of relative numbers and types of organisms collected in 1965 and 1970 is provided in Figure 2.

In general, numbers of organisms collected at all stations in 1970 decreased on the average by 45% below the 1965 mean. However, qualitatively the 1965 and 1970 samples were very similar registering respective averages of 11.4 and 11.5 taxa per station.

At reference stations A and B on the Eramosa and E and F on the Speed, an average of 17 taxa per station was collected. This figure compares favourably with the 20 taxa average for the same stations in 1965. Clean-water forms of stoneflies, mayflies and caddisflies were well represented in each of these well balanced benthic associations. Water was clear and odourless at the four sampling sites although *Cladophora* covered approximately 80% of the riffle at 'A' during the summer.

On the Eramosa River at station C (below Hart Chemicals and the Ontario Reformatory) single specimens of four taxa and three individuals of another were found reflecting toxic conditions. Since the variety and number of organisms found at this station in 1965 had decreased from 11 to 5 and from 75 to 7 respectively, it appeared that water quality documented in the 1965 report as being poor had been further impaired. Down-stream at station D, the benthic association had improved considerably over conditions both upstream at station C and over the situation in 1965. A significant increase in variety (12 taxa) over station C (five taxa) and a marked

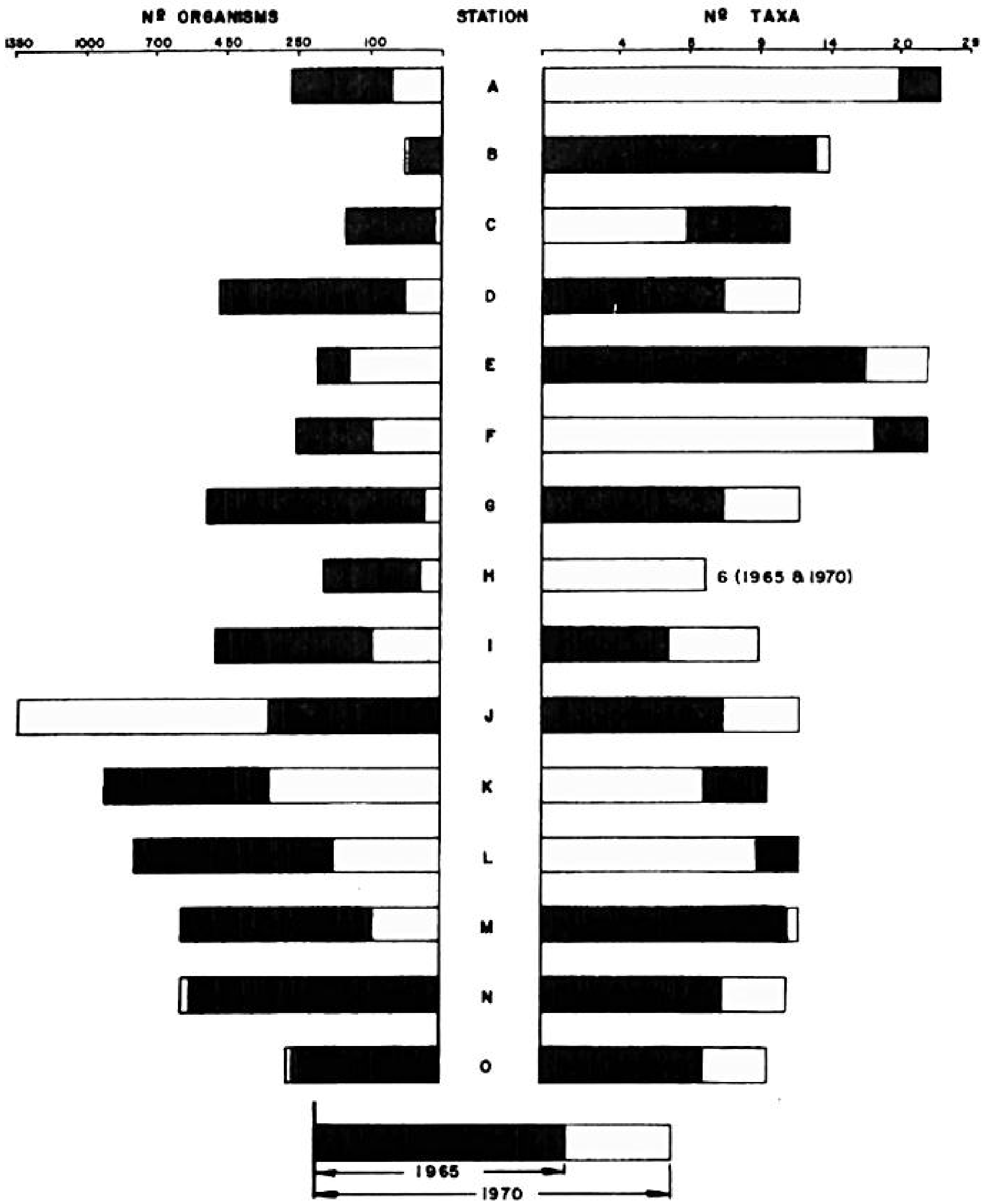

FIGURE 2. Numbers 8 taxa of benthic organisms collected at fifteen stations on the Speed-Eramosa river in may 1965 and may 1970 (methods outlined in text).

decrease in total numbers of organisms (49) compared to 1965 (479), attests to this improvement. Although the association was dominated by a wide variety of tolerant forms, more sensitive mayflies (*Baetis, Ephemerella* and *Leptophlebia*) *were* present and the community imbalance found in 1965 was not evident. Water at both stations C and D was tea-coloured and septic-smelling.

Station G was located within Guelph on the Speed River just above its confluence with the Eramosa. Compared to upstream reference stations E and F where pollution-sensitive forms (stoneflies, mayflies and caddisflies) were abundant, the benthic association at G had been degraded noticeably to 12 taxa and a total of only 20 organisms. However, the presence of some may-flies and caddisflies among the 20 organisms and extreme reductions in numbers of pollution-tolerant midges and sludgeworms which dominated 1965 collections at this site, reflected considerable improvement over the organically-enriched condition found in 1965.

Physically, the water was slightly turbid and the bottom was littered with everything from old tires to baby carriages. At H, diversity was further reduced to only 6 tolerant taxa and a total of 24 organisms indicating degraded water quality within Guelph below the confluence of the two rivers and upstream of the sewage treatment plant. Qualitatively, there was no improvement at this station since 1965 although total numbers were significantly reduced. Water was septic-smelling and turbid.

The river at station I below the Guelph sewage treatment plant became extremely septic-smelling and increasingly turbid with grey heterogeneous suspended matter. Rocks for some distance downstream were tinted orange-red. In response to wastes from the Guelph sewage treatment plant, numbers of bottom organisms began to increase and pollution-tolerant midges and sludgeworms dominated the community of 9 taxa and 93 organisms.

Whereas organic decomposition seemed to peak at station K in 1965, it was most striking in 1970 at station J where 1335 benthic organisms (1300 of which were sludgeworms) were collected. A strong septic odour still emanated from the river and the grey colour persisted in May.

A substantial decrease in numbers of organisms to 321 at station K was evidence of major assimilation of organic wastes between station J and K. From K to L, a further decrease in numbers of organisms and an increase in variety attested to a gradual improvement in water quality. However, recovery was only partial as pollution-tolerant forms (leeches, sludgeworms and midges) predominated and pollution-sensitive forms were found only rarely on the Lower Speed River. To station L the water was slightly turbid and had a slight septic smell. The Hespeler reservoir was choked with aquatic weeds and decomposing algae mats floated on the surface. Gas bubbles from bottom ooze in the reservoir were evidence of the active decomposition occurring some seven miles below the Guelph sewage treatment plant.

At station M below Hespeler, sewage fungus was common and a strong septic odour was present. At the time of benthic sampling, the river was black with dye from one of the woollen mills as was the case in 1965 when the river was red. Pollution-tolerant sludgeworms and midges predominated in the association of 94 organisms. A mile downstream at station N, the decomposition of municipal and industrial wastes from Hespeler appeared most active. As indicated by a major increase in numbers of benthic organisms to 599 (mainly tolerant sludgeworms, midges and leeches) the river was significantly enriched below Hespeler not at all unlike the situation in 1965.

Aquatic weeds choked the river from Hespeler to its mouth at Preston (Station O) where a reduction in numbers of benthic organisms to 254 indicated a limited degree of assimilation of wastes from Hespeler.

Fish

An inventory of fish collected from the sixteen sampling sites in 1970 is listed in Table II of the Appendix. Figure 3 illustrates numbers of taxa and total numbers of fish collected at each station in 1965 and 1970.

Fish associations at each station in 1970 were very similar to those recorded in 1965. Differences in variety and numbers of fish netted were not substantial among stations A through F although trout were taken only from the uppermost sampling sites (R2, A, B) on the Eramosa. As was the case in 1965, a sharp increase in numbers of fish at station G was followed by a steady decrease in both variety and numbers to an alarming low at station J about a quarter mile below the Guelph sewage plant. At this location, no fish were found in 1970. Although some qualitative recovery was evident to Hespeler, numbers were extremely low from the Guelph sewage treatment plant to Hespeler.

The population was further depressed both qualitatively and quantitatively at station N below Hespeler to the same extent in both 1965 and 1970. Greater diversity occurred at Station O in both years.

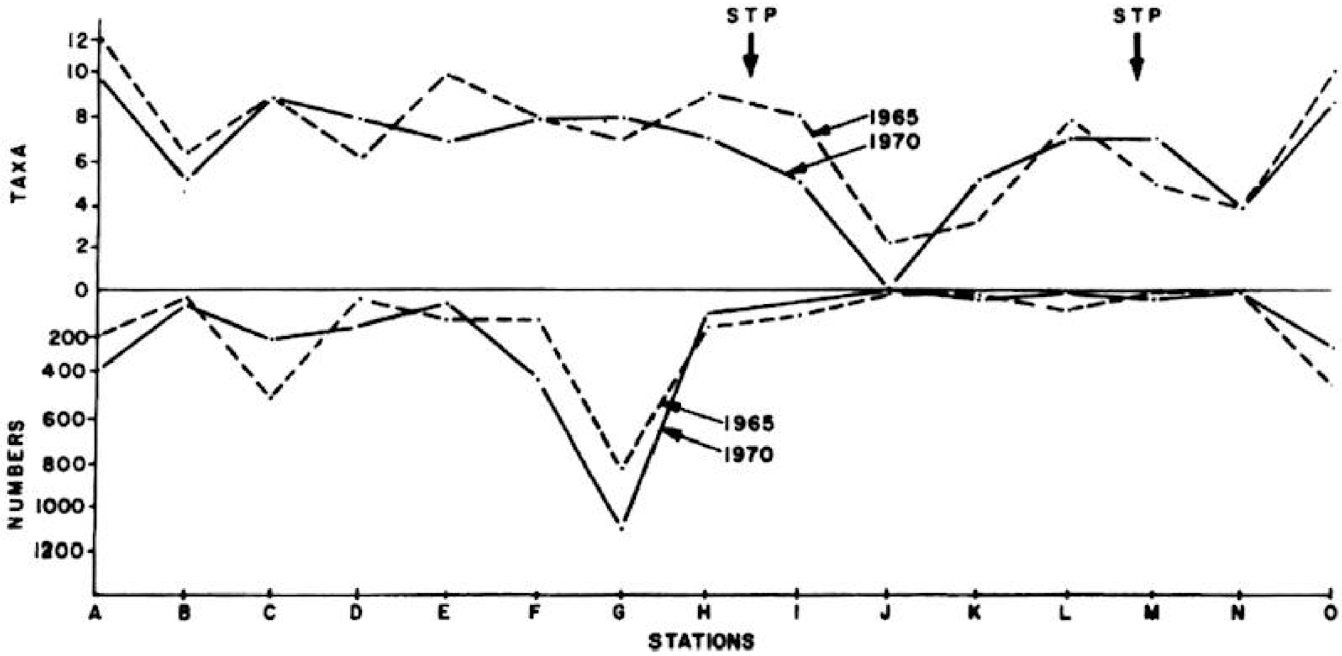

FIGURE 3. Comparative numbers of individuals and taxa of fish collected at 15 sampling sites on the Speed - Eramosa River in May 1965 and May 1970.

Bacteriological Analyses

Results of bacteriological analyses are illustrated in Table I of the text.

Upstream of Eden Mills on the Eramosa, levels of total coliform, fecal streptococcus and fecal coliform bacteria were low with the exception of the July 30 run at which time numbers at all stations were somewhat higher. At station A below Eden Mills, coliform and streptococcus concentrations increased noticeably and during the July 30 run all three parameters exceeded OWRC objectives for public surface water supplies. At station C bacteriological quality of the water was impaired by some nearby upstream source. At station D near the mouth of the Eramosa, bacteriological quality similar to that upstream of Eden Mills was restored.

Samples were collected from a wading and swimming area on the Upper Speed within the northern limits of Guelph just below station F. Although sampling frequency was inadequate, on each sampling period levels of fecal streptococci equalled or surpassed the 20 organisms per ml. concentration at which water is considered impaired for body contact recreational activities by OWRC criteria. For most other uses, water was of good bacteriological quality at this location and was comparable in quality to the Eramosa above Eden Mills. Bacteriological contamination within Guelph at station H was not evident.

On the Lower Speed River below the Guelph sewage treatment plant heavy chlorination resulted in a complete elimination of fecal coliform and fecal streptococcus bacteria on three of the four sampling periods. However, on the July 30 run, severe bacteriological contamination was evident with a total of 10 million coliform organisms per ml., 1.1 million fecal coliforms and 100,000 fecal streptococcus organisms per ml. At station J and L downstream, conditions gradually improved.

Table 1. Results of bacteriological determinations on samples collected at 13 stations on the Speed-Eramosa River during June, July and November, 1970. (results per 100 ml).

STATION	JUNE 7			JUNE 29			JULY 30			NOVEMBER 5		
	Total Coli.	Fecal Coli.	Fecal Strep.	Total Coli.	Fecal Coli.	Fecal Strep.	Total Coli.	Fecal Coli.	Fecal Strep.	Total Coli.	Fecal Coli.	Fecal Strep.
R 1	400	84	46	460	164	158	6600	240	960	80	<4	48
R 2	800	40	52	310	72	36	5100	320	320	76	<4	12
R 3	100	8	8	340	80	62	2700	404	520	196	<4	132
A		-No sample-		290	152	120	6400	3600	1200	188	8	20
C	480	80	24	1500	168	100	5100	2000	1600	3300	100	8
D		No sample-		380	36	138	7200	20	16	1100	12	12
F	210	48	20	410	184	140	348	48	60	140	20	28
H	1200	88	22	0	12	50	2600	40	236	1600	52	24
I	12	0	0	140	0	0	10 M	1.1M	100,000	0	0	0
J	810	800	500	460	344	224	18,000	1400	2400	2500	700	256
L	14,000	76	14	330	120	74	1,000	16	300	244	4	12
M	30,000	TNTC*	TNTC*	740,000	TNTC	TNTC	290,000	76,000	34,000	32,000	1.3M	670,000
N	930	96	34	360	272	76	3,300	400	132	1,500	116	64
O	2,800	252	134	1,100	240	72	2,500	480	280	5,400	280	524

* TNTC - Too numerous to count < - Less than M - Million

Bacteriological contamination below Hespeler at station M was extremely serious with levels of both focal coliforms and fecal streptococci too numerous to count during two of the four sampling periods. Recovery to conditions similar to those upstream of Hespeler were recorded at station N. A small but discernible decrease in bacteriological quality in the Lower Speed was evident at Station O below Preston.

Chemical Characteristics

Results of chemical analyses on water samples collected at the 16 stations are provided in Table 2 of the text. At most stations, samples were collected at only two intervals (May and November) although at three locations (H, J, M) year-round monitoring results from the Water Quality Surveys Branch were included in the averages. It is realized that sampling frequency at most stations is inadequate to allow accurate interpretation of the results and only general comments are made.

In general, most parameters indicated a gradual increase in concentration from stations upstream of Guelph to station H immediately above the Guelph sewage treatment plant. No significant alterations in water quality were indicated by the data to this point. Below the waste treatment facility (station I) a six-fold increase in inorganic nitrogen and twenty and fifty-fold increases in total and soluble phosphorus concentrations respectively were of most significance. Most other parameters increased markedly indicating the impact of wastes from Guelph on the chemical quality of the river.

Between Guelph and Hespeler, concentrations of most parameters gradually decreased but at no locations did nutrient or B.O.D. concentrations even approximate levels upstream of the Guelph sewage treatment plant.

Table 2. Results of chemical analyses on water samples collected at sixteen stations on the Speed-Eramosa River in 1970. (All results except pH and conductivity in ppm).

Station	Times Sampled	BOD	Solids		Conductivity	Nitrogen		Phosphorus		pH
			Tot.	Susp.	(µmho)	TKN	Inorganic	Tot.	Sol.	
R2	2	0.9	344	<15	485	0.54	0.436	0.028	0.009	8.2
A	1	<0.5	320	<15	491	0.46	0.646	0.030	0.009	8.2
B	2	0.5	344	<15	503	0.50	0.570	0.020	0.007	8.2
C	2	1.8	362	<15	535	0.62	0.622	0.028	0.009	8.2
D	2	1.1	364	<15	525	0.56	0.607	0.024	0.009	8.2
E	1	<0.5	300	<15	426	0.55	0.339	0.032	0.013	8.3
F	1	<0.5	300	<15	426	0.63	0.350	0.029	0.012	8.3
G	2	1.4	357	<15	481	0.57	0.535	0.037	0.014	8.3
H	9*	1.6	367	15	538	0.71	0.508	0.044	0.013	8.3
I	2	10.5	528	15	727	4.60	3.27	0.92	0.64	8.0
J	13*	4.7	431	15	640	2.15	2.29	0.33	0.20	8.2
K	2	5.3	415	<15	546	0.88	1.24	0.24	0.17	8.1
L	2	3.7	449	33	544	2.10	1.04	0.53	0.17	7.9
M	15*	8.5	523	<15	803	2.60	2.35	0.68	0.44	8.2
N	2	4.2	404	<15	605	0.82	1.13	0.23	0.14	8.1
O	2	4.2	424	15	566	0.91	1.22	0.30	0.18	8.1

* Data includes results of year-round monitoring by Water Quality Surveys Branch in 1970.

< - Less then

At station M below the Hespeler waste treatment facility chemical quality of the river was further deteriorated by significant increases in B.O.D., conductivity and nutrient concentrations. Slight elevations in nutrient levels were detected below Preston.

Dissolved Oxygen

To illustrate the effect of increased nutrient loadings to the river, diurnal dissolved oxygen curves (Figure 4) were prepared for ten stations and were complemented by observations on the occurrence of aquatic weeds and periphyton. For information during low-flow conditions, oxygen determinations on a 24-hour basis were conducted on August 9.

At stations R1 and R2 on the Eramosa near Rockwood, oxygen concentrations were relatively stable throughout the day, with day and night levels differing by a maximum of only 2 ppm. Although suitable substrate was common, periphyton growth was very sparse. Further downstream at station C on the Eramosa, green slime and sewage fungus was present and oxygen levels ranged from 7 to 12 ppm over 24 hours, indicative of an increase in biological activity.

At station H just above the Guelph S.T.P. the gap between maximum and minimum dissolved oxygen levels on August 9 widened to 7 ppm although the minimum concentration did not become critical. Periphyton (*Cladophora*) was found on all of the larger stones occupying roughly 40% of the streambed. Lack of suitable substrate rather than inadequate nutrient levels likely limited the abundance of *Cladophora* at this location.

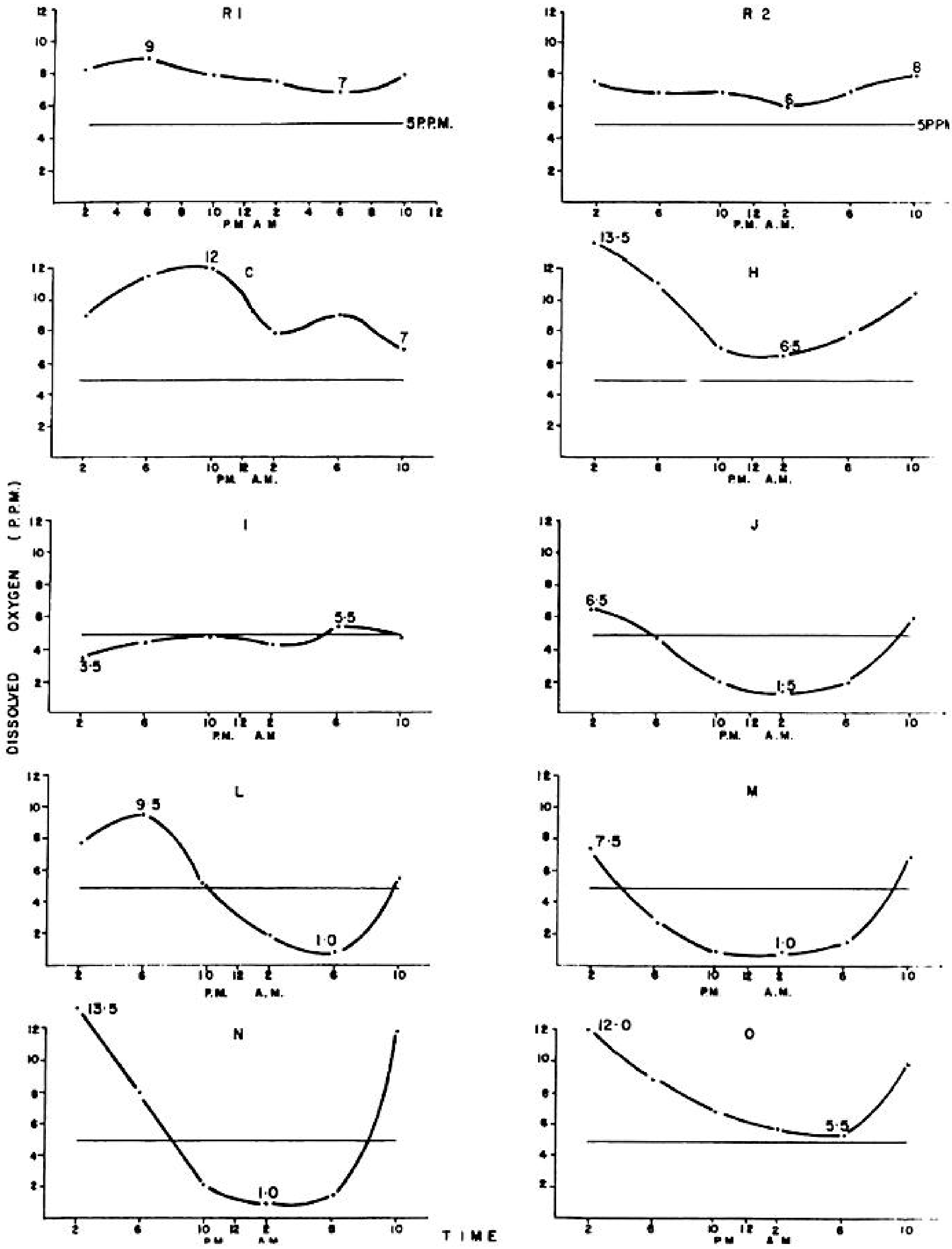

FIGURE 4. Diurnal oxygen curves at 10 stations on the Speed-Eramosa River (August 9, 1970).

Average nutrient concentrations from nine sampling intervals in 1970 were 0.013 ppm soluble P and 0.508 ppm soluble N.

Oxygen levels at station I immediately below the Guelph S.T.P. were severely depressed and varied between 3.5 to 5.5 ppm throughout the 24 hour sampling period. Although *Cladophora* growth covered roughly 70% of the bottom, biological activity appeared inhibited as indicated by the narrow range in day and night-time oxygen levels, likely the result of heavy chlorination at this point. About ¼-mile downstream at J, dissolved oxygen levels ranged from 6.5 ppm at 2 p.m. to 1.5 at 2 a.m. For at least half the day, oxygen concentrations were below the critical 5 ppm figure partially explaining the absence of fish life. *Cladophora* in May gave way to heavy aquatic weed growth which covered 100% of the riverbed in July and August.

At stations M and N below Hespeler, diurnal oxygen variations increased with night-time lows sinking to 1 or 2 ppm for as long as eight hours and daytime peaks reaching 7.5 and 13.5 ppm respectively. Decomposition appeared most active at station N where a wide range in maximum and minimum dissolved oxygen of 12.5 ppm occurred. Aquatic weeds choked the river from Hespeler to the Grand River although at Station O at Preston, night-time respiration and organic decomposition did not reduce dissolved oxygen levels below 5.5 ppm.

Algae Growth Potential

Results of growth potential experiments with *S. capricornutum* are illustrated in Figures 5, 6 and 7. Growth at each station is summarized in Table 3 of the text while precise numbers of cells per millilitre for each station and date are found in Table III of the Appendix.

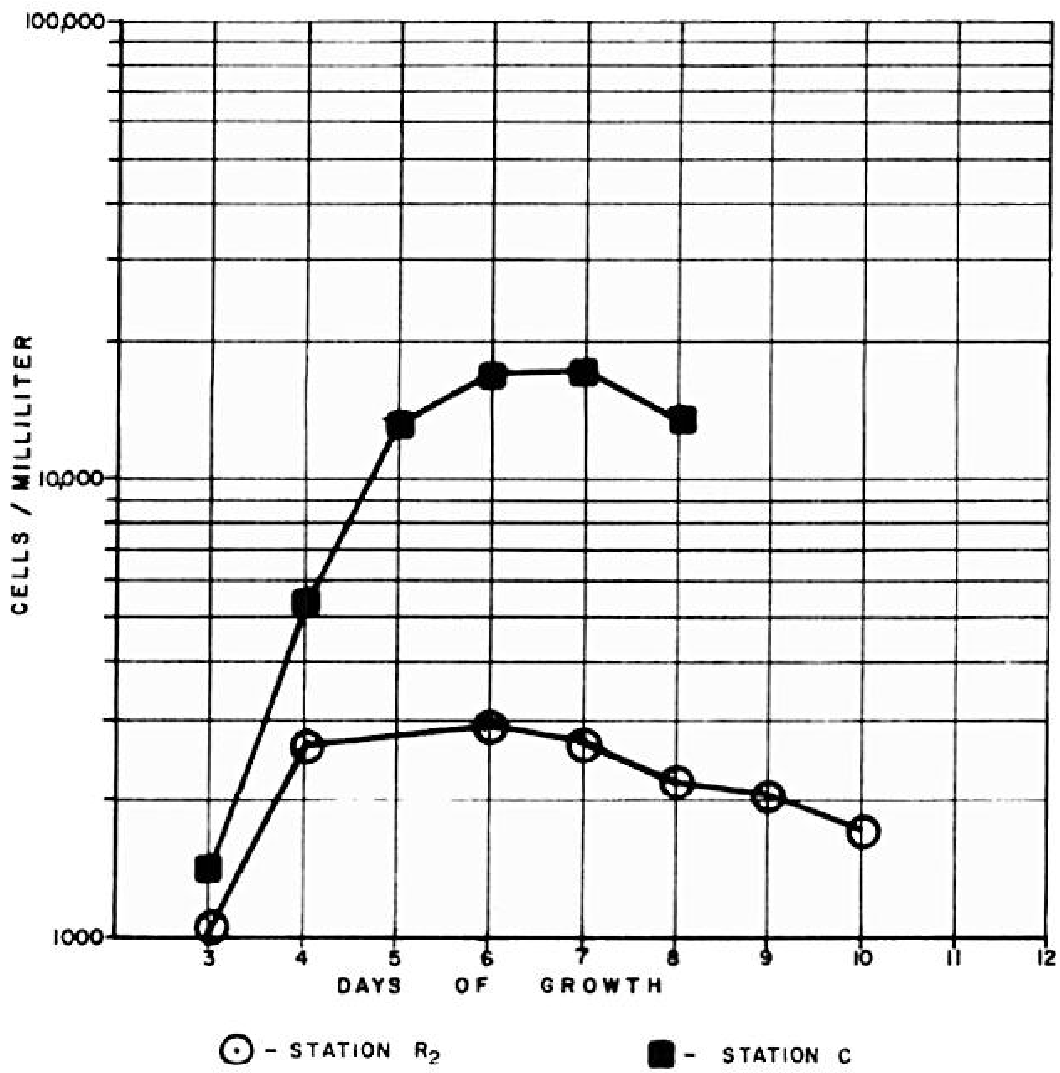

FIGURE 5. Semi-logarithmic plot of the growth of *Selenastrum capricornutum* at Stations R2 and C on the Eramosa River. Curves are comprised of the mean of two water samples.

Table 3. Numerical values for area under the curve of *Selenastrum capricornutum* growth at stations R_2, C, E, G, H, J and N.

Station	Area	Experiment Duration	Area/Day
R2	464	7	66.3
H	529	7	75.6
G	752	6	125.3
E	2,916	7	416.6
C	2,671	5	534.2
J	293,108	13	22,546.8
N	610,100	12	50,836.2

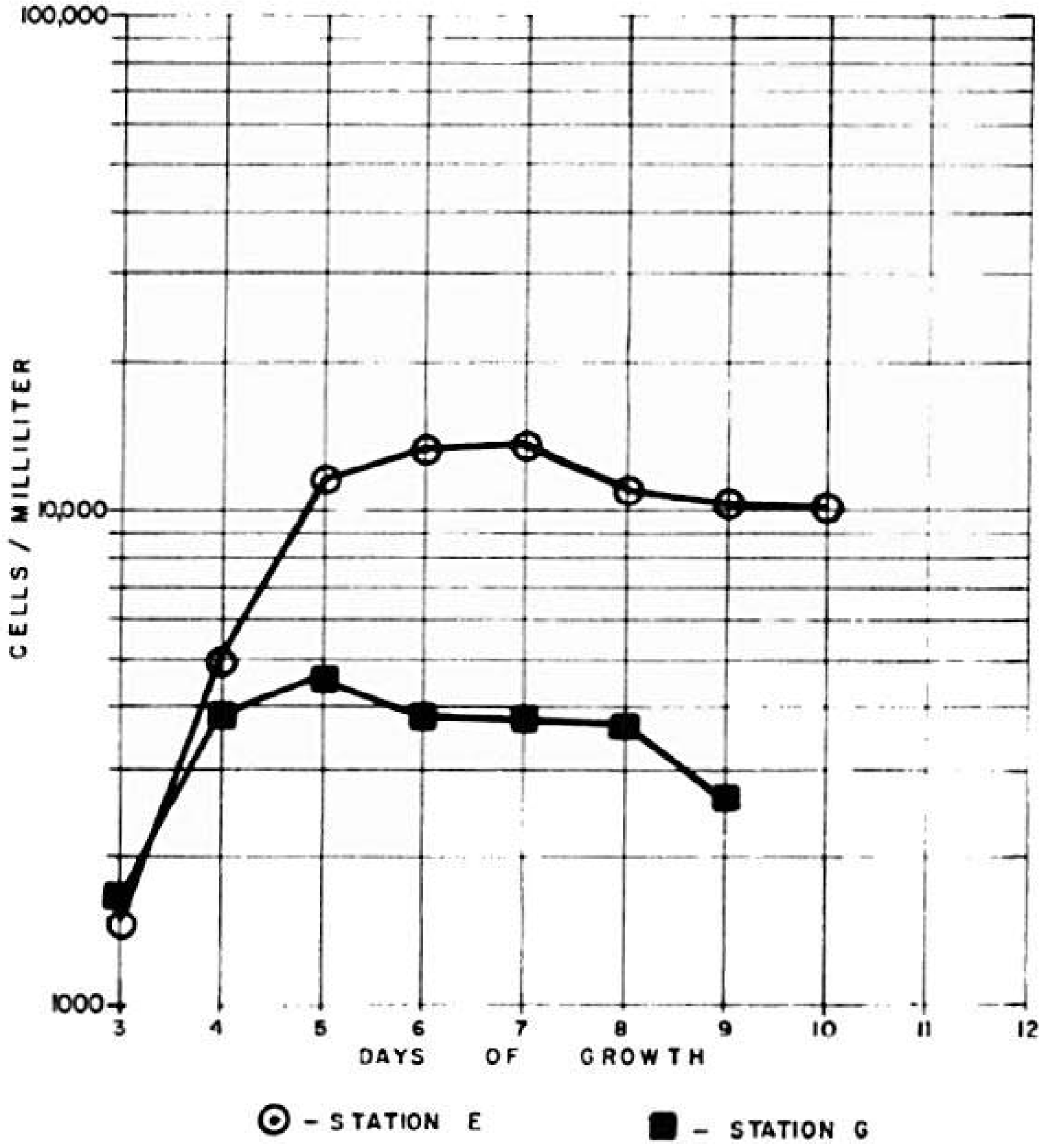

FIGURE 6. Semi-logarithmic plot of the growth of *Selenastrum apricornutum* at Stations E and G on the Upper Speed River. Curves are comprised of the mean of two water samples.

Growth potential of the Eramosa River is represented in Figure 5. Station R2, located immediately below the Rockwood Reservoir, was characterized by the lowest potential for growth of all analyzed samples. The low growth potential at R2 reflected the nature of the drainage basin which, flowing through marsh and wooded areas was subjected to low natural nutrient inputs. At station C a substantial increase in growth potential was evident in response to nutrient gaining access to the river between stations R2 and C.

Station E on the Upper Speed River was characterized by a higher growth potential than downstream station G (Figure 6). This growth pattern was related to the influx of nutrients from agricultural runoff above station E.

Growth potential for *S. capricornutum* in waters from the Lower Speed River are graphically presented in Figure 7. Station H possessed the second lowest potential for growth of all analyzed samples and may reflect a toxic effect due to waste products from the Guelph area. Station J, located approximately one mile downstream from the Guelph sewage treatment plant, possessed the second highest growth potential in this survey. The large increase was a direct result of nutrient input from the recently enlarged Guelph sewage treatment plant. The gradual slope of the growth curve indicates that a toxic effect from the plant was influencing algal growth (Matulova 1967, Middlebrook *et al* 1971). Station N was characterized by the highest growth potential which was largely the result of high nutrient inputs from Guelph and from the domestic waste influx from Hespeler. The slope of the growth curve at station N indicated that the toxic effect detected at station J had been substantially reduced.

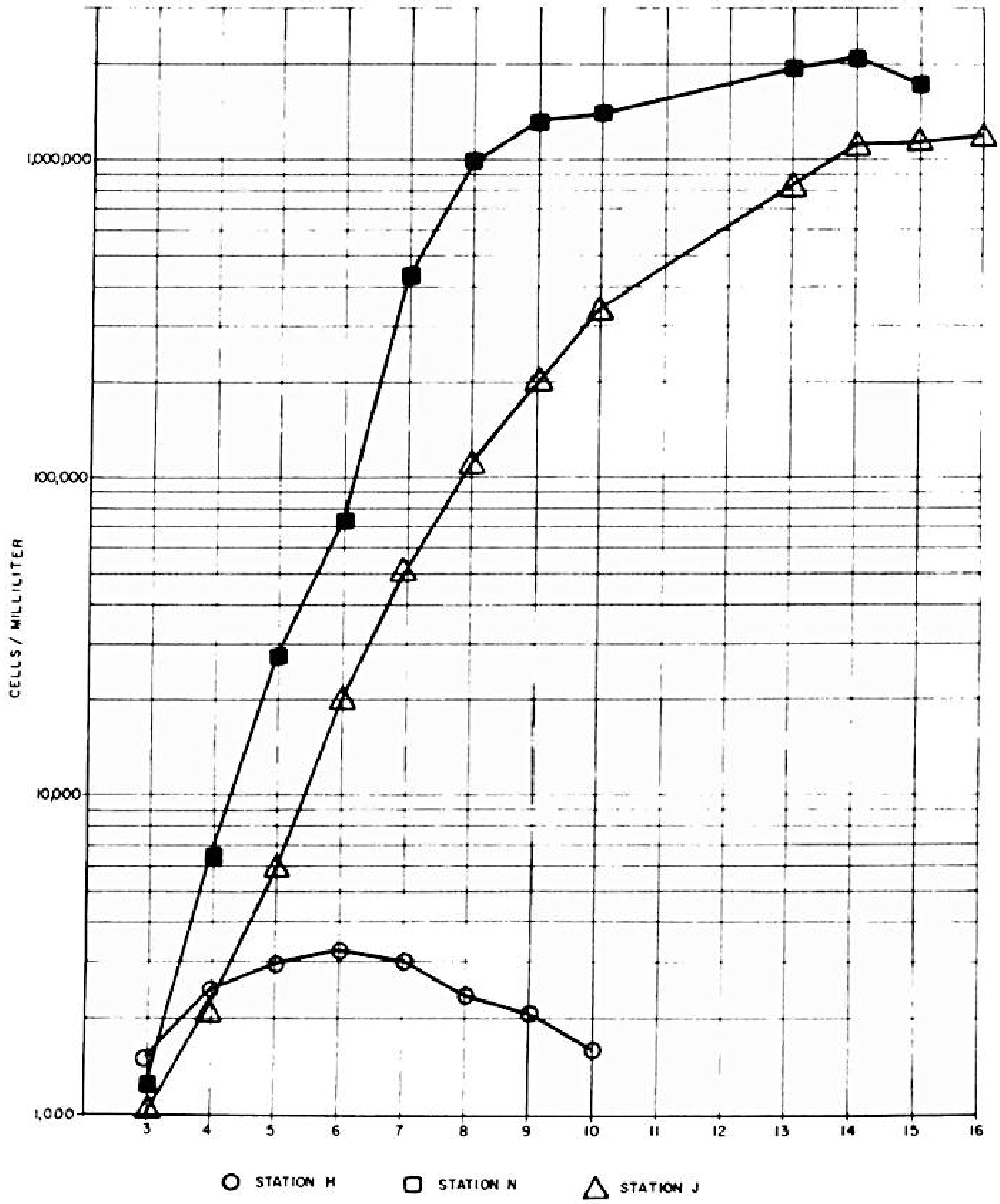

FIGURE 7. Semi-logarithmic plot of the growth of *Selenastrum capricornutum* at Stations H, J and N on the Lower Speed River. Curves are comprised of the mean of two water samples.

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Messrs Chaplin and Morgenroth, summer students, provided assistance in the field.

APPENDIX

Table I - Bottom fauna collected at sixteen stations on the Speed-Eramosa River, May 1970. (Results of two 10-minute qualitative samples per station).

Table II - Species and numbers of fish collected on the Speed-Eramosa River, May 1970. (Methods outlined in the text).

Table III - Numbers of cells per ml of *Selenastrum capricornutum* in incubated water from seven stations on the Speed-Eramosa River, August 1971.
(All values are comprised of a mean of two water samples).

Table I. Bottom fauna collected at 16 stations on the Speed-Eramosa River May 1970. (Results of two 10-minute qualitative samples per station) Samples are designated 70B2-1 through 32 inclusive in the permanent collection in Toronto.

	STATIONS															
ORGANISMS	R	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
STONEFLIES (unident)		3	1			1	3									
MAYFLIES (unident)		5					2									
Baetis	2	1			1		2		1	3	2					1
Caenis	1		1			1	1	1								
Epeorus		2														
Ephemerella		7	2	1	2	5	8									
Heptagenia		4					1									
Leptophlebia				1	1		4	1								
Paraleptophlebia	1	9	6				4									
Stenonema		3	2			3	5	2								
DOBSONFLIES			1													
CADDISFLIES (unident)						1	1									
Chimarra							1	1								
Cheumatopsyche	1	5	8			3	9	1								
Helicopsyche	10					33	27							2		
Hydropsyche		3	3													
Neureclipsis			1													
unident pupae	2	7	4			27	11	1								
DRAGONFLIES		1			2									1		
DAMSELFLIES				3	9	15		1		1	1	6	27	2	13	20
BUGS		1				10										

Table 1 - Continued

ORGANISMS	R	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
BEETLES																
Elmidae	1	2	3		1	1	2				1				6	
Pspheniidae		1				5	3				1			1	2	
Unident. adults	1	3	2		1	2		1				1		1	4	
DIPTERA (unident)		2	3						1							
Chironomidae	17	3	6		5	21	7	5	19	57	20	21	9	17	49	96
pupae	1		1		2						2			15		
Simuliidae												1				
MITES		1							1	2						
CRAYFISH																
Orconectes propinquus		3	3			4	1	2			1		1	1		1
Cambarus robustus			1			1										
AMPHIPODS																
Crangonyx													1		7	11
Hyallela azteca					1					2			3	13	69	16
LEECHES(unident)						1		2		2	2	6	1	2	18	9
SNAILS (unident)							1									
Campeloma														1		
Gyraulus					1					1					2	1
Ferissia								1			1		1			
Helisoma				1		1										
Physa				1	21				1	1	1			1	3	1
Valvata tricarinata					1						1			1	43	

Table 1 - continued

ORGANISMS	R	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
CLAMS																
Pisidium		1									2					
Sphaerium						1										
WORMS																
Lumbriculidae	1	1														
Tubificidae					1			1	1	24	1300	286	128	36	383	98
Branchiura sowerbyi													2			
1970 - NO. TAXA	8	20	14	5	12	17	18	12	6	9	12	6	9	12	11	10
NO. ORGANISMS	38	68	48	7	49	136	93	20	24	93	1335	321	173	94	599	254
1965 - NO. TAXA		24	13	11	7	23	23	7	6	4	7	10	12	11	7	6
NO. ORGANISMS		268	43	148	479	210	252	514	189	489	321	913	776	595	575	263

Table II. Species and numbers of fish collected on the Speed-Eramosa River, May 1970. (Methods outlined in report).

Species	R2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
White sucker	6	62		13	54	1	45	109	36	4		13		8	1	7
Hog sucker		6	1				2									
Fathead minnow														1		
Bluntnose minnow	49	105		2	8	17	18	57	8	3				7		
Common shiner	356	88	22	161	51	35	211	857	44	2				7	1	212
Golden shiner													3	2		
Creek chub		58	10	3	15	10	72	17	3	2			1	5	3	1
Hornyhead chub	1	36	11	3												
Brown bullhead												1	P		2	P
Brook stickleback				23	17		35	1				1	2			1
Rock bass				6					1			2				
Pumpkinseed													P			3
Smallmouth bass				3	6	1							4			P
Brassy minnow	4				1			1								
Rainbow darter		2	10													
Fantail darter						3	1									
Blackside darter		2														
Johnny darter		5		1	7			16	2							
Mottled sculpin							3									
Carp												11	P			P
Redbelly dace	13	2														
Blacknose dace						6		35	16	24				2		
Longnose dace																1
Brook trout	1															
Total Species	7	10	5	9	8	7	8	8	7	5	0	5	7	7	4	9
Total No. of Fish	430	356	54	215	184	73	387	1093	110	35	0	28	10	32	7	225

Table III. Numbers of cells/milliliter of *Selenastrum capricornutum* in incubated water from seven stations on the Speed-Eramosa River, August 1971. (All values are comprised of a mean of two water samples).

	STATION						
DAY	R2	C	E	G	H	J	N
1							
2							
3	926	1320	1487	1681	1577	519	1,211
4	2672	5146	5043	3841	2508	2,202	6,586
5		12581	11355	4503	2977	5,815	24,781
6	2941	16281	13215	3812	3344	18,979	72,521
7	2699	16058	13667	3815	3003	48,142	436,729
8	2177	12477	10646	3817	2355	106,698	985,250
9	2049		10081	2710	2161	193,535	1,310,250
10	1694		9936	2661	1581	348,164	1,360,345
11							
12							
13						784,697	1,901,675
14						1,164,500	1,866,500
15						1,141,500	1,763,698
16							1,749,750
17							
18							