CLXXXVII. THE DIURNAL VARIATION OF THE GASEOUS CONSTITUENTS OF RIVER WATERS. PART II.

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THE work described in Part I [1927] in connection with the diurnal variation of the gaseous constituents of river waters has been continued throughout the summer of 1927, and the following experiments over periods of 24 hours have now been performed.

<i>River Lark.</i>	Series	I. March 30th-31st
	„	II. April 27th-28th
	„	III. May 18th-19th
	„	IV. June 28th-29th
	„	IV <i>a.</i> June 30th
	„	V. August 4th-5th

<i>River Itchen.</i>	Series	I. April 6th-7th
	„	II. May 4th-5th
	„	III. May 31st-June 1st
	„	IV. July 5th-6th
	„	V. July 27th-28th

The results obtained in March and April on the River Lark and in April and May on the River Itchen have been given and discussed in Part I, while the remainder are here tabulated as follows:

Table	VI. River Lark.	May 18th-19th.	Fig. 5
„	VII. „	June 28th-29th.	„ 6
„	VII (a).	June 30th.	
„	VIII. „	August 4th-5th.	„ 7
„	IX. River Itchen.	May 31st-June 1st.	„ 8
„	X. „	July 5th-6th.	„ 9
„	XI. „	July 27th-28th.	„ 10

The times and values of the maxima and minima of the gaseous constituents on the River Lark are tabulated in Table XII, together with a summary of the weather conditions and river vegetation on the dates of the experiments.

Table VI. *River Lark. May 18th-19th, 1927. Series III.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	pH value	Remarks
6 p.m.	15.0	1.696	165	0.01-0.015	8.0	Bright sun. Floating diatoms
7 "	14.5	1.567	151	0.01-0.015	8.0	Dull. Floating diatoms
8 "	14.25	1.451	139	0.01-0.015	8.0	Light failing
9 "	14.0	1.255	119.5	0.01-0.015	7.9-8.0	Dusk
10 "	13.4	1.099	104	0.01-0.015	7.8	Fine. Dark. Clear
11 "	13.2	0.977	92	0.015	7.7	Full moon rising. Fine
Midnight	13.0	0.824	77	0.015	7.6	Moonlight. Fine
1 a.m.	12.6	0.744	69	0.02	7.5-7.6	" "
2 "	12.1	0.675	61	0.02-0.03	7.5-7.6	" "
3 "	11.75	0.631	57	0.02-0.03	7.5	Sky lightening. Cloudy
4 "	11.6	0.519	47	0.08	7.5	Dull. Misty
5 "	11.0	0.419	37	0.16	7.5	Cloudy. Misty
6 "	11.0	0.407	36	0.16-0.18	7.5	Cloudy
7 "	10.8	0.431	38	0.16-0.18	7.5	Dull
8 "	10.8	0.448	40	0.16-0.18	7.6	Sun breaking through clouds
9 "	11.25	0.550	49	0.16-0.18	7.6	Bright sun
10 "	12.0	0.681	62	0.2	7.6	" "
11 "	12.0	0.894	81	0.18-0.2	7.6-7.7	" "
Midday	13.8	1.053	100	0.18-0.2	7.7	" "
1 p.m.	14.0	1.345	128	0.16	7.8-7.9	" "
2 "	14.6	1.569	151	0.08	7.8-7.9	" "
3 "	14.6	1.734	167	0.04	7.9-8.0	" "
4 "	15.0	1.851	180	0.03	8.0	" "
5 "	15.4	1.844	181	0.02	8.0	Cooler. Bright
6 "	15.2	1.822	177	0.01-0.015	8.0	" "

Sunset May 18th, 7.48 p.m.

Sunrise " 19th, 4.4 a.m.

Table VII. *River Lark. June 28th-29th, 1927. Series IV.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	pH value	Remarks
10 a.m.	12.6	0.618	57	0.16	7.5-7.6	Dull. Cloudy. Drizzle
11 "	12.75	0.682	63	0.12-0.13	7.6	" " "
Midday	13.2	0.828	77	0.07-0.08	7.6	" " "
1 p.m.	13.4	0.906	85	0.04	7.7	" " "
2 "	14.2	1.033	98	0.025-0.03	7.7-7.8	Sun through
3 "	14.5	1.140	110	0.015	7.8	" "
4 "	14.3	1.153	111	0.015	7.8-7.9	Heavy rain. Dull
5 "	14.25	1.103	106	0.015	7.9	Drizzle. Rainstorm
6 "	14.2	1.063	102	0.01-0.015	7.9	Dull. Cloudy
7 "	14.1	1.073	102	0.01-0.015	7.9-8.0	" "
8 "	13.8	1.033	98	0.01	7.9	Sunset
9 "	13.7	0.963	91	0.01-0.015	7.9	Dusk
10 "	13.5	0.886	84	0.01-0.015	7.8	Almost dark
11 "	13.5	0.824	78	0.01-0.015	7.7	Dark. Raining
Midnight	13.4	0.786	74	0.01-0.015	7.6-7.7	Clearer
1 a.m.	13.4	0.744	70	0.015	7.6	Fine. Cloudy
2 "	13.1	0.688	64	0.015-0.02	7.5-7.6	Sky just lightening
3 "	13.0	0.604	56	0.04	7.5	Light. Cloudy
4 "	12.8	0.489	45	0.08	7.5	Cloudy
5 "	12.8	0.427	40	0.13	7.4-7.5	Sun up
6 "	12.75	0.399	37	0.16	7.4-7.5	Sun through. Fine. Eclipse
7 "	12.75	0.420	39	0.16	7.4-7.5	Rain. Dull
8 "	12.7	0.482	45	0.16-0.18	7.4-7.5	" "
9 "	12.7	0.514	48	0.18	7.5	Drizzle. Dull
10 "	13.1	0.590	55	0.16	7.5-7.6	Dull. Fine

Sunset June 28th, 8.21 p.m.

Sunrise " 29th, 3.45 a.m.

Sunset " 29th, 8.21 p.m.

Table VII (a). *River Lark. June 30th, 1927. Series IVa.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% saturation of dissolved oxygen	Remarks
2 p.m.	15.3	0.93	91	Afternoon considerably more sunny than that of June 29th
3 "	15.4	1.004	98	
4 "	15.7	1.063	105	
5 "	15.9	1.114	110	
6 "	16.2	1.093	108	
7 "	15.9	1.091	108	
8 "	15.6	1.051	103

Fig. 5.

Table VIII. *River Lark. August 4th-5th, 1927. Series V.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	pH value	Remarks
9 a.m.	16.25	0.579	58	0.01	7.5-7.6	Bright sun after bright morning
10 "	16.3	0.654	65	0.01	7.6-7.7	Bright sun
11 "	16.65	0.801	80	0.01-0.015	7.8	"
Midday	17.6	0.971	99	0.015-0.02	7.9	"
1 p.m.	17.9	1.079	111	0.015-0.02	8.0	Cloudy. Occasional sun
2 "	18.0	1.171	121	0.015-0.02	8.0-8.2	Cloudy. Water level falling rapidly. Mill stopped just before 2 p.m. and level rose again
3 "	18.1	1.148	118	0.015-0.02	8.0-8.2	Cloudy
4 "	18.2	1.174	121	0.015-0.02	8.0-8.2	Less cloud
5 "	18.4	1.197	124	0.015	8.0-8.2	Clear. Sunny
6 "	18.2	1.162	120	0.01-0.015	8.0-8.2	Sunny
7 "	17.85	1.060	109	0.01	8.0-8.2	Sun setting
8 "	17.6	1.038	106	0.01	8.0	Dusk. Fine
9 "	17.1	0.990	100	0.01	8.0	
10 "	16.9	0.891	90	0.01	7.8-7.9	
11 "	16.8	0.819	83	0.01	7.8	Clear
Midnight	16.8	0.772	77	0.01	7.7-7.8	"
1 a.m.	16.35	0.708	71	0.01	7.7-7.8	Fine
2 "	16.2	0.678	67	0.01	7.6-7.7	Sky just lightening
3 "	16.1	0.603	60	0.01	7.6	Dawn
4 "	15.9	0.534	53	0.01	7.5-7.6	Daylight. Fine
5 "	15.8	0.493	49	0.01	7.5	Misty
6 "	15.8	0.458	45	0.01	7.5	"
7 "	15.7	0.428	42	0.01	7.5	"
8 "	15.8	0.442	44	0.01	7.5	Dull
9 "	16.1	0.528	53	0.01	7.5-7.6	Sunshine

Sunset August 4th, 7.45 p.m.
 Sunrise " 5th, 4.28 a.m.
 Sunset " 5th, 7.43 p.m.

Oxygen curves.

The oxygen curves of May, June and August are in general similar to those obtained in March and April, although the times of the maximum and minimum values vary to a certain extent.

One noticeable feature of the oxygen curves (R. Lark) is the progressive shortening of the period of minimum of oxygen from March (6 hours) and April (3 hours) to May (2 hours), while July and August give a single minimum value. These differences may be accounted for by the variation of the duration of the periods of darkness at the different dates.

Confirmatory results were not obtained on the Itchen since consistent small irregularities of samples were caused by the turbulence of this stream.

The time of the increase from the minimum value does not appear to be influenced by the time of sunrise so much as by the meteorological conditions.

It would appear that the current weather conditions have a considerable effect upon the times of the maximum and minimum values, and the results of an experiment performed during Series IV *a* on the River Lark bear out this point: on June 29th, after a dull day with intermittent rain, the maximum

oxygen values (111 %, 110 %) were obtained at 3 and 4 p.m., whereas on the following day, June 30th, after an afternoon considerably more sunny than that of the previous day, the maximum values (110 %, 108 %, 108 %) were obtained from 5-7 p.m.

Fig. 6.

Considerable differences were noted in the maximum values of dissolved oxygen obtained on the River Lark; the March, April and May maxima were respectively 157, 178, and 181 % of saturation, and it is difficult at this stage to assign these differences definitely to the effects of either different actinic conditions or different conditions of plant life. The June and August maxima of 111 and 124 % respectively are considerably lower than those of March, April and May, and it is safe in conjunction with the botanical data (see p. 1433) to account for the difference by the decrease in the number of diatoms present.

Table IX. *River Itchen. May 31st-June 1st, 1927. Series III.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	pH value	Remarks
10 a.m.	10.6	1.145	101	0.005	7.8	Dull showery. Water turbid
11 "	11.3	1.206	109	0.005	7.8	" "
Midday	12.3	1.257	116	0.005	7.8	" "
1 p.m.	12.5	1.172	109	0.005	7.8	" "
2 "	12.8	1.245	116	0.005	7.9	" "
3 "	13.5	1.192	112	0.005	7.85	" "
4 "	13.9	1.135	108	0.005	7.85	Sunshine. "
5 "	14.3	1.201	115	0.005	7.85	" "
6 "	14.0	1.115	106	0.005	7.85	" "
7 "	13.9	1.103	105	0.005	7.8	" "
8 "	13.0	1.004	94	0.005	7.8	Sunset. "
9 "	12.7	0.895	83	0.005	7.8	Cloudy. Almost dark
10 "	12.5	0.871	81	0.005	7.7	" Dark
11 "	12.1	0.886	81	0.005	7.7	" "
Midnight	12.0	0.827	76	0.005	7.7	" Slight drizzle
1 a.m.	12.0	0.859	79	0.005	7.7	" "
2 "	11.7	0.829	75	0.005	7.7	Cloudy. Slight drizzle. Sky lightening
3 "	11.5	0.852	77	0.005	7.6	Dawn. Slight drizzle
4 "	11.3	0.833	75	0.005	7.6	Dull. "
5 "	11.1	0.846	76	0.005	7.6	" "
6 "	11.0	0.935	86	0.005	7.6	" Fine "
7 "	11.0	0.913	83	0.005	7.6	" "
8 "	11.0	1.060	94	0.005	7.75	" "
9 "	11.5	1.168	105	0.005	7.8	" "
10 "	11.9	1.177	108	0.005	7.9	" "

Sunrise May 31st, 3.50 a.m.

Sunset " 31st, 8.5 p.m.

Sunrise June 1st, 3.49 a.m.

Fig. 7.

Table X. *River Itchen. July 5th-6th, 1927. Series IV.*

Time G.M.T.	Temp. ° C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	p _H value	Remarks
9 a.m.	12.6	1.135	105	0.015-0.02	7.85	Thunderstorm 5.30-6.30 a.m.
10 "	13.1	1.151	108	0.005	7.9	Dull. Occasional sun
11 "	13.1	1.105	103	0.005	7.9	Dull. Raining. Windy
Midday	13.5	1.221	115	0.005	7.9	Dull. Fine
1 p.m.	13.6	1.147	108	0.005	7.9	" "
2 "	14.1	1.271	121	0.005	7.95	" "
3 "	15.0	1.217	118	0.005	8.0	Brighter.
4 "	15.0	1.203	117	0.005	8.0	" Little sun
5 "	15.0	1.200	116	0.005	8.0	Sunshine
6 "	15.1	1.167	113	0.005	8.0	"
7 "	14.9	1.122	109	0.005	8.0	"
8 "	14.0	0.998	95	0.005	7.85	" Sun low
9 "	13.0	0.923	86	0.005	7.7	Dusk. Fine. Moon shining
10 "	12.5	0.932	86	0.005	7.7	Clear. " "
11 "	12.0	0.857	79	0.005	7.6	" "
Midnight	11.8	0.880	80	0.005	7.5	Slight cloud. Moonset
1 a.m.	11.6	0.825	74	0.005	7.5	Cloudy. Sky just lightening
2 "	11.5	0.838	76	0.005	7.5	Daybreak. Some cloud. Fine
3 "	11.1	0.807	72	0.005	7.5	Dawn. Some cloud. Fine
4 "	11.0	0.838	76	0.005	7.5	Daylight. Fine. Clear
5 "	10.7	0.893	79	0.005	7.5	Sunshine
6 "	10.9	0.919	82	0.005	7.6	"
7 "	11.2	1.026	92	0.005	7.7	"
8 "	12.0	1.154	106	0.005	7.8	" Wind rising
9 "	12.6	1.177	109	0.005	7.9	Dull. Fine

Sunrise July 5th, 3.49 a.m.

Sunset " 5th, 8.19 p.m.

Sunrise " 6th, 3.50 a.m.

It would appear that the oxygen exuded from diatoms is more likely to produce a supersaturated solution than is that evolved from the higher green plants which tends to escape in bubbles from their relatively large stomata.

The minimum oxygen values in May, June and August are considerably lower than those of March and April, and it is possible that the larger green plants present during the summer (which were absent in March and April), by increased respiration, have caused this decrease in oxygen during the night. This is confirmed by the slightly lower p_H values obtained during the nights of May, June and August compared with those of March and April. An added factor to the progressive decrease in value of the oxygen minima may be the increased oxygen-consuming power of the river bed and vegetation due to the seasonal increase in temperature.

Nitrogen curves.

As in Series I and II on the River Itchen, no diurnal variation of ammoniacal nitrogen was recorded in Series III, IV and V.

On the River Lark the ammoniacal nitrogen curves of May and June are in general similar in structure to those of March and April, although considerable differences were obtained in the times of the maximum periods. The maximum periods of March and April were from 2-5 a.m. and from

Fig. 8.

Fig. 9.

Table XI. *River Itchen. July 27th-28th, 1927. Series V.*

Time G.M.T.	Temp. °C.	Dissolved oxygen. Parts per 100,000	% satura- tion dis- solved oxygen	Am- moniacal nitrogen. Parts per 100,000	pH value	Remarks
9 a.m.	12.8	1.060	99	0.005	7.8	Much rain 4-6 a.m. Bright occasional sun. River turbid
10 "	13.5	1.122	106	0.005	7.9	Cloudy. Windy
11 "	13.9	1.128	107	0.005	7.9	Sunshine. Water clearing
Midday	14.7	1.241	119	0.005	8.0	Cloudy. Windy. Water clear
1 p.m.	15.4	1.223	120	0.005	8.1	Sunshine. Windy
2 "	16.0	1.270	126	0.005	8.2	Cloudy. "
3 "	15.9	1.1825	117	0.005	8.2	" "
4 "	15.5	1.193	117	0.01	8.2	Dull. Very rough
5 "	15.0	1.107	107	0.005	8.0	" Windy
6 "	14.2	1.067	102	0.005	7.9-8.0	" Raining 5-6 p.m. Windy
7 "	13.6	0.970	91	0.005	7.9	" "
8 "	13.1	0.863	81	0.005	7.8	Fine. Dull. Windy
9 "	12.9	0.821	77	0.005	7.7	Almost dark. Windy. Cloudy
10 "	12.5	0.833	75	0.005	7.6-7.7	Dark. Windy. Raining
11 "	12.1	0.808	74	0.005	7.6	Dark. Wind dropped. Raining
Midnight	12.0	0.784	72	0.005	7.5	Wind rising. Fine. Cloudy
1 a.m.	12.0	0.789	72	0.005	7.5	Some wind. " "
2 "	12.0	0.801	73	0.005	7.5	Rain 1.15 a.m. " "
3 "	12.0	0.760	68	0.005	7.5	Sky lightening. Less wind
4 "	11.8	0.801	73	0.005	7.4-7.5	Dawn. Fine. Some cloud
5 "	11.9	0.793	73	0.005	7.5	Daylight. Cloudy
6 "	12.1	0.834	77	0.005	7.6	Dull. Fine. Some wind
7 "	12.7	0.931	86	0.005	7.7	" " Sunny intervals
8 "	13.3	1.106	104	0.005	7.9	" "
9 "	13.4	1.234	116	0.005	7.9-8.0	" "

Sunrise July 27th, 4.14 a.m.

Sunset " 27th, 7.58 p.m.

Sunrise " 28th, 4.16 a.m.

Fig. 10.

Table XII.

Date	% saturation of dissolved oxygen		p_H value		Ammoniacal nitrogen		Temperature °C.		Weather conditions	Sunrise a.m.	No. of days from June 21st	Plants
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.				
March 30th-31st	{ 3 p.m. 157	{ 1-7 a.m. 65	{ 2-7 p.m. 7.9-8.0	{ 2-9 a.m. 7.6-7.7	{ 2-5 a.m. 0.16	{ 3-6 p.m. 0.01	{ 3-4 p.m. 10.0	{ 5 a.m. 6.75	Bright	5.40	82	Submerged and littoral plants just appearing. Diatoms abundant
April 27th-28th	{ 3-4 p.m. 178	{ 3-6 a.m. 57	{ 2-6 p.m. 8.0	{ 4-7 a.m. 7.5-7.6	{ 3-9 a.m. 0.16	{ 4-11 p.m. 0.02	{ 6 p.m. 11.5	{ 5-7 a.m. 7	Sunny	4.40	55	Submerged and littoral plants 1 ft. in height. Green algae appearing
May 18th-19th	{ 4-5 p.m. 181	{ 5-7 a.m. 36	{ 4-8 p.m. 8.0	{ 3-7 a.m. 7.5	{ 6 a.m.-midday 0.2	{ 6-10 p.m. 0.01-0.015	{ 5 p.m. 15.4	{ 7-8 a.m. 10.8	Sunny	4.5	35	Submerged plants at height of growth. Diatoms on decrease. Green algae dominant
June 28th-29th	{ 3-4 p.m. 111	{ 6 a.m. 37	{ 5-9 p.m. 7.9-8.0	{ 5-8 a.m. 7.4-7.5	{ 6-10 a.m. 0.18	{ 6 p.m.-midnight 0.01	{ 3 p.m. 14.5	{ 8-9 a.m. 12.7	Dull and rain	3.40	8	Submerged plants at height of growth. Cut June 22nd. Few diatoms. Some green algae
June 30th	{ 5-7 p.m. 110	{ —	{ —	{ —	{ —	{ —	{ 6 p.m. 16.2	{ —	Afternoon more bright than June 29th			
August 4th-5th	{ 4-5 p.m. 124	{ 7 a.m. 42	{ 2-7 p.m. 8.0-8.2	{ 5-8 a.m. 7.5	{ 1-4 p.m. 0.015-0.02	{ 7 p.m.-10 a.m. 0.01	{ 5 p.m. 18.4	{ 7 a.m. 15.7	Sunny	4.20	44	Submerged plants at height of growth. Some green algae

3-9 a.m. respectively, whereas those of May and June were from 6 a.m.-midday and from 6-10 a.m. In this respect, some slight relation is shown between the curves of ammoniacal nitrogen and temperature, and it would appear that the higher afternoon temperature of May over June corresponds to an increased and later production of ammonia in May compared to that of June.

A remarkable difference was noted in the ammoniacal nitrogen curve obtained on August 4th-5th—in this case only small differences were obtained throughout the 24 hours, and the maximum period took place between 1 and 4 p.m.

It is difficult to account for this difference between the August curve and those of the previous months, but it is most probable that the river flora and the condition of the river bed are the dominant factors in the disappearance of the high nitrogen values obtained in Series I-IV.

p_H curves.

The May, June and August curves were similar in structure to those of March and April, and in general again follow the oxygen curves.

Temperature curves.

All the temperature curves show the expected diurnal similarity, but over different ranges.

VEGETATION OF THE RIVERS.

A detailed account is given below of the vegetation on the Rivers Lark and Itchen at the times of the various experiments.

The River Lark. For 2 miles above the point of sampling at Icklingham the river is slow flowing and moderately silted. In the summer there is a broad margin of erect littoral plants, mostly *Sparganium erectum* and *Glyceria aquatica*. The submerged plants are sufficiently abundant to hold up the water, causing flooding of the adjoining land even at dry periods. A mile above the point of sampling, the dominant plants are *Potamogeton lucens* and *P. pectinatus*, while immediately above the station, where the water is somewhat deeper, are *Sagittaria sagittifolia* and *Sparganium simplex*. The following is a full account of the vegetation at the various dates of the experiments.

March 30th. The submerged plants were just appearing above the mud and were about 2 inches high. The littoral plants were also just appearing through the mud and previous year's debris.

The diatoms were very abundant, and the figures from deposits on glass slides are given below.

March 9th to 23rd	(1) 10 mg./cm. ²
	(2) 15 „
March 23rd to April 7th	(1) 73 „
	(2) 70 „

Dominant organisms: *Synedra ulna* (about 50 %), *Nitzschia acicularis*, *Navicula Reinhartii*, *N. viridula*.

April 27th. The submerged and littoral plants were about 1 foot in height but vigorous growth had not commenced. The diatoms were still abundant, but the proportions of species were not identical.

Deposits:	April 7th to 21st	(1) 47 mg./cm. ²
	April 21st to May 5th	(2) 55 „

Dominant organisms:

(1) *Synedra ulna* 40 %, *Gomphonema olivaceum* 35 %, *Nitzschia acicularis*, *Diatoma vulgare*, *Melosira varians*.

(2) *Synedra ulna* 40 %, *Ulothrix zonata* 30 %, *Stigeoclonium tenue*, *Gomphonema olivaceum*, *Nitzschia acicularis*, *Amphora minuta*.

A point of note in Sample (2) is the presence of two filamentous green algae among the diatoms.

May 18th. The submerged vegetation had now reached its most vigorous stage of growth and was beginning to hold up the water. Just above the sampling station there was a considerable amount of *Sparganium simplex* (a grass-like plant) but the dominant plants were *Potamogeton lucens* and *P. pectinatus*, both of which were overgrown with *Cladophora glomerata*, a filamentous green alga.

Diatom deposits: May 14th to 30th, 45 mg./cm.²

Dominant organisms: *Ulothrix zonata* 70 %, *Synedra ulna*, *Cymbella gastroides*, *Amphora minuta*.

The diatoms were definitely on the decrease and the filamentous green algae were dominant.

June 29th. Towards the end of May the weeds grew very rapidly, causing flooding of the adjoining fields. On June 22nd weed cutting took place at Icklingham, so that on June 29th a normal amount of vegetation was present, chiefly *Potamogeton lucens* and *Sparganium simplex*. Two miles above the sampling station the littoral plants were fully grown.

Diatom deposits:

	May 30th to June 16th	(1) 1.2 mg./cm. ²
		(2) 2.3 „
	June 16th to 30th	(1) 1.2 „
		(2) 2.4 „

Dominant organisms: *Chlorococcum infusionum* and *Protoderma viride*; the deposit consisted of 80 % of *Protococcales*. There were few diatoms; *Amphora minuta*, *Synedra ulna*, *Cymbella gastroides*.

August 3rd. The submerged plants were very abundant, and there was more *Sparganium simplex* than in June. *Cladophora glomerata* and *Potamogeton pectinatus* were present in smaller quantity.

Deposits:	July 1st to 18th	(1) 1.1 mg./cm. ²
		(2) 0.7 „
	July 18th to August 3rd	(1) 1.4 „
		(2) 1.2 „

Dominant organisms: *Protoderma viride* and *Chlorococcum infusionum*.

The River Itchen. The Itchen at the Alresford Research Station is a swift stream and the dominant plants are *Sium angustifolium* and *Ranunculus penicillatus*, although immediately above the weir where the samples are taken is a short silted stretch (about 50 yards) with *Callitriche stagnalis* and *Potamogeton densus* in some quantity. Littoral plants are scarce and consist of plants of the habit of *Nasturtium officinale* (water-cress) and *Myosotis palustris* (forget-me-not).

The most remarkable feature of the phanerogamic vegetation is that it persists throughout the year, the area of green plants in the water being not much less in December than in July. The area occupied by the plants is also small in comparison with that in the Lark. The increase in the vegetation therefore in the period considered may be taken as small.

The micro-flora. No direct measurements or systematic collections have been made of the diatoms on the Itchen this year but from previous collections the general seasonal variation is the same as for the Lark, though the quantities are not so large. There is a maximum growth of diatoms in March and April, the dominant organisms being *Synedra ulna*, *Gomphonema olivaceum* and *Amphora minuta*. These decrease in May and are followed by the appearance, as small tufts on all the stones, of the filamentous algae, *Vaucheria* sp. and *Cladophora* sp. At the end of August, these had disappeared and all the micro-flora there was consisted of a few diatoms, *Synedra*, *Gyrosigma*, etc. and *Batrachospermum* in comparatively small quantity.

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REFERENCE.

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