

Nichols & Farlow

With the Compliments of Wm. Ripley Nichols.

REPORTS

OF

PROFESSOR NICHOLS AND DR. FARLOW

ON MATTERS CONNECTED WITH THE

BOSTON WATER SUPPLY.

[From the Report of the Water Board, 1877.]

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REPORTS ON CONDITION OF HORN POND.

REPORT OF PROFESSOR NICHOLS.

To the Water Commissioners of the City of Boston:—

GENTLEMEN, — On the 8th inst. I was requested by you to visit Horn pond, one of the ponds connecting with the Mystic-water supply, in order to investigate the present condition of the water. In accordance with your request I visited the locality on the following day, and made the entire circuit of the pond in a boat.

I found the trouble to be due to the presence in the water of an enormous number of a microscopic organism, an alga belonging to Nostoc family, subsequently identified by Dr. Farlow as an *Anabana* (perhaps *gigantea*).

The water over the whole surface of the pond, and to the depth of several inches, was filled with these minute bodies, which gave to it a greenish-yellow hue. The same vegetable matter in other stages of growth and decay had caused the accumulation of large masses of variously colored gelatinous matter, and where it was in a state of decay the odor was very disagreeable, reminding one of a pig-pen more than of anything else.

Most ponds and reservoirs are liable in summer to be troubled by such growths, and it is probable that each year there has been more or less in Horn pond; but never, as far as I can learn, has the trouble been so great. The water supplies of other cities have, however, been affected in the same way, and in the report of the Water Board of New York for 1859, and in that of Albany for 1865, may be found a description of a similar condition of things.

Under the circumstances I did not judge that any chemical examination would be necessary, but in order to identify fully the vegetable growth, and especially in order to learn if there was anything in the condition and surroundings of the pond which might tend to cause or to aggravate the evil, I requested Dr. Farlow, Professor of Botany in Harvard University, to examine the pond, and to identify such vegetable species as might have a bearing on this subject. I visited the pond, in company with Dr. Farlow, on the 12th inst. At that time the condition of things

was much improved, and the water was becoming clearer; in Wedge pond, however, the water was rather worse than in Horn pond. Dr. Farlow's statement accompanies this report.

The two practical questions which arise are, whether the matter is injurious to health, and whether anything can be done to prevent the reoccurrence of the trouble. I do not know of any direct evidence as to the wholesomeness or unwholesomeness of the water when in this condition.

The vegetable matter is not generally considered injurious, but it gives to the water, especially when decaying, a disagreeable taste and odor, much of which can be removed by filtration; most efficiently by means of filters of animal charcoal, which should be frequently cleansed.

It would be, with our present knowledge, impossible in any way to *prevent* the growth of the plant in the pond; but it is the opinion of Dr. Farlow that the abundance of the growth may be in a measure due to the presence in the upper part of the pond of large masses of another plant, a species of *Plectonema*. This plant may perhaps be described as resembling masses of tangled horse-hair as much as anything, except that when held up, so that the light shines through, it is evidently bluish-green. This plant begins to grow on sticks and stalks of other plants under water, most commonly at a depth of not more than ten or fifteen feet, but subsequently rises in large masses to the surface, and furnishes a favorable starting point for the growth of the *Anabæna*. I do not know whether there is more this year than usual; there is certainly a large quantity of it. Whether it would be of any use to remove this now, it would be impossible to say, but it would be well another year, between the middle and last of June, to remove as much of it as practicable.

I would further suggest the desirability of some sort of screen at the outlet of Horn pond, by which the masses of floating material might be arrested. The present year it would have been possible to remove at this point, and also along the shores of the pond, much of the decomposing matter which, after a time, found its way to the lower pond.

Yours respectfully,

WM. RIPLEY NICHOLS.

Mass. Institute of Technology,
Boston, Aug. 16, 1876.

REPORT OF DR. FARLOW.

To the Board of Water Commissioners of the City of Boston :—

GENTLEMEN, — By request of Prof. W. R. Nichols I went with him to Horn pond, in the middle of the month of August, for the purpose of ascertaining if it were possible to account for the disagreeable odor exhaled by the water, owing to the presence of any vegetable substance visible to the naked eye or determinable by the microscope. We walked for some distance along the shore of the pond, and examined the water at both the upper and lower ends. I took away with me, for microscopical analysis, some bottles of the water, and others were sent me by Prof. Nichols.

The odor seemed to be caused by the presence in the water of a large mass of a species of *Anabana* in a state of decomposition. This was perceptible to the naked eye, floating in the water in a healthy condition in the form of minute glistening rods, and also collected on the surface, and often adhering to sticks and plants in gelatinous masses, at first of a bluish-green, and afterwards of a brown color, in which condition it was more or less decomposed, and emitted an odor which reminded one of horse-dung.

A microscopic examination showed a large number of filaments which could be recognized as belonging to a species of *Anabana*, but, unfortunately, so far decayed as to render the determination of the species impossible. Although to be regretted in a scientific point of view that the specific name could not be determined, as far as all practical bearings of the case are concerned it is of no consequence. The genus *Anabana* belongs to the order *Nostochineæ*, the order to which belong most of the plants which appear suddenly in fresh or salt water, often accompanied by a disagreeable odor. As an example, I may mention the plant *Trichodesmium roseum*, to which the Red Sea owes its color, which appears suddenly in immense masses and as suddenly disappears.

To anticipate the appearance of the *Anabana*, and to prevent its growth, is at least, in the present state of knowledge, impossible. That is not, however, necessary in the present case, for so long as the *Anabana* floats freely in the water it is not likely to prove offensive. When, however, it collects in masses on the surface, exposed to the heat of a midsummer's sun, it at once begins to decompose. This collecting on the surface is favored when the water of the pond is low enough to

allow the weeds growing in it to reach the surface; for the *Anabæna* collects readily on water weeds and sticks. There is furthermore in Horn pond an *alga*, which is very abundant, and which must have a great deal to do with hastening the decay of the *Anabæna*. About a year ago I received from a gentleman in Bethlehem, Pa., a curious *alga*, not only new to this country, but to the world, which I named after the discoverer, *Plectonema Wollei*, and which I had intended to describe in a paper to be published in a few weeks. This plant, which I saw growing for the first time in Horn pond, forms long matted tufts of a spongy consistence, formed of an immense number of long, dark green threads closely interlaced. It is attached in the beginning to sticks and water plants, and grows in length until it reaches the surface of the water. Later in the season it breaks away from its attachment, floats round on or near the surface in patches of greater or less extent, and is finally washed ashore. I visited the pond on October 3d, and found that the large attached masses which Prof. Nichols and myself had observed in August at the upper end of the pond, had disappeared, and that large quantities had been washed up on the beach.

The *Plectonema Wollei*, from its spongy nature and filamentous structure, must absorb into its meshes and collect on its surface quantities of the *Anabæna*, which, thus forcibly retained on the surface and exposed to the sun's rays, must soon decompose.

It seems as though it might be desirable as a preventive measure to remove the *Plectonema*. It probably does not reach any perceptible size before the middle of June, and from that time until July would be the most favorable period for removing it. If the pond is kept comparatively clear of the *Plectonema* one great source of danger from the *Anabæna* is avoided.

Respectfully submitted,

(Signed)

W. G. FARLOW.

BOSTON, October 5, 1876.

The *Plectonema* which I have mentioned is known to persons living near the pond under the name of "eel grass." It is not, however, what is called by that name in other parts of the country, viz., *Vallisneria spiralis*, a flowering plant not in the least related to *Plectonema*.

REPORT OF PROFESSOR NICHOLS.

To the Water Commissioners of the City of Boston:—

The following table contains the results of the partial chemical examinations of Cochituate water made in the laboratory of the Institute of Technology during the year from July, 1876, to July, 1877. The water has been uniformly of good quality and generally very free from any matter in suspension.

Yours respectfully,

WM. RIPLEY NICHOLS.

Examination of Boston Water Supply.

[Results expressed in Parts per 100,000.]

DATE.	UNFILTERED WATER.		FILTERED WATER.		SOLID RESIDUE.		
	Ammonia.	"Albuminoid Ammonia."	Ammonia.	"Albuminoid Ammonia."	Inorganic.	Organic and Volatile.	Total at 212° F.
1876.							
July 7	0.0037	0.0173	0.0053	0.0157	2.34	1.52	3.86
" 14	0.0040	0.0171	0.0040	0.0163	2.34	1.90	4.24
" 21	0.0040	0.0171	0.0040	0.0163	2.38	1.78	4.16
" 28	0.0040	0.0171	0.0040	0.0160	2.42	1.74	4.16
Aug. 4	0.0040	0.0176	0.0040	0.0165	2.16	1.64	3.80
" 11	0.0040	0.0173	0.0040	0.0160	2.50	1.66	4.16
" 18	0.0040	0.0165	0.0040	0.0160	1.94	1.88	3.82
" 26	0.0037	0.0173	0.0037	0.0160	2.06	1.72	3.78
Sept. 4	0.0040	0.0168	0.0040	0.0160	2.14	2.10	4.24
" 23	0.0040	0.0168	0.0040	0.0136	2.44	1.76	4.20
" 30	0.0040	0.0163	0.0040	0.0163	2.26	1.76	4.02
Oct. 7	0.0040	0.0160	0.0040	0.0157	2.78	1.46	4.24
" 14	0.0040	0.0152	0.0040	0.0149
" 23	0.0037	0.0160	0.0037	0.0155
Nov. 4	0.0037	0.0136	0.0037	0.0136	2.02	1.94	3.96
" 11	0.0032	0.0125	0.0032	0.0125	2.56	1.40	3.96

Examination of Boston Water Supply. — Continued.

DATE.	UNFILTERED WATER.		FILTERED WATER.		SOLID RESIDUE.		
	Ammonia.	"Albuminoid Ammonia."	Ammonia.	"Albuminoid Ammonia."	Inorganic.	Organic and Volatile.	Total at 212° F.
Nov. 17	0.0029	0.0141	0.0029	0.0141
" 28	0.0029	0.0141	0.0029	0.0141	1.92	1.80	3.72
Dec. 5	0.0008	0.0141	0.0008	0.0136	2.24	1.78	4.02
" 14	0.0008	0.0144	0.0008	0.0139	2.12	1.76	3.88
" 21	0.0021	0.0136	0.0021	0.0131	2.10	1.82	3.92
" 28	0.0016	0.0139	0.0016	0.0136	2.22	1.70	3.92
1877.							
Jan. 4	0.0005	0.0136	0.0005	0.0136	2.22	1.74	3.96
" 10	0.0005	0.0133	0.0005	0.0131	2.34	1.86	4.20
" 18	0.0005	0.0128	0.0005	0.0120	2.62	1.72	4.34
" 25	0.0005	0.0120	0.0005	0.0120	2.74	2.06	4.80
" 31	0.0008	0.0120	0.0008	0.0115	2.38	2.26	4.64
Feb. 15	0.0011	0.0112	0.0011	0.0107	2.82	2.30	5.12
" 22	0.0019	0.0109	0.0019	0.0101	3.26	2.32	5.58
" 28	0.0021	0.0115	0.0021	0.0107	3.20	2.10	5.30
Mar. 8	0.0019	0.0128	0.0019	0.0125	2.72	2.28	5.00
" 14	0.0016	0.0120	0.0016	0.0115	2.64	2.34	4.98
" 28	0.0019	0.0117	0.0019	0.0112	2.96	1.98	4.94
April 5	0.0019	0.0107	0.0019	0.0104	2.32	2.04	4.36
" 11	0.0019	0.0099	0.0019	0.0099	2.68	2.08	4.76
" 25	0.0016	0.0120	0.0016	0.0115	2.68	2.00	4.68
May 2	0.0029	0.0115	0.0029	0.0109	2.60	2.04	4.64
" 10	0.0024	0.0120	0.0024	0.0115	2.28	2.04	4.32
" 15	0.0024	0.0120	0.0024	0.0117	2.80	1.68	4.48
" 23	0.0027	0.0123	0.0027	0.0120	2.48	2.16	4.64
" 31	0.0044	0.0120	0.0043	0.0120	2.44	1.68	4.12
June 6	0.0040	0.0147	0.0040	0.0141	2.68	1.64	4.32
" 13	0.0056	0.0152	0.0056	0.0149	2.28	1.88	4.16
" 20	0.0048	0.0165	0.0048	0.0157	2.16	1.72	3.88
" 27	0.0053	0.0136	0.0053	0.0131	2.56	1.64	4.20

