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# OBSERVATIONS UPON THE DRAINING OF STEPHENSON'S POND OCTOBER 28-29,1935

by
M.W.Smith.

On the morning of October 28 it was found that the water in the kettle was not sufficiently low to seine with efficiency although two hauls were made. No trout were taken, but these hauls revealed a very large number of sticklebacks (Pungitius pungitius), dragon-fly larvae, water beetles and bugs, and tadpoles.

Operations were resumed on the morning of October 29. Two small trout were found stranded near the kettle by the men who had arrived before us. They had not retained these fish, but had put them into the kettle. The kettle was thoroughly seined. One trout only was taken (7.8 cm.;3.1 in.). As on the previous day it was found that sticklebacks were present in surprisingly large numbers, along with larval and adult insects, and tadpoles.

At 1:25 P.M. the temperature of the water entering the kettle was 11.4°C. (52.5°F.). The water had a dissolved oxygen content of 3.53 c.c. per litre (45.4 per cent. saturation) and an acid reaction, having a pH value of 6.3. The sky was clear at this time and the air temperature was 20.0°C.(68.0°F.).

From 1:40 to 3:00 P.M., 200 pounds of hydrated lime were added to the inlet stream (the only one in which any water was visibly entering the pond area), beginning at the upper screen and working downward to the level of the pond when flooded. Although the greater part of the lime dissolved readily, some remained on the bottom and required stirring up. It was not until 5:55 P.M. that the limed water reached the kettle, as indicated by the water's reaction to phenolphthalein. Since the flowage of water was rather small the progress of the lime downstream was slow. The seine was placed across the stream just above the kettle in order to intercept any fish that might be driven down. The result of these operations was the capture in the seine of one trout (21 cm.;8.3 in.), a gravid female, apparently from the planting of last fall, a very large number of sticklebacks, dragon-fly larvae and tadpoles. An examination of the stream, following the application of the lime, also revealed only one trout (6.cm.;2.5 in.).

## DISCUSSION OF RESULTS.

The results are not surprising when one reviews the conditions found in the pond on August 9, for instance. (See previous report.) At that time the surface water which contained sufficient oxygen for good trout growth had a high temperature, while the bottom water, although cool enough, had a poor supply of dissolved oxygen. It is considered that the combination of high temperatures and low oxygen content was the principal cause of the loss of fry. Predaceous birds and aquatic insects would account for a certain number. It is to be expected in such an area as Stephenson's pond where a large quantity of vegetation has been covered by water that its subsequent

decay would materially lower the oxygen content of the water. The extent of this depletion would depend upon how stagnant the water remained, and upon the temperature. In Stephenson's pond there was little or no water entering in late summer and early fall, as the season was a particularly dry one. It is anticipated, however, that if the area is kept flooded the amount of decomposition will diminish, how rapidly, of course, is difficult to predict. As the amount of decomposition does decrease and the quantity of algae (oxygen producers) increases, the oxygen supply will become more and more favourable. The pond will age and more stable pond conditions will be realized.

Some idea of the possible trout production in this pond, when conditions become suitable for these fish, is given by the large number of sticklebacks that the pond produced during the last summer. Since they did not demand such ideal conditions as trout they were able to thrive. Their presence in such quantities indicates that the supply of food for small fish was good, i.e. the plankton supply. There was also plenty of food in the form of insect larvae, particularly desired for larger fish. For small fish, unfortunately, the large dragon-fly larvae, beetle larvae (water tigers), and aquatic bugs are potential enimies, and a certain loss is to be expected from them in this pond if they are present in the future in numbers comparable to last summer. Their presence cannot be very well avoided.

The planting of fry in Stephenson's pond should be continued in order to correlate the physical and chemical conditions of the water with trout survival and growth. There is no reason, however, to make extensive plantings until a good survival has been experienced. The area should be kept flooded so as to promote the decomposition of the abundant organic materials.

Mr. James Catt very kindly helped in this work. I wish also to thank the members of the St.John hatchery staff and Messrs. Stephenson for their assistance.

## Observations on Stephenson's pond, 1936.

May 14th

Cloudy, rain, light south wind. Air - 13.5°C.

At the dam

| | temp. °C. | Oxygen cc. per litre | pH value |
|---|---|---|---|
| Surface | 13.2 | 6.48 | 6.0 (B.C.P) |
| Bottom | 12.4 | 4.99 | 6.0 (B.C.P) |

The pond was full. Approximately three inches of water was flowing over the planks in the dam.

June 8th

Air - 22.0°C 8.00 p.m.

At the dam

| | temp. °C. | Oxygen cc. per litre | pH value |
|---|---|---|---|
| Surface | 25.5 | 5.27 | 7.0 (B.T.B) |
| Bottom | 20.7 | 4.82 | 7.0 (B.T.B) |

There appeared to be considerable plankton growth in the water. Quantitative and qualitative samples were taken.

July 2

Sky, mostly clouded. Air - 22.6°C. 2.00 p.m.

Station 1. - ½ way up the pond - 4 ft. of water

temperature { surface - 18.7
bottom - 14.0

Oxygen cc. per litre { surface - 5.17
bottom - 2.78

Station 2. - ¼ way up pond - 4.5 ft. of water

temperature - bottom - 13.55
Oxygen - cc. per litre - bottom - 5.71

Station 3. - approximately 25 yds from inlet - 5 ft. of water

temperature - bottom - 12.1
Oxygen - cc. per litre - 3.92

Station 4. - at screen in inlet (fair flow of water)

temperature - 14.5
Oxygen - cc. per litre - 5.79
pH value - 6.6

Station 5. - at dam at outlet.

| | | |
|---|---|---|
| temperature | surface | 20.5 |
| | bottom | 13.6 |
| Oxygen - cc. per litre | surface | 5.38 |
| | bottom | 2.30 |
| pH value | surface | 6.7 |
| | bottom | 6.3 |

Quantitative and qualitative samples of the plankton taken from pool above dam.

Approximately one inch of water flowing over planks in dam.

Sticklebacks, Tadpoles and filamentous algae noted as plentiful.

August 13th - 9.30 a.m. Air 17.6°C.

At dam

| | Temp. °C. | Oxygen- cc. per litre | pH value |
|---|---|---|---|
| Surface | 19.4 | 1.93 | 5.6 |
| Bottom (81 in.) | 15.6 | 0.93 | 5.4 |

Water level about two inches from top of planks. Small drainage through dam as leakage.

Myrica and Spiraea still alive in pond. Sticklebacks numerous.

May 18th, 1938

M.W.Smith
Atlantic Biological Station

## OBSERVATIONS AT STEPHENSON'S POND

An examination of the water conditions in Stephenson's pond was made on August 25, 1937. One station was occupied at the dam, which station is considered representative of the water conditions as a whole.

In the following table are presented the recorded temperatures of the water, pH values, and dissolved oxygen content, not only for August 25, 1937, but also for August 13, 1936, and August 9, 1935, for comparison. All data apply to the station at the dam.

| | Temperature °C. | | | pH value | | | Dissolved oxygen (% sat. in brackets) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1935 | 1936 | 1937 | 1935 | 1936 | 1937 | 1935 | 1936 | 1937 |
| Surface | 27.3 | 19.4 | 23.25 | 7.4 | 5.6 | 6.0 | 3.22 (55.4) | 1.93 (29.1) | 4.10 (66.0) |
| 3 feet | 17.1 | | 18.2 | | | | 1.86 (26.8) | | 3.84 (56.6) |
| Bottom (About 6 feet) | 15.0 | 15.6 | 17.3 | 5.9 | 5.4 | 5.6 | 0.20 (2.8) | 0.93 (13.0) | 3.96 (57.3) |

The recorded temperatures, except possibly those for the surface in 1935 and 1937, are favourable for trout survival. All pH values are quite suitable.

In flooding areas which are covered with decomposable material, as was the case with Stephenson's pond, one of the great dangers is that the water, as a result of decomposition, will lose its dissolved oxygen and become unsuitable for trout survival. This is particularly liable to occur in summer when the decomposition is most rampant. Usually more than 2.0 to 2.5 c.c. of dissolved oxygen per litre, or 30 to 40 per cent. saturation, are required for the well-being of trout. In August 1935 and 1936, the dissolved oxygen content was thus too low for trout (except the surface in 1935, at which time however the surface temperature was adverse). In 1937, to the contrary, the dissolved oxygen values are very good, although the season has been very warm and dry. It is to be noted that the bottom oxygen content for August has become progressively greater from 1935 to 1937, increasing from 0.20 c.c. to 3.96 c.c. per litre and from 2.8 per cent. to 57.3 per cent. saturation. This increase in the amount of oxygen indicates that the decomposition or rotting of a large amount of the flooded organic material has reached completion, or nearly so, and although decomposition is still taking place, the demand upon the dissolved oxygen in the water is not nearly so great. On the basis of these observations it is to be expected that the oxygen conditions will continue to improve with each ensuing year.

The food conditions for small fish have been good and continue to be so. This is well illustrated by the abundant production of sticklebacks which has occurred each year in the pond. On August 25, 1937, trout were in evidence as they were seen jumping for flies.

On August 25 considerable water was escaping from the pond by a leak at the bottom of the spillway. The water level was 7 inches below the top of the spillway.

It is suggested that the pond be drained in October, 1937, and any surviving trout removed. This procedure would permit the pond to fill and be in condition for planting in the spring.

M.W.Smith,
Atlantic Biologival Station,

August 27, 1937.

REPORT ON THE DRAINING OF STEPHENSON'S POND, OCTOBER 20,1937.

By the morning of October 20 the water had drained to the stream-bed level. At 11:30 A.M. two hundred pounds of slaked lime were added to the stream at the upper screen and in the larger tributary flowing in from the right side of the pond (approximately 15 pounds in the latter). At noon the kettle was seined and twenty-two trout removed. These were transferred to Loch Lomond. The net was then stretched across the stream immediately above the kettle, and during the afternoon three more trout were captured there. These were also put into Loch Lomond. Five trout, which had been killed in the process of draining and liming, were preserved. Two of these were taken from the stream about two-thirds the way up the pond. Thus, altogether thirty trout were recovered.

By 5:45 P.M. the effects of the lime had not yet reached the kettle. The net was left in place and visited by John Stephenson the following morning. In a letter he states that there were no additional trout and that the net was removed on October 21. It is assumed that the lime was as efficient in its action as on previous occasions for conditions were quite similar to those when the pond was drained on October 29, 1935, for instance.

The lengths of the trout (25) taken from the pond and transferred to Loch Lomond were as follows (measured to the nearest quarter inch):

| | | | | |
|---|---|---|---|---|
| 5.0 | 8.0 | 9.75 | 10.5 | 12.25 |
| 5.5 | 8.5 | 9.75 | 11.0 | 12.25 |
| 7.0 | 8.75 | 9.75 | 11.5 | 12.25 |
| 7.5 | 9.0 | 10.25 | 12.0 | 13.5 |
| 7.5 | 9.25 | 10.25 | 12.0 | 13.5 |

The lengths, weight and sex of the five preserved specimens were as follows:

| | Length | | Weight | | Sex |
|---|---|---|---|---|---|
| | cm. | in. | gm. | lb. | |
| 1. | 27.0 | 10.6 | 257.5 | 0.57 | male |
| 2. | 26.7 | 10.5 | 226.0 | 0.50 | female |
| 3. | 23.5 | 9.2 | 185.5 | 0.41 | female |
| 4. | 26.7 | 10.5 | 277.0 | 0.61 | female |
| 5. | 23.3 | 9.2 | | | male (poor shape, not weighd) |

As when last drained in the fall of 1935, there was a very large number of sticklebacks, Pungitius pungitius.

For the first time yellow perch, Perca flavescens, were taken. Six were secured. It is likely that these fish came down into the pond from the small lake above. It is possible that they could have been washed through the guarding screen at the head of the pond either as fertilized ova (yellow perch spawn in early spring, thus at high water) or as small fry. John Stephenson reported that this screen had holes in it during the last summer, but was repaired. The perch might have

entered at that time, that is the smaller individuals but not the larger since the latter were two years old at least; although the low water of summer would seem to preclude such a possibility. Following are the lengths and weights of the preserved specimens.

| | Length | | Weight | | Sex |
|---|---|---|---|---|---|
| | cm. | in. | gm. | lb. | |
| 1. | 21.1 | 8.3 | 129.0 | 0.28 | female |
| 2. | 18.5 | 7.3 | 79.0 | 0.17 | female |
| 3. | 16.5 | 6.5 | 56.0 | 0.12 | female |
| 4. | 10.8 | 4.3 | 15.5 | 0.03 | female |
| 5. | 10.1 | 4.0 | 13.5 | 0.02 | male |
| 6. | 10.8 | 4.3 | 15.5 | 0.03 | female |

Also for the first time the chub, Couesius plumbeus, was secured from the pond. Two specimens were taken.

Immature frogs (tadpoles) were numerous.

The pond at the time of draining was also supporting a very large population of invertebrate forms such as dragon fly nymphs, bugs (Corixa, Notonecta, Lethocerus), beetles (Dytiscus, Gyrinus), and snails (Physa)

The flooding has killed considerable of the shubbery. Alders, Alnus, wherever flooded, have been dead for some time. Chamaedaphne and Spiraea seem to have withstood the submergence most successfully of any.

DISCUSSION

A recovery of thirty trout is a small return from the planting of 5,000 fry made on June 16, 1936. However an important point to consider is the fact that a certain number of trout did survive in the pond and did make a good growth under adverse, but improving, water conditions. Indeed the size of the larger fish indicates an excellent rate of growth. Scales from those individuals that were preserved showed that the fish were in their second year.

As was done in a previous report, it is again to be pointed out that the amount of dissolved oxygen in the water, in regard to summer conditions, was the best this last summer since the pond was first flooded. With gradual improvement in the quantity of oxygen, along with the excellent food conditions which are apparent in the pond, future plantings should yield recoveries.

In a flooded area of this type where there exists a large amount of decomposable organic material, it is to be expected that for the first few years the dissolved oxygen content of the water would be low. The rampant decomposition of the first three years seems, however, to be definitely falling off. On the other hand decomposition of organic substances signifies a fertilizing of the water. The large production of aquatic life in this pond illustrates this fertilizing action. Naturally as the decomposition diminishes this fertilizing effect will be lessened, with the logical result that the quantity of fish foods

will become smaller. However there should be a period in the pond's history when sufficient oxygen for trout growth will be present and when there will still be a large quantity of food organisms. Stephenson's pond appears to be entering upon this phase of its development. As the pond is kept flooded more normal pond conditions will arise, namely less decomposition, plenty of dissolved oxygen, and less food for trout growth. It is obvious therefore that the best production of trout will be realized when a balance is reached whereby there is the maximum fertilizing effect coupled with sufficient oxygen for trout growth. In the future, if the production of Stephenson's pond materially decreases, it can again be restored by allowing the pond to remain dry in order that a crop of vegetation may grow up. This vegetation when flooded will again produce the desired fertilizing effect.

M.W.Smith
Atlantic Biological Station
October 29, 1937.