plankton 7.5
fish - B

Inkpot and Forest Service Bog
A Study and Comparison

The Yellow Perch

Sheila Liebscher
Spring 1979

Professors:
Dr. Duman
Dr. Greene
Dr. Morgan

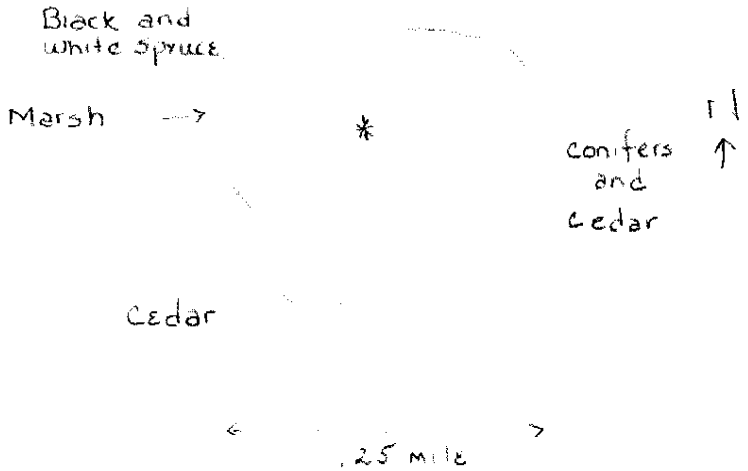
INKPOT

I. General Description

Inkpot Lake is approximately one quarter mile wide. The northwest corner of the lake is marsh land. The marsh extends for almost one hundred yards and is bounded exteriorly by a hardwood forest. The forest is composed of basically three different types of trees: black spruce, white spruce, and cedar. The east end of the lake is surrounded by conifers with a few cedar trees interspersed.

Moccasin Lake drains into Inkpot which then drains ultimately to Tenderfoot Creek via Plum, Kickapoo, Brown Creek, Palmer, and the Ontonogan River.

The sampling was done in the center of the lake where the depth was 4.25 meters.*



II. Water Chemistry

A. Data

1. Water Sample 6-5-79
   Sunny morning with no clouds; moderate wind

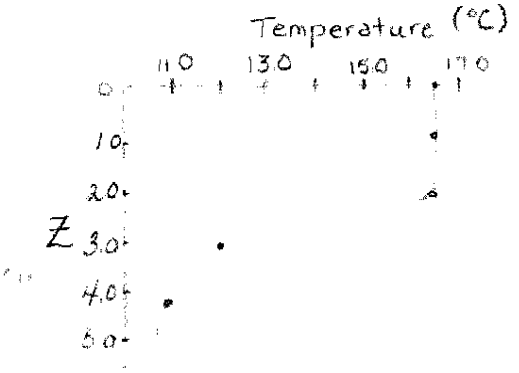
Test	Depth (M)	Measurement
Acidity	1	170mg/l
	3	160mg/l
Alkalinity	1	30mg/l
	3	30mg/l
pH	1	6.2
	3	6.0
Hardness		
Ca^{++}	1	33mg/l
	3	30mg/l
Mg^{++}	1	10mg/l
	3	15mg/l
Total	1	40mg/l
	3	45mg/l
Specific Conductance	1	80micromhos/cm (Range3)
	3	82micromhos/cm
Color		
Apparent	1	72.5
	3	65
True	1	70
	3	60
Secchi Disc	1.84	
Phosphate	1	.16mg/l
	3	.17mg/l
Nitrate	1	.2mg/l
	3	.2mg/l

No H_2S present

2. Temperature Profile

Depth (M)	Temperature (°C)
Air	13.2
0	16.5
1	16.5
2	16.5
3	12.0
4.25	10.9

3. Temperature/Depth Graph



B. Observations and Conclusions

From the data obtained, Inkpot Lake is seen to have a high acidity but a relatively moderate alkalinity, hardness, conductivity, and pH. The high acidity could be the result of many factors, two of which will be suggested here. First, it is possible that there was/is a build-up in organic materials which, as they decompose, release carbon dioxide gas. This gas, in turn, reacts with the water to form hydrogen ions, the cause of the acidity.

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3$$

Secondly, with the sulfur dioxide being pumped into the air by many industries, it is possible that dilute sulfuric acid is

being rained into the lake, raising its acidity.

$$SO_2 + H_2O \rightleftharpoons H_2SO_4$$

The moderacy of the other four factors- alkalinity, hardness, conductivity, and pH- implies an interdependence of each of the four upon one another. If the pH were higher, the predicted alkalinity would be higher because there would be a higher buffering capacity. This increased buffering capacity would increase specific conductance because of the higher concentrations of ionic materials. The increased ionic concentrations would predict an increase in water hardness.

The absence of hydrogen sulfide from the tropholytic zone and the presence of dissolved oxygen suggest that spring turnover had already occured at the time the water sample was collected. From the temperature profile, the beginnings of stratification can be seen. At the time there was simply a warm layer and a cold layer with no real defined thermocline. The sun had begun to warm the upper layer faster than the wind could mix it, resulting in the two general layers. It is probable that, if the readings were measured again in the late summer, there would be a well-defined thermal stratification present.

Based on the data compiled, the conditions of Inkpot are characteristic of a eutrophic lake. The shallow littoral zone, the brownish-green color, the limited transparency (Secchi disc reading of 1.84M), the abundant nutrients and calcium ions, the implication of the lake's turnover, and the abundant phytoplankton present all characterize a state of eutrophy.

III. Plankton Data

A. Zooplankton

The Rotiferans, by far, dominated the zooplankton population. Two genera of rotiferans constituted the majority of the sample: Keratella and Asplanchna. In much less abundance, although still definitely present, there were Brachionus and Trichocera. Only a few Kellicottia were identified. The Copepoda were present in small numbers and those that were identified were Nauplii and Cyclops. The Cladocerans were absent from the observed sample.

B. Phytoplankton

The vast majority of the phytoplankton sample was Asterionella. Second to the Asterionella in terms of amount present were the Fragilaria, Synedra, and Dinobryons. Below these were the Tabellaria, Ceratium, and Closterium. There were a few Microspora and Melosira scattered through the sample.

C. Observations

The population of the nightime sample was greater than the sample collected in the morning because the fear of predation near the surface is lower at night. Many plankton migrate to the surface after dark while many fish sink to the lower depths. This migration by the plankton is a survival tactic adapted to further their population.

FOREST SERVICE BOG

I. General Description

Forest Service Bog is surrounded by an extensive bog mat which, on the northern edge, has grown out into the center of the bog. The bog mat consists of sphagnum, pitcher plants, tamaracks, and Bog Rosemary and is bounded by a hardwood forest. The bog sits in a type of valley which renders it extremely protected from the wind.

There seems to be no apparent drainage of Forest Service Bog. The water is shallower near the outgrowth and increases in depth to 5.0 meters where the sampling was done.

II. Water Chemistry

FOREST SERVICE BOG

A. Data

1. Water Sample
Rainy morning with overcast skies; calm water and little wind

Test	Depth (M)	Measurement
Acidity	.5	190 mg/l
	3	200mg/l
Alkalinity	.5	10 mg/l
	3	10 mg/l
pH	.5	2.9
	3	2.8
Hardness		
Ca^{++}	.5	10 mg/l
	3	10 mg/l
Mg^{++}	.5	-
	3	-
Total	.5	10 mg/l
	3	10 mg/l
Specific Conductance	.5	10 micromhos/cm (Range 3)
	3	9.5 micromhos/cm
Color		
Apparent	.5	45
	3	75
True	.5	25
	3	35
Secchi Disc	2.0	
Phosphate	.5	.14 mg/l
	3	.10 mg/l
Nitrate	.5	.4 mg/l
	3	.4 mg/l

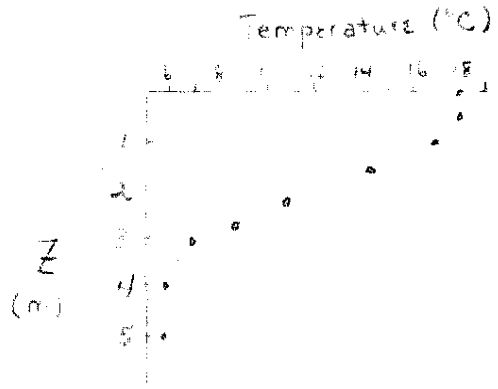
H_2S present

FOREST SERVICE BOG.

2. Temperature Profile

Depth (M)	Temperature (°C)
Air	18.5
0	18.0
.5	18.0
1	17.0
1.5	14.5
2	11.0
2.5	8.7
3.0	7.0
4.0	6.0
5.0	6.0

3. Temperature/Depth Graph



B. Observations and Conclusions

Forest Service Bog has a very high acidity and a low alkalinity, hardness, specific conductance, and pH. The high acidity in the bog is probably the result of an ion exchange. The sphagnum of the bog mat produces uronic acid. The acid exchanges calcium ions ions for hydrogen ions, thereby increasing the acidity.

$-COOH_{H^+}$
$-COO^{2}_{\frac{1}{2}-Ca^{++}}$

This exchange is also one of the causes for the low hardness i.e. softness of the water in the bog.

The amount of carbonate and bicarbonate present is a measure of the total alkalinity of the water and it is limited, not by the amount of carbon dioxide available, but by the abundance of calcium ions and magnesium ions. Since most of the calcium ions are involved in the ion exchange with uronic acid, their concentration is decreased, leading to a decrease in the total alkalinity and specific conductance. With the alkalinity low and the concentration of hydrogen ions high, the tendency would be for the pH to also be low, in which in this case the prediction is affirmed.

The presence of hydrogen sulfide in the tropholytic zone of Forest Service Bog suggests that the bog does not turnover. It is protected from the wind and therefore the layers do not mix and there is no dissolved oxygen present in the lower regions of the hypolimnion. Decomposition must occur there through anaerobic means which result in the formation of hydrogen sulfide, carbon dioxide, and methane.

The true color reading for the bog was relatively low which explains the deeper thermocline present in Forest Service Bog. The other bogs, in general, were far more colored, hence less sun penetrated and their thermocline was shallower. Due to the clearness of Forest Service Bog, the sun was able to penetrate further resulting in a deeper thermocline.

The conditions of Forest Service Bog are characteristic of a dystrophic body of water. It is protected from the wind, poorly drained, acidic and low in electrolytes- all signs of dystrophy. As a result of the low rates of vegetation decay getting into the bog, it is probably allotrophic instead of autotrophic. Any animals residing in it must be adapted to low pH, low ion concentrations, and low oxygen levels.

III. Plankton Data

A. Zooplankton

By far, the most abundant species were the Chaoborus. There were a large number of Keratella, Daphnia, Ceriodaphnia, Nauplii, and Diaptomus. The next group, with only a few representatives of each, were the Brachionus, Conochiloides, Cyclops, and Senecella.

B. Phytoplankton

There was very little phytoplankton present. Those that were found included Desmidium, Tabellaria, Anabaena, Penium, and Dictyosphaeria.

C. Observations

The population of the nightime sample, as with that of Inkpot, was more dense than the sample taken in the morning. Again, surface predation decreased at night causing the plankton migration.

INKPOT and FOREST SERVICE BOG
A Comparison of the Two

Inkpot and Forest Service Bog have distinct surrounding vegetation, water chemistry, and size. Inkpot is a much larger lake and probably a younger lake than Forest Service Bog. The area encompassing Inkpot has a climax community of conifers and hardwoods, such as spruce and cedar. Immediately surrounding Forest Service Bog there is a bog mat with a few conifers and tamaracks. At the outer edge of the bog mat, though, there is a hardwood forest and some conifers. The vegetation of Inkpot is characteristic of a wet habitat similar to Forest Service Bog without the developed bog mat.

The water chemistry of the two bodies of water is obviously different, although Inkpot may be headed towards a situation similar to that of the bog. Within the last four years, the pH has dropped more than two pH units and there is a marsh-type area developing in the northwest corner of the lake.

THE YELLOW PERCH

I. Food Types

The majority of the food consumed by the yellow perch includes: insects, young crayfish, snails, scuds, midge fly larvae, mayflies, cladocera, ostracods, and chironomid larvae. After the first year the odonatas and ephemeropteras are a major food source. Prior to six years of age they prey upon decapods, small fish, and odonata nymphs.

II. Predators

The yellow perch are preyed upon by two general groups: water birds and other fish. The water birds include gulls, mergancers, loons, and kingfishers. The feared fish predators are the sunfish, bass, walleye, Northern Pike, Muskies, Lake Trout, and other perch.

do fish feel fear?

III. Habitats

Perch are basically shallow fish that do not live below thirty feet. They abound in open water lakes that have moderate vegetation and bottoms made of muck, sand, or gravel. Their number usually decreases with increases in turbidity and/or vegetation.

Their presence was identified in Bergner, Long, and Morris but not in Bolger Bog.

IV. Observations and Conclusions

A. Long Lake

The only fish caught in Long Lake were larger fish, ages 4-6+. For their age group they were comparatively greater in size. One of the reasons for the presence of only larger size perch is that they out compete the small fish for the few insects present. The larger perch, along with the bass present, are predators on the small perch and lead to a decrease in their prevalence. Then where do larger perch come from?

B. Morris

One perch, age 4+, was caught in Morris. It was very large for its age. For a perch to survive in Morris amongst all the Pike, it would have had to have been strong. Many of the perch are used for food by the Pike when they are young, hence any that are capable of surviving will have a more abundant food supply since the competing members for their food supply will have been killed off. It is probable that there are more perch present in Morris but the method of capture (rod and reel) did not give the most random sample. true!

C. Bergner

There was a large number of average size perch collected in Bergner where the food is in plentiful supply. Many years ago, a large percentage of the bass in Bergner were removed. The perch therefore increased greatly in number due to the large decrease in predators. This is one reason why there is such an abundance of the small perch.

D. Bolger Bog

There were no perch caught in Bolger Bog. The main reason for their scarcity is that the conditions there are not suitable to their lifestyle. The habitat is not conducive to yellow perch growth.

V. Recommendations

The only lake observed where it seems necessary to control the perch population is Morris Lake. It seems that if more of the Pike were removed, the perch would be able to survive in more substantial numbers. The other three lakes seem to have a relatively stable perch population and there does does not seem to be any immediate need for action either way to them.

BIBLIOGRAPHY

Andrews, William A., A Guide to the Study of Freshwater Ecology, Prentice-Hall Inc., 1972

Brown, Alison Leadley, Ecology of Freshwater, Harvard University Press, 1971

Carlandar

Cole, Textbook of Limnology

Standard Methods for the Examination of Water