A-

The University of Notre Dame

Environmental Research Center

(UNDERC)

Dr. David Morgan

The Fish Community

John Fezy

May - June 1977

The Fish Community of UNDERC

The fish community of the University of Notre Dame Environmental Research Center (UNDERC) is well stocked, and includes such members as Walleye (Stizostedion vitreum), Northern Pike (Esox lucius), Muskellunge (Esox masquinongy), Yellow Perch (Perca flavescens), Largemouth Bass (Micropterus salmoides), Smallmouth Bass (Micropterus dolomieui), Pumpkinseed (Lepomis gibbosus) and Mudminnow (Umbra limi), to name only a few. These fish species and others are present in many of the lakes on the UNDERC property, in which there is much interaction between the same species and different species. The interactions that take place pertain to survival: reproduction and competition for food, which includes predation.. In order to insure the future existence of the fish community, successful reproduction must take place within the same species. Fish lay many eggs, however, very few survive to become adults as a result of nature and interference of man. As the fish matures and reaches adulthood, the competition for survival is a constant threat. It is an integral part of the fishes life: eat or be eaten, in which the strongest survive. The major predators, that are found in the UNDERC waters, are Muskellunge, Northern Pike and Largemouth Bass. These fish usually maintain a lake's population. However, this is not always the case as may be seen in Morris Lake.

The two bodies of water sampled for fish were lakes Bergner and Morris. Each lake represented two different types of fish communities; Bergner a well-balanced fish population, and Morris depicting over-population. Bergner showed a balanced community, that consisted of ~~Smallmouth~~ Largemouth

Bass, Pumpkinseed and Bluegill (Lepomis macrochirus). The fish samples from Bergner Lake were large in size and quite healthy, because they had a good supply of food, and were not too densely populated. Morris Lake, on the other hand, consisted primarily of Northern Pike and a few Yellow Perch. The Yellow Perch samples from this lake were good size, while the Northern Pike were quite long and thin, as a result of over population and lack of food. This topic of over-population in Morris Lake shall be discussed in more detail later in the paper.

There are two types of water bodies on the property, bogs and eutrophic lakes, which have different chemical composition. Bogs, characteristically, have low pH's, and are low in O_2 levels. They are primarily inhabited by mudminnows (Umbra limi), which are quite small; less than four inches in length. Since the mudminnows are small, their O_2 need is not as great as for larger fish, and are thus able to survive in the low oxygen contained bogs. These bogs are choked with aquatic vegetation, which supply the mudminnows with ample food sources. These fish are also able to burrow into the mud when the water levels become low, and they have teeth, which enables them to eat insects and small crustaceans. Through the course of evolution, their skin and scales must have built up a resistance to low pH, which enable them to survive in bogs, in acidic conditions. Usually being the only species of fish found in this type of water, predation is not a problem, and therefore makes survival easier. As a result of their low O_2 need, low pH resistance, ample food sources, having teeth and lack of predation pressure, mudminnows are able to inhabit the small area of bogs in abundance.

Eutrophic lakes have a greater variety of fish species, because

of its chemical composition, and its area. These types of waters have larger amounts of O_2, and thus are able to support larger species of fish. The chemical balance of nutrients in an eutrophic lake; phosphate, nitrate and sulfate, is the key that insures productivity. As a result, plants and phytoplankton use these nutrients in the photosynthetic process to produce oxygen. They also serve as food sources for the zooplankton, which in turn serve as food sources for the fish. These nutrients are resupplied by waste material and the remains of dead fish. This cycle insures the existence of a productive lake, in which there is enough oxygen and food to support many species of fish.

Another reason, for this type of population of increased species of fish in eutrophic lakes, is the pH, which is normally much higher than in bogs and usually between 5 - 9. This type of pH allows more and various species of insects and crustaceans to habit the water, because it is not acidic, and therefore more life is able to tolerate it. They serve as an additional food source for fish, which allows for a greater chance of survival.

A final reason for the different types of population is the water area. Eutrophic lakes have much larger areas than bogs, which allow larger fish to inhabit the waters. This increased area also reduces the possibility of a population density problem and insures normal growth and little stunting. In this type of setting, the population is controlled through nature by predation pressure and by man's sport - fishing.

The main reason why river fish are smaller than lake fish is because of the conditions, that are present in rivers. Rivers are flowing bodies

of water, and the current water temperature is lower than lake water. As a result of the water being colder, oxygen concentration is not as great, and therefore for the fish to survive, its metabolism must increase. This increase in metabolic rate serves to control the size of the fish, and it has been shown that there is a rapid decrease in the relative performance with increasing fish size.* The total water area of rivers is confining, which causes stunting in many of the larger fish. This leads to a reduction in size. The plankton that inhabit rivers are also smaller, and not as numerous, because of the flowing current, that carries them downstream. Smaller fish are more suitable for the flowing water, because they have less mass, which they must move through the water and many times against the current. The river current is physically taxing on the fish, and is size reducing because of the metabolic increase, which the fish must compensate for. As a result of diminution, predation pressure is not as great, therefore, there is an abundance of small fish.

Morris Lake has a zooplankton crop, that includes calanoid and cyclopoid copepods, Ticchocerca, Bosmina and Polyphemus, while the phytoplankton includes Dinobryon, Volvox and Staurastrum. These planktonic communities are well populated, however, the Northern Pike, that were sampled, there, were only 20 inches at 4 years of age and quite skinny. This is the case, because Morris Lake has a population density problem, in which there are too many fish with not enough food in too small an area. Predation pressure is not a control here, because all of the fish are generally the same size, and not able to eat each other. Man does not play a role in the control, due to the fact that not many fish the lake, and few pike are caught to decrease the number of the pop-

ulation. If this persists, Morris Lake may become a dystrophic body of water if the pike consume all or most of the plant life in which photosynthesis would stop, and the lake would be unproductive and die.

The Yellow Perch taken from Morris Lake were large, in that they were the strongest and biggest to avoid predation of the Northern Pikes. When the Northerns were introduced to Morris Lake, the Yellow Perch had a good spawning season, in which many offspring were produced. Since both started their existences at approximately the same time, some of the perch were able to maintain growth rates, that were equal and more rapid than the pikes. This allowed them to grow to a larger size before being consumed by the predacious pike. For this reason, the Yellow Perch, that were caught and sampled from Morris Lake, were large, because their growth rate surpassed that of the Northern Pikes, and were able to avoid predation, and yet, were able to consume enough food to survive.

Pike had good spawning year days ago.

* Fish Physiology, Hoar and Randall
Academic Press, New York and Landon,
copyright 1969, p-421, volume 1