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A POPULATION CENSUS OF *ESOX LUCIUS*
MORRIS LAKE, GOEGIBIC COUNTY, MICHIGAN

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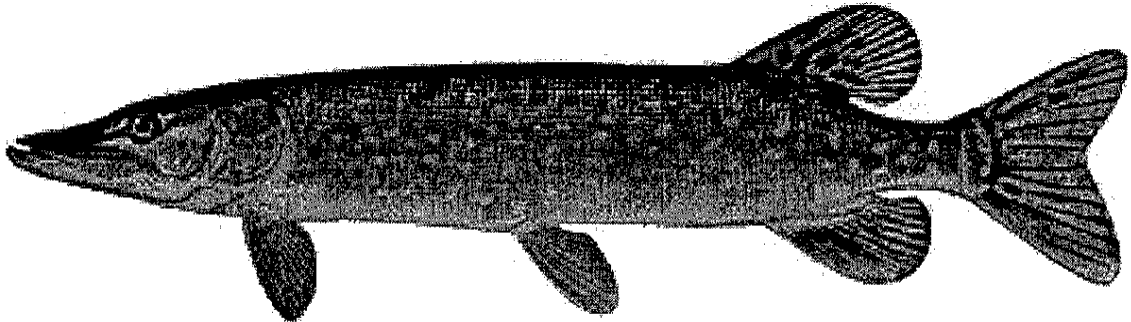
ABSTRACT

Lord and Lewandowski (1999) conducted a population census of *Esox lucius* on Morris Lake, Goegibic County, MI. Population census' are beneficial in determining the relative health of a specified species and the dynamics of the ecosystem in study. The use of a Fyke net and angling were the primary methods implemented in this census. Lord and Lewandowski used a catch and recapture technique. Primary catches were marked, scale samples were taken, and the fish were measured for weight, girth and length. The measurements provided data for whether or not the population was stunted. The census found a large abundance of *Esox lucius*. Data revealed that the size of these fish were comparable to other lakes given their young age, but many of these fish were older than we estimated. The relative size of the *E. lucius* suggests that the immense abundance has retarded growth because of inter-species competition and provided the lake with smaller *E. lucius*. Morris Lake is not unhealthy, but Lord and Lewandowski propose that human manipulation may be beneficial in returning the lake to having more uniform populations.

INTRODUCTION

Esox lucius, common name Northern Pike, is widely regarded as a gamefish. In most aquatic habitats, however, they hold importance as the primary predator and have a marked influence on ecosystems. Northern Pike have dark to olive green sides with rows of light, ova spots. The fins are marked with dark spots and a reddish tinge. On the underside of the lower jaw there are usually 10 pores. Northern Pike reach lengths of 12 to 47 inches and weights of 8 ounces to 24 pounds. Northern Pike reach greatest abundance in weedy bays of natural lakes and along moving water surrounded by heavy weed growth. Northern Pike spawn directly after the ice melts in the spring when water temperatures rise to between 34 and 40 degrees. Spawning occurs in shallow weedy bays and in small tributary streams or marshes connected to the lake. The spawning period of Northern Pike occurs earlier than muskellunge, which explains their domination due to

quicker maturity. Northern Pike are opportunists when it comes to diet. They prey primarily on other fishes, but frogs, crayfish and other animals are also victimized.



We conducted this population census to quantify and vigorously characterize the population of Northern Pike in Morris Lake. The acquisition of age and size data will further reveal the robustness of Northern Pike and how this population relatively compares with other populations in the lake, i.e. competitors and prey. This data will aid us in understanding the overall ecosystem of the lake by hypothesizing its effects on other species in and around Morris Lake. The information gained through the census will provide insight as to the population's effect on the ecology of the surrounding wilderness, and whether active manipulations are necessary to maintain a biologically stable homeostasis. An increasingly pertinent use is to determine the effects of human activity on a body of water.

We hypothesize that, due to a lack of predators and competition, and an abundance of prey, that Morris lake is overpopulated with stunted northern pikes.

Materials and Methods

Conducting a thorough fish population census includes the positioning of one or more fyke nets. After studying the topographic map of Morris Lake, we settled on a relatively weed-less, shallow point off the northwestern shore for our lone fyke net. We chose the location as a culmination of three objectives: that the fyke net could operate unobstructed by weeds, that we could check the trap contents in a reasonably efficient manner, and that the location rested among a heavy fish traffic point.

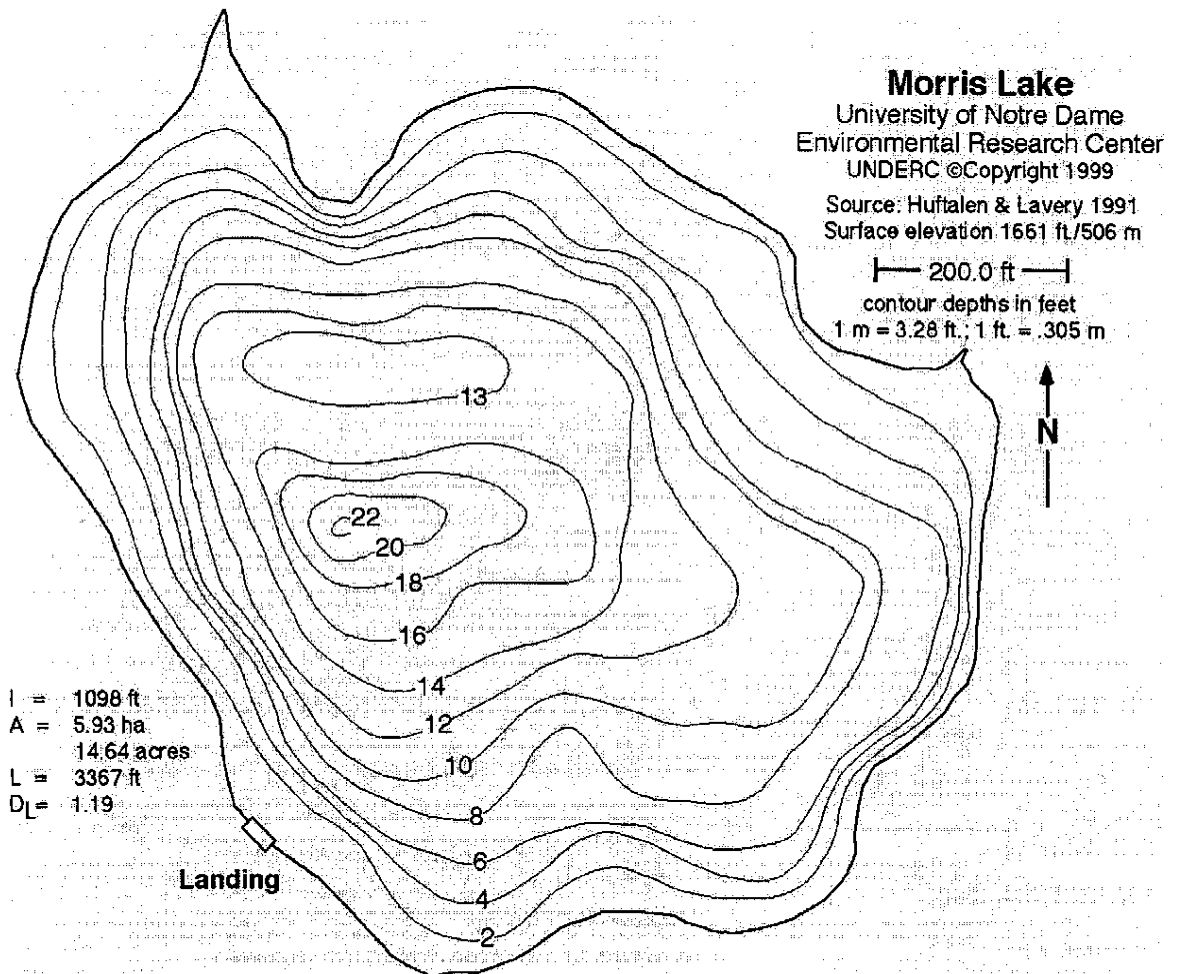


Figure 1. Topographical map of Morris lake.

The following summarizes the physical setup of the fyke net. Ideally a three boat system should be used to setup any fyke net. Two persons in a single boat erected the fyke net on Morris Lake. Initially, we tied the main panel (Fig. 1, A) to a sturdy crop of deciduous shoreline brush. We continued to stretch out the panel from shore in a perpendicular fashion. Once taut, we dropped the main cage (Fig. 1, B) off the bow of the

boat. The accordion-like trapping (Fig. 1, C) temporarily rested in the water while we tended to the adjacent wing appendages (Fig. 1, D). The wing appendages were stretched taut and anchored at a 45° angle from the main cage. Cinder blocks anchored the end of each appendage. In addition, red buoys marked the cage, the appendages and the trapping in order to warn boaters, fisherman and other recreationists of the underwater nets. Stretching out and anchoring the accordion-like trapping completed the setup of the fyke net on Morris Lake.

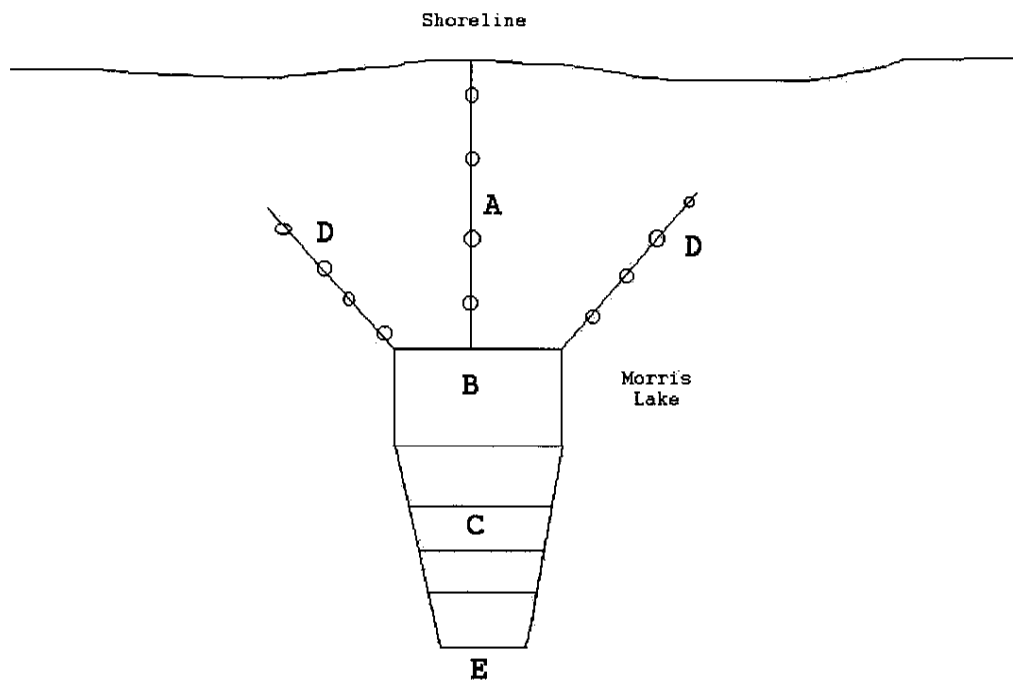


Figure 2. Schematic design of fyke net.

The following outlines the daily retrieval of trapped specimens. A three-person crew, accompanied by an outboard motor, is recommended for checking the fyke net. Unfortunately, limited resources often restricted our crew to two persons and left oars as the only means of locomotion. One person generally positioned the boat at the tip of the trapping (Fig. 1, E). The other perched at the bow of the boat and raised the anchor; followed by the actual trapping. Captured specimens were extracted via an opening at the tip. The Northern Pike retrieved were measured and logged, as will be described in further detail below. Any other specimens were recorded and released immediately. Repositioning of the fyke net followed complete extraction of all specimens.

The fyke net assumed the static method of this project, while angling provided a more dynamic mechanism for data acquisition. The value of angling as a collection method can be affected by many external variables: air temperature, water temperature, water clarity, cloud cover, wind direction and velocity, lunar cycles and the temperament of the anglers. These variables were considered when selecting angling equipment (lures, trolling motor, locations on the lake, et cetera) prior to individual outings. For instance, on an overcast day of moderate temperature with a northwesterly wind of approximately 20 knots we would angle the northwest shore with bright and vibration-producing lures. Artificial baits were exercised most frequently, the most productive of which included various spinner baits and perch-patterned crank baits. Live bait consisting primarily of minnows also found occasional action. Both spinning and casting reels were employed with dark, nylon braided fishing lines ranging from 18-27# test and reinforced with black, 9", 30# steel leaders.

The following technique achieved maximum efficiency. The two anglers organized measuring and tagging equipment prior to the excursions. Upon capture of a Northern Pike, be it either through the fyke net or by angling, one researcher would measure (length and girth), weigh, tag and remove scale samples while the other would record the data. The anglers released each fish immediately to ensure maximum survival rates. Back in the lab, the scale samples were studied under dissecting microscopes. By counting

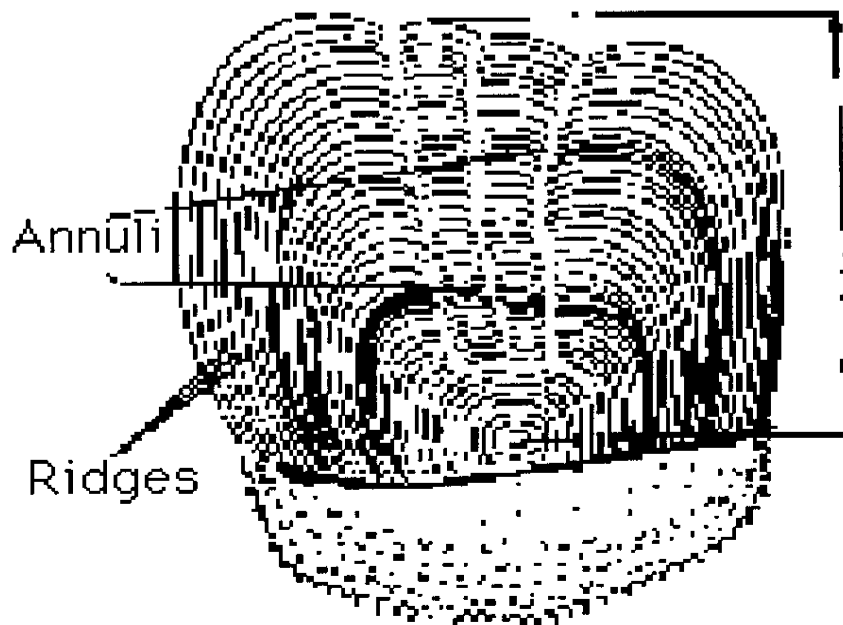


Figure 3. Fish scale displaying annuli.

annuli we determined the age of each fish. (Fig. ?). Standard Methods details the technique used to count annuli. We tagged each fish by clipping a portion of the right anal fin.

We estimated the population size of the Northern Pike in Morris Lake using two computer generated models, Schumacher and Schnabel Binomial.

Results

We captured 78 fish in total, 38 males and 40 females. Of the 78, 11 of these were recaptured fish. From this data we used two different methods of estimating the population size. Using a Schumacher's estimate we determined the population size to be 219.97 with 95% confidence limits of 148.33 to 425.49. Using the Schnabel Binomial estimate we determined the population size to be 248.91 with 95% confidence limits of 143.73 to 514.37.

We determined the volume of Morris lake to be 18058 m^3 . (Cole 1994) This gives us fish per unit volume estimates of $.012 \text{ fish / m}^3$ and $.014 \text{ fish / m}^3$.

Figure 4 shows what percent of the captured fish fall into each particular length category. There is a bell curve with the mean around 425 to 450 mm for the males and 450 to 500 mm for the females. Overall, the female population were observed to be slightly larger than their male counterparts.

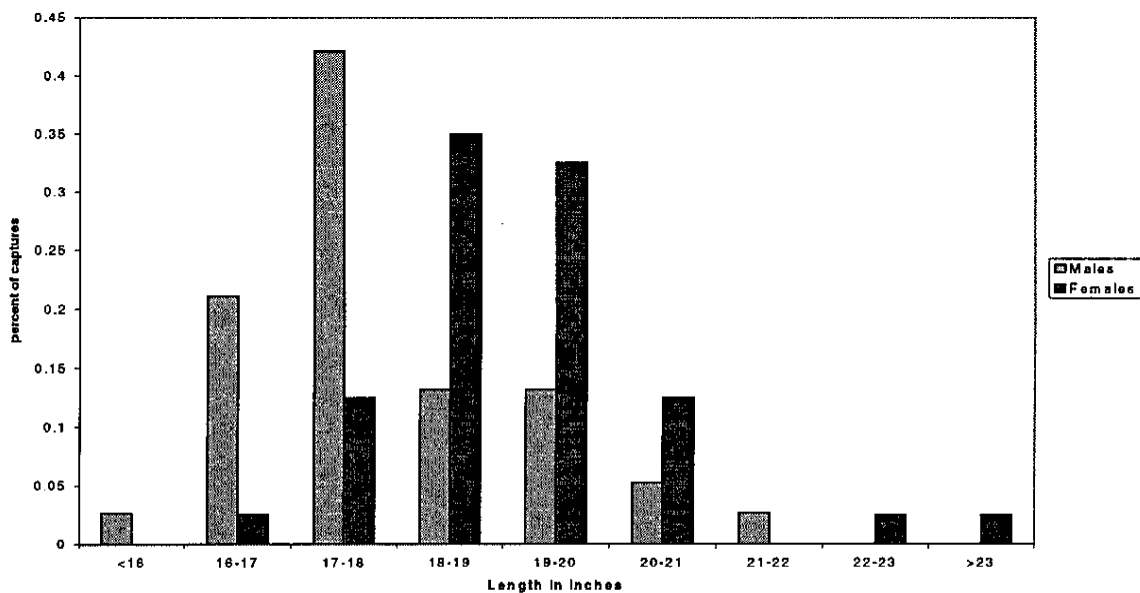


Figure 4. Length Frequency.

Figure 5 demonstrates the percentage of captures that fall into each individual weight category. We once again see a bell curve with the females weighing slightly more than the males. The female bell peaked out from 2 to 3 lbs. with the males at only 1 to 2 lbs.

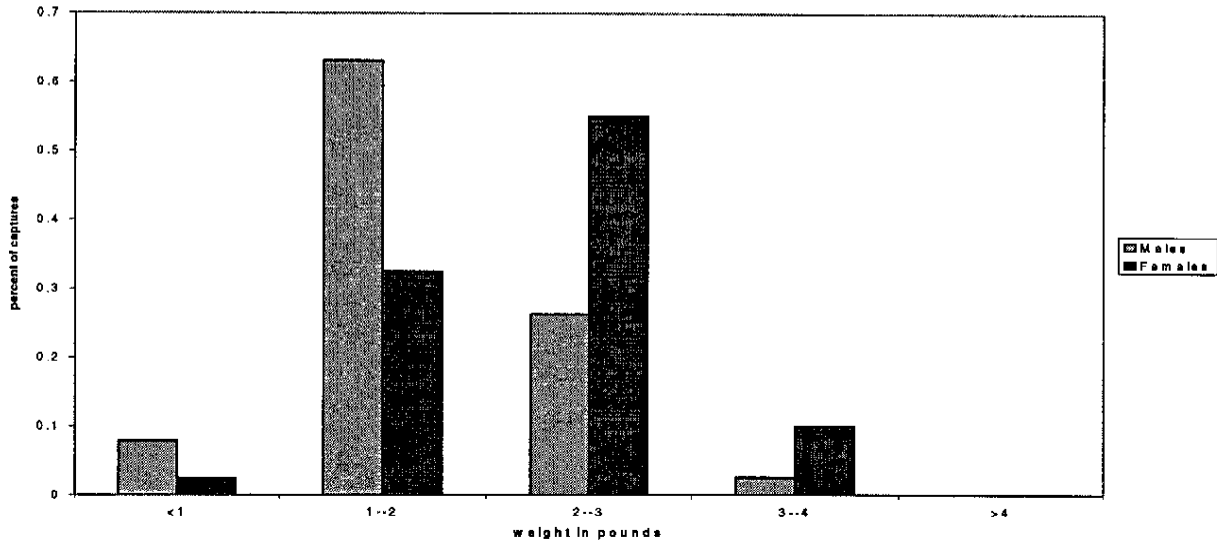


Figure 5. Weight Frequency.

Figure 6 reveals that the majority of the males we caught were 2 to 3 years old, while the average female was closer to 3 or 4. This most likely explains the trend for females to be both longer and heavier than the males.

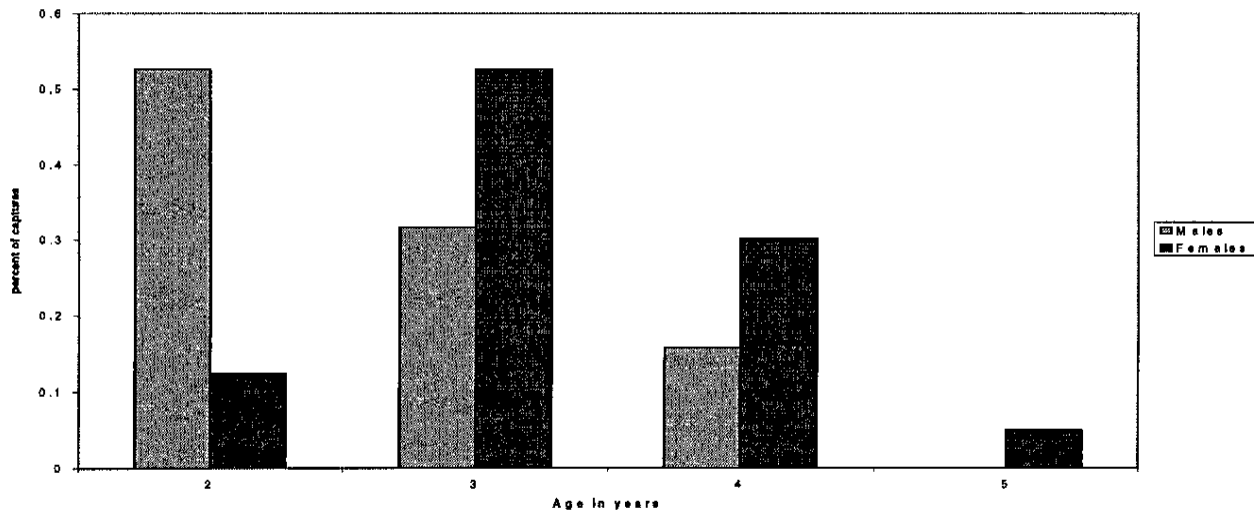


Figure 6. Age Frequency.

Figure 7 simply demonstrates the relationship between the age of the fish and their weight. For our data this was primarily a straight line function as the age of the fish directly correlated with their weight. We calculated an R^2 value for the female regression line to be .515 and the R^2 value for the male regression line to be .6065.

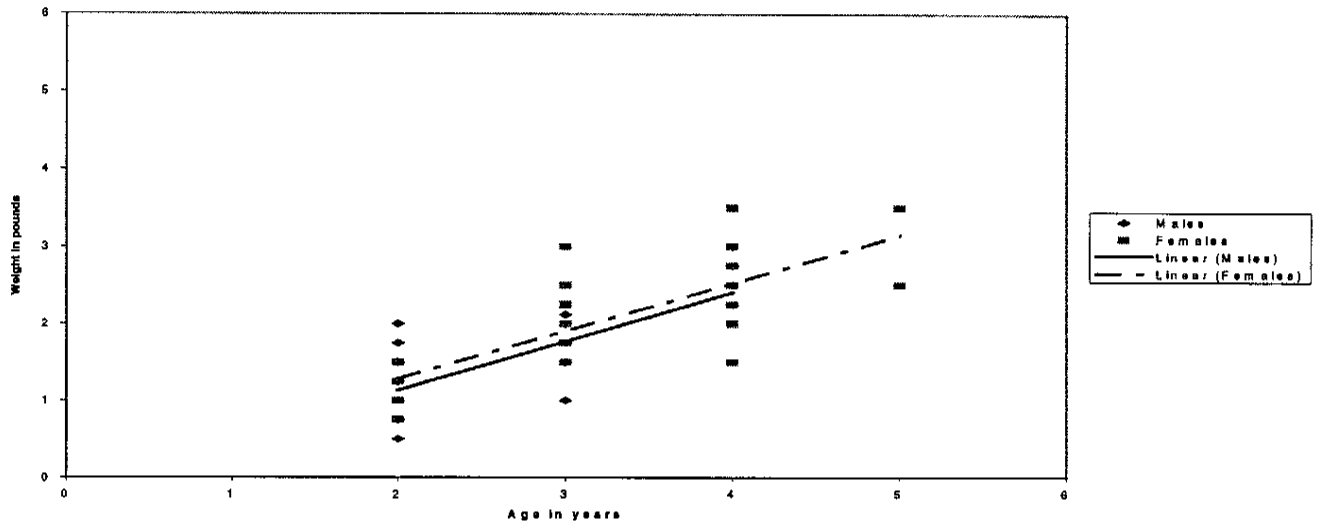


Figure 7. Age vs. Weight

Figure 8 is another linear relationship with respect to age, this time, with length. Our data show a straight-line correlation between the age of fish and their length. We found an R^2 value of .5404 for the regression line of the female population and an R^2 of .5431 for the males.

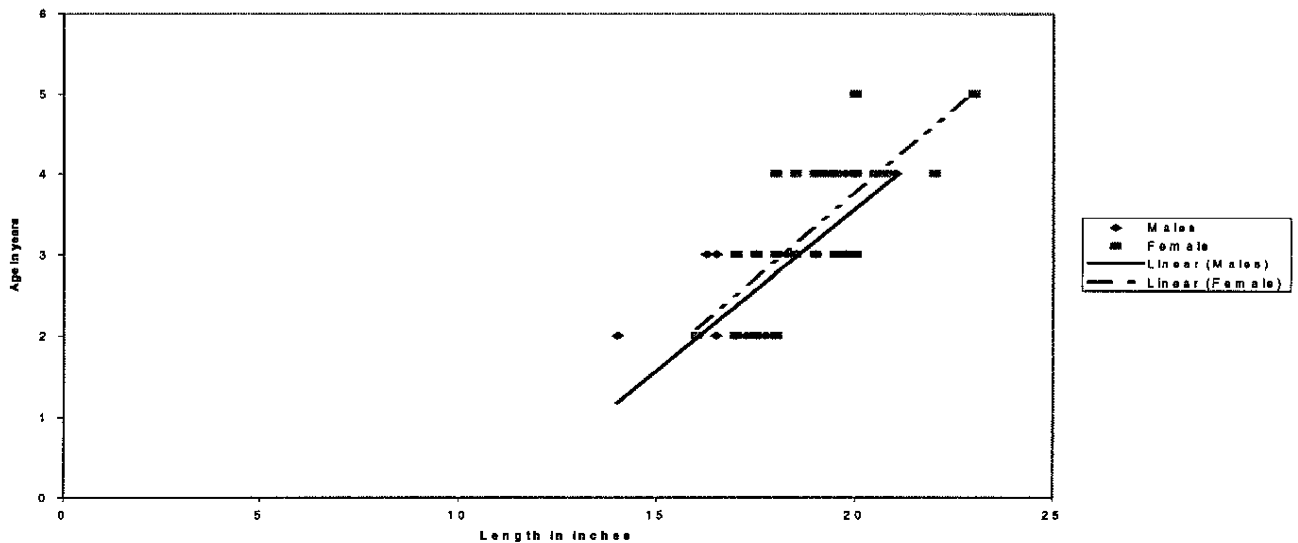


Figure 8. Age vs. Length

Figures 9a and 9b are both plots of length and weight. Figure 9a should be a sigmoidal curve, but we obtained a more linear graph. The R^2 for the female curve was calculated to be .7519, while the R^2 for the male regression line was .6485. Figure 9b is a graph of the log of both the length and the weight. This allows us to get more of a straight line function. For this graph we obtained an R^2 value of .7383 and the equation for the line is: $y = 4.3908x - 8.789$.

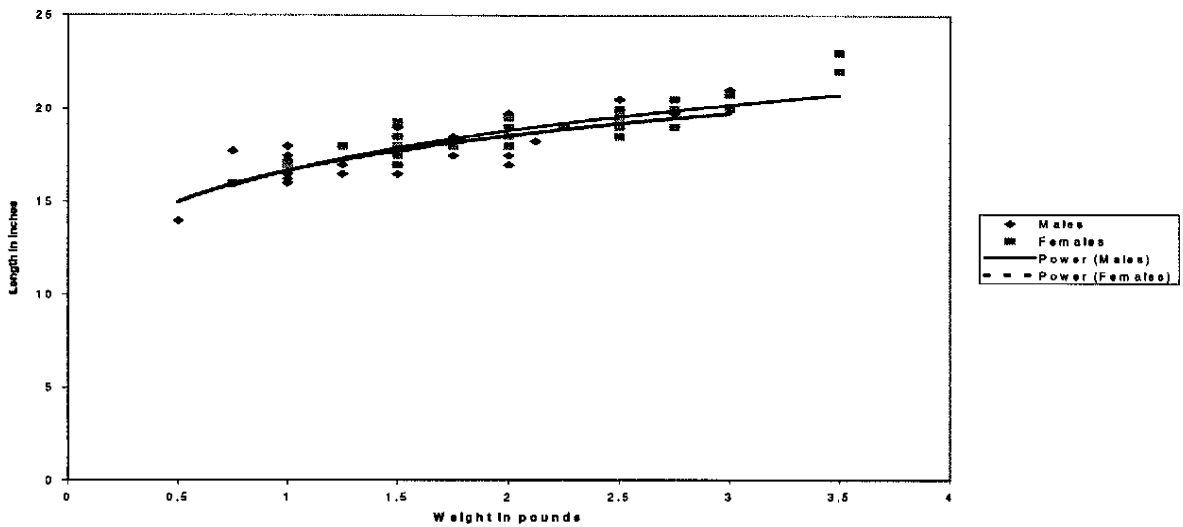


Figure 9a. Length vs. Weight

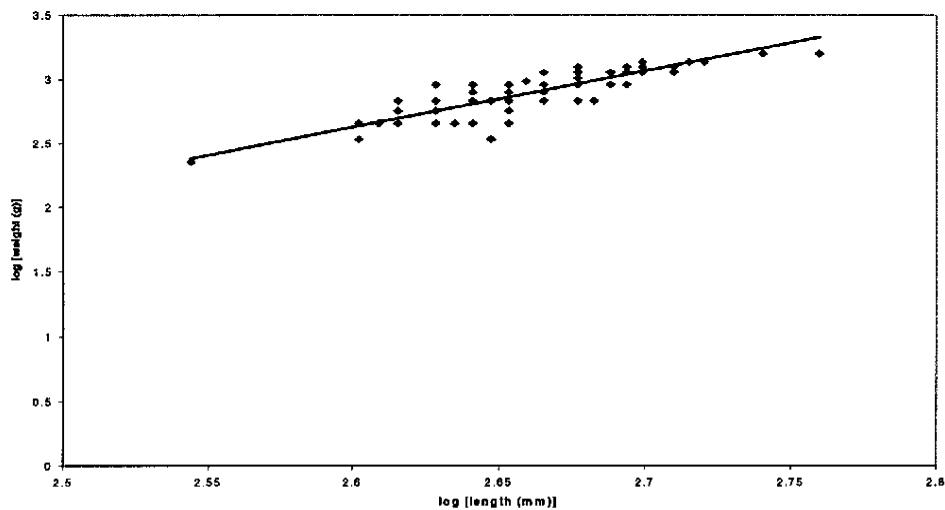


Figure 9b. log(length) vs. log(weight)

In addition to recording all of the Northern Pike we captured, we kept track of the other fish, and aquatic creatures captured in the fyke net. Table 1 shows what specimens were taken each day, with the quantity of the particular animal in parentheses.

<u>DAY</u>	<u>CATCH</u>	<u>DAY</u>	<u>CATCH</u>	<u>DAY</u>	<u>CATCH</u>
1	bluegill (1) perch (1) minnows(3)	6	bluegill (4) perch (1) minnows (4)	11	bluegill (4) perch (2) painted turtle (2)
2	snapping turtle (1) bluegill (9) perch (3) minnows(3)	7	painted turtle (2) perch (1) bluegill (2) minnows (4)	12	bluegill (2) crayfish (2)
3	perch (2) bluegill (5) painted turtle (1)	8	perch (1) bluegill (3) minnows (3)	13	perch (1) bluegill (3) painted turtle (1)
4	snapping turtle (1) painted turtle (2) perch (2) minnows (5)	9	bluegill (1) painted turtle (3) snapping turtle (1) minnow (1)	14	bluegill (6) minnow (5) perch (3) crayfish (3)
5	painted turtle (2) perch (2) minnows (2)	10	blue gill (1)	15	bluegill (1) minnow (3) crayfish (1) snapping turtle (1)

Table 1. Non-Pike fyke net captures

Discussion

The ecosystem of Morris Lake has a reputation of being abnormal. Morris Lake is considered to have an abundance of undersized Northern Pike and not much else. The Pike are accused of dominating the lake and eliminating other species. We predicted that due to an overpopulation of Pike that their growth would be stunted, and that there are not enough available resources to support a normal healthy population.

While all of the fish we caught were small, supporting this hypothesis, they were also fairly young. The size of the fish for their age was comparable to Northern Pike from other lakes at similar latitudes in Wisconsin. (Becker) We could not definitively show that this population is stunted, because we did not

catch any old fish that were still very small. We see two possible explanations for this. The first is that we were simply unable to capture any older fish. The older fish may have been more docile, or simply fed on different prey than the younger fish. This would seem to make sense, because these types of experiments are always biased to one or more groups. This could have also been influenced by our small sample size. Perhaps, with a much larger sample size we would have captured some older fish.

However, the most likely explanation is simply that we were not able to accurately determine the age of the fish from the scales. The annuli of Northern Pike are very undefined, and it takes a well-trained eye to precisely identify them. The annuli from the first year or two are fairly easy to recognize, but after 3 years they are very bunched up, and it is difficult to determine exactly how many there are. In other words, it is possible that many of the fish that we labeled as being 3,4, or 5 years old were really much older. If that is true, then we would be able to state with some amount of confidence that this population is growth stunted. Basically, an 8 or 9 year old fish should be much bigger than any of the fish we caught, and it is possible that some of our captures were this old.

We believe that this inaccuracy in the aging process is what kept us from confirming our hypothesis as being true. Using the two different population size estimates we found the population to be well over two hundred. That is quite a large population of one species for a lake the size of Morris. Barring some unexplained ecological oddity, it is certain that out of these 200 or so fish, that a good number are older than 5 years. Based on our captures, these older fish are most likely the same size as the 2 and 3 year old fish. It is quite clear that this has influenced all of our data.

We found the female fish to be slightly longer and weigh more than the male fish. This would seem to make sense, because the females in most fish populations, including Northern Pike, are generally larger than the males. However, we determined that our female captures were also on average older than the male captures. This would mean that the female fish are longer than the male fish simply because they are older. One explanation for this could be that due to preferential habitat differences, the older males tended to separate themselves from the younger males and the females. Most of our captures came from the same

general areas, it is possible that the older males simply did not dwell in these locations. Another possible explanation is that the older males were simply not able to be captured by our methods. These fish may have grown too wary to be captured by artificial bait, or may have sensed danger when near the fyke net and swam away. This leads us back to the ever-present bias in mark-recapture experiments.

The relationships between age and weight, and age and length are quite simple. The older a fish is, the more it will weigh and the longer it will be. We demonstrated this in our age vs. weight and age vs. length graphs. There will always be some variation due to different genetic strains, but the relationships are relatively constant for the most part. We were not able to observe the weights or lengths of these fish tapering off as they get older, because we did not record the captures of any older fish. If some of our fish had been older, we would have seen more of a logarithmic regression line for these curves. This would have been a definite sign of stunted growth.

Our length vs. weight graphs could possibly be seen as providing support for our hypothesis. In a normal, healthy fish population, a length vs. weight graph should have a sigmoidal look to it. This is because the fish grows heavier as it grows longer, but once it gets to a certain length, its weight begins to increase due to a growing girth. In other words, once the fish are long enough they just get fatter. Our fish showed a direct correlation between weight and length. This shows that the fish never grew to a length where they would start to increase in girth. Due to an overpopulation, resources were not plentiful enough for any of the fish to get fat.

The most sound evidence for an overpopulation of Northern Pike in Morris lake is the analysis of other species present. The largest fish that is not a Northern Pike is the yellow perch. However, this species does not grow much longer than 12''. The yellow perch is the primary food source for most larger Pike species. There are no fish in Morris Lake that present any competition whatsoever for the Northern Pike. Species like the muskellunge and largemouth bass usually compete with Northerns to balance out the ecosystem, but they are not present in Morris. The only sources affecting the population at all are some competition

with snapping turtles, predation by bald eagles, and the occasional fisherman. Bluegills, minnows and crayfish, all abundant in Morris, also provide excellent food for large fish species.

While we did not definitively prove that the population of the *Esox Lucinus* in Morris Lake is stunted, we did provide some evidence alluding to this, and we showed that the population is quite numerous and without competition. Further research of this nature should be done to more accurately characterize the stunted growth. More time will be necessary in order to obtain a larger sample size, and a more accurate method of age determination should be employed. Once this is accomplished, research should be done as to formulating a solution to the problem. This could include elimination of some of the northern pike population along with the introduction of other species to try to induce a more balanced ecosystem in Morris Lake.

References

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