SPECIFIC MEASUREMENTS OF A YELLOW PERCH HEAD COMPARED TO THE TOTAL LENGTH

Alex Timm
Department of Biology, Aquatic Biology Program
Bemidji State University
Bemidji, MN, USA
alexander.timm@live.bemidjistate.edu
Faculty Sponsor: Dr. Andrew W. Hafs (andrew.hafs@bemidjistate.edu)

Abstract—**Yellow Perch *Perca flavescens* is a popular fish for harvesting in Minnesota. Because of this the Minnesota Department of Natural Resources survey populations with gill nets, however, some water bodies have Rusty Crayfish *Faxinous rusticus* that commonly consume most of the body leaving only the head to be accurately measured. The goal of this research was to see if there is a relationship between specific measurements of the head and the total length of the fish. The number of Yellow Perch sampled in this study was 72 and all came from Lake Bemidji in Minnesota during the month of October in 2023. All the fish collected were measured in millimeters using a digital caliper for the head measurements. The best relationship was using the measurement of the opercular bone (TL = 3.8137x + 2.0415; R² = 0.99). The measurement of the mouth was the second best (TL = 9.3343x + 15.992; R²=0.99) and from the tip of the mouth to the eye was the worst relationship (TL= 13.142x + 8.9854; R²=0.97). All relationships had a p value less than 0.01.**

I. Introduction

Yellow Perch *Perca flavescens* is a key species for many fisheries in Northern Minnesota, both for forage and harvest. Because of this, measuring the size structure is important to observe the health of the populations. However, there are many times where the only measurable part of the Yellow Perch is the head. Often this occurs because of Rusty Crayfish *Faxinous rusticus* that consume the body while the fish is caught in a gill net.

Studies have been conducted in Europe on European Perch *Perca fluviatilis* comparing operculum length to the total length of the fish and there was found to be a relationship between the two measurements (Machiels and Wijsman 1996). The study on European Perch was conducted to compare the size selective mortality of different cohorts so there was data from a few different years. This was done by measuring the opercular bones of the different cohorts and running a regression analysis. A similar study was conducted on Yellow Perch from Lake Mendota in Wisconsin (Bardach 1996) but only focused on the opercular bone and not any other measurements.

Unlike the study on European Perch, the goal of this study is to determine if there are multiple measurements on Yellow Perch that can be used if the rest of the body is unmeasurable. The measurements chosen were the distance from the tip of the mouth to the beginning of the eye socket, the total length of the mouth, and the distance from the tip of the mouth to the end of the opercular bone. The data from this research would be used to determine the best estimated total length of the perch if only the head is measurable.

II. Methods

The Yellow Perch for this study were sampled on Lake Bemidji using multi-mesh gill nets that were approximately 14.6 m long, 1.8 m high with various mesh sizes of 9.5, 12.7, 15.9, 19.1, 25.4, and 31.8 mm. The gill nets were set at six predetermined locations around the lake and Yellow Perch were sampled from 5 - 19 October 2023.

When a Yellow Perch was sampled, the total length was measured first with a bump board, then the distance from the tip of the mouth to the beginning of the eye socket, total length of the mouth, and the distance from the tip of the mouth to the end of the opercular bone were all measured with a digital caliper (Figure 1).

There was a total of 72 perch that were measured. The measurements were then entered into a table and a regression analysis was run to see if there was a correlation between the head measurements of the perch and the overall length.

III. Results

There were 72 Yellow Perch collected that ranged from 84 to 248 mm in total length. All three of the relationships had a p value of less than 0.01 (Table 1). The relationships between the total length measurement were as follows, the tip of the head to the inside edge of the eye ranged in size from 5.72 to 18.74 mm and had an R² value of 0.97 (Figure 2). The total length of the mouth had a range of 7.27 to 25.00 mm and an R² value of 0.99 (Figure 3), and the length from

the tip of the mouth to the edge of the opercular bone measured from 22.03 to 64.22 mm and had an R^2 value of 0.99 (Figure 4).

IV. DISCUSSION

Based off the data collected, the total length of a Yellow Perch can be extrapolated with a high degree of confidence by using measurements from the head morphology. Previous studies on other species, such as Red Drum *Sciaenops ocellatus* (Serafy et al. 1996), demonstrated this can be used on multiple different species. Like the study on Red Drum, all the measurements that were taken are good predictors of the total length of the Yellow Perch because the R^2 value of the measurements was between 0.97 and 0.99.
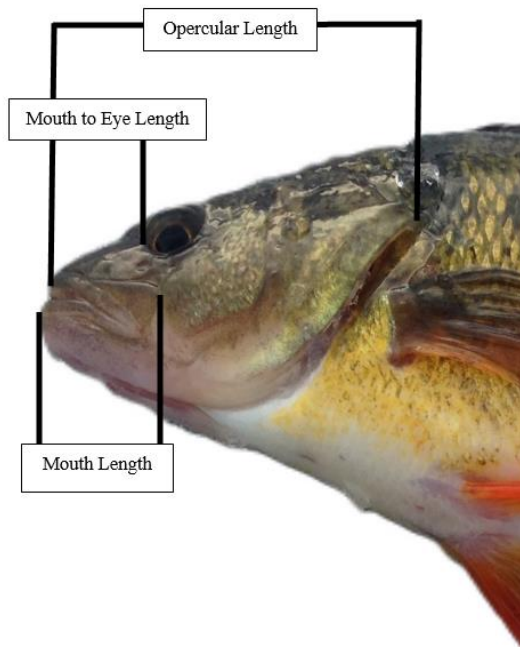

Fig. 1. Measurement taken of the Yellow Perch *Perca flavescens* head.

TABLE 1. RELATIONSHIPS AND R² VALUES OF THE OPERCULAR, MOUTH, AND EYE TO MOUTH MEASUREMENTS.

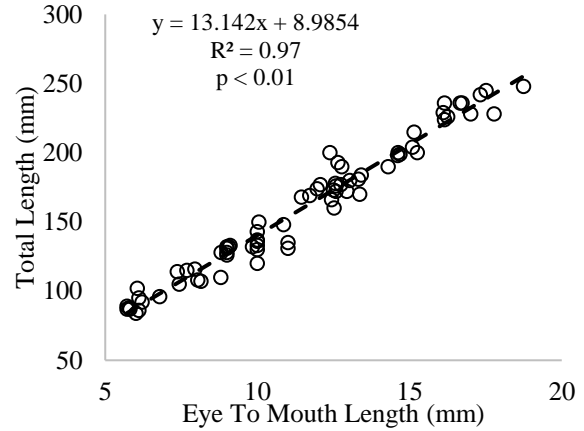| Measurement	Regression Equation	R² Value
Opercular	y = 3.8137x + 2.0415	0.99
Mouth Length	y = 9.3343x + 15.992	0.99
Eye to Mouth	y = 13.142x + 8.9854	0.97

Fig. 2. Total length and distance from tip of mouth to inside of the eye regression analysis with R^2 and p value.

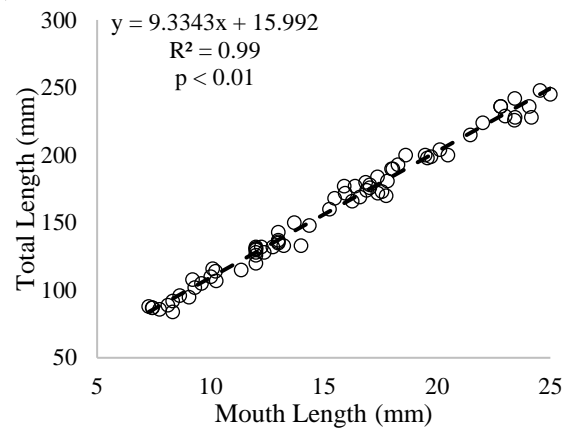
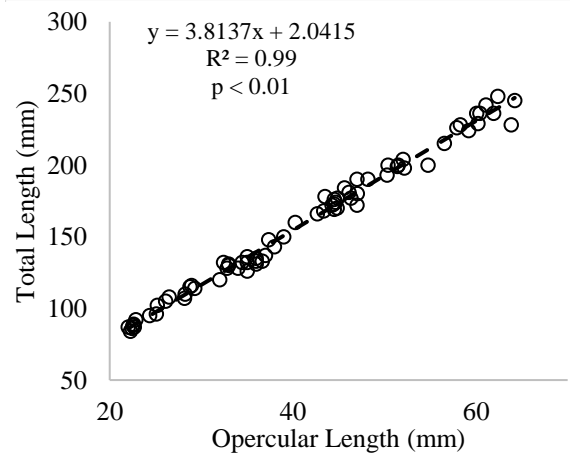Fig. 3. Total length and mouth length regression analysis with R^2 and p value.

Fig. 4. Total length and opercular length regression analysis with R^2 and p value.

Since it was found that head measurements can be used to determine the total length of a Yellow Perch, this research found that the opercular bone is the most accurate measurement for extrapolating the total length. This supports the findings from Lake Mendota (Bardach 1955). The biggest difference between the two studies would be that different equations are formed from the data collected from different systems. This means that to have the most accurate data possible, if this was to be used on a system that was not Lake Bemidji the data might not be the most accurate.

This data can be used for size estimates of the Yellow Perch populations by using only the heads, whether they are the only measurable part or obtained from anglers after they utilize the fish. This would add more supplemental data for fisheries managers to use and get a better understanding of what the harvest and populations look like beyond the normal data that is collected. The Yellow Perch were only collected from Lake Bemidji but can be expanded upon by including Yellow Perch from other systems to get a more accurate measure for the species and form an equation that can be used on multiple lakes large and small.

REFERENCES

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