GROWTH CHARACTERISTICS OF CREEK CHUB FROM THE SAW MILL RIVER

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Introduction

The creek chub *Semotilus atromaculatus* (Figure 1*)* can be found throughout New York State[(1)] but for the purpose of this study we focus on those found in the Saw Mill River at Chappaqua, Westchester Co. NY. A total of 176 fish were used in the analysis to evaluate the current status and growth characteristics of the creek chub in the Saw Mill River.

From simple fishery statistics[(2)] such as length-weight relationships and length frequency histograms the growth characteristics of fish populations can be calculated. Among these determinations are the average length at age, the equation of a second order polynomial describing the raw length-weight relationship, and the slope of log-transformed length-weight curves from which a determination of either allometric or isometric growth can be made. In addition one can use these data to determine the coefficients of growth between age cohorts.

Methods

The Saw Mill River is 36.9 km long. It is fed by Tercia pond in Westchester County and has its mouth in the Hudson River at Yonkers NY. The samples were collected using a push net, which is a small 1.2-m^2 seine constructed of 0.3-cm mesh stretched nylon. Sampling occurred during June – July and the river was visited about once a week. Upon capture the fish were anesthetized with MS 222 and then 10% formaldehyde was added to preserve them. They were kept in formaldehyde for 1-2 weeks and then transferred to 75% ETOH[(3)]. After transfer all Creek Chubs were measured for standard length in centimeters and weighed in grams. To these data was added the length and weight data of 77 additional chubs that were collected from the Saw Mill River at Chappaqua in previous years yielding a total of 176 specimens for the analysis. These data were used to generate a length frequency histogram and length-weight regression plots. Scales were taken from selected fish based on the peaks found in the histogram and were used to confirm the age of the sampled fish.

Figure 1. Creek Chub *Semotilus atromaculatus*

References

(1) Smith, C.L. 1985. The Inland Fishes of New York State. NYSDEC, 522 pages.
(2) Ricker, W.E. 1978. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin 191 Dept. Env. Fisheries & Marine Service, Ottawa Can. 382 pages.
(3) Rachlin, J.W. and B.E. Warkentine. 2012. An evaluation of fish assemblages of the Saw Mill River, New York: An urban stream. Norhteastern Naturalist 19: 129-142
(4) Zar, J.H. 1974. Biostatistical Analysis. Prentice-Hall Inc. Englewood Cliffs NJ. 620 pages

Results and Discussion

Creek chub ranged in size from 2.2 to 12.7 centimeters standard length, and a length frequency histogram generated from these data indicated 3 peaks (Figure 2.). To confirm the age, scales were taken from various fish represented by the different peaks and checked for the number of growth rings (Figure 3). This scale data confirmed the histograms 3 peaks as indicating three age classes, 0+, 1+, and 2+.

The length-weight relationship in fish, when used with a student t-test of the slope of the relationship, can indicate if the population under study is growing isometrically or allometrically. The length-weight relationship can best be expressed by the equation $W = aL^b$, where W = weight, L = length, a = a constant (the y intercept), and b = the slope of the regression line. These values describe a second order polynomial as shown on the length-weight regression on untransformed data (Figure 4.).

In order to calculate the slope (b) which is needed for the t- statistic a log transformation is performed (Figure 5). The slope of this regression line (3.0793) is subtracted from 3.0 and this absolute value is divided by the standard estimate of the error of the slope to generate a Student t statistic[(4)]. This value was calculated to be 3.06 which based on a table of t distributions and an n-1 value of 175 indicated that the slope 3.0793 is significantly different from 3.0 so the fish are growing allometrically.

The growth rate is a sufficient approximation of growth for short time intervals like one year. Using the average weight for each age class the growth rate was calculated using the equation $\ln(W_t/W_0)=g$, which is derived from the expression $W_t = W_0 e^{gt}$, and t is assumed to be 1. The data in Table 1 shows that there is rapid growth during the first year, and this growth begins to slow by the next year. This makes sense as the fish's first year of life is the most vulnerable to predation, and later as the fish approach maturity less time is spent eating and more time spent producing gametes and looking for mates.

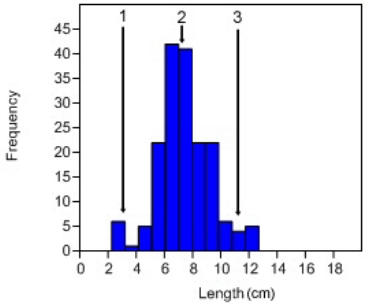

Figure 2 Length Frequency Histogram

Acknowledgements

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Figure 3. Creek Chub Scale from 1+ Fish

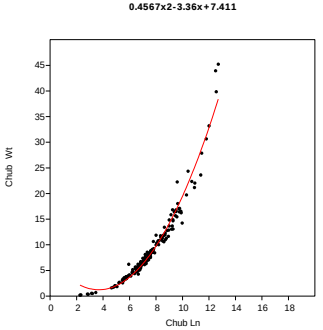

Figure 4. Length-Weight Regression on Untransformed Data

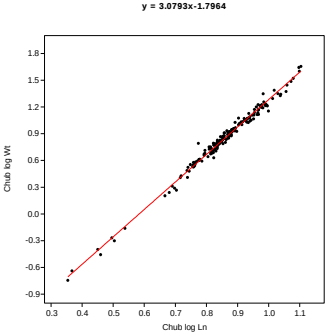

Figure 5. Length-Weight Regression on Log Transformed Data.

Table 1

Ages Classes	Growth Constant (g)
0+ - 1+	0.89
1+ - 2+	0.77