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Assessing the Body Condition of Brook Trout (*Salvelinus fontinalis*) in the Loyalsock Creek Watershed

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Background

The body condition of an animal is an indicator of their health based on their size and weight. Assessing body condition is useful for evaluating individuals and ecological disturbances. There are several methods to measure the condition of fishes from different species, regions, and sizes, such as Fulton's condition factor and relative weight equations. These equations were used to predict the condition of brook trout populations in the Loyalsock Creek watershed after Tropical Storm Lee on September 7-8, 2011. Following Hurricane Irene, Tropical Storm Lee caused historic damage to north-central Pennsylvania. The heavy rainfall saturated the soil in the watershed and triggered a catastrophic flood. Floods can severely harm freshwater habitats and disrupt fish populations. Assessing the health of these individuals before and after this event revealed how the brook trout populations responded and recovered from the flood.

Figure 1. Sample site locations in the Loyalsock Creek Watershed.

Methods

Fish populations were surveyed at 30 sites in the Loyalsock Creek watershed from 2011 to 2020. Streams were electroshocked following Pennsylvania Fish and Boat Commission protocols for 100-meter reaches and using triple-pass detection to estimate populations. Fish were netted, identified, and released back into the stream. Fish lengths and weights were recorded for trout. R-Studio was used to conduct analyses of body condition using the following formulas. Fulton's Condition Factor required the weight (grams) and length (millimeters) of adult individuals[1]. The standard weight equation used the total length (millimeters) of individuals[2]. The relative weight formula combined the weight of individual to the standard weight of individuals of similar length[3]. Both equations used indexes to predict the body condition of the brook trout populations.

Fulton's Condition Factor[1]

$$K = \left(\frac{W}{L^3}\right) \times 100{,}000, \quad L \geq 75\ mm$$

Standard Weight[2]

$$log_{10}W_s = -3.364 + 1.378\ log_{10}L + 0.397(log_{10}L)^2,$$
$$80\ mm \geq L \leq 266\ mm$$

Relative Weight[3]

$$W_r = \frac{W}{W_s} \times 100$$

Results & Discussion

Fulton's condition factor and a relative weight equation predicted the overall body condition of the brook trout populations in the Loyalsock Creek watershed. The results from both equations are consistent with each other. The overall body condition of the populations varied from 2011 to 2020. Body condition dropped considerably in 2013, two years after Tropical Storm Lee. The body condition of the populations improved over the 10-year period, but never returned to the median body condition in 2011 before the flooding event.

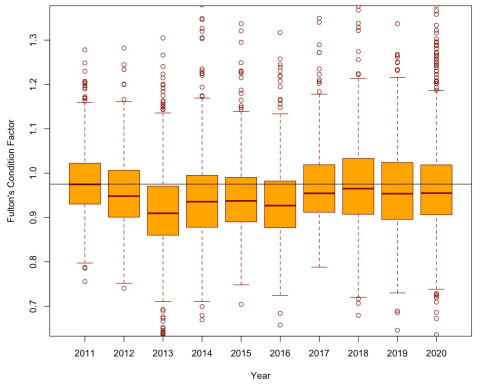

Figure 2. Changes in the body condition of brook trout from 2011 to 2020 using Fulton's condition factor. The median relative weight in 2011 was 0.97. (n = 4985)

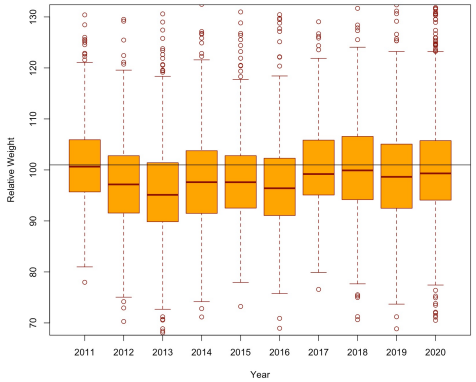

Figure 3. Changes in the body condition of brook trout from 2011 to 2020 using standard and relative weight equations. The median relative weight in 2011 was 100.64 (n = 4873)

Conclusion

Catastrophic floods can severely harm freshwater habitats. Excess sediment and nutrients are introduced which degrades the stream and creates an unsuitable environment for animals. Fish populations are disrupted and forced downstream, impacting fish distribution and population sizes. Flooding also impacts the availability of food sources and increases competition between individuals.

The flooding event caused by Tropical Storm Lee greatly impacted the brook trout populations in the Loyalsock Creek watershed. There was a strong decline in body condition after the 2011 flooding event, but the brook trout populations continue to recover over the 10-year period. While the flood is assumed to be greatest contributor to the decline in brook trout populations, other ecological factors (e.g., competition, food availability) may have also contributed to the change in body condition. It is recommended that further studies should be conducted to analyze the trout populations in the Loyalsock Creek watershed.

References

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3. Wege, G. W. & Anderson, R. O. (1978). Relative weight (Wr): a new index of condition for largemouth bass. *American Fisheries Society*, 5, 79-91.