FILLET WEIGHT COMPARISON FOR BLUEGILL, BLACK CRAPPIE, AND YELLOW PERCH

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***Abstract*—Panfish, including bluegill *Lepomis macrochirus*, black crappie *Pomoxis nigromaculatus*, and yellow perch *Perca flavescens* are three sought-after species. Anglers often perceive a change in regulations as an attempt at limiting the amount of harvest. However, the goal of many regulation proposals is to increase the size structure of panfish, allowing anglers to achieve their ideal harvest with less fish. The primary objective of this study was to assess the relationship between panfish fillet weight and total length to estimate how many fillets would be needed to reach a harvest weight of 0.5 lbs. The secondary objective was to compare this relationship between ten West Central Minnesota lakes to previously published data from seven Wisconsin lakes. Minnesota fillet weights and yields were calculated from 360 bluegill, 167 crappie, and 108 yellow perch. Mean fillet yield was 36.5%, 42.3%, and 44.5% for bluegill, black crappie, and yellow perch, respectively. On average the fillet yield from Minnesota lakes was 10.72% greater than fillet yields from the previous research done in Wisconsin. In conclusion, fillet weight can be useful metrics for managers to generate harvest limits that allow anglers to reach the 0.5 lbs fillet goal.**

I. INTRODUCTION

Many panfish populations of historically high quality have seen declines in size structure in recent years (Lyons et al. 2017). Panfish are described as rock basses *Ambloplites* spp., sunfishes *Lepomis* spp., crappie *Pomoxis* spp., and yellow perch *Perca flavescens* (Lyons et al. 2017). With a lack of large individuals, anglers struggle to find adequate fisheries (Lyons et al. 2017). Continuous removal of large parental males alters the energy expense in the remaining towards gonadal development and reproductive activity (Jacobson et al. 2005). Having an abundant number of small fish affects the overall population's maturity, age, growth, and weight (Neuswanger et al. 2015). Decline in panfish size structure has inspired management attempts to increase biological and ecological qualities of aquatic systems (Jacobson et al. 2005).

Managers have addressed stunted populations with various techniques. Predatory species, such as walleye *Sander vitreus* and largemouth bass *Micropterus nigricans*, have been used to manage growth rates for stunted populations (Forney 1977). Predation reduces competition within the fish community to allow for yellow perch, black crappie *Pomoxis nigromaculatus*, and other panfish to reach a desirable harvest size (Forney 1977). Another technique involved the removal of colonial nests targeting egg and fry to manage bluegill *Lepomis macrochirus* reproduction (Neuswanger et al. 2015). Restrictions on daily bag limits attempt to combat overabundance of smaller fish by improving the size structure of panfish species. Under some conditions, the increase in fishery yield may be due to the size of fish harvested offsetting the reduction of fish being kept (Lyons et al. 2017).

Fish weight and yield can be used to communicate the tradeoffs between the harvest of a greater quantity of smaller fish versus fewer larger fish (Lyons et al. 2017). Total fishery yield, the estimated sum of the weights of all harvested fish, will sometimes be used by managers to compare the effects of various regulations (Lyons et al. 2017). The weight of edible fillets available to anglers from specific sizes would represent a better metric for communication of restrictive regulations (Lyons et al. 2017). The primary objective of this study was to assess the relationship of total fillet weight and total length among bluegill, black crappie, and yellow perch. A secondary objective was to compare the species from ten west central Minnesota lakes to seven previously studied Wisconsin lakes.

II. METHODS

Bluegill, black crappie, and yellow perch were collected during the 2023 standard lake survey season. The season started in May 2023 and ended August 2023. Sampled lakes were from the west central Minnesota region including Barrett, Chippewa, Ida, Linka, Maple, Miltona, Moon, Page, Pomme de Terre, and Reno. Moon and Reno samples were collected in September 2023 from the standard fall panfish surveys.

Sampling methods included techniques outlined by the MNDNR standard survey which included standard gill nets, and standard fyke nets (MNDNR 2017). Gill and fyke nets were deployed and retrieved in 24 hours. The process was repeated to reach a total of 66 fyke net sets and 60 gill net sets for the summer sampling season. Sample size was subjected to opportunities from gill net mortalities and fyke net otolith extraction. A minimum standard length of quality fish was determined as 150 mm for bluegill and 200 mm for black crappie and yellow perch (Gabelhouse 1984).

Fish that were brought back to the office were re-measured using a standard measuring board down to the nearest millimeter. The total weight was measured in grams. Fillets were extracted by one experienced individual. The individual avoided, if not removed rib structures from fillet and any left-over skin. Belly meat was included on all fillets. A single fillet weight was then recorded and doubled for total fillet weight (TFW). Percent yield was then the calculated quotient from the total fillet weight by the total weight. Then multiplied by one hundred to be viewed as a percentage.

% Fillet yield= (TFW (g)/ Weight (g)) x 100

A table was then created to communicate the projected results to angling regulation by including the three species from both Minnesota and Wisconsin. Each fish species had increased total length measurements (TL) that would be obtained from a realistic combination of observed means. This was to display the total number of fish that would be needed to reach 0.5 pounds or 227 grams of fish fillet that would be produced from different TL (Lyons et al. 2017).

Data was summarized into species groups. The covariate total length (TL) was used to compare fillet yield among the three species. Fillet weight was estimated from fish TL for each species using a linear regression. The form was as: $\log_{10}$ (fillet weight) = B_0 + $B_1 \times \log_{10}$ (TL) where B_0 and B_1 are estimated coefficients (Lyons et al. 2017).

$$\log_{10}(\text{fillet weight}) = B_0 + B_1 \times \log_{10}(\text{TL})$$

III. Results

Data was collected from 360 bluegill, 167 crappie, and 108 yellow perch from ten west central Minnesota lakes. Samples were opportunistically collected from gill net mortalities and otolith extractions over the summer survey sampling period. Number of fish per species varied from sampling location.

Fillet weight for all three species had a strong, positive relationship to total length (Figure 1). For Minnesota and Wisconsin bluegill had the highest fillet weight at any given TL while yellow perch the lowest. Mean fillet yield for Minnesota was 36.5% for bluegill, black crappie was 42.3%, and yellow perch at 44.5% (Table 1). Minnesota demonstrated and increased fillet yield by 10.72% over Wisconsin mean fillet yield. The fillet yield of individual fish varied for Minnesota with minimum and maximum values differing by 25.24% for bluegill, 21.74% for black crappie, and 28.41% for yellow perch. While Wisconsin reported 34.6% for bluegill, 27.8% for black crappie, and 20.8% for yellow perch (Lyons et al. 2017).

Table 1. Summary of statistical fillet yield for 2023 summer survey for West Central Minnesota Bluegill (BLG), Black Crappie (BLC), and Yellow Perch (YEP).

Species	Mean	SD	Minimum	Maximum
BLG	36.5	3.8	24.8	50
BLC	42.2	3.5	33.2	55
YEP	44.5	4.2	36.6	65

Minnesota bluegills, black crappies and yellow perch all had a slight yet significant negative correlation between fillet yield and TL (Figure 1). Where (Lyons et al. 2017) reported only significant negative correlation in black crappies for fillet yield to TL. In other words, Minnesota larger fish had a slightly lower fillet yield than respected smaller fish (Figure 1).

Estimating the effect of a reduced bag limit on TL, based off the findings of Repel (2015), West Central Minnesota would have an increase average of 219 mm with a range of 179 mm to 283 mm (Figure 2). While Lyons et al. (2017) reported an estimated TL after the regulation change of 194 mm, with a range of 168 to 237 mm (Figure 2). Realistic combinations of size and quantity would result in higher total weight of harvestable fillets from an increased bag limit (Table 2).

The maximum projected increase for bluegill would have a greater fillet weight if an angler were to keep 10 fish from a 10-fish bag limit (Table 2).

VI. Discussion

Minnesota fillet weight and yields were greater than the respective Wisconsin fillet data. Literature to support the assessment of fillet weight to TL relationship was difficult to find. Aquaculture often uses fillet yield measurement when fillet weight is known to manage stock (Lyons et al. 2017).

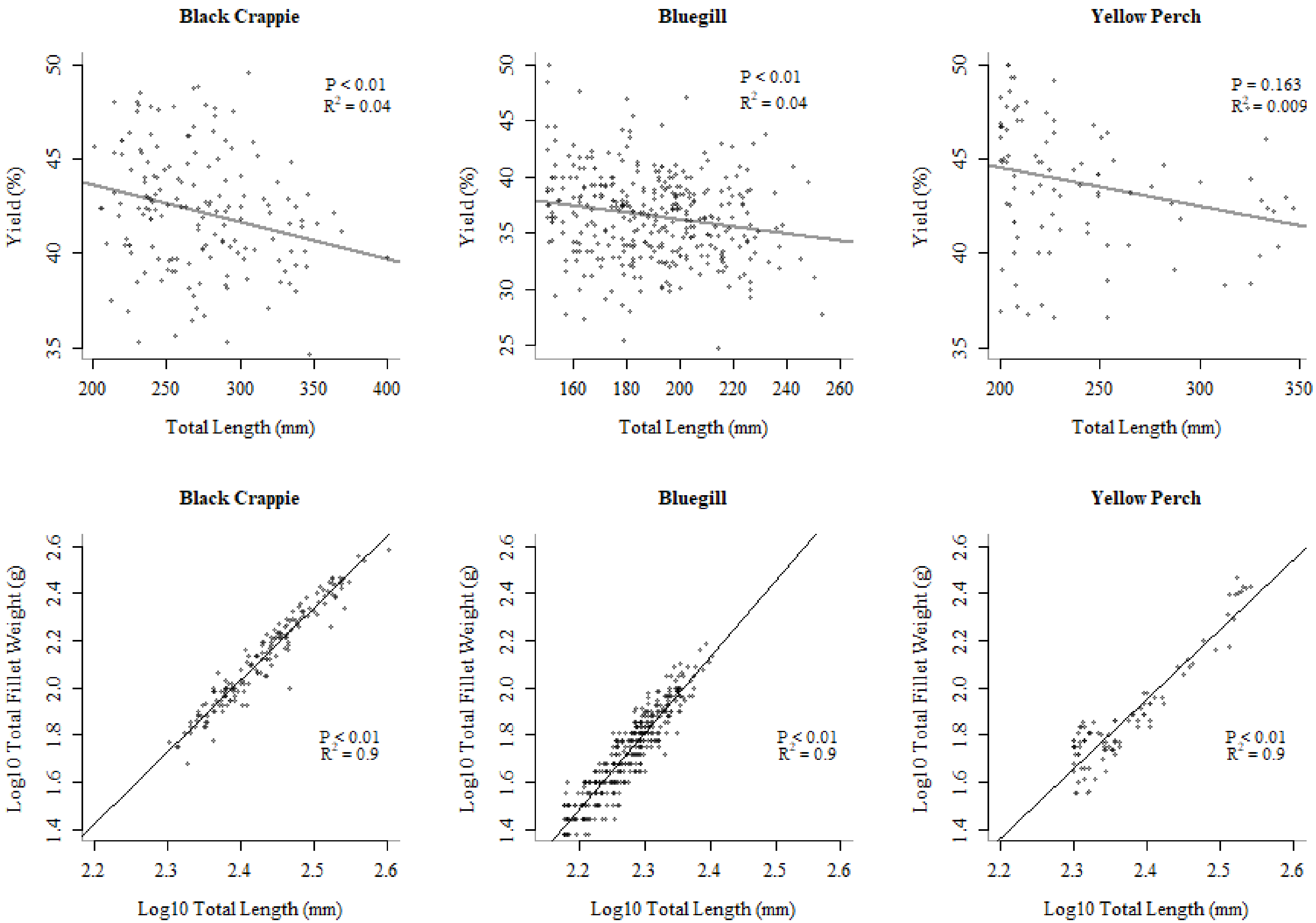

Fig. 1. The relationship of fish total length to fillet yield (top) and fillet weight (bottom) for bluegill, black crappie, and yellow perch from 2023 summer survey data for West Central Minnesota. Significant regression lines are shown. P values and R^2 values are shown for each graph.

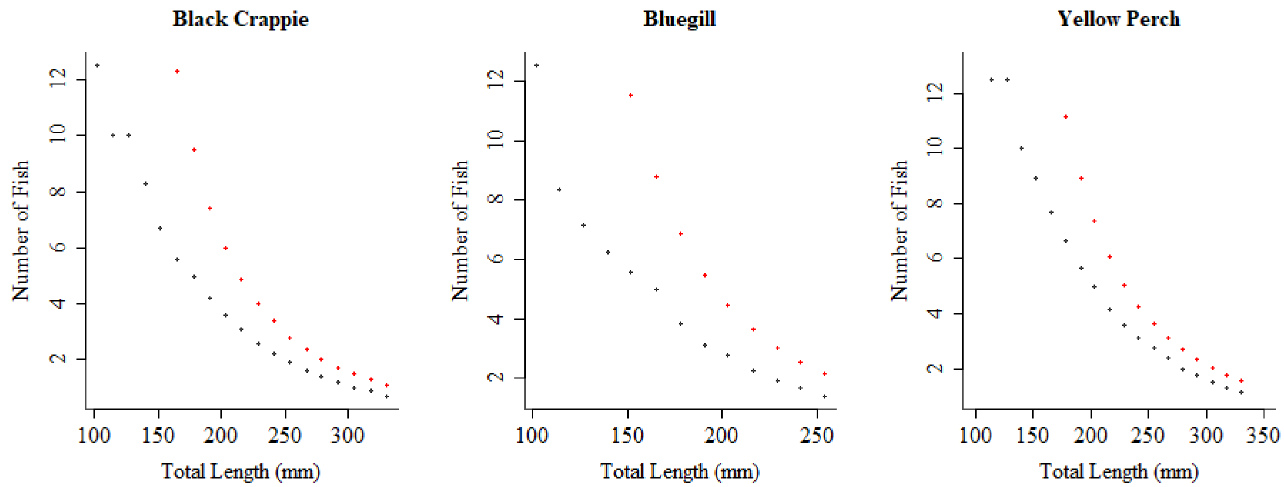

Fig. 2. Relationship of number of fish needed to reach the 0.5 lbs angling benchmark to total length (mm) for bluegill, black crappie, and yellow perch.

TABLE 2. NUMBER OF FISH FOR 0.5 LBS OF FILLET FOR BLUEGILL, BLACK CRAPPIE, AND YELLOW PERCH FROM 2023 SUMMER LAKE SURVEY FOR WEST CENTRAL MINNESOTA AND LYONS ET AL. (2017) WISCONSIN LAKES.

Species	5 in	6 in	7 in	8 in	9 in	10 in	11 in	12 in	13 in
$\text{Bluegill}_{\text{Minnesota}}$	7.1	5.6	3.8	2.8	1.9	1.4	N/A	N/A	N/A
$\text{Bluegill}_{\text{Wisconsin}}$	20.8	11.5	6.9	4.5	3.0	N/A	N/A	N/A	N/A
$\text{Black crappie}_{\text{Minnesota}}$	10	6.7	5	3.6	2.6	1.9	1.4	1	0.7
$\text{Black crappie}_{\text{Wisconsin}}$	N/A	16.2	9.5	6	4	2.8	2	1.5	1.1
$\text{Yellow perch}_{\text{Minnesota}}$	16.7	8.9	6.7	5	3.6	2.8	2	1.5	1.1
$\text{Yellow perch}_{\text{Wisconsin}}$	32.4	18.5	11.2	7.4	5	3.6	2.7	N/A	N/A

Captive estimates of yellow perch in Rosauer et al. (2011) reported fillet yield of 34.6-35.2% which was less than the Minnesota mean fillet yield of 44.5%. The difference in estimates across studies could reflect populations condition, methods of filleting or both.

Applying fillet weight and fillet yield data can estimate the potential results of a reduced bag limit change. Bag limit reductions can increase the total weight of fillet if they lead to an increase average size of the population (Lyons et al. 2017; Jacobson 2005; Rypel 2015). It may take several years to obtain a population with an average total size increase have a bag limit reduction (Lyons et al. 2017; Jacobson 2005; Rypel 2015). The lake productivity may also influence fish condition. Lakes that are highly productive that are subject to more angling pressure are more likely to benefit from the regulation change (Lyons et al. 2017).

Methods used for filleting vary by experience and location. The variation of filleting techniques influence fillet weight and fillet yield data of any species at any size. The difference may come from the ability to limit bones in the fillets or leaving out belly meat. Equations or estimations trying to relate fillet weight to total length should be considered rough approximations due to the variability.

V. REFERENCES

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