Growth Potential of Muskellunge in Northern Wisconsin

Matthew D. Faust and Michael J. Hansen
College of Natural Resources, University of Wisconsin–Stevens Point, Stevens Point, WI 54481

Introduction

•Muskellunge *Esox masquinongy* value is often size dependent, with many populations managed as trophy fisheries.

•Estimating growth potential requires: (1) accurate estimation of age; and (2) an adequate sample from a range of populations.

•Accurate age estimation requires fish sacrifice and large samples are difficult to obtain for long-lived, low-density species.

Objective

•To determine the scope of muskellunge growth for a range of large-, medium-, and small-bodied northern Wisconsin populations.

Methods

- Cleithrum (n = 277) used to estimate age:
  - − Subset (n = 123) read by three independent readers.
  - −Reader bias tested using age-bias plots and regression (α = 0.05).
  - − Precision assessed using coefficient of variation (C*V*).
- Back-calculated growth histories using biological-intercept model:
  - − Model requires fish and structure length at hatching.
  - − Acquired 70 post-hatch muskellunge fry (< 1 day old).
- Growth potential estimated using von Bertalanffy model:
  - − Asymptotic length (L_∞) must be well estimated (*CV* < 20%).
  - − Asymptotic length must be plausible (L_∞ < 65 in).
- Classified into large-, medium-, and small-bodied populations:
  - − Large-bodied ≥ 67th percentile of average L_∞.
  - − Small-bodied ≤ 33rd percentile of average L_∞.
- Compared results to Ontario muskellunge populations:

− Cleithrum Project (John Casselman).

FIGURE 1.—Image of three muskellunge cleithra, from a range of ages and lengths, which illustrates location of annuli and origin (black dots), along with anterior cleithral radius (black line), used in age estimation and back-calculation of growth history.

Results

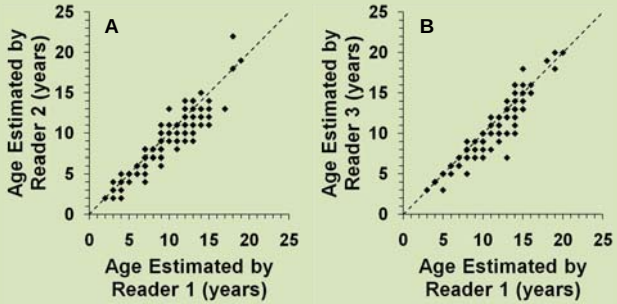

FIGURE 2.—Age-bias plots comparing muskellunge age estimates between reader 1 and reader 2 (A), and reader 1 and reader 3 (B) for 123 muskellunge collected from northern Wisconsin during 2007–2010. Dashed line indicates 1:1 line.

Reader bias and precision:

TABLE 1.—Summary statistics for slope and intercept estimates for age-bias plots comparing muskellunge age-estimates among three independent readers. An asterisk (*) denotes a significant difference. *t* = t-statistic, *df* = degrees of freedom, and *P* = P-value.

Parameter	Reader 1 & 2				Readers 1 & 3			
	Estimate	*t*	*df*	*P*	Estimate	*t*	*df*	*P*
Slope	0.98	0.70	121	0.49	1.02	0.70	121	0.49
Intercept	-0.36	1.09	121	0.28	-0.81	2.52	121	0.01*

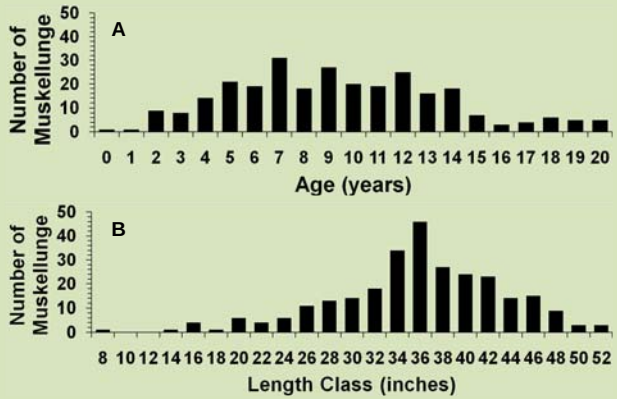

FIGURE 3.—Number of muskellunge (n = 277) by age (years; A) and length class (inches; B) collected from northern Wisconsin during 1995–2010.

Age and length summary:

- Age: average = 9.4 years; range = 0–20 years.
- Length: average = 36.6 inches; range = 9.9–53.0 inches.

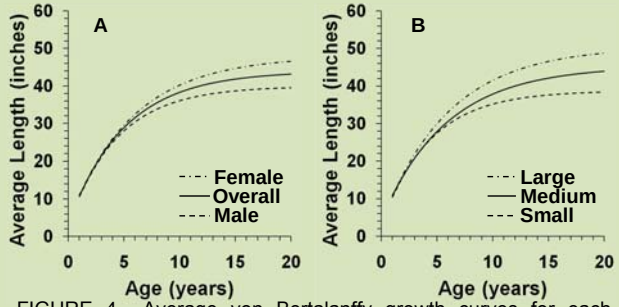

FIGURE 4.—Average von Bertalanffy growth curves for each gender (A) and body type (B) based on 197 muskellunge collected from northern Wisconsin during 1995–2010.

Growth by gender:

- Average L_∞ = 44.0 inches.
- Females grew larger (L_∞ = 48.0 in) than males (L_∞ = 39.9 in).

Growth by body type:

- Large-bodied L_∞ = 50.4 inches.
- Medium-bodied L_∞ = 45.3 inches.
- Small-bodied L_∞ = 38.7 inches.

Muskellunge growth across North America:

TABLE 2.—Average asymptotic length (inches) by body type for muskellunge populations from northern Wisconsin and Ontario.

Body type	Average L_∞ (inches)	
	Wisconsin	Ontario
Large-bodied	50.4	50.0 – 55.0
Medium-bodied	45.3	45.0 – 50.0
Small-bodied	38.7	40.0 – 45.0

Conclusion and Management Implications

•Northern Wisconsin muskellunge reached similar asymptotic length as other North American populations.

•Our estimates of muskellunge growth potential may be useful for understanding growth potential of other North American populations.

Acknowledgments

- Funded by Wisconsin Department of Natural Resources.
- Many WDNR and GLIFWC employees collected cleithra.
- Mark Luehring and Dan Isermann estimated age.