Effect of Harvest Mortality on Muskellunge Size Structure in Wisconsin’s Ceded Territory

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Introduction
Muskellunge in WI

http://www.ohiodnr.com/muskielog/images/MuskieMGMT.png
Introduction
Ceded Territory
Introduction

Question

• Can trophy angling fisheries be sustained on lakes with high levels of exploitation?
Introduction
Objective

• Determine the extent that harvest mortality affects muskellunge population size structure in Wisconsin’s ceded territory
  — Muskellunge growth potential
    • Use cleithra to back-calculate growth histories
  — Develop simulation model
    • Predict size structure response to a range of harvest mortality
Methods
Methods
Growth Potential

• Cleithrum
  – 277 from across northern WI

• Back-calculate individual growth histories
  – Biological-intercept model (Campana 1990)
    • Fish and cleithrum length at hatching

• Fit von Bertalanffy growth curves to individual fish
  – Classify populations into either small-, medium-, or large-bodied
Methods
Simulation Model

• Individual-based simulation model
  – Growth potential vs. risk of mortality

• Populate model with muskellunge of varying growth potential (i.e. body type)
  – Based on age and growth results

• Subject simulated muskellunge to varying mortality rates
  – Angling and spearing fisheries
Methods
Simulation Model

Growth Parameters
Age
Fish
1
2
\ldots
n
Probability of Death
Methods
Simulation Model

![Graph showing the relationship between length (in inches) and age (in years).]
Results
Results

Body Type

$L_\infty = 45.3$ in
Results

Body Type

\[ L_\infty = 45.3 \text{ in} \]

\[ L_\infty = 50.4 \text{ in} \]
Results

Body Type

\[ L_\infty = 50.4 \text{ in} \]
\[ L_\infty = 45.3 \text{ in} \]
\[ L_\infty = 38.7 \text{ in} \]
Results

28” MLL-Angling Only
Results

40” MLL-Angling Only
Results

45" MLL-Angling Only
Results

50" MLL-Angling Only

Number of Muskellunge

Instantaneous Fishing Mortality (F)
Results
Spearing Only

![Graph showing the relationship between Instantaneous Fishing Mortality (F) and Number of Muskellunge.](Image)
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.1 \]
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.2 \]
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.3 \]
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.4 \]
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.5 \]
Results

40" MLL-Mixed Fishery

$F_{sp} = 0.6$
Results

40" MLL-Mixed Fishery

$F_{sp} = 0.7$
Results

40" MLL-Mixed Fishery

F_sp = 0.8
Results

40" MLL-Mixed Fishery

\[ F_{sp} = 0.9 \]
Results

40" MLL-Mixed Fishery

$F_{sp} = 1.0$
Results

45" MLL-Mixed Fishery

![](chart.png)

Number of Muskelunge vs Instantaneous Fishing Mortality (F)

- F\(_{sp}\) = 0.1
Results

45" MLL-Mixed Fishery

\[ F_{sp} = 0.2 \]
Results

45” MLL-Mixed Fishery

\[ F_{sp} = 0.3 \]
Results

45" MLL-Mixed Fishery

\[ F_{sp} = 0.4 \]
Results

45" MLL-Mixed Fishery

\[ F_{sp} = 0.5 \]
Results

45" MLL-Mixed Fishery

\[ F_{sp} = 0.6 \]
Results

45" MLL-Mixed Fishery

$F_{sp} = 0.7$
Results

45" MLL-Mixed Fishery

Number of Muskellunge

$F_{sp} = 0.8$

Instantaneous Fishing Mortality (F)
Results

45" MLL-Mixed Fishery

$F_{sp} = 0.9$
Results

45" MLL-Mixed Fishery

\[ F_{sp} = 1.0 \]
Results

50" MLL-Mixed Fishery

Instantaneous Fishing Mortality (F)

Number of Muskelunge
Results

50" MLL-Mixed Fishery

$F_{sp} = 0.2$
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.3 \]
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.4 \]
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.5 \]
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.6 \]
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.7 \]
Results

50" MLL-Mixed Fishery

$F_{sp} = 0.8$
Results

50" MLL-Mixed Fishery

\[ F_{sp} = 0.9 \]

Number of Muskellunge

Instantaneous Fishing Mortality (F)
Results

50" MLL-Mixed Fishery

$F_{sp} = 1.0$
Discussion
Discussion

• Increasing harvest mortality caused decrease in number of muskellunge reaching trophy sizes
  – Spearing only fishery
  – Mixed fishery
  – Angling only fishery
Management Implications

• Insight into WI muskellunge population response to increasing exploitation
• Pinpoint combinations of angling and spearing harvest mortality that reduce trophy potential
  – Identify fisheries suspected of being at or near such combinations
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Questions?

**Muskietoons by Chuck Weiss**

Plop! Plop! Plop!

"Remember, Practice catch and release, Son, try to grab the lure and then spit it out."