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## Introduction

- In the Laurentian Great Lakes, nonnative Rainbow Smelt (*Osmerus mordax*) provide forage for Lake Trout (*Salvelinus namaycush*) and other predatory fish and are potential competitors with and predators of young *Coregonus* species.
- Rainbow Smelt have declined across the Great Lakes in recent years.
- Whitefish Bay (WFB; Fig. 1) is warmer and has a lower abundance of piscivores than the rest of Lake Superior.
- Little is known about growth of Rainbow Smelt in the Great Lakes.
- We know of no published reports where Rainbow Smelt ages were estimated from otolith thin sections.

## Objectives

- Compare age estimates among whole cleared (WC), whole uncleared (WUC), and thin sectioned (TS) otoliths.
- Describe age structure and growth (length-at-age) for Rainbow Smelt from WFB.

## Methods

- Fish were collected using a bottom trawl during June, 2015.
- Ages were estimated using whole cleared (WC), whole uncleared (WUC), and thin sectioned (TS) otoliths.
- Bias in age estimates between readers on the same structure and between different structures with the same reader were assessed with age-bias plots and the Evans-Hoenig test of symmetry.
- If no significant bias between readers was detected, precision between readers was described with the average coefficient of variation (ACV).
- An age-length key (ALK) was constructed from the more experienced reader's age estimates from TS otoliths and was used to assign ages to the unaged fish.



Fig. 1. Whitefish Bay, Lake Superior.

## Age Estimate Comparisons

- No significant bias in estimated ages between readers for TS and WC, but significant bias between readers using WUC (Fig. 2-left).
- No significant bias in estimated ages between TS and WC or between WC and WUC, significant bias in estimated ages between TS and WUC (Fig. 2-right).

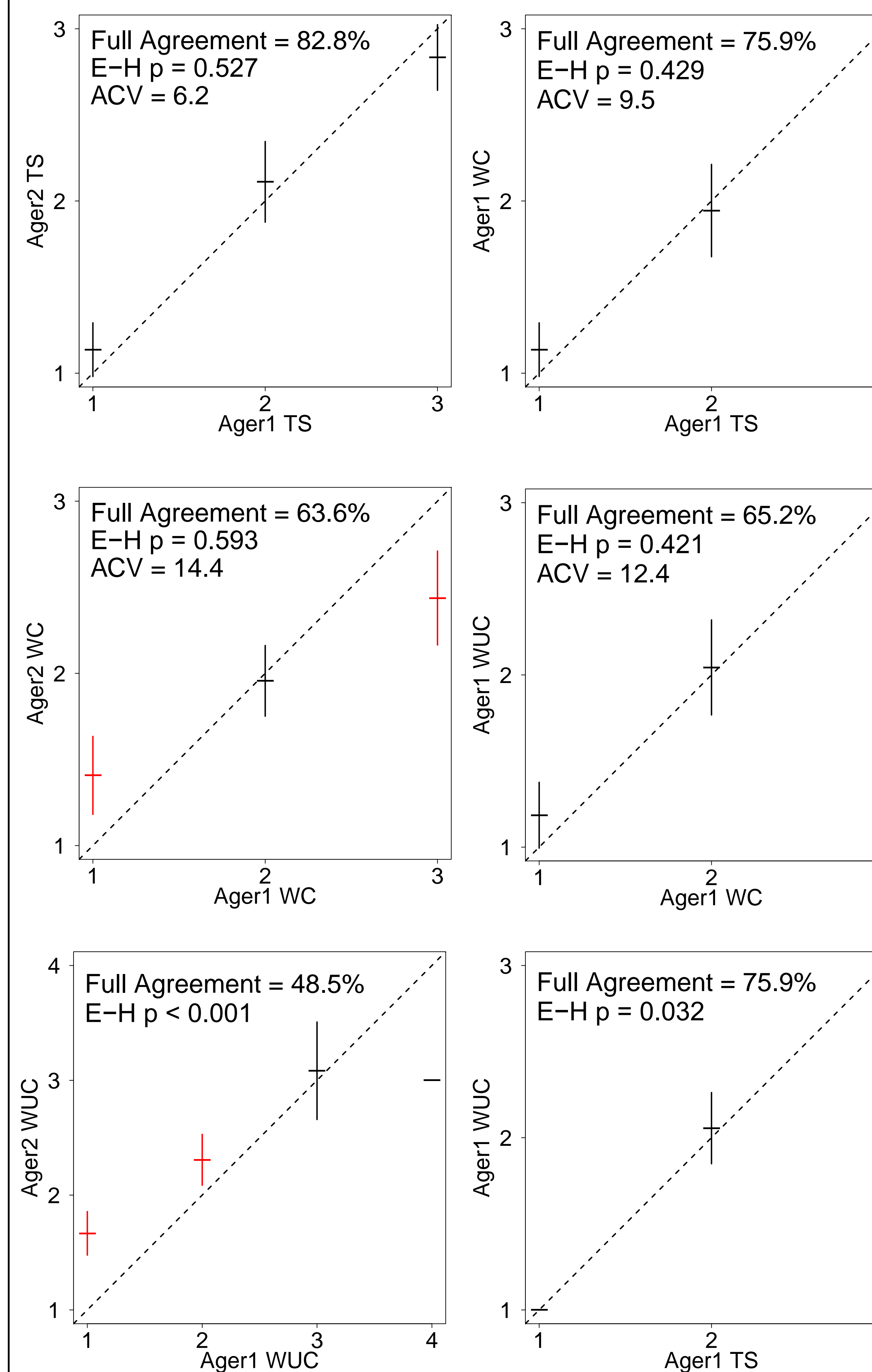


Fig. 2. Age-bias plots for between reader (left) and between structure (right) comparisons, with percent full agreement, Evans-Hoenig p-value (E-H p), and ACV results shown.

## Age Structure and Growth

- No fish over age III sampled in 2015 (Table 1, Fig. 3).
- Mean lengths-at-age differed substantially between years after age II (Table 1, Fig. 3).

Table 1. Sample size (n), percent of sample (percent), and mean and standard deviation (SD) of total length (TL; mm) by age for Rainbow Smelt sampled from WFB in 2015 and 1978-1981.

Age	This Study (2015)			1978-1981	
	n	Percent	Mean (SD) TL	Percent	Mean TL
I	157	40%	69.5 (15.9)	48%	74.2
II	112	30%	130.6 (15.6)	32%	130.6
III	124	30%	143.8 (15.5)	15%	160.4
IV	-	-	-	3%	190.3
V	-	-	-	<1%	215.6

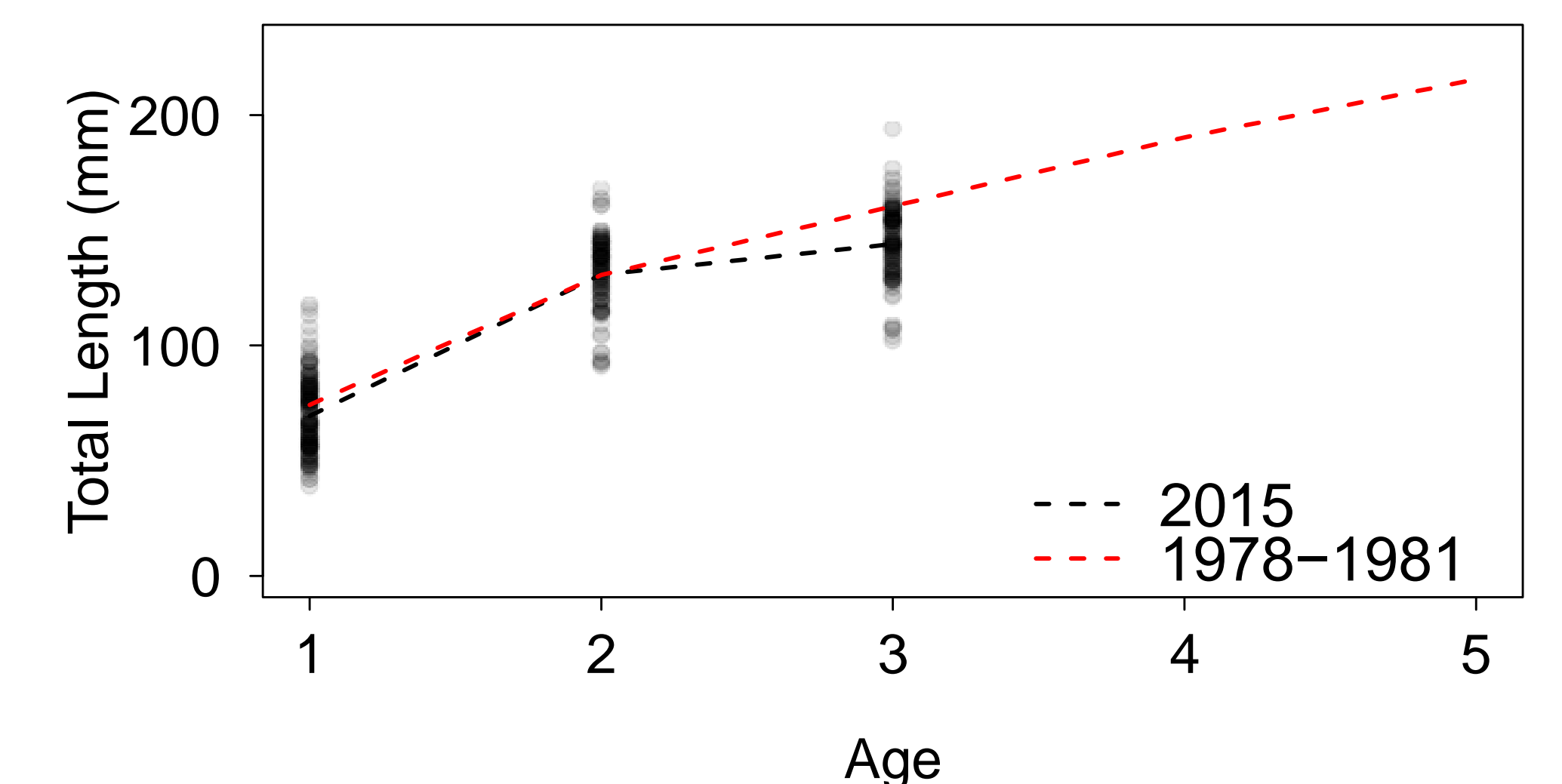


Fig. 3. Lengths-at-age for Rainbow Smelt from WFB in 2015. The dashed lines represent the mean lengths-at-age for each study period.

## Conclusions

- Thin-sectioned otoliths are superior to whole (cleared or uncleared) otoliths for estimating the ages of Rainbow Smelt.
- Maximum age and growth were lower in 2015 than in 1978-1981.

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