

Center for Quantitative Fisheries Ecology

## PROTOCOL

# AGE ESTIMATION OF OTOLITH TRANSVERSE CROSS-SECTIONS FOR

## ATLANTIC CROAKER

*Micropogonias undulatus*



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## Introduction

This protocol is for age estimation of Atlantic croaker (*Micropogonias undulatus*) using sagittal otolith transverse cross-sections. For detailed information on how to make a Atlantic croaker otolith thin-section slide, please see the protocol for Preparation of Otolith Transverse Thin-sections for Age Estimation of Atlantic croaker *Micropogonias undulatus*. Hereafter, sagittal otoliths will be referred to as "otolith" and otolith transverse cross-section will be referred to as "thin-section".

## General thin-section ageing procedure

All fish are to be aged in chronological order, based of collection date, without reader knowledge of the specimen lengths. Two readers will independently age each otolith. When readers agree on an age, that age is assigned to the fish. When readers disagree, both readers will sit together and re-age the fish, without knowledge of previously estimated ages and specimen lengths, and assign a final age to the fish. When readers are unable to agree on a final age, that fish must be excluded from further analysis.

## Specific Atlantic croaker ageing procedure

Ageing Atlantic croaker otoliths involves two steps:

1. Reading the thin-section by counting the number of annuli.
2. Assigning an age to the fish based on sacrifice date and annulus formation period.

Step 1: Reading the thin-section:

1. Remove a labeled slide (Figure 1) with mounted Atlantic croaker thin-section from the slide box labeled "Atlantic croaker, VMRC (Year)" (Figure 2).



Figure 1: Atlantic croaker thin-section mounted on labeled micro slide.



Figure 2: Otolith slide storage box labeled for Atlantic croaker.

2. Place the slide on the microscope stage and turn on the transmitted light source. Adjust the dark-field polarization (Figure 3) until a dark blue background appears behind the otolith section. On other microscopes, the polarizer may be located on the base or stage of the microscope.
3. Adjust the coarse and fine foci until the entire otolith section is in clear view (Figure 4). A well-sectioned otolith will provide a clear view of the core, annuli, and sulcal groove. The annual rings will be plainly visible along its edge. If the section lacks a clear "V" shape within the sulcal groove, the cut did not go through the core. The otolith must be



Figure 3: Nikon SMZ 1000 stereo microscope with 1x objective and dark-field polarization.

re-sectioned following the otolith preparation protocol.

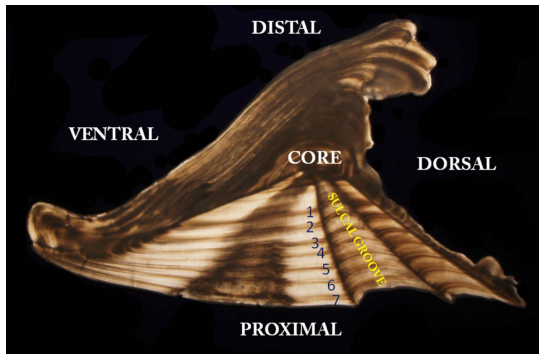


Figure 4: Atlantic croaker thin-section under transmitted light and dark-field polarization.

4. When a good section has been obtained, count each visible annulus on the section, starting from the core and moving to the proximal edge. Technically, an otolith annulus is a combination of opaque and translucent bands. When ageing otoliths however, only the opaque bands are counted. The translucent areas of the thin-section represent growth between annuli.

Step 2: Assigning an age to the fish

Once the number of annuli in the otolith, ("X"), has been identified, one of two scenarios determine the estimated age of the fish:

1. There is no growth beyond the last annulus: The age of the fish becomes an even "X". This typically happens when a fish has been collected during the annulus deposition period: April 1 to May 31 (Barbieri et al. 1994a and b).
2. There is growth beyond the last annulus: The growth is indicated by a "+" after the number of annuli, that is "X+".
  - 2.1 If the sacrifice date for the fish is between January 1, the assigned birth date for all finfish of the Northern hemisphere, and the end of the last month in which Atlantic croaker annuli are laid down, May 31, the age of the fish is represented as "X+(X+1)". For example, a fish with 2 visible annuli on its thin-section would be assigned the age "2+3", indicating that it belongs to the "age 3" age class.
  - 2.2 If the sacrifice date for the fish falls after May 31 and before January 1, the fish has laid down its annulus for the year and has experienced growth since that time. The age of the fish is represented as "X+(X)". A fish with 6 annuli visible on its otolith thin-section would be assigned the age "6+6", indicating that it belongs to the "age 6" age class.

## Assigning age and year-class

The following images demonstrate how we assign the age and year-class to fish by using the age assigning table (Figure 5).

An Atlantic croaker taken in March 2009 (before the annulus deposition period) with 7 visible annuli and translucent growth beyond the last annulus (Figure 6) would be called "7+8" and put into the 2001 (=2009-8) year-class.

		Atlantic Croaker																							
		Year One				Year Two				Year Three															
Year	Assigned Birth Date 1/1	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Annulus Formation																									
Month																									
Number of Rings		-	-	-	-	-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2
Assigned Age		-	-	-	-	-	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	

Figure 5: Atlantic croaker age assigning table

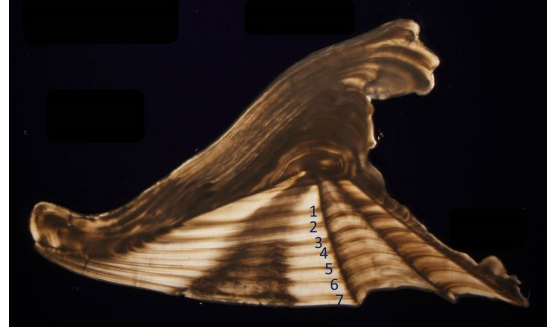


Figure 6: Otolith thin-section from an Atlantic croaker showing 7 visible annuli with translucent growth beyond the last annulus. Its sacrifice date was March 2009, before the annulus deposition period. The fish is assigned an age of "7+8" and placed in the 2001 (=2009-8) year-class.

An Atlantic croaker taken in April 2009 (during the annulus deposition period) with 8 visible annuli and no translucent growth beyond the last annulus on its thin-section (Figure 7) would be called "8 even" and placed into the 2001 (=2009-8) year-class. The last annulus should fall on the edge, or very close to the edge of the section and have little or no visible extra growth.

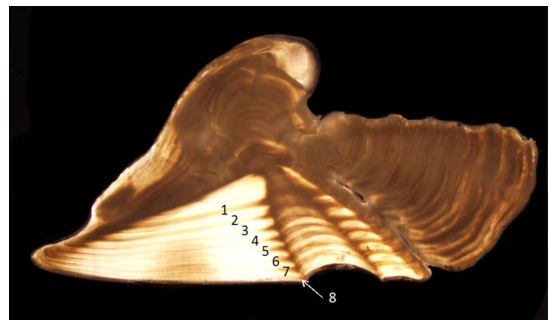


Figure 7: Otolith thin-section from an Atlantic croaker showing 8 visible annuli and no translucent growth beyond the last annulus. Its sacrifice date was April 2009, during annulus deposition period. The fish is assigned an age of "8 even" and placed in the 2001 (=2009-8) year-class.

An Atlantic croaker taken in August 2009 (after the annulus deposition period) with 7 visible annuli and a small amount of

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translucent growth beyond the last annulus (Figure 8) would be called "7+7" and put into the 2002 (=2009-7) year-class.

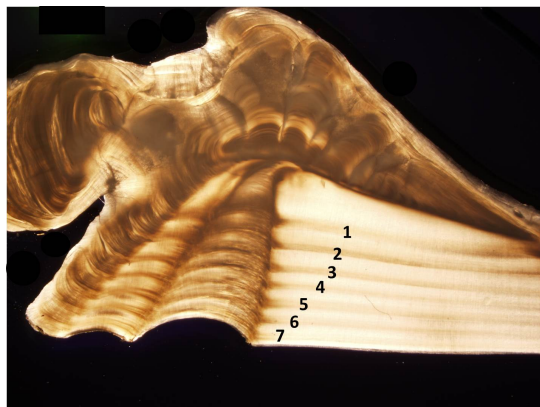


Figure 8: Otolith thin-section from an Atlantic croaker showing 7 visible annuli and translucent growth beyond the last annulus. Its sacrifice date is August 2009, after the annulus deposition period. The fish is assigned an age of "7+7" and placed in the 2002 (=2009-7) year-class.

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## Literature Cited

- Barbieri, L. R., Chittenden, M.E. Jr., Lowerre-Barbieri, S.K. 1994a. Maturity, spawning, and ovarian cycle of Atlantic croaker, *Micropogonias undulatus*, in the Chesapeake bay and adjacent coastal waters. *Fishery Bulletin* 92:671-685.
- Barbieri, L. R., Chittenden, M.E. Jr., Lowerre-Barbieri, S.K. 1994b. Age, growth, and mortality of Atlantic croaker, *Micropogonias undulatus*, in the Chesapeake bay region, with a discussion of apparent geographic changes in population dynamics. *Fishery Bulletin* 92:1-12.

## Photographs

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