

BOOK REVIEW

Age and Growth of Fishes: Principles and Techniques. Edited by Michael C. Quist and Daniel A. Isermann. *American Fisheries Society, Bethesda, Maryland. 2017. 359 pages. \$79.00 (\$55.30 for American Fisheries Society members) (hardcover).*

When I was asked to review Michael Quist and Daniel Isermann's *Age and Growth of Fishes: Principles and Techniques*, I wasn't sure what I would be getting. Would it be simply a technical manual describing how to prepare and determine age from calcified structures, or would it instead be more quantitative, focusing on how to statistically assess and analyze age and growth data? I was pleased to learn that it was a bit of both. The book is more or less divided into four sections. The first two chapters provide a brief background on the history of the field and describe the general morphology of the calcified structures used for fish age determination. Chapters 3–5 discuss the quality control procedures used to assess the accuracy and precision of age determination and offer guidance on the most appropriate calcified structure for determining the ages of fish in common freshwater families, the construction of age–length keys, and sampling methods and considerations for age and growth studies. Chapters 6–9 explain how to dissect, prepare, and interpret some of the more commonly used calcified structures. The final section (Chapters 10–12) describes data analysis and applications.

Admittedly, my own background is limited to the study of marine species, largely from a management perspective. Thus, I was surprised to see an entire chapter on scales, since their pitfalls have been described by many authors and, aside from a few short-lived species such as salmonids and forage fishes, they are rarely used for marine species. But, as I learned, scales are still widely used in freshwater fish ecology, mostly due to the need for non-lethal methods of age estimation in systems with small populations or rare species. Certain concepts, such as interpreting the growth on the edges of calcified structures to assign fish to the correct cohort—an approach used by many production age determination laboratories—are better explained in other volumes. The lack of an index is a

regrettable oversight, and I would hope that future editions of the book would opt to include one to fully extend its utility as a reference. I found the sections on sampling considerations and data analysis to be quite useful, especially the final chapter on growth modeling, which includes introductions to hierarchical models and Bayesian inference as well as R code (with examples). I feel that these sections are where the book really shines, setting it apart from published manuals that merely discuss hard structure interpretation and making it truly one-stop shopping for anyone preparing to design a new age-and-growth study. In particular, graduate students who are embarking on thesis projects may find this volume to be a handy guide.

The editors have assembled an impressive list of authors, mostly from state agencies and universities and nearly all with freshwater backgrounds. Indeed, my main quibble with the book is the title; its focus is almost entirely freshwater, with very little mention of elasmobranchs or other marine species, and thus I think it would be more aptly named *Age and Growth of Freshwater Fishes*. That said, much of the information, particularly that pertaining to sampling and data treatment, is transferrable across disciplines.

According to the editors, the book is intended to serve several purposes—as a reference, field sampling and laboratory analysis guide, and textbook. I think it succeeds at all these goals and will be a useful reference volume for students as well as managers in the years to come.

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