

BOOK REVIEW:

Recirculating Aquaculture, 2nd Ed.

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Reviewed by:

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The field of recirculating aquaculture has grown tremendously over the last twenty years, and this book, developed during those years, reflects not only the current state of the art but a bit of the history and reasoning for recirculating aquaculture systems (RAS) in general. The first edition of the book has been seen by many producers, industrial and academic professionals as “the book” in this area. The second edition has updated many areas of interest and clarified a number of issues. While the authors are well respected academic and research scientists (Timmons is at Cornell University, Ithaca NY; and Ebeling is with Aquaculture Systems Technologies, LLC, New Orleans, LA), the book is quite accessible for the practitioner. Several other specialists have also contributed to the book by writing or editing chapters and sections. These include Summerfelt and Vinci at Freshwater Institute; Liltved and van Rijn, with European and Mediterranean perspectives; Rakocy, perhaps the world’s premier aquaponics expert; and a number of experts in pathology, veterinary medicine, physiology, nutrition and related areas. This enhances the value and seriousness of the book.

The book is organized in such a way that preliminary comments on markets, economics, business and other practical aspects lead the way, after which basics such as water quality and various unit operations approaches for maintaining water quality integrate with basics of biology relevant to many species cultured in RAS. Physical and chemical aspects such as fluid mechanics and gas transfer each receive chapters, and process control for water and buildings receive attention in later chapters. Finally, the last few chapters deal with management, health, nutrition and

unique applications such as aquaponics. The appendix may be as useful as the text, with numerous tables and charts for basic design of piping, water quality parameters, unit operations and related parameters. Overall the book provides an excellent source of information on many subjects and is well organized.

Chapter 1 is an introduction to RAS and includes technical information on advantages; market and economic aspects; business aspects and other references. Chapter 2 gets directly to the most important aspects for species raised in an aquatic environment: water quality, and includes parametric standards, measurement techniques and related issues. Chapter 3 introduces the biological aspect of the systems: the fish and their water quality requirements, growth rates and some design examples. These examples continue through the text, giving specifics of how to size systems for optimal production.

Chapter 4 focuses on culture units, namely tanks and raceways, noting that when the percentage of recirculated water falls to zero, the analysis returns to a flow-through system. This means the mathematics and design techniques can apply to a variety of systems. Among the practical aspects in this chapter are comments on how to minimize solids (e.g. the teacup or Cornell Dual-Drain design) and how to remove dead fish, both critically important in real systems.

Chapter 5 focuses on solids capture and Chapter 6 on waste management and disposal. A variety of technologies are discussed and the solids issue reappears in Chapters 7, 8 and 9 which focus on biofiltration (e.g. nitrogen management) and design of biofilters. Many aquaculturists no longer custom design their own biofilters, but the background is helpful to appreciate how much the technologies have advanced. Where Chapter 7 focused on nitrification, Chapter 9 on denitrification and completes the series on nitrogen management in RAS. Chapter 10 explains the fundamentals of oxygen transfer into RAS and carbon dioxide transfer out of loaded systems. Chapter 11 focuses on ozonation and UV-irradiation to reduce pathogens and improve water quality. In some sense this chapter links with Chapter 16 on fish health.

Chapter 12 gets to the basics of fluid mechanics and pumps, including airlift pumps, which have the advantage of aerating and degassing as well as moving water. Chapter 13 focuses on monitoring and control,

mostly automated electronic systems these days. Specific water quality parameters and more general alarm and monitoring systems are included. Chapter 14 continues the control theme, focusing on how to maintain building environmental control, including air conditioning. Chapter 15 moves into even more general systems management such as site selection, backup power, laboratory and quarantine facilities, labor and related issues.

Chapter 16 focuses on fish health and includes discussion of biosecurity, health maintenance (via good water quality management), diagnosis, treatment and suggestions for diagnostic services. The chapter included a healthy focus on prevention of disease and recognizes that serious disease outbreaks can be difficult not only biologically but economically, which brings us to Chapter 17: Economic Realities and Management Issues. Discussion of economics, scale, risk, labor, price volatility of products and even comparison of fish to poultry provide useful advice – and fair warning – for potential investors. Despite the honesty, the advice is well taken and can be very useful to individuals or companies considering whether to start or expand an aquaculture business.

Chapter 18 focuses on fish nutrition and feeds, from physical to chemical to vitamin and mineral content. Discussion of types of feed and considerations for particular species are included. Additional references are included, as in each chapter, that allow the reader to access more information about specific areas of interest. Chapter 19 is an excellent chapter on aquaponics, which includes fish and plants in combination. The fish excrete waste and carbon dioxide which the plants use to grow. In this way, crops of fish and vegetables can be grown simultaneously, reducing wastes and improving economics. This chapter is placed last, perhaps because of thoughts that this adds another level of complexity and possible difficulties. Still, this type of system offers some of the best hope for a sustainable and productive future.

As noted, the appendix includes valuable information from conversion factors to information on many water quality parameters to fish health and mechanical and electrical sizing charts. In short, this book is an excellent text and reference that belongs in the library of any serious aquaculturist and is worth the read for anyone considering starting or expanding an aquaculture business.