

THE BEHAVIOR AND ECOLOGY OF PACIFIC SALMON AND TROUT: SECOND EDITION

By Thomas P. Quinn, University of Washington Press, Seattle, WA, in association with the American Fisheries Society, Bethesda, MD, 2018. 562 pp. ISBN-9780295743332, CDN 80; USD 60; GBP 47.67.

The Behavior and Ecology of Pacific Salmon and Trout presents an extensive review of the current scientific understanding of salmonid ecology and behaviour on a global scale. Following Quinn's first edition published in 2005, the second edition expands the scope and introduces new information about salmon life histories, particularly recent comprehensive studies in the Pacific Northwest. With over 350 references to new studies and over 100 more pages, the extensively updated second edition also provides newly synthesized figures, detailed illustrations, new photographs and devotes an entire chapter to transplanted populations. Quinn also covers large phases of Pacific trout and char life histories that were previously unknown. All graphs have been recreated and colour-coded for easy reading, and several graphs have been updated with more data. In addition, the quality of photographs throughout the book has vastly improved. However, changes made do not affect the structure, topics and tone of the first edition. This review is a component of a graduate level fisheries course and is the collective effort of both students and faculty.

Thomas Quinn has used his career's work in salmon and associated research to put together a cohesive and understandable summary of research into salmonid life histories, ecosystems and behaviours. Quinn writes this book for a wide audience, from professionals within the field to salmon enthusiasts. His candid tone helps present an extensive compilation of scientific information in a compelling and reader-friendly fashion, allowing him to reach amateurs and researchers alike. Quinn also remains neutral about controversial issues, not seeking to change opinions, but rather to "inform and excite the reader." His enthusiasm clearly shines through in particular chapters; however, remaining neutral leaves some controversial topics unexplored.

The structure of Quinn's book follows the life cycle of salmonids. He begins with homeward migration followed by reproductive behaviours and mortality. The subject then shifts to offspring, describing their growth in streams, lakes and estuaries and finally their oceanic migration. Quinn enriches this complex story with tangential chapters describing topics including homing and straying, transplants, evolution, population structure, and past and future trends in salmon abundance.

Quinn begins with an overview of the biology of each species and defines the common terms used to describe them. From here, the

exploration of salmonid life history starts with anadromous adults migrating back to their natal streams (chapters 2–5). The diversity of migratory patterns from open and coastal waters to natal streams is described with respect to each species. Within some chapters, Quinn selects one species or population as a model to explain interactions and behaviour. As he transitions through ecosystems, all aspects of salmonid behaviour, mortality and biology are considered.

The next major life phase discussed is reproduction and the nutrient cycling associated with semelparous salmon die-offs in riverine ecosystems (chapters 6 & 7). Quinn builds a storyline through each topic using a comprehensive literature review, building from foundational concepts to complex and abstract ideas. Regarding reproductive behaviour, Quinn begins by explaining sex-specific roles and describes how these are played out by individuals through competition, courtship and genetic success. He points out specific areas needing future study including sperm competition and hybridization in nature. Quinn then discusses the utility of stable isotope analysis in discovering the contribution of salmon carcasses to terrestrial nutrient cycling. The approach, here and elsewhere in the book, of first describing an important scientific methodology before establishing its relevance to salmonid life histories demonstrates Quinn's aptitude as a writer and educator.

Reproduction and mortality are followed by chapters on egg survival, larval growth and downstream migration (chapters 8–12). Each of these subjects is explored in sequence and insufficient research into early mortality is acknowledged. Quinn structures each chapter in this section around a description of the physical environment, followed by behavioural adaptations used by salmonids to take advantage of their habitat. This progressive format allows for easy comparison within each life stage across the different species. In chapter 12 on downward migration, Quinn asks three vital questions from the perspective of each species: "Shall I Migrate to Sea?" "Do I Migrate This Year or Defer the Decision?" and "Do I Migrate Now or Later This Year?" This creative style keeps the reading fresh and varied, and the reader engaged.

Chapters 13–17 describe salmonid life in estuaries and at sea. Quinn highlights the importance of estuarine habitats and their conservation in the context of salmon survival. In chapter 14, Quinn illustrates marine migrations of salmonids through tables, showing his aptitude for synthesizing statistics and providing a core message (although perhaps maps would have provided more useful infographics). For example, in Chapter 15 while discussing the reproductive output required to stabilize populations, he lists all the statistics which he follows with: "A single female (and some hypothetical mate) would produce 11.5 returning salmon!"

The remaining chapters of this book are a mixed bag. In his final three chapters (chapters 18–20), Quinn takes the time to explore

transplants, population evolution, and a historical and prospective look at salmonids. In the first edition, transplanted populations were a section of the chapter on population structure and ecology; but in this second edition, it has been carved out as an independent chapter. Quinn's enthusiasm for the capacity of salmon to adapt to different global ecosystems shines through in this chapter, but he fails to mention the negative ecological effects associated with these invasive populations. Given the difficult topics reviewed in chapter 19, Quinn does a good job of explaining the geological processes that have created the evolutionary diversity and population structure seen in salmonid populations today. His skill as a teacher and a researcher is illustrated through his ability to simplify complex concepts into memorable abbreviations, such as the 4 Cs associated with salmon survival. In his final remarks (chapter 20), Quinn provides a summation of his personal opinions about salmon sustainability with a personal touch of optimism and humility.

Weaknesses are found in multitopic chapters as Quinn's single-narrative structure does not adapt well to the large amount of incongruent information required in explaining some life stages and ecosystems; the narrative often seems incomplete and non-linear, creating confusing transitions between subjects. The avoidance of controversial topics such as the increased use of hatcheries and negative effects associated with transplanted populations takes away from the impact of the book. The lack of discussion about these topics leaves the reader with little information from which to draw their own conclusions. However, end-of-chapter summaries were of particular use after long and arduous topics, allowing the reader to step

back and examine important elements of each topic. The acknowledgement of information gaps and proposed further research distinguishes this book as a must-read for young biologists interested in pursuing these outstanding questions.

Overall, Quinn pulls together years of personal research with a cumulative review of the research by others in his field. The second edition is timely as the field is rapidly progressing in tracking technologies, DNA sequencing and information about salmon behaviour at sea. Quinn has managed to distill all this new information into this second edition while also indicating important areas for new research, cementing *The Behavior and Ecology of Pacific Salmon and Trout: Second Edition* as a fundamental resource.

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