

Preface

I started thinking about this book after being approached by Sam Elworthy, who suggested a book based on recent food web theory, a synthesis of sorts. At about the same time, Joe Rasmussen, a friend and colleague at McGill told me that he believed no one understands recent food web theory. Taken together, I felt there was a need for such a book and that a synthesis with more attention to conceptual details was clearly in order. One of the more active research areas of late pertains to the "theory of weak interactions," which I and numerous collaborators have played a role in developing. While this theory emphasizes weak interactions, it necessarily also considers the role of interactions of all strengths. This book seeks to illustrate how interaction strength governs the dynamics of food webs. As such, it is a very broadly based synthesis.

Nonetheless, the book does not cover all areas of food webs exhaustively nor does it attempt to. Further, as a monograph, it necessarily pays attention to work developed both in my laboratory and with my many excellent collaborators. At the end of each chapter I briefly scan empirical evidence. In some cases, this constitutes a review or meta-analysis, but frequently it is really just a cursory look at the emerging data and is done to promote further comparison among theory, experiment, and empirical patterns. Clearly this book is not a full review, as to provide such a review would be well beyond its scope.

The ideas laid out in this book are best developed with the language of mathematics, specifically dynamical systems. Thus, not surprisingly, this book has a fair amount of mathematics in it. However, I have made attempts to present it in an accessible format by constantly interpreting all mathematical logic within a biological framework. Further, I have tried to present the intuitive side of the results. You will see that much of this biological interpretation employs a bioenergetic framework. It just as easily could have been interpreted in terms of limiting nutrients or other relevant currencies, but this was the language of my Ph.D. advisor, Peter Yodzis, and I have grown accustomed to it.

For those who understand mathematics, I hope this book will be easy, and for those who do not, I hope they can harness the biological intuition behind these results and so contribute to the development of further food web theory (either theoretically or empirically). At a certain level, theory is about the development of heightened logical intuition, and so whether one understands

the mathematics or not is not as important as understanding the underlying concept. It just so happens that some people find it easier to think about things in terms of x 's and y 's, and others in terms of rabbits and lynx. I am convinced that all theory in ecology is potentially accessible to those with a more empirical background; however, I think both theoreticians and empiricists must make an effort to overcome the barriers imposed by history. I find this an exciting time, as it is becoming obvious that researchers of both ilk seem quite ready to delve deeply into each other's realms and benefit from each other's different perspectives and knowledge. Biocomplexity initiatives have worked wonders to force collaborations over traditional scientific boundaries, making today's ecological and evolutionary science a truly dynamical research environment.

I owe a great debt to Joe Rasmussen, who has talked to me frequently about various and sundry ideas, but much of this talk has attempted to better train me in ecosystem ecology. I also owe a great debt to my graduate and post-doctoral researchers, James Umbanhowar, Tim Bartley, Gabriel Gellner, Tyler Tunney, Jason Rip, and Colette Ward, who have discussed various of these ideas with me in earlier manifestations. Often one learns a lot from the new ideas that their less focused approach allows. Gabriel Gellner deserves special mention, as he has pushed me to consider community matrices all over again, and many of the ideas related to this comes largely from his pushing me along this axis. He led me to rediscover the excellent work of Daniel Haydon, who employed Gershgorin discs to interpret matrix food web theory—a highly informative and, in my opinion, undercited set of novel contributions. Neil Rooney, a friend and postdoctoral researcher, played a large conceptual role in development of the later chapters. This work originates historically from my early training from Peter Yodzis, Don DeAngelis, and Alan Hastings, all of whom have had an enormous influence on my work—they have collectively formed my scientific perspective, and I feel extremely lucky to have worked with such great mentors. I obviously would not have been able to put this book together without the patience and understanding of my wife, Amy, and my children, Caden, Bronwyn, and Robyn. Amy allows me the freedom to pursue all my interests and does so without question. I thank my parents, without whose support I would never have been in a position to write a book like this in the first place. From day one they had no issue with my pursuing something that seemed unimaginable to them ("You are getting a Ph.D. in zoology. They have careers for that?"). Finally, I am grateful to the people who ultimately support scientific research. I am truly blessed to have the opportunity to ponder daily the workings of one of nature's most beautiful entities, the food web.