Preface

This is first and foremost a book about evolutionary biology. Though it is filled with equations, it is not an applied mathematics book, nor is it a population genetics text, though that subject dominates half of the chapters. Rather, it is a book about the mechanics of evolution, as illuminated by mathematics, and about the conceptual structure of evolutionary theory. I hope to convey the fact that evolutionary theory is not just a collection of separately constructed models, but is a unified subject in which all of the major results are related to a few basic biological and mathematical principles.

The audience I had in mind while writing the book is made up primarily of graduate students in biology. These students know there is a body of formal evolutionary theory and are familiar with some of its conclusions, but often have never been shown where these conclusions originate from. I also hope that the book will be of interest to researchers in related fields, as well as to biology undergraduates who are frustrated with the fact that they learn calculus and then rarely use it in their courses. In short, my intended audience is composed of readers who know a bit of evolutionary biology and a bit of mathematics. My goal is to take these readers deep into the subject of evolutionary biology, and hopefully expand both their biological and mathematical knowledge in the process.

The single most difficult thing about writing a book that covers this range of material is deciding what to leave out. Most of the topics that I cover have entire books devoted exclusively to them. Giving a comprehensive treatment of each subject would make the book prohibitively long (for both author and readers) and would detract from the goal of uniting different fields and emphasizing the biological insights that they yield.

In deciding what to include and what to leave out, I chose to focus on those results that I feel have the greatest power to influence our thinking about how evolution works. By showing in detail how these central results are derived, I hope to convey some feel for how the different branches of evolutionary theory are constructed and connected.

Because I chose subjects based on their significance to understanding evolution rather than on the kind of mathematics that they require, the level of mathematical sophistication varies throughout the book. Some sections use only basic algebra and a bit of calculus while others, sometimes in the same chapter, use more sophisticated methods. I assume only that the reader is familiar with basic calculus. Beyond this, I strive to explain more advanced mathematical techniques when they arise or in the Appendices.

Acknowledgments

This book is based on a course that I have taught for a number of years. I am grateful to all of the students who, through challenging and insightful questions, lively discussions, and comments on my lecture notes, have not only improved my presentation of the material but have helped me to learn the subject more deeply.

My thinking about this subject has been influenced by many colleagues over the years. Those whose influence I clearly see when I look at what I have written include Jack Cohen, Paul Magwene, Monty Slatkin, Mike Rosenzweig, and Günter Wagner. David Houle and Mark Kirkpatrick read parts of the manuscript and provided helpful input regarding the material and presentation.

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Most importantly, I would never have completed this book without the continuing encouragement and support of my wife, Melissa. When the project seemed daunting, she reminded me why it was worthwhile and inspired me to continue.