
Preface

With the field of animal movement modeling evolving so rapidly, navigating the expanding literature is challenging. It may be impossible to provide an exhaustive summary of animal movement concepts, biological underpinnings, and behavioral theory; thus, we view this book as a starting place to learn about the fundamental suite of statistical modeling tools available for providing inference concerning individual-based animal movement.

Notice that the title is focused on "*statistical models* for telemetry data." The set of existing literature related to animal movement is massive, with thousands of individual papers related to the general topic. All of this information cannot be synthesized in a single volume; thus, we focus on the subset of literature mainly concerned with parametric statistical modeling (i.e., statistical approaches for inverse modeling based on data and known probability distributions, mainly using likelihood and Bayesian methods). There are many other approaches for simulating animal movement and visualizing telemetry data; we leave most of those for another volume.

Our intention is that this book reads more like a reference than a cookbook. It provides insight about the statistical aspects of animal movement modeling. We expect two types of readers: (1) a portion of readers will use this book as a companion reference for obtaining the background necessary to read scientific papers about animal movement, and (2) the other portion of readers will use the book as a foundation for creating and implementing their own statistical animal movement models.

We designed this book such that it opens with an overview of animal movement data and a summary of the progression of the field over the years. Then we provide a series of chapters as a review of important statistical concepts that are relevant for the more advanced animal movement models that follow. Chapter 4 covers point process models for learning about animal movement; many of these rely on uncorrelated telemetry data, but Section 4.7 addresses spatio-temporal point processes. Chapters 5 through 6 are concerned with dynamic animal movement models of both the discrete- and continuous-time flavors. Finally, Chapter 7 describes approaches to use models in sequence, properly accommodating the uncertainty from first-stage models in second-stage inference.

We devote a great deal of space to spatial and temporal statistics in general because this is an area that many animal ecologists have received no formal training in. These subjects are critical for animal movement modeling and we recommend at least a light reading of Chapters 2 and 3 for everyone. However, we recognize that readers already familiar with the basics of telemetry data, as well as spatial and temporal statistics, may be tempted to skip ahead to Chapter 4, only referring back to Chapters 2 and 3 for reference.

Finally, despite the rapid evolution of animal movement modeling approaches, no single method has risen to the top as a gold standard. This lack of a universally accepted framework for analyzing all types of telemetry data is somewhat unique in the field of quantitative animal ecology and can be daunting for new researchers just

wanting to do the right thing. On the other hand, it is an exciting time in animal ecology because we can ask and answer new questions that are fundamental to the biology, ecology, and conservation of wildlife. Each new statistical approach for analyzing telemetry data brings potential for new inference into the scientific understanding of critical processes inherent to living systems.

There are two main reasons why this book is needed. First, the field of animal ecology is becoming increasingly interdisciplinary, and the integration of animal movement ecology, behavioral ecology, and population ecology is becoming increasingly important. Second, the field of animal ecology is becoming increasingly interdisciplinary, and the integration of animal movement ecology, behavioral ecology, and population ecology is becoming increasingly important.

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