

Preface

The use of stable isotopes in ecological and biological sciences is nowadays routine and often an integral component of several large-scale ecological and interdisciplinary environmental studies. Stable isotopic methods are well established and invaluable for investigating the ecology of migrant individuals and populations.

Animal migration is a compelling area of evolutionary and ecological research, and understanding the movement patterns in animals has become a serious topic of concern as we struggle to conserve threatened and other species that move across geopolitical boundaries. Traditional applications of tagging techniques have met with little success except for only a few larger and conspicuous species that can be intercepted with high probability. For most migratory birds, mammals, fishes, and insects, fundamental internal markers are required, and among these, stable isotopes show great promise if used appropriately, and with other tools.

In this completely revised second edition of *Tracking Animal Migration With Stable Isotopes*, we focus on the topic of using stable isotopes in unraveling terrestrial animal migration at various spatial scales around the globe. However, since the first edition 10 years ago, there have been numerous technological advances and field studies that have provided a growing and rich body of knowledge to

advance our understanding of animal migration phenomenon.

Key changes in this second edition include:

- Review of current and new isotopic methods and remote analyses (Chapter 1: Animal Migration: A Context for Using New Techniques and Approaches, Chapter 2: Introduction to Conducting Stable Isotope Measurements for Animal Migration Studies, and Chapter 7: Amino Acid Isotope Analysis: A New Frontier in Studies of Animal Migration and Foraging Ecology)
- New computerized isoscape and isotope assignment approaches (Chapter 3: Isoscapes for Terrestrial Migration Research and Chapter 9: Isoscape Computation and Inference of Spatial Origins With Mixed Models Using the R package IsoriX)
- New chapter on marine animal migration (Chapter 6: Isotopic Tracking of Marine Animal Movement)
- New chapter on terrestrial mammal migration (Chapter 5: Tracking of Movements of Terrestrial Mammals Using Stable Isotopes)
- Updated case studies and comprehensive review of contemporary literature (all the chapters)

The aim of this volume is to provide a foundational handbook that will serve to introduce

students, professional ecologists, and biologists interested in terrestrial animal migration to the key aspects of measuring, applying, and interpreting stable isotopes for terrestrial and marine migratory systems.

From an educational perspective, there are still few textbooks available for biologists and ecologists to provide an introductory overview of stable isotopes. Several textbooks include B. Fry, *Stable Isotope Ecology* (2006); R. Michener and K. Lajtha, *Stable Isotopes in Ecology and Environmental Science* (2007); Dawson and Seigwolf, *Stable Isotopes as Indicators of Ecological Change* (2007), and outdated benchmark books like P.W. Rundell, *Stable Isotope in*

Ecological Research (1989). In addition, some websites are also of interest, primarily via electronic forum for researchers using isotopes in migration. These include the biannual *Applications in Stable Isotope Ecology* international scientific meetings (www.isoecol.org) where ecologists often present findings on migratory research, as well as the discussion list *sever Isogeochem* (www.isogeochem.com).

Our hope is that the foundational aspects of migration and isotopes reviewed here provide a compelling research stimulus for spawning new ideas and research into the fascinating topic and mysteries of animal migration in terrestrial and aquatic environments into the future.