There are many books on Ecological and Biodiversity modeling available at global level. The present academic book can anticipate different level of preparedness and logical interventions emphasis on the formulation of real environmental data sets. Befitting soothe of the book is not initiatory, it venture various statistical and mathematical models induction for solving real world problems of ecological imbalance. Reader is presuming to know the paramount or vital role of recent analytical tools and data base management of ecology. An expeditious of the text book can trace salient objectives and practical applicability to insight what mechanisms are convenient and more significant, when they should be applied in real life. Numerous illustrations are accord to clarify the use of latest statistical techniques and to substantiate what conclusions can be made at the right time for implication of environmental policy at global level. Ongoing text book is more benevolent for post graduates, research scholars, Doctoral, Post-doctoral degree scholars and academicians etc. Nonetheless, post graduates and research Scholars will easily holdout the various analytical methods to enable for the compilation of high dimensional ecological datasets (Big data) and also to know the techniques of econometric modeling on tribal. Although, the book scantily discussed on the very few topics, each topic thrash out functional relationship between ‘NICHE’ and derivatives of various ecosystem. The current academic book intends to be advance, used as a textbook for post graduate students in ecology, botany, wildlife, plant and animal genetics, but it can also be used by researchers as a reference book. For advanced readers, they can opt for read any particular chapters as they desire.
In the summer of 1993, twenty-six graduate and postdoctoral students and fourteen lecturers converged on Cornell University for a summer school devoted to structured-population models. This school was one of a series to address concepts cutting across the traditional boundaries separating terrestrial, marine, and freshwater ecology. Earlier schools resulted in the books Patch Dynamics (S. A. Levin, T. M. Powell & J. H. Steele, eds., Springer-Verlag, Berlin, 1993) and Ecological Time Series (T. M. Powell & J. H. Steele, eds., Chapman and Hall, New York, 1995); a book on food webs is in preparation. Models of population structure (differences among individuals due to age, size, developmental stage, spatial location, or genotype) have an important place in studies of all three kinds of ecosystem. In choosing the participants and lecturers for the school, we selected for diversity—biologists who knew some mathematics and mathematicians who knew some biology, field biologists sobered by encounters with messy data and theoreticians intoxicated by the elegance of the underlying mathematics, people concerned with long-term evolutionary problems and people concerned with the acute crises of conservation biology. For four weeks, these perspectives swirled in discussions that started in the lecture hall and carried on into the sweltering Ithaca night. Diversity may or may not increase stability, but it surely makes things interesting.

This handbook focuses on the enormous literature applying statistical methodology and modelling to environmental and ecological processes. The 21st century statistics community has become increasingly interdisciplinary, bringing a large collection of modern tools to all areas of application in environmental processes. In addition, the environmental community has substantially increased its scope of data collection including observational data, satellite-derived data, and computer model output. The resultant impact in this latter community has been substantial; no longer are simple regression and analysis of variance methods adequate. The contribution of this handbook is to assemble a state-of-the-art view of this interface. Features: An internationally regarded editorial team. A distinguished collection of contributors. A thoroughly contemporary treatment of a substantial interdisciplinary interface. Written to engage both statisticians as well as quantitative environmental researchers. 34 chapters covering methodology, ecological processes, environmental exposure, and statistical methods in climate science.

This book gives a unifying framework for estimating the abundance of open populations: populations subject to births, deaths and movement, given imperfect measurements or samples of the populations. The focus is primarily on populations of vertebrates for which dynamics are typically modelled within the framework of an annual cycle, and for which stochastic variability in the demographic processes is usually modest. Discrete-time models are developed in which animals can be assigned to discrete states such as age class, gender, maturity, population (within a metapopulation), or species (for multispecies models). The book goes well beyond estimation of abundance, allowing inference on underlying population processes such as birth or recruitment, survival and movement. This requires the formulation and fitting of population dynamics models. The resulting fitted models yield both estimates of abundance and estimates of parameters characterizing the underlying processes.

The current eBook collection includes substantial scientific work in describing how insect species are responding to abiotic factors and recent climatic trends on the basis of insect physiology and population dynamics. The contributions can be broadly split into four chapters: the first chapter focuses on the function of environmental and mostly temperature driven models, to identify the seasonal emergence and population dynamics of insects, including some important pests. The second chapter provides additional examples on how such models can be used to simulate the effect of climate change on insect phenology and population dynamics. The third chapter focuses on describing the effects of nutrition, gene expression and phototaxis in relation to insect demography,
growth and development, whilst the fourth chapter provides a short description on the functioning of circadian systems as well as on the evolutionary dynamics of circadian clocks.

Individual-based models are an exciting and widely used new tool for ecology. These computational models allow scientists to explore the mechanisms through which population and ecosystem ecology arises from how individuals interact with each other and their environment. This book provides the first in-depth treatment of individual-based modeling and its use to develop theoretical understanding of how ecological systems work, an approach the authors call "individual-based ecology." Grimm and Railsback start with a general primer on modeling: how to design models that are as simple as possible while still allowing specific problems to be solved, and how to move efficiently through a cycle of pattern-oriented model design, implementation, and analysis. Next, they address the problems of theory and conceptual framework for individual-based ecology: What is "theory"? That is, how do we develop reusable models of how system dynamics arise from characteristics of individuals? What conceptual framework do we use when the classical differential equation framework no longer applies? An extensive review illustrates the ecological problems that have been addressed with individual-based models. The authors then identify how the mechanics of building and using individual-based models differ from those of traditional science, and provide guidance on formulating, programming, and analyzing models. This book will be helpful to ecologists interested in modeling, and to other scientists interested in agent-based modeling.

This book is an introduction to mathematical biology for students with no experience in biology, but who have some mathematical background. The work is focused on population dynamics and ecology, following a tradition that goes back to Lotka and Volterra, and includes a part devoted to the spread of infectious diseases, a field where mathematical modeling is extremely popular. These themes are used as the area where to understand different types of mathematical modeling and the possible meaning of qualitative agreement of modeling with data. The book also includes a collections of problems designed to approach more advanced questions. This material has been used in the courses at the University of Trento, directed at students in their fourth year of studies in Mathematics. It can also be used as a reference as it provides up-to-date developments in several areas.

Applied Hierarchical Modeling in Ecology: Distribution, Abundance, Species Richness offers a new synthesis of the state-of-the-art of hierarchical models for plant and animal distribution, abundance, and community characteristics such as species richness using data collected in metapopulation designs. These types of data are extremely widespread in ecology and its applications in such areas as biodiversity monitoring and fisheries and wildlife management. This first volume explains static models/procedures in the context of hierarchical models that collectively represent a unified approach to ecological research, taking the reader from design, through data collection, and into analyses using a very powerful class of models. Applied Hierarchical Modeling in Ecology, Volume 1 serves as an indispensable manual for practicing field biologists, and as a graduate-level text for students in ecology, conservation biology, fisheries/wildlife management, and related fields. Provides a synthesis of important classes of models about distribution, abundance, and species richness while accommodating imperfect detection Presents models and methods for identifying unmarked individuals and species Written in a step-by-step approach accessible to non-statisticians and provides fully worked examples that serve as a template for readers' analyses Includes companion website containing data
Powerful analytical tools from statistical physics, guided by field observations are applied to spread of epidemics and movement ecology.

Interest in the temporal fluctuations of biological populations can be traced to the dawn of civilization. How can mathematics be used to gain an understanding of population dynamics? This monograph introduces the theory of structured population dynamics and its applications, focusing on the asymptotic dynamics of deterministic models. This theory bridges the gap between the characteristics of individual organisms in a population and the dynamics of the total population as a whole. In this monograph, many applications that illustrate both the theory and a wide variety of biological issues are given, along with an interdisciplinary case study that illustrates the connection of models with the data and the experimental documentation of model predictions. The author also discusses the use of discrete and continuous models and presents a general modeling theory for structured population dynamics. Cushing begins with an obvious point: individuals in biological populations differ with regard to their physical and behavioral characteristics and therefore in the way they interact with their environment. Studying this point effectively requires the use of structured models. Specific examples cited throughout support the valuable use of structured models. Included among these are important applications chosen to illustrate both the mathematical theories and biological problems that have received attention in recent literature.

Computer-aided process engineering (CAPE) plays a key design and operations role in the process industries, from the molecular scale through managing complex manufacturing sites. The research interests cover a wide range of interdisciplinary problems related to the current needs of society and industry. ESCAPE 23 brings together researchers and practitioners of computer-aided process engineering interested in modeling, simulation and optimization, synthesis and design, automation and control, and education. The proceedings present and evaluate emerging as well as established research methods and concepts, as well as industrial case studies. Contributions from the international community using computer-based methods in process engineering Reviews the latest developments in process systems engineering Emphasis on industrial and societal challenges

The author uses mathematical techniques along with observations and experiments to give an in-depth look at models for mechanical vibrations, population dynamics, and traffic flow. Equal emphasis is placed on the mathematical formulation of the problem and the interpretation of the results. In the sections on mechanical vibrations and population dynamics, the author emphasizes the nonlinear aspects of ordinary differential equations and develops the concepts of equilibrium solutions and their stability. He introduces phase plane methods for the nonlinear pendulum and for predator-prey and competing species models. Haberman develops the method of characteristics to analyze the nonlinear partial differential equations that describe traffic flow. Fan-shaped characteristics describe the traffic situation that occurs when a traffic light turns green and shock waves describe the effects of a red light or traffic accident. Although it was written over 20 years ago, this book is still relevant. It is intended as an introduction to applied mathematics, but can be used for undergraduate courses in mathematical modeling or nonlinear dynamical systems or to supplement courses in ordinary or partial differential equations.

Demography is everywhere in our lives: from birth to death. Indeed, the universal currencies of survival, development, reproduction, and recruitment shape
the performance of all species, from microbes to humans. The number of techniques for demographic data acquisition and analyses across the entire tree of life (microbes, fungi, plants, and animals) has drastically increased in recent decades. These developments have been partially facilitated by the advent of technologies such as GIS and drones, as well as analytical methods including Bayesian statistics and high-throughput molecular analyses. However, despite the universality of demography and the significant research potential that could emerge from unifying: (i) questions across taxa, (ii) data collection protocols, and (iii) analytical tools, demographic methods to date have remained taxonomically siloed and methodologically disintegrated. This is the first book to attempt a truly unified approach to demography and population ecology in order to address a wide range of questions in ecology, evolution, and conservation biology across the entire spectrum of life. This novel book provides the reader with the fundamentals of data collection, model construction, analyses, and interpretation across a wide repertoire of demographic techniques and protocols. It introduces the novice demographer to a broad range of demographic methods, including abundance-based models, life tables, matrix population models, integral projection models, integrated population models, individual based models, and more. Through the careful integration of data collection methods, analytical approaches, and applications, clearly guided throughout with fully reproducible R scripts, the book provides an up-to-date and authoritative overview of the most popular and effective demographic tools. Demographic Methods across the Tree of Life is aimed at graduate students and professional researchers in the fields of demography, ecology, animal behaviour, genetics, evolutionary biology, mathematical biology, and wildlife management.

Increasingly used to represent climatic, biogeochemical, and ecological systems, computer modeling has become an important tool that should be in every environmental professional’s toolbox. Environmental Modeling: A Practical Introduction is just what it purports to be, a practical introduction to the various methods, techniques, and skills required for computerized environmental modeling. Exploring the broad arena of environmental modeling, the book demonstrates how to represent an environmental problem in conceptual terms, formalize the conceptual model using mathematical expressions, convert the mathematical model into a program that can be run on a desktop or laptop computer, and examine the results produced by the computational model. Equally important, the book imparts skills that allow you to develop, implement, and experiment with a range of computerized environmental models. The emphasis is on active engagement in the modeling process rather than on passive learning about a suite of well-established models. The author takes a practical approach throughout, one that does not get bogged down in the details of the underlying mathematics and that encourages learning through “hands on” experimentation. He provides a set of software tools and data sets that you can use to work through the various examples and exercises presented in each chapter, as well as presentational material and handouts for course tutors. Comprehensive and up-to-date, the book discusses how computational models can be used to represent environmental systems and illustrates how such models improve understanding of the ways in which environmental systems function.

This book provides an introduction to age-structured population modeling which emphasizes the connection between mathematical theory and underlying biological assumptions. Through the rigorous development of the linear theory and the nonlinear theory alongside numerics, the authors explore classical equations that describe the dynamics of certain ecological systems. Modeling aspects are discussed to show how relevant problems in the fields of demography, ecology and epidemiology can be formulated and treated within the theory. In particular, the book presents extensions of age-structured modeling to the spread of diseases and epidemics while also addressing the issue of regularity of solutions, the asymptotic behavior of solutions, and numerical approximation. With sections on transmission models, non-autonomous models and global dynamics, this book fills a gap in the literature on theoretical population dynamics. The Basic Approach to Age-Structured Population Dynamics will appeal to graduate students and researchers in
mathematical biology, epidemiology and demography who are interested in the systematic presentation of relevant models and mathematical methods.

This edited volume, with contributions by area experts, offers discussions on a range of evolving topics in economics and social development. At center are important issues central to sustainable development, economic growth, technological change, the economics of climate change, commodity markets, long wave theory, non-linear dynamic models, and boom-bust cycles. This is an excellent reference for academic and professional economists interested in emerging areas of empirical macroeconomics and finance. For policy makers and curious readers alike, it is also an outstanding introduction to the economic thinking of those who seek a holistic and all-comprising approach in economic theory and policy. Looking into new data and methodology, this book offers fresh approaches in a post-crisis environment. Set in a profound understanding of the diverse currents within the many traditions of economic thought, this book pushes the established frontiers of economic thinking. It is dedicated to a leading scholar in the areas covered in this book, Willi Semmler.

This comprehensive book, rich with applications, offers a quantitative framework for the analysis of the various capture-recapture models for open animal populations, while also addressing associated computational methods. The state of our wildlife populations provides a litmus test for the state of our environment, especially in light of global warming and the increasing pollution of our land, seas, and air. In addition to monitoring our food resources such as fisheries, we need to protect endangered species from the effects of human activities (e.g. rhinos, whales, or encroachments on the habitat of orangutans). Pests must be be controlled, whether insects or viruses, and we need to cope with growing feral populations such as opossums, rabbits, and pigs. Accordingly, we need to obtain information about a given population’s dynamics, concerning e.g. mortality, birth, growth, breeding, sex, and migration, and determine whether the respective population is increasing, static, or declining. There are many methods for obtaining population information, but the most useful (and most work-intensive) is generically known as capture-recapture, where we mark or tag a representative sample of individuals from the population and follow that sample over time using recaptures, resightings, or dead recoveries. Marks can be natural, such as stripes, fin profiles, and even DNA; or artificial, such as spots on insects. Attached tags can, for example, be simple bands or streamers, or more sophisticated variants such as radio and sonic transmitters. To estimate population parameters, sophisticated and complex mathematical models have been devised on the basis of recapture information and computer packages. This book addresses the analysis of such models. It is primarily intended for ecologists and wildlife managers who wish to apply the methods to the types of problems discussed above, though it will also benefit researchers and graduate students in ecology. Familiarity with basic statistical concepts is essential.

Integrated Population Biology and Modeling: Part A offers very complex and precise realities of quantifying modern and traditional methods of understanding populations and population dynamics. Chapters cover emerging topics of note, including Longevity dynamics, Modeling human-environment interactions, Survival Probabilities from 5-Year Cumulative Life Table Survival Ratios (Tx+5/Tx): Some Innovative Methodological Investigations, Cell migration Models, Evolutionary Dynamics of Cancer Cells, an Integrated approach for modeling of coastal lagoons: A case for Chilka Lake, India, Population and metapopulation dynamics, Mortality analysis: measures and models, Stationary Population Models, Are there biological and social limits to human longevity?, Probability models in biology, Stochastic Models in Population Biology, and more. Covers emerging topics of note in the subject matter. Presents chapters on Longevity dynamics, Modeling human-environment interactions, Survival Probabilities from 5-Year Cumulative Life Table Survival Ratios (Tx+5/Tx), and more
Integrated Population Models: Theory and Ecological Applications with R and JAGS is the first book on integrated population models, which constitute a powerful framework for combining multiple data sets from the population and the individual levels to estimate demographic parameters, and population size and trends. These models identify drivers of population dynamics and forecast the composition and trajectory of a population. Written by two population ecologists with expertise on integrated population modeling, this book provides a comprehensive synthesis of the relevant theory of integrated population models with an extensive overview of practical applications, using Bayesian methods by means of case studies. The book contains fully-documented, complete code for fitting all models in the free software, R and JAGS. It also includes all required code for pre- and post-model-fitting analysis. Integrated Population Models is an invaluable reference for researchers and practitioners involved in population analysis, and for graduate-level students in ecology, conservation biology, wildlife management, and related fields. The text is ideal for self-study and advanced graduate-level courses. Offers practical and accessible ecological applications of IPMs (integrated population models) Provides full documentation of analyzed code in the Bayesian framework Written and structured for an easy approach to the subject, especially for non-statisticians

An important first step in studying the demography of wild animals is to identify the animals uniquely through applying markings, such as rings, tags, and bands. Once the animals are encountered again, researchers can study different forms of capture-recapture data to estimate features, such as the mortality and size of the populations. Capture-recapture methods are also used in other areas, including epidemiology and sociology. With an emphasis on ecology, Analysis of Capture-Recapture Data covers many modern developments of capture-recapture and related models and methods and places them in the historical context of research from the past 100 years. The book presents both classical and Bayesian methods. A range of real data sets motivates and illustrates the material and many examples illustrate biometry and applied statistics at work. In particular, the authors demonstrate several of the modeling approaches using one substantial data set from a population of great cormorants. The book also discusses which computer programs to use for implementing the models and contains 130 exercises that extend the main material. The data sets, computer programs, and other ancillaries are available at www.capturerecapture.co.uk. The book is accessible to advanced undergraduate and higher-level students, quantitative ecologists, and statisticians. It helps readers understand model formulation and applications, including the technicalities of model diagnostics and checking.

Sampling theory considers how methods for selection of a subset of units from a finite population (a sample) affect the accuracy of estimates of descriptive population parameters (mean, total, proportion). Although a sound knowledge of sampling theory principles would seem essential for ecologists and natural resource scientists, the subject tends to be somewhat overlooked in contrast to other core statistical topics such as regression analysis, experimental design, and multivariate statistics. This introductory text aims to redress this imbalance by specifically targeting ecologists and resource scientists, and illustrating how sampling theory can be applied in a wide variety of resource contexts. The emphasis throughout is on design-based sampling from finite populations, but some attention is given to model-based prediction and sampling from infinite populations.

The main purpose of this article is to describe the formulation of an appropriate mathematical representation of a population based on physiological attributes relevant to the individual species considered and to the problem under investigation. There are two main parts of the article. The first discusses the relationship between model hypotheses and model conclusions. We will discuss some problems of applicability that arise from employing classical age or size structured models as representations of a population. We describe certain properties of the dynamic behavior of these continuous, structured populations
to demonstrate that it is often necessary to include additional physiological variables other than just age and size if one wishes to obtain biologically realistic deterministic population dynamics. We apply the method of characteristics for solving hyperbolic partial differential equations to the population model and discuss problems of interpretation. The second part of the article focuses on the computation of solutions of physiologically structured models. Here we will indicate the motivation and describe the protocol for formulating a dynamic population that was employed in an investigation of effects of toxic chemicals on aquatic populations. Illustrations of the numerical solution of the population model are presented. The protocol is presented because it is generic and the approach seems to be applicable with modification to many environments. 26 refs., 6 figs.

Ecological Modeling: A Commonsense Approach to Theory and Practice explores how simulation modeling and its new ecological applications can offer solutions to complex natural resource management problems. This is a practical guide for students, teachers, and professional ecologists. Examines four phases of the modeling process: conceptual model formulation, quantitative model specification, model evaluation, and model use. Provides useful building blocks for constructing systems simulation models. Includes a format for reporting the development and use of simulation models. Offers an integrated systems perspective for students, faculty, and professionals. Features helpful insights from the author, gained over 30 years of university teaching. "I can strongly recommend the book as textbook for all courses in population dynamic modeling particularly when the course is planned for the second or third year of a bachelor study in ecology, environmental science or ecological engineering. It uncovers very clearly for the readers the scientific idea and thinking behind modeling and all the necessary steps in the development of models." Ecological Modeling Journal, 2009

This book is a "How To" guide for modeling population dynamics using Integral Projection Models (IPM) starting from observational data. It is written by a leading research team in this area and includes code in the R language (in the text and online) to carry out all computations. The intended audience are ecologists, evolutionary biologists, and mathematical biologists interested in developing data-driven models for animal and plant populations. IPMs may seem hard as they involve integrals. The aim of this book is to demystify IPMs, so they become the model of choice for populations structured by size or other continuously varying traits. The book uses real examples of increasing complexity to show how the life-cycle of the study organism naturally leads to the appropriate statistical analysis, which leads directly to the IPM itself. A wide range of model types and analyses are presented, including model construction, computational methods, and the underlying theory, with the more technical material in Boxes and Appendices. Self-contained R code which replicates all of the figures and calculations within the text is available to readers on GitHub. Stephen P. Ellner is Horace White Professor of Ecology and Evolutionary Biology at Cornell University, USA; Dylan Z. Childs is Lecturer and NERC Postdoctoral Fellow in the Department of Animal and Plant Sciences at The University of Sheffield, UK; Mark Rees is Professor in the Department of Animal and Plant Sciences at The University of Sheffield, UK.

The book presents nine mini-courses from a summer school, Dynamics of Biological Systems, held at the University of Alberta in 2016, as part of the prestigious seminar series: Séminaire de Mathématiques Supérieures (SMS). It includes new and significant contributions in the field of Dynamical Systems and their applications in Biology, Ecology, and Medicine. The chapters of this book cover a wide range of mathematical methods and biological applications. They - explain the process of mathematical modelling of biological systems with many examples, - introduce advanced methods from dynamical systems theory, - present many examples of the use of mathematical modelling to gain biological insight - discuss innovative methods for the analysis of biological processes, - contain extensive lists of references, which allow interested readers to continue the research on their own. Integrating the theory of dynamical
The Edwards Aquifer in south-central Texas is the primary source of water for one of the fastest growing cities in the United States, San Antonio, and it also supplies irrigation water to thousands of farmers and livestock operators. It is also the source water for several springs and rivers, including the two largest freshwater springs in Texas that form the San Marcos and Comal Rivers. The unique habitat afforded by these spring-fed rivers has led to the development of species that are found in no other locations on Earth. Due to the potential for variations in spring flow caused by both human and natural causes, these species are continuously at risk and have been recognized as endangered under the federal Endangered Species Act (ESA). In an effort to manage the river systems and the aquifer that controls them, the Edwards Aquifer Authority and stakeholders have developed a Habitat Conservation Plan (HCP). The HCP seeks to effectively manage the river-aquifer system to ensure the viability of the ESA-listed species in the face of drought, population growth, and other threats to the aquifer. The National Research Council was asked to assist in this process by reviewing the activities around implementing the HCP. Review of the Edwards Aquifer Habitat Conservation Plan: Report 1 is the first stage of a three-stage study. This report reviews the scientific efforts that are being conducted to help build a better understanding of the river-aquifer system and its relationship to the ESA-listed species. These efforts, which include monitoring and modeling as well as research on key uncertainties in the system, are designed to build a better understanding of how best to manage and protect the system and the endangered species. Thus, the current report is focused specifically on a review of the hydrologic modeling, the ecological modeling, the water quality and biological monitoring, and the Applied Research Program. The fundamental question that Review of the Edwards Aquifer Habitat Conservation Plan: Report 1 addresses is whether the scientific initiatives appropriately address uncertainties and fill knowledge gaps in the river-aquifer system and the species of concern. It is hoped that the successful completion of these scientific initiatives will ultimately lead the Edwards Aquifer Authority to an improved understanding of how to manage the system and protect these species.

A synthesis of contemporary analytical and modeling approaches in population ecology The book provides an overview of the key analytical approaches that are currently used in demographic, genetic, and spatial analyses in population ecology. The chapters present current problems, introduce advances in analytical methods and models, and demonstrate the applications of quantitative methods to ecological data. The book covers new tools for designing robust field studies; estimation of abundance and demographic rates; matrix population models and analyses of population dynamics; and current approaches for genetic and spatial analysis. Each chapter is illustrated by empirical examples based on real datasets, with a companion website that offers online exercises and examples of computer code in the R statistical software platform. Fills a niche for a book that emphasizes applied aspects of population analysis Covers many of the current methods being used to analyse population dynamics and structure Illustrates the application of specific analytical methods through worked examples based on real datasets Offers readers the opportunity to work through examples or adapt the routines to their own datasets using computer code in the R statistical platform Population Ecology in Practice is an excellent book for upper-level undergraduate and graduate students taking courses in population ecology or ecological statistics, as well as established researchers needing a desktop reference for contemporary methods used to develop robust population assessments.
This book gives a unifying framework for estimating the abundance of open populations: populations subject to births, deaths and movement, given imperfect measurements or samples of the populations. The focus is primarily on populations of vertebrates for which dynamics are typically modelled within the framework of an annual cycle, and for which stochastic variability in the demographic processes is usually modest. Discrete-time models are developed in which animals can be assigned to discrete states such as age class, gender, maturity, population (within a metapopulation), or species (for multi-species models). The book goes well beyond estimation of abundance, allowing inference on underlying population processes such as birth or recruitment, survival and movement. This requires the formulation and fitting of population dynamics models. The resulting fitted models yield both estimates of abundance and estimates of parameters characterizing the underlying processes.

The term "zooplankton" describes the community of floating, often microscopic, animals that inhabit aquatic environments. Being near the base of the food chain, they serve as food for larger animals, such as fish. The ICES (International Council for the Exploration of the Sea) Zooplankton Methodology Manual provides comprehensive coverage of modern techniques in zooplankton ecology written by a group of international experts. Chapters include sampling, acoustic and optical methods, estimation of feeding, growth, reproduction and metabolism, and up-to-date treatment of population genetics and modeling. This book will be a key reference work for marine scientists throughout the world. Sampling and experimental design Collecting zooplankton Techniques for assessing biomass and abundance Protozooplankton enumeration and biomass estimation New optical and acoustic techniques for estimating zooplankton biomass and abundance Methods for measuring zooplankton feeding, growth, reproduction and metabolism Population genetic analysis of zooplankton Modelling zooplankton dynamics This unique and comprehensive reference work will be essential reading for marine and freshwater research scientists and graduates entering the field.

This monograph introduces the theory of structured population dynamics and its applications, focusing on the asymptotic dynamics of deterministic models.

A beginner’s guide to stochastic growth modeling The chief advantage of stochastic growth models over deterministic models is that they combine both deterministic and stochastic elements of dynamic behaviors, such as weather, natural disasters, market fluctuations, and epidemics. This makes stochastic modeling a powerful tool in the hands of practitioners in fields for which population growth is a critical determinant of outcomes. However, the background requirements for studying SDEs can be daunting for those who lack the rigorous course of study received by math majors. Designed to be accessible to readers who have had only a few courses in calculus and statistics, this book offers a comprehensive review of the mathematical essentials needed to understand and apply stochastic growth models. In addition, the book describes deterministic and stochastic applications of population growth models including logistic, generalized logistic, Gompertz, negative exponential, and linear. Ideal for students and professionals in an array of fields including economics, population studies, environmental sciences, epidemiology, engineering, finance, and the biological sciences, Stochastic Differential Equations: An Introduction with Applications in Population Dynamics Modeling: • Provides precise definitions of many important terms and concepts and provides many solved example problems • Highlights the interpretation of results and does not rely on a theorem-proof approach • Features comprehensive chapters addressing any background deficiencies readers may have and offers a comprehensive review for those who need a mathematics refresher • Emphasizes solution techniques for SDEs and their practical application to the development of stochastic population models An indispensable resource for students and practitioners with limited exposure to mathematics and statistics, Stochastic Differential Equations: An Introduction with Applications in Population
Dynamics Modeling is an excellent fit for advanced undergraduates and beginning graduate students, as well as practitioners who need a gentle introduction to SDEs. Michael J. Panik, PhD, is Professor in the Department of Economics, Barney School of Business and Public Administration at the University of Hartford in Connecticut. He received his PhD in Economics from Boston College and is a member of the American Mathematical Society, The American Statistical Association, and The Econometric Society.

Although numerous books have been written on both monitoring and modelling of coastal oceans, there is a practical need for an introductory multi-disciplinary volume to non-specialists in this field. The articles commissioned for this book, organized into four major themes, are written by experts in their disciplines while the text is intended for scientists who do not have extensive training in marine sciences and coastal zone management. As such, the articles in this monograph can be a valuable reference for practicing professionals. The first section introduces the complex physical processes with main emphasis on waste disposal in the coastal ocean. Following this, examples of instrumentation techniques that are commonly used for measuring different properties of oceans are described. Coastal and estuarine transport and dispersion modelling is introduced in the next section with examples from different parts of the world. The last section provides an overview of coastal disasters such as tropical cyclones, storm surges and oil spills.

Wood, Robert M. Zink, Benjamin Zuckerberg

Novel Statistical Tools for Conserving and Managing Populations

By gathering information on key demographic parameters, scientists can often predict how populations will develop in the future and relate these parameters to external influences, such as global warming. Because of their ability to easily incorporate random effects, fit state-space mode

A guide to data collection, modeling and inference strategies for biological survey data using Bayesian and classical statistical methods. This book describes a general and flexible framework for modeling and inference in ecological systems based on hierarchical models, with a strict focus on the use of probability models and parametric inference. Hierarchical models represent a paradigm shift in the application of statistics to ecological inference problems because they combine explicit models of ecological system structure or dynamics with models of how ecological systems are observed. The principles of hierarchical modeling are developed and applied to problems in population, metapopulation, community, and metacommunity systems. The book provides the first synthetic treatment of many recent methodological advances in ecological modeling and unifies disparate methods and procedures. The authors apply principles of hierarchical modeling to ecological problems, including occurrence or occupancy models for estimating species distribution * abundance models based on many sampling protocols, including distance sampling * capture-recapture models with individual effects * spatial capture-recapture models based on camera trapping and related methods * population and metapopulation dynamic models * models of biodiversity, community structure and dynamics * Wide variety of examples involving many taxa (birds, amphibians, mammals, insects, plants) * Development of classical, likelihood-based procedures for inference, as well as Bayesian methods of analysis * Detailed explanations describing the implementation of hierarchical models using freely available software such as R and WinBUGS * Computing support in technical appendices in an online companion web site