

Population Parameters: Estimation for Ecological Models

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Population Parameters Estimation For Ecological Models

Alan Andrew Berryman



Population Parameters Estimation For Ecological Models:

Population Parameters Hamish McCallum, 2008-04-15 Ecologists and environmental managers rely on mathematical models both to understand ecological systems and to predict future system behavior. In turn, models rely on appropriate estimates of their parameters. This book brings together a diverse and scattered literature to provide clear guidance on how to estimate parameters for models of animal populations. It is not a recipe book of statistical procedures. Instead, it concentrates on how to select the best approach to parameter estimation for a particular problem and how to ensure that the quality estimated is the appropriate one for the specific purpose of the modelling exercise. Commencing with a toolbox of useful generic approaches to parameter estimation, the book deals with methods for estimating parameters for single populations. These parameters include population size, birth and death rates, and the population growth rate. For such parameters, rigorous statistical theory has been developed, and software is readily available. The problem is to select the optimal sampling design and method of analysis. The second part of the book deals with parameters that describe spatial dynamics and ecological interactions such as competition, predation, and parasitism. Here, the principle problems are designing appropriate experiments and ensuring that the quantities measured by the experiments are relevant to the ecological models in which they will be used. This book will be essential reading for ecological researchers, postgraduate students, and environmental managers who need to address an ecological problem through a population model. It is accessible to anyone with an understanding of basic statistical methods and population ecology. Unique in concentrating on parameter estimation within modelling. Fills a glaring gap in the literature. Not too technical, so suitable for the statistically inept. Methods explained in algebra, but also in worked examples using commonly available computer packages: SAS, GLIM, and some more specialised packages where relevant. Some spreadsheet-based examples also included. Population-Level Ecological Risk Assessment Lawrence W. Barnhouse, Jr., Munns, Mary T. Sorensen, 2007-09-25 Most ecological risk assessments consider the risk to individual organisms or organism-level attributes. From a management perspective, however, risks to population-level attributes and processes are often more relevant. Despite many published calls for population risk assessment and the abundance of available scientific research and technical tools. A Practical Guide to Ecological Modelling Karline Soetaert, Peter M. J. Herman, 2008-10-14 Mathematical modelling is an essential tool in present-day ecological research. Yet for many ecologists, it is still problematic to apply modelling in their research. In our experience, the major problem is at the conceptual level: proper understanding of what a model is, how ecological relations can be translated consistently into mathematical equations, how models are solved, steady states calculated, and interpreted. Many textbooks jump over these conceptual hurdles to dive into detailed formulations or the mathematics of solution. This book attempts to fill that gap. It introduces essential concepts for mathematical modelling, explains the mathematics behind the methods, and helps readers to implement models and obtain hands-on experience. Throughout the book, emphasis is laid on how to translate

ecological questions into interpretable models in a practical way The book aims to be an introductory textbook at the undergraduate graduate level but will also be useful to seduce experienced ecologists into the world of modelling The range of ecological models treated is wide from Lotka Volterra type of principle seeking models to environmental or ecosystem models and including matrix models lattice models and sequential decision models All chapters contain a concise introduction into the theory worked out examples and exercises All examples are implemented in the open source package R thus taking away problems of software availability for use of the book All code used in the book is available on a dedicated website

Theory of Wildlife Population Ecology Bruce D. Leopold, 2018-10-25 Understanding wildlife population ecology is vital for all wildlife managers and conservation biologists Leopold draws on 30 years of research and teaching experience to give students and natural resource professionals the foundation they need to effectively manage wildlife populations He begins with the key statistical concepts and research approaches necessary to gain insight into various models of population dynamics The many factors that influence wildlife populations are thoroughly explored and their consequences are investigated In addition the author presents techniques for analyzing wildlife harvest data and a lucid discussion of valuable wildlife census methods Frequent examples of foundational literature supplement each chapter with applications of the theories and provide a concise compendium of fundamental concepts of population ecology Abundant statistical exercises reinforce students learning throughout the text

Fundamentals of Ecological Modelling S.E. Jorgensen, 2011-01-10 Fundamentals of Ecological Modelling Applications in Environmental Management and Research Fourth Edition provides a comprehensive discussion of the fundamental principles of ecological modeling The first two editions of this book published in 1986 and 1994 focused on the roots of the discipline the four main model types that dominated the field 30 40 years ago 1 dynamic biogeochemical models 2 population dynamic models 3 ecotoxicological models and 4 steady state biogeochemical and energy models The third edition focused on the mathematical formulations of ecological processes that are included in ecological models This fourth edition uses the four model types previously listed as the foundation and expands the latest model developments in spatial models structural dynamic models and individual based models As these seven types of models are very different and require different considerations in the model development phase a separate chapter is devoted to the development of each of the model types Throughout the text the examples given from the literature emphasize the application of models for environmental management and research Presents the most commonly used model types with a step by step outline of the modeling procedure used for each Shows readers through an illustrated example of how to use each model in research and management settings New edition is revised to include only essential theory with a focus on applications Includes case studies illustrations and exercises case study of an ecological problem with full illustration on how to solve the problem

Ecological Census Techniques William J. Sutherland, 2006-08-03 This is an updated version of the best selling first edition Ecological Census Techniques with updating some new chapters and authors Almost all ecological

and conservation work involves carrying out a census or survey This practically focussed book describes how to plan a census the practical details and shows with worked examples how to analyse the results The first three chapters describe planning sampling and the basic theory necessary for carrying out a census In the subsequent chapters international experts describe the appropriate methods for counting plants insects fish amphibians reptiles mammals and birds As many censuses also relate the results to environmental variability there is a chapter explaining the main methods Finally there is a list of the most common mistakes encountered when carrying out a census

Capture-Recapture: Parameter Estimation for Open Animal Populations George A. F. Seber, Matthew R. Schofield, 2019-08-13 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 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

Conservation Biology for All Navjot S. Sodhi, Paul R. Ehrlich, 2010-01-08 Conservation Biology for All provides cutting edge but basic conservation science to a global readership A series of authoritative chapters have been written by the top names in conservation biology with the principal aim of disseminating cutting edge conservation knowledge as widely as possible Important topics such as balancing conservation and human needs climate change conservation planning designing and analyzing conservation research ecosystem services endangered species management extinctions fire habitat loss and invasive species are covered Numerous textboxes describing additional relevant material or case studies are also included The global biodiversity crisis is now unstoppable what can be saved in the developing world will require an educated

constituency in both the developing and developed world Habitat loss is particularly acute in developing countries which is of special concern because it tends to be these locations where the greatest species diversity and richest centres of endemism are to be found Sadly developing world conservation scientists have found it difficult to access an authoritative textbook which is particularly ironic since it is these countries where the potential benefits of knowledge application are greatest There is now an urgent need to educate the next generation of scientists in developing countries so that they are in a better position to protect their natural resources

Advanced Mathematical Methods in Biosciences and Applications Faina Berezovskaya, Bourama Toni, 2019-09-19 Featuring contributions from experts in mathematical biology and biomedical research this edited volume covers a diverse set of topics on mathematical methods and applications in the biosciences Topics focus on advanced mathematical methods with chapters on the mathematical analysis of the quasispecies model Arnold's weak resonance equation bifurcation analysis and the Tonnelier Gerstner model Special emphasis is placed on applications such as natural selection population heterogeneity polyvariant ontogeny in plants cancer dynamics and analytical solutions for traveling pulses and wave trains in neural models A survey on quasiperiodic topology is also presented in this book Carefully peer reviewed this volume is suitable for students interested in interdisciplinary research Researchers in applied mathematics and the biosciences will find this book an important resource on the latest developments in the field In keeping with the STEAM H series the editors hope to inspire interdisciplinary understanding and collaboration

Analysis of Ecological Systems: State-of-the-Art in Ecological Modelling W.K. Lauenroth, G.V. Skogerboe, M. Flug, 2013-10-22 The International Society for Ecological Modelling ISEM sponsors conferences workshops and training courses with the aim of advancing the development of ecological and environmental modelling The 3rd International Conference on the state of the art in ecological modelling was sponsored by the ISEM in cooperation with the National Park Service Water Resources Laboratory and hosted by the Natural Resource Ecology Laboratory at Colorado State University Its theme was the application of ecological modelling to environmental management and this book contains the full texts of the three invited papers presented in the five general sessions plus the final summaries and syntheses of the topics covered during those sessions

Modeling Biological Systems: James W. Haefner, 2005-05-06 I Principles 1 1 Models of Systems 3 1 1 Systems Models and Modeling 3 1 2 Uses of Scientific Models 4 1 3 Example Island Biogeography 6 1 4 Classifications of Models 10 1 5 Constraints on Model Structure 12 1 6 Some Terminology 12 1 7 Misuses of Models The Dark Side 13 1 8 Exercises 15 2 The Modeling Process 17 2 1 Models Are Problems 17 2 2 Two Alternative Approaches 18 2 3 An Example Population Doubling Time 24 2 4 Model Objectives 28 2 5 Exercises 30 3 Qualitative Model Formulation 32 3 1 How to Eat an Elephant 32 3 2 Forrester Diagrams 33 3 3 Examples 36 3 4 Errors in Forrester Diagrams 44 3 5 Advantages and Disadvantages of Forrester Diagrams 44 3 6 Principles of Qualitative Formulation 45 3 7 Model Simplification 47 3 8 Other Modeling Problems 49 viii Contents 3 9 Exercises 53 4 Quantitative Model Formulation I 4 1 From Qualitative to Quantitative

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Modelling and Informatics Sven Erik Jørgensen, T-S. Chon, Friedrich Recknagel, 2009-01-30 The book gives a comprehensive overview of all available types of ecological models It is the first book of its kind that gives an overview of different model types and will be of interest to all those involved in ecological and environmental modelling and ecological informatics Encyclopedia of Ecology Brian D. Fath, 2018-08-23 Encyclopedia of Ecology Second Edition Four Volume Set continues the acclaimed work of the previous edition published in 2008 It covers all scales of biological organization from organisms to populations to communities and ecosystems Laboratory field simulation modelling and theoretical approaches are presented to show how living systems sustain structure and function in space and time New areas of focus include micro and macro scales molecular and genetic ecology and global ecology e g climate change earth transformations ecosystem services and the food water energy nexus are included In addition new international experts in ecology contribute on a variety of topics Offers the most broad ranging and comprehensive resource available in the field of ecology Provides foundational content and suggests further reading Incorporates the expertise of over 500 outstanding investigators in the field of ecology including top young scientists with both research and teaching experience Includes multimedia resources such as an Interactive Map Viewer and links to a CSDMS Community Surface Dynamics Modeling System an open source platform for modelers to share and link models dealing with earth system processes *Membrane Computing* David Corne, Pierluigi Frisco, Gheorghe Păun, Grzegorz Rozenberg, Arto Salomaa, 2009-01-20 This book constitutes the thoroughly refereed extended postproceedings of the 9th International Workshop on Membrane Computing WMC 2008 held in Edinburgh UK in July 2008 under the auspices of the European Molecular Computing Consortium EMCC and the Molecular Computing Task Force of IEEE Computational Intelligence Society The 22 revised full papers presented together with 5 invited papers went through two rounds of reviewing and improvement The papers in this volume cover all the main directions of research in membrane computing ranging from theoretical topics in mathematics and computer science to application issues A special attention was paid to the interaction of membrane computing with biology and computer science focusing both on the biological roots of membrane computing on applications of membrane computing in biology and medicine and on possible electronically based implementations **Conservation of Wildlife Populations** L. Scott Mills, 2012-12-17 Population ecology has matured to a sophisticated science with astonishing potential for contributing solutions to wildlife conservation and management challenges And yet much of the applied power of wildlife population ecology remains untapped because its broad sweep across disparate subfields has been isolated in specialized texts In this

book L Scott Mills covers the full spectrum of applied wildlife population ecology including genomic tools for non invasive genetic sampling predation population projections climate change and invasive species harvest modeling viability analysis focal species concepts and analyses of connectivity in fragmented landscapes With a readable style analytical rigor and hundreds of examples drawn from around the world Conservation of Wildlife Populations 2nd ed provides the conceptual basis for applying population ecology to wildlife conservation decision making Although targeting primarily undergraduates and beginning graduate students with some basic training in basic ecology and statistics in majors that could include wildlife biology conservation biology ecology environmental studies and biology the book will also be useful for practitioners in the field who want to find in one place and with plenty of applied examples the latest advances in the genetic and demographic aspects of population ecology Additional resources for this book can be found at www.wiley.com/go/mills_wildlifepopulations

Software Engineering and Formal Methods Carlos Canal, Akram Idani, 2015-01-31 This book constitutes revised selected papers from the workshops collocated with the SEFM 2014 conference on Software Engineering and Formal Methods held in Grenoble France in September 2014 The 26 papers included in this volume were carefully reviewed and selected from 49 submissions They are from the following workshops the 1st Workshop on Human Oriented Formal Methods From Readability to Automation HOFM 2014 the 3rd International Symposium on Modelling and Knowledge Management Applications Systems and Domains MoKMaSD 2014 the 8th International Workshop on Foundations and Techniques for Open Source Software Certification Open Cert 2014 the 1st Workshop on Safety and Formal Methods SaFoMe 2014 and the 4th Workshop on Formal Methods in the Development of Software WS FMDS 2014

Applying Ecosystem and Landscape Models in Natural Resource Management Robert E. Keane, 2019-08-15 Managing today's lands is becoming an increasingly difficult task Complex ecological interactions across multiple spatiotemporal scales create diverse landscape responses to management actions that are often novel counter intuitive and unexpected To make matters worse exotic invasions human land use and global climate change complicate this complexity and make past observational ecological studies limited in application to the future Natural resource professionals can no longer rely on empirical data to analyze alternative actions in a world that is rapidly changing with few historical analogs New tools are needed to synthesize the high complexity in ecosystem dynamics into useful applications for land management Some of the best new tools available for this task are ecological and landscape simulation models However many land management professionals and scientists have little expertise in simulation modeling and the costs of training these people will probably be exorbitantly high because most ecosystem and landscape models are exceptionally complicated and difficult to understand and use for local applications This book was written to provide natural resource professionals with the rudimentary knowledge needed to properly use ecological models and then to interpret their results It is based on the lessons learned from a career spent modeling ecological systems It is intended as a reference for novice modelers to learn how to correctly employ ecosystem landscape

models in natural resource management applications and to understand subsequent modeling results **Ecological Modeling in Risk Assessment** Robert A. Pastorok, Steven M. Bartell, Scott Ferson, Lev R. Ginzburg, 2016-04-19 Expanding the risk assessment toolbox this book provides a comprehensive and practical evaluation of specific ecological models for potential use in risk assessment Ecological Modeling in Risk Assessment Chemical Effects on Populations Ecosystems and Landscapes goes beyond current risk assessment practices for toxic chemicals as applied to individual organism endpoints to describe ecological effects models useful at the population ecosystem and landscape levels The authors demonstrate the utility of a set of ecological effects models eventually improving the ecological relevance of risk assessments and making data collection more cost effective **Population Cycles** Alan Andrew Berryman, 2002 For over sixty years understanding the causes of multiannual cycles in animal populations has been a central issue in ecology This book brings together ten of the leaders in this field to examine the major hypotheses and recent evidence in the field and to establish that trophic interactions are an important factor in driving at least some of the major regular oscillations in animal populations that have long puzzled ecologists **Modeling and Simulation in Ecotoxicology with Applications in MATLAB and Simulink** Kenneth R. Dixon, 2016-04-19 Exploring roles critical to environmental toxicology Modeling and Simulation in Ecotoxicology with Applications in MATLAB and Simulink covers the steps in modeling and simulation from problem conception to validation and simulation analysis Using the MATLAB and Simulink programming languages the book presents examples of mathematical functions a

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