

Life Sciences Research Report 25

Population Biology of Infectious Diseases

R. M. Anderson and R. M. May
Editors

Dahlem Konferenzen



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Population Biology Of Infectious Diseases

K. Wöhrmann, V. Löschcke



Population Biology Of Infectious Diseases:

Population Biology of Infectious Diseases R.M. Anderson, R.M. May, 2012-12-06 for the design of control programs in extreme cases as discussed below by Fine et al this volume and elsewhere it can happen that immunization programs although they protect vaccinated individuals actually increase the overall incidence of a particular disease The possibility that many nonhuman animal populations may be regulated by parasitic infections is another topic where it may be argued that conventional disciplinary boundaries have retarded investigation While much ecological research has been devoted to exploring the extent to which competition or predator prey interactions may regulate natural populations or set their patterns of geographical distribution few substantial studies have considered the possibility that infectious diseases may serve as regulatory agents 1 8 On the other hand the many careful epidemiological studies of the transmission and maintenance of parasitic infections in human and other animal populations usually assume the host population density to be set by other considerations and not dynamically engaged with the disease see for example 1 2 With all these considerations in mind the Dahlem Workshop from which this book derives aimed to weave strands together testing theoretical analysis against empirical facts and patterns and identifying outstanding problems in pursuit of a better understanding of the overall population biology of parasitic infections For the purpose of the workshop the term parasite was defined widely to include viruses bacteria protozoans fungi and helminths

Population Biology of Infectious Diseases Roy M. Anderson, Robert McCredie May, 1982 *Population Biology of Infectious Diseases ; Report* R. M. May, 1982 *Population Biology of Vector-Borne Diseases* John M. Drake, Michael Bonsall, Michael Strand, 2020-12-30 Population Biology of Vector Borne Diseases is the first comprehensive survey of this rapidly developing field The chapter topics provide an up to date presentation of classical concepts reviews of emerging trends synthesis of existing knowledge and a prospective agenda for future research The contributions offer authoritative and international perspectives from leading thinkers in the field The dynamics of vector borne diseases are far more intrinsically ecological compared with their directly transmitted equivalents The environmental dependence of ectotherm vectors means that vector borne pathogens are acutely sensitive to changing environmental conditions Although perennially important vector borne diseases such as malaria and dengue have deeply informed our understanding of vector borne diseases recent emerging viruses such as West Nile virus Chikungunya virus and Zika virus have generated new scientific questions and practical problems The study of vector borne disease has been a particularly rich source of ecological questions while ecological theory has provided the conceptual tools for thinking about their evolution transmission and spatial extent Population Biology of Vector Borne Diseases is an advanced textbook suitable for graduate level students taking courses in vector biology population ecology evolutionary ecology disease ecology medical entomology viral ecology evolution and parasitology as well as providing a key reference for researchers across these fields

Population Biology and Evolution K. Wöhrmann, V. Löschcke, 2012-12-06 This volume contains the papers presented at a

symposium on population biology sponsored by the Deutsche Forschungsgemeinschaft. It was held at the guest house of the University of Tübingen at Oberjoch on May 15-19, 1983. Prior to this conference a small group of European biologists had met in Berlin (June 1981) and Pavia (September 1982) to discuss research problems on the borderline between population genetics and evolutionary ecology. From the contributions and discussions at these meetings it became evident that the unification of approaches to evolutionary problems in population genetics and evolutionary ecology has not yet been successful and requires further efforts. It was the consensus that a larger symposium with international participation would be helpful to confront and discuss the different approaches to population biology in order to assess where we are now and where we should be going. As a result an organizational committee was formed: F. Christiansen, S. Jayakar, V. Loeschcke, W. Scharloo, and K. Wöhrmann to identify topics that seemed at least to them to be fruitful in tackling problems in population biology. Consequently a number of colleagues were asked to participate in the meeting. We have divided this book into chapters corresponding to the eight topics chosen. The volume begins with the relation between genotype and phenotype and is followed by a chapter on quantitative genetics and selection in natural populations. **Population Biology** K.

Wöhrmann, S.K. Jain, 2012-12-06 Fascinated by the diversity of living organisms humans have always been curious about its origin. Darwin was the first to provide the scholarly and persuasive thesis for gradual evolution and speciation under natural selection. Although we now have much information on evolution we still don't understand it in detail. Many questions still remain open due to the complexity and multiplicity of interacting factors. Several approaches mainly arising from population ecology and genetics are presented in this book in order to help understand genetic variation and evolution. **Diseases**

and Plant Population Biology J. J. Burdon, 1987-05-07 Mathematics in Population Biology Horst R. Thieme, 2018-06-05 The formulation, analysis and re-evaluation of mathematical models in population biology has become a valuable source of insight to mathematicians and biologists alike. This book presents an overview and selected sample of these results and ideas organized by biological theme rather than mathematical concept with an emphasis on helping the reader develop appropriate modeling skills through use of well-chosen and varied examples. Part I starts with unstructured single-species population models, particularly in the framework of continuous-time models, then adding the most rudimentary stage structure with variable stage duration. The theme of stage structure in an age-dependent context is developed in Part II covering demographic concepts such as life expectation and variance of life length and their dynamic consequences. In Part III the author considers the dynamic interplay of host and parasite populations, i.e. the epidemics and endemics of infectious diseases. The theme of stage structure continues here in the analysis of different stages of infection and of age structure that is instrumental in optimizing vaccination strategies. Each section concludes with exercises, some with solutions and suggestions for further study. The level of mathematics is relatively modest; a toolbox provides a summary of required results in differential equations, integration and integral equations. In addition a selection of Maple worksheets is provided. The book

provides an authoritative tour through a dazzling ensemble of topics and is both an ideal introduction to the subject and reference for researchers

Population Biology of Vector-Borne Diseases John M. Drake, Michael Bonsall, Michael R. Strand, Michael Strand, 2021 *Population Biology of Vector Borne Diseases* is the first comprehensive survey of this rapidly developing field The chapter topics provide an up to date presentation of classical concepts reviews of emerging trends synthesis of existing knowledge and a prospective agenda for future research The contributions offer authoritative and international perspectives from leading thinkers in the field The dynamics of vector borne diseases are far more intrinsically ecological compared with their directly transmitted equivalents The environmental dependence of ectotherm vectors means that vector borne pathogens are acutely sensitive to changing environmental conditions Although perennially important vector borne diseases such as malaria and dengue have deeply informed our understanding of vector borne diseases recent emerging viruses such as West Nile virus Chikungunya virus and Zika virus have generated new scientific questions and practical problems The study of vector borne disease has been a particularly rich source of ecological questions while ecological theory has provided the conceptual tools for thinking about their evolution transmission and spatial extent *Population Biology of Vector Borne Diseases* is an advanced textbook suitable for graduate level students taking courses in vector biology population ecology evolutionary ecology disease ecology medical entomology viral ecology evolution and parasitology as well as providing a key reference for researchers across these fields

Population Biology H.I. Freedman, C. Strobeck, 2013-03-13 This volume contains the Proceedings of the International Conference in Population Biology held at The University of Alberta Edmonton Canada from June 22 to June 30 1982 The Conference was sponsored by The University of Alberta and The Canadian Applied Mathematics Society and overlapped with the summer meeting of CAMS The main objectives of this Conference were to bring mathematicians and biologists together so that they may interact for their mutual benefit to bring those researchers interested in modelling in ecology and those interested in modelling in genetics together to bring in keynote speakers in the delineated areas to have sessions of contributed papers and to present the opportunity for researchers to conduct workshops With the exception of the last one the objectives were carried out In order to lend some focus to the Conference the following themes were adopted models of species growth predator prey competition mutualism food webs dispersion age structure stability evolution of ecological parameters evolution of behaviour life history strategies group and social selection and evolution of genetic systems There were speakers invited and or contributed papers in each of these areas Talks were given on Tuesday June 22 to Friday June 25 and on Monday June 28 to Wednesday June 30 On each day there were several talks by the principal speakers as well as contributed sessions Altogether there were ninety one papers given of which twelve were by the principal speakers There were one hundred and twenty three registered participants from twelve different countries

Mathematical Models in Population Biology and Epidemiology Fred Brauer, Carlos Castillo-Chavez, 2011-11-09 The goal of this book is to search for a balance between simple and analyzable

models and unsolvable models which are capable of addressing important questions on population biology Part I focusses on single species simple models including those which have been used to predict the growth of human and animal population in the past Single population models are in some sense the building blocks of more realistic models the subject of Part II Their role is fundamental to the study of ecological and demographic processes including the role of population structure and spatial heterogeneity the subject of Part III This book which will include both examples and exercises is of use to practitioners graduate students and scientists working in the field

Introduction to Population Ecology Larry L. Rockwood, 2015-04-07 Introduction to Population Ecology 2nd Edition is a comprehensive textbook covering all aspects of population ecology It uses a wide variety of field and laboratory examples botanical to zoological from the tropics to the tundra to illustrate the fundamental laws of population ecology Controversies in population ecology are brought fully up to date in this edition with many brand new and revised examples and data Each chapter provides an overview of how population theory has developed followed by descriptions of laboratory and field studies that have been inspired by the theory Topics explored include single species population growth and self limitation life histories metapopulations and a wide range of interspecific interactions including competition mutualism parasite host predator prey and plant herbivore An additional final chapter new for the second edition considers multi trophic and other complex interactions among species Throughout the book the mathematics involved is explained with a step by step approach and graphs and other visual aids are used to present a clear illustration of how the models work Such features make this an accessible introduction to population ecology essential reading for undergraduate and graduate students taking courses in population ecology applied ecology conservation ecology and conservation biology including those with little mathematical experience

Applied Population Biology S.K. Jain, L.W. Botsford, 2007-07-23 An increasing variety of biological problems involving resource management conservation and environmental quality have been dealt with using the principles of population biology defined to include population dynamics genetics and certain aspects of community ecology There appears to be a mixed record of successes and failures and almost no critical synthesis or reviews that have attempted to discuss the reasons and ways in which population biology with its remarkable theoretical as well as experimental advances could find more useful application in agriculture forestry fishery medicine and resource and environmental management This book provides examples of state of the art applications by a distinguished group of researchers in several fields The diversity of topics richly illustrates the scientific and economic breadth of their discussions as well as epistemological and comparative analyses by the authors and editors Several principles and common themes are emphasized and both strengths and potential sources of uncertainty in applications are discussed This volume will hopefully stimulate new interdisciplinary avenues of problem solving research

The Population Dynamics of Infectious Diseases: Theory and Applications Roy M. Anderson, 2013-11-22 Since the beginning of this century there has been a growing interest in the study of the epidemiology and population dynamics of

infectious disease agents Mathematical and statistical methods have played an important role in the development of this field and a large and sophisticated literature exists which is concerned with the theory of epidemiological processes in populations and the dynamics of epidemic and endemic disease phenomena Much of this literature is however rather formal and abstract in character and the field has tended to become rather detached from its empirical base Relatively little of the literature for example deals with the practical issues which are of major concern to public health workers Encouragingly in recent years there are signs of an increased awareness amongst theoreticians of the need to confront predictions with observed epidemiological trends and to pay close attention to the biological details of the interaction between host and disease agent This trend has in part been stimulated by the early work of Ross and Macdonald on the transmission dynamics of tropical parasitic infections but a further impetus has been the recent advances made by ecologists in blending theory and observation in the study of plant and animal populations

Biological Invasions: Theory and Practice Nanako

Shigesada, Kohkichi Kawasaki, 1997-02-06 This book deals with the ecological effect a species can have when it moves into an environment that it has not previously occupied commonly referred to as an Invasion It is unique in presenting a clear and accessible introduction to a highly complex area the modelling of biological invasions The book presents the latest theories and models developed from studies into this crucial area It includes data and examples from biological case studies showing how the models can be applied to the study of invasions whether dealing with AIDS the European rabbit or prickly pear cactuses In nature all organisms migrate or disperse to some extent either by walking swimming flying or being transported by wind or water When a species succeeds in colonising an area that it has not previously inhabited this is referred to as an invasion Humans can precipitate biological invasions often spreading disease or pests by their travels around the world Using the large amount of data that has been collected from studies worldwide ranging from pest control to epidemiology it has been possible to construct mathematical models that can predict which species will become an invader what kind of habitat is susceptible to invasion by a particular species and how fast an invasion will spread if it occurs This book presents a clear and accessible introduction to this highly complex area Included are data and examples from biological case studies showing how these models can be applied to the study of invasions whether dealing with AIDS the European rabbit or prickly pear cactuses

Hyperbolic Partial Differential Equations Matthew Witten, 2014-05-17

Hyperbolic Partial Differential Equations Volume 1 Population Reactors Tides and Waves Theory and Applications covers three general areas of hyperbolic partial differential equation applications These areas include problems related to the McKendrick Von Foerster population equations other hyperbolic form equations and the numerical solution This text is composed of 15 chapters and begins with surveys of age specific population interactions populations models of diffusion nonlinear age dependent population growth with harvesting local and global stability for the nonlinear renewal equation in the Von Foerster model and nonlinear age dependent population dynamics The next chapters deal with various applications of hyperbolic partial differential equations

to such areas as age structured fish populations density dependent growth in a cell colony boll weevil cotton crop modeling age dependent predation and cannibalism parasite populations growth of microorganisms and stochastic perturbations in the Von Foerster model These topics are followed by discussions of bifurcation of time periodic solutions of the McKendrick equation the periodic solution of nonlinear hyperbolic problems and semigroup theory as applied to nonlinear age dependent population dynamics Other chapters explore the stability of biochemical reaction tanks an ADI model for the Laplace tidal equations the Carleman equation the nonequilibrium behavior of solids that transport heat by second sound and the nonlinear hyperbolic partial differential equations and dynamic programming The final chapters highlight two explicitly numerical applications a predictor convex corrector method and the Galerkin approximation in hyperbolic partial differential equations This book will prove useful to practicing engineers population researchers physicists and mathematicians

Mathematical Epidemiology Fred Brauer, Pauline van den Driessche, J. Wu, 2008-04-30 Based on lecture notes of two summer schools with a mixed audience from mathematical sciences epidemiology and public health this volume offers a comprehensive introduction to basic ideas and techniques in modeling infectious diseases for the comparison of strategies to plan for an anticipated epidemic or pandemic and to deal with a disease outbreak in real time It covers detailed case studies for diseases including pandemic influenza West Nile virus and childhood diseases Models for other diseases including Severe Acute Respiratory Syndrome fox rabies and sexually transmitted infections are included as applications Its chapters are coherent and complementary independent units In order to accustom students to look at the current literature and to experience different perspectives no attempt has been made to achieve united writing style or unified notation Notes on some mathematical background calculus matrix algebra differential equations and probability have been prepared and may be downloaded at the web site of the Centre for Disease Modeling www.cdm.yorku.ca

Symposium--the Role of Diseases in Marine Fisheries Management, 1986 **A Celebration of Statistics** Anthony C. Atkinson, Stephen E. Fienberg, 2012-12-06 The International Statistical Institute was founded in 1885 and is therefore one of the world's oldest international scientific societies The field of statistics is still expanding rapidly and possesses a rich variety of applications in many areas of human activity such as science government business industry and everyday affairs In consequence the celebration of the Institute's centenary in 1985 is of considerable interest not only to statisticians but also more widely to the international scientific community As part of its centennial celebration planning the Institute decided to publish a volume of papers representing the immensely wide range of interests encompassed by statistics in its international context viewed both from a historical and from a contemporary standpoint We were fortunate in securing the services of Anthony Atkinson and Stephen Fienberg as Editors of this volume they have worked hard over a period of several years to put together a most fascinating collection of papers On behalf of the Institute it is my pleasant duty to thank them and the authors for their contributions J DURBIN President International Statistical Institute Preface The papers in this volume were prepared to help

celebrate the centenary of the International Statistical Institute During the ISI s first 100 years statistics has matured both as a scientific discipline and as a profession in ways that the ISI s founders could not possibly have imagined

Veterinary Epidemiology Michael Thrusfield, 2018-02-15 A comprehensive introduction to the role of epidemiology in veterinary medicine This fully revised and expanded edition of Veterinary Epidemiology introduces readers to the field of veterinary epidemiology The new edition also adds new chapters on the design of observational studies validity in epidemiological studies systematic reviews and statistical modelling to deliver more advanced material This updated edition begins by offering an historical perspective on the development of veterinary medicine It then addresses the full scope of epidemiology with chapters covering causality disease occurrence determinants disease patterns disease ecology and much more

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