Mathematical Models In Population Biology And Epidemiology

Population BiologyCompetition Models in Population BiologyCase Studies in Population BiologyDynamical Systems in Population BiologyPopulation BiologyMathematics in Population BiologyIntegrated Population Biology and Modeling, Part AMathematical Models in Population Biology and EpidemiologyPopulation Biology and EvolutionPopulation BiologyNetwork Models in Population BiologyIntroduction to Population BiologyPopulation Ecology of IndividualsTopics in population biologyApplied Population BiologyIntroduction to Plant Population BiologyApplied Population BiologyPopulation Biology of the Florida ManateePrimer Of Population BiologyPopulation Biology Alan Hastings Paul Waltman Laurence Martin Cook Xiao-Qiang Zhao Simon A. Levin Horst R. Thieme Fred Brauer K. Wöhrmann Thomas C. Emmel E. R. Lewis Dick Neal Adam Lomnicki O. T. Solbrig S.K. Jain Jonathan Silvertown S.K. Jain Thomas J. O'Shea Edward O. Wilson H I Freedman

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population biology has been investigated quantitatively for many decades resulting in a rich body of scientific literature ecologists often avoid this literature put off by its apparently formidable mathematics this textbook provides an introduction to the biology and ecology of populations by emphasizing the roles of simple mathematical models in explaining the growth and behavior of populations the author only assumes acquaintance with elementary calculus and provides tutorial explanations where needed to develop mathematical concepts examples problems extensive marginal notes and numerous graphs enhance the book s value to students in classes ranging from population biology and population ecology to mathematical biology and mathematical ecology the book will also be useful as a supplement to introductory courses in ecology

this book uses fundamental ideas in dynamical systems to answer questions of a biologic nature in particular questions about the behavior of populations given a relatively few hypotheses about the nature of their growth and interaction the principal subject treated is that of coexistence under certain parameter ranges while asymptotic methods are used to show competitive exclusion in other parameter ranges finally some problems in genetics are posed and analyzed as problems in nonlinear ordinary differential equations

population dynamics is an important subject in mathematical biology a cen tral problem is to study the long term behavior of modeling systems most of these systems are

governed by various evolutionary equations such as difference ordinary functional and partial differential equations see e g 165 142 218 119 55 as we know interactive populations often live in a fluctuating environment for example physical environmental conditions such as temperature and humidity and the availability of food water and other resources usually vary in time with seasonal or daily variations therefore more realistic models should be nonautonomous systems in particular if the data in a model are periodic functions of time with commensurate period a periodic system arises if these periodic functions have different minimal periods we get an almost periodic system the existing reference books from the dynamical systems point of view mainly focus on autonomous biological systems the book of hess 106j is an excellent reference for periodic parabolic boundary value problems with applications to population dynamics since the publication of this book there have been extensive investigations on periodic asymptotically periodic almost periodic and even general nonautonomous biological systems which in turn have motivated further development of the theory of dynamical systems in order to explain the dynamical systems approach to periodic population problems let us consider as an illustration two species periodic competitive systems dui dt i t ul u2 0

the lecture notes contained in this volume were presented at the ams short course on population biology held august 6 7 1983 in albany new york in conjunction with the summer meeting of the american mathematical society these notes will acquaint the reader with the mathematical ideas that pervade almost every level of thinking in population biology and provide an introduction to the many applications of mathematics in the field research mathematicians college teachers of mathematics and graduate students all should find this book of interest population biology is probably the oldest area in mathematical biology but remains a constant source of new mathematical problems and the area of biology best integrated with mathematical theory the need for mathematical approaches has never been greater as evolutionary theory is challenged by new interpretations of the paleontological record and new discoveries at the molecular level as world resources for feeding populations become limiting as the problems of pollution increase and as both animal and plant epidemiological problems receive closer scrutiny a background of advanced calculus introduction to ordinary and partial differential equations and linear algebra will make the book accessible all of the papers included have high research value a list of the contents follows

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

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

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

this volume contains the papers presented at a symposium on popula tion biology sponsored by the deutsche forschungsgemeinschaft it was held at the guest house of the university of ttibingen 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 re search 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 suc cessful and requires further efforts it was the consensus that a larger symposium with international participation would be helpful to con front 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 w6hrmann to iden tify 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

introduction to population biology the genetic structure of populations evolution at the population level population size growth and dynamics regulatory systems in populations dispersion dispersal and populations population structure age and sex life history patterns and selection in populations mating systens and behavior in populations seasonality and populations interactions of unrelated populations in communities

this book is an outgrowth of one phase of an upper division course on quantitative ecology given each year for the past eight at berkeley i am most grateful to the students in that course and to many graduate students in the berkeley department of zoology and colleges of engineering and natural resources whose spirited discussions inspired much of the book s content i also am deeply grateful to those faculty colleagues with whom at one time or another i have shared courses or seminars in

provides a quantitative and darwinian perspective on population biology with problem sets simulations and worked examples to aid the student

a common tendency in the field of population ecology has been to overlook individual differences by treating populations as homogeneous units conversely in behavioral ecology the tendency has been to concentrate on how individual behavior is shaped by evolutionary forces but not on how this behavior affects population dynamics adam lomnicki and others aim to remedy this one sidedness by showing that the overall dynamical behavior of populations must ultimately be understood in terms of the behavior of individuals professor lomnicki s wide ranging presentation of this approach includes simple mathematical models aimed at describing both the origin and consequences of individual variation among plants and animals the author contends that further progress in population ecology will require taking into account individual differences other than sex age and taxonomic affiliation unequal access to resources for instance population ecologists who adopt this viewpoint may discover new answers to classical questions of population ecology partly because it uses a variety of examples from many taxonomic groups this work will appeal not only to population ecologists but to ecologists in general

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

this completely revised fourth edition of introduction to plant population biology continues the approach taken by its highly successful predecessors ecological and genetic principles are introduced and theory is made accessible by clear accurate exposition with plentiful examples models and theoretical arguments are developed gradually requiring a minimum of mathematics the book emphasizes the particular characteristics of plants that affect their population biology and evolutionary questions that are particularly relevant for plants wherever appropriate it is shown how ecology and genetics interact presenting a rounded picture of the population biology of plants topics covered include variation and its inheritance genetic markers including molecular markers plant breeding systems ecological genetics intraspecific interactions

population dynamics regional dynamics and metapopulations competition and coexistence and the evolution of breeding systems and life history an extensive bibliography provides access to the recent literature that will be invaluable to students and academics alike effective integration of plant population ecology population genetics and evolutionary biology the new edition is thoroughly revised and now includes molecular techniques the genetics chapters have been completely rewritten by a new co author deborah charlesworth

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this is a collection of papers presented at a 1992 technical workshop on manatee population biology sponsored by the u s fish and wildlife service and the florida department of natural resources topics covered include manatee research programs techniques for studying manatee population biology and reports of completed studies the book concludes with recommendations from the workshop and a brief synopsis of pertinent work that has been published since the workshop

how to learn population biology population genetics ecology biogeography species equilibrium theory

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