

Brian Charlesworth

Cambridge Studies in Mathematical Biology

Evolution in age-structured populations

**Second
edition**



Evolution In Age Structured Populations

LL Leslie

A decorative red circular graphic with a gradient, appearing as a partial circle or a stylized arrow pointing to the right, located to the right of the LL Leslie text.

Evolution In Age Structured Populations:

Evolution in Age-Structured Populations Brian Charlesworth, 1994-06-30 The populations of many species of animals and plants are age structured i.e. the individuals present at any one time were born over a range of different times and their fertility and survival depend on age. The properties of such populations are important for interpreting experiments and observations on the genetics of populations for animal and plant breeding and for understanding the evolution of features of life histories such as senescence and time of reproduction. In this new edition Brian Charlesworth provides a comprehensive review of the basic mathematical theory of the demography and genetics of age structured populations. The mathematical level of the book is such that it will be accessible to anyone with a knowledge of basic calculus and linear algebra.

Evolution of Age-Structured Populations Brian Charlesworth, 1980-09-25 **Age-Structured Population Dynamics in Demography and Epidemiology** Hisashi Inaba, 2017-03-15 This book is the first one in which basic demographic models are rigorously formulated by using modern age structured population dynamics extended to study real world population problems. Age structure is a crucial factor in understanding population phenomena and the essential ideas in demography and epidemiology cannot be understood without mathematical formulation; therefore this book gives readers a robust mathematical introduction to human population studies. In the first part of the volume classical demographic models such as the stable population model and its linear extensions, density dependent nonlinear models and pair formation models are formulated by the McKendrick partial differential equation and are analyzed from a dynamical system point of view. In the second part mathematical models for infectious diseases spreading at the population level are examined by using nonlinear differential equations and a renewal equation. Since an epidemic can be seen as a nonlinear renewal process of an infected population, this book will provide a natural unification point of view for demography and epidemiology. The well known epidemic threshold principle is formulated by the basic reproduction number, which is also a most important key index in demography. The author develops a universal theory of the basic reproduction number in heterogeneous environments. By introducing the host age structure epidemic models are developed into more realistic demographic formulations which are essentially needed to attack urgent epidemiological control problems in the real world. *The Basic Approach to Age-Structured Population Dynamics* Mimmo Iannelli, Fabio Milner, 2017-08-27 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

The Dynamics of Physiologically Structured Populations Johan A. Metz,Odo Diekmann,2014-03-11

Demographic Methods across the Tree of Life Roberto Salguero-Gomez,Marlène Gamelon,2021-08-31 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

An Introduction to Structured Population Dynamics J. M. Cushing,1998-01-01 This monograph introduces the theory of structured population dynamics and its applications focusing on the asymptotic dynamics of deterministic models

Structured-Population Models in Marine, Terrestrial, and Freshwater Systems Shripad Tuljapurkar,Hal Caswell,2012-12-06 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 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 not increase stability but it surely makes things interesting

Optimal Control of Age-structured Populations in Economy, Demography, and the Environment Raouf Boucekkine, Natali Hritonenko, Yuri Yatsenko, 2013-05-13

This book covers a wide range of topics within mathematical modelling and the optimization of economic demographic technological and environmental phenomena Each chapter is written by experts in their field and represents new advances in modelling theory and practice These essays are exemplary of the fruitful interaction between theory and practice when exploring global and local changes The unifying theme of the book is the use of mathematical models and optimization methods to describe age structured populations in economy demography technological change and the environment Emphasis is placed on deterministic dynamic models that take age or size structures delay effects and non standard decision variables into account In addition the contributions deal with the age structure of assets resources and populations under study Interdisciplinary modelling has enormous potential for discovering new insights in global and regional development Optimal Control of Age structured Populations in Economy Demography and the Environment is a rich and excellent source of information on state of the art modelling expertise and references The book provides the necessary mathematical background for readers from different areas such as applied sciences management sciences and operations research which helps guide the development of practical models As well as this the book also surveys the current practice in applied modelling and looks at new research areas for a general mathematical audience This book will be of interest primarily to researchers postgraduate students as well as a wider scientific community including those focussing on the subjects of applied mathematics environmental sciences economics demography management and operations research

Population Dynamics and the Tribolium Model: Genetics and Demography Robert F. Costantino, Robert A. Desharnais, 2012-12-06

The study of populations is becoming increasingly focused on dynamics We believe there are two reasons for this trend The first is the impact of nonlinear dynamics with its exciting ideas and colorful language bifurcations domains of attraction chaos fractals strange attractors Complexity which is so very much a part of biology now seems to be also a part of mathematics A second trend is the accessibility of the new concepts The barriers to communication between theorist and experimentalist seem less impenetrable The active participation of the experimentalist means that the theory will obtain substance Our role is the application of the theory of dynamics to the analysis of biological populations We began our work early in 1979 by writing an ordinary differential equation for the rate of change in adult numbers which was based on an

equilibrium model proposed a decade earlier. During the next few months we filled our notebooks with straightforward deductions from the model and its associated biological implications. Slowly some of the biological observations were explained and papers followed on a variety of topics: genetic and demographic stability, stationary probability distributions for population size, population growth as a birth-death process, natural selection and density-dependent population growth, genetic disequilibrium, and the stationary stochastic dynamics of adult numbers.

Forward-Time Population Genetics Simulations Bo Peng, Marek Kimmel, Christopher I. Amos, 2012-01-25. The only book available in the area of forward time population genetics simulations applicable to both biomedical and evolutionary studies. The rapid increase of the power of personal computers has led to the use of serious forward time simulation programs in genetic studies. *Forward Time Population Genetics Simulations* presents both new and commonly used methods and introduces simuPOP, a powerful and flexible new program that can be used to simulate arbitrary evolutionary processes with unique features like customized chromosome types, arbitrary nonrandom mating schemes, virtual subpopulations, information fields, and Python operators. The book begins with an overview of important concepts and models, then goes on to show how simuPOP can simulate a number of standard population genetics models with the goal of demonstrating the impact of genetic factors such as mutation, selection, and recombination on standard Wright-Fisher models. The rest of the book is devoted to applications of forward time simulations in various research topics. *Forward Time Population Genetics Simulations* includes: An overview of currently available forward time simulation methods, their advantages and shortcomings; An overview and evaluation of currently available software; A simuPOP tutorial; Applications in population genetics; Applications in genetic epidemiology, statistical genetics, and mapping complex human diseases. The only book of its kind in the field today. *Forward Time Population Genetics Simulations* will appeal to researchers and students of population and statistical genetics.

Analysis and Management of Animal Populations Byron K. Williams, James D. Nichols, Michael James Conroy, Michael J. Conroy, 2002-04-17. *Analysis and Management of Animal Populations* deals with the processes involved in making informed decisions about the management of animal populations. It covers the modeling of population responses to management actions, the estimation of quantities needed in the modeling effort, and the application of these estimates and models to the development of sound management decisions. The book synthesizes and integrates in a single volume the methods associated with these themes as they apply to ecological assessment and conservation of animal populations. Integrates population modeling, parameter estimation, and decision theoretic approaches to management in a single cohesive framework. Provides authoritative state-of-the-art descriptions of quantitative approaches to modeling, estimation, and decision making. Emphasizes the role of mathematical modeling in the conduct of science and management. Utilizes a unifying biological context, consistent mathematical notation, and numerous biological examples.

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 Issues in Genetic Medicine: 2011 Edition ,2012-01-09 Issues in Genetic Medicine 2011 Edition is a ScholarlyEditions eBook that delivers timely authoritative and comprehensive information about Genetic Medicine The editors have built Issues in Genetic Medicine 2011 Edition on the vast information databases of ScholarlyNews You can expect the information about Genetic Medicine in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Genetic Medicine 2011 Edition has been produced by the world's leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com>

Population Genetics and Microevolutionary Theory Alan R. Templeton,2006-09-29 The advances made possible by the development of molecular techniques have in recent years revolutionized quantitative genetics and its relevance for population genetics Population Genetics and Microevolutionary Theory takes a modern approach to population genetics incorporating modern molecular biology species level evolutionary biology and a thorough acknowledgment of quantitative genetics as the theoretical basis for population genetics Logically organized into three main sections on population structure and history genotype phenotype interactions and selection adaptation Extensive use of real examples to illustrate concepts Written in a clear and accessible manner and devoid of complex mathematical equations Includes the author's introduction to background material as well as a conclusion for a handy overview of the field and its modern applications Each chapter ends with a set of review questions and answers Offers helpful general references and Internet links

Structured Population Models in Biology and Epidemiology Pierre Magal,Shigui Ruan,2008-04-12 In this new century mankind faces ever more challenging environmental and public health problems such as pollution invasion by exotic species the emergence of new diseases or the emergence of diseases into new regions West Nile virus SARS Anthrax etc and the resurgence of existing diseases in uenza malaria TB HIV AIDS etc Mathematical models have been successfully used to study many biological epidemiological and medical problems and nonlinear and complex dynamics have been observed in all of those contexts Mathematical studies have helped us not only to better understand these problems but also to find solutions in some cases such as the prediction and control of SARS outbreaks understanding HIV infection and the investigation of antibiotic resistant infections in hospitals Structured population models distinguish individuals from one another according to characteristics such as age size location status and movement to determine the birth growth and death rates interaction with each other and with environment infectivity

etc The goal of structured population models is to understand how these characteristics affect the dynamics of these models and thus the outcomes and consequences of the biological and epidemiological processes There is a very large and growing body of literature on these topics This book deals with the recent and important advances in the study of structured population models in biology and epidemiology There are six chapters in this book written by leading researchers in these areas

Demography - Volume II Zeng Yi, 2010-11-30 Zeng Yi is a Professor at the Center for the Study of Aging and Human Development and Geriatric Division Dept of Medicine of Medical School and Institute of Population Research and Dept of Sociology Duke University He is also a Professor at the China Center for Economic Research National School of Development at Peking University in China and Distinguished Research Scholar of the Max Planck Institute for Demographic Research MPIER in Germany He received his doctoral degree from Brussels Free University in May 1986 and conducted post doctoral study at Princeton University in 1986-87 Up to Feb 2008 he has had 81 professional articles written in English published in academic journals or as book chapters in the United States and Europe among them 51 articles were published in anonymous peer reviewed academic journals He has had 85 professional articles written in Chinese and published in China among them 55 articles were published in national top Chinese academic journals He has published sixteen books including five research books as first author such as Family Dynamics in China published by the University of Wisconsin Press one textbook on demographic methods as the sole author two volumes of demographic software and user's manuals as the first author on family status life table analysis six edited books four as the chief editor and two as the second editor such as the 2005 and 2008 books published by Springer for which he served as the chief editor Six of Zeng Yi's published books were written in English one was written in both Chinese and English and the remainders were written in Chinese Zeng Yi has been awarded more than ten national and international academic prizes such as the Dorothy Thomas Prize of the Population Association of America the Harold D Lasswell Prize in Policy Science awarded by the international journal Policy Sciences and Kluwer Academic Publishers the second class prize for advancement of science and technology awarded by the State Sciences and Technology Commission of China the first class prize for advancement of science and technology awarded by the State Education Commission and the highest academic honor of Peking University Prize for Outstanding Contributions in Sciences According to the search report up to March 1 2008 the internationally most important literature sources SSCI Social Science Citation Index and SCI Science Citation Index published in the U S indicate that Zeng Yi's articles and books have been cited in 755 journal articles by authors other than Zeng Yi Among them 440 citations refer to the work of Zeng Yi as the first author 315 citations refer to the work of Zeng Yi as a co author Zeng Yi is one of the authors of High Impact Papers worldwide in the period of 1981-1998 as announced by International Scientific Institute ISI in September 2000

Encyclopedia of Evolutionary Biology, 2016-04-14 Encyclopedia of Evolutionary Biology Four Volume Set is the definitive go to reference in the field of evolutionary biology It provides a fully comprehensive review of the field in an easy to

search structure Under the collective leadership of fifteen distinguished section editors it is comprised of articles written by leading experts in the field providing a full review of the current status of each topic The articles are up to date and fully illustrated with in text references that allow readers to easily access primary literature While all entries are authoritative and valuable to those with advanced understanding of evolutionary biology they are also intended to be accessible to both advanced undergraduate and graduate students Broad topics include the history of evolutionary biology population genetics quantitative genetics speciation life history evolution evolution of sex and mating systems evolutionary biogeography evolutionary developmental biology molecular and genome evolution coevolution phylogenetic methods microbial evolution diversification of plants and fungi diversification of animals and applied evolution Presents fully comprehensive content allowing easy access to fundamental information and links to primary research Contains concise articles by leading experts in the field that ensures current coverage of each topic Provides ancillary learning tools like tables illustrations and multimedia features to assist with the comprehension process

Population Dynamics and Laboratory Ecology

Robert Desharnais, 2005-08-04 Population Dynamics and Laboratory Ecology highlights the contributions laboratory studies are making to our understanding of the dynamics of ecological and evolutionary systems Chapters address the scientific rationale for laboratory ecology its historical role within the broader discipline and recent advances in research The book presents results from a wide range of laboratory systems including insects mites plankton protists and microbes A common theme throughout the book is the value of microcosm studies in advancing our knowledge of ecological and evolutionary principles Each chapter is authored by scientists who are leading experts in their fields The book addresses fundamental questions that are of interest to biologists whether they work in the laboratory or field or whether they are primarily empiricists or theorists Details a scientific rationale for laboratory systems in ecological and evolutionary studies Offers a view on historical role of laboratory studies Includes examples of recent research advances in ecology and evolution using laboratory systems ranging from insects to microbes Integrates mathematics statistics and experimental studies

Sex, Reproduction and Darwinism

Filomena de Sousa, Gonzalo Munévar, 2015-10-06 This collection of essays looks at sexuality and reproduction from an evolutionary perspective Covering experimental discoveries as well as theoretical investigations the volume explores the relationship between evolution and other areas of human behaviour

Evolution In Age Structured Populations Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has be much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Evolution In Age Structured Populations**," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound affect our existence. Throughout this critique, we will delve in to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

<http://www.pet-memorial-markers.com/results/detail/HomePages/En%20Compania%20De%20Los%20Filosofos.pdf>

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