

1. Record Nr.	UNINA9910821063403321
Autore	Matthiopoulos Jason
Titolo	How to be a quantitative ecologist : the 'A to R' of green mathematics and statistics // Jason Matthiopoulos
Pubbl/distr/stampa	Chichester, West Sussex, U.K., : Wiley, 2011
ISBN	1-283-40535-0 9786613405357 1-119-99172-2 1-119-99158-7 1-119-99159-5
Edizione	[1st ed.]
Descrizione fisica	1 online resource (491 pages)
Disciplina	577.0285/5133
Soggetti	Ecology - Mathematics Ecology - Research Ecology - Vocational guidance Mathematics - Vocational guidance Quantitative analysts Quantitative research
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Bibliographic Level Mode of Issuance: Monograph
Nota di bibliografia	Includes bibliographical references and indexes.
Nota di contenuto	Intro -- How to be a Quantitative Ecologist -- The A to R of green mathematics & statistics -- How I chose to write this book, and why you might choose to read it Preface -- 0. How to start a meaningful relationship with your computer Introduction to R -- 0.1 What is R? -- 0.2 Why use R for this book? -- 0.3 Computing with a scientific package like R -- 0.4 Installing and interacting with R -- 0.5 Style conventions -- 0.6 Valuable R accessories -- 0.7 Getting help -- 0.8 Basic R usage -- 0.9 Importing data from a spreadsheet -- 0.10 Storing data in data frames -- 0.11 Exporting data from R -- 0.12 Quitting R -- Further reading -- References -- 1. How to make mathematical statements Numbers, equations and functions -- 1.1 Qualitative and quantitative scales -- Habitat classifications -- 1.2 Numbers -- Observations of spatial abundance -- 1.3 Symbols --

Population size and carrying capacity -- 1.4 Logical operations -- 1.5 Algebraic operations -- Size matters in male garter snakes -- 1.6 Manipulating numbers -- 1.7 Manipulating units -- 1.8 Manipulating expressions -- Energy acquisition in voles -- 1.9 Polynomials -- The law of mass action in epidemiology -- 1.10 Equations -- 1.11 First order polynomial equations -- Population size and composition -- 1.12 Proportionality and scaling: a special kind of first order polynomial equation -- Simple mark-recapture -- Converting density to population size -- 1.13 Second and higher order polynomial equations -- Estimating the number of infected animals from the rate of infection -- 1.14 Systems of polynomial equations -- Deriving population structure from data on population size -- 1.15 Inequalities -- Minimum energetic requirements in voles -- 1.16 Coordinate systems -- Non-Cartesian map projections -- 1.17 Complex numbers -- 1.18 Relations and functions -- Food webs. Mating systems in animals -- 1.19 The graph of a function -- Two aspects of vole energetics -- 1.20 First order polynomial functions -- Population stability in a time series -- Population stability and population change -- Visualising goodness-of-fit -- 1.21 Higher order polynomial functions -- 1.22 The relationship between equations and functions -- Extent of an epidemic when the transmission rate exceeds a critical value -- 1.23. Other useful functions -- 1.24 Inverse functions -- 1.25 Functions of more than one variable -- Two aspects of vole energetics -- Further reading -- References -- 2. How to describe regular shapes and patterns Geometry and trigonometry -- 2.1 Primitive elements -- 2.2 Axioms of Euclidean geometry -- Suicidal lemmings, parsimony, evidence and proof -- 2.3 Propositions -- Radio-tracking of terrestrial animals -- 2.4 Distance between two points -- Spatial autocorrelation in ecological variables -- 2.5 Areas and volumes -- Hexagonal territories -- 2.6 Measuring angles -- The bearing of a moving animal -- 2.7 The trigonometric circle -- The position of a seed following dispersal -- 2.8 Trigonometric functions -- 2.9 Polar coordinates -- Random walks -- 2.10 Graphs of trigonometric functions -- 2.11 Trigonometric identities -- A two-step random walk -- 2.12 Inverses of trigonometric functions -- Displacement during a random walk -- 2.13 Trigonometric equations -- VHF tracking for terrestrial animals -- 2.14 Modifying the basic trigonometric graphs -- Nocturnal flowering in dry climates -- 2.15 Superimposing trigonometric functions -- More realistic model of nocturnal flowering -- 2.16 Spectral analysis -- Dominant frequencies in density fluctuations of Norwegian lemming populations -- Spectral analysis of oceanographic covariates -- 2.17 Fractal geometry. Availability of coastal habitat -- Fractal dimension of the Koch curve -- Further reading -- References -- 3. How to change things, one step at a time Sequences, difference equations and logarithms -- 3.1 Sequences -- Reproductive output in social wasps -- Unrestricted population growth -- 3.2 Difference equations -- More realistic models of population growth -- 3.3 Higher order difference equations -- Delay-difference equations in a biennial plant -- 3.4 Initial conditions and parameters -- 3.5 Solutions of a difference equation -- 3.6 Equilibrium solutions -- Harvesting an unconstrained population -- Visualising the equilibria -- 3.7 Stable and unstable equilibria -- Parameter sensitivity and ineffective fishing quotas -- Stable and unstable equilibria in a density-dependent population -- 3.8 Investigating stability -- Cobweb plot for an unconstrained, harvested population -- Conditions for stability under unrestricted growth -- 3.9 Chaos -- Chaos in a model with density dependence -- 3.10 Exponential function -- Modelling bacterial loads in continuous time

-- A negative blue tit? Using exponential functions to constrain models
-- 3.11 Logarithmic function -- Log-transforming population time series -- 3.12 Logarithmic equations -- Further reading -- References
-- 4. How to change things, continuously Derivatives and their applications -- 4.1 Average rate of change -- Seasonal tree growth -- Tree growth -- 4.2 Instantaneous rate of change -- 4.3 Limits -- Methane concentration around termite mounds -- 4.4 The derivative of a function -- Plotting change in tree biomass -- Linear tree growth -- 4.5 Differentiating polynomials -- Spatial gradients -- 4.6 Differentiating other functions -- Consumption rates of specialist predators -- 4.7 The chain rule.
Diurnal rate of change in the attendance of insect pollinators -- 4.8 Higher order derivatives -- Spatial gradients -- 4.9 Derivatives of functions of many variables -- The slope of the sea-floor -- 4.10 Optimisation -- Maximum rate of disease transmission -- The marginal value theorem -- 4.11 Local stability for difference equations -- Unconstrained population growth -- Density dependence and proportional harvesting -- 4.12 Series expansions -- Further reading -- References -- 5. How to work with accumulated change Integrals and their applications -- 5.1 Antiderivatives -- Invasion fronts -- Diving in seals -- 5.2 Indefinite integrals -- Allometry -- 5.3 Three analytical methods of integration -- Stopping invasion fronts -- 5.4 Summation -- Metapopulations -- 5.5 Area under a curve -- Swimming speed in seals -- 5.6 Definite integrals -- Swimming speed in seals -- 5.7 Some properties of definite integrals -- Total reproductive output in social wasps -- Net change in number of birds at migratory stop-over -- Total number of arrivals and departures at migratory stop-over -- 5.8 Improper integrals -- Failing to stop invasion fronts -- 5.9 Differential equations -- A differential equation for a plant invasion front -- 5.10 Solving differential equations -- Exponential population growth in continuous time -- Constrained growth in continuous time -- 5.11 Stability analysis for differential equations -- Constrained growth in continuous time -- The Levins model for metapopulations -- Further reading -- References -- 6. How to keep stuff organised in tables Matrices and their applications -- 6.1 Matrices -- Plant community composition -- Inferring diet from fatty acid analysis -- 6.2 Matrix operations -- Movement in metapopulations -- 6.3 Geometric interpretation of vectors and square matrices.
Random walks as sequences of vectors -- 6.4 Solving systems of equations with matrices -- Plant community composition -- 6.5 Markov chains -- Redistribution between population patches -- 6.6 Eigenvalues and eigenvectors -- Growth in patchy populations -- Metapopulation growth -- 6.7 Leslie matrix models -- Stage-structured seal populations -- Equilibrium of linear Leslie model -- Stability in a linear Leslie model -- Stable age structure in a linear Leslie model -- 6.8 Analysis of linear dynamical systems -- A fragmented population in continuous time -- Phase-space for a two-patch metapopulation -- Stability analysis of a two-patch metapopulation -- 6.9 Analysis of nonlinear dynamical systems -- The Lotka-Volterra, predator-prey model -- Stability analysis of the Lotka-Volterra model -- Further reading -- References -- 7 How to visualise and summarise data Descriptive statistics -- 7.1 Overview of statistics -- 7.2 Statistical variables -- Activity budgets in honey bees -- 7.3 Populations and samples -- Production of gannet chicks -- 7.4 Single-variable samples -- 7.5 Frequency distributions -- Activity budgets in honey bees -- Activity budgets from different studies -- Visualising activity budgets -- Height of tree ferns -- Gannets on Bass rock --

7.6 Measures of centrality -- Chick rearing in red grouse --
Swimming speed in grey seals -- Median of chicks reared by red
grouse -- 7.7 Measures of spread -- Gannet foraging -- 7.8 Skewness
and kurtosis -- 7.9 Graphical summaries -- 7.10 Data sets with more
than one variable -- 7.11 Association between qualitative variables --
Community recovery in abandoned fields -- 7.12 Association between
quantitative variables -- Height and root depth of tree ferns -- 7.13
Joint frequency distributions -- Mosaics of abandoned fields.
Joint distribution of tree height and root depth.
