

ADVANCES IN ECOLOGICAL RESEARCH

41



EDITED BY
HAL CASWELL



Contents

Contributors to Volume 41	xi
Preface	xiii

Allometry of Body Size and Abundance in 166 Food Webs

DANIEL C. REUMAN, CHRISTIAN MULDER, CAROLIN
BANAŠEK-RICHTER, MARIE-FRANCE CATTIN BLANDENIER,
ANTON M. BREURE, HENRI DEN HOLLANDER,
JAMIE M. KNEITEL, DAVE RAFFAELLI, GUY WOODWARD
AND JOEL E. COHEN

Summary	2
I. Introduction	3
II. Theory	5
A. The Energetic Equivalence Hypothesis	5
B. The Energetic Equivalence Hypothesis with Trophic Transfer Correction	6
III. Methods	6
A. Testing Theory	6
B. Testing Linearity	7
C. Reasons for Nonlinearity and Alternative Models	9
D. General Methods	11
IV. Data	11
V. Results	14
A. Testing Theory	14
B. Testing Linearity	18
C. Reasons for Nonlinearity and Alternative Models	19
VI. Discussion	22
A. Slopes and Predictions of Theory	23
B. Examples of Ecological Errors from Unsupported Models	24
C. Discussion of Methods	26
D. Recommendations and Future Directions	28
Acknowledgments	29
Appendix I. How and Why Linearity Tests Differ from Those of Cohen and Carpenter	30

A. Testing the Assumption of Linearity of Conditional Expectation	30
B. Testing the Assumption of Homoskedasticity of Residuals	31
C. Testing the Assumption of Normality of Residuals	32
D. Testing the Assumption of Homoskedasticity of Absolute Residuals	32
Appendix II. Testing the Composite Test of Linearity	33
Appendix III. Symmetric Linear Regression	35
Appendix IV. Additional Results of Linearity Testing	36
Appendix V. Abundance and Diversity of Bacteria	37
Appendix VI. Limitations of the Data	38
References	40

Human and Environmental Factors Influence Soil Faunal Abundance–Mass Allometry and Structure

**DANIEL C. REUMAN, JOEL E. COHEN AND
CHRISTIAN MULDER**

Summary	46
I. Introduction	47
II. Soil Faunal Descriptors	49
A. Abundance–Mass Slope	50
B. Faunal Diversity and Total Biomass	52
C. Abundance–Mass Intercept and Expected Log Population Density of Smallest Taxa	52
III. Data	53
A. Data on Taxonomy, Average Body-Mass, and Population Density	53
B. Environmental Data	53
C. Human-Use Data	54
D. Carbon Resource Data	55
IV. Methods	56
A. Classification of Variables	56
B. Stepwise Regression	56
C. Testing Assumptions of Linear Models	56
V. Results	57
A. Models of Soil Faunal Community Structure	57
B. Relative Importance of Variables	57
C. Interpreting Variation in Structure	60
D. Testing for Artifacts	65

CONTENTS

vii

VI. Discussion	68
A. Food Web Descriptors	69
B. Relative Importance of Variables	70
C. Limitations of This Study	70
D. Future Directions	71
Acknowledgments	73
Appendix I. Stepwise Regression	73
Appendix II. Testing Assumptions of Linear Models	75
Appendix III. Detailed Statistical Results	77
A. Abundance–Mass Slope	77
B. Log Faunal Biomass	78
C. Faunal Diversity	78
D. Abundance–Mass Intercept and Expected Log Population Density of Smallest Taxa	79
E. Log Faunal Population Density	81
References	81

**Modeling Individual Animal Histories with Multistate
Capture–Recapture Models**

JEAN-DOMINIQUE LEBRETON, JAMES D. NICHOLS, RICHARD J.
BARKER, ROGER PRADEL AND JEFFREY A. SPENDELOW

Summary	88
I. Introduction	89
II. A Historical Account	93
III. Conditional Multistate Models as a Generalization of Survival Models	100
A. Multistate Models and Data: Meadow Vole Example . .	100
B. The Conditional Arnason–Schwarz (CAS) Model . . .	103
C. The Jolly–Movement (JMV) Model	108
D. Assumptions and Fit Assessment of the Jolly–Movement (JMV) Model	109
IV. Constrained Models and Model Selection	113
A. The Vole Case Study: Some Predictions	113
B. Constrained Conditional Multistate Models	114
C. Constrained Models for the Vole Case Study	116
V. Random Effects	121
A. Fixed and Random Effects in Capture–Recapture Models	121
B. Mixed Models	123
C. Treatment Effect and Time Variation in Survival in Voiles	125

VI.	Recruitment Models as an Example of General Multistate Models	126
A.	The Rapid Development of MSMR	126
B.	The Roseate Tern Case Study	128
C.	General Umbrella Model	130
D.	Model Selection	135
VII.	Multistate Models for Mixtures of Information	140
A.	Recoveries and Recaptures	140
B.	Modeling Live Resightings Between Capture Occasions	142
C.	Other Mixtures of Information	146
VIII.	Discussion	146
A.	Multistate Models as a General Framework	146
B.	Perspectives	150
C.	Conclusion	159
	Acknowledgment	159
	References	159

Sustained Research on Stream Communities: A Model System and The Comparative Approach

ALAN G. HILDREW

	Summary	176
	A. Broadstone Stream as a Model System	176
	B. Comparisons Across Communities	178
	C. More General Questions	179
I.	Introduction	180
	A. Of Streams and Humans	181
	B. Communities, Patterns, and Initial Hypotheses	185
	C. The Structure of This Paper	188
II.	The Model System Approach: Species Interactions in a "Simple" Community	189
	A. Important Players	189
	B. Fish Predation	191
	C. Patchiness, Mobility, and Invertebrate Predators in the Benthos	193
	D. Resource Partitioning Among Predators	199
	E. The Physical Context: Stream Flow and Refugia	202
	F. Field Experiments on Predator Impact	205
	G. Community Persistence	210
	H. An "Invading" Top Predator	212
	I. The Development of Connectance Food Webs for Broadstone Stream	215

J. Body-Size Patterns in Connectance Food Webs	221
K. Alternative Approaches: A Large-Scale Experiment and An Intergenerational Model	223
III. An Extensive Approach: Comparisons Across Communities	227
A. Patterns and Early Hypotheses	227
B. Cross-Community Patterns and Predation	228
C. Cross-Community Patterns and Food Resources	229
D. Course Particulate Organic Matter	229
E. Biofilms and Grazing	235
F. Broadstone Stream in Its Physical Context: Flow Refugia, Disturbance, and Mobility	243
G. Patterns in Community Persistence	252
IV. Broader Perspectives, More General Questions	253
A. Scaling and Patterns in Connectance Food Webs	254
B. Body Size, Production, and A Quantified Web	257
C. Acidification, Recovery, and Invasions	271
D. Community Structure and Ecosystem Processes	277
E. Into the Landscape	282
V. What We Have Learned and How: Perspectives and Prospects	291
A. Persistence and Stability	291
B. Patterns in Food Webs	292
C. Structure, “Function,” and Acidity	292
D. Prospects	293
Acknowledgments	294
Appendix I	295
References	298

Empirical Evidence of Density-Dependence in Populations of Large Herbivores

CHRISTOPHE BONENFANT, JEAN-MICHEL GAILLARD, TIM COULSON, MARCO FESTA-BIANCHET, ANNE LOISON, MATHIEU GAREL, LEIF EGIL LOE, PIERRICK BLANCHARD, NATHALIE PETTORELLI, NORMAN OWEN-SMITH, JOHAN DU TOIT AND PATRICK DUNCAN

Summary	314
I. Introduction	315
II. Methods and Problems	317
A. Assessing Density-Dependence	317

B. Measuring Population Density and Demographic Parameters	317
C. Literature Survey of Case Studies	318
III. Strength and Prevalence of Density-Dependence in Demographic Parameters.	318
A. Reproductive Parameters	318
B. Density Effects on Age-Specific Survival Rates.....	329
C. Dispersal Rate and Density.....	332
IV. Linking Density-Dependence with Other Major Sources of Variation in Demographic Parameters	333
A. The Confounding Effects of Age	333
B. On the Importance of Sex	334
C. Cohort Effects	335
D. Interaction Between Climate and Density.....	336
V. The Evolutionary Context of Density-Dependence	337
A. Linking Density-Dependent Patterns to Environmental Canalization	337
B. Testing the Eberhardt's Model	339
C. The Role of Species-Specific Energy Allocation to Reproduction.....	339
D. On the Importance of Timing of Birth.....	340
E. The Pivotal Role of Body Mass in Density-Dependence.....	340
VI. Detection of Density-Dependence in Demographic Parameters	341
A. Delayed and Non-Linear Effects of Density-Dependence	342
B. Pattern-Versus Process-Oriented Approaches	343
VII. Conclusions	344
Acknowledgments.....	344
References	345
Index	359
Cumulative List of Titles	367