

Contents

Preface to the First Edition	vii
Preface to the Second Edition	ix
Acknowledgments	xi
Part I Population Systems	
Introduction to Part I	1
Chapter 1 A Brief Look at Systems in General.....	3
1.1 What is a System?.....	3
1.2 The State of a System	6
1.3 Dynamical Systems	6
1.4 System Diagrams.....	7
1.5 Feedback Control.....	9
1.6 The Stability of Systems.....	12
1.7 Anticipatory Feedforward.....	15
1.8 Systems Analysis in Biology	17
1.9 Chapter Summary	22
Exercises	23
Notes	24
Chapter 2 Population Dynamics and an Elementary Model	27
2.1 What is a Population?	27
2.2 Dynamics of Populations.....	29
2.3 An Elementary Population Model	35
2.4 Analysis of the Model.....	41
2.5 Environmental and Genetic Effects	47
2.6 Chapter Summary	48
Exercises	50
Notes	51

Chapter 3 Population Regulation and a General Model.....	57
3.1 Density-Dependent Mechanisms.....	57
3.1.1 Competitive Processes.....	58
3.1.2 Cooperative Processes.....	60
3.2 Feedback Integration.....	62
3.3 A General Population Model.....	65
3.4 Analysis of the Model.....	70
3.4.1 Environmental and Genetic Effects.....	73
3.5 Populations in Changing Environments.....	75
3.5.1 Environmental Feedback.....	77
3.6 Complex Density-Dependent Relationships.....	79
3.7 Chapter Summary.....	83
Exercises.....	85
Notes.....	86
 Part II Systems of Interacting Populations	
Introduction to Part II.....	93
Chapter 4 Interactions Between Two Species.....	95
4.1 Population Interactions.....	95
4.2 Cooperative Interactions.....	96
4.3 Competitive Interactions.....	100
4.3.1 Nonlinear Competitive Interactions.....	104
4.3.2 Competition in Variable Environments.....	106
4.3.3 Strategies of the Competitor.....	109
4.4 Predator-Prey Interactions.....	110
4.4.1 Nonlinear Predator-Prey Interactions.....	115
4.4.2 Predator Functional Responses.....	119
4.4.3 Predation in Variable Environments.....	124
4.4.4 Predator and Prey Strategies.....	126
4.5 Chapter Summary.....	128
Exercises.....	130
Notes.....	132
Chapter 5 Interactions in Space	149
5.1 Introduction.....	149
5.2 Movements in Space.....	150
5.3 Dynamics in Space	154
5.4 The Spread and Collapse of Pest Epidemics	157
5.5 Stability in Space	161
5.6 Population Quality in Space	164
5.7 Environmental Stratification.....	167
5.8 Chapter Summary	170
Notes	171

Chapter 6 Interactions Between Many Species (Ecological Communities)	177
6.1 Community Structure	177
6.2 Community Stability.....	179
6.2.1 Predation as a Stabilizing Influence	187
6.3 Community Dynamics.....	189
6.4 Chapter Summary	193
Exercises	195
Notes.....	196
Epilogue: The Human Dilemma	199
Answers to Exercises.....	205
Name Index.....	211
Subject Index.....	215