Contents

Editorial 5

Preface 7

1 Evolutionary game theory 9
- 1.1 The Hawk-Dove game . . . 9
- 1.2 Darwinian vs. group selection . . . 11
- 1.3 Normal form games . . . 12
  - 1.3.1 Fitness for mixed strategies . . . 12
  - 1.3.2 The Nash equilibrium . . . 13
- 1.4 Evolutionary stable strategies . . . 15
  - 1.4.1 Analysis of two-player games with two strategies. . . . 18
  - 1.4.2 The rock-scissors-paper game . . . 19
- 1.5 The habitat selection game . . . 20
  - 1.5.1 Patch payoff is a linear function . . . 21
  - 1.5.2 Parker's matching principle . . . 22
- 1.6 Replicator dynamics . . . 23
- 1.7 Dispersal dynamics . . . 29
  - 1.7.1 The best response dynamics . . . 31
  - 1.7.2 Better response dynamics . . . 34
  - 1.7.3 Continuous dynamics . . . 36
  - 1.7.4 Suboptimal dispersal . . . 36
  - 1.7.5 Dispersal of lady beetles . . . 38
- 1.8 Games with a continuum of strategies. . . . 42
- 1.9 Asymmetric games . . . 44
  - 1.9.1 The habitat selection game for competing species . . . 47
  - 1.9.2 Two-patch predator-prey systems . . . 49
- 1.10 Optimal diet selection model . . . 51

2 The effects of adaptive behavior on population dynamics 55
- 2.1 The habitat selection game for a growing population . . . 55
- 2.2 The Lotka-Volterra predator-prey model . . . 57
- 2.3 The Lotka-Volterra model with foraging-predation risk trade-offs . . . 60
  - 2.3.1 Adaptive predators . . . 61
  - 2.3.2 Adaptive prey . . . 63
  - 2.3.3 Both species are adaptive . . . 64
- 2.4 The functional response . . . 67
- 2.5 Effects of functional and numerical responses on prey-predator stability . . . 70
  - 2.5.1 Prey growth is density independent . . . 71

2.5.2 Prey growth is density dependent 74
2.5.3 Effects of the optimal diet choice on predator-prey dynamics 76
2.6 Patchy environments 78
2.7 Models of competition 80
2.7.1 Lotka-Volterra model of competition 81
2.7.2 Two species competing in two patches 83
2.7.3 Exploitation competition. 85
2.7.4 Apparent competition 87
2.7.5 Parker's matching principle when resources undergo population dynamics 87
2.7.6 Apparent competition when consumers are adaptive foragers 88
2.8 Both consumers and predators behave adaptively 92
2.9 APPENDIX: Existence and uniqueness of Filippov solutions 93

Bibliography **95**