

Ecology and Classification of NORTH AMERICAN FRESHWATER INVERTEBRATES



Edited by

JAMES H. THORP
ALAN P. COVICH

Contents

Preface xi

1 Introduction to Freshwater Invertebrates 1

- James H. Thorp and Alan P. Covich
I. Introduction 1
II. Approaches to Taxonomic Classification 1
III. Synopses of the North American Freshwater Invertebrates 2
Literature Cited 15

2 An Overview of Freshwater Habitats 17

- James H. Thorp and Alan P. Covich
I. Introduction 17
II. Lotic Environments 17
III. Underground Aquatic Habitats 26
IV. Lentic Ecosystems 28
Literature Cited 35

3 Protozoa 37

- William D. Taylor and Robert W. Sanders
I. Introduction 37
II. Anatomy and Physiology 38
III. Ecology and Evolution 52
IV. Collecting, Rearing, and Preparation for Identification 61
V. Identification of Protozoa 62
Literature Cited 86

4 Porifera 95

- Thomas M. Frost
I. Introduction 95
II. Anatomy and Physiology 96
III. Ecology and Evolution 103
IV. Collection, Culture, and Preparation for Identification 112
V. Classification 113
Literature Cited 121

5 The Freshwater Cnidaria—or Coelenterates 125

- Lawrence E. Slobodkin and Patricia E. Bossert
I. Introduction 125
II. General Biology of Cnidaria 126
III. Descriptive Ecology of Freshwater Cnidaria 130
IV. Collection and Maintenance of Freshwater Cnidaria 138
V. Classification of Freshwater Cnidaria 140
Literature Cited 142

6 Flatworms: Turbellaria and Nemertea 145

- Jerzy Kolasa
Turbellaria
I. Introduction: Status in the Animal Kingdom 146
II. Anatomy and Physiology 146
III. Ecology 148
IV. Current and Future Research Problems 151
V. Collecting, Rearing, and Identification Techniques 152
VI. Identification of North American Genera of Microturbellaria 153

Nemertea

- VII. General Characteristics, External and Internal Anatomical Features 164
VIII. Ecology 164
IX. Current and Future Research Problems 166
X. Collection, Culturing, and Preservation 166
XI. Identification 166
Literature Cited 167
Appendix 6.1. List of North American Species of Microturbellaria 170

7 Gastrotricha 173

- David L. Strayer and William D. Hummon
- I. Introduction 173
 - II. Anatomy and Physiology 174
 - III. Ecology and Evolution 175
 - IV. Collecting, Rearing, and Preparation for Identification 180
 - V. Identification of the Gastrotrichs of North America 180
 - Literature Cited 183

8 Rotifera 187

- Robert L. Wallace and Terry W. Snell
- I. Introduction 187
 - II. Anatomy and Physiology 189
 - III. Ecology and Evolution 199
 - IV. Collecting, Rearing, and Preparation for Identification 222
 - V. Classification and Systematics 224
 - Literature Cited 240

9 Nematoda and Nematomorpha 249

George O. Poinar, Jr.

Nematoda

- I. Introduction 249
- II. Morphology and Physiology 250
- III. Development and Life History 254
- IV. Ecology 255
- V. Collecting and Rearing Techniques 259
- VI. Identification 263

Nematomorpha

- VII. Introduction 273
- VIII. Morphology and Physiology 273
- IX. Development and Life History 275
- X. Sampling 277
- XI. Identification 277
- Literature Cited 280
- Appendix 9.1. Systematic Arrangement of the Nematode Genera 282

10 Mollusca: Gastropoda 285

Kenneth M. Brown

- I. Introduction 285
- II. Anatomy and Physiology 286
- III. Ecology and Evolution 290
- IV. Collecting and Culturing Freshwater Gastropods 300
- V. Identification of the Freshwater Gastropods of North America 301
- Literature Cited 309

11 Mollusca: Bivalvia 315

- Robert F. McMahon
- I. Introduction 315
 - II. Anatomy and Physiology 316
 - III. Ecology and Evolution 335
 - IV. Collecting, Preparation for Identification, and Rearing 370
 - V. Identification of the Freshwater Bivalves of North America 373
 - Literature Cited 390

12 Annelida: Oligochaeta and Branchiobdellida 401

Ralph O. Brinkhurst and Stuart R. Gelder

Oligochaeta

- I. Introduction to Oligochaeta 401
- II. Oligochaete Anatomy and Physiology 402
- III. Ecology and Evolution of Oligochaeta 408
- IV. Collecting, Rearing, and Preparation of Oligochaetes for Identification 414
- V. Taxonomic Keys for Oligochaeta 416

Branchiobdellida

- VI. Introduction to Branchiobdellida 428
- VII. Anatomy and Physiology of Branchiobdellidans 428
- VIII. Ecology and Distribution 429
- IX. Identification of Branchiobdellida 430
- Literature Cited 433

13 Annelida: Leeches, Polychaetes, and Acanthobdellids 437

Ronald W. Davies

- I. Introduction 437
- II. Taxonomic Status and Characteristics 438
- III. Leeches and Acanthobdellidae 439
- IV. Ecology 446
- V. Collection and Rearing 454
- VI. Identification 455
- VII. Polychaeta 457
- VIII. Taxonomic Keys 459
- Literature Cited 469
- Appendix 13.1. Distribution of Leech and Acanthobdellid Taxa in North America 476
- Appendix 13.2. Distribution of Polychaete Taxa in North America 478

14	<i>Bryozoa</i>	481	II. Anatomy and Physiology of Crustacea	668
Timothy S. Wood			III. Ecology and Evolution of Selected Crustacea	673
I. Introduction 481			IV. Collecting, Rearing, and Preparation for Identification	681
II. Anatomy and Physiology 481			V. Classification of Peracarida and Branchiura	682
III. Ecology and Evolution 487			Literature Cited 683	
IV. Entoprocta 490				
V. Study Methods 491				
Literature Cited 497				
15	<i>Tardigrada</i>	501		
Diane R. Nelson				
I. Introduction 501				
II. Anatomy 502				
III. Physiology (Latent States) 508				
IV. Reproduction and Development 509				
V. Ecology 511				
VI. Techniques for Collection, Extraction, and Microscopy 514				
VII. Identification 515				
Literature Cited 518				
16	<i>Water Mites</i>	523		
Ian M. Smith and David R. Cook				
I. Introduction 523				
II. External Morphology and Internal Anatomy 527				
III. Ecology 537				
IV. Collecting, Rearing, and Preparation for Study 544				
V. Taxonomic Keys to Subfamilies of Water Mites in North America 546				
Literature Cited 589				
17	<i>Diversity and Classification of Insects and Colembola</i>	593		
William L. Hilsenhoff				
I. Introduction 594				
II. Orders of Aquatic Insects 597				
III. Partially Aquatic Orders of Insects 613				
IV. Semiaquatic Collembola—Springtails 631				
V. Identification of the Freshwater Insects and Collembola 632				
Literature Cited 653				
18	<i>Crustacea: Introduction and Peracarida</i>	665		
Alan P. Covich and James H. Thorp				
I. Introduction to the Subphylum Crustacea 665				
19	<i>Ostracoda</i>	691		
L. Denis Delorme				
I. Introduction 691				
II. Anatomy and Physiology 692				
III. Life History 697				
IV. Distribution 699				
V. Chemical Habitats 699				
VI. Physical Habitat 701				
VII. Physiological and Morphological Adaptations 703				
VIII. Behavioral Ecology 703				
IX. Foraging Relationships 704				
X. Population Regulation 704				
XI. Collecting and Rearing Techniques 704				
XII. Current and Future Research Problems 706				
XIII. Classification of Ostracodes 706				
Literature Cited 716				
20	<i>Cladocera and Other Branchiopoda</i>	723		
Stanley I. Dodson and David G. Frey				
Cladocera				
I. Anatomy and Physiology 725				
II. Ecology of Cladocerans 730				
III. Current and Future Research Problems 743				
IV. Collecting and Rearing Techniques 744				
V. Taxonomic Keys for Cladoceran Genera 745				
Other Branchiopods				
VI. Anatomy and Physiology of the Other Branchiopods 764				
VII. Ecology of the Other Branchiopods 765				
VIII. Current and Future Research Problems 770				
IX. Collecting and Rearing Techniques 770				
X. Taxonomic Keys for Non-Cladoceran Genera of Branchiopods 770				
Literature Cited 776				

21 *Copepoda* 787

Craig E. Williamson

- I. Introduction 787
- II. Anatomy and Physiology 788
- III. Ecology and Evolution 790
- IV. Current and Future Research Problems 803
- V. Collecting and Rearing Techniques 804
- VI. Identification Techniques 805
- VII. Identification of the Order Calanoida 806
- VIII. Identification of the Order Cyclopoida 807
- IX. Identification of the Order Harpacticoida 810
- Literature Cited 813

22 *Decapoda* 823

H. H. Hobbs III

- I. Introduction 823
- II. Anatomy and Physiology 824
- III. Ecology and Evolution 829
- IV. Current and Future Research Problems 847
- V. Collecting and Rearing Techniques 848
- VI. Identification 850
- Literature Cited 852

Glossary 859***Index*** 875