Patterns of Vertebrate Biology

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To my wife, Sumiko

Preface

This book grew from a series of lectures on vertebrate natural history. The topics have been developed over a period of nearly 30 years, and today scarcely resemble the original subject matter. The progress is primarily technical. Some concepts provide a synthetic framework for viewing much modern research, but many of these concepts either date from Darwin or have developed from observations of later students.

Animal science courses follow a sequential pattern in which there are three discrete levels of undergraduate instruction. Initially, students study subject matter contained in such courses as biology and general zoology. These courses introduce students to animal phylogeny, basic plans of morphology and certain physiological aspects; incidental to these subjects the student acquires a broad zoological vocabulary.

At the other end of the academic spectrum are courses that emphasize synthesis and theory: evolution, zoogeography, behavior and ecology are important courses whose role is to explore the relationships of various aspects of the physical and biological world. In these courses theory and analysis prevail. They are not, however, essentially "subject matter" courses with distinct bodies of knowledge. For example, a student can relate information from many fields to concepts in evolution or ecology, but one does not in fact "study evolution" or "study ecology."

Between these two types of course are several discrete fields, each with its own subject matter which is generally distinct from that of another field. A student emphasizing biological sciences, such as zoology, botany or bacteriology, will pursue knowledge in such fields as genetics, morphology, physiology, cell biology and cytology, as well as taxon-oriented fields, such as entomology or mammalogy.

Although natural history has long been a popular subject, the limits between natural history on the one hand and ecology on the other are nebulous. Ecology is, or originally was, an outgrowth of natural history. It has since become an activity that emphasizes analysis and theory and bases its concepts on information

from many separate fields. Natural history remains a study of natural events in the life cycles of wild animals. In writing this textbook on natural history, I have tried to preserve the concept of three levels of courses: (1) introductory, (2) advanced subject matter and (3) analysis and theory.

I have assumed the reader to have a background normally derived from one or two introductory courses, and I have proceeded to more detailed and specific discussions of vertebrate biology. This has demanded occasional references to anatomy, physiology, geology and other disciplines, but the student need not have had advanced work in such fields to follow the discussions in this book. Rather, a background in natural history will assist him or her in an appreciation of other aspects of biology. Because this textbook is primarily descriptive, comprising a collection of discussions of field biology of vertebrates, I have tried to avoid the modern theories that have developed within ecology, evolution and behavior. Nevertheless these fields derive much of their foundation from natural history, and hence overlap is unavoidable.

The subject matter is subdivided so as to assist the reader in finding specific topics. I have attempted to organize examples from as many parts of the earth as possible so that the reader can derive some feeling for the similarities and differences that are founded on contrasting environments as well as on diverse taxa.

Stated most simply, my aim is to pursue the study of vertebrate life cycles, to explore their patterns and variations in terms of the influences of (1) their biotic associates and (2) the abiotic (physical) influences. My ultimate goal is the pleasure of satisfying this aim. The assembling of one's own data and elucidation of specific patterns of behavior and physiology provide the sole base from which general concepts can be generated. To study population cycles of voles, one should study voles, or, if one wishes to explore adaptations of an amphibian, one needs to consult the amphibian. As Louis Agassiz expressed it several generations ago: "Study nature, not books."

In addition to establishing the originality and authenticity of one's own data, one must analyze the information so as to establish or reject all possible relationships. Special responses to the activities of other species, abiotic factors or endogenous patterns ultimately rest on the analysis of original data. The separation of different factors and their aggregate effects on biological patterns constitutes a major challenge to the field biologist. Although simultaneously exerted forces can be clearly isolated by meticulous statistical procedures, cautiously designed analyses succeed only with unimpeachable data.

The most realistic as well as the most difficult approach is the analysis of an activity as a part of the whole, and not in isolation. This *Gestalt* approach, however painstaking and slow, eventually yields patterns that are unequivocally valid. Biological events are rarely exactly the same in every place and in every year; eventually concepts are modified and qualified to accommodate the continual variations in space and time.

Please do not interpret my enthusiasm for the *Gestalt* as a criticism of laboratory studies. Many phenomena are virtually impossible to monitor in the field, and controlled observations of isolated factors greatly aid in their identification

and description. But the laboratory, however essential and productive, is a departure from the animal's real world. In this context one should heed Professor Einstein's gentle admonition: "Everything should be made as simple as possible, but not simpler," or the more acrimonious comment of H. L. Mencken, "For every problem there is a simple solution, which is usually wrong."

One example will illustrate the pitfall of drawing hasty conclusions from isolated studies. In laboratory populations of ground squirrels (*Citellus lateralis*), females enter hibernation before males. In the field, however, adult females are active long after the males have become dormant. The reason for this difference may reflect the failure of captive females to breed; wild females spend some weeks nursing young, while males are already accumulating fat. It is not known for certain that lactation accounts for the delayed dormancy of female squirrels in nature, but the patterns of captive and wild squirrels are nevertheless different.

In this volume are included many investigations by students who have found lifetimes of satisfaction in pursuing segments of the natural history of vertebrates. These examples are of many sorts, but they all have the underlying genesis of providing joy to the investigator. I hope that their effects will both stimulate you to develop your own distinctive program of study and also contribute to a more profound understanding of vertebrate patterns.

Davis, California

E. W. Jameson, Jr.

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Contents

PART I PHYLOGENETIC DEVELOPMENT	1
Chapter 1. An Overview of Vertebrate Phylogeny	3
Vertebrate Progenitors	3
Jawless Fish	6
Jawed Fish	8
Bony Fish	9
Amphibians	11
Reptiles	16
Birds	17
Mammals	19
Chapter 2. Mechanics of Evolution	22
Requirements for Selection	22
Rates of Evolution	23
Selection and Adaptation	24
Preadaptation	24
Extinction and Survival	25
Geography and Subspecies	26
Ecogeographic Rules	27
Sexual Selection	28
Genetic Stability	29
Genetic Drift	30
Speciation versus Phyletic Evolution	31
Chapter 3. Zoogeography	32
Disjunctions and Endemism	32
Background to Plate Tectonics	35

Modern Vertebrate Distributions and Plate Tectonics	39
Dispersal	46
Faunal Distributions	47
Islands	55
Deserts	60
The Pleistocene	61
Summary	71
Chapter 4. Movements and Migration	72
Territory and Home Range	72
Migration	80
Orientation and Navigation	91
Dispersal	98
 PART II INDIVIDUAL ENVIRONMENTAL RESPONSES	 101
Chapter 5. Breathing	103
Gills of Fish	104
Amphibians	110
Reptiles	112
Birds	114
Mammals	117
Comparisons	119
Chapter 6. Food and Feeding	121
Food Intake	121
Fat Cycles	124
Foraging	129
Resource Partitioning	139
Seasonal Changes in Food Supply	144
Toxic Foods	144
Summary	145
Chapter 7. Thermoregulation and Water Balance	146
Physiologic and Behavioral Relationships	146
Fish	152
Amphibians	155
Reptiles	158
Birds	169
Mammals	176
Summary	184

Chapter 8. Activity and Seasonal Dormancy	187
Activity	187
Seasonal Dormancy	201
Summary	222
 PART III COMMUNICATION	223
 Chapter 9. Sensory Receptors and Perception	225
Olfaction and Taste	225
Vision	230
Hearing and Vocalization	240
Sensory Pits of Snakes	249
Extraoptical Photoreceptors	251
Electroreception	252
Summary	255
 Chapter 10. Signals	257
Fishes	257
Amphibians, Reptiles and Birds	258
Mammals	258
Scent Production	259
Coloration	260
Sound Production	270
Echolocation	280
Bioluminescence	286
Electric Fishes	289
Summary	291
 PART IV POPULATION PHENOMENA	293
 Chapter 11. Reproduction	295
Vertebrate Ovulatory Cycle	295
Mating	305
Parthenogenesis and Intersexual Conditions	308
Parental Care in Fishes	312
Parental Care in Amphibians	315
Parental Care in Reptiles	319
Delayed Births	320
Breeding Seasons	325
Summary	349

Chapter 12. Growth	351
Specializations in Early Growth	351
Age of Sexual Maturity	362
Viviparity in Ectotherms	368
Summary	381
Chapter 13. Community and Population Density	384
Community Structure	384
Population Dynamics	391
References	408
Index	451