



Bumblebees: Behaviour, Ecology, and Conservation. Second Edition.

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ing corresponding text from a plate figure is very cumbersome, since text entries are not cited in the figure caption. One is forced to look up a species entry in one of three indexes (insect, plant, and general), then must flip back to the text. This could easily have been avoided by providing text citations in the figure captions.

Powell and Opler provide a remarkably comprehensive overview of the vast western moth fauna; not only will this volume serve to highlight the Lepidoptera as a significant and integral part of North America's biodiversity, it will also undoubtedly become the standard reference on western moths for both specialists and amateurs.

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BUMBLEBEES: BEHAVIOUR, ECOLOGY, AND CONSERVATION. *Second Edition.*

By Dave Goulson. Oxford and New York: Oxford University Press. \$120.00 (hardcover); \$55.00 (paper). xi + 317 p. + 16 pl.; ill.; index. ISBN: 978-0-19-955306-8 (hc); 978-0-19-955307-5 (pb). 2010.

This second edition, like the first, covers an impressive breadth of topics on a fascinating group of social bees. The book is well organized, easy to read, and provides substantial updates. Specifically, previous sections on foraging economics and foraging range are now combined and include new subsections on approaches for determining foraging ranges (mass-marking bees that are recaptured in the field and mathematical modeling). The discussion of how foragers choose among flowers is much expanded, with new sections on learning, variation in learning ability, flowers that cheat (providing no reward), and the influence of pollen quality. The new emphasis upon learning is most welcome and reflects increased research on the neuroethology of bumblebee learning. The author primarily addresses this literature by focusing on how learning may affect floral constancy. More material on memory dynamics and associative learning could be included, facilitating comparisons with other bees groups, and perhaps will appear in the next edition.

Goulson has expanded his chapter on intraspecific floral choices with separate sections on thermal rewards and motivation and choosiness. There is also a new chapter on foraging cues obtained from other bees. This chapter summarizes recent work that examines visual local enhancement and learning of odor cues (footprints), research that has led investigators to reconsider the role of olfactory signals (pheromones) and odor cues in bumblebees and other social bees. The final two

chapters take up the topics of conservation and bumblebee introductions, updating the material from the first edition and adding a section on the effects of introgression (hybridization). Quite appropriately, this edition highlights the problem of dwindling bumblebee populations by now including "conservation" in the title.

I enjoyed the literary touch of brief quotes that begin some chapters. The figures are clear, and the color photographs are excellent. This book is a good choice for students just learning about the beguiling world of bumblebees and it will serve as a general reference for research scientists. The latter may benefit most from seeing what remains to be learned. For example, there is a brief new description of intriguing "hilltopping" behavior by males seeking mates and a new discussion of social parasitism by drifting workers, which has implications for the evolution of obligate social parasitism. Other such examples abound. Overall, this volume will appeal to students and researchers interested in social insects as well as those focused on bumblebees. It is a welcome addition to a growing body of research on these marvelous bees.

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EARLY LIFE HISTORY OF MARINE FISHES.

By Bruce S. Miller and Arthur W. Kendall, Jr. Berkeley (California): University of California Press. \$60.00. xii + 364 p.; ill.; taxonomical and general indexes. ISBN: 978-0-520-24972-1. 2009.

The vast majority of marine fishes (excluding cartilaginous species) have complex life histories that include a pelagic larval stage differing markedly from the adult in appearance, ecology, and habitat. Many species have such highly specialized larvae that they were initially thought to belong in genera or even families different from the adult. The study of egg and larva biology has long lagged behind that of adult fishes, yet is of great importance in many areas: systematics, population demography, evolution, marine reserve design, and fishery management. The events of early life history have a profound influence on the rest of every fish's life. Miller and Kendall, long-time students of temperate fish early life history, provide an excellent introduction to the subject, starting with gonad development, then including identification, ecology, sampling, population dynamics, conservation biology, and culture.

This volume, which emphasizes Northern Hemisphere temperate subjects, can be used as a university textbook, and contains 12 laboratory exercise sections. What is included is well done, and the volume gathers together and reviews a