

Gastropod mating systems: An introduction to the symposium*

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Sex is what organisms are all about, and gastropods are no exception. The sexual behavior and reproductive biology of gastropods has fascinated naturalists from earliest times. The aerial mating behavior of *Limax maximus* Linnaeus, 1758, the chains of copulating *Aplysia* Linnaeus, 1767, the love dart of *Helix* (Linnaeus, 1758), the egg cases of whelks and naticids, and the delicate gelatinous egg masses of nudibranchs have been objects of wonder and speculation for centuries and the more we learn about such phenomena, the more marvelous they seem. Our childish pleasure at the delicacy and symmetry of a moon snail's egg collar is only enhanced by the understanding of its importance in allowing eggs to develop on muddy substrata; our astonishment at the length of the entwined penes that suspend a pair of mating *L. maximus* is only intensified by consideration of the conflicting pressures of natural and sexual selection that must have produced the phenomenon. The papers in this volume provide a wealth of new pleasures both by describing new and fascinating observations in gastropod sexual biology and by providing deeper insights into some of the more familiar systems.

The term mating system is shorthand for the species-typical reproductive behavior of a species: that is, who mates, when they mate, who is successful and why. The mating system is a product of both natural and sexual selection and is, in a sense, the grand finale to the life history of a species. Understanding the mating system of a species requires knowledge of many aspects of its ecology, physiology, and behavior. There is perhaps no species, including our own, for which the mating system is completely understood. However, in recent decades tremendous progress has been made in understanding mating systems from the standpoint of behavioral and evolutionary ecology. Modern mating systems theory views the mating system as the outcome of selection acting on selfish individuals who may have conflicting interests, even as they come together to produce and perhaps, rear, their offspring. Much of this work has dealt with humdrum and boring taxa such as birds, mammals,

and insects but application of what Eric Charnov (1982) has termed, "selection thinking" to invertebrates, including gastropods, came early, with the publication of Mike Ghiselin's (1974) book, "The Economy of Nature and the Evolution of Sex" and George Williams's (1975) "Sex and Evolution". However, it has taken time for malacologists to embrace sexual selection and mating systems theory for a variety of reasons; many gastropods are hermaphrodites and the application of sexual selection theory to hermaphrodites is not entirely straightforward (see review in Leonard 2006); Darwin's idea that gastropods lacked the sensory and mental capacity to choose mates has been very influential and has had much intuitive appeal. However, it has been shown that the hermaphroditic basommatophoran, *Bulinus truncatus* (Audouin, 1826) can discriminate among mates based on their infection status and that this differs with the genotype of the chooser (Webster and Gower, 2006).

Over the last three decades, gradually and one by one, a variety of laboratories have begun to explore the sexual biology of gastropods as models for testing predictions of mating system theory and to use mating systems theory to understand the biology of the gastropods they are interested in. The immediate stimulus for the current symposium came from the realization that a certain critical mass has been reached and that it was time to bring together a selection of these workers from around the world to compare notes and provide an overview into the diversity of gastropod biology and gastropod research. The joint meeting at Asilomar seemed to be the ideal opportunity and the resulting symposium, "Gastropod Mating Systems" on the morning of June 27, 2005 consisted of nine talks, covering a wide variety of topics from the genetics of sex ratio (Yusa, this volume), to reproductive physiology (Ter Maat *et al.* and Mayeri) and paternal care (Grosberg). Three of the talks dealt with prosobranchs; two with opisthobranchs and four with pulmonates; one with the basommatophoran, *Lymnaea stagnalis* (Linnaeus, 1758), and three with stylommatophorans. Two of the talks are unfortunately not represented in this volume:

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“Mating systems and family conflicts in a marine snail” by Rick Grosberg, Center for Population Biology, University of California-Davis

and

“Mating and egg-laying behavior in *Aplysia* – Pheromones and neural mechanisms” by Earl Mayeri, Department of Physiology, University of California-San Francisco

However, we have added two important papers from authors who were not able to attend the symposium: a review of the mating system and reproductive biology of *Arianta arbustorum* (Linnaeus, 1758) by Bruno Baur of the University of Basel and a review of work on dart-shooting in helicids by Ronald Chase of McGill University. Several of the papers (by Yusa, Reise, Davison, Baur, and Chase) represent important reviews and syntheses of previously published work while others (e.g., Takeuchi *et al.*, Krug, and Leonard *et al.*) present new data. The paper by Ter Maat *et al.* provides an important comparison of field and laboratory data on reproductive allocation. While this volume may not convey a sense of the beauty and magical atmosphere of the Asilomar Conference Grounds, the papers presented here will provide a sense of the many stimulating directions and developments in the new field of gastropod mating systems research.

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