possible for a short time frame, largely because everyone is jumping on everyone else's bandwagon, but has anyone ever evaluated the 'science forecast' ten years down the road? Nevertheless, this chapter provides several extremely useful starting points.

The chapters are a bit heterogeneous in style, with some having glossaries and/or useful 'future directions' sections, whilst others do not. However, the quality of the chapters is consistently high, and all are easily intelligible, offering comprehensive and up-to-date reviews of their respective fields, making the book extremely valuable for teaching. The final sentence in Price's chapter reads '…we can still learn from Darwin's example – first the great naturalist, then the detector of pattern, then the formulator of mechanisms, and finally the creator of the central theory for life'. Few of us are destined to go through all these stages, but *Plant–Animal Interactions* will certainly be a useful tool for students of biology wishing to be successful in at least one!

References

1 Chittka, L. (1996) Does bee colour vision predate the evolution of flower colour? *Naturwissenschaften* 83, 136–138

Of males and females

Sex Ratios. Concepts and Research Methods edited by Ian C.W. Hardy. Cambridge University Press, 2002.
£32.95 pbk (xii + 424 pages) ISBN 0 521 66578 7

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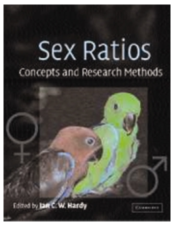

Danaus and Aegyptus were sons of King Belus, a descendent of Io and Zeus. Both brothers began ruling Egypt together, but could not agree on how to reign. As a result, Danaus fled with his 50 daughters to Argus, where he became King, and Aegyptus, who had 50 sons, persecuted Danaus, following him across the Aegean Sea. To reconcile, the two brothers agreed to have a grand wedding between each of their children. But Danaus could not forget the slight and he ordered his 50 daughters to murder their husbands. On the wedding night, all but one daughter took a dagger and stabbed their husbands to death.

This episode of the Greek Odyssee is a good illustration of some of the major themes developed in *Sex Ratios, Concepts and Research Methods*. In essence, this book considers the proximate and ultimate causes underlying the extreme variation in sex ratios across different levels of biological organization (species, populations and individuals) as well as the potential conflicts that can arise between nuclear genes and sex-ratio distorters that modify the sex ratio of their host to promote their own transmission.

The book begins with a clear history of sex-ratio studies and an introduction to models of sex-ratio evolution. The next section discusses how to analyze sex-ratio data correctly, which is done in very few published studies. Both Wilson and Hardy, and Boomsma and Nachman argue convincingly that powerful methods enabling us to consider simultaneously the effect of several factors (e.g. logistic regressions models and generalized linear models) are now available and should be routinely used.

An interesting issue raised in several chapters is whether adaptive changes in sex ratios might be constrained by sex-determining mechanisms. For example, it has long been thought that sex chromosomes might constrain adaptive variation. However, recent studies have shown that some birds produce extreme sex ratios, suggesting that, under some conditions, genotypic sex determination might enable greater flexibility than was previously thought. Indeed, not only does it appear that sex-ratio mechanisms are very labile (and vary greatly across taxa), but also that sex is frequently determined by an interaction between environmental and genetic factors. Hence, genotypic and environmental sex determination might only be extremes of a continuum. Our understanding of the molecular basis of sex determination in an increasing number of species will enable us to determine to what extent the proximate mechanisms resulting in sex have been conserved across species, and how natural selection has lead to the adaptive evolution of these mechanisms.

A major theme of the book is that sex-ratio studies are one of the most triumphant areas of evolutionary biology. The impetus for these studies came from W.D. Hamilton's paper [1] on 'extraordinary sex ratios', one of the central aspects of which was an explanation of the female-biased sex ratios found in many arthropod species. Hamilton showed that natural selection favours a female-biased sex ratio when the offspring of one or a few mothers mate among themselves in their natal patch before daughters disperse. He also provided several published examples of mites and other insects where sib mating is the rule, and more recent studies have reported further female-biased sex ratios associated with local mate competition (LMC). However, after a critical review of the data, Orzak argues that there are almost no cases where LMC has been demonstrated unambiguously. Most studies rely on occasional observations of behaviour and virtually none

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provides data about the populations structure and mating dynamics (which is surprising, given the importance of sex-ratio studies and the advent of genetic markers enabling a detailed characterization of breeding structures).

According to Orzak, fig wasps are one of the few taxa in which LMC should occur, because females oviposit inside a fig, where their offspring then eclose and mate. Interspecific variation in foundress number per fig provides an ideal system with which to test LMC. In line with theory, comparative studies showed not only that sex ratios are highly female biased, but also that the bias is higher in species with lower numbers of foundresses per fig. These data are arguably the stronger test of LMC and are frequently presented in textbooks as tests of sex-ratio theory and examples of adaptation. Incidentally, a new genetic study showed that, even for fig wasps, reality might be more complex than it actually seems (D. Molbo *et al.*, unpublished). Contrary to the common belief that figs are pollinated by a single species, two or three cryptic species of wasps were found in most species of figs. Moreover, not all foundresses in a fig reproduce, thus leading to an even higher level of LMC than was estimated previously from counts of dead foundresses.

In summary, this excellent book provides an up-to-date and critical review of the models and data relating to sex ratios. The book is very well structured and demonstrates that a multi-authored book can be cohesive. The authors demonstrate convincingly that sex ratio is an excellent model trait for examining general questions in evolutionary biology. And, as clearly pointed out by Orzack, and West and Herre, although we have learned much from sex-ratio studies, there is much more left to do than simply dotting i's and crossing t's.

References

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Predicting the future and saving species

Population Viability Analysis edited by S.R. Beissinger and D.R. McCullough. University of Chicago Press, 2002. £24.50 pbk (496 pages) ISBN 0 22604178 6.
Quantitative Conservation Biology by W.F. Morris and D.F. Doak. Sinauer Associates, 2002. £24.99 pbk (480 pages) ISBN 0 87893546 0

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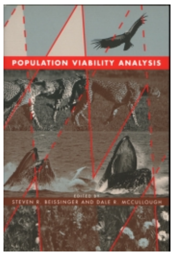

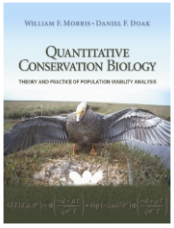

Population viability analysis (PVA) is the first methodology that most conservation biologists would use when assessing or identifying conservation strategies for a population. It involves constructing a mathematical model of the population dynamics, which is then used to assess the probability of a population either going extinct or declining below a threshold size within a specified number of years. The performance of different conservation strategies can then be assessed by imposing them on the model and comparing results. For a population of an endangered species, the best strategy is usually considered the one that gives the lowest probability of extinction or declining below the threshold. PVA has become a widely used tool in conservation biology, but has recently attracted some controversy. Its advocates pedal PVA as a tool that accurately produces probabilistic population trajectories under a wide range of circumstances [1]. Critics argue that, given the quality of data available for most populations of endangered species, constructing a model that can produce accurate and useful population trajectories might often not be possible [2].

Quantitative Conservation Biology provides a clear guide about how to do a PVA, beginning with a consideration of PVAs that are based on count data (the number of individuals seen in each census). It moves through more complex demographically structured models to spatially explicit models, and covers problems in parameter estimation and the incorporation of observation error. The book is so clearly written that it provides an excellent introduction to population modelling that will prove useful to biologists of all levels who wish to learn more about the subject.

The book contains over 40 MATLAB programs that can be used as the basis for any PVA. This is a nice touch. Many PVAs are currently performed using off-the-shelf packages, such as VORTEX [3], which, although powerful, have the drawback that they enable PVAs to be run by anyone, regardless of their understanding of the population model assumptions or structure. By encouraging the reader to construct their own PVA from scratch based on the source MATLAB code, Morris and Doak will hopefully promote a solid understanding among applied conservation biologists about how PVAs work, and how they can be performed.

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