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Book review

The Biology of Decapod Crustacean Larvae *Crustacean Issues* Volume 14
Klaus Anger. A.A. Balkema, The Netherlands; 2001; ISBN 90 265 1828 5; 419 pp.; US$130.00, € 130.00

The A.A. Balkema series *Crustacean Issues* is almost 20 years old now. Founded by my old friend and mentor Fred Schram, it has covered a wide suite of issues from phylogeny, systematics and evolution; to egg production, larval and adult growth; to specific volumes on barnacles and alien crayfish; to the history of carcinology; and, more recently, to the biodiversity crisis. In all cases, up to now, these have been edited, multiauthored volumes, usually the outcomes of small meetings and large conferences. With Volume 14, the mold is broken—Klaus Anger provides the first single-authored volume on "The Biology of Crustacean Larvae".

Dr. Anger is extremely well qualified to take on this daunting task. For over 20 years, he has been studying larval crustacean development, physiology and behaviour. His group of students, collaborators and visitors at Helgoland Biological Station has been a powerhouse in gaining fundamental understanding of both extrinsic and intrinsic factors affecting larval growth and survival.

In the Preface, Dr. Anger explains that he wants to provide a synopsis, a multidisciplinary review, "attempting to promote an integrated view of the biology of larval Decapoda and other taxa". He recognises that, with increasing specialization, it is very difficult to integrate across the disciplines of morphology, anatomy, physiology, biochemistry, ecology and behaviour. In addition, there are "common patterns" or "adaptive traits" in understanding complex systems like life history strategies that are shared across crustacean groups and, indeed, most larval forms. To this end, he reviews almost 1800 references in nine chapters: Morphology, Anatomy and Organogenesis, The Molting Cycle, Nutrition, Growth, Chemical Composition, Metabolism, Energy Partitioning, and Ecology and Behaviour. He states "These aspects of larval life may thus provide comparative information for theoretical considerations of life history evolution". I would add they also provide the fundamental underpinning when considering very broad population studies of larval ecology and recruitment dynamics.

The majority of the book (260 of 325 text pages) deals with the first eight chapters. This is an expected bias as they cover the areas of Dr. Anger's personal expertise. The chapters are a *tour de force* with exhaustive reviews of relevant literature, from the classic studies of 18th and 19th centuries right up to modern day (latest references were 2001). While not my area of specialty, I found the chapters very readable, extremely informative and they certainly fulfill Dr. Anger's aim of bringing specialist understanding to the nonspecialist.

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I was drawn to Chapter 10 Ecology and Behaviour, my particular area of interest. This chapter draws from the previous ones and puts many of the physiological studies into an ecological context—again consistent with Dr. Anger's ecophysiological background. I found the sections on larval responses to toxicants, pollutants and pesticides (Section 10.1.5); the discussion of competing "biotic factors" (Section 10.1.6); as well as the development in extreme environments (Section 10.4) particularly enlightening.

Dr. Anger's final chapter (Chapter 11 Concluding Remarks) is about gaps in our present knowledge of larval biology. He stresses we know more about morphology, ecology and behaviour than about biochemistry and physiology. Further integration of the physiological traits that have been studied in isolation is necessary. He points to a very challenging area of marrying understanding of phenotypic plasticity to an understanding of evolutionary adaptation and speciation. Lastly, Dr. Anger feels a more rigorous comparison of laboratory and field studies; to gain a better understanding of both environmental effects and laboratory artifacts is necessary.

This volume of *Crustacean Issues* is a must for all larval biologists, not just ones interested in crustaceans. It is suitable for university postgraduate seminars in all the disciplines covered and, most importantly, it provides for students and researchers the raw material and guidance to integrate across the disciplines. It brings together an enormous amount of information about the complexity, diversity and adaptive flexibility that larvae have, far beyond that of the juvenile or adult forms. It reminded me of the sense of awe and incredulity when I saw for the first time the elegant porcelain crab larva hatch from its egg (see his Fig. 1.1). Lastly, the book exhaustively documents the view of a young student in our lab who exclaimed "Larvae are **totally** cool".

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