

Book Reviews

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Ichthyology Handbook

By B. G. Kapoor and B. Khanna

Springer-Verlag Berlin, 2004.

ISBN 3-540-42854-2, GBP 229, USD 325,

SFR 504, EUR 298. Hardback, pp. xiii + 1059,

80 tables, 473 figures.

To quote from the Preface, which conveys the flavour of the whole, "This handbook is the culmination of determinate endeavour to cover the curriculum of fish biology in postgraduate class and to show future approaches and directions to researchers. The richly illustrated chapters are centered on two aspects – structure and function, presenting integrated, up to date account with relevant references." To this end the authors have prepared a weighty tome divided into 12 chapters. In this day of multi-authored texts and specialized multi-author volumes on various aspects of fish biology, it is unusual to see an effort of this scope with but two authors. The herculean effort involved is perhaps reflected in the lack of overview or synthesis in the treatments. One can sense the pasting together of excerpts to form the chapters. For example, on page 327 the spiracle of *Polypterus* is said "to play a minor role in respiration," but on page 339 we find that "Spiracles [in *Polypterus*] are used to inhale air."

If a work of this nature is to be useful, the reader must be able to locate topics, so an index is indispensable. Unfortunately, the index is but 2 ½ pages, as a guide to 950 pages of fact-filled text (the textbook *The Diversity of Fishes*, Blackwell Science 1997, has a 19-page index). Even the most determined searcher would be daunted to find 118 entries on 'gills', ranging from pages 4 to 950, or 75 entries for 'swim bladder'. H.L. Mencken, onetime editor of the literary journal *The American Mercury*, would not review a book without an index; this one comes close to failing his test.

This reviewer confesses to not having read every chapter, instead allowing an examination of those

chapters with whose subjects I am conversant to represent the whole. Illustrations are profuse, as promised. They are mostly rather crudely redrawn, but usually clear enough (however, figures 12.24 and 18.13 defy interpretation). There are some strange lapses: one searches in vain for a description – or explanation – of the differences between cycloid, ctenoid and spinoid scales in a 12-page discussion, and the treatment of fin rays is both uninformative and misleading. Inexplicably, *Amia* and *Lepisosteus* are referred to as "ancient Teleosts", although they are properly placed phylogenetically in Chapter 1. The weakest chapter is that on taxonomy, wherein only isozyme analysis is discussed, completely ignoring the last two decades of progress, which have seen molecular genetic techniques replace it.

Nevertheless, there is a wealth of information and references in this book. My advice to the postgraduates and researchers for whom the work is intended is to have your library buy it (few individuals will be able to afford its outrageous price). Use it as a starting point, but do not expect a synthesis of the subject, and do not trust it implicitly.

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Eco-labelling in Fisheries: What Is it All About?

Edited by B. Phillips, T. Ward and C. Chaffee

Blackwell Science, Oxford, 2003.

ISBN 0-632-06422-6, £39.50. Soft cover, pp. xii + 196, 3 tables, 1 box, 8 figures, subject index, species index.

Eco-labelling allows the consumer to identify products that have been brought forward in an

environmentally acceptable way. Provided consumers are sufficiently concerned about environmental issues, such labelling will promote environmentally sound practices, as defined by those who control the eco-label. Environmentally conscious consumers will shun unlabelled products and, if they are many enough, will either drive the producers out of business or force them to mend their ways.

This book is largely about the work of the Marine Stewardship Council (MSC), established in 1997 by the World Wildlife Fund and Unilever. This is not surprising, because the MSC is the most ambitious attempt so far to establish a worldwide eco-label for fish products. Two contributors (Chapter 13), representing the original MSC partners, state that the purpose was to increase the long-term supply of fish through promoting better management of fisheries. One wonders. If the purpose is to increase the long-term supplies of fish, then the eco-label should be awarded to those who manage their fisheries successfully for a maximum long-term yield. But many of the principles laid down by MSC, especially those on ecosystem management, have little or nothing to do with this. These principles, discussed in Chapter 4, suffer from the illusion that we can eat our fish and preserve it too. Among these principles are various points of strictly environmental concern, reflecting non-use values, which sometimes would be at the expense of fish as food supply for humans, such as providing forage for 'icon' or 'charismatic' species (p. 50) like seals and sea birds. It is unlikely that the industry will be enthusiastic for such principles; fishermen are about as likely to be willing to share their fish with seals and sea birds as farmers are to share their crop with birds or locusts and their livestock with foxes and wolves. It is indeed highly unlikely that maximizing our production of fish can take place without having wide repercussions in the environment where the fish live, and there are many signs that continued fishing has had such effects. In fact interference with the ecological balance in the sea, or rather turning it to our favour, is likely to be a precondition for maximizing our food supplies from the sea. Man is the only animal that has vastly outgrown its natural size in terms of numbers. The places where we grow our food and build our cities look nothing like what they once were; the original ecological balance is long gone and replaced by some other constellation. Why should the oceans be any different?

Nevertheless seven fisheries so far have taken the trouble to obtain certification from the MSC, and several chapters in the book discuss the certification process in these fisheries. What makes these chapters particularly interesting is that the contributors are in most cases drawn from different and antagonistic groups; industry, management and environmental groups. One of the most interesting of these is the discussion of the hoki fishery in New Zealand. An environmental organization in New Zealand disputed the certification of this fishery, pointing out among other things that its deleterious effects on fur seals and sea birds had not been properly taken into account. This led to a grievance procedure being established in the MSC, described in Chapter 6. The principles on which certification is meant to be based are open to interpretation, but had they been interpreted strictly, they might easily have prevented certification of the hoki fishery. The hoki fishery results in incidental catches of seals and sea birds, some of the latter considered to be endangered, which contradicts the ecological principles set down by the MSC. The chapter refers to impacts of an unknown magnitude which nevertheless "cannot be assumed to be insignificant, or even acceptable" (p. 149). Clearly it depends on the strictness of interpretation whether this precludes certification. Applying for certification was probably a shrewd risk-taking by the hoki fishery. The MSC would have risked marginalizing itself by refusing certification, and the hoki industry can make use of the MSC label for whatever it is worth.

Another interesting case is the Australian rock lobster fishery (Chapter 8), which was the first to be certified, as a part of developing the certification process. The part of this chapter penned by a representative of an Australian environmental organization argues forcefully that the certification of this fishery was in breach of the ecological standards of the MSC itself. This contributor points out how the MSC could modify its principles to make them compatible with its practice. Against this, it might be argued, as done above, that the MSC principles are open to interpretation, but this last contribution drives home the point that on a strict interpretation, no fishery in the world could probably be certified. That, however, would quickly put the MSC out of business.

Chapter 9 deals with the Alaska salmon fisheries. This is an interesting case because these fisheries comprise a very large number of independent stocks

of five different species. This case raised surprisingly few concerns from environmentalists, given that the fishery intercepts runs of sub-stocks in precarious conditions in the Pacific north-west and Canada, and is in part based on the release of large quantities of juveniles from hatcheries. Chapter 10 deals with the Thames driftnet fishery, which is very small indeed and chosen because it was a simple test case.

The success of the MSC and its eco-label is still uncertain; currently it covers about 1% of world fisheries. Its success, needless to say, depends on its recognition among consumers and the priority they give to the issues the label promotes. How concerned are consumers at large about the ocean and its fish? And are the world fisheries in trouble? Perhaps there is hope in the apparent fact that “perception is always more important than reality”, as it is put in the chapter on the history of the MSC (p. 30). However that may be, this is a timely and a useful book. Eco-labelling is a subject discussed in various places and in a number of courses at universities and colleges. The book includes a lot of factual information on eco-labelling in fisheries and discusses the issues from various angles.

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Imperfect Symmetry: Thermodynamics in Ecology and Evolution

Edited By L. Johnson

Torgoch Publishing, Sidney, BC, 2002.

ISBN 0-9731512-0-X, CAD 39.95, \$29.95, £19.95.

Available from Torgoch Publishing, 10201 Wildflower Place, Sidney, British Columbia, Canada V8L 3R3 (<http://www.torgochpublishing.com/>).

The raw materials of Lionel Johnson's *Imperfect Symmetry* were collected over three decades of biological surveys by the author and his colleagues in simple lake ecosystems of the Barren Grounds of the Canadian Arctic. The result is a grandly ambitious self-published volume that quite seeks to identify the key to the coalescence of physics and

biology. Johnson correctly points out that the historical scientific literature is littered with failed attempts. However, unless ecological and evolutionary processes operate outside the purview of science, physical and biological concepts must unite at some point. The truth in this is self evident and *Imperfect Symmetry* is Johnson's persuasive attempt to identify this junction.

Imperfect Symmetry begins with a thorough review of work on autonomous, pristine Arctic lakes, which yields an intriguing set of apex predator population data (lake trout, lake whitefish, Arctic charr) that are not easily interpreted but consistently share a suite of characteristics.

- Despite extremely low primary productivity, fish abundance in these lakes rivalled that in much more productive southern systems.
- Many fish individuals were found to be very large and old (25–30 years); but
- Length frequency distributions were almost invariably unimodal, with the modal class containing individuals from all age classes.

Fish growth being indeterminate, one would expect to find individuals of all sizes, with abundance decreasing with size and age. Resolution of this Arctic anomaly and integration of the emergent theories with the greater body of ecological knowledge sets the foundation for Johnson's grand proposal: *The Principle of Most Action*.

Johnson turns to first principles of physics to explain his ideas. Central to modern energetic theory is the *Principle of Least Action (PLA)*, which dictates energy will pass through a system as rapidly as possible – thus the *action* (time × energy) is minimized, given the constraints on the system. A thrown ball will follow the path that dissipates energy at a maxim rate (i.e. *least action*), given the constraints (initial speed, angle, resistance etc.). Conversely, Johnson argues these Arctic lake populations exist in a state of maximum biomass relative to energy assimilated; i.e. contrary to physical laws, individuals have acted to maximize the time delay of energy dissipation. This was made possible because of a suite of characters found only rarely in the contemporary natural world – literally pristine, autonomous biological systems experiencing environmental hyperstability. Under such conditions, individuals and populations can successfully maximize the time delay of energy dissipation through maximizing individual size, mean life span and individual uniformity. Johnson formalizes the idea as the *Principle of Most Action*. *Imperfect*

Symmetry of the title refers to the battle for ascendance between the two opposing forces – the biological *most action* and the physical *least action* – in living systems.

The relationship between the opposing forces is not static. In what amounts to a survey of the foundation of modern population and community ecology, Johnson demonstrates biological systems are characterized by rapid increases in biomass early on (i.e. are dominated by the *Principle of Most Action*). Accumulation of viable genetic changes leads to increasing population diversity and community complexity, which in turn increase the rate of energy dissipation by the system – the ascendance of the *Principle of Least Action* over evolutionary time. Johnson argues the interaction between the two forces explains most ‘emergent properties’ of ecosystems – this being no small claim.

The book is divided into two parts. Part One, the ‘Development of the Hypothesis’, is itself presented in two sections. The first is a thorough review of the Arctic lake survey data. With generous use of comparative graphics, Johnson outlines his ‘stepping stones of the Rosetta’ in developing his ideas around *most action*. He does a good job of addressing potential alternative interpretations of data while illustrating the uniqueness of these systems. With the *Most Action* hypothesis framed out, the second section of Part One turns to the question of ‘are Arctic systems unique?’. If so, Johnson’s insights would remain very interesting but of limited interest outside a select readership. The pelagic fishes of Lake Tanganyika, orange roughy and the cave fishes of the Ozark region of the USA are used among others to demonstrate that the *Most Action* hypothesis is not limited to Arctic systems. Here, as is the case throughout the book, there is a marine/aquatic bias in the examples and case histories examined. However, terrestrial and non-fish aquatic species and systems are prominently examined too, with European and North American forests, giant tortoises, bowhead whales and temperate and tropical molluscs all used to underscore the potential applicability of the *Most Action* hypothesis.

The final chapter of Part One, entitled ‘Strong Inference’, draws the heretofore discrete components of the *Most Action* hypothesis together and sets the stage for Part Two, ‘Testing the Hypothesis’. This leads to what I see as the only major

criticism of this work. The ‘tests’ of the hypothesis are in fact a collection of inferences (to which the author acknowledges). However, with this caveat, I was hard-pressed to find a significant hole in Johnson’s logic or interpretation. Part Two of the book recasts the *Most Action* hypothesis in eight different applications, chapters devoted to each and providing novel insight to, among other issues: succession and climax; the stability/diversity debate; *r*- and *k*-selection; and global energy flow. Some of the latter chapters are brief but all provide grist for the intellectual mill. The reader must approach *Imperfect Symmetry* as a starting point, not an ending – rigorous quantitative empirical tests of Johnson’s hypothesis are yet to come. Indeed I suspect the book was written for this purpose, to engage a new generation of scientists in this long-standing debate.

The text is engagingly written with ample references running the gamut from The Old Testament, Popper to Feynman and von Baer to MacArthur. The breadth of scope, not to mention the novelty of some of the ideas contained here, make this volume an interesting option for teaching. The materials used by Johnson to build his case are rarely less than two decades old, certain to be seen as problematic by some. However, given the novelty of the ideas presented, opting for a firm foundation over a thinner more expansive treatment is the more desirable approach – again, this is but a starting point. Johnson’s book lays a fresh set of ideas to be brought to the laboratory bench; it is up to the next generation to test and use them to best effect.

This book, 25 years in the making, is an intrepid piece of work by a journeyman ecologist. All ecologists will at the very least be engaged by Johnson’s insights, if not inspired outright to pick up where he leaves off. Indeed this work is crying out for quantitative examination and expansion. If Johnson’s inferences are correct – thermodynamic processes are the key to unifying physics and biology – the results will obviously be revolutionary.

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Tuna: Physiology, Ecology, and Evolution.
Fish Physiology Series Vol. 19 (Series editors:
W. S. Hoar, D. J. Randall and A. P. Farrell).

Edited by B. A. Block and E. D. Stevens

Academic Press, San Diego and London, 2001.

ISBN 0-12-350443-0, £89.00. Hardback, acid-free paper, pp. xiv + 468, 12 tables, 102 figures (19 in colour), subject index, extensive reference lists.

Tunas (Thunnini, Scombroidei) are fishes that are of interest to a wide scope of researchers: those drawn to study them because of unique morphological and physiological traits, and those with fisheries interests. *Tuna: Physiology, Ecology, and Evolution* is intended for such biologists, but is not concerned with commercial or game fisheries aspects of these fishes. There is, however, no lack of literature in these areas.

In page order, the book concerns the systematics, metabolism, cardiovascular system, adaptations for endothermy, tagging, reproduction, adaptations for swimming, oceanography, captivity and conservation. Every topic is relevant and deserves to be included. Each chapter is written by one or more leading authorities on the topic.

Block and Stevens have edited this book carefully. The chapters are consistent with one another and are presented in a clear style so that the book is lucid for its whole audience: biomechanics will understand the section on metabolism and energetics. I am not a native speaker of English, but I believe the text is clear for both native and non-native speakers.

Throughout the book, not only in the chapter on systematics, it is evident that the issue of tuna relationships (and of scombroid relationships as a whole) is unresolved. If there would be more clarity on the phylogeny of the Scombroidei, there would be more clarity on issues such as the evolution of

tuna endothermy and swimming adaptations. I regret not seeing the fossil record of tuna applied in evolutionary studies here. This area has therefore remained an unmarked territory. Only Graham and Dickson, in their chapter on adaptations for endothermy, refer to evolution in geological periods. Scombroids have an excellent fossil record, hence there is much potential for their use to solve evolutionary puzzles.

The coverage of published work consists of historical overviews and surveys of the most recent state-of-the-art developments, with the most relevant and freely available references all included, as well as suggestions for future research. All this is very valuable for the researcher, and even more so for students who may not be familiar with much of the available literature. But besides the surveys mentioned above, this book contains much that is new and exciting, for example chapters on tagging and biomechanics that present sound, new data. The book contains many new and informative figures, some excellently coloured, which are worth having.

Tuna: Physiology, Ecology, and Evolution makes essential reading for tuna researchers, but is also of relevance to others: comparisons to other scombroids and occasionally to yet other fishes appear throughout. As a whole, this collection has set a high standard in ichthyological literature. Although I heartily recommend this book, I do find it expensive. However, if you have not yet purchased it, then have your library order it. This ichthyological reference work is a worthy addition to any biological library.

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