

Giant Tiger Prawns and Their Culture

Publication of "**Biology and Culture of *Penaeus monodon***" by the BRAIS Project Staff has been announced by the Brackishwater Aquaculture Information System, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo, Philippines. The volume, authored by members of the BRAIS Project Staff and second in the BRAIS State-of-the-Art Series of publications, is a thorough review of the biology, ecology, and culture of the giant tiger prawn or "sugpo."

Much work on the species, important in aquaculture in the Indo-Pacific region, has been done by the SEAFDEC Aquaculture Department, and each chapter of the publication consolidates and synthesizes recent data in the respective fields. Following chapter one, which reviews the species' taxonomy, morphology, distribution, bionomics, and life history, various authorities cover: Maturation, reproduction, and broodstock technology; hatchery operations and management; prawn grow-out practices in the Philippines; nutrition; and diseases. Each chapter presents selected references for further information. Paperbound, the 178-page handbook costs US\$50 (P300), and is available from Sales/Circulation, Publications Section, Information Division, SEAFDEC, AQD, P.O. Box 256, Iloilo City, Philippines.

Also available from SEAFDEC is the "**Directory of Brackishwater Aquaculture Scientists**," an 82-page paperbound listing of 202 researchers, arranged alphabetically, who are involved in this aspect of fish culture. Given are the scientists' names, affiliations and addresses, degrees earned, field of specialization, and the species that they are knowledgeable about. It costs US\$25 (P100). Another BRAIS item is the "Di-

rectory of Brackishwater Aquaculture Institutions," an 89-page listing that costs US\$30 (P150).

In September 1987, a Seminar on Aquaculture Development in Southeast Asia was held in Iloilo City, Philippines. The proceedings of the have also been published by SEAFDEC as "**Perspectives in Aquaculture Development in Southeast Asia and Japan**," which is subtitled Contributions of the SEAFDEC Aquaculture Department. The proceedings, a comprehensive account of the seminar, reviews and examines the existing aquaculture technologies in Southeast Asia, evaluates the contribution of

Assessment of Fish Diseases

"**Methods for the Microbiological Examination of Fish and Shellfish**," edited by B. Austin and D. A. Austin who are with the Heriot-Watt University's Department of Biological Sciences, Edinburgh, Scotland, has been published by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158 in the Ellis Horwood Series in Aquaculture and Fisheries Support. Disease remains an important problem and an impediment to aquaculture although many advancements have been made in recent years. This new multi-authored volume is a manual for those with not only an interest in fish diseases, but who are directly involved in the practical, day-to-day aspects of fish disease and diagnostics. And the many authors have provided detailed and practical information here on the methods used for the study of fish and shellfish microbiology.

SEAFDEC's Aquaculture Department to these technologies, and suggests future avenues of regional aquaculture research and training.

Articles provide, first, a broad overview of the region's aquaculture industry, and then more specific analyses of aquaculture development in Japan, Malaysia, the Philippines, Singapore, Thailand. Other contributions discuss broodstock management and seed production of *Penaeus monodon*; milkfish; rabbitfish, *Siganus guttatus*; sea bass, *Lates calcarifer*; tilapia; carp; and the farming of mussels and oysters. A final chapter review the training programs of the SEAFDEC Aquaculture Department. The 316-page paperbound volume is available from SEAFDEC (price not listed).

Other SEAFDEC publications produced include extension manuals ("Nutrition and feeding of *Penaeus monodon*," US\$28, P80; "Broodstock of Sugpo," US\$28, P80) as well as extension pamphlets and color posters on prawns and prawn culture.

Following a general introduction, chapters discuss methods for sampling fish and shellfish, live and dead; transportation of samples, clinical examination of diseased fishes and shellfishes, histology, serology, microflora of healthy animals, various bacterial pathogens of aquatic vertebrates, the isolation and characterization of fungal and viral pathogens/parasites, and human pathogens in shellfish.

Material is included on disease signs indicated by observation of infected stocks, behavioral changes that are attributable to diseases in fish, external appearances and internal clinical signs indicative of diseases, and more. The chapters conclude with bibliographical or selected references for further guidance. In short, this is a good, practical guide to fish and shellfish problems and how to assess them. Included are organism and general indexes, and the 317-page hardbound volume is available from the publisher at \$89.95.

What Is a Gadiform?

“**Papers on the Systematics of Gadiform Fishes**,” edited by Daniel M. Cohen, has been published by the Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007, as number 32 in its Science Series. The book is an outgrowth of the Workshop on Gadiform Systematics (WOGADS) which was convened at the Museum in January 1986. The meeting addressed three basic points: 1) What belongs in the Gadiforms? 2) What is the relationship of the order to other groups? and 3) What are the interrelationships among gadiforms? The presentations in this volume, then, are an effort to answer those basic questions—obviously not an easy task.

Two papers are presented by Dirk Nolf and Etienne Steurbaut, one in which they characterize most gadiform fishes by a unique otolith character, noting similarities between otoliths of gadiforms and batrachoids and suggesting ophidiiforms as a possible sister group. In the other paper they describe and compare the otolith-based fossil record for gadiforms and ophidiiforms and discuss hypotheses on the evolution and paleoecology of them. Douglas F. Markle, in “Aspects of character homology and phylogeny of the Gadiforms,” considers the gadiforms to be monophyletic, as do Colin Patterson and Donn E. Rosen who evaluate the characters and relationship of gadiform fishes within the framework of the Paracanthopterygii, accepting the consensus, including in the Gadiformes the macrouroids and excluding ophidioids and zoarcids. Markle also excludes ophidiiforms and zoarceoids, and calls the batrachoids the most likely sister group.

Additional papers then deal at length with the various taxa within the gadiforms, with various authors utilizing different character sets, different evaluations of the meaning of character states, and different analytic methodologies to arrive at considerably different conclusions. As editor Cohen notes, this “. . . makes it abundantly clear that gadiform systematics remain far from a closed book.” This book, however, does

a fine job of elucidating the differences in approaches to gadiform systematics and the varied conclusions for the systematics student. Hardbound and indexed, the 262-page volume is available from the publisher at \$50.00.

Canada's Response to the LOS Regime

Publication of “**Canadian Oceans Policy, National Strategies and the New Law of the Sea**,” edited by Donald McRae and Gordon Munro, has been announced by the University of British Columbia Press, 6344 Memorial Road, Vancouver, BC Canada V6T 1W5. McRae is Dean, Common Law Section, Faculty of Law, University of Ottawa and Munro is professor of economics, University of British Columbia.

This volume presents a multidisciplinary perspective on the nature and adequacy of Canada's ocean management policies and practices in light of the international regime that emerged from the 1982 Convention on the Law of the Sea. Chapter authors are noted lawyers, political scientists, economists, fisheries scientists, and diplomats who specialize in various marine disciplines.

The first two chapters specifically address fisheries matters and illustrate the wide range of issues that Canada has had to confront in implementing its 200-mile zone, particularly in relation to the allocation of shares of resources to foreign fishing vessels. Parzival Copes first reviews the international dimensions of Canadian fisheries management policy, and notes that long-term economic prospects for distant-water foreign fleets in the Canadian zone do not appear bright; this may help ease some of Canada's marine fishery management problems. Munro and Robert L. Stokes then review the Canada-United States Pacific salmon treaty, providing a historical background to it and assessing the important legal, biological, political, and economic aspects of it, but stressing the economic aspects.

Part 2 considers Canada's seabed mineral resources, while Part 3 treats the marine environment and its protection,

and Canadian policy on aquatic science research, in which Norman J. Wilimovsky states: “Management of natural resources is heavily dependent on basic and applied research. Identification of research needs and their relative priorities in the context of regional or national policy requires documentation for rational evaluation. Policy formulation begins at the top, but to be realistic and workable, such policies require development upward and from the local or regional level.”

Chapters on sovereignty discuss the delimitation of maritime boundaries, sovereignty and security in the Arctic, and the balance between seapower, security, and sovereignty. Final chapters assess the future of international oceans management and both domestic and international dimensions of future Canadian oceans policy. The 268-page volume is available from the publisher at \$39.95 (hardbound) and \$22.95 (paper).

New NMFS Scientific Reports Published

Some publications listed below may be sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Copies of all are sold by the National Technical Information Service, Springfield, VA 22151. Writing to either agency prior to ordering is advisable to determine availability and price (prices may change and prepayment is required.)

NOAA Technical Report NMFS 67. Squires, Dale. “**Index numbers and productivity measurement in multi-species fisheries: An application to the Pacific coast trawl fleet.**” July 1988, iii + 34 p., 1 fig., 36 tables, 6 app.

ABSTRACT

This study is concerned with the measurement of total factor productivity in the marine fishing industries in general and in the Pacific coast trawl fishery in particular. The study is divided into two parts. Part I contains suitable empirical and introductory theoretical material for the examination of productivity in the Pacific coast trawl fleet. It is self-contained, and contains the basic formulae, empirical results, and discussion. Because the

economic theory of index numbers and productivity is constantly evolving and is widely scattered throughout the economics literature, Part II draws together the theoretical literature into one place to allow ready access for readers interested in more details.

The major methodological focus of the study is upon the type of economic index number that is most appropriate for use by economists with the National Marine Fisheries Service. This study recommends that the following types of economic index numbers be used: chain rather than fixed base; bilateral rather than multilateral; one of the class of superlative indices, such as the Tornqvist or Fisher Ideal.

NOAA Technical Report NMFS 68. McHugh, J. L., and Marjorie W. Sumner. "Annotated bibliography II of the hard clam *Mercenaria mercenaria*." September 1988, iii + 59 p.

SUMMARY

This publication we add another 460 citations to an earlier collection of 2,233 titles (McHugh et al., 1982), nearly all accompanied by abstracts. This bibliography is divided into three parts. Part 1 comprises the bulk of the bibliography, while parts 2 and 3 contain additional titles that we decided to include during editing, submission, and approval of the manuscript for publication. All three parts are indexed together, however. Reexamined were those titles in the previous bibliography (McHugh et al., 1982) which did not include abstracts. These are included in Parts 2 and 3 of this bibliography.

NOAA Technical Report NMFS 69. Sindermann, Carl J. (editor). "Environmental quality and aquaculture systems. Proceedings of the thirteenth U.S.-Japan meeting on aquaculture, Mie, Japan, October 24-25, 1984." October 1988, iii + 50 p.

CONTENTS

Relationship between fish culture methods and pondwater quality in freshwater fish culture by C. Kenji; Environmental management of larval rearing of marine fishes—A short history of research to prevent lordosis in red sea bream, *Pagrus major* by K. Fukusho and C. Kitajima; Salinity tolerances of marine bivalves by S. Funakoshi, T. Suzuki, and K. Wada; Temperature preference of immature horse mackerel, *Trachurus japonicus*, in a vertical temperature gradient by A. Furu-kawa, H. Fukatani, and S. Tsuchida; Effects of environment on seedlings of king crab, *Paralithodes camtschaticus* by T. Nakanishi; Some methods of water-flow control for mariculture by T. Noma; and Environmen-

tal conditions in pearl oyster culture grounds in Japan by K. Ohwada and H. Uemoto.

NOAA Technical Report NMFS 70. Sparks, Albert K. (editor). "New and innovative advances in biology/engineering with potential for use in aquaculture. Proceedings of the fourteenth U.S.-Japan meeting on aquaculture, Woods Hole, Massachusetts October 16-17, 1985." November 1988, iii + 69 p.

CONTENTS

Chum salmon growth hormone: isolation and effects on growth of juvenile rainbow trout by H. Kawauchi and S. Moriyama; Cloning and expression of cDNA for salmon growth hormone in *Escherichia coli* by S. Itoh, S. Sekine, and H. Kawauchi; Molecular toxicology: A new frontier by T. T. Chen, R. J. VanBeneden, L. B. Agellon, D. A. Howard, and R. A. Sonstegard; Necessity of dietary sterols and phospholipids for growth of the prawn, *Penaeus japonicus* Bate by S. Teshima and A. Kanazawa; Applications of endocrinology to salmon culture: Hormonal induction of spawning of adults and hormone patterns during development of juveniles by W. W. Dickhoff; Isolation and development of protoplast in *Porphyra* by H. Kito; Genetic engineering and biotechnology of economically important seaweeds by D. P. Cheney; Mass culture of *Ulva lens* as a feed for abalone, *Haliotis discus hannai* by K. Takahashi and A. Koganezawa; Bacterial products and polysaccharide films as cues and enhancers of oyster set by R. M. Weiner, L. Dagan, M. P. Labare, R. R. Colwell, D. B. Bonar, and S. L. Coon; Juvenile hormone in crustaceans by H. Laufer, D. Borst, F. C. Baker, and D. A. Schooley; Recent advances in nursery culture of bivalve mollusks in North America by J. J. Manzi and N. H. Hadley; Tissue culture and genetic engineering for seaweed aquaculture by N. Saga and Y. Sanbonsuga; Preliminary investigations on cryopreservation of marine bivalve gametes and larvae by L. L. Ellis; Microparticulate diets for fish larvae by A. Kanazawa and S. Teshima; Sowing culture of scallop in Japan by H. Ito.

NOAA Technical Report NMFS 71. Alton, Miles S., Richard G. Bakkala, Gary E. Walters, and Peter T. Munro. "Greenland turbot *Reinhardtius hippoglossoides* of the eastern Bering Sea and Aleutian Islands region." December 1988, iii + 31 p., 34 figs., 10 tables.

ABSTRACT

Greenland turbot (*Reinhardtius hippoglos-*

soides) is a commercially important flounder in both the North Atlantic and North Pacific Oceans. In the latter, its center of abundance is in the eastern Bering Sea and along the Aleutian Islands chain where its population is managed as a single stock. Harvest levels in this region of the North Pacific during the period 1970-81 were comparable with those in the northwest and northeast Atlantic, with annual average catches of 53,000 metric tons (t). However, the catch in 1984 dropped sharply to 23,100 t, in part because of reduced quotas arising from concern over continued poor recruitment and declining catch-per-unit-effort.

Recruitment failure was manifested in 1) the sharp decline in the catch rate of young fish in annual research trawl surveys on the continental shelf of the eastern Bering Sea and 2) an increasing proportion of older and larger fish in the commercial catch from the continental slope of both the eastern Bering Sea and Aleutian Islands. The cause of the decline in recruitment could not be clearly identified.

Greenland turbot of the Bering Sea-Aleutian Islands share certain distributional features with the North Atlantic form. There is an apparent bathymetric change in the size and age of fish, with younger animals occupying continental shelf depths and the older individuals residing at depths of the continental slope. At shallow depths the young are exposed to temperature fluctuations, whereas older animals along the slope are exposed to relatively stable temperatures.

A hypothesis is proposed for describing the temporal and spatial paths by which young animals reach the mature or spawning portion of the population.

NOAA Technical Report NMFS 72. Penttila, Judy, and Louise M. Dery (editors). "Age determination methods for northwest Atlantic species." December 1988, iv + 135 p.

ABSTRACT

The successful application of techniques to enhance detection of age marks in biological specimens is of vital importance in fisheries research. This manual documents age determination techniques used by staff at the Woods Hole Laboratory, National Marine Fisheries Service. General information on procedures for preparing anatomical structures is described, together with criteria used to interpret growth patterns and assign ages. Annotated photographs of age structures are provided to illustrate criteria. Detailed procedures are given for the following species: Atlantic herring (*Clupea harengus*), haddock (*Melanogrammus aeglefinus*), Atlantic cod (*Gadus morhua*), pollock (*Pollachius virens*), silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), black sea bass (*Centropristis striata*), weakfish (*Cynoscion regalis*),

Atlantic mackerel (*Scomber scombrus*), butterfish (*Peprilus triacanthus*), redfish (*Sebastes fasciatus*), summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), witch flounder (*Glyptocephalus cynoglossus*), American plaice (*Hippoglossoides platessoides*), yellowtail flounder (*Limanda ferruginea*), surf clam (*Spisula solidissima*), and ocean quahog (*Arctica islandica*).

NOAA Technical Report NMFS 73. Vecchione, Michael, Clyde F.E. Roper, and Michael J. Sweeney. "Marine flora and fauna of the eastern United States Mollusca: Cephalopoda." February 1989, iii + 23 p., 29 figs.

ABSTRACT

The cephalopods found in neritic waters of the northeastern United States include myopsid and oegopsid squids, sepiolid squids, and octopods. A key with diagnostic illustrations is provided to aid in identification of the eleven species common in the neritic waters between Cape Hatteras and Nova Scotia; included also is information on two oceanic species that occur over the continental shelf in this area and that can be confused with similar-looking neritic species. Other sections comprise a glossary of taxonomic characters used for identification of these species, an annotated systematic checklist, and checklists of the 89 other oceanic species and 18 other Carolinian and subtropical neritic species that might occur occasionally off the northeastern United States.

NOAA Technical Report NMFS 74. Krzynowek, Judith, Jenny Murphy, Richard S. Maney, and Laurie S. Panunzio. "Proximate composition and fatty acid and cholesterol content of 22 species of Northwest Atlantic finfish." May 1989, iii + 35 p., 3 tables, 1 app.

ABSTRACT

The moisture, fat, ash, fatty acid profile, and cholesterol content are reported for cooked and raw fillets from 22 species of finfish found in the Northwest Atlantic. All but nine species had 1% or less fat. Ocean perch and a spring sampling of mackerel and wolffish had about 2% fat, followed by yellowfin tuna, whiting, silver hake, butterfish, and a summer sampling of mackerel and wolffish with a range of 3-7% fat. Herring had a range of 5-12% fat representing a winter sampling on the low end and summer sampling on the high end of the range. Bluefin tuna (a summer sampling) contained the most fat with a high of 23% fat. Omega-3 fatty acids were present in excess of omega-6 fatty acids. The fattier fish supplied the most omega-3 fatty acids per gram of tissue. The mean cholesterol content for all species was 57 + 16 mg/100 g raw tissue. Finfish from the Northwest Atlantic would appear to fit into the regime for a healthy heart, being low in fat and cholesterol and rich in omega-3 fatty acids.

NOAA Technical Report NMFS 75. Simpson, David G. "Codend selection of winter flounder *Pseudopleuronectes americanus*." March 1989, iii + 10 p., 5 figs., 5 tables.

ABSTRACT

Codend selection of winter flounder (*Pseudopleuronectes americanus*) in 76-127 mm mesh codends was examined from experiments conducted in Long Island Sound during the spring of 1986-87. The results show a slightly larger size at selection than was found in earlier work as indicated by the selection factor, 2.31 in the present study compared with 2.2 and 2.24 from previous studies. Diamond mesh was found to have a length at 50% retention about 1 cm longer ($L_{50} = 22.6$ cm), and a selection range (3.4 cm) about 1 cm narrower, than square mesh in 102-mm codends. Tow duration varied from 1 to 2 hours using 114-mm diamond mesh. As has been found in previous studies, tow duration and L_{50} are positively related, with 1-hour tows averag-

ing 24.6 cm and 2-hour tows averaging 26.6 cm. The importance of the slope of the selection curve was examined in yield-per-recruit analyses by comparing knife-edge and stepwise recruitment. In all mesh sizes, stepwise recruitment provides a more conservative estimate of yield in the presence of a minimum size limit. Differences in yield estimates between the two models were generally small (1-7%), except in the largest mesh size, 127 mm, where yield is overestimated by 10% when assuming knife-edge recruitment.

NOAA Technical Report NMFS 76. Love, Milton S., Jeffrey Stein, Robert H. Moore, Michael Mullin, John S. Stephens, Jr., Meenu Sandhu, and Kevin T. Herbison. "An analysis of fish diversion efficiency and survivorship in the fish return system at San Onofre Nuclear Generating Station." April 1989, iii + 16 p., 14 figs., 3 tables, 4 app.

ABSTRACT

This study examined the efficiency of fish diversion and survivorship of diverted fishes in the San Onofre Nuclear Generating Station Fish Return System in 1984 and 1985. Generally, fishes were diverted back to the ocean with high frequency, particularly in 1984. Most species were diverted at rates of 80% or more. Over 90% of the most abundant species, *Engraulis mordax*, were diverted. The system worked particularly well for strong-swimming forms such as *Paralabrax clathratus*, *Atherinopsis californiensis*, and *Xenistius californiensis*, and did not appreciably divert weaker-swimming species such as *Porichthys notatus*, *Heterostichus rostratus*, and *Syngnathus* sp. Return rates of some species were not as high in 1985 as in 1984. Individuals of most tested species survived both transit through the fish return system and 96 hours in a holding net. Some species, such as *E. mordax*, *X. californiensis*, and *Umbrina roncadorensis*, experienced little or no mortality. Survivorship of *Seriphys politus* was highly variable and no *Anchoa delicatissima* survived.