

3) increased food processing, and 4) substantial growth in domestic seafood consumption. Industry experts concede that the country's over-reliance on shrimp (almost 80 percent of its seafood exports) and Japanese and U.S. markets pose dangers for the future. Meanwhile, alternative seafood products such as squid, tuna, cuttlefish, and various bottomfish remain almost totally unexploited by the Indian fishing industry. These fish are not being ignored, however. Fishermen allege widespread poaching by East Asian fishermen and the Indian Navy and Coast Guard have confiscated about 30-40 fishing vessels over the last 3 years.

A number of countries, as well as the UNDP and FAO, have promised assistance for the development of India's fishing sector, and particularly its shrimp

farms. Japan has offered the West Bengal State Government 700 million rupees (\$45 million) to expand shrimp farms. Thailand, France, and the UNDP also intend to assist in the development of a number of fresh and brackishwater shrimp farms and hatcheries. Australia will provide \$50 million in concessional credits to augment India's deep-sea fishing industry.

Some diversification of markets has taken place in recent years. There has been a steady decline in the percentage of seafood exports to Japan as that country increases its cultured shrimp imports from Indonesia, China, Thailand, Taiwan, and Vietnam. Western European countries have picked up some of the slack for India's exports, particularly in nonshrimp commodities.

India's Central Institute of Fisheries

Technology and other groups are seeking ways to expand seafood processing, utilizing the "trash" fish caught with shrimp, going after deep-sea and other nontraditional fish, and generating follow-up growth in domestic Indian seafood consumption—at prices higher than obtainable through exporting. The hurdles include the traditional Indian aversion to frozen and processed seafood (and the seafood processors' subsequent lack of faith in the domestic market), the huge costs of distributing fish in India, the inability to supply processors with fish in quantities to assure cost-competitiveness, and the reluctance of businessmen to invest in non-shrimp operations. (Source: IFR-89/104, prepared by Paul E. Niemeier, Foreign Affairs Specialist, Office of International Affairs, NMFS, NOAA, Silver Spring, MD 20910.)

Publications

Florida Bay, Artificial Reef Symposia Published

Papers and abstracts from the "Fourth International Conference on Artificial Habitats for Fisheries" have been published in the *Bulletin of Marine Science*, 44(2):527-1073, William J. Richards, editor. This large number is an impressive reference with reviews and recent work on artificial habitats, their construction, use, and economics; utilization by fishermen, fishes, and other marine life; and their role in mitigating habitat losses from various parts of the world.

Other articles discuss aspects of artificial reef development in the Mediterranean and Adriatic Seas; the current status, recent trends, and future plans for artificial reefs in Japan; a comparison of the accuracy of visual assessment methods for coral reef fishes; and the efficacy of different artificial reef designs in trop-

ical waters. Also included is an interesting debate on responsible artificial reef development. Articles also address aspects of rigs-to-reefs programs in U.S. and North Sea waters, tire reefs, development of epibenthic communities on artificial reefs, and effects of reef deployment on nearby resident fishes.

Abstracts published present work on artificial fish habitats in Guatemala, Lake Erie, Monaco, the U.S. Virgin Islands, Louisiana, and India. Other abstracts discuss estimation of reef productivity, building a coral reef, transplanting kelp in Los Angeles Harbor, artificial habitats in traditional fisheries, and much more. Altogether, the issue is an excellent reference on artificial fish habitat research and development. It costs \$35.00 plus \$3.00 shipping to non-U.S. addresses (an an-

nual subscription to the *Bulletin* costs \$68 for individuals and \$155 for institutions) and is available from the BMS Subscription Office, P.O. Box 368, Lawrence, KS 66044.

Issue number 1 of the same volume, 44(1):1-524, of the *BMS* was devoted to the "Symposium on Florida Bay, a Subtropical Lagoon," held 1-5 June 1987, and cosponsored by the U.S. National Park Service's Everglades National Park and the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Over 80 scientists, representing diverse disciplines participated and many contributed to this huge volume on the bay's ecology, management, and research. Most of the bay lies within the Everglades National Park, and this volume is the first compilation of research results for the unique ecosystem. The bay and its resources are threatened by environmental problems that originate well outside its protected borders, and knowledge about its functional processes, as documented by the symposium, may help to protect its natural state.

Many of the contributions deal specifically with the bay's fisheries and aquatic resources, including reports on juve-

nile fishes, ichthyoplankton, and early life history of spotted seatrout and gray snapper. Other articles discuss the areas spiny lobster and mullet, as well as fishery harvests and population dynamics of sea trout, red drum, and gray snapper. Food habits studies of various fishes are presented, as is work on fish movements and spatial distribution.

Other papers address decapod and stomatopod communities there, ecology of mangrove crabs, abundance and productivity of seagrasses and macroalgae, mangrove ecology, etc. Abstracts document studies on stone crab population characteristics, movement of various sport fishes, trammel net efficiency, osprey nesting, geology of the bay, distribution and abundance of pink shrimp within the bay, mollusk distribution in bay sediments, snook harvest and population dynamics, and more. Relatively little has been published on the resources and ecology of Florida Bay which makes this volume an even more useful reference. This is also available from the BMS Subscription Office for \$35 plus \$3 shipping to non-U.S. addresses.

Marine Toxins, Sulphur, and Natural Products in the Environment

Publication of "**Marine Toxins**," subtitled "Origin, Structure, and Molecular Pharmacology" and edited by Sherwood Hall and Gary Strichartz, has been announced by the American Chemical Society, 1155 Sixteenth Street, N.W., Washington, DC 20036 as ACS Symposium Series 418. This particular volume brings together results from selected fields of study into one handy reference, with emphasis on the structures and metabolic origin of toxins and the molecular basis for their toxicity. It was developed from the conference at the Marine Biological Laboratory in 1987 entitled "Natural Toxins from Aquatic and Marine Environments."

The toxins are discussed without chemical or taxonomic bias and range from small molecules to proteins; source organisms for them range from bacteria to vertebrates. Traditional structural studies

are included, as are discussions of contemporary molecular pharmacology and conformational chemistry. The book is divided into four parts, with Section one, "general considerations," presenting discussions of marine toxins and membrane channels; biosynthesis of red tide toxins; sources, chemistry, and pharmacology of the saxitoxins; the HPLC method applied to PSP research; tetrodotoxins and saxitoxins in marine bacteria (i.e., *Vibrio*, *Alteromonas*, *Plesiomonas*, and *Pseudomonas*); and natural toxins from blue-green algae.

Section two, on polyether toxins in seafood poisoning, includes articles on the molecular basis of ciguatera action; detection, metabolism, and pathophysiology of brevetoxins; X-ray crystallographic studies of marine toxins; and effects of maitotoxin on smooth and cardiac muscle. Section three presents perspectives on palytoxin—one of the most potent coronary vasoconstrictors known—including its pharmacological action, antibody production and development of a radioimmunoassay for it, and other pharmacological and toxicological studies. The final section, on peptide toxins, contains a review of the work on conotoxins, the biologically active peptides in cone snail venom; sea anemone polypeptide toxins that affect sodium channels; and chapters on sea snake venom (neurotoxins), the cytolytic peptides found in sea anemones, some natural jellyfish toxins, plus an article on pardaxin, the neurotoxic polypeptide from the Red Sea Moses sole, *Pardachirus marmoratus*, which targets gills and pharynx of aquatic animals and is eyed as a shark repellent.

Some of these toxins may have various pharmaceutical applications; some are of growing public health concern. This volume, presenting such a wide variety of research and reviews, is a useful contribution to many of those concerned with such problems or applications, for it presents or describes the sources of the natural toxins, emphasizing the metabolic pathways responsible for their synthesis. It also addresses the structures of the toxins and the features which determine both the distribution of toxic materials among the organs of intoxicated

species and the stability, disposition, and biotransformation of those toxins.

Noted one contributor, "Collaboration among research groups of different disciplines and among those in different regions seems indispensable for further progress in seafood toxin research." This volume should help advance such progress. Hardbound, the 377-page volume includes author, affiliation, and subject indexes, and is available from the ACS Distribution Offices at the headquarters address at \$74.95.

Progress in developing safer, more specific pesticides is being made along the lines of utilizing various natural products, including certain marine species or products. Work toward this end is covered in number 380 in the ACS Symposium Series, "**Biologically Active Natural Products**," edited by Horace G. Cutler of the USDA's Agricultural Research Service. This 31-chapter volume provides reviews and analyses of many biologically active substances that, formulated into a variety of products, could hold promise for "relief from a broad spectrum of agricultural problems." Or, for that matter, some fisheries problems. One chapter, "Protecting crops and wildlife with chitin and chitosan" by M. L. Bade and R. L. Wick, reviews potential utilization of these shellfish wastes to inhibit crop-damaging fungi and nematodes in lieu of using highly toxic pesticides. Another aspect reviewed is the use of chitosan-based biodegradable plastics to prevent some aspects of marine pollution.

Following a personal overview of natural products and their potential uses in agriculture by editor Cutler, chapters discuss the biological and pesticidal activities of avermectins—biologically active products from fungi; production of herbicidal and insecticidal metabolites by soil microorganisms; structural diversity and physiological activity of toxins of phytopathogenic microorganisms; approaches to studying structure/function relationships in naturally occurring cyclic peptides; and tentoxin as a potential herbicide. Another chapter by J. H. Cardellina, II, relates his investigation of marine algae and invertebrates which

might produce products active against terrestrial plants and insects, and reports isolation of some novel bioactive compounds. In all, the book provides a wealth of information and insights into this rapidly progressing field for chemists and biotechnologists. With author, affiliation, and subject indexes, the hardbound 483-page volume costs \$89.95.

“Biogenic Sulfur in the Environment,” edited by Eric S. Saltzman and William J. Cooper, number 393 in the ACS Symposium Series, provides a thorough look at the origins and fates of natural sulfur compounds. It also deals specifically with the cycling of biologically produced sulfur throughout both terrestrial and marine environments.

Included is previously unavailable data on the production of dimethyl sulfide by phytoplankton species, along with information on the emission of sulfur from the roots of trees, and an analysis of the role of marine and freshwater bodies in the sulfur cycle. In addition, organosulfur (thiol) formation and metabolism of acrylate and 3-mercaptopropionate in marine sediments are discussed, along with the roles of organisms ranging from common algae to anoxyphotobacteria in the ongoing sulfur cycle.

Following the overview of biogenic sulfur emissions for terrestrial and marine environments, the volume presents several chapters on sulfur emissions and transformation, with reports on the U.S. National Biogenic Sulfur Emissions Inventory, sulfur emissions from Florida wetlands, emissions from higher plants and trees, origin of hydrogen sulfide in

freshwater sediments, and sulfur cycling in an acidified lake. Additional chapters review dimethyl sulfide in the oceans, biogeochemical cycling of dimethyl sulfide in marine environments, dimethyl sulfide reproduction in marine phytoplankton, and dimethyl sulfide and (dimethylsulfonio)propionate in European coastal and shelf waters.

Other articles discuss thermodynamics and kinetics of hydrogen sulfide in natural waters, hydrogen sulfides in oxic seawater, microbial metabolism of dimethyl sulfide, decomposition products of DMSP in anoxic marine sediments, and more. Following that are contributions on the distribution and gas-phase and aqueous-phase transformations of sulfur compounds in the atmosphere, including a review of dimethyl sulfide and hydrogen sulfide in marine air. Altogether, the 43 scientific papers in chapter form provide a broad overview of the state-of-the-art in research and knowledge about the sulfur cycle, which is useful in comparing the impacts of human induced sulfur emissions. Included are author, affiliation, and subject indexes, and the 572-page hardbound volume costs \$99.95 (U.S. and Canada) and \$119.95 elsewhere.

A Handbook on the U.S. Freshwater Invertebrates

Publication of the third edition of **“Freshwater Invertebrates of the United States”** by Robert W. Pennak has been announced by John Wiley & Sons,

Inc., 605 Third Avenue, New York, NY 10158. This thorough volume has been considerably revised, and the author has reviewed more than 5,000 articles on the various species since 1978 in doing so. The result is a fine reference for field biologists and limnologists as well as for advanced students. Besides the extensive updating, the major difference between the second and third editions is that aquatic insects have now been dropped. At that, the book still runs a massive 628 pages. The Author is Emeritus Professor of Biology, University of Colorado, Boulder.

Also mostly new is a well written “introductory essay” which reviews the freshwater environment, origins of the freshwater invertebrate fauna, freshwater emigrants to the sea, and the major distinctions between marine and freshwater invertebrates. The 24 following chapters, ranging from the protozoans to the pelecypods, provide succinct reviews of the various groups’ general characteristics, historical notes on early studies of them, foods and feeding, biology, general ecology, reproduction, dispersal and geographical distribution, collecting and preserving, culture (where appropriate), taxonomy, and much more. Each chapter discusses a major animal group and presents an illustrated key for identifying its species or genera. Also included is a selected bibliography for further reading. The volume is very well illustrated, indexed, and an appendix lists various reagents, solutions, and laboratory items mentioned in the text. Hardbound, it costs \$42.50.