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 SSRF-776. Richards, William J. **"Kinds and abundances of fish larvae in the Caribbean Sea and adjacent areas."** May 1984, 54 p.

ABSTRACT

Fish larvae were studied from collections made in the western central Atlantic, principally the Caribbean Sea. Larvae were collected with bongo and neuston nets during two cruises of the FRV *Oregon II* in the summer of 1972 and winter of 1973. Eighty-eight families were represented in the bongo collections, and 58 families were represented in the neuston collections, for a total of 97 families represented overall. In the bongo tows, myctophid larvae were the most abundant and were represented in every collection. Gonostomatid larvae ranked second in abundance and occurred in all but two collections. Other abundant larvae were bothids, scarids, bregmacerotids, paralepidids, gobiids, scombrids, labrids, carangids, and serranids. The top 15 families accounted for 69-74 percent of the total larvae for both cruises.

On the summer cruise, five stations had >1,000 larvae under 10 m² of sea surface, with two of these near the Virgin Islands, one east of the Antilles, one south of Hispaniola, and one between Cuba and the Bahama Islands. On the winter cruise, two stations had 1,000 larvae under 10 m² of sea surface, and these were off the northern coast of Venezuela in an area of upwelling. This area is especially abundant in reef fishes with mid-depth fishes also common. Large concentrations of clupeids are not seen here, since they are in the Gulf of Mexico for lack of a large shelf area. Oceanic pelagic fishes, such as the scombrids, were only moderately abundant here compared with the eastern Atlantic. Since there is no major nutrient transport to most of the area, great abudances of fish are precluded. For the most part, the area is uniform in distribution and abundance of larvae, the exception being the northern coast of South America, an area of upwelling.

NOAA Technical Report NMFS SSRF-782. Wenner, E. L., W. P. Coon III, M. H. Shealy, Jr., and P. A. Sandifer. **"A five-year study of seasonal distribution and abundance of fishes and decapod crustaceans in the Cooper River and Charleston Harbor, S.C., prior to diversion."** July 1984, 16 p.

ABSTRACT

Fluctuations in the distribution and abundance of fishes and decapod crustaceans collected by a 6 m otter trawl net

ZEOLITES AND FISH CULTURE

"Zeo-Agriculture: Use of Natural Zeolites in Agriculture and Aquaculture," edited by Wilson G. Pond and Frederick A. Mumpton, has been published by Westview Press, 5500 Central Avenue, Boulder, CO 80301, as one of the Westview Special Studies in Agriculture/Aquaculture Science and Policy series. Pond is a research leader in nutrition at the USDA Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Neb.; Mumpton is a professor in the Department of the Earth Sciences, State University of New York, College at Brockport. The volume is a collection of research and review papers presented by an international group of experts at the "Zeo-Agriculture '82" conference organized by Mumpton.

Zeolites are a group of natural, inorganic silicates. Discovered in 1756, nearly 50 species of natural zeolites have now been recognized; more than 100 others have been synthesized in the laboratory. They are crystalline, hydrated metal aluminosilicates of alkali and alkaline earth cations with infinitely extending three-dimensional networks of AlO_4 and SiO_4 tetrahedra linked by the sharing of all oxygen atoms. As such, they are characterized by an ability to lose and gain water reversibly and to exchange some of their constituent cations without major change in structure. With their natural ion-exchange, absorption, and hydration properties, these minerals have broad applications for agricultural and aquacultural sciences: They can act as slow-release fertilizers for nitrogen and potassium, carriers for herbicides and pesticides, traps for heavy metals in sewage-sludge amended soils, and decaking agents for feed and fertilizer storage. They can remove toxic ammonia from fish hatchery waters and provide oxygen-enriched air to aquacultural systems.

Though some zeolite studies have shown great agricultural promise, others have not. However, their beneficial effects in fish hatchery/culture systems seem clearer, allowing reductions in energy use and increasing production. Additionally, use of zeolites in certain solar refrigeration systems may benefit fishery product storage in some areas. Some also forsee potential improvement in fish food with zeolites.

Mumpton begins with an overview of the use of natural zeolites in agriculture and aquaculture. The following section, "Fundamentals of Zeolite Science," reviews their occurrence, availability, properties, etc., and provides background information on this emerging field.

Sections 3, 4, and 6 review studies and research the uses of natural zeolites in agronomy and horticulture and in animal science and nutrition, and their use in agricultural engineering (animal wastes treatment, soil treatment, solar refrigeration). The

from the Cooper River-Charleston Harbor estarine system (South Carolina, USA) were examined over a 5-year sampling period. A total of 101 fish species and 41 decapod crustacean species were collected. Species richness was greatest at stations nearest the harbor mouth. Annual fluctuations in species abundance were apparently related to low bottom-water temperatures which affected year-class strength. Ten species accounted for ~90 percent of the total number and ~71 percent of the total biomass of finfishes collected in the estuary; *Stellifer lanceolatus, Anchoa mitchilli, Micropogonias undulatus, Brevoortia tyrannus, Leiostomus xanthurus, Symphurus plagiusa, Bairdiella chrysoura, Cynoscion regalis, Urophycis regia* and *Trinectes maculatus.* The decapod crustaceans *Penaeus setiferus, P. aztecus, Xiphopenaeus kroyeri,* and *Callinectes sapidus* dominated the finfishes in abundance but not biomass. They composed ~96 percent by number and ~97 percent by weight of the total decapod fauna. The biomass of fishes from this study is lower than values reported for other estuaries along the Atlantic coast of the United States.

The Cooper River-Charleston Harbor estuarine system, an important nursery area for fishes and decapod crustaceans, is characterized by gradual changes in faunal assemblages and considerable overlap in spatial distributional patterns of resident and transient species. Numerically dominant species of fish and decapod crustaceans form assemblages which are spatially and temporally ubiquitous. Resident estuarine species and stenohaline marine species are more restricted in their distribution.

NOAA Technical Report NMFS SSRF-783. Maurer, Don, and Roland L. Wigley, **"Biomass and density of macrobenthic invertebrates on the U.S. continental shelf off Martha's Vineyard, Mass., in relation to environmental factors."** July 1984, 20 p.

ABSTRACT

The mean density and mean biomass of macrobenthic invertebrates on the U.S. continental shelf off Martha's Vineyard, Mass., were 3,008/m² and 245.7 g/m², respectively. The latter estimate was considerably higher than values from the North Sea, Scotian Shelf, and Middle-Atlantic Bight. Mollusks (pelecypods and gastropods) and echinoderms (echinoids and ophiuroids) greatly influenced patterns of total biomass distribution. The ocean quahog, *Arctica islandica,* was the dominant species in terms of biomass. Total density was dominated by crustaceans (amphipods), polychaetous annelids, mollusks (small pelecypods), and echinoderms (ophiuroids). Mean density of molluscans was positively associated with sediment size. Mean biomass and density of crustaceans were negatively associated with depth, grain size, and bottom temperature, whereas the same parameters for the Echinodermata were positively associated with those environmental factors.

Three faunal assemblages emerged which were analagous to those described from earlier studies on Georges Bank (sand fauna, silt-sand fauna, muddy-basin fauna). The fauna from the Mud Patch most closely resembled the silty-sand fauna.

NOAA Technical Report NMFS 6. Collins, L. Alan, and John H. Finucane. **"Ichthyoplankton survey of the estuarine and inshore waters of the Florida Everglades, May 1971 to February 1972."** July 1984, 75 p.

ABSTRACT

Quarterly ichthyoplankton sampling was conducted at 16 estuarine and 24 inshore stations along the Florida Everglades from May 1971 to February 1972. The area is one of the most pristine along the Florida coast. The survey provided the first comprehensive information on seasonal occurrence, abundance (under 10 m² of surface area), and distribution of fish eggs and larvae in this area. A total of

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fifth section relates the use of clinoptilolite for ammonia removal in fish culture systems and in salmon rearing. And, several Italian scientists evaluate Phillipsite tuff for ammonia removal and its use in ammonium ion exchange in aquaculture systems. The conference presented much useful information for those unaware of current studies of zeolite research, its present uses, and its potential. Indexed, the 296-page hardbound volume is available from the publisher for $52.50.

Principles of Sonar Systems for Fisheries

Publication of **"Fisheries Sonar"** by R. B. Mitson has been announced by Fishing News Books Ltd., 1 Long Garden Walk, Farnham, Surrey, England. The new volume incorporates and greatly updates D. G. Tucker's 1966 volume "Underwater Observation Using Sonar." Mitson is with the Lowestoft Fisheries Laboratory of England's Ministry of Agriculture, Fisheries, and Food.

The book begins with an introduction to several methods of obtaining information under water for fish harvesting, fisheries research, oceanography, navigation, etc. Chapter 2 then provides basic technical data on acoustic waves, how they behave, and how beams and echos are formed. Chapter 3 reviews basic principles of simple sonar systems, with numerous figures of schematic drawings and photographs of echo-sounder recordings and CRT displays. The author also discusses transducers, theoretical considerations of sonar systems, noise, calibration, etc.

Processing of sonar signals from fish is discussed in chapter 4, while chapter 5 reviews the limitations and use of fishing echosounders, including use in demersal fish detection, pelagic fishing, and CRT displays in echosounding. Chapter 6 discusses horizontal beam sonars and their fisheries applications (practical sonar systems, operating and interpreting sonar, electronic beam scanning, computer controlled display, and color sonar). Finally, chapter 7 provides a look at other types of sonar (sonar imaging systems, frequency modulated sonar, long-range sonar and sector scanning sonar), acoustic estimation of fish abundance, freshwater vs. marine sonar requirements, detection of deep-water fish, and a look at future trends.

The author emphasizes practical interpretation and has provided a good clear review of basic physics of acoustics and the principles and operation of sonar systems. The volume is well illustrated with 140 diagrams and photographs, and includes a section on paper recordings and color displays of fish traces. The 287-page hardbound volume has a subject index and a glossary, and is available from the publisher for £26.00.

209,462 fish eggs and 78,865 larvae was collected. Eggs, were identified only as fish eggs, but among the larvae, 37 families, 47 genera, and 37 species were identified. Abundance of eggs and larvae, and diversity of larvae, were greatest in the inshore zone. The 10 most abundant fish families which together made up 90.7 percent of all larvae from the study area were, in descending order of abundance: Clupeidae, Engraulidae, Gobiidae, Sciaenidae, Carangidae, Pomadasyidae, Cynoglossidae, Gerreidae, Triglidae, and Soleidae. Clupeidae, Engraulidae, and Gobiidae made up 59.9 percent of all larvae. The inshore zone (to a depth of about 10 m) was a spawning ground and nursery for many fishes important to fisheries. The catch of small larvae (≤ 3.5 mm SL) indicated that most fishes identified from the 10 most abundant families spawned throughout the inshore zone at depths of ≥ 10 m, but *Orthopristis chrysoptera,* Gerreidae, and *Prionotus* spp. spawned at depths of > 10 m, with offshore to inshore (eastward) larval transport. Salinity was one of several environmental factors that probably limited the numbers of eggs and larvae in the estuarine zone. Abundance of eggs and larvae at inshore stations was usually as great as, and sometimes greater than, the abundance of eggs and larvae at offshore stations (due west of the Everglades).

Fish Populations and Their Analysis

"Fish Stock Assessment," subtitled "A Manual of Basic Methods" and written by J. A. Gulland, has been published as Volume 1 in a new FAO/Wiley Series on Food and Agriculture by John Wiley & Sons, Inc., One Wiley Drive, Somerset, NJ 08873. Gulland is Chief of the Marine Resources Service of the FAO Fishery Resources and Environment Division in Rome.

The author opens with an introductory chapter explaining why fish stock assessment is needed, the models used, and the effects of fishing on a population. The bulk of the book then deals with basic single species analyses. Chapters discuss the main types of fishery data obtained and used, methods of analysis, and methods of estimating such parameters as growth, mortality, etc. Two basic types of models are described—the simple surplus-production approaches and the analytic, age-structured models. Later chapters discuss methods used to account for other factors that affect stocks of individual species and interactions between different species.

The volume is a very good, practical handbook, providing many selected and additional references, as well as question and answer exercises for each chapter. The author outlines the theoretical basis of the methods described, as well as the limitations of the various techniques. An Appendix provides tables of yield per recruit for selected value of M/K. As a review and description of the techniques used in assessing fish stocks, evaluating the effects of fishing on them, and gauging the likely impact of different policies for developing and managing fisheries, the book is a handy and concise reference. Indexed, the 223-page hardbound volume is available from the publisher for $34.95.

The Management of Marine Fisheries

"Fisheries Management: Theoretical Developments and Contemporary Applications" by Geoffrey Waugh has been published as a Westview Replica Edition by the Westview Press, 5500 Central Avenue, Boulder, CO 80301. Waugh is a senior lecturer in economics at the University of New South Wales, Australia, and a fisheries management consultant to the NSW government. The Replica Edition series is designed to permit rapid publication of original scholarly works (softcover, typescript) in very small printings at high standards.

The book contains three parts: Part One reviews the problem of excessive depletion and the types of models that can be utilized to manage fishery resources. The author uses three fisheries for illustration: The international whale fishery, the Pacific halibut fishery, and the Western Australian rock lobster fishery.

Part Two is concerned with the practical problems of management. Fishery program objectives are evaluated and the types of regulations of fishing activity and catch level are evaluated "in terms of economic efficiency, flexibility and ease of implementation and enforcement."

Part Three examines the application and development of fishery management tools in Australia's Exmouth Gulf prawn fishery and the New South Wales abalone fishery. In sum, the author reviews the development of fisheries theory, outlines and develops bioeconomic models that can be applied to fisheries, and discusses institutional and regulatory possibilities for successful fisheries management, utilizing two examples of Australian fisheries. Paperbound and indexed, the 247-page volume is available from the publisher for $21.50.

IGFA Lists World Record Game Fishes

The 1984 edition of **"World Record Game Fishes,"** Elwood K. Harry, Director, published by the International Game Fish Association, is much more than a listing of the largest sport-caught and fly-caught freshwater and saltwater fishes. Although the angling records are a significant part, the book also presents articles and data of interest to sportsmen, conservationists, and other professionals involved in marine recreational fisheries.

Standard annual sections relate IGFA's philosophy, goals, etc., its international angling rules, world record requirements, and fishing contest and club requirements, as well as a guide to the identification of more than 150 major game fish species. Appendices list fish record-keeping organizations worldwide, U.S. state record-keeping agencies, and illustrate fishing knot tying techniques. Also provided is an index to common and

scientific names of fishes.

New articles this year include "A scientific look at light line fishing," by Paul C. Johnson, for those seeking the best chance of setting angling records with ultralight tackle. Well-known angler Stu Apte gives expert advice on catching world record fish and flies, while another prominent angler, Peter Goadby, discusses Sport fishing for sharks—the when, where, and how.

And, NMFS fisheries scientists Edwin L. Scott and Grant L. Beardsley of the Southeast Fisheries Center provide a worldwide inventory of marine and anadromous fish tag and release programs. Included is data on the history and uses of fish tags and tagging, as well as an extensive listing of state, federal, and international fish tagging programs, including species tagged and number tagged, area of tagging operations, type of tags used, tagging cooperators, and the chief scientist involved. Finally, "Fishing rods and their classification" is related by Joy Dunlap.

With 619 new world game fish records in 1983, the records section has been vastly updated. It includes listings (as of 1 January 1984) for IGFA freshwater and saltwater all tackle records (up to 130-pound test line), line class world records, and fly rod world records. Species are listed alphabetically by common names. IGFA also reports ample opportunities for record-seeking anglers, especially since expanding its all-tackle record program to species not previously listed.

A revised and expanded Glossary is keyed to the section on "Species Identification." Also included is a "Multilingual Guide to Common Names of Saltwater Fishes" in such languages as French, German, Hawaiian, Italian, Japanese, Portuguese, and Spanish.

1984 also marks the 45th Anniversary of IGFA's service to anglers. The organization, founded in 1939, is the largest data collection center for recreational angling in the world. Its extensive International Library of Fishes catalogs both popular and scientific literature from around the world on species, angling, biology, etc., and acts as an international clearinghouse for such data.

In sum, the paperbound volume is the comprehensive listing of world angling records and fish tagging programs, with an excellent selection of articles of interest to conservation-minded anglers. It is available from the IGFA, for $7.95.

Marine Recreational Angling and Management

"Marine Recreational Fisheries 8," subtitled "Marine recreational fisheries at the crossroads" and edited by Richard H. Stroud, has been published by the Sport Fishing Institute for the International Game Fish Association, National Coalition for Marine Conservation, and the SFI. It presents the proceedings of the Eighth Annual Marine Recreational Fisheries Symposium held in San Diego, Calif., on 26-27 April 1983.

The symposium and its proceedings were divided into six panels: 1) A general audit of important MRF resources and habitats chaired by Charles Fullerton; 2) a profile of marine resource user groups and the recreational industry, and their relationship to each other and to conservation chaired by Stuart Wilk; 3) an assessment of the state of the art of fisheries science, management, and enforcement techniques, plus an identification of specific needs chaired by Herbert Kameon; 4) a review of the structure and operation of the various management institutions and their successes and failures chaired by Ted Naftzger, Jr.; 5) an examination of the management policies affecting various species chaired by Izadore Barrett; and 6) a look at the present and future of marine fisheries management chaired by Peter Fithian.

In Panel 1, Elizabeth Venrick assesses the marine recreational fisheries of the California Current and John Pearce gives a detailed look at problems facing marine fisheries habitats. J. Frank Cogdell, in Panel 2, relates the MRF industry's role in fisheries development, while Lee Weddig and Edwin Martin give perspectives on the common grounds of the commercial and recreational fisherman.

In Panel 3, Gary Stauffer discusses the tools and concepts of fishery stock assessments, while Richard Hennemuth examines the role of scientific information in MRF management. And, James Messersmith and John Baxter examine the role of enforcement in marine fisheries management. In the fourth panel, Carmen Blondin reviews international fisheries management institutions, John Gottschalk discusses interstate cooperation in marine fish management, and George Reiger suggests ways that private organizations could do more to improve fisheries management. In the final panel, Charles Lyles and Richard A. Klingbeil discuss various facets of recreational fisheries management and William Gordon outlines several complex issues (allocations, conservation, funding, and habitat quality) which impinge on the future of MRF. In addition, he suggests moving toward a "unifying theory of fisheries management designed to provide fair and equitable treatment to all fisheries resource users," and toward a "conservation ethic in the future centered around the principle of taking no more than is needed or can be used."

The book provides some excellent and timely reviews of issues important to the future of MRF. Indexed, the 236-page hardbound volume is available from the International Game Fish Association, 3000 East Las Olas Boulevard, Fort Lauderdale, FL 33316-1616 for $15.00.

Recreational Fishermen

"Understanding Involved Fishermen: A Survey of Members of the Gulf Coast Conservation Association," by Robert B. Ditton and Stephen M. Holland, has been published by the Sea Grant College Program, Texas A&M University, College Station, TX 77843 as TAMU-

SG-84-623. It is a study of members of an association (of about 10,000 members) concerned with fishery conservation issues and the protection of recreational fishing interests.

Respondents (392 of 559 randomly selected members) were mostly middle-aged male anglers in professional-technical occupations with $40,000+ annual family incomes. Virtually all were active anglers who fished an average of 37 days per year, seeking most often speckled trout (in which 67 percent specialized), redfish, flounder, largemouth bass, and king mackerel, in that order. The GCCA members exhibited a pattern of "enhanced involvement" in fishing via magazine readership, club membership, tournament participation, boat ownership, and higher self-reported skill and catch levels. A majority of respondents also would support a variety of fishery conservation options, even if it required self-sacrifice in lower catch or higher fees. The 70-page paperbound report is available from the publisher for $2.00.

Salmon and Salmon Fisheries of Alaska

"Alaska's Salmon Fisheries," edited by Jim Rearden, has been published by The Alaska Geographic Society as one of the quarterly issues of *Alaska Geographic*, 10(3):1-128. Lavishly illustrated with color photographs and charts of catch data, the issue covers each of the Pacific salmon caught in Alaska: Chinook, *Oncorhynchus tshawytscha*; coho, *O. kisutch*; pink, *O. gorbuscha*; sockeye, *O. nerka*; and chum, *O. keta*. Each species' biology, range, common names, and other characteristics, plus native and commercial utilization, and average weights by state region and the statewide salmon catch (1973-82) are given.

Another section reviews salmon fishing gear and how it is used. Seines take almost half of Alaska's commercial salmon harvest (depending on species) (85 percent of the pink salmon, but only 2 percent of the chinook and 15 percent of the sockeye). Gill nets (drift and set) take about 48 percent of all salmon. Fish wheels, take less than 1 percent of the salmon and troll gear takes about 2 percent.

The largest section reviews Alaska's salmon fisheries by fishing region—and there are 13 different salmon management areas: Southeastern, Prince William Sound, Cook Inlet, Kodiak, Chignik, South Peninsula and North Peninsula, Aleutians, Bristol Bay, Kuskokwim, Yukon, Norton Sound, and Kotzebue Sound. Climate, geology, and other data is given for each, along with the types of fishing, species harvested, and percentages of the total state catch, brief histories of the fisheries, and the current fishery status. The paperbound 128-page volume is available from the Society at Box 4-EEE, Anchorage, AK 99509-6057 for $12.95 ($15.50 in Canada). Other marine-related AGS publications include "Islands of the seals: The Pribilofs," 9(3), $9.95; "The Aleutians," 7(3), $14.95; and "Alaska whales and whaling," 5(4), $12.95. A revised edition of "Fisheries of the North Pacific" by Robert Browning is also available, hardbound, at $24.95.

Fisheries of Indonesia And Taiwan Are Reviewed

Indonesia

Indonesian fishermen caught 1.87 million metric tons (t) of fish and shellfish in 1981, just 1 percent over the 1980 catch of 1.84 million t. Small-scale, artisanal fishermen harvested about 90 percent of the catch. Curing is the most important form of fish processing and over 50 percent of the catch was salted or dried in 1981. Only a small portion of the catch was canned and the rest was frozen or marketed fresh.

Indonesia's 1981 exports totalled 85,000 t, valued at over US$230 million. Indonesia's fishery imports totalled 31,000 t in 1979 and, while more current data are not yet available, projections indicate that imports have decreased in recent years and many observers expect them to continue to decline. Opportunities for U.S. fishery-related exports to Indonesia are primarily for fishing vessels, freezing equipment, processing euipment, and fishing gear.

Tappan Banerjee, a National Marine Fisheries Service official assigned to the U.S. Embassy in Jakarta, has prepared a 77-page report on Indonesian fishery developments in 1981. The report contains information on catch, processing, trade, and consumption. The report also contains information on Indonesian companies, government officials, development plans, and foreign aid programs in Indonesia. U.S. companies can obtain a copy of the report for $5.00 by requesting ITA-83-02-009, "Indonesian Fisheries—A Status Report," from NTIS, Springfield, VA 22161.

Taiwan

Taiwan's 1982 fisheries catch totalled 922,383 t, also a 1 percent increase over the 1981 catch of 911,678 t. The value of the catch increased to US$1.44 billion, a 5 percent increase over the 1981 value of $1.37 billion. Taiwan's fishery exports amounted to $756 million in 1981 (latest available figure), a decline compared with fishery exports in 1978.

Taiwan's decrease in fishery exports is believed to have been caused by the worldwide economic recession and a Japan-China joint venture in Hongchow, China, which has begun to compete with Taiwanese fishery exporters for the Japanese market.

The American Institute in Taiwan has prepared a 15-page report on Taiwan's fishing industry in 1983, with 7 statistical tables, which presents a general outline of Taiwan's fisheries and chapters on Taiwan's fisheries catch, fleet, and trade. The report also contains a section describing opportunities for U.S. companies. U.S. firms can obtain a copy of this report for $7.00 by requesting PB 83-214650, "Taiwan's Fishing Industry," from NTIS, Springfield, VA 22161.