

should be a required study for anyone with an interest in any aspect of environmental biology. It is a fascinating story and Pearcy has done it justice.

The book begins with a review of the life histories of the salmon and trouts, emphasizing the variations on the common theme of spending part of their lives at sea. Most species show some variation in time of migration and other life history parameters. The contrasting theories of marine versus freshwater origin of the salmon are discussed although the arguments for a freshwater origin are most convincing. There is still some conflict between life history and genetic data on interrelationships between the various species.

Once this foundation is laid the author focusses on the ecology of salmonids at sea and concentrates on seven Pacific species: five salmon and two trouts that have sea run populations. The general plan follows the life histories of the fish themselves beginning with the question "When is the best time to enter the dangerous ocean environment?" Salmon are most vulnerable to predation when they first enter the ocean as small fish facing big predators. In addition to predation, food availability plays a role in determining survivorship during this critical period and different species and stocks have met this challenge in diverse ways.

The role of estuaries varies with the species and the advantages and disadvantages of estuarine life are discussed with numerous examples. Chinook salmon in particular have developed a number of different ways of utilizing estuaries. Yearling chinook, along with coho and sockeye salmon, spend more time and grow to a larger size in fresh water, then move quickly through the estuaries. Some subyearling chinooks and chum salmon spend relatively less time in fresh waters and more time in estuaries. Pink salmon leave fresh water at a small size and pass quickly through the estuaries.

Survival in freshwater versus marine habitats comes next. There is evidence that the salmon have especially high mortality rates soon after they enter the ocean but it is difficult to correlate mortality with any single environmental factor. Variability in survival is reviewed along with such possible causes of mortality as predation, starvation, advective losses, osmotic stress and disease. Correlation with variable environmental factors such as temperature, salinity, and coastal upwelling provide some clues as to the causes of mortality but there is still much to be learned.

The author then concentrates on salmonids in three of the five oceanographic domains of the northeastern Pacific, beginning with the Oregon coho in the Transitional Domain of the California Current off the coasts of California, Oregon, and Washington. This is the author's specialty and he deals with this complicated subject with the strength of his own extensive experience. A review of the history of the fishery and the contribution of hatchery raised fish is followed by an examination of the causes of poor coho production including disease, smolt quality, and ocean conditions. Special attention is given to the El Niño events in 1982–1983 which caused increased temperatures, reduced upwelling, and reduced plankton production. Years with weak upwellings have low salmon production and several theories as to the processes that affect survival rates are reviewed.

The carrying capacity of the Central Subarctic Domain for these species forms a separate chapter. This includes a summary of trends in salmon production and a consideration of the causes for increases in total salmon production including oceanographic and atmospheric factors as well as the contribution of ranched salmon. Some intriguing speculations on the possibility for still further increases make this one of the most fascinating chapters.

The concluding chapter deals with the migration patterns of pink, chum, and sockeye salmon in the Alaska Coastal Current and concludes with some general considerations of the migrations of salmon and how they manage to return to their natal streams.

Altogether this is a most readable and informative book and one that should be on the shelf of all fishery biologists and anyone else who is sincerely interested in the environment. The documentation is extensive and the reference list includes more than 500 titles.

C. Lavett Smith
Curator, Department of Ichthyology
American Museum of Natural History
New York, NY 10024, U.S.A.

Ocean Resources, Volume I, Assessment and Utilization and Volume II, Sub-sea Work Systems and Technologies, edited by Dennis A. Arduis and Mi-

chael A. Champs, 1990. Kluwer Academic Publishers, Dordrecht, The Netherlands. Volume I 330 pages ISBN 0-7923-0952-9 (I). Volume II 240 pages, ISBN 0-7923-0953-7 (II). ISBN 0-7923-0954-5 (Set).

In 1983, President Reagan proclaimed a 200-mile Exclusive Economic Zone (EEZ) for the United States. This ocean zone, extending from the outer edge of the territorial sea to a distance of 200 nautical miles from the shoreline, is an ocean zone within which the coastal nation has sovereign rights over essentially all resources and economic uses. Given the size of the United States and its extensive coastline, the U.S. has the largest exclusive economic zone of any nation and, probably, the richest.

The U.S. EEZ proclamation followed by about a year the conclusion of the marathon Third United Nations Law of the Sea Conference. In April 1982, that conference produced the 1982 Law of the Sea Convention. While the United States has neither signed nor ratified the LOS Convention, the 1983 U.S. EEZ proclamation was consistent with the provisions of the Convention dealing with this new offshore ocean zone. The two volumes constitute the proceedings of the first meeting of the International Ocean Technology Congress established by an international group of ocean scientists and engineers "with a common interest in the development and conservation of ocean space and resources." Co-sponsors included the U.S. National Science Foundation, the Commission of European Communities, the Institut Francais de Recherche pour l'Exploitation de la Mer, the Industrial Technology Research Institute (Taiwan), University of Hawaii, Heriot-Watt University (Edinburgh), the Society for Underwater Technology, and the Marine Technology Society.

This set of two books, produced from camera-ready manuscript, has both the advantages and the disadvantages of most conference proceedings. On the positive side, much of the information presented is up to date (as of the time of the January 1989 conference) and has the freshness and diversity of the conference program itself. On the negative side, the papers are somewhat uneven being a mix of resource assessments in various locations, descriptions of mapping and exploration technologies, and (in Volume II) papers devoted to an assessment of the state of the art in sub-sea work systems and related developments in sensors and telemetry systems.

Volume I includes papers discussing the legal regime in general and, specifically, the impact of the Law of the Sea on ocean resource development and ocean resource technology. Additionally, Part 2 of the volume deals with the problem of geological assessment and the various technologies that are now available for mapping, EEZ resource reconnaissance, various types of surveying, and geotechnical investigations. Part 3 involves geological utilization and contains papers on various types of mineral resources found in the EEZ (aggregate resources, calcareous sands and the like). Ocean renewable energy topics are discussed in Part 4 including an assessment of wave energy technologies, the status of ocean thermal energy conversion (OTEC) developments in several locations. Living resources and space utilization and opportunities are dealt with in Parts 5 and 6. Only two papers deal with fisheries, one of which involves the use of acoustics with the assessment of fish stocks and the observation of fish behavior. The ocean enterprise concept as a way of bridging the gap between government funded R & D of new ocean technologies, on the one hand, and commercial funding by industry, on the other, is discussed in one of the papers in the space utilization chapter. The final part of Volume I deals with environmental assessment and includes papers on the use of circulation and pollution transport models for impact assessment in connection with various types of EEC development and issues associated with environmental assessments related to offshore oil and gas development.

Volume II will be of special interest to those concerned with the sea floor and, especially, with the status of sub-sea technology. Topics covered include marine robotic technology, underwater surveillance and work systems such as the JASON, manganese nodule mining systems, geotechnical tools for measuring the properties of the sea floor, sea bed mineral sampling systems, positioning systems of various types, and underwater acoustics and optical techniques.

In summary, these two volumes present a good cross-section of articles describing the state of the art in exploration and exploitation of ocean resources as of the date of this international congress, January 1989, and will be of considerable interest to professionals interested in the field. The publications will be of most usefulness to individuals desiring to "come up to speed" relatively quickly on this subject matter. Given the nature of these proceedings volumes, however,

readers will not find scholarly analytical presentations or carefully prepared review articles that put the subject matter in a broader perspective and context.

Robert W. Knecht
Center for the Study of Marine Policy
University of Delaware
Newark, DE 19716, U.S.A.