

Report

Fourth International Conference On Artificial Habitats for Fisheries

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350 Attend Four-Day Conference in Miami, Florida

The Fourth International Conference on Artificial Habitats for Fisheries was held November 2-6, 1987 in Miami, Florida USA. Its purpose was to organize and evaluate rapidly developing research and development for enhancing aquatic habitat and fishery populations in the world's freshwater and marine ecosystems.

Participants from 26 nations examined theoretical and practical state-of-the-art advances in science and technology by plenary and technical sessions, exhibits, posters, and discussions. About 350 scientists, managers, business people, and others exchanged information on artificial

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reefs, fish aggregating devices, and other artificial habitats.

Lucian Sprague, staff consultant to the World Bank on fisheries development and international marine policy, gave the keynote address. He told conferees that their work is especially important "because many natural habitats are fully exploited or degraded by nonfisheries use.

"In addition," he said, "artificial habitats have proven to be cost-effective tools for both fishermen and fisheries managers. This opens a treasure chest of classical studies on behavior and ecology."

Dr. Sprague reminded his listeners that the worldwide commercially important fish catch is no longer growing at a rapid rate, despite increased efforts. This coupled with increased fishing costs "has been an important element in



focusing attention on the investment potential for artificial habitats. Investors both large and small will wait to invest in technologies until there is a fairly high level of confidence in the data concerning costs and benefits," he said.

Sprague also stressed the need for understanding natural ecosystems.

"Greater efforts devoted to studies of tropical reef and forest ecology could also make a significant contribution to the development of unifying concepts in artificial reef research. I look forward to the time when more answers to some cost benefit questions will be available."

The conference examined artificial habitats from eight vantages: ecology, engineering and design, artisanal fisheries, fishery management, mitigation, rigs-to-reefs conversions, economics and policy, and assessment and monitoring. According to

William Seaman, Jr., Associate Director of the Florida Sea Grant College Program and conference steering committee chairman, the reef-building picture "is one of varied colors and clarity. We have a field that involves science and art,

high and low technology, and planning versus nearly haphazard activity."

In the opening plenary session, regional reviews of larger, older artificial habitat development efforts described technology used in Japan, the Mediterranean, Southeast

Asia, Australia, and North America. The range of uses of such habitat ranges from commercial and industrial fisheries to artisanal fishing, and recreational fishing as well as sport diving.

Richard Stone of the U.S. National Marine Fisheries Service told conferees that study of reef designs able to attract selected species is an im-

"...a field that involves science and art, high and low technology..."

portant area for future work. He noted that there had been a lack of information exchange between builders, researchers, and agencies. New funds for U.S. study are available from the 1984 National Fisheries Enhancement Act and Wallop-Breaux monies.

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Three Views on Reef Construction: Expand Efforts, Control Through Planning, or Abandon Inefficient Fisheries Management Tool

In what turned out to be one of the most well-received and stimulating portions of the agenda, to conclude the first day of the conference a debate presented three viewpoints on U.S. reef construction:

- 1) the public and private sector should continue building reefs;
- 2) artificial reefs should be built only by fishery managers and researchers;
- 3) reefs should not be built because it has not been demonstrated that they are the best fishery management tool.

This plenary session was organized by the steering committee to challenge conferees' concepts of artificial habitats. The speakers were asked to present information that did not necessarily reflect their own positions or those of their organizations.

Mike Meier, fisheries reef manager for the Virginia Marine Resources Commission, advocated public and private construction. He pointed out that the Atlantic and Gulf Coast nearshore seabeds are limited, and that relatively barren, flat sandy bottom is not generally considered productive of finfish. Natural drop-offs, ridges, wrecks,

and coral reefs do attract populations, as do fish aggregating devices. Thus, fishing activity clusters around these areas.

In the U.S., Meier continued, artificial reef-building has been largely the result of volunteer effort by recreational fishermen, sometimes working with public agencies. Where reefs were buoyed and anchored properly, sites have been productive for 15 to 20 years. In addition, the rigs-to-reefs movement of repositioning oil platforms as artificial reefs shows promise for sports and commercial fishermen, SCUBA divers, researchers, and oil companies to benefit together as obsolete equipment finds a new use.

The National Fishing Enhancement Act provides for a National Artificial Reef Plan, which offers technical guidance on reef planning, design, and siting for regional, state, and local development. Also, states are beginning to write their own plans, with provision for design and site evaluation and monitoring of permitted artificial reefs. According to Meier, the outlook is bright for improved communication among reef builders, state agencies, and re-

searchers that will lead to productive artificial reef programs along the U.S. coastline.

Ray Buckley, research scientist in the Washington State Department of Fisheries, stated that artificial reefs are a perturbation of the natural ecosystem, causing a redistribution of fisheries. He said it would be irresponsible to allow reef development for reasons other than research and carefully planned resource enhancement.

In too many cases, reefs have been sited with lack of planning and funding, resulting in little more than solid waste disposal areas. What is required is responsible development that evaluates benefits and impacts and enhances recreational fisheries. Researchers will work within these programs to assess the balance between aggregation and production, juvenile recruitment, and need for spawning preserves. Designs can provide for biological balance stable over time, under the direction of fishery managers and scientists concerned with long term marine resource development.

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Conference Report

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James C. Cato, Director of Florida Sea Grant, welcomed attendees, describing this state's marine and artificial reef activity.

"Florida is fifth in the U.S. in commercial fisheries and receives 14% of national recreational fishing income. We lead the country in boat sales. It's appropriate that Florida, with 218 active, permitted artificial reefs, act as host for a conference exploring marine habitats for both recreational and commercial use."



Private businesses and public agencies displayed 11 exhibits showing the latest developments in artificial reef technology and management.

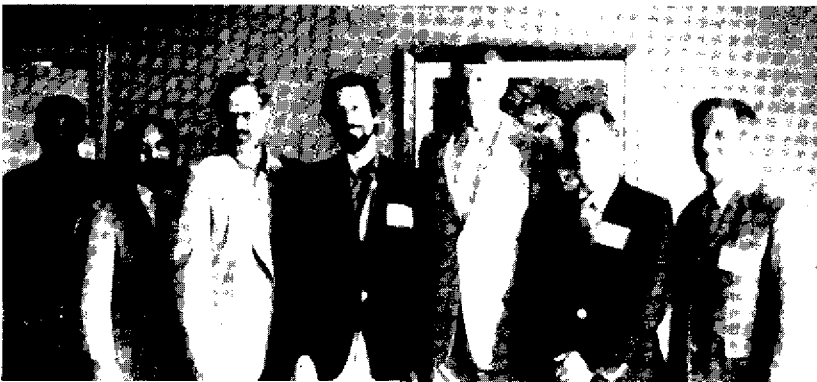
Letter from the Conference Steering Committee

The remarkable worldwide growth of interest and activity in the area of artificial habitats for fisheries was dramatically indicated by attendance at the Fourth International Conference on Artificial Habitats for Fisheries. We are gratified that 349 colleagues from 26 nations attended.

As described elsewhere in this newsletter, conference presentations revealed that not only has much new information about aquatic habitats been developed, but also new ways of looking at their uses have emerged in the last few years. For example, artificial reefs and related structures are viewed increasingly as one of what should be a package of fishery and ecosystem management practices, instead of just being used to foster excessive exploitation of fishery populations. Meanwhile, these habitats offer what one speaker described as a "treasure chest" of classical scientific study opportunities.

The 23 sponsors involved with the conference deserve special recognition. Their support enabled a broader geographic participation and a more diverse and complete program. We look forward to building even more cooperative efforts as planning for the Fifth International Conference on Artificial Habitats for Fisheries begins.

Until that time, scientists, managers, and laypersons will be able to take advantage of the global information network established in Miami. A new agenda for research, technology transfer, and development was established, and we believe that it will foster increased benefits in this field, while ameliorating some of the concerns expressed by conference participants. Our hope is that the momentum and enthusiasm generated by the program will have a lasting impact on artisanal, commercial, recreational, aquacultural, and conservation interests on all continents.



The steering committee met often during the conference to compare impressions and discuss the sessions. Left to right: Bill Alevizon, Jim Bohnsack, Dick Brock, Jeff Polovina, Bill Seaman (chairman), Dick Stone, and Ray Buckley.

Ancillary Meetings During Conference

As a forum, the Fourth International Conference on Artificial Habitats for Fisheries promoted exchange among various organizations and interest groups by encouraging ancillary meetings during the week. Among them were the following.

- Task Force of the Great Lakes Fishery Commission held organizational and planning meetings to draft a policy statement on artificial habitats in the Great Lakes of the U.S. and consider how to utilize conference presentations.
- Atlantic States Marine Fisheries Commission Artificial Reef Committee met to discuss a publication of reef profiles and development of a research agenda, database, and information exchange among the eastern U.S. states.
- Summit Meeting on Artificial Reefs in Florida was convened by Florida Sea Grant the day before the conference, with 90 leaders from around the state drafting various recommendations for legislative and other policy and programs.
- Review and exchange among formal reef programs conducted by state-level agencies in the U.S. was centered around the poster session, which promoted standard profiles of individual state efforts. Twelve posters were presented: California, District of Columbia, Florida, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Virginia, Washington, as well as Chesapeake Bay and Lake Erie.

Overview of Global Artificial Habitat Activities . . .

Conference reports from 19 nations reflected a greatly expanded level of scientific and technical effort directed to artificial habitat deployment and evaluation since the third international conference in this field in 1983. Although creation of artificial habitats to either enhance capture of fishes or increase their populations has been practiced for centuries in many areas of the world, only since 1974 have scientists and other interests convened international conferences to exchange information. Whereas the number of technical papers at the three previous conferences ranged from 17 to 43, reflecting effort in 4 to 7 countries, at the Fourth International Conference on Artificial Habitats for Fisheries 94 papers were presented. They were complemented by 37 posters (versus 14 in

1983 and none in earlier years).

Clearly the most technologically sophisticated habitat development program is in Japan, where large federal government investments in deployment and research affected 2036 square kilometers of fishing grounds in a two-phase program between 1976 and 1987. In this period approximately 460 billion yen were spent in creating over 6400 artificial reefs. The goal of this effort, to enhance seafood production, is shared with many other nations, including Taiwan, Israel, Italy, France and Australia. These latter nations, however, typically make lower investments and may use less costly or free surplus materials in less geographically extensive programs.

Artisanal fisheries also employ manmade structures to enhance harvest. Often natural materials such as

bamboo and brushpiles are used in floating or benthic structures. Reports from areas such as the Philippines, Jamaica, India and Sri Lanka were made to the conference. Some international development agencies (e.g., Bread for the World, World Bank) assist this effort as a means of restoring habitat, relieving existing fisheries, and creating new fisheries.

*...94 papers were presented
complemented by 37 posters...*

Creation of habitat to conserve environmental resources or manage overall fisheries is increasing. In Monaco, for example, reefs were deployed on the bottom to divert commercial trawling away from certain inshore areas.

Recreational fishing and diving benefits are sought by a relatively small number of nations, including Australia, Indonesia, and the United States. In the U.S., reefs and other habitats are built in a decentralized and largely uncoordinated manner by state and local public and private interests.

Worldwide, interest in artificial fishery habitats has accelerated in the 1980's. Effort runs the gamut from highly engineered structures to use of materials of opportunity. Historically, artificial habitats were bottom structures but use of mid-water or floating structures has become popular recently. Much effort is localized, and the application of scientific criteria to design and deployment is lagging actual efforts to create habitat, so that art and science are combined in this field. National plans exist only in a few countries, but research and development that has only started in the last few years will contribute to rapid advances worldwide in the near future.

Role of Artificial Habitats in Fisheries: Why?

Freshwater and marine habitats have been altered or had structures added to them even before the advent of modern fishery science. Efforts to enhance or conserve fishes, invertebrates, and plants include construction of stream gravel beds for spawning, sinking brushpiles to aggregate reservoir and lake fishes, stabilization of dredge spoil islands with various grasses, using buoys to attract pelagic fishes, sinking various concrete or steel structures for shellfish nursery and finfish reproductive sites, etc.

In the 1980's industrial, recreational, and artisanal fishing interests expanded their efforts to deploy artificial habitats because previous efforts proved to be effective in enhancing harvests of fishes. The popularity of this approach has spread to lay audiences, environmental managers, and various economic development interests. Many of these interests require basic information about arti-

cial habitats. Science meanwhile is grappling with certain basic issues and even explanations of how artificial habitats function. Evidence now exists that artificial habitats both add to basic biological productivity of areas as well as attract existing populations in a given area.

Explanation and evaluation of reefs and related structures have proceeded unevenly and lagged behind the actual application of technology. Certain studies, such as economics, are still quite new.

As noted in the accompanying article about "alternate viewpoints on responsible development" of reefs and related structures, there are now a diversity of organizations and individuals seeking to build reefs. Reefs are no longer considered in isolation from other elements of the environment. It is imperative that careful and responsible action be taken in this field.

... Summarizing the Research and Technology

In the closing plenary session, moderators of the eight sessions presented brief statements of at least some of the major findings and conclusions from the papers and discussion. To assist this process, during the conference attendees were asked to complete and return survey sheets regarding advances and priorities in this field. Immediately after the conference a late afternoon open forum met to allow remaining attendees to express additional views on needs and priorities. A more complete account is part of the special journal issue containing conference proceedings (see article on conference reports).

Artisanal Fishing

Benthic reefs and mid-water fish aggregating devices have been proven cost-effective for these fisheries' needs for food and income. Continued improvement of techniques is required, along with attention to practical controls of fishing mortality. Integration of artificial habitats with mariculture is envisioned.

Assessment & Monitoring

Techniques to assess the productivity and other effects of artificial habitats have lagged behind other areas of research. Limited studies indicate the need for greater effort in developing precise methods of assessing reef biota.

Ecology

Long-term data for many ecological phenomena are lacking, but a significant amount of new research has demonstrated both production and attraction of resources at artificial habitats, and documented physical factors and ecological composition associated with reefs. Emerging areas of research include limitations of ecological factors and requirements of individual species that can be addressed in habitat design.

Economics & Policy

National policies are highly variable, with perhaps only two national plans existing. Industrial and recreational fisheries express more concern for sustained harvest, while artisanal fishing nations seek better technology for more efficient harvest. Economic data are scant, and only in the last decade has limited research quantified benefits and costs.

Engineering

This, too, is largely a new field worldwide, although close integration of engineering and biological studies exists in a few places. Increasing quantification of design and construction is foreseen, along with transfer of technology from Japan where major industries now fabricate habitats.

Fishery Management

More than half the papers in this session demonstrated rapidly growing use of FADs. Trends in the use of artificial reefs, FADs, and other structures as fishery management tools include their use as research tools to answer ecological questions and to conserve aquatic resources.

Mitigation

Reefs (but not FADs) have been used in mitigation only recently, and in the U.S. mainly on the Pacific coast. There, development of a biota index for prediction of reef effectiveness has assisted agency and industry planning of mitigation. This field is also newly evolving as a branch of environmental science, so that long-term databases do not exist yet.

Rigs-to-Reefs

It is apparent that the greatest potential for conversion of obsolete petroleum structures to permanent fisheries habitat exists in the U.S., principally in the Gulf of Mexico. Policy constraints need to be addressed in realizing this potential, while economic and ecological im-

Three Views

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Jeff Polovina, of the Honolulu Laboratory of the U.S. National Marine Fisheries Service, claimed that artificial reefs are simply a management tool as are minimum size restrictions, closed seasons, catch limits, limited entry plans, closed areas, and habitat restoration. In his view, relative to other management tools, reefs are generally inefficient, and at worst counter-productive and expensive.

As examples of better fisheries management, he explained that size

"...artificial reefs are simply a management tool..."

at entry and fishing effort restrictions manage growth overfishing problems more effectively than artificial reef building. For recruitment overfishing, limiting the fishing effort and protection/replenishment of spawning stock are strategies of choice. He stated that, in either case, natural habitat was underutilized and that providing more habitat in the form of artificial reefs was inappropriate. In addition, if the reefs succeeded in aggregating the fewer remaining fish, the problems of growth and recruitment overfishing would be exacerbated.

pacts will need to be assessed.

Finally, general items include a need for public education and continuing exchange of technical information. The newness of several areas of inquiry argues for additional research, including quantitative study and experimentation. From a management standpoint transfer and utilization of existing data should be encouraged. Cooperative regional and international projects are seen as a cost-effective way of directing demonstrations and research.

Converting Obsolete Oil Structures to Reefs

Because of increased recognition and publicity for potential fisheries enhancement by offshore petroleum platforms, a special session of the conference was organized on the current status of "Rigs-to-Reefs." Productive fisheries around active platforms have led to efforts to use obsolete platforms as fish habitat by keeping them in the ocean, rather than salvaging them as scrap metal.

Rigs-to-reefs conversion represents a new research and development area for artificial habitat technology. Beginning in 1980 with the sinking of an Exxon Corporation structure off the U.S. Gulf of Mexico in Florida, the idea of platform recycling has become increasingly attractive in the U.S. and elsewhere. Sinking obsolete rigs for use as artificial reefs is an attractive economic alternative for petroleum companies, who might otherwise have to spend millions of dollars per structure for removal and salvage.

Recreational and commercial fishermen in the Gulf of Mexico have cruised off existing rigs for years, knowing that fish were attracted to the structures. About 4000 operable petroleum platforms are located in the Gulf and an additional 26 are off California, thus offering a significant source of materials.

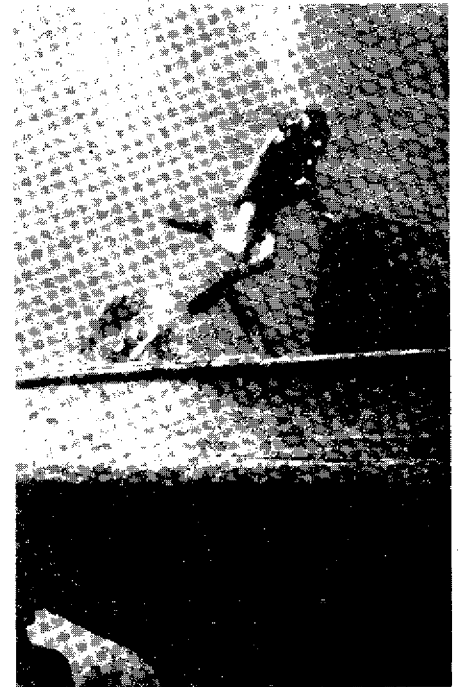
The variety of conference papers presented indicates that this is a fertile new field for research. Subjects included study of ecosystems and shellfish mariculture, wave force engineering, geological features of suitable seabottoms, technical problems in removal/relocation, and legal and policy issues.

Rigs-to-reefs research mainly stems from U.S. interests on the Pacific Coast and in Gulf of Mexico states, with one paper at this conference from Scotland. However, offshore oil rigs exist worldwide in various fishery settings. Rigs-to-reefs

research might focus on topics appropriate to artisanal-type harvesting as well as large-scale commercial or recreational fishing.

Robert Meek, of Ecomar, Inc. in Goleta, California, presented a conference paper on mussel and oyster culture on a rig in the Santa Barbara Channel. Establishment of shellfish beds on converted rigs in artisanal fisheries could offer diversification with a product that stays close to the fisherman's home. Meek says, for instance, that mussel production at the Santa Barbara site averages 10,000 pounds per month, with 200,000 oysters under culture.

According to Dana Larson, co-moderator with Villere Reggio of this conference session, effort might also be directed toward implementing results from the 1984 U.S. legislation, the placement versus disposal debate, and improvement of the ecosystem with technology.



Field trips included firsthand inspection of ship and petroleum platform reefs. The waterfront location of the conference also afforded easy access to an evening dinner cruise on Biscayne Bay.

Sponsors for the Fourth International Conference On Artificial Habitats for Fisheries

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U.S. National Marine Fisheries
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Development Cooperation



Conferees at the Knight Center and adjoining Hyatt Regency Hotel in Miami enjoyed facilities of exceptional quality.

The Artisanal Fisheries Viewpoint

Although habitat enhancement practices appear to be most commonly used in conjunction with industrial/commercial and recreational fishing, artisanal fisheries also employ them although they may not be as well publicized and certainly are less intensive. To broaden the geographic appeal of the conference program, the steering committee developed a special session on this topic.

Artisanal fisheries are characterized by family or cooperative village fishing efforts with small-scale harvest and local distribution. In countries where artisanal fishing predominates, information on species-specific design, creation of ecological models, and species protection and propagation is sought.

Dr. Giovanni Bombace, Acting Director for Marine Fisheries Research in the Mediterranean, Istituto di Ricerca sulla Pesca Marittima, Italy, mentioned the need to protect 3-mile artisanal fishing areas from trawlers.

"There is a narrow shelf along Mediterranean coastlines and conflict with illegal trawlers. We must use materials heavy enough that trawlers cannot sweep them away. We also would like to recycle materials as reefs to culture oysters and mussels, and to encourage growth of organisms low on the food chain," Dr.

Bombace said.

His colleague in India, Dr. P. J. Sanjeeva Raj, has been working with three villages in Tamil Nadu state.

Dr. Raj said, "We would like to extend more modern technology to all of this state, perhaps reaching out to the other nine maritime states. We are experimenting with a bamboo and coconut frond bottom FAD in an A-frame shape. Village fishermen can harvest with liftnets from catamarans positioned over the FADs."

Dr. Nurzali Naamin, Director of the Agency for Agricultural Research and Development, Research Institute for Marine Fisheries in Indonesia, says that artificial habitat building is an old technology in his island nation.

"However," he says, "we are working with new materials. Trawlers have been banned from the western island areas because of conflicts with artisanal fishing. About one million fishermen live here. We are concerned with restoring natural coral reef areas and increasing catch. We would also like to attract more tourist fishing and diving."

Dr. Bombace, speaking for Mediterranean regional problems, says that reduction in stocks and overfishing mandate the need to increase the area's biomass. Young life

forms need shelter, and study of breeding cycles and habitat characteristics is required. "Artificial reefs should not only attract and aggregate, but also be the means to cycle marine energy."

Jeffrey Polovina of the U.S. National Marine Fisheries Service spoke on Southeast Asian needs based on his work there and in Japan.

"In Thailand," he said, "artificial reefs help villages add reef habitat to the natural soft bottom habitat and hence attract more valuable reef-associated species."

Frederick J. Vande Vusse, a consultant in the Philippines, described how villages there work communally in a World Bank-financed project. Since 1984, these artisanal fisheries have tried to integrate with larger operations. Bamboo reefs were initially used but recently bamboo reinforced concrete reefs are being used because they have a longer life.

Plans for Next Conference

During the conference week, many attendees expressed enthusiasm for the next such event. While it's too early to mark calendars or select a location, the steering committee has started preliminary planning. Before dissolving, the committee will identify a chairman for the Fifth International Conference on Artificial Habitats for Fisheries and identify potential organizing/administrative sponsors and satisfactory conference sites.

The committee has received suggestions to hold the next conference in the Mediterranean basin or coastal Asia. Possible U.S. East or West Coast locations also were identified. Anyone wishing to chair the next conference should send a letter expressing qualifications and ideas to the address listed in this newsletter.

The Fifth International Conference will probably occur in 1990 or 1991. Two years of active planning are required to ensure success.

Published Reports from the Fourth International Conference

Three documents may be useful to persons seeking more information about the conference presentations:

1. Many of the contributions were accepted as peer-reviewed manuscripts for publication as a single issue of the *Bulletin of Marine Science*. This technical document (essentially a conference proceedings) may be available as early as late 1988, thanks to prompt editing. For purchase information, contact Editor, *Bulletin of Marine Science*, RSMAS, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149-1098, USA.

2. All presented papers and posters were summarized in individual abstracts distributed at the conference. A total of 134 abstracts are bound in

a document that may be purchased for U.S. \$10.00 from Florida Sea Grant Publications, G022 McCarty Hall, University of Florida, Gainesville, FL 32611-0103, USA. Checks should be made payable to University of Florida. Checks or money orders must be drawn against U.S. banks, only. Do not send currency.

3. Papers from the "Rigs-to-Reefs" special session are being produced in a standardized abridged format by the U.S. Minerals Management Service. Ordering information may be obtained from Minerals Management Service (LE2), Leasing and Environment Division, 1201 Elmwood Park Boulevard, New Orleans, LA 70123, USA.

The Report on the Fourth International Conference on Artificial Habitats for Fisheries was published by the Florida Sea Grant College Program, Building 803, Room 4, University of Florida, Gainesville, FL 32611-0341 USA. The report was produced by William Seaman, Jr., and Lin Welch. Dr. Seaman is Associate Director of Sea Grant and Associate Professor in the Department of Fisheries and Aquaculture, Institute of Food and Agricultural Sciences (IFAS), University of Florida. Ms. Welch is a writer/editor for Florida Sea Grant, IFAS Editorial Department.

