Artificial Reefs: Toward a New Era in Fisheries Enhancement?

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Anglers have used artificial reefs to enhance their fishing opportunities for centuries. Early reef construction in the United States dates back to the mid-1980's (Stone, 1974), while reef construction in Japan started even earlier. Ino (1974) found written evidence suggesting that artificial reefs were already in use in Japan between 1789 and 1801.

Since 1930, Japan has granted subsidies for the construction of various types of reefs. In 1952, Japanese artificial reef research and construction efforts intensified and since then they have continued to expand and improve their program. Artificial reefs are used by the Japanese to improve coastal fisheries. They build both shallow-water reefs (called "tsukiiso") for shellfish and seaweeds and deeper water reefs (called "gyosho") for finfish (Sheehy, 1981). Japanese scientists have evidence that specifically designed shallow water reefs can improve survival and growth of juvenile abalone (Sheehy, 1979).

While the Japanese have been putting millions, and in recent years billions, of dollars into developing sophisticated techniques to create new habitat and increase seafood production (Sheehy, 1982), the United States has pursued a less sophisticated and much more frugal approach. States and local groups have been responsible for most of the reef construction to date, often with limited budgets (Futch, 1981). Scrap materials, because of the low cost, have been used extensively in the United States (Parker et al., 1974), while Japan, and more recently Taiwan (Sheehy, 1981), have put most of their effort into specifically designed and constructed units.

Properly constructed artificial reefs made of scrap materials can enhance rough bottom habitat, provide quality fishing grounds closer to access area, benefit anglers and the economies of shore communities (Buchanan, 1973), and increase total fish biomass within a given area without detracting from biomass potential in this area (Stone et al., 1979). However, the extensive biological and engineering studies conducted by the Japanese, reflected in specifically designed reef material, allow for greater certainty that the reef will stay in place and provide the proper conditions for the particular species desired (Sheehy, 1979).

In recent years, several studies have been initiated in the United States to evaluate techniques that are commonly used in Japan and Taiwan, or to develop new techniques. Speakers at recent artificial reef conferences in Daytona Beach, Fla. (1979), and Atlantic City, N.J. (1981), highlighted these efforts and stressed the need to make reef construction more sophisticated and better organized.

The transfer of advanced Japanese artificial reef technology to the United States was one technique described at both conferences (Sheehy, 1981, 1982) that could provide considerable benefits for both recreational and commercial fisheries. Japanese reef units, made of fiberglass-reinforced plastic, are being tested at locations off Jacksonville and Panama City, Fla. Sheehy's (1981) presentation at the Atlantic City Conference explained how these reefs will be compared with rock reefs built in the same area by the State of Florida to determine biological and cost differences between the two types of reefs.

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The use of midwater and surface fish attractors is another fisheries enhancement technique that is receiving considerable attention both in Japan and in the United States. National Marine Fisheries Service experiments in the Gulf of Mexico and off Hawaii in the 1960's and 1970's demonstrated the potential of these devices. Since then, States and U.S. Territories have installed midwater and surface structures and have successful fisheries occurring around them. These units have been particularly productive in the western Pacific. Myatt (1982) described South Carolina's successful venture into the use of midwater fish attractors. In a controlled study, South Carolina biologists found that angler catch per unit of effort for pelagic species was 80.3 percent higher on the fish attractors than on traditional trolling areas.

Two relatively new reef construction techniques that have been developed in the United States involve mineral accretion and the use of coal combustion waste products. Hilbertz (1981) has described the process he has developed to use electrodeposition of minerals naturally present in seawater to build artificial reefs. His process involves the use of direct electrical current through preformed conductive material which precipitates calcium carbonates and magnesium hydroxides from seawater to form a stable substrate.

The second innovative reef construction technique was described by Woodhead et al. (1982). He reported progress in the use of blocks of coal combustion waste products as reef material. The proper mixture of coal wastes and stabilization additives has been determined so the blocks can be made with standard block making machines. A reef was constructed off Long Island, N.Y., in 1980 with 500 tons of these blocks. It will be monitored for 3-4 years to determine biological and environmental impacts.

Speakers at both recent artificial reef conferences promoted the need to inform the public and managers that the technology is available to enhance fisheries using artificial reefs. Buckley (1982) outlined effective management techniques with artificial reefs now being used in Washington to enhance both boat and pier fisheries. Similar information exists for some other States but frequently remains unpublished and unavailable to the public and the resource manager.

Another factor mentioned at both conferences as being integral to successful reef programs is the need for a stable funding base. Radonski (1982), in his summary statement on the 1981 Mid-Atlantic Artificial Reef Conference, suggested using the receipts from a saltwater fishing license on offshore anglers to fund artificial reef construction. He also discussed other funding sources such as tax incentives to industries that participate in reef construction efforts.

Another possibility that appears to have merit is the use of industry funds in the construction or maintenance of artificial reefs. In some cases, industries may build artificial reefs to mitigate habitat loss from development in estuarine or marine environments, while other industries may be willing to provide funds to maintain structures, such as gas and oil structures, as artificial reefs after their industry application is completed. The funding question will be a key to how rapidly advancements in artificial reef technology occur in the United States.

The papers presented at both of these recent conferences are indicative of the considerable interest by private companies and by local, State, and Federal Governments in improving the resource managers' options for habitat enhancement and fisheries development. They reflect what I believe is the movement toward a new era in fisheries enhancement. In this new era, industry and Government will have to work together to solve the problems of financing reef programs, improving the technology level, and communicating to resource managers the economic and environmental benefits that can result from habitat enhancement with artificial reefs.

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