## CASE STUDY 5

# ARTIFICIAL REEF PROGRAM IN LAKE ERIE, OHIO

#### Background

Artificial reefs are synthetically constructed underwater structures — they may be rock, sunken ships, auto bodies, rubber tires, and wood. Designed for structureless bottom areas in either fresh or salt water environments, they provide habitat for fish, habitat that includes food, shelter, protection, and spawning areas. Drawn by the new habitat, fish concentrate in these areas. Often artificial reefs are strategically placed at various depths and are built to particular heights to attract a specific species of fish.

Artificial reef construction may be a community effort, with technical assistance provided by state and federal agencies. Recreational fishing reefs are placed near access areas such as launch ramps and marinas and in locations where they will not interfere with navigation and commercial fishing activities.<sup>1</sup> Artificial reefs have been constructed all along the U.S. coast in salt water and in many inland lakes and reservoirs. Artificial reef programs have been implemented in many coastal states, e.g.,



Georgia, Florida, California, Texas, Alabama, Virginia, New Jersey, South Carolina, and Delaware. Studies indicate that when artificial reefs are constructed with proper materials, placed in good locations, and developed with a specific purpose and plan, they can enhance sustainable fisheries. Research in South Carolina, for example, attributes increases in time spent fishing and catch rates to the presence of artificial reefs. In many areas, new aquatic communities created by the artificial reefs draw increased numbers of recreational and commercial fishers and scuba divers — one result is travel and tourism dollars brought in by visiting anglers and their families, thus leading to positive economic impacts to local communities.

<sup>&</sup>lt;sup>1</sup> Kelch, D. O. and J.M. Reutter. 1991. Lake Erie's Artificial Reef Program. Ohio Sea Grant Program, OHSU-FS-021.

## Artificial Reef Program

Ohio's Lake Erie is the warmest, shallowest, and most productive of the Great Lakes; its western basin is known as the "walleye capital of the world" and produces more walleye per hectare than any other lake in the world. Historically, the western basin walleye fishery has made up the major component of Ohio's primarily recreational sport fishery.<sup>2</sup> As a result, Ohio's north coast has developed into a major recreational economy. The historical predominance of the walleye fishery within the western basin of Lake Erie is also the result of easy access to areas where the fish congregate.

Unlike the western basin, the central basin is deeper and larger — it also lacks the productive bottom structures that provide habitat for fish. These features, combined with the fact that schools of walleye are often located further from shore, make the walleye more difficult to locate in the central basin. Access for boat anglers is another difficulty: the rocky bluff and high bank terrain of the central basin impedes the construction of marinas and launch ramps, which are readily available to boat anglers in the western basin. As Kelch and Reutter point out, while there are many excellent fishing areas in the central basin, not all are within safe running distance for smaller boats. Fishery managers have recognized that construction of artificial reefs strategically located in areas easily accessible to boat anglers could attract greater numbers of anglers in the central basin. Furthermore, if the artificial reefs yield the expected results — attracting fish and thus increasing angler participation and catch rates — the fishery's role in helping develop a recreational economy in the Central Basin communities could be enhanced.

Ohio began an artificial reef project in 1986. While artificial reefs have been planned for the entire shoreline of Ohio, the central basin presently is the key area of development for reasons outlined above. The U.S. Army Corps of Engineers has granted permits for five sites. To date, two reef structures have been constructed — the Lorain County reef and the Cuyahoga County reef. The purpose of the reef project is to create a demonstration project to evaluate the productivity and feasibility of reef construction in other areas of Lake Erie and the other Great Lakes. Evaluation of the demonstration project's effects on recreational activity and the expected effects of similar reef structure in other coastal areas are priority needs for sustainable coastal development policy of the central basin.

The Lorain County reef consists of two reef structures, one about 370 meters long and the second about 183 meters long. The Cuyahoga County reef, also known as the Cleveland site, is made up of one reef structure 213 meters long in 8.5 meters of water and a series of unconnected sandstone "rubble piles" in deeper water. The reefs were constructed from scrap rock and concrete and are located within close proximity to ports of shelter, an advantage for smaller vessels.

The Ohio artificial reef project plans to construct additional reefs in Lake and Ashtabula Counties, but the construction is awaiting scientific evaluation of the completed structures. The only evidence available regarding the ecological and economic benefits of the artificial reefs has been anecdotal information from various anglers who report successful fishing within proximity to

<sup>&</sup>lt;sup>2</sup> Lake Erie's total 1993 fish harvest yielded 12.9 million pounds of fish, only 4.3 million pounds of which were caught by commercial fish producers. The bulk of the harvest (8.6 million pounds) were caught by recreational sport and charter boat anglers.

the reefs and some underwater videos taken in 1989 and 1990. No formal scientific data demonstrating the success of the structures has been gathered. According to Dave Kelch, District Specialist with The Ohio State University's Sea Grant Program and the project's director, research is needed for both the scientific community's acceptance of the artificial reefs and for interested shoreline communities.

## Costs and Benefits of the Artificial Reef Program

**COSTS.** Ohio's Artificial Reef project has been financed by the local communities, fishing public, local government, local business and industry, and fishing tackle companies. Donations exceeded \$100,000, the majority of which has been used to pay marine contractors for materials placement (more than 7,000 tons of material were used to build the reefs at the Lorain site and a total of about 6,800 tons were used to construct the reefs at the Cleveland site). Much of the project supervision, fund raising and donation procurement, and materials site inspection was conducted by volunteers from the North Central Sea Grant Advisory Committee. Overall project supervision and monitoring was the responsibility of the Sea Grant District Specialist, which resulted in no monetary outlay for these services.

According to Kelch and Reutter, only \$10,000 of state and federal dollars were made available. Because of the donation of material, dollars, services, and labor, exact costs for the construction of artificial reefs are difficult to assess. Estimates are that the cost of placement varied from \$6 to \$14 a ton (based on 1984 to 1989 costs) depending on the contractor. Small, non-union contractors fees averaged \$7.50 a ton, while unionized contractor fees were as much as \$14.8.

**BENEFITS.** One rationale for the Ohio Artificial Reef project is to improve the integrity of the central basin area. In the past, eastern Ohio waters have been plagued by heavy pollution. At one time the situation was so bad that the surface of the Cuyahoga River ignited. Since then, environmental enhancement measures have significantly improved water quality. Residents of the central Lake Erie region wanted assurance that the central basin could provide water-related recreational pleasures similar to those available in the western basin. The construction of artificial reefs has been perceived as an effective strategy to improve the area's character.

Additional gains to local small boat anglers are also expected: anglers should experience increases in recreational fishing value as a result of the new, productive, quality fishing sites within close proximity to sheltered ports. In addition, communities as a whole should benefit from some increases in tourist-related activities resulting from improved sportfishing opportunities.

# Preliminary Analysis and Evaluation of the Artificial Reef Program

While scientific analysis of the effects of artificial reefs on fish production has not been conducted, data on angler hours and catch rates indicate that walleye harvests have increased substantially over the last two decades (Case Table 5.1).

Two research efforts began in 1992 to evaluate the success of the artificial reefs. The aim of

Year	Walleye (thousands)
1975	86
1976	638
1977	2,171
1978	1,596
1979	3,288
1980	2,165
1981	2,932
1982	3,013
1983	1,846
1984	4,038
1985	3,730
1986	4,400
1987	4,438
1988	4,890
1989	4,192
1990	2,283
1991	1,578
1992	2,082
1993	2,669

Case Table 5.1. Walleve sport boat

one was to determine the fish concentration ability of the reefs; towards this end, an underwater video assessment was conducted at the Lorain artificial reef site. This effort involved monthly dives at both the reef site and a non-reef control site to identify and enumerate fish as well as to determine habitat differences. Analysis reveals that the 1992 and 1993 total seasonal numbers of fish were significantly higher at the reef site than at the control site. Thus, the reefs appear to be effective as a fish concentration device.<sup>3</sup>

The second research effort to evaluate the effectiveness of the reefs sites was designed to identify changes in social and economic values resulting from the artificial reef project. In 1992, survey data were collected from a random sample of individuals at various launch sites and marinas regarding their recreational use and expenses on Lorain County waters. Initial analysis reveals that 87 percent of the 466 respondents (55 percent response rate) knew about the reef and 64 percent of these individuals used the reef during 1992.

The typical respondent made 20 trips to Lorain County waters during 1992 and 7.1 of those trips involved fishing out at the artificial reef for at least part of the trip. Of those respondents who traveled less than 40 miles to Lorain County, more than two-thirds used the artificial reef. Of those who traveled 40 or more miles to Lorain County, less than one-half used the artificial site. These figures indicate that the artificial reef use is dominated by local sport anglers, as intended.<sup>4</sup>

#### Exercise

This case study suggests that there are significant potential economic benefits beyond positive economic impacts from the construction of artificial reefs. Fishery managers of the Lake Erie region have expressed satisfaction with the artificial program thus far. It has been highly visible and generated much enthusiasm within the local sport-fishing community. Many believe that the reef has also helped improve the integrity of Lake Erie's central basin. Given the information pro-

<sup>&</sup>lt;sup>3</sup> The Cleveland site is currently being investigated utilizing the video technique.

<sup>&</sup>lt;sup>4</sup> Glenn, S.J., D.O.Kelch, and L.J. Hushak. 1994. Economic Evaluation of the Lorain County Artificial Reef in 1992: An Overview. Ohio Sea GrantProgram. Technical Summary OHSU-TS-022.

vided above, outline the economic analysis that you would recommend be included in an environmental impact statement of other similar reef programs. Use the following questions as a guide:

- 1. What type of economic analysis would be appropriate in determining whether to proceed with an artificial reef project?
- 2. Some believe environmental valuation, which would assess the benefits of artificial reef projects to society, should be standard protocol in all planned artificial reef projects within the Great Lakes. Do you agree?
- 3. Assuming adequate cost information exists, what sorts of value information would you need to assess in order to conduct a benefit-cost analysis of an artificial reef project?
- 4. What methodologies or techniques would you recommend for each of the value categories identified above?
- 5. Fish and fishers move. How would you account for this movement in your analysis of changes in commercial or recreational fishing values?
- 6. Which of the various economic approaches described in this handbook would be used by different stakeholders in the policy decision process?
  - Developers
  - Local agencies making decisions regarding public investments
  - Interest groups
  - Public at large
  - Federal regulators/decision makers
- 7. How would economic information be developed and presented by each group?