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MITIGATION OF DREDGING IMPACTS TO OYSTER POPULATIONS

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ABSTRACT Maintenance and extensive navaigational dredging in coastal areas along the Northeast and Mid-Atlantic coasts have altered the population dynamics of oysters, *Crassostrea virginica*. In most instances, oyster production has been reduced by removing shell bases and reefs upon which spat could set. One type of mitigation of dredging impacts may be made through a variety of reshelling programs. In Guilford, Connecticut, periodic maintenance dredging since 1957 has been the source of increased mortality of seed oysters and removes the shell base upon which seed oysters set. In 1985, taking into account the Army Corps dredging schedule and seasonal emplacement of private moorings, the Guilford Shellfish Commission acted upon an earlier Sea Grant proposal and made an agreement with a local oyster company to manage oyster bed restoration in this area. Eight thousand bushels of crushed clam shell were planted in 1985 to form a shell base.

In July 1986, 8,000 bushels of clam shell were planted over the shell base which obtained a set of 0-year oysters. A harvest of several thousand bushels of seed oysters was anticipated in 1987. Mitigation agreements which are small in scale and do not interfere with other coastal activities can be expanded to improve oyster resources.

KEY WORDS: *Crassostrea virginica*, dredging, mitigation, natural shell bed, spatfall

INTRODUCTION

The earliest settlers of New England found vast "natural beds" of oysters, *Crassostrea virginica* (Ingersoll, 1881; Goode, 1887; Brooks, 1905), which became a stable and reliable food for many shore communities (Kochiss, 1974). Initially valued as a source of winter sustenance, oyster beds became vital to settlements that eventually became more dependent upon coastal trade for economic survival. Thus, greater attention was focused upon building wharfs and piers. Often, precisely the same areas which first were utilized for fish and shellfish resources were later developed for commercial wharfs. Observations on specific changes in utilization of these estuarine areas, indicated that a discussion of oyster ecology and its impacts upon navigation should be included (Galtsoff, 1964). An example of this is the lower East River in Guilford, Connecticut, which borders the towns of Guilford and Madison. The East River contained a natural oyster bed (Collins, 1889) that was dredged to create a mooring and anchorage area in 1957 (Otis, 1984).

In Connecticut, the natural oyster beds were located in or near river mouths. Often these beds flourished in this brackish environment protected from the severe effects of full-salinity predators such as the starfish. Depending upon recruitment of seed, local oystermen tonged 2,000 to 4,000 bushels of adult oysters in the annually from the East River in 1930s (F. Dolan, pers. comm. 1984). It was commonly stated that "Guilford oysters, taken from the channel of East River, are noted as among the best in Connecticut" (Smith, 1877). In this paper, I report on a study in which a natural oyster bed in the East River continues to reseed itself and in which procedures have been adopted to mitigate damage caused by navigation projects.

Study Site

The East River is located in the eastern part of the Town of Guilford, Connecticut (Fig. 1). It forms much of the boundary between Guilford and the western edge of Madison. The East River is intertidal and exchanges water freely with Long Island Sound around a barrier spit called "Grass Island," also in the Town of Guilford. Its drainage lies mainly to the north and west, consisting of salt marsh, bogs and wetlands. The East River also receives fresh water from the Neck River to the east and from a small tidal creek to the west. The mean tidal range at the mouth of the East River is about 5.4 feet. A long sand bar at the river's mouth identifies it as an ebb channel and is tidal approximately four miles upstream. In 1940, a channel 6 to 12 feet deep and up to 100 feet wide existed at the river's mouth (U.S. House of Representatives, 1941). In 1957, 1,500 feet of the lower East River was dredged to create a mooring area 100 feet wide and six feet deep at mean low water. This mooring area has been maintenance dredged in 1964, 1974 and 1981 (Otis, 1984).

Natural Bed Restoration

The 1957 "improvement" of the lower East River, according to local oystermen, eliminated most of the oyster resources in this area. Oyster sets continued to occur on what few shells remained on shallow bank edges (Walston, pers. comm. 1987). These areas supported a small fishery utilizing tongs until 1966, when pollution closed the river to direct shellfishing (Walston, pers. comm. 1987).

At a February 1984 meeting of the Guilford Oyster Ground Committee, various methods to restore and manage this natural oyster bed, so as not to interfere with boating interests, were discussed. A proposal was made to try to

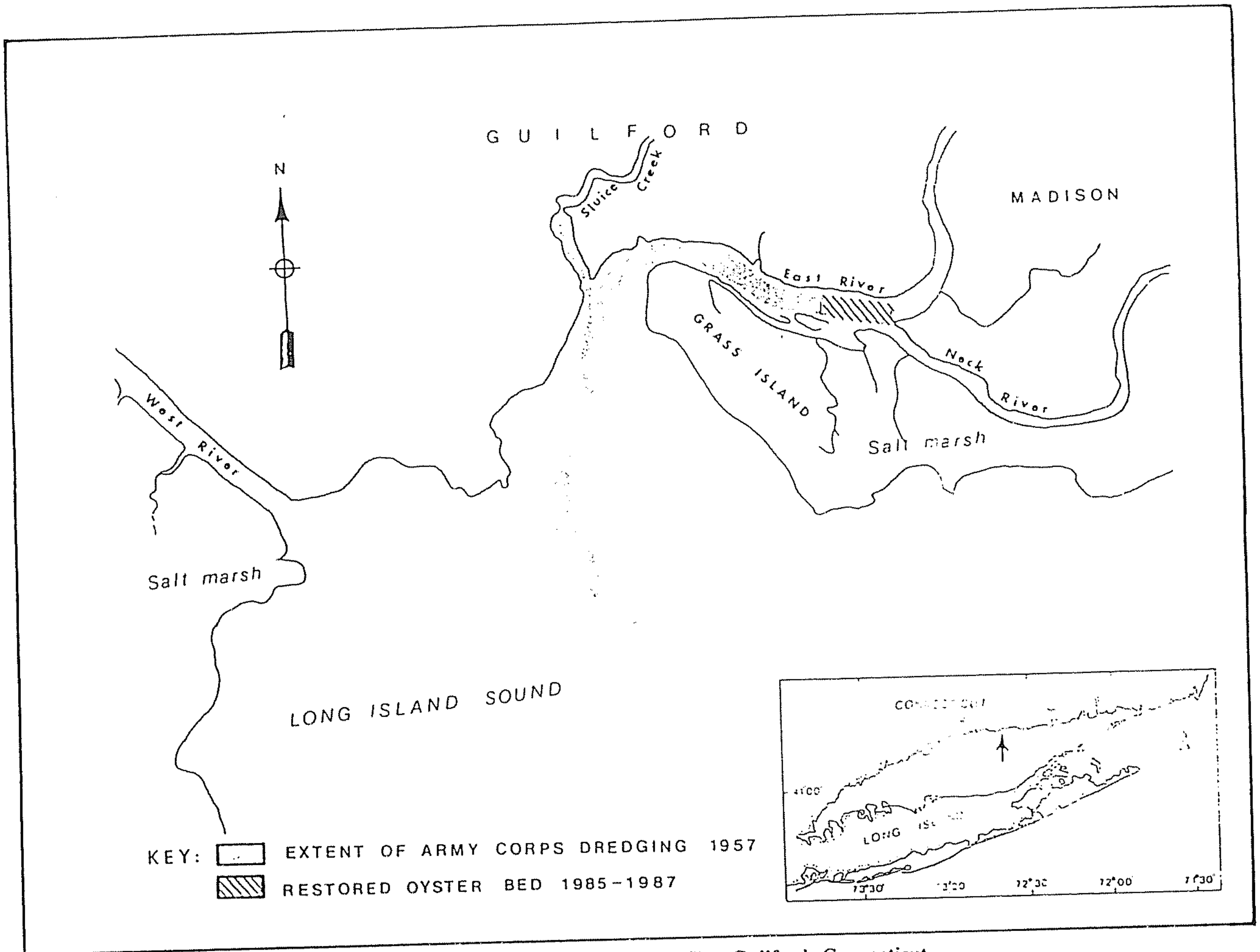

Figure 1. Map of East River Study Site, Guilford, Connecticut

plant cultch in the area for setting purposes but not to allow the growth of oysters to lessen the channel depth and impact navigation.

At a June 12, 1985 meeting of the Guilford Shellfish Commission, Mr. Frank Dolan, a local oysterman, formally requested permission to plant 2,000 bushels of cultch per acre over 12 acres down to the Guilford launch ramp (Minutes of the Guilford Shellfish Commission, June 12, 1985). This area encompassed the entire portion of the federal anchorage in the East River.

METHODS

In late June 1985, Mr. Dolan obtained approval from the Guilford Shellfish Commission to plant cultch in the area 200 feet south of the confluence of the East and Neck Rivers. This cultch planting was followed by additional plantings in 1986 and 1987.

Shell planting was accomplished utilizing an oyster boat belonging to the Dolan Brothers shellfish company. Whole clam shells (*Spisula solidissima*) were selected for their ability to form a firm shell base and obtain an oyster set. By 1987, the section of the East River from the confluence of the Neck River to approximately 400 feet west (about 2 acres) was planted (Figure 1). Permission was obtained from Mr. Dolan to conduct a dredge survey for some clam shells containing seed oysters during the summer.

In July 1987, a hand oyster dredge equipped with a metal pressure plate was utilized to examine shells for seed oysters. This was not an in-depth quantitative study but a presence or absence monitoring survey designed to obtain the number of one- and two-year-old set on a bushel of planted clam shells. To sample the cultched area, five test sites were selected at random. Sampling was accomplished by conducting three one-minute dredge tows over each test site. As each dredge was hauled, all extraneous material, such as glass, leaves and marsh grass, were separated from the clam shell cultch. At each test site shells obtained from the dredge were shoveled into two five-gallon plastic buckets equal to a bushel measure. Each sample was examined for 1985 and 1986 spatfalls. Only oysters attached to clam shells and, therefore, planted were included in the results.

RESULTS

The random sampling previously described yielded many two-year olds and set from last year's spatfall on these shells. The oysters all appeared healthy and growing rapidly. The average number of oysters per bushel of sampled cultch was found to be 74 and ranged from a high of 130/bushel to a low of 27/bushel. No distinction was made between the 1985 and 1986 spatfalls. Several shells contained both year classes and had multiple spat, some up to 10 per shell. It should be noted that from the appearance of the shell surfaces many of the clam shells were partially buried and had formed a shell base. It was not possible to determine to what extent the cultch planted thus far acted as a shell base or as a possible setting surface. Underwater photography of the bed is scheduled in the late fall of 1988 and should show bed configuration and profile. To date, approximately 26,000 bushels of clam shells have been planted.

DISCUSSION

The negative effect of navigation improvements upon oyster resources has been well documented in the scientific literature (Galtsoff, 1964; MacKenzie, 1977). Today, social and economic issues often conflict with various user groups of coastal resources. However, aside from resource allocation decisions, a poor understanding of oyster bed ecology does contribute to reduce oyster production (Visel, 1985).

MacKenzie (1983) states that these natural oyster beds often have deep shell bases, some as deep as 23 feet. John Volk, Chief of the Connecticut Department of Agriculture—Aquaculture Division, has found shell bases to be over 40 feet deep in the Housatonic River in Connecticut (Volk, pers. comm. 1985). These deep shell bases can be attributed to successive oyster generations setting and growing on older oysters, eventually killing them by overgrowth. The elevation of these beds continues to rise and the shells of the dead oysters accumulate underneath, forming the base of the oyster bed. Upward pattern of natural bed development is also discussed at length by Galtsoff (1964) and Brooks (1905). This phenomenon, associated with natural oyster beds in rivers, can significantly lessen channel depths, negatively impacting navigation.

In 1985, the Guilford Shellfish Commission developed a comprehensive plan to address the management of the natural oyster beds within its jurisdiction (Guilford Shellfish Commission Management Plan, 1984). The principal objective of the Guilford Shellfish Commission's new management plan is: "To maintain, over the long term abundant stocks of oysters and clams in order to provide a suitably large fishery for recreational and commercial interests." The program to deepen the channel in the West River with increased oyster harvesting and shell removal and the East River reshelling effort reflect new shellfish management policies. These new policies differed greatly from the traditional regulation of bag limits and restrictions upon gathering methods.

It is evident that a greater understanding of natural oyster bed ecology could provide additional restoration opportunities in many Connecticut municipalities (MacKenzie, 1970). Shell deposits that could be utilized as a cultch source occur in most estuaries (MacKenzie, 1975). In areas of continued oyster setting, on-site reshelling activities should be evaluated. The suitability of pilot projects require the careful review of site specific biological, environmental and social limitations.

It was felt that the East River was a good candidate for a small restoration project; oyster setting was frequent, the Shellfish Commission and the industry both supported the effort and conflicting uses were seasonal. Under no circumstances was the growth of seed and adult oysters to impact upon navigation.

In this case, implementation of new shellfish management policies could possibly eliminate or reduce the need for continued maintenance dredging. If channel depths can be controlled by removing excess oysters or shell, navigation dredging costs would be reduced and the environmental impacts associated with upland disposal of dredge spoils lessened. Follow-up studies of the East River restoration and bed management programs could provide valuable information to other resource managers. Similar small scale projects should be investigated and, in my opinion, warrant further research.

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