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MAN'S ALTERATION OF ESTUARIES BY DREDGING AND FILLING A GRAVE THREAT TO MARINE RESOURCES

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ABSTRACT

Despite the recognized importance of estuaries to the well-bing and economy of our Nation, these areas are being unwisely exploited to develop water-front real estate by dredging and filling operations. Accumulative adverse effects of these activities threaten the precarious balance of nature. The Fish and Wildlife Service, working closely with appropriate state agencies to conserve estaurine areas, has made little headway. The power of public opinion, suppored by sound scientific data concerning the importance and continuing value of estuaries, offers hope for success.

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Presented by

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at

American Fisheries Society Meeting
Clearwater, Florida, October 19, 1964

In today's era of precise terminology and classification the term "estaury" is an exception in that definitions are modified as estaurine

studies progress. Johns (1964) stated that an estuary may be thought of as simply "an edge—a border between land and sea, the boundaries of which can neither be accurately set nor defined." A more detailed concept which I consider to be satisfactory for this presentation is offered by Sykes (1964), as follows: "Estuaries are those shallow waters with fluctuating salinities that differ from those of the adjacent sea. Usually, they are semi-enclosed bodies of water. Physical factors resulting from the mixing of fresh and salt waters and the resulting nutrient enrichment and high productivity of these waters constitute the unique features of estuaries."

While minor controversy may still exist with respect to their exact definition, there can be no disagreement concerning the importance of estauries to the well-being of our Nation. Each year, millions of Americans enjoy aquatic sports such as boating, fishing, swimming, and skiing in the relative safety of these protected waters. Large numbers of hunters, in season, seek waterfowl along their shores and throughout adjacent marshlands. Many commercial fishermen earn their livelihood by harvesting the abundant fish and shellfish found in estuarine areas. Of more concern to us, as fishery biologists, is the vital role played by estuaries in maintaining marine resources. Their importance in this respect was clearly indicated by Walford (1958), when he said "Thus the brackish area is not only the home of its own fauna of year-round permanent residents, but it is also a spawning ground for some species that come in seasonally, a nursery for others that drift in during planktonic stages, an occasional feeding ground for others that wander in and out at random, and a thoroughfare for still others that are migrating between river and sea destinations. With all this flow of life, the biological content of the brackish area is extraordinarily rich, and, being conveniently close to land, shallow, and well protected from the open sea, it is the most likely part of the sea subject to cultivation." Statistical data and pertinent studies reveal that at least 60 per cent of the total catch of sport and commercial fish are made up of species that are estuarine-dependent during all or part of their lives. Included in this category are shrimp and menhaden, ranking first in value and volume, respectively, in the Nation's commercial fisheries. One-sixth of all game fish are taken in coastal maters, and this proportion is expected to double by the turn of the century (Gresh 1963). Odum (1961) considers estuaries to be the most naturally fertile areas in the world, and that they usually produce more dry organic matter per acre per year than rich farm land, or the sea.

In view of the aforesaid importance of estuaries, any planned alteration of these areas by man, for any purpose whatsoever, should be weighed carefully and subjected to thorough review by the elected or appointed officials to whose stewardship they are entrusted. Unfortunately, this is seldom the case. Growth of our coastal communities has been accompanied by widespread changes in the estaurine complex, usually brought about with little or no regard for fish and wildlife resources. Some of these changes, such as those resulting from navigational improvements, flood control ,and other engineering projects, are inevitable and essential for continued growth and progress of our Nation. But they are not responsible for major changes that have occurred.

These major changes, so plainly evident along our coasts, result from innumerable land-development projects that are characterized by the creation of lucrative water-front real estate by dredging and filling operations. The shallower bay bottoms and tidal flats are preferred by promoters due to the obviously lower cost of development. Thus the typical dredge and fill project is most destructive to marine productivity, for in these shallows occur the extensive grass beds that serve as prime nursery and forage areas. Facilitated by huge drag-lines, bulldozers, and giant hydraulic dredges that can "suck up" more than 10,000 cubic yards of bay bottom per day, and despite the repeated warnings of

alarmed conservationists, dredge and fill activities have been accelerating during the past fifteen years, especially along the Florida coast. The attendant eradication of irreplaceable bay bottoms and vegetated shorelines, with subsequent alteration of long-established current patterns, pose the gravest of threats to marine resources, and present a problem that urgently needs solution.

A striking example of the magnitude of this problem is the number of applications for U. S. Army Corps of Engineers' permits to perform this type of work in the navigable waters of Florida. Over the past year, 122 such applications have been received by the District Engineer in Jacksonville, averaging approximately one every three days. The following slides further emphasize the problem's magnitude by graphically illustrating the alterations that have taken place in Boca Ciega Bay, Pinellas County, through indiscriminate dredging and filling:

Slide 1 is an aerial photograph of Johns Pass, taken in 1926, prior to any man-made changes. Slide 2, taken from a 1930 U. S. Coast and Geodetic Survey chart, shows Boca Ciega Bay in its entirety, again prior to any alterations by man. Slide 3 presents schematic drawings of the bay in 1945 and 1963. Areas in black show the proliferations of pumped-up real estate over this 18-year period. The filled areas, however, do not represent the total loss of productive bay bottoms. In obaining fill material, developers customarily dredge in the adjoining shallows. For many projects, this additional area, denuded and dredged to depths unsuitable for vegetative growth, approximates the acreage of the completed fill.

Slides 4-6 are aerial photcgraphs of lower Boca Ciega Bay in 1957 and 1960, and show the loss of shallow areas and mangrove islands to the huge Tierra Verde development, now about half completed. The Fish and Wildlife Service and the Florida Board of Conservation, with strong support of various conservation groups, civic organizations, and local residents, are firmly opposing the completion of this massive dredge and fill project. Contrary to conclusions reached in prior investigations of the area, which undoubtedly were instrumental in obtaining the original construction permit, our joint studies have revealed that the bay bottoms slated for destruction are not only excellent nursery and forage areas, but also are among the most luxuriantly vegetated submerged lands in the Tampa-Boca Ciega Bay complex, (Slide 7). Fill material needed to complete this project, according to the developer's plans, will amount to 9¼ million cubic yards, or enough dredged-up submerged land to cover, to a depth of one foot, a highway 40 feet in width extending from the project site to New York City, a distance of about 1,280 miles.

Slides 8-11 are aerial photographs of various types of fills in Boca Ciega Bay. Interference with normal tidal flow by these developments is plainly evident. The creation of dead water, stagnant pockets, and erosion dangers also is indicated.

What is being done to preserve our estuarine areas from ill-advised exploitation? The Branch of River Basin Studies, Bureau of Sport Fisheries and Wildlife, devotes a major part of its efforts to this objective. Working in close coordination with the Bureau of Commercial Fisheries whenever marine fisheries are concerned, and with appropriate state conservation agencies, it conducts surveys and prepares detailed reports on projects that could affect marine resources. Federal law requires that sponsors of all projects involving work in navigable waters of the United States must obtain approval from the U. S. Army Corps of Engineers, the constituted licensing authority, before beginning construction. This requirement applies to federal and state agencies as well as private firms or individuals. It is also the legal responsibility of the District Engineer to notify the Bureau of Sport Fisheries and Wildlife of all such projects and set reasonable time limits for submission of pertinent Bureau reports to the appropriate District Engineer for his review and consideration. Basically, these reports assess the natural

resources that are involved, the extent of expected project damages to these resources, and recommend measures that will eliminate or reduce these damages. Seldom do reports recommend that approval of the project be withheld or denied.

With this apparent safeguard, why has estuarine exploitation continued—even accelerated? The answer is simply that fish and wildlife resources have not been receiving adequate consideration by the Corps of Engineers. For many years, its decisions on water resource projects were based primarily, and legally, upon the project effects on navigation. In 1958, however, after long years of struggle by conservationists, Congress passed the Fish and Wildlife Coordination Act, which provides a general policy that fish and wildlife conservation shall receive *equal consideration* with other project purposes and be coordinated with other features of water resource development programs. Our hopes that this would be a giant stride forward along the path of conservation were understandably high, but were very short-lived! To date, in open disregard of the stated provisions of the Coordination Act, and in spite of repeated objections by the Department of the Interior, the Corps of Engineers has consistently maintained that in final analysis its decisions on all projects relating to water resources must be based primarily upon project effects on navigation. In 1962, for example, 552 applications involving dredging and filling operations on the Atlantic and Gulf coasts were reviewed by the Bureau of Sport Fisheries and Wildlife. Of this total, only 18 (about 3 per cent) recommended denial. Twelve of these had been acted upon by the Corps as of January 1963. Two recommendations for denial of the permits were withdrawn by the Bureau due to modifications of the proposed developments. Of the remaining 10 applications, *permits were issued in all cases in complete disregard of Bureau recommendations*. Until this inexplicable attitude of the Corps changes, either by persuasion or legal compulsion, the climate for making real headway against estuarine exploitation leaves much to be desired.

How can this unfavorable climate be improved? The procedures whereby public submerged lands are acquired for development suggest a solution. Although the Corps of Army Engineers makes final decisions regarding all water resource projects, most involve prior approval by state and local authorities. The immense and continuing value of their estuaries, therefore, must be impressed upon the officials intimately concerned. On an optimistic note, these views already prevail in South Carolina and Massachusetts. The South Carolina Constitution states "All navigable waters shall forever remain public highways free to the citizens of the State and the United States. The title to land below the high water mark on tidal navigable streams . . . is in the State, not for purpose of sale, but to be held in trust for public purposes." The Massachusetts Legislature, on May 22, 1963, recognizing the importance of estuarine areas, enacted a law that empowered its Commissioner of Natural Resources to decide whether or not developments affecting these areas would be in the best public interest. Passage of this law resulted from aroused public opinion, a powerful force in a field where politics play such an important part. The few successes that we have had in preserving submerged lands from ill-advised developments were due largely to this factor, aided by a favorable press.

Public opinion must not only be sought and obtained by marine biologists who are working constantly to save our estuaries, but also must be supported by pertinent and sound scientific data to be effective against the promotional methods of would-be developers. Members of the American Fisheries Society can be of great assistance in this respect by keeping well informed concerning water resource development projects in their areas, by alerting the public regarding the importance of estuaries, and by providing basic information and guidance whenever necessary. Such efforts should do much to restrict estuarine development to those projects that, after careful review and study, are found to be essential and in the best public interest. When the alternative is con-

sidered, namely, the relatively unchecked loss of irreplaceable estuarine environment, every preventative action that we can undertake will be a highly significant contribution to the cause of conservation.

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DISTRIBUTION AND ABUNDANCE OF POSTLARVAL AND EARLY JUVENILE STAGES OF THE BROWN SHRIMP IN GALVESTON BAY, TEXAS

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ABSTRACT

The early life history of the brown shrimp (*Penaeus aztecus* Ives) in Galveston Bay was investigated during 1963 and 1964. Postlarvae, after entering from the Gulf, were most abundant in the channels and deeper waters as they moved into the upper reaches of the estuary. In each season of study, they were observed to spread throughout the estuary and become concentrated in surrounding marshes and bayous within about 2 weeks of first entry. After spending 2 to 4 weeks in these peripheral areas where they grew rapidly, the young shrimp, now juveniles, once again dispersed throughout the estuary before eventually returning to the Gulf. Observations also indicated that the estuarine life history phase of the brown shrimp is quite variable, with its duration probably being related in large measure to prevailing water temperature.

A PLEMINARY REPORT OF SEXUAL DEVELOPMENT OF FISHES IN BILOXI MARSH, LOUISIANA

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