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NORTH CAROLINA SHELL SURVEY

1964

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A. Introduction

To rehabilitate the North Carolina oyster industry, the Department of Conservation and Development is investigating the feasibility of dredging and planting large quantities of reef shells. Since other states are successfully dredging and planting shells, it was thought that similar shell deposits probably could be found in North Carolina. It was, therefore, essential that the major North Carolina shell reefs be located, if this source of shells is to be utilized.

Submerged shell deposits were reported to be present in lower Albemarle Sound. However, these shells are not near the most productive oyster growing waters in Pamlico Sound and its tributaries. If shells could be found in sufficient quantities near the desirable oyster growing areas, then their distribution would be more efficient and less costly.

To determine whether shells were present near the oyster growing areas, the dredging firm of C. J. Langenfelder & Son, Inc., Baltimore, Maryland, was employed to search out and evaluate the shell deposits in the following areas: Alligator River, Eastern Albemarle Sound, Croatan Sound, Roanoke Sound, and Pamlico Sound. Emphasis in the open waters of Pamlico Sound was to be within two miles of the shoreline where it would be feasible to use a dredge. The major bays and tributaries north and east of Pungo River, including Pungo River, and that of Pamlico Sound east and north of Point of Marsh (adjacent to the ocean) were also to be examined.

B. Methods and Procedures

The shell survey was conducted by experienced shelldredging personnel. Messrs. Cockey, Parkinson, and Ent performed the field work under the supervision of Ralph C. Hammer. A twin screw diesel, open deck crew boat equipped with auxiliary pumps was assigned to this work. Aluminum pipe - 1/2 and 3/4 inch - with perforated steel points was used to probe into the bottom. These sounding rods were used with and without water pressure. Records were made of the water depth, amount and type of overburden, the type of bottom, the depth and extent of the shell deposit. The boat was anchored for all deep probes and the exact location determined by the use of a Plath Surveying Sextant.

All shell layers, regardless of thickness, were noted in this survey. Usually, shell deposits less than three feet in thickness are not considered economical to dredge. However, compact shell layers two feet in depth should be considered in those areas which are more distant from the commercial deposits. A small oyster dredge was used to determine the type and quality of the exposed shells as well as the presence of live oysters.

The normal survey procedure was to first study the navigation charts and other sources of hydrographic data to designate those bottoms where oysters could be expected to grow and shells accumulate. Special attention was given to these selected areas. As the boat slowly cruised over the area under investigation, the bottom was probed manually with an aluminum rod. Periodically, the boat was anchored for deep soundings. These deep probes were made by jetting the rod into the bottom with water introduced into the rod, under pressure. These anchored soundings were then plotted on the field chart and a record of the type of bottom materials found was entered in the field books. Representatives of the North Carolina Department of Conservation and Development were advised of the survey progress and findings.

All field data, charts, and logs have been filed with the North Carolina Division of Commercial Fisheries.

C. Areas Surveyed

1. Roanoke Sound:

This is a very shoal body of water having a sandy bottom throughout it's length, with the exception of limited mud areas mixed with sand north of Roanoke Island. Manual soundings in the southern and more shoal areas indicated sand mixed with scattered clam and other ocean-type shells. An area off Mann Point was said to contain a commercial shell deposit, however, repeated soundings within this area disclosed only a limited layer of shells, one foot in thickness, under two and three feet of sand. A "hard pan" of heavy compacted sand or gravel was found below the shells.

Manual soundings across the mouth of Buzzards Bay to the soft bottom located about one mile south of Colington Island, indicated other thin layers of oyster shells and an occasional sea shell mixed in the sand over a very dense, hard, underlying substance. No commercial deposits of shells were found in Roanoke Sound.

II. Albemarle Sound - Southeast Portion and Southern Currituck Sound

Oyster shell deposits are said to exist in this area, and estimates of several reefs containing almost unlimited quantities of shells have been made. There is general agreement that shell deposits do exist in this vicinity. A shell reef was said to be

located between Croatan Light and Colington Island Shoal Light. However, a systematic and thorough search of this area revealed few shells. The water was eight to ten feet in depth, over a ten-foot layer of sand, with a hard layer of sand or gravel at a depth of 18 to 20 feet below the surface. A small pocket of shells of about five acres in size was found approximately one mile southwest of Colington Island Shoal Light. The water here is nine feet deep and the shells were up to three feet in thickness, mixed with sand at surface. This deposit was on a one to three-foot layer of mud which covered the underlying "hard pan" common to this area.

A small pocket of shells was also found one-half mile east of navigation marker 30. Here, the water is eight feet deep over four feet of shells, followed by mud and sand mixed to the "hard pan" at 20 feet.

The most extensive deposit of shells was found along the deep channel from Peter Mashoes Creek to Haulover Point. This is a long narrow deposit about 2-1/2 miles long and up to 300 yards wide. The shells have a depth of seven feet. Due to the length of this shell deposit, it is estimated that a minimum of 1,000,000 cubic yards of shells can be dredged from this location. A deposit of gravel was noted off Caroon Point in 14 feet of water, and under two feet of sand. The depth of this gravel deposit could not be determined with this type of probing equipment.

A large area off Colington Island and north of Colington Island Shoal Light was reported to be a large shell reef and was said to be three and one-half miles long by two miles wide. Fourteen deep soundings were made from south to north over this areas, and a series of soundings from west to east across this area disclosed no shells. However, a small seven-foot shell reef was found in the natural channel adjacent to Colington Island. This is a small deposit in area, although scattered shells in layers were found extending along much of this two-mile long channel. This is a commercial deposit, and could possible yield up to 50,000 cubic yards of shells.

A survey of Kitty Hawk Bay with soundings up to 22 feet indicated no shells. Most of this bay is sand with sand and mud mixed in the more protected areas. Scattered sea shells were found mixed with the beach sand.

In the mouth of southern end of Currituck Sound, the navigation chart indicates shoal areas surrounded by deeper waters. These abrupt shoals are similar to the shell deposits usually found at the mouth of a river. These shoals or hills, as suspected, were shells having a thickness of as much as 12 feet. Some of the shells were exposed and mixed with sand. Clean, firm, surface

shells were collected with a small dredge. No oysters are present, although live barnacles were found attached to the shells. Conservatively, it is estimated that a million cubic yards of shells could be dredged from this lower Currituck Sound deposit. In consideration of the shell reefs found in this southern Albemarle Sound region, there are likely to be other shell deposits which might be located by a more intensive survey. However, it should be noted that these deep shell deposits are confined to a limited area and we did not find the shells as abundant as generally reported. In summary, a minimum of 2,500,000 cubic yards of shells could be dredged from these concentrated deposits.

III. Croatan Sound is another shallow body of water lying between the mainland and Roanoke Island. Much of the shallow bottom is loose shifting sand, not conducive to oyster development. This layer of shells, less than six inches in depth, were found in the sticky bottoms near shore. Occasional layers of marsh turf were found along the east side of this sound. Since major shell deposits are often found in the mouths of rivers, where the fresh and salt water first mix, it was anticipated that shell reefs would be found in Croatan Sound where the waters became sufficiently saline to support oysters. As anticipated, shell reefs with live oysters on the surface were found in the southern end of Croatan Sound. The shells were generally small, indicating that the oysters grow slowly and are frequently stunted or killed by prolonged periods of fresh water. The local conservation officer, Captain Arnold Daniels, came alongside our boat and confirmed our findings that the oysters did not grow well in this area and that they have been transplanted as seed. Shell deposits in the southern end of Croatan Sound were found to be up to five feet in depth and were of sufficient areas to be dredged. However, these shells are frequently mixed with sand which helps to stabilize the bottom. Some shells are already covered with sand. Shell dredging in this area might permit the sand to shift and cover the living oyster reefs, since the area is exposed to heavy seas during southerly winds. Some of the more stable bottom could be planted with shells for seed production.

IV. Alligator River

Since Alligator River is near the known shell reef in Albemarle Sound, a careful examination was made in the mouth of the river north of U. S. Rt. 64. Most of the river is shallow with sand and sand-mud bottoms. Only in that area off Little Alligator River were scattered shells encountered. A large area around the Alligator River Entrance Light has a foot layer of shells under three to ten feet of sand over a layer of mud.

V. Pamlico Sound - Mainland Side
Croatan Sound to Engelhard

Stumpy Point Bay has a few scattered shells, but no deposits or shell concentrations suitable for dredging.

Long Shoal River has a large area of stiff mud bottom suitable for oyster growth. Shells were found throughout this river and were often exposed supporting a good population of oysters. Some of the shells were as much as two feet in depth. Oysters and shells were found to extend to the extreme upper end of this river. Shell dredging here would be costly due to the thin shell layers and would destroy some live oyster beds.

The open waters of Pamlico Sound is largely sand. A six-inch layer of shells was found off Long Shoal River. In general, shells are associated with the soft or muddy bottoms. However, from Pingleton Shoal to Engelhard Channel, scattered and layers of exposed shells up to one foot in depth were found. The irregular pattern of these surface shells resemble shells which may have been planted for oyster propogation. No commercial deposits were found in these waters.

VI. Pamlico Sound - Mainland Side - Engelhard
to and including Pungo River

This portion of the Sound has several similar bays and rivers. Usually, the protected areas are favorable for oyster growth and shell deposition. Good stocks of oysters of mixed sizes and ages were found wherever the shells were exposed.

Wysocking Bay should be a most productive oyster growing area. Shells were found throughout the ~~river~~, but usually were only one foot in thickness. Manual soundings were made throughout this bay. Gull Rock, a shoal extending into Pamlico Sound, was extensively probed and no deep shell deposits found. Heavy seas prevented sounding the more shallow portion of this bar. Repeated probes around the shoal section indicated the presence of only a few shells lying on a very hard material thought to be stone or heavy gravel. Samples of the bottom material were not collected due to the rough seas.

West Bluff Bay and Juniper Bay are shallow and have a sandy bottom. Few shells were found. Deep soundings were made off the mouth of these bays. Here, the surface sand up to ten feet was usually over a clay substratum. Off Juniper Bay Point a layer of hard gravel was encountered.

Swanquarter Narrows has a firm botton largely of clay and sand, mixed with shells and oysters. Some sand had covered the shells which were from one to one and one-half feet in thickness. A hard layer of sand or gravel was found at 10 and 12 feet below the bottom. Shells in this area were scattered in small pockets and not of sufficient size to warrant dredging.

Swanquarter Bay has a mud bottom in the deeper waters. A uniform layer of shells one foot in depth was found throughout most of this bay. Occasionally, patches of these shells were exposed with oysters attached. Shells were not compact and were usually near the surface of the mud.

Judith Marsh Canal is a dug canal through a marsh between Swanquarter Bay and Deep Bay. When dug, the dredged material was cast along the banks of the canal and appeared to be largely clay. No shells could be seen in the spoil material. Water depths in the canal were up to 16 feet. A three-foot layer of large clam, conch, scallop and other ocean-type shells were found. These shells appear to be fossil shells and had a good population of living oysters attached. The source of these shells is not known. At first, it was thought that they were planted for oyster cultivation. It could be possible, however, that this is a true fossil shell which was uncovered by the channel dredging and was exposed through subsequent water currents which may have washed the lighter materials away, leaving the shells exposed. It was noted that the oysters which were attached to these large shells were less than three years old. It is, therefore, assumed that these shells were recently exposed.

Soundings in Deep Bay near the canal entrance indicated a mud bottom over a very stiff layer of clay. The clay could not be penetrated more than two feet with our probing equipment. It is, therefore, possible that there are other fossil shell deposits beneath the clay. However, the dredging of shells from beneath the clay overburden is not practical since the clay would have to be stripped off first. A limited area of oyster shells was found in Deep Bay and, as usual, it was only one foot in thickness.

Rose Bay has very good oyster growing bottoms and, as expected, a thin layer of shells was found throughout the deeper waters. Occasionally, the shells were exposed with live oysters attached.

A good natural oyster bar was found in the mouth of Pungo River, offshore from Rose Bay to Abel Bay. This bottom was covered with shells up to two feet in depth. Many large oysters were found on these shells. Only an occasional small oyster was present which is probably due to lower salinity. A dense layer of shells was found off Currituck Point in Pungo River. While this shell layer has a maximum thickness of only two feet, it is entirely possible that this deposit could be dredged. Oysters were not found in this area in spite of the fact that some of the shells were exposed. Small deposits of shells were also found beyond Currituck Point but were not surveyed. It is estimated that a minimum of 50,000 cubic yards could be dredged from Currituck Point and the other small reefs in the upper portion of the river. A more comprehensive survey is necessary to determine whether it would be more economical to dredge Albemarle Sound. Of all the areas examined, with the exception of Albemarle Sound, the shells in Pungo River seem to be best suited for dredging.

The open sound from Engelhard to Pungo River, like most of the sound, is sand or sand and mud mixtures with only an occasional thin layer of shells in the more protected areas.

VII. Pamlico Sound - Brant Island to Core Sound

Jones Bay, a tributary, has some good oyster growing bottoms. A dense population of oysters was found in a limited area near the Intercoastal Canal. Thin layers of shells (one foot or less in thickness) were found in the deeper waters of the bay. A large expanse of shells, one foot in depth and mixed with muddy sand, was found west of number 2 navigation marker beyond the mouth of Jones Bay (prohibited area). Similar layers of shells were found in Bay River. A few scattered shells were found off the mouth of Bay River and around Maw Point Shoals. No shells could be found in the open waters of Pamlico Sound from Swan Island east to Core Sound. West Bay, however, does have exposed shells and oysters. A small deposit of shells was found in the mouth of Cedar Island Bay but this reef is too small to dredge. Shell Island in Core Sound was found to be a small exposed hill of oyster and clam shells. This island is surrounded by sand shoals. A maximum shell depth of four feet was found on the island. Dredging these few shells would not be practical since it would be necessary to dig a channel across the flats to the island.

VIII. Pamlico Sound - Core Sound to Hatteras

The following areas were carefully examined but no commercial shell deposits found: Hodges Reef, Royal Shoals, North of Ninefoot Shoal and three shallow areas off Hatteras Inlet. Vast sand shoals were found throughout this portion of the Pamlico Sound. This is an exposed area where dredging would be limited to calm weather.

IX. Pamlico Sound - Hatteras to Oregon Inlet

The section north of Hatteras, like most of the sound, is shifting sands. Occasionally, sea shells were found mixed in this loose sand. It is doubtful whether oysters have ever existed in these exposed waters. The navigation charts occasionally list shells, but when these locations were examined, no oyster shells were found. An exposed layer of shells and oysters was found approximately one mile northwest of Oregon Inlet Channel Marker No. 17. This deposit is up to 1-1/2 feet in thickness and is probably a productive oyster reef. While in this section of the sound the south end of the Roanoke Sound was again examined. This shoal water and sandy bottom had few oyster shells.

D. Conclusion

Commercial shell deposits were found in southeast Albemarle Sound and Currituck Sound. This limited survey disclosed that a minimum of 2,500,000 cubic yards of shells (41,750,000 North Carolina oyster bushels) can be dredged from this area. These shells are of good quality and are ideally suited for oyster propogation. Since most of these shells are buried and the water is too fresh for oysters, there should be no objections from the oystermen. A more detailed survey in this area would undoubtedly disclose more shell deposits. However, the quantity of these shells has a definite limit and constitutes a valuable non-renewable natural resource.

Thin layers of shells exist throughout Pamlico Sound and its tributaries, however, with the exception of the shells in Pungo River, none of the deposits were considered to be of sufficient depth for dredging. Limited shell reefs were found in the southern end of Croatan Sound, however, the abundance of oysters on these shells would probably eliminate their use. Shell dredging in Pungo River would be inefficient since the shell layers, while very compact, are two feet or less in thickness. However, in consideration of the long tow from the more concentrated deposits in Albemarle Sound, it is suggested that the thin shells in Pungo River might be used for nearby plantings. Prior to dredging in Pungo River, a more extensive survey should be made by the dredge operator.

E. General Observations and Comments

The presence of an almost uniform thin layer of shells throughout the area surveyed was most revealing. We have therefore, come to the conclusion that the oyster population in most of Pamlico Sound is of recent origin.

Without a doubt, the second most striking observation was the vast area where oysters can be grown. The oyster industry potential for North Carolina is virtually unlimited. Many of the oyster's natural enemies are excluded from this vast growing area due to the low salinity barrier. At the same time, oysters reproduce well and soon attach to any exposed shell or other suitable surface. It is not necessary for North Carolina to engage in a large seed production effort, since prudent shell plantings can restore most of the former oyster areas to full production. In fact, some consideration should be given to the possibility of an over population in the areas of weak tidal currents. Crowded oysters do not fatten well and must be sold at reduced prices. Those areas which have excessive oyster sets could be used for seed production. However, seed movement is costly and is not necessary in most of the waters examined.

Oyster reproduction seems to occur over a long period in North Carolina so the planting of shells within a short period is not as critical as it is further north. The most important planting technique is to make every effort to place the shells where they will not sink or be covered by shifting sands. All of the exposed shells, other than those in fresh water, had oysters of all ages and sizes attached.

Much of the open sound subjected to heavy seas have not, and cannot support oysters. The absence of shells in these exposed areas is a good indication that oysters will not survive under these adverse conditions.

Other valuable fisheries, such as the shrimp and crab indistries, may conflict with any extensive program of oyster rehabilitation. However, the oyster growing areas are so immense that there is undoubtedly room for all. North Carolina's oyster growing potential is so large that these waters could be the foremost oyster center of the world.

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