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The public oyster bottoms in Virginia : An overview of their size, location, and productivity

Dexter S. Haven
Virginia Institute of Marine Science

James P. Whitcomb
Virginia Institute of Marine Science

THE PUBLIC OYSTER BOTTOMS IN VIRGINIA: AN OVERVIEW OF THEIR SIZE, LOCATION, AND PRODUCTIVITY

DEXTER S. HAVEN
and
JAMES P. WHITCOMB
VIRGINIA INSTITUTE OF MARINE SCIENCE
AND SCHOOL OF MARINE SCIENCE
THE COLLEGE OF WILLIAM AND MARY
GLOUCESTER POINT, VIRGINIA 23062, U. S. A.

ABSTRACT

The location size and extent of Virginia's public oyster grounds was determined using a long pole to probe the bottom, a towed sonic device that detected shell or oysters, and by sampling the bottom with patent tongs for shell and oyster density. Station location was determined using an electronic positioning system (Raydist®). Bottoms were classed as oyster reefs, mud-shell or sand shell (productive or potentially productive). Areas having mud or sand or those in deep water over 30 ft. (9.1 m) were considered unproductive. Average oyster harvest for seed and market size oysters over the last ten years for various areas is related to size and location of various bottom type.

About 203,404 acres out of the total of about 243,000 acres of public bottom were surveyed; about 21.8% of the surveyed areas was classed as productive or potentially productive. Average production was low on most of these public bottoms and ranged from 84.4 bushels/acre in the Great Wicomico River to only 1.6 bushels/acre in the York River.

The seven areas producing the most seed and market oysters in terms of their average annual production in Virginia bushels were: James River 432,171; Rappahannock River 146,999; Pocomoke and Tangier Sounds 86,150; Sea side of Eastern Shore 63,122; Great Wicomico River 41,622; Piankatank River and Milford Haven 39,024; and Mobjack Bay 29,730.

This paper gives an overview of the location, size and productivity of the public oyster grounds (Baylor Grounds) in Virginia. In preparing this paper, data were summarized from an extensive study carried out from 1976 to 1981 titled: "The Present and Potential Productivity of the Baylor Grounds in Virginia (Vols. I and II) (Haven *et al.,* 1981a). A portion of this report relating to the James River, Virginia, has been published (Haven and Whitcomb, 1983), and reference can be made to the original report and the latter publication for additional details on the composition of the various types of oyster bottoms, salinity of the various growing areas, setting data, information on predators and diseases, and the best use of various areas for molluscan culture.

In discussing the overall productivity of Virginia for oysters, it is pertinent to review historical landing data for the state. Prior to 1960, Virginia was the leading oyster producer in the United States, but since 1961 it experienced a major decline in total production. To understand the reason for the decline we must first recognize the dual nature of the state's industry which is based on the public sector managed by the State, and the private sector managed by individuals or companies. It has been the major decline in production from the leased bottoms that has been responsible for the major decline in total statewide production. Production from the public bottoms has also declined, but until recently its production relative to that from the leases has always been much lower.

No detailed studies have been made on the productivity of individual leases or their suitability for oyster culture. Therefore, this paper deals with public bottoms where data are available. It includes information on the location of the most important growing areas, their recent productivity, and acreages of productive and potentially productive bottoms in various estuaries.

PUBLIC AND PRIVATE SECTORS

The naturally productive public oyster bottoms in Virginia were charted through a survey by Lt. J. B. Baylor (hence referred to as the Baylor Survey) and were set aside by

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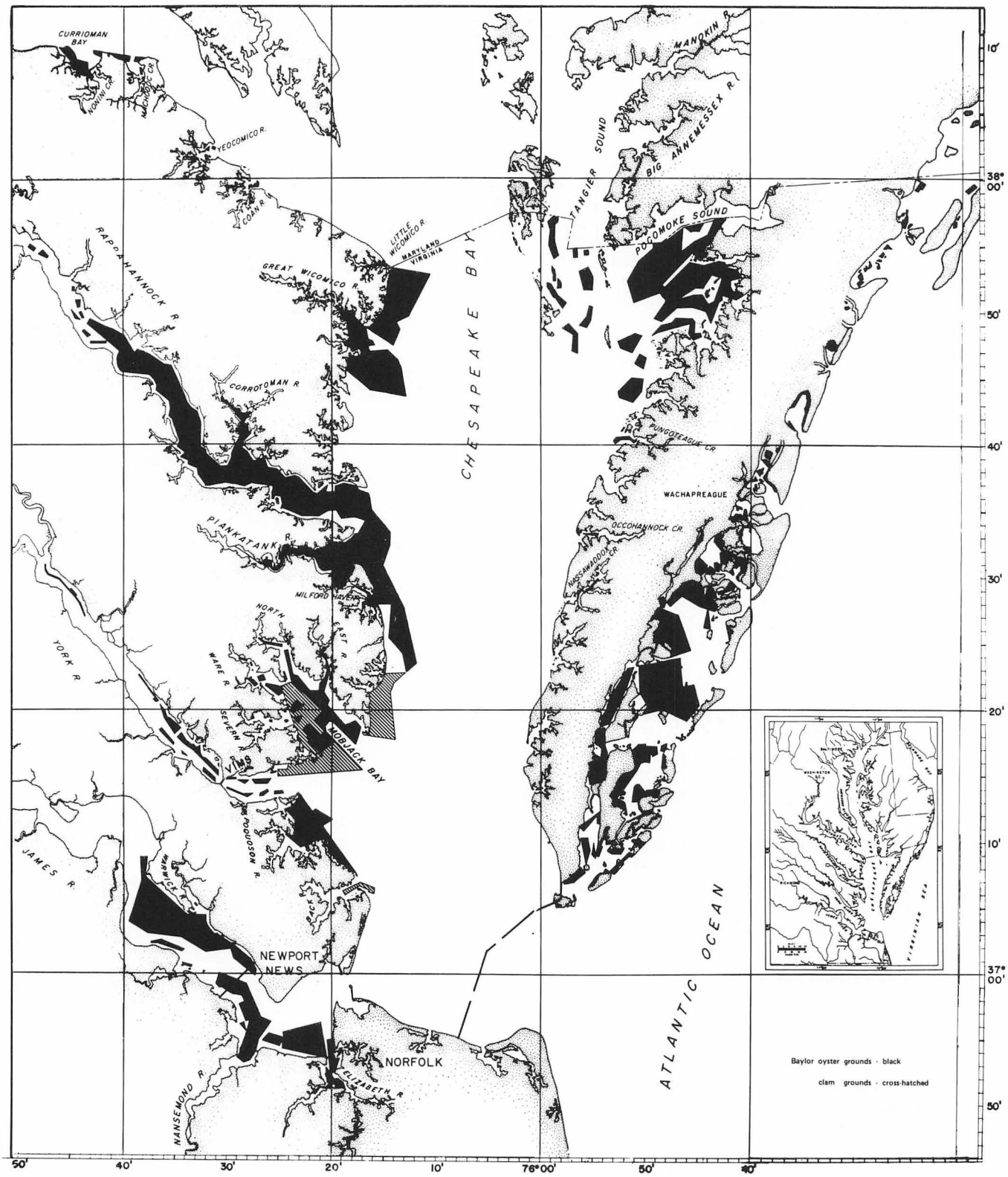

Fig. 1. Location of public oyster grounds (Baylor Grounds) in Virginia. Shaded areas are public clam grounds.

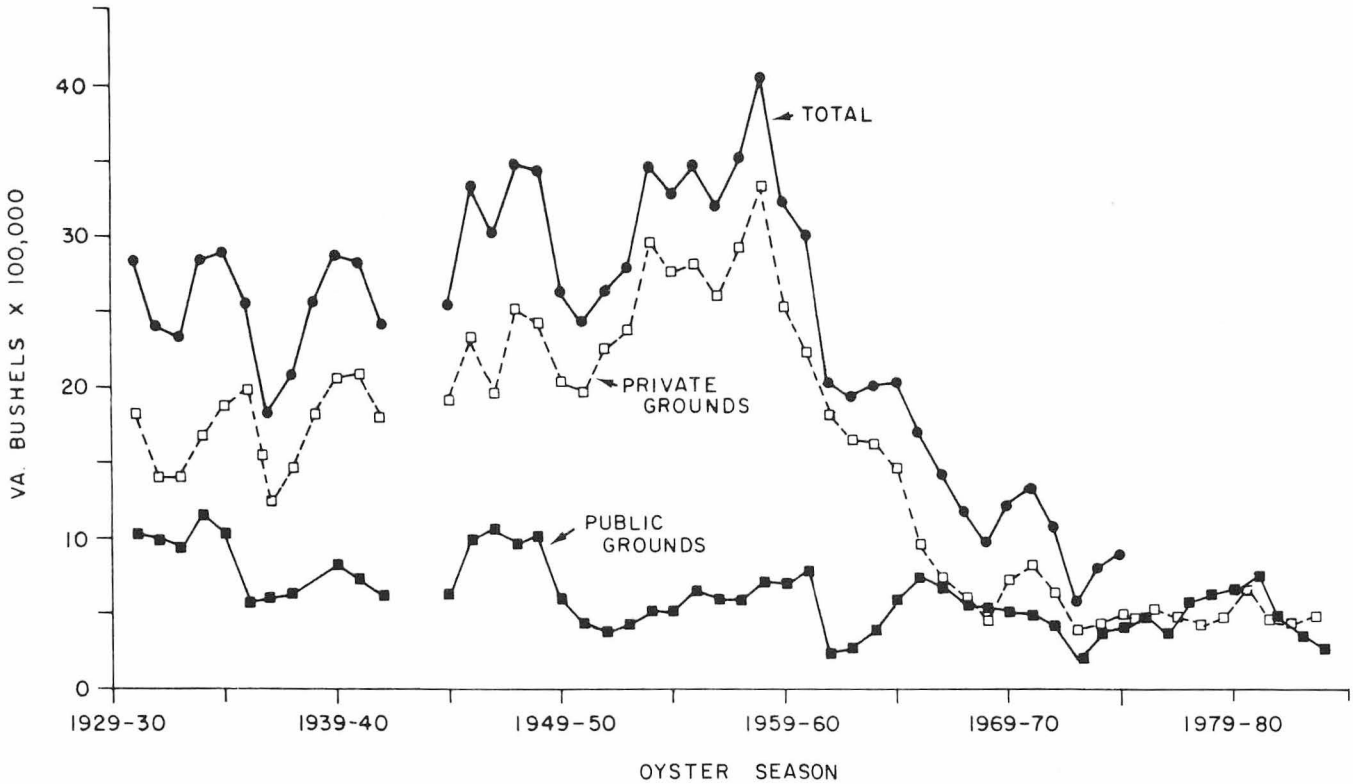

Fig. 2. Landing of market sized oysters in Virginia from 1947 to 1984. Data for Virginia bushels.

legislative action for public use (Baylor, 1894). Changes and additions to the public ground boundaries have been made since, and today they total about 243,000 acres. Data relative to the industry, the decline in production, and the onset of the oyster disease MSX *Haplosporidium (Minchinia) nelsoni* (Haskin, Stauber and Mackin) (Andrews, 1968) are summarized below from an earlier publication (Haven *et al.,* 1981a).

The state's Baylor Grounds contain most of the areas where oysters set and grow naturally, but they also contain large areas of unproductive bottom (Fig. 1). These public oyster bottoms are managed by the Virginia Marine Resources Commission (VMRC), which collects statistical data, enforces fisheries laws and regulations, regulates season of harvest, collects various taxes on oysters and license fees from harvesters and dealers, and plants shells or seed oysters on public bottoms to enhance oyster production. Salinities on most of these bottoms range from about 5 to 20 $^{0}/_{00}$.

Bottoms located outside designated public bottoms can be leased from the VMRC by individuals or companies for renewable 10 year periods. The annual leasing fee in Chesapeake Bay is $0.75 per acre per year and $1.50 in all other locations. Salinities on leased bottoms usually range from about 5 to 30 $^{0}/_{00}$. During the 1950s total lease size ranged from about 100,000 to about 125,000 acres; in 1984 about 110,000 acres were leased. Most leased bottoms are not naturally productive, as are many public bottoms, and most must be planted with seed oysters to make them productive. For the last 100 years over 75% of this seed has been tonged from the public bottoms in the James River. Therefore, the private sector is largely dependent on this source of seed for its basic production (Haven *et al.,* 1981b).

THE MAJOR DECLINE IN PRODUCTION

In Virginia the decline in oyster production began in 1960 when the oyster pathogen *Haplosporidium (Minchinia) nelsoni* commonly known as MSX entered Chesapeake Bay and caused high mortalities in the high-salinity growing areas (Andrews, 1968). In the decade before 1960, annual production of market oysters in Virginia averaged about 3.2 million Virginia bushels.[1] Of this total, about 0.55 million came from Virginia's 243,000 acres of public bottom, and 2.65 million from about 125,000 acres of leased bottoms. That is, leased bottoms were producing nearly 5 times as many oysters as did the public bottoms and on fewer acres (Fig. 2). The reason for this large difference in production was that leased areas were usually planted with seed oysters from the James River at rates ranging from 500 to 1000 bushels per acre. In contrast, harvest from the public bottoms originated from a natural set, or from limited repletion efforts by the State (Haven *et al.,* 1981b).

About 5 years after MSX became active total production of market oysters fell sharply to about 1.7 million bushels

[1]The Virginia oyster bushel is 1.397 times larger than the U. S. standard bushel.

Table 1. Acres of productive or potentially productive bottom, unproductive areas and average oyster production (1974-75 to 1983-84) in Virginia estuaries in Chesapeake Bay that may produce seed or market oysters.

River system	Acres productive or potentially productive	Unproductive acres	Total acres	% productive bottom	Average production in bushels	Total market plus seed
James[1]	16,246	8,906	25,152	64.6		
market					55,301	
seed					376,870	
					Total	432,171
Piankatank & Milford Haven	839	7,327	8,166	10.2		
market					17,223	
seed					21,801	
					Total	39,024
Great Wicomico	493	3,578	4,071	12.1		
market					38,954	
seed					2,668	
					Total	41,622
Corrotoman	213	1,348	1,561	13.6		
market					6,401	
seed					0	6,401
Total	17,791	21,159	38,950			

[1]Includes Production from Nansemond River.

with most of the decline due to the absence of production from leased bottoms. The decline continued and by 1984 total production was only 523,614 bushels; leased bottoms yielded 285,015 bushels, and public bottoms produced 238,614 bushels (VMRC, An. Rpts.).

MSX was the cause of the initial major decline in production from leased bottoms after 1960 since many large leases were in high salinity areas. Since that time, the continued decline has been associated with the persistence of MSX, adverse economic conditions related to costs of growing and harvesting oysters, and failure of the private sector to utilize modern technology. The public oyster grounds existing in low salinity areas have also been influenced by MSX but to a lesser degree (Haven *et al.,* 1981b).

MATERIALS AND METHODS

BOTTOM TYPES

The nature of the bottom was determined at nearly 250,000 stations by an experienced operator who used a long pole (probe) to determine bottom composition by the poles impact as it touched shell, sand or mud. An underwater microphone was towed over the bottom between stations and its amplified sound, as it impacted shell or oysters, was recorded to supplement information obtained with the probe (Haven *et al.,* 1979). Additionally, many thousands of samples of the bottom were obtained with patent tongs to record oyster and shell densities (Haven *et al.,* 1981a). Each probe of the bottom was made at a known position which was established by electronic positioning gear, Raydist® , which showed the vessels location in terms of a parabolic grid system referenced to latitude and longitude. Using these data, the Baylor bottoms were classified as sand, gravel, mud, shell-mud, shell-sand or shell-oysters (hard oyster reef). Subsequently, the boundaries of the various bottom types were outlined on charts. Areas were determined with a digitizing planimeter (Haven *et al.,* 1979 and Haven *et al.,* 1981a).

Firm bottoms (oyster reefs) largely composed of a shell-oysters mixture are rated as having the highest value for oyster culture. The less firm bottoms composed of shell-mud or shell-sand are next in value. They may or may not have living oysters and are classed as productive or potentially productive. Bottoms lacking shell or those composed of sand, mud or gravel and those in waters exceeding about 10 m are considered to have a low potential for growing oysters (unproductive).

The sonic gear and bottom probe did not differentiate between living oysters and non-living oyster shell; however, we do not regard this distinction of major importance in our formulation of a classification, i.e., productive, potentially productive, or unproductive. The presence of shell material (live oysters or shells) showed the present state or past history of a bottom. If "shell" (live oysters or non-living shell) is detected, it meant that oysters were growing there or did grow there in the recent past.

Statistical data on landings of oysters in Virginia were obtained from the Virginia Marine Resources Commission,

Table 2. Acres of productive or potentially productive bottom, unproductive areas and average market oyster production (1974-75 to 1983-84) in Virginia estuaries where market oysters are grown.

River system	Acres productive or potentially productive	Unproductive acres	Total acres	% productive bottom	Average production in bushels
Poquoson[1]	808	8,123	8,931	9.0	5,949
York	1,089	1,359	2,449	44.5	1,729
Mobjack Bay	412	5,197	5,609	7.3	29,730
Mobjack Bay Tributaries[2]	195	2,258	2,453	7.9	9,283
Rappahannock	9,502	33,191	42,693	22.2	146,999
Back & Little Wicomico	—	—	—	—	5,627
Potomac River Tributaries[3]	817	1,951	2,768	29.5	6,914
Total	12,823	52,079	64,902		

[1]Includes large areas in Chesapeake Bay.
[2]Includes East, North and Ware and Severn Rivers (about 5% of Baylor Areas not included).
[3]Includes Nomini, Lower Machodoc, Coan and Yeocomico Rivers; Currioman not surveyed.

Newport News, Virginia (VMRC, 1947-1984). Statistical data on landings (production) are based on the biological year which extends from 1 October to 30 June. These data were averaged for a ten-year period (1974-75 to 1983-84).

Areas in this paper are given in acres since this is the official method used by Virginia to measure size of oyster grounds. The conversion factor is: 1 acre = 0.4047 hectacres.

RESULTS

SHAPE OF PRODUCTIVE OR POTENTIALLY PRODUCTIVE BOTTOMS

Most of the areas of shell-oyster bottoms within the Baylor Survey bottoms in Virginia occur at depths between the 6 and 18 feet (1.8 - 5.5 m) contours as shown on NOAA charts. In a few instances shells or oysters occur as deep as 30 feet (9.1 m). However, in the shallow lagoonal areas on the seaside of the Eastern Shore, oysters occur intertidally, or just below the low tide level.

Areas termed oyster reefs are not contiguous, but occur as irregularly shaped areas usually surrounded by shell-sand or shell-mud bottoms. The reef areas occur in a definite pattern in respect to channels and other features of the bottom, and although they appear irregular in outline they may be classed into four types: parallel, longitudinal, pancake and transverse (Price, 1954; Scott, 1968; Haven and Whitcomb, 1983). The reef areas may vary in area from less than one acre to several hundred.

OYSTER PRODUCTION, LOCATION AND SIZE OF PRODUCTIVE BOTTOMS

Four of Virginia's estuaries produce seed or market sized oysters[2] (Fig. 1; Table 1). Of these, the James has by far the largest acreage of productive or potentially productive bottom (16,246 acres) and the highest average annual production (432,171 bushels). Most of the production (376,870 bu. annually) consists of seed size oysters. The three remaining estuaries have produced relatively little seed during the 1974-75 to 1983-84 period, but annual average market oyster production has been substantial: 17,223 bushels in the Piankatank River and 38,954 bushels from the Great Wicomico River, and 6,401 from the Corrotoman River.

Most of Virginia's estuaries on the western side of Chesapeake Bay produce market oysters (Fig. 1; Table 2). Usually these oysters originate from a natural set on naturally occurring shell, or in some instances, from a natural set on shell planted by the VMRC. Of the seven areas shown, the Rappahannock River has by far the largest acreage of productive or potenially productive bottom (9,502 acres) and the greatest average annual production (146,999 bushels). Mobjack Bay, with only 412 acres, ranked next in average annual production with 29,730 bushels annually. The remaining areas, with acreages ranging from 195 to 1,089 acres, had relatively low average annual production. The percentage of productive or potentially productive bottom within these seven locations follows: Rappahannock River - 22.2%; York River - 44.5%; Potomac River tributaries - 29.5%; Poquoson River - 9.0%; and Mobjack Bay and tributaries - 7.3% and 7.9%, respectively.

Large acreages of Baylor bottom exist on the western side of Chesapeake Bay off the entrances to the Rappahannock, Piankatank, and Great Wicomico rivers (Fig. 1; Table 3). In this large area only 639 of the 27,247 acres (2.3%) are classified as productive or potentially productive. Average annual production of 22,884 bushels, is fairly high for the 639 acres of productive and potentially productive bottoms.

Estuaries on the eastern side of Chesapeake Bay include Pocomoke and Tangier Sounds and several small

[2]Three inches in length or longer.

Table 3. Acres of productive or potentially productive bottom, unproductive acres and average market oyster production (1974-75 to 1983-84) in two areas on the western side of Chesapeake Bay where market oysters are grown.

River	Acres productive or potentially productive	Unproductive acres	Total acres	% productive bottom	Average production in bushels
Off Entrance to Piankatank River	610	16,229	16,839	3.6	
Off Entrance to Great Wicomico River	29	10,378	10,407	0.3	
Total	639	26,607	27,246		22,884

Table 4. Acres of productive or potentially productive bottom, unproductive areas and average oyster production (1974-75 to 1983-84) in Pocomoke - Tangier Sounds, several bay side Eastern Shore creeks.

River	Acres productive or potentially productive	Unproductive acres	Total acres	% productive bottom	Average production in bushels
Seaside of Eastern Shore	7,226	33,587	40,813	17.7	
market					32,314
seed					30,808
Total					63,122
Pocomoke & Tangier Sound market	5,875	25,096	30,971	19.0	86,150
The Bay Side Tributary Creeks[1] market	83	439	522	15.9	very low-landings included above

[1]Includes Pungoteague, Occohannock, and Nassawadox Creeks.

tributary creeks on the western side of the Eastern Shore peninsula (Fig. 1; Table 4). The Seaside of the Eastern Shore has a total of 40,813 acres, but only 7,226 (17.7%) is classed as productive or potentially productive. Annual production for the last 10 years from this location has been 63,122 bushels. Pocomoke and Tangier Sounds also have large areas of Baylor bottom (30,971 acres), but only 19.0% or about 5,875 acres has shell. From this large area annual production was 86,150 bushels. Productions from the three Bayside tributaries has been very low (Table 4).

The preceeding data outlined the extent of the productive and potentially productive bottoms, the size of unproductive areas and average annual production. Table 5 summarizes production in terms of bushels per acre. These data show the low level of productivity of most of the estuaries. The highest level of productivity (84.4 bu/acre) is for the Great Wicomico River, and the next highest is 72.2 bu/acre for Mobjack Bay; both areas have had shells planted on them by the VMRC in recent years, and it is probable that at least half of the mature oysters originated from these plantings.

DISCUSSION

The total acreage surveyed in this study (Tables 1-4) is 203,405 acres which is slightly less than the 243,000 acres usually cited as the total acreage of Public Bottoms in Virginia. That is, our study included about 84% of the State's reported acreage of Public Bottoms. Areas omitted from the study include sites now used for spoil disposal, areas now located on dry land due to shoreline changes since 1894, some shallow marsh areas on the Seaside of the Eastern Shore, and certain small areas where the electronic positioning gear would not operate. One large bottom area in the open part of Chesapeake Bay to the north of the entrance to the Rap-

Table 5. Total oyster production related to total acres of productive or potentially productive bottoms. Expressed as bushels per acres (data from Tables 1, 2, 3 and 4).

River	Acres productive or potentially productive	Average production in bushels	Bushels oysters per acre
I. SEED AND MARKET AREAS (TABLE 1).			
James	16,246	432,171	26.6
Piankatank & Milford Haven	839	39,024	46.5
Great Wicomico	493	41,622	84.4
Corrotoman	213	6,401	30.1
II. MARKET GROWING AREAS IN ESTUARIES ON THE WESTERN SIDE OF CHESAPEAKE BAY (TABLES 2 AND 3).			
Poquoson	808	5,949	7.4
York	1,089	1,729	1.6
Mobjack Bay	412	29,730	72.2
Mobjack Bay Tributaries	195	9,283	47.6
Rappahannock	9,502	146,999	15.5
Back & Little Wicomico Rivers	—	5,625	—
Potomac River Tributaries	817	6,914	8.5
Off Entrance to Piankatank River	610	22,884	37.5
Off Entrance to Great Wicomico River	29	—	—
IV. POCOMOKE-TANGIER SOUND (TABLE 4).			
Seaside of Eastern Shore	7,226	63,112	8.7
Pocomoke and Tangier Sound	5,875	86,150	14.7
Eastern Shore Tributary Creeks (3) on Bay-side	83	Very low	—

pahannock River was not surveyed because of time limitations; however, it was largely an unproductive sand bottom (Haven *et al.,* 1981a).

The study showed that statewide, 44,437 acres had moderate to high potential for oyster culture, or 21.8% of the acreage surveyed. This does not mean that the remaining 78.2% have no value. Often, bottoms without shell may be highly productive of hard clams, soft clams, fish or crabs.

The estuary which produced the most oysters was the James River which averaged about 376,870 bushels of seed and 55,301 bushels of market-sized oysters annually from about 16,246 acres. The Rappahannock River ranks next to the James River with an average annual production of 146,999 bushels from about 9,502 acres. Next in order of rank are Pocomoke and Tangier Sound followed by the Seaside of the Eastern Shore.

Care must be used in interpreting production data presented in this study. In the James River, for example, the present demand for seed is very low due to adverse economic factors influencing the purchase of seed by lease holders. It is believed that if demand increased, production could be higher. In contrast to the James River, most of the remaining areas surveyed produced relatively few oysters from their productive and potentially productive bottoms. Yields from these latter areas are probably as high as the areas can now support under the present system of management. We believe that with proper management and more funds for repletion, many areas might yield more oysters. Suggested improvements include the adoption of modern technology in dredging seed and in planting shell, and in a more efficient use of seed oysters produced in the James River.

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