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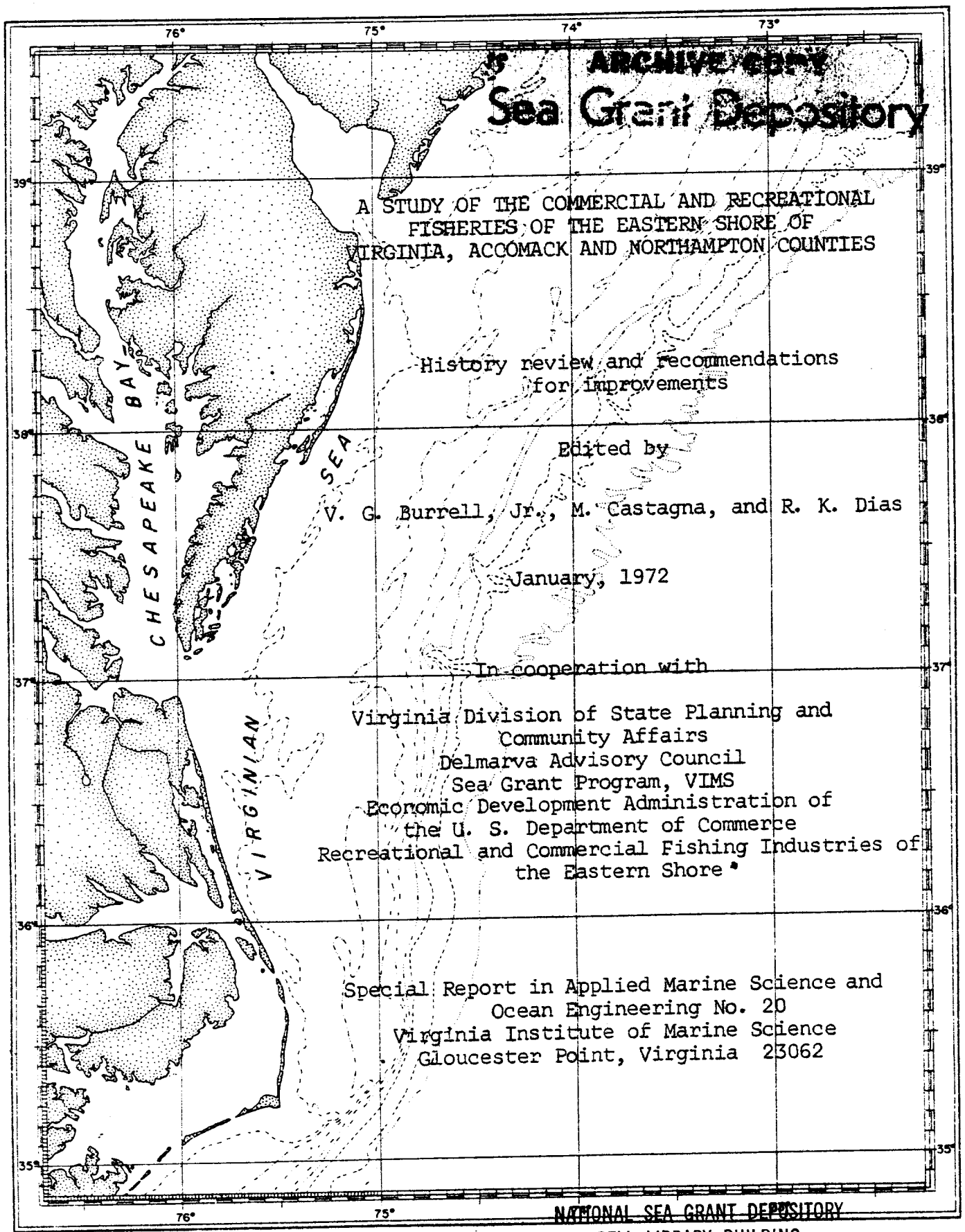

A STUDY OF THE COMMERCIAL AND RECREATIONAL FISHERIES OF THE EASTERN SHORE OF VIRGINIA, ACCOMACK AND NORTHAMPTON COUNTIES

History review and recommendations for improvements

Edited by

V. G. Burrell, Jr., M. Castagna, and R. K. Dias

January, 1972

In cooperation with

Virginia Division of State Planning and Community Affairs
Delmarva Advisory Council
Sea Grant Program, VIMS
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Recreational and Commercial Fishing Industries of the Eastern Shore

Special Report in Applied Marine Science and Ocean Engineering No. 20
Virginia Institute of Marine Science
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This study was carried out under provisions of Technical Assistance Grant Project #03-6-09198 from the Economic Development Administration of the U. S. Department of Commerce to the Virginia Division of State Planning and Community Affairs. Additional support was also provided as a result of research sponsored by NOAA Office of Sea Grant, Department of Commerce, under Grant #I-36032. Matching funds were provided by Virginia Institute of Marine Science of the Commonwealth of Virginia. The U. S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

TABLE OF CONTENTS

INTRODUCTION

The fishing industry of the Eastern Shore is probably the oldest industry in Virginia. Its importance has been reflected within the Eastern Shore and throughout Tidewater. As part of the industrial development section of the Accomack and Northampton Counties, Virginia Developmental Study, the Virginia Institute of Marine Science was requested by the Governor's Office to submit a report of the seafood industry of this important bi-county area of the Commonwealth. Specialists in the biology of various species presently utilized reviewed that portion of the industry in which they have expertise. This report is a compilation of their studies. The participants were Dr. J. D. Andrews, V. G. Burrell, Jr., M. Castagna, Dr. W. J. Davis, R. K. Dias, W. P. Duggan, D. S. Haven, Dr. E. B. Joseph, Dr. J. Loesch, J. J. Norcross, J. B. Pleasants, C. E. Richards, and W. A. Van Engel. Other staff members were consulted for specific information. Dr. A. B. King of the School of Business Administration of William and Mary acted as a consultant. Questionnaires to provide additional information from various segments of the seafood industry were used in interviews. Separate questionnaires were designed for processors, harvesters, oyster lease holders, commercial and sport fishermen. Interviews were also held to define long-term fishery trends and included former operators of ocean pound net fisheries and former employees of

the Smith Menhaden Factory. Virginia Marine Resource Commission inspectors were interviewed to obtain information on licenses and trends in commercial fisheries. Motel, marina, and campground operators were interviewed to ascertain the seasonality of the sport fishery. Boat ramps were visited on several occasions, including weekends, to determine most used areas and home areas of the fishermen.

These studies have brought to light some interesting aspects of the commercial fishing industry on the Eastern Shore. We find that many of the problems that plague the industry are the same ones that have been with the industry from its early days and are not unique to this area. Many of the industry's problems will be exceedingly complex and will be difficult to overcome.

We are indebted to the many industry personnel, fishermen, and inspectors for answering our questions and for their interest and generous help in this study.

2-7.001

Chapter I

ECONOMIC HISTORY

by

J. B. Pleasants

Introduction

The Eastern Shore of Virginia is composed of two counties which divide the Virginia portion of the peninsula between them on an east-west line. Accomack, the northern-most, has more than twice the land area of its southern neighbor, Northampton. They aggregate 696.1 square miles in land area, and 263 square miles in water area. This is divided as follows:

	Land (sq. mi.)	Water (sq. mi.)
Accomack	476.0	137.0
Northampton	220.1	126.0
Total Eastern Shore	696.1	263.0

The land is flat, with the Chesapeake Bay on the western side, and the Atlantic Ocean on the eastern. Both shores are cut and indented by numerous bays, inlets, and meandering creeks. The eastern side is protected from the full fury of the Atlantic by a chain of barrier islands which extend nearly the entire length of the peninsula. These provide cover for extensive salt marshes, shallows, and flats, which are inundated daily by the tides.

The average annual rainfall for the Eastern Shore is 43 inches, and the average temperatures are 41°F in January and 77°F in July for Northampton, and 42°F and 79° for the same months for Accomack (Division of State Planning and Community Affairs, 1968a and 1968b).

Historical Data

The Eastern Shore was explored by Captain John Smith in 1608, and settled in 1614. From the earliest times, the fishing industry has played a significant part in the economic life of the peninsula. Witness John Rolfe, in 1621:

> At Dales Gift, being upon the sea near unto Cape Charles, about thirty miles from Kecoughtan (Hampton) are seventeen inhabitants under command of Lieutenant Cradock. All these are fed and maintained by the Colony. Their duty is to make salt and catch fish....(Wharton, 1957)

Some unusual methods of fishing were employed in the early days. For example, a Col. T. J. Randolph, writing of the years around 1800 reported:

> Rockfish were hunted on the Eastern Shore on horseback with spears. The large fish coming to feed on the creek shores, overflowed by the tide, showed themselves in the shallow water by a ripple before them. They were ridden on behind and forced into water too shallow for them to swim well, and were speared. (Wharton, 1957)

The economic history of the Eastern Shore has been greatly affected by both its natural characteristics and its location. Each has had good and bad effects, with the very advantages carrying

with them serious disadvantages in a bewildering juxtaposition. For instance, the sea and bay provide a boundless resource of commercially desirable species; yet, in these days of the dominance of terrestrial transportation, they lead to isolation from major markets of the area. The very isolation of the Eastern Shore and its low population density lessens the possibility of pollution, thus preserving the environment on which estuarine animals are dependent. The long narrow shape of the peninsula permits an enormous amount of waterfront with its attendant advantages; one is never further than about ten miles from the water. On the other hand, problems arise with the distribution of services, labor and electric power.

The migratory habits of the finfish and the seasonal nature of the shellfisheries (with the possible exception of the fishery for clams) cause problems by producing a great variance in the supply of fish. This was especially true prior to the introduction of artificial refrigeration and was not confined to the Eastern Shore. George Washington commented:

> In the height of the fishery they are not prepared to cure or otherwise dispose of them as fast as they could be caught; of course the seines slacken in their work, or the fish lie and spoil when that is the only time I can make anything by the seine, for small hauls will hardly pay the wear and tear of the seine and the hire of hands. (Wharton, 1957)

And again in 1794:

> ... I again repeat that when the school of fish run you must draw night and day; and whether Smith is prepared to take them or not, they must be caught and charged to him; for it is then and then only I have a return for my expenses; and then it is that the want of several purchasers is felt; for unless one person is extremely well prepared he cannot dispose of the fish as fast as they can be drawn at those times....(Wharton, 1957)

The problem continues today but with the emphasis on labor and capital outlay. The fluctuating abundance produces many "part time" fishermen and processing personnel and mitigates against the investment of large sums in plants and equipment which lie useless during certain part of the year, unless they, like the people, can find alternate employment.

The Eastern Shore has remained relatively isolated over the years. This isolation is curious when one considers that, according to figures given for 1966, over 750,000 people live within 50 miles, and more than 31 1/2 million...nearly 16% of the U. S. population...within 250 miles (U. S. Bureau of Outdoor Recreation, undated).

In 1871, the United States Commission of Fish and Fisheries was established. It was not until 1887 however, that the first statistics for the Eastern Shore were published; and these, for the year 1880, were somewhat disjointed and fragmentary. Nevertheless, they are of considerable interest. Many of the statements made concerning economic conditions in the Eastern Shore fishing

industry have a remarkable similarity to those of today. Some of these concern the lack of suitable transportation, the lack of a convenient market, the presence of many part-time fishermen, and "green gill" oysters (Goode, 1887).

All dollar values given in the following paragraphs are in "current" or "reported" dollars. Later, for purposes of comparison, a common base is utilized. This is more fully discussed under "Explanation of Tables."

The report for 1880 states that the clam and terrapin fisheries were extensively developed, with the latter producing 23,000 dozen terrapin valued at nearly $10,000 annually (Goode, 1887). Since clams and terrapin can be held successfully for long periods of time, they were retained until a selling opportunity, or convenient transportation to more distant markets, presented itself.

During this period, also, the "fisheries proper" (finfisheries) was confined largely to Bayside. Handlines were much in evidence, with about 300 men engaged in their use with a catch value of $39,250 (Goode, 1887) Gill nets had been little used except for shad, but in 1878 were introduced for the capture of mackerel and were soon adapted to other species.

The first pound nets were introduced on the Eastern Shore by Messrs. Shediker and Warren in the spring of 1877 and were found to be extremely effective and profitable. By 1879, there were seventeen of these nets utilizing the labor of sixty-four men and returning a catch valued at $57,000 (Goode, 1887).

Haul seines, of course, had been used in the area since the early days of colonization. Due to declining shad catches, however, by the summer of 1879, there were only 12 seines in operation employing 85 men and taking only $16,000 worth of fish (Goode, 1887).

Another interesting comment from this report concerns the infant menhaden industry which "...promises to become quite important... ." The first "oil and guano" (menhaden) factory in Virginia was built on the Eastern Shore near Cape Charles by two gentlemen named Gallup and Kenniston "...in 1866 or 1867, but owing to its exposed location it was abandoned..." (Goode, 1887).

Unfortunately very limited figures are given in this report for the Eastern Shore oyster fishery, which merely indicate the numbers of vessels utilized, (895 "canoes and skiffs" and 320 "larger vessels") and the number of men employed (total 2945) (Goode, 1887).

In the same time frame (1878-79), Lt. Francis Winslow, USN, attached to the Coast and Geodetic Survey, made a detailed survey of the oyster grounds of Tangier and Pocomoke Sounds and calculated the number of oysters per square yard. The incidence of dead to living shells was taken as "tangible proof" of depletion by overfishing (Smith, 1893).

In 1889-90, the fisheries of the Cape Charles City area were surveyed. It was noted that the principle method of fishing was by the pound net, and:

> Owing to ample facilities for shipment by rail and water, the favorable character of the shore, proximity of the ocean, and general abundance of fish, this is perhaps the finest region for pound net fishing in Chesapeake Bay as regards marine species (Smith, 1893).

The Spanish mackerel was listed as the leading catch, followed by bluefish and squeteague. It was indicated that catch of mackerel per pound net was probably higher here than anywhere else on the Atlantic Coast.

Also of interest is the note that pompano were very abundant at some seasons and "undoubtedly spawn in the Chesapeake" (Smith, 1893).

Statistics were given for the pound net fishery of the area as follows (Smith, 1893):

Year	Number of Pound Nets	Total Catch Pounds	Value ($)
1889	17	934,835	16,155
1890	16	1,169,033	15,988

The value of the catch, which is in apparent disagreement with the relative weights of the two years, is undoubtedly related to the amounts of the various species caught.

Ingenuity was not lacking in the industry. In an attempt at preservation, Mr. A. A. Freeman, owner of the International Oyster Company, Cape Charles, was reported to have developed a method of "wiring" oysters, whereby the two valves were held firmly together by a piece of wire wrapped around them. Initially, this was done by hand with pliers, and then by a special machine which could wire

up to 48 oysters per minute. A noted biologist of the time, Professor John A. Ryder, was prevailed upon to say:

> I have examined and had in my possession a number of wired oysters, and I am satisfied that the oyster can be preserved when the shells are thus wired for a considerable length of time. I have carefully examined oysters which I am satisfied have been wired for sixty days, and I find their vitality is fully preserved and the oysters in no way deteriorated in quality of flavor. I think the process of preserving oysters by placing a wire around them is a practically useful process, and in my opinion would lead to the transportation of oysters to distant points as an article of commerce, when it would be otherwise impossible to transport them alive in the shell (Smith, 1893).

No mention was made of temperatures or other conditions that prevailed during the "sixty days," however.

Statistical Data

All basic fishery statistics utilized in this paper have been extracted from the official publications of the United States Commission of Fish and Fisheries, and the Bureaus which succeeded it. These publications have had various titles over the years, and are listed under "Literature Cited."

In the Bulletin of the United States Fish Commission for 1894, very complete statistics for the fisheries of the Eastern Shore are given. These figures, for the years 1890 and 1891, may serve as a baseline for economic discussions of the industry.

Since their inception, the statistics collected by the United States Government on the Eastern Shore have varied considerably in frequency of collection, method of arrangement, and data contained.

For instance, in the earlier years, statistics were collected from various parts of the United States on a sort of "round robin" basis, and often several years would go by with no collection from the Eastern Shore, or, indeed, from Chesapeake Bay.

Development of statistics on personnel engaged in fishing has proven complex. It was decided early to utilize figures for fishermen only, since data on persons who worked in other phases of the industry are not generally available. This decision, while providing an overall simplification, led to certain problems of its own. For instance, for the years 1920 and before, industry personnel were broken down as follows:

On fishing vessels,
On transport vessels,
Inshore and boat fishermen,
Shoresmen.

No further explanation is given for each category. Those persons listed as "On transport vessels" and "Shoresmen" have been excluded from these computations.

In the report for 1925 alone, the heading "Persons Engaged" is employed without further explanation. Apparently this figure, which is relatively high, represents the total industry and, therefore, is not in consonance with the personnel figures for other years. All computations for the year 1925 relating to the number of persons involved should be viewed with skepticism.

In 1929 the following headings were adopted:

On vessels,
On boats and shore.

This last was broken into two sub-headings, "regular" and "casual," with figures for each. All these, it is assumed, are "fishermen."

Frequently, particularly from 1939 onward, the annual statistics are not broken down by counties, but rather into "Chesapeake Bay Waters" and "Ocean Waters." This format does not lend itself to the abstraction of figures for the Eastern Shore as a unit and accounts for the missing data for some of the years before 1939 and all those afterwards.

Explanation of Tables

The values in all tables are given both as "current" (reported) dollars, and as "adjusted" dollars. The Wholesale Price Index for "All Commodities" based on Bureau of Labor Statistics calculations (Bureau of the Census, 1949, 1951, and 1961) was utilized. Early Wholesale Price Indices (All Commodities) from the statistics of the Bureau of Labor Statistics are based on 1926 as 100. Later, the period 1947-49 is used as a base. Calculations established 1.53892 as a close approximation of the conversion factor between the two. Dividing the dollar values based on 1926 as 100 by this number established 1947-49 as a common base. The year 1960 was then chosen to give a better perspective though of course any year could have been used.

With 1947-49 as 100, 1960 was given as 119.6. Therefore, all values based on the 1947-49 era were divided by 119.6 to establish 1960 as a base (1960 equals 100).

The statistics on oyster catch value were included because they are historically the single most valuable species in the Eastern Shore Catch. Figures for seed oysters posed a special problem. Prior to 1920 such figures were not reported, although it was common practice in the 19th and 20th centuries to ship small oysters to northern waters for the final stages of their growth and subsequent sale. From 1920 on, reporting of seed oyster harvests was sporadic. As an example, in 1930 no seed oysters were reported from Accomack County, although 1929 showed a value of $1380 and 1931 a value of $21,153. Similarly, Northampton County reported no seed oysters in 1934, with a catch worth $20,440 in 1933 and $8,800 in 1935. Neither Accomack nor Northampton reported any in 1937, although other Virginia counties did. After 1938, seed oysters were not separately listed in the time frame considered.

In this discussion, seed oysters values, where listed, were included in the value of the total oyster catch for the year. It can be argued that seed oysters, which are replanted to be recovered later as market oysters, are thus counted twice. If we were attempting to determine the total number or weight of oysters caught, this point would certainly be valid. Since, however, watermen are

paid for the oyster each time they recover it, and our object is to discover economic returns, the adopted method seems the more logical. Notice that the value, but not the weight, is considered for oysters.

Table 2 shows the total fish catch for the state of Virginia in weight and value, for comparison with Eastern Shore figures for the same years.

Table 3 is composed of computations based on the figures from Tables 1 and 2. All columns are self explanatory, but comment on two of them is appropriate.

"Dollar Return per Fisherman" may be taken as a partial indicator of the economic success of a year's fishery; similarly, "Pounds Caught per Fisherman" may be considered a partial indicator of biologic abundance. Of course, many other factors must be considered for each. Such things as weather, which hinders or enhances fishing, the relative amounts of the various species caught, the many corditions which may cause migratory fish to vary from normal patterns, and the innumerable complex relationships, even now not clearly understood, which affect the behavior of fish, are all of importance. Even "Luck of the Chase" must certainly be included. Economic success and biologic abundance are, of course, highly interrelated; if too many fish are caught, the price drops; and dollar return per man may be lowered. On the other hand,

TABLE 1

		Eastern Shore Total Catch			Oyster Catch Value		
			Value				
Year	Fishermen	Weight (Pounds)	Current Dollars	Adjusted Dollars * (1960=100)	Current Dollars	Adjusted Dollars * (1960=100)
1890	3784	50,764,553	955,073	3,128,310	738,487	2,418,890
1891	3880	44,731,327	968,568	3,194,485	736,166	2,427,988
1897	4225	47,585,412	692,991	2,736,931	472,467	1,865,983
1901	4914	89,777,304	1,186,177	3,948,658	821,165	2,733,572
1920	2373	76,270,905	1,916,851	2,284,958	475,363	566,650
1925	4391	53,980,560	2,219,268	3,946,769	Not Available	Not Available
1929	2292	37,149,921	1,896,568	3,664,158	464,237	896,903
1930	2200	35,712,077	1,929,542	4,113,285	531,958	1,133,997
1931	2341	27,760,324	1,063,914	2,684,618	228,251	575,955
1933	2106	18,280,091	749,341	2,093,716	283,811	792,990
1934	2206	21,487,500	868,851	2,133,721	258,853	635,690
1935	2134	21,607,000	809,439	1,861,635	231,222	531,789
1936	2073	25,301,600	931,491	2,121,847	334,748	762,524
1937	1949	24,478,400	834,053	1,777,986	214,130	456,470
1938	1894	27,198,700	1,009,315	2,362,076	231,679	542,193
1945	1959	20,974,700	4,034,410	7,012,706	2,117,055	3,679,915
1950	2510	26,834,000	3,229,091	3,746,045	955,390	1,108,341
1955	2482	18,435,700	3,553,249	3,838,860	2,314,625	2,500,675
1960	2711	27,388,600	3,616,960	3,616,960	1,695,893	1,695,893

*to the nearest dollar

TABLE 2

Total Virginia Catch

Year	(Pounds) Weight	Value Current Dollars	Value Adjusted Dollars* (1960=100)
1890	185,283,000	3,637,000	11,912,873
1891	183,994,000	3,648,000	12,031,662
1897	277,994,000	3,180,000	12,559,242
1901	387,184,000	4,613,000	15,356,192
1920	471,219,089	8,541,724	10,182,053
1925	276,228,000	9,085,000	16,156,856
1929	211,285,829	7,285,669	14,075,867
1930	245,294,380	7,487,302	15,960,993
1931	226,636,917	4,732,128	11,940,772
1933	217,018,263	3,326,974	9,295,820
1934	246,800,900	4,176,923	10,257,669
1935	217,592,000	3,520,938	8,097,833
1936	270,304,000	4,312,000	9,822,323
1937	242,291,800	3,829,205	8,162,876
1938	237,331,000	4,403,000	10,304,236
1945	252,786,600	21,518,272	37,403,567
1950	313,799,400	16,118,602	18,699,074
1955	440,959,000	20,454,000	22,098,099
1960	366,684,000	20,925,000	20,925,000

*To the nearest dollar

TABLE 3

Year	Pounds Caught Per Fisherman+	Dollar Return Per Fisherman* Current Dollars	Dollar Return Per Fisherman* Adjusted Dollars (1960=100)	Percentage of Catch Value From Oysters	Percentage of Total Virginia Catch Weight	Percentage of Total Virginia Catch Value
1890	13,416	252	827	77.32	27.40	26.26
1891	11,529	250	823	76.00	24.31	26.55
1897	11,263	164	648	68.18	17.12	21.79
1901	18,270	241	804	69.23	23.19	25.71
1920	32,141	808	935	24.80	16.19	22.44
1925	12,293	505	899	Not Available	19.54	24.43
1929	16,209	827	1,599	24.48	17.58	26.03
1930	16,233	877	1,870	27.57	14.56	25.77
1931	11,858	454	1,147	21.45	12.25	22.48
1933	8,680	356	994	37.87	8.42	22.52
1934	9,740	394	967	29.79	8.71	20.80
1935	10,125	379	872	28.57	9.93	22.99
1936	12,205	449	1,024	35.94	9.36	21.60
1937	12,559	428	912	25.67	10.10	21.78
1938	14,360	533	1,247	22.95	11.46	22.92
1945	10,707	2,059	3,581	52.47	8.30	18.75
1950	10,691	1,286	1,492	29.59	8.55	20.03
1955	7,428	1,432	1,547	65.14	4.18	17.37
1960	10,103	1,334	1,334	46.89	7.47	17.29

+To the nearest pound
*To the nearest dollar

if prices are initially low, less effort will be expended resulting in a smaller catch.

Discussion of Figures

Certain portions of all three tables, notably Table 3, are presented in the form of graphs (Figs. 1-4). While year-to-year variance may be regarded as inconclusive, overall trends are of interest. In some cases, the lack of statistics is unfortunate; one would enjoy, for instance, seeing graphed all the period of World War II (1941-45) and slightly after, which has been referred to as the "Golden Age of the Chesapeake Bay Seafood Industry." Certainly, if the graph of "Dollar Return per Fisherman" (Fig.2) for 1945 is an example, it is easy to see why the industry, in years since, has been regarded as depressed. The period of World War II was unique for several reasons; among these were the rationing of meats other than seafoods, the limited availability of men to fish, and the relative lack of competition from off-shore fisheries. However, the statistics are not broken down by counties for this period, except for 1945.

In Figure 1, we note that fishing effort as indicated by the number of fishermen was highest around the turn of the century, leveling off in the 1920's and remaining relatively constant after that time (As previously discussed, it is believed that the personnel figures for 1925 which are unusually high, are not in consonance with those for other years). The success of the fishery from a

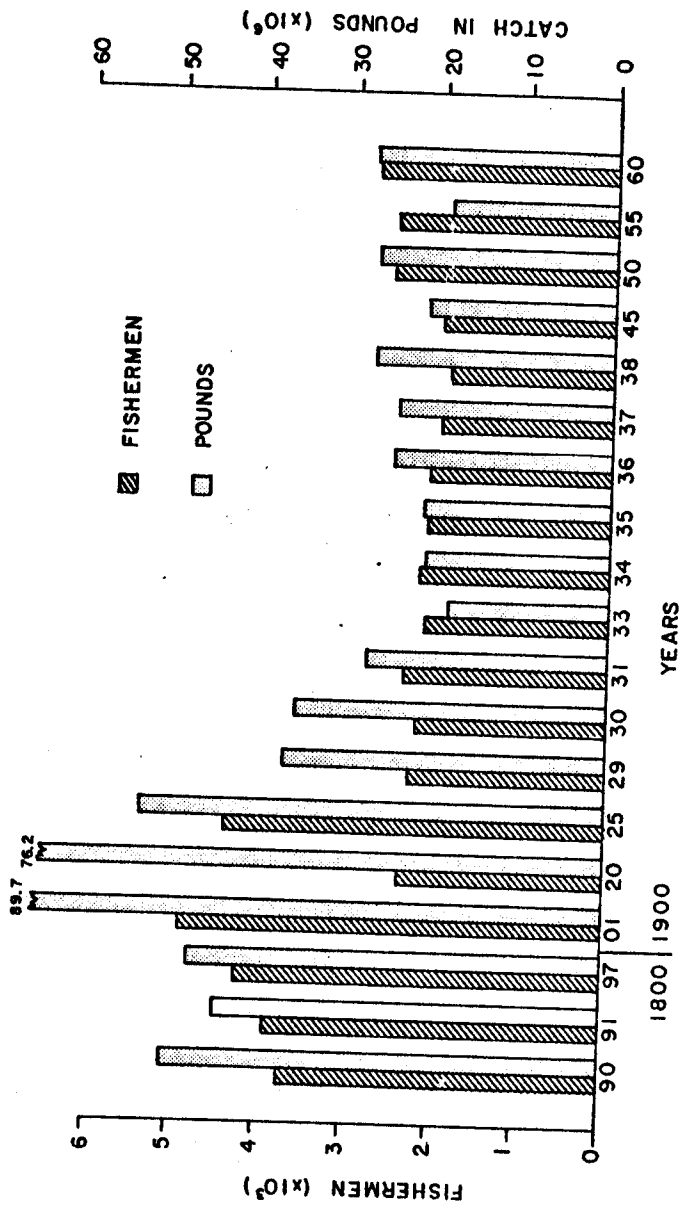

Figure 1. Eastern Shore To Total: Fishermen and Catch in Pounds. (Selected Years, 1890-1960).

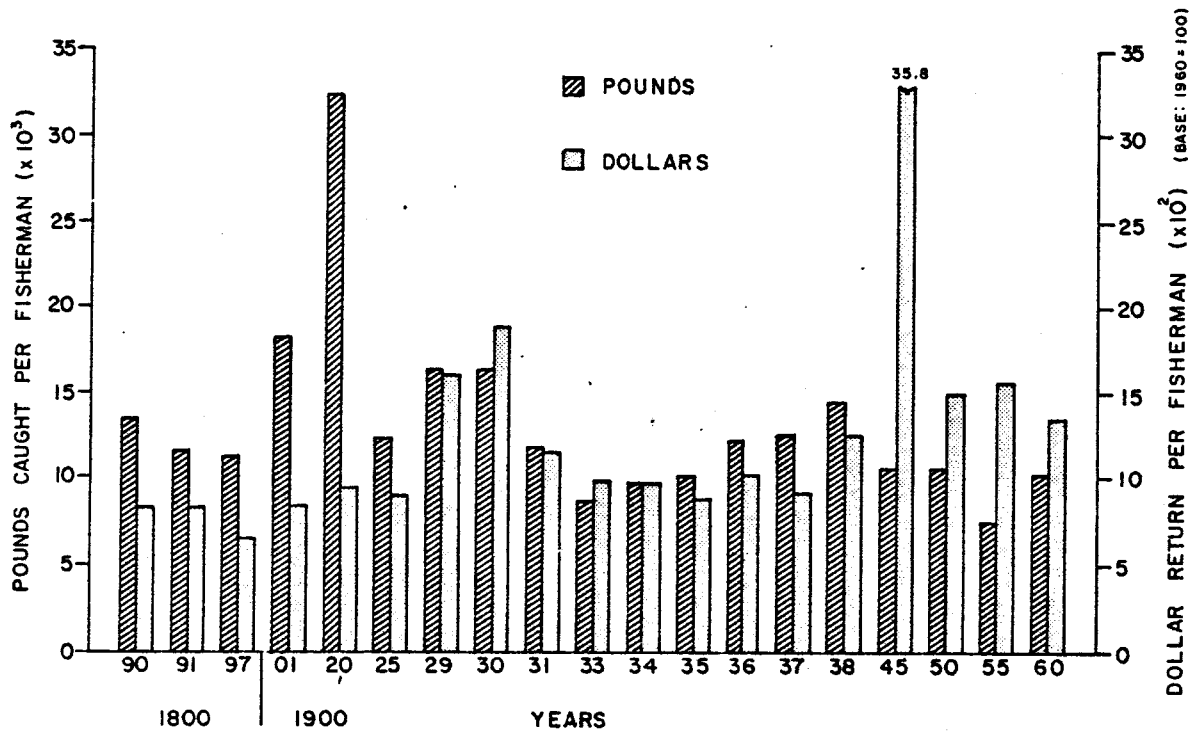

Figure 2. Eastern Shore: Pounds Caught and Dollar Return per Fisherman. (Selected Years, 1890-1960).

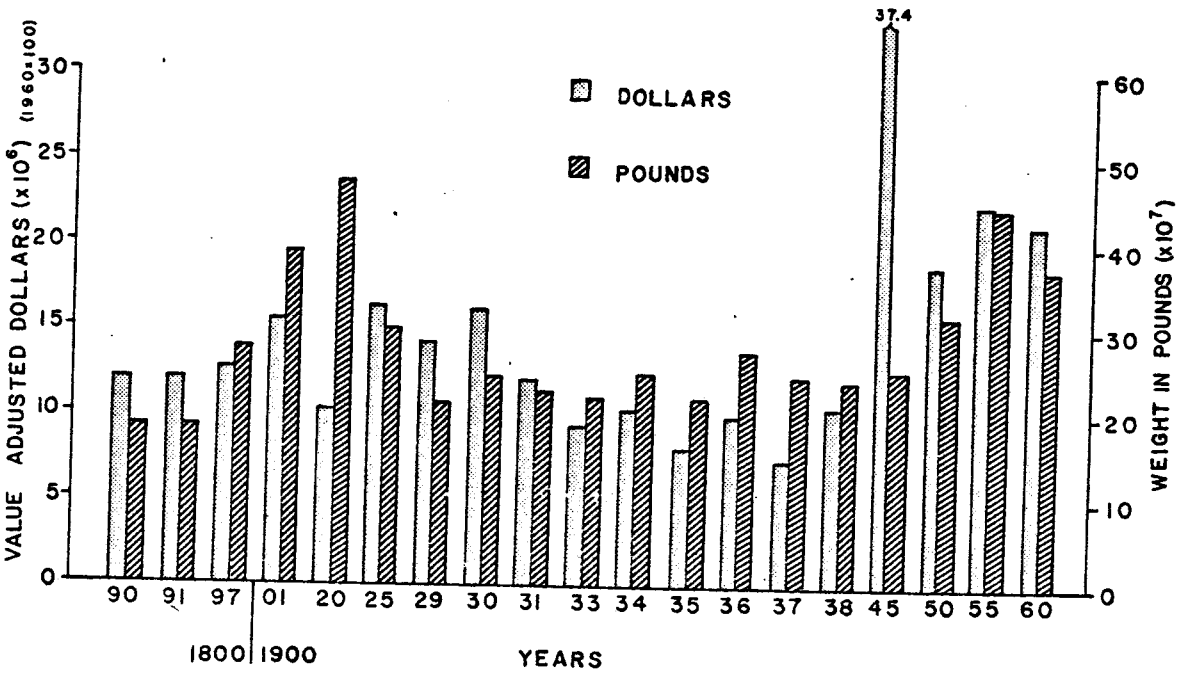

Figure 3. Virginia's Total Catch (Selected Years, 1890-1960).

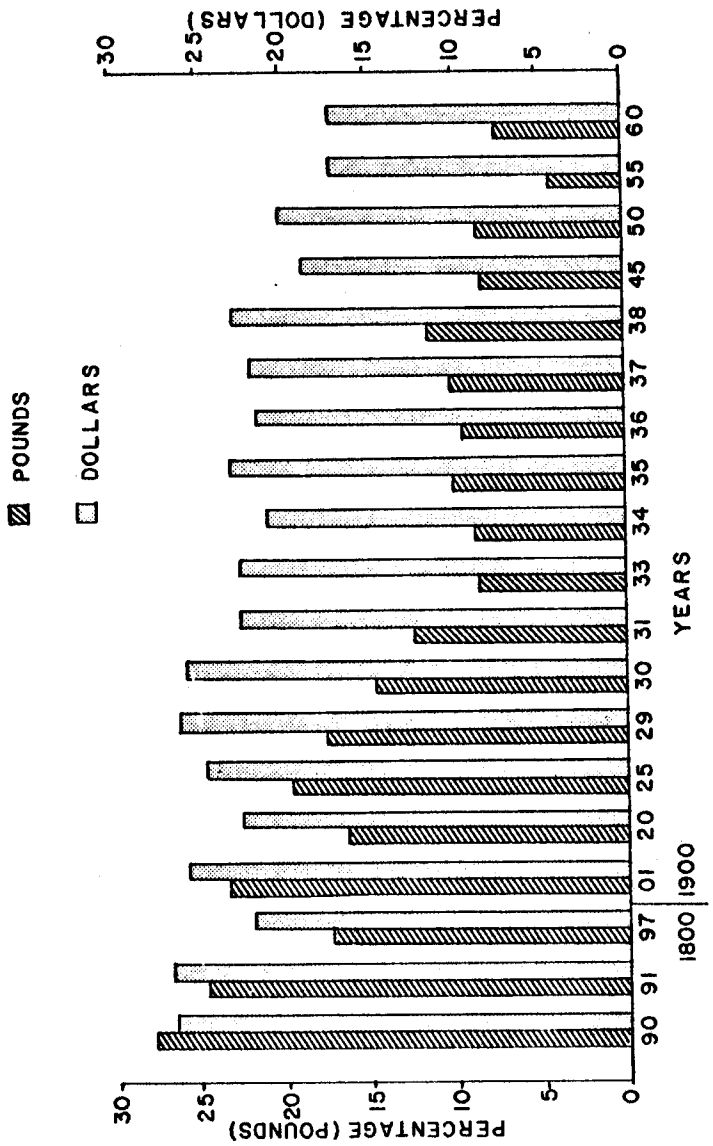

Figure 4. Eastern Shore Catch as a Percentage of Total Virginia Catch, in Dollars and Pounds (Selected Years, 1890-1960).

peak at the turn of the century also gradually declined to a low in the early 1930's, remaining almost constant with a somewhat upward trend after that time. It must be remembered that these figures are simply "pounds caught" with no differentiation made as to species.

Figure 2, which is a measure of return per unit effort, is of considerable interest. Since there have been no major accepted breakthroughs in methodology or equipment to greatly enhance productivity, pounds caught per fisherman is a partial measure of biologic abundance plus favorable fishing conditions as previously stated. Dollar return per man is a somewhat better measure of economic success; and, viewing the overall range, it can be seen that the years from 1959 on are somewhat better than average, except when compared to the phenomenal year of 1945. Economically, then, in the time frame considered, the period 1955 through 1960 may be held to be more than moderately successful in relation to earlier years, considering the Eastern Shore alone.

Figure 3, which presents statistics fron the entire state of Virginia, shows an overall upward tendency over the years in weight of catch, ignoring short term cyclic changes. Not so those of the Eastern Shore, which tend downward. This trend is particularly noticeable since 1938. Even 1945 was not a particularly good year for the Eastern Shore in terms of pounds caught. A phenomenal oyster catch, however, (the highest, by nearly one million dollars, of any year considered -- see last column, table 1) with its high value, pushed the dollar return per man to a high figure.

Figure 4 is the most interesting and revealing of all. It clearly indicates, both in percentages of dollars and pounds, the relative decline of the Eastern Shore fisheries in comparison to those of the state of Virginia as a whole. The downward trend is long term, clear, and uncompromising.

Conclusion

The overall conclusion may be drawn from the foregoing that the fisheries of the Eastern Shore declined relative to the rest of the State rather steadily since the first statistics were collected. This is, however, only a relative decline. The Shore catch in terms of weight caught has remained relatively constant since 1931, ranging up and down between about 18.2 and 27.1 million pounds.

For the years considered, the value of the catch (in dollars adjusted to 1960) was consistantly high after World War II. Among the years for which statistics are available, only four early years (1901, 1925, 1929, and 1930) exceeded even the lowest year since the war (1960). All years since the war pale, however, in the light of the halcyon days of 1945, which conveys the feeling of later depression. This is even more apparent in terms of dollar return per fisherman, where the figures from 1938 onward were exceeded only twice previously (1929 and 1930). Again, the figure for 1945 towers over the others, being more than twice all the rest except 1930. This reinforces the concept of latter depression, when, in fact, returns were relatively high.

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Chapter II

THE OYSTER INDUSTRY

by Dexter Haven

Introduction

The American oyster has always been a highly desirable and nutritious seafood from early times, when they were consumed by Indians, until the present. In the past, the Eastern Shore of Virginia was among the more important oyster growing regions along the Atlantic Coast. As early as 1880, shipments from the Chincoteague area alone ammounted to almost a third of a million bushels each year. Today, however, production has dropped to a very low level. On the Bayside of the Eastern Shore the decline is associated with a recent appearance of a most destructive disease called MSX. Throughout the Eastern Shore, this decline is also associated with the development of socio-economic conditions which are detrimental to the well-being of the industry.

Natural History

The American oyster, known technically as Crassostrea virginica, grows along the Atlantic and Gulf Coasts of the United States.

On the Eastern Shore, the oyster industry may be divided into the Seaside and the Bayside. The Seaside is now the most important

oyster growing area. Here, oysters are grown in the channels and shallow bays between the barrier islands and the mainland. This large expanse of water and land is characterized by wide flats, interspersed with low marshy land, cut by numerous channels. Tidal range in the area is from 3 to 4 feet.

The sexes in oysters are separate, and spawning occurs on the Eastern Shore from late June through October. Most spawning, however, takes place during July, August and September. After the eggs are released from the female and are fertilized, the resulting larvae swim about for about two weeks before attaching (setting) on some hard object such as an oyster shell. After attachment, growth is rapid; and a length of one to one and one-half inches may be reached by the end of the first summer. At this early stage the small oysters are known as seed. Commonly, on Seaside, 10 to 30 spat may attach to a shell during a season (Loosanoff 1932; Makin 1946; Haven, Castagna and Whitcomb 1966). In many years, the problem is that too many spat attach rather than too few. The disadvantage of too heavy a set is that, when the oysters mature, 3 to 10 are attached to each other; and this clumped condition makes them difficult to shuck.

Oysters may reach market size approximately 3 years after setting -- 3 to 4 inches long.

Diseases and Predators

The principal predator of oysters on the Eastern Shore is the

large oyster drill, Urosalpinx cinerea, which kills by boring a hole through the oyster shell. This snail is found in almost all locations where oysters are grown. Several management techniques are used to combat this pest. One of the most widely used is to plant seed in areas where oysters have not been planted for some time. That is, oysters are planted where there are few drills. This technique is only partially successful. Other means of combating drills have been studied. Among them are control with a chemical termed Polystream (Haven, et al., 1966). This method was not successful. Trapping drills in wire bags baited with seed also proved to be of little value (Carriker 1955). The State paid a bounty for drill collection in past years but this has not resulted in effective control.

Other predators which may sometimes kill large numbers of oysters are the black drum and the cow-nosed ray.

While predators kill large quantities of oysters their presence in the past on the Seaside and on the Bayside was no bar to commercial production. There seems to have been no change in the abundance of these predators. Consequently, mortalities from these enemies should be no greater today than they were in the past.

There are three oyster pathogens on the Eastern Shore of Virginia which cause varying degrees of mortality in oyster populations. Two of these have probably always been in the region, and oyster culture was possible despite their presence. These two were Dermocystidium marinum, a fungus, and Minchinia costalis which

of mortalities is short and well-defined by season. There is no reliable way to predict the extent of losses. Although latent infections occur during the mortality period, an incubation period of 8 to 10 months follows when diagnosis is difficult or impossible. Then, in the month of May, clinical level infections develop rapidly and deaths occur immediately thereafter.

SSO may kill up to 50 percent of a crop during the second year, but losses are usually 20 percent or less (Andrews and Wood 1967). An important generalization is that oysters held beyond the usual 12 to 18 months from seed planting usually experience heavy mortalities; therefore, planters make every effort not to carry over oysters another year. On the Bayside, SSO is only a minor factor as a cause of mortality.

Treatment of oysters infected with Dermocystidium, SSO or MSX is not possible at present; but effects of all three diseases may be minimized by proper management. For example, as mentioned above, an important generalization for SSO is that if oysters are held on the Seaside beyond the usual 12 to 18 months after planting seed, then the grower will experience heavy mortalities with a resulting economic loss on his crop. Harvest before the critical period will greatly minimize losses. Timing of planting is also important in reducing losses due to Dermocystidium marinum. Losses may also be reduced by not overcrowding plantings and removal of all old oysters prior to planting a new crop (Andrews and Hewatt 1957). The only effective way to deal with MSX is to plant in areas

is the causitive agent of the disease SSO. A third pathogen, Minchinia nelsoni, which is thought responsible for the disease MSX, appeared first in 1959. It has caused such extensive mortalities that oyster culture in high salinity regions within Chesapeake Bay has been abandoned (Andrews 1968).

MSX on the Eastern Shore is principally a disease of the Bayside creeks and Pocomoke Sound. In this location it may cause light to moderate mortalities. On the Seaside MSX is found occasionally and caused only light mortalities (Andrews 1968).

Dermocystidium may cause moderate to severe mortalities on the Bayside during mid to late summer (Andrews and Hewatt 1957). However, indications are that this fungus has been present for many years and losses due to it were an expected aspect of oyster culture.

The major oyster disease of the Virginia Seaside is SSO (Andrews and Wood 1967). Presumably SSO operates in all the high-salinity waters from Cape Henry to Cape Henlopen, although data are quite scarce from Delaware waters. This disease kills both native and imported oysters (losses are greater in the latter) every year, mostly in the month of June. Annual losses fluctuate from year to year but tend to be high or low in all Seaside bays in a particular year. The death rate tends to be high, but the duration

where it does not cause heavy mortalities or, in problem areas, harvest in a year or less after planting seed.

In concluding the section on disease, it is noted that while diseases do occur on the Eastern Shore they may seriously influence commercial oyster culture only on the Bayside Creeks where MSX has added another source of mortality to those already present. On the Seaside, conditions of disease and predators offer no more of a deterent to commercial culture today than they did 20 years ago. That is, there has been no added source of mortality which would make culture more difficult today than it was in the past when production was much higher.

Description of the Fishery

Where Oysters Grow

In view of the sedentary nature of oysters, the ground or "bottoms" where they grow is of major importance.

Oysters are grown on the Eastern Shore as a wild crop and also as a cultivated crop. As a resource, they differ from fish since oysters are grown on discrete areas of bottom. In contrast, fish may come or go depending on the food supply, wind, tides, and other environmental factors.

The wild oyster crop is obtained from grounds "owned" by the State of Virginia. These grounds are known as Baylor survey grounds or public grounds. Here, the public may harvest oysters provided they obtain a license and follow certain regulations. Oysters grow naturally on public grounds. However, the Virginia Marine

Resources Commission does assist by planting shells where small oysters attach and grow. At present, production of oysters from the public bottoms is very low. Public grounds are administered by the Virginia Marine Resources Commission by districts (Figure 5). The public oyster grounds on the Eastern Shore exist as subtidal or intertidal beds in very large blocks with many containing several thousand acres. The total size of Baylor grounds on Seaside is 44,591 acres; on the Bayside, there are 36,623 acres. Today, the public bottoms on the Bayside are almost totally unproductive as will be discussed later. The little production that does occur on public grounds is from the Seaside.

Bottoms outside public grounds may be leased from the State, and these are termed private oyster grounds. Once a lease is granted it is renewable on an annual basis for 20 years. The annual fee for leases granted after 1961 is $1.50 per acre per year.

Total acreage of private leases on the Eastern Shore fluctuates from year to year as leases are taken up or are abandoned. They are more productive than public bottoms and offer the best hope for increased production in the immediate future. Consequently, leased bottoms will be discussed in detail.

Acreage under lease on the Bayside increased from 4043 acres in 1925 to a maximum of 14,835 acres in 1960, due to the expansion of the oyster industry (Table 4). After 1960, there was a drop to 11,228 acres in 1970. This latter decline was due to the fact that growers were abandoning leases which could no longer be profitably

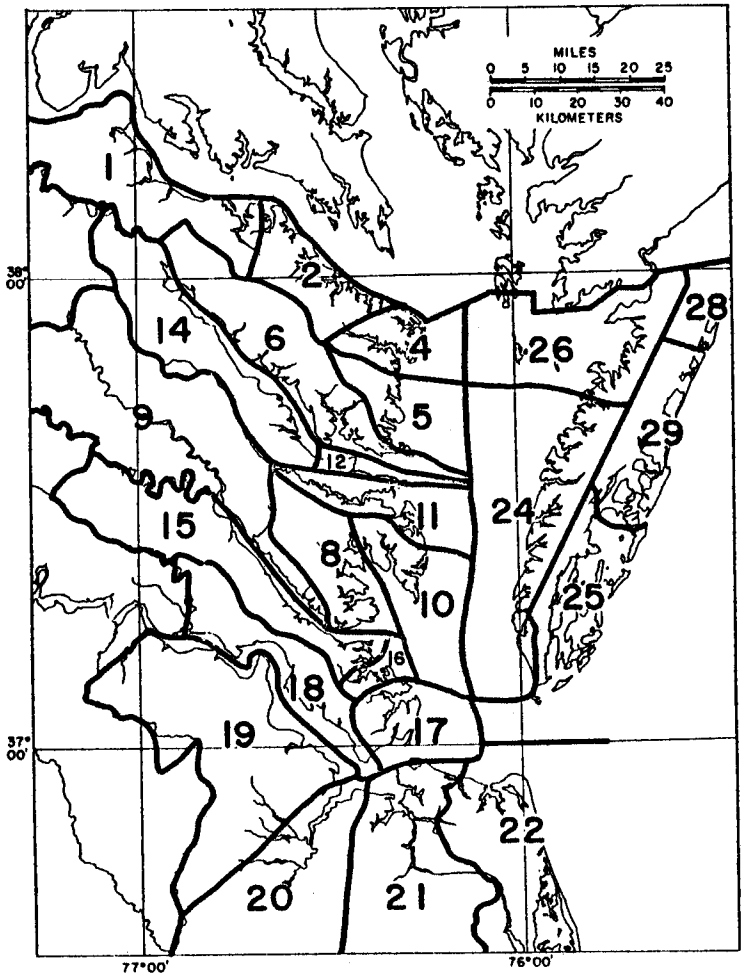

Figure 5. Virginia Oyster Districts.

TABLE 4

Amount of Leased Oyster Planting Ground on the Eastern Shore[1]

End of Fiscal Year	DISTRICTS 24 26 (Bayside)	25 28 29 (Seaside)	Total
1900			
1905		6,615	
1910			
1915			9,023
1920			18,280
1925	4,043	9,860	13,903
1930	4,589	12,245	16,834
1935	5,201	12,902	18,103
1940	5,191	11,163	16,354
1945	5,511	11,260	16,771
1950	8,125	12,204	20,329
1955	13,907	16,221	30,128
1960	14,835	18,127	32,962
1965	13,630	18,754	32,384
1970	11,228	17,644	28,872

Notes:

1. Data from reports of the Commission of Fisheries of Virginia for 1900 through 1965. Data for 1970 was taken from VMRC records on 1st January, 1970 by Paul Kendall. Blanks indicate that datawere not available. Data prior to 1915 was admittedly inaccurate (See report for 1915. pp. 6-8). Some data prior to 1935 has been calculated from rent receipts.

cultivated to grow oysters (Table 4).

On the Seaside, there has always been more leased ground (Table 4). From 1925, when 9860 acres were leased, there was a gradual rise until 1965 when the maximum size of 18,754 acres was reached. This rise was because growers were acquiring more ground since it was profitable to grow oysters in this region. After 1965, there was only a slight decrease to 17,664 acres as growers abandoned leases which they considered unprofitable.

In comparing the extent of the private leases on the Eastern Shore today with their size in 1960, it is evident that there has been no real trend in this 10-year period toward abandonment of leases. This is most remarkable since, as will be shown later, production from the grounds has declined to a very low level. The fact that growers are still holding leases suggests that they think that they are still valuable and may at some future date be used profitably for producing oysters.

Oyster grounds on the Eastern Shore are grouped into five separate districts for administrative purposes, as previously mentioned (Figure 5). A study was made of the number of lease holders and the total acres held in relation to the size of the holdings. Total acres held by districts and total for the Eastern Shore as of January 1970 are shown in Table 5.

These tabulations provided the basis for a series of five bar graphs depicting the number of oyster lease holders in each

TABLE 5

Distribution of Leased Ground on Eastern Shore*

District	Location	Total Acres	Total Persons Holding Leases
25	Fisherman I. to Machipongo River.	9,576	111
29	Machipongo R. to Chincoteague	3,283	123
28	Chincoteague Area	4,785	230
26	Pocomoke Sound to Onancock	3,800	160
24	Onancock to Cape Charles	7,398	332
	TOTAL	28,842	956

* Number of oyster lease holders in six acreage groups, and the total acres held by these lease holders with the percent of total for each catagory. Size catagories in acres are 0-5, 5-10, 10-20, 20-25, 50-100 and 100 and over.

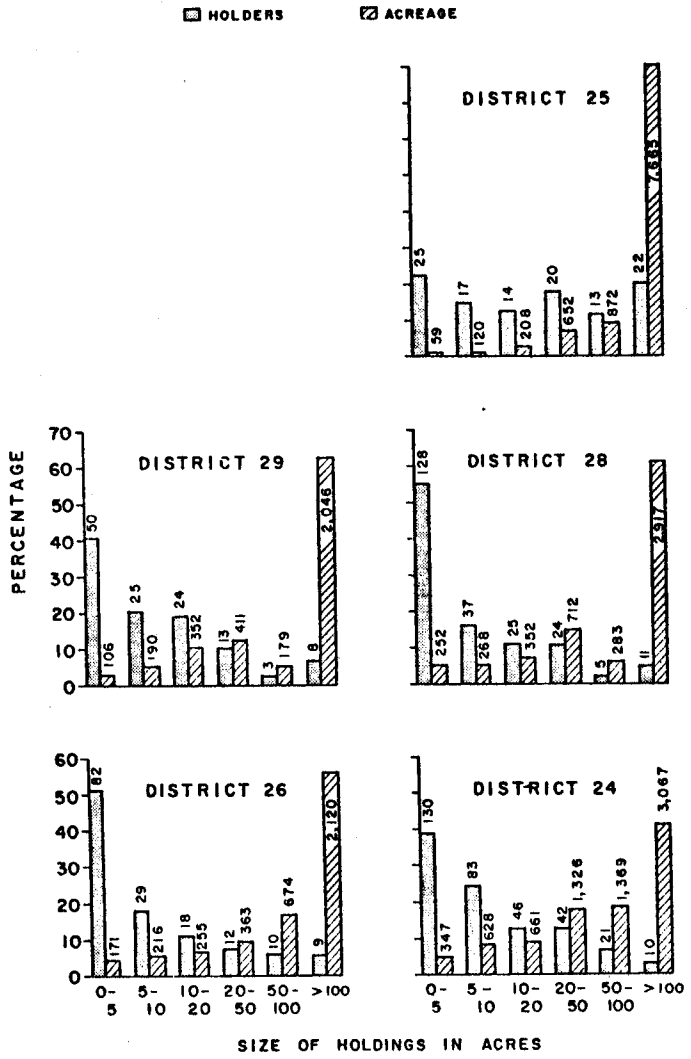

Figure 6. Size of Private Oyster Ground Lease Holdings, Eastern Shore of Virginia.

acreage group, the total acres held by these owners, and percent of total (Fig. 6). An inspection of holdings in each of the five districts showed a similar pattern. There were a great many lease holders who held 10 acres or less; but most of the private acreage was held by a very few, large lease holders. This relation is shown more clearly by district (Table 6).

District 25 (Smith Island to Machipongo Inlet) had the largest amount of big leases in proportion to the smaller ones for any of the five districts. Here 80 percent of the leased acreage was held in units of 100 acres or more.

Districts 29 and 28 on the Seaside, extending from Machipongo Inlet to Chincoteague, were almost identical in respect to size distribution of leases. Those over 100 acres accounted for 60.9 and 62.3 percent of the total acreage and these were held by only 4.3 and 6.5 percent of the total lease holders. A large majority of the lease holders (60.9 and 71.7 percent) held leases under 10 acres.

On the Bayside of the Eastern Shore in districts 24 and 26, from 41.4 to 55.3 percent of the total acreage was held in units of 100 acres or more by only 3.0 to 5.6 percent of total lease holders. From 69.3 to 64.1 percent of the total lease holders held 10 acres or less.

In summary, it is evident that large areas held by a few persons exist on the Bayside and the Seaside. That is, areas do exist where

TABLE 6

Distribution of Leased Acreage by District on the Eastern Shore

District	% of total acreage which is held in units of 100 acres or more.	% of total persons holding leases	% of total acreage which is held in units of 10 acres or less	% of total persons holding leases
25	80.0	19.8	1.9	37.8
29	62.3	6.5	9.0	60.9
28	60.9	4.3	10.9	71.7
26	55.3	5.6	10.1	69.3
24	41.4	3.0	13.2	64.1

large scale operations might be carried out.

How Oysters are Grown, Harvested and Processed

Details of growing, harvesting, processing and marketing oysters are shown in figure 7, and some types of harvesting gear in Figure 8.

On the Public oyster ground, oysters, as previously outlined, occur as a wild crop. Market or seed oysters are harvested from these areas by tongs or by hand picking. From time to time, oyster shells are planted by the Virginia Marine Resources Commission on these public bottoms as sites for attachment of oysters. Seed oysters are seldom transplanted to public bottoms of the Eastern Shore.

On private leases, growers typically use seed produced on the Eastern Shore as planting stock. There are several different ways growers produce seed; only one commonly utilized method is described. In the more protected bays or coves, oyster shells are placed in the intertidal zone in parallel rows. Each row may be about forty feet long, 6 feet wide and 2 or 3 feet high. Distance between rows may be about 8 to 10 feet. Shells are placed in the water in early spring and the small oysters or spat attach to the shells from late June through September. Numbers of oysters attaching to each shell are high compared to the set in other sections of Virginia. Commonly, on the Seaside, 10 to 30 spat may attach to each shell during a season. Strike or set is usually much lower on the Bayside.

Seed is generally allowed to grow on a seed rock for one or two years. Then, the small oysters, known locally as seed,

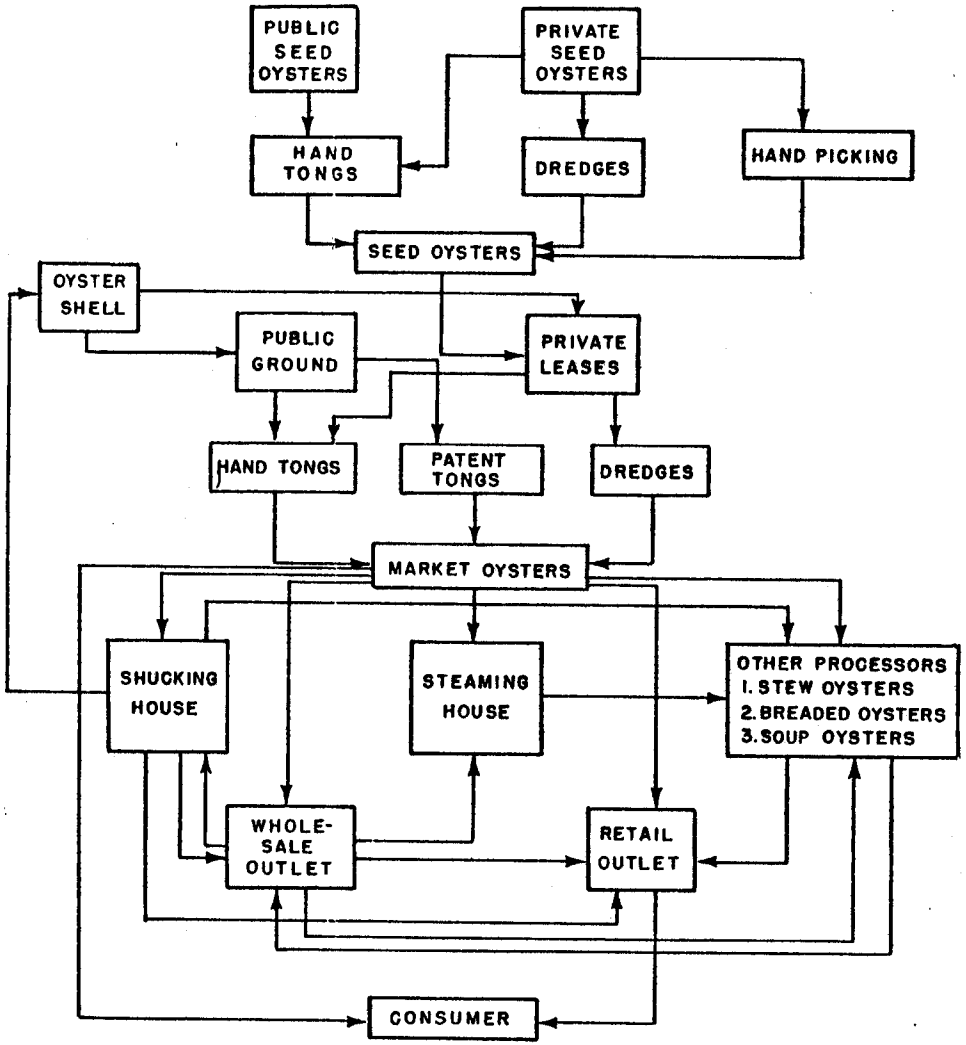

Figure 7. Stages in the harvesting, processing, and distribution of seed and market oysters in Virginia.

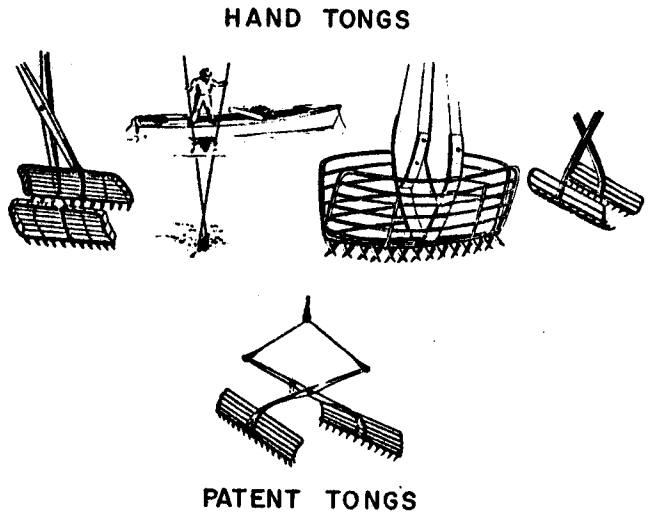

Figure 8. Types of tongs used to harvest oysters and clams. (Illustrations from "Commercial Fishing Gear of the United States" by W. H. Dumont and G. T. Sundstrom, 1961. U. S. Fish and Wildlife Service, Circular No. 109).

buttons or brush according to size, are picked by hand. These seed are transfered to small barges called monitors which transport the stock to the subtidal growing areas and are planted at the rate of 200 to 1000 bushels per acre. Generally, they are allowed a maximum of two years in the growing area since experience has shown that longer periods result in excessive mortilities due to predators and diseases. On private grounds, market oysters are dredged from the growing area.

When they reach market size, oysters are transported to shucking houses; among the more important centers on the Eastern Shore are Oyster, Saxis, Hungers Creek, Wachapreague, Willis Wharf and Chincoteague.

Shucking houses are long low buildings where oysters are opened (shucked) and processed. At these locations, oysters are shoveled from the dredge boat into wheelbarrows and carried to a storage room. Later, they are again shoveled into wheelbarrows and carried into the shucking room where they are placed onto a long, waist-high table. Shuckers, standing before this table, pick up the oysters and open them on a small elevated block, with the aid of a shucking knife, and place them into a gallon can filled with water.

Packing, Grading, Distribution

After each gallon can is filled with oysters, it is dumped on a stainless steel skimming table perforated with holes which retain oysters but allow liquid and bits of shell to fall through.

Here, the number of gallons shucked is tallied. The shuckers are paid by the gallon. After measuring, oysters are placed in a large tank called a blower. This tank holds about 100 gallons of water and is equipped with air jets at the bottom. Oysters are agitated by jets of air to remove sand and bits of shell and then drained. Oysters are next sealed in cans holding from 12 ounces to 5 gallons. They are graded on the basis of size when packed as standards, selects or extra selects. Average price in 1970 for the three grades was, respectively, $8.50, $9.50 and $10.50 per gallon. After canning they are iced and stored at just above 32°F prior to shipment.

Oysters from the Eastern Shore are sold raw, and none are processed into breaded or frozen prepared foods. They are marketed along the Atlantic Coast and as far inland as Davenport, Iowa.

Nearly all oysters are trucked to market.

Oyster Production

From 1880 to 1931 there are only occasional references to oyster production on the Eastern Shore. Ingersoll (1881) states that production in Chincoteague Bay in the 1880's was a third of a million bushels annually. Statistical data obtained in this early period are not reliable. Conversations with watermen, growers, dealers and brokers suggest that prior to 1931 many acres of public as well as leased bottoms were highly productive.

Collection of statistics on a regular basis began in Virginia in 1926. At that time producers, packers, brokers, etc. were required by law to keep a record for tax purposes of the number of gallons or bushels of oysters processed during each month of operation. Records showed, in addition, whether oysters came from public or private grounds. Records were kept in a book which is open to inspection by personnel of the Virginia Marine Resources Commission. This information is the basis of a tax which is paid by the processor at the rate of 1-1/2 cents a bushel or 2 cents per gallon. The ammount of tax collected is published by the Marine Resources Commission and is used as a basis for estimating Virginia oyster production. Tax is reported by districts (Figure 5).

There are disadvantages in basing oyster production from private leases on tax data. One is that the present system of recording, as in the past, does not show where oysters come from. This means that oysters from private grounds processed in a given district may have been grown in any other district in the State or even in another state such as Maryland, Delaware or New Jersey. There is no reliable way of determining exactly how many did originate out of state because records of imports into Virginia are not on file for the period 1931 to 1963. Since 1963 records are available which list Virginia grown oysters from private leases separately from imports, but district where they were grown is still not given.

Data on catch of oysters from public oyster grounds from 1931 to 1962 are based on the same type of tax as those originating from private leases. A fault of data on catch from public grounds based on tax records is that, from 1931 to 1962, seed and market oyster production can not be separated. In 1962 tax laws were revised, and buyers were required to keep records of where market and seed oysters from public rocks originated.

The Eastern Shore of Virginia has in the period from 1930 to 1970 procurred, on the average, from 22 to 34 percent of all oysters taxed in Virginia from private leases (Table 7). These figures may be interpreted in two ways. Either the Eastern Shore was producing many oysters, or many were being shipped in from other regions. It is though that prior to 1960, however, that most of the oysters shucked on the Eastern Shore were grown in the area.

Peak production on the Eastern Shore was reached in 1954 when about 1,035,867 bushels were processed. After this date there was a steady decline to only 143,350 bushels in 1969.

The preceding data have made it possible to calculate yield of oysters from private leases if it is assumed that oysters taxed on the Eastern Shore were grown there. Comparison shows that for 1950, 20,329 acres produced 542,730 bushels or about 26 bushels per acre. In contrast, in 1969, 29,237 acres produced only 143,350

Table 7

Comparison between total oyster landings from private Grounds[1] for District 24, 25, 26, 28 & 29 on the Eastern Shore and for all Virginia

Year	Total Leased Acres	Eastern Shore bu.	Virginia bu.	% of Total
1931		302,713	1,236,068	
2		158,038	858,469	
3		224,060	949,900	
4		279,958	1,566,586	
5	5,201	353,334	1,492,213	22
6		417,509	2,130,125	
7		273,854	1,202,255	
8		291,905	1,208,690	
9		433,645	1,695,727	
1940	16,354	699,589	1,783,541	26
1		525,894	1,656,969	
2		434,911	1,518,902	
3		394,580	1,857,321	
4		335,540	1,338,603	
5	16,771	536,490	1,625,062	28
6		666,920	2,067,264	
7		655,509	2,179,542	
8		472,464	1,972,417	
9		403,079	1,816,832	
1950	20,329	542,730	2,195,201	27
1		502,589	1,799,462	
2		587,313	1,861,232	
3		969,475	2,346,491	
4		1,035,867	2,755,142	
5	30,128	903,544	3,056,901	34
6		668,537	2,383,457	
7		820,002	2,549,529	
8		838,333	2,447,823	
9		603,631	2,536,970	
1960	32,962	557,808	2,196,851	29
1		690,530	2,615,871	
2		548,794	2,167,639	
3		334,100	906,243	
4		366,250	1,288,093	
5	32,384	355,500	1,647,645	22
6		193,923	1,273,888	
7		144,272	725,453	
8		179,548	840,749	
9	29,237	143,350	650,445	22

1. Annual reports. VMRC. Prior to 1963 figures may include oyster imported from other states, after this time only Virginia grown oysters are listed.

bushels or about 5 bushels per acre. This latter figure represents a large decrease over the former period. The decrease in productivity on the Seaside from private grounds, as noted previously, is not due to the unavailability of planting ground or predators or disease, but is due to growers planting or growing fewer oysters on the acreage they hold. The probable reason for this situation is that growers are not attempting to plant seed due to an unfavorable price situation. It is the author's opinion, and also that of many oyster growers, that the reason more oysters are not grown on Seaside today is that the price of the shucked oyster has not increased sufficiently to allow the processor to pay higher wages necessary to procure enough shuckers to increase production. While cost analysis studies have not been made to substantiate the view, it is widely held by most people in the industry.

From 1931 to 1962 catch of seed oysters and market oysters combined from the public rocks was very erratic (Table 8). In this early period production ranged from 8,164 to 166,730 bushels. A dominant aspect of the period, however, was a downward trend beginning in 1966.

Production of market oysters from public grounds from 1963 to 1970, when seed and market oyster catch were separated, showed a downward trend and very low productivity (Table 9). All public

Table 8

Production of Market Oysters from Public Rocks on the Eastern Shore of Virginia[1]

Fiscal Year	Size Public Rock 1931 - 1970	Quantity (bu.)
1931	(81,214) acres	12,666
2		8,164
3		12,288
4		27,624
5		33,188
6		57,709
7		16,557
8		40,827
9		41,939
1940		80,635
1		21,452
2		97,698
3		52,430
4		99,470
5		34,863
6		49,656
7		17,038
8		31,056
9		166,730
1950		31,065
1		28,204
2		23,047
3		50,578
4		104,854
5		131,922
6		26,572
7		23,701
8		19,931
9		19,472
1960		11,035
1		22,886
2		8,146
3		9,015
4		10,466
5		45,560
6		10,442
7		9,086
8		8,635
9		9,953
1970		6,847

1. Data for 1931 through 1962 calculated from inspection tax receipts reported in the annual and biennial reports of the Marine Resources Commission and the Virginia Fisheries Commission predecessors; some exported seed are included. Data after 1962 from reports published by the VMRC based on the Oyster Buyer's reports.

Table 9

Market Oyster Landings from Public Rocks in Virginia Compared to Eastern Shore Production in Bushels 1963 - 1970[1][2]

Area	Fiscal Year 1963	1964	1965	1966	1967	1968	1969	1970	Total	% of Total
Potomac	15,584	10,717	5,376	44,976	23,665	36,709	25,264	13,074	175,365	6.0
L. Wicomico	66	135	1,412	239	1,406	1,803	1,211	1,364	7,636	.3
G. Wicomico	1,447	6,358	3,874	3,092	1,793	900	915	648	19,027	.7
Rapp. Piank. & Milford Haven	38,553	61,589	42,560	30,418	10,397	27,263	29,402	23,698	263,880	9.2
Mobjack	1,547	7,275	918	1,008	1,391	839	75	983	14,036	.5
York	0	0	982	165	361	568	1,088	388	3,502	.1
James	0	258	122	2,697	540	742	204	360	4,913	.2
Nansemond	175,695	417,375	449,971	487,937	166,937	182,020	157,669	143,778	2,181,424	76.1
Misc.	17,893	60,709	65,099	25,008	11,227	3,517	1,796	1,003	186,252	6.5
	8,195	1,975	0	0	0	0	0	94	10,264	.4
Total	258,980	566,391	570,304	595,540	217,769	254,361	217,624	185,340	2,866,299	
Eastern Shore										
Bayside	0	409	1,000	1,843	3,178	5,974	3,564	2,217	16,185	.5
Seaside	9,015	10,057	44,560	8,599	5,908	2,661	6,389	4,630	91,819	3.1
Total	9,015	10,466	45,560	10,442	9,086	8,635	9,953	6,847	108,004	
STATE TOTAL	267,995	576,857	615,864	605,982	226,855	262,996	227,577	192,187	2,974,303	

Notes: 1. Based on VMRC data.

2. Total acres Bayside 36,623; Seaside 44,592.

rocks on the Bayside of the Eastern Shore, with a total acerage of 36,623 acres, produced only 16, 185 bushels of oysters in an eight year period or about .05 bushels per acre per year. Seaside production was only slightly better. Here 44,591 acres produced only 91,819 bushels in the period from 1962 to 1970. This was about .31 bushels per acre per year. This productivity was much lower than that from private leases. It strongly suggests that only a small fraction of the public bottom is productive at present. The absence of shell substrate on the public rocks may contribute in a small part to their lowered production. It is more probable, however, that seed present on the rocks is not being harvested. The contribution of the public ground on the Eastern Shore to total Virginia market oyster landings during this period was low. It ranged from .5 percent on the Bayside to 3.1 percent on the Seaside (Table 9).

From 1963 to 1970, the Seaside of the Eastern Shore produced 553,441 bushels of seed, or 9.1 percent of all seed produced in Virginia (Table 10). This quantity, when compared to the total acres of public ground on the Seaside where the seed is grown (44,591 acres), gives an average yield of about 1.6 bushels of seed per acre per year.

It is the author's opinion that this quantity is far below the potential of the area. This view is based on the enormous sets or strike of oysters observed over the years in many of the protected bays and inlets along the Seaside of the Eastern Shore and on the availability of large acres of public bottom on which seed could be grown.

Table 10

Seed Oyster Landings from Public Rocks in Virginia in Bushels Based on Buyer's Report Showing Relative Contribution of Eastern Shore to Total Virginia Production 1963 - 1970

AREA	FISCAL YEAR							TOTAL	% of TOTAL
	1963	1964	1965	1966	1967	1968	1969	1970		
E. Shore Seaside	45,928	82,517	31,117	45,789	79,313	100,022	45,949	122,806	553,441	9.1
Gt. Wicomico	0	0	102,016	232,739	146,103	88,513	50,776	98,380	718,527	11.8
James	843,833	840,675	424,234	611,167	532,569	483,690	486,536	264,203	4,486,907	73.9
Piank. & M. Haven	0	0	91,152	99,275	60,325	71,704	3,848	3,581	329,885	5.4
TOTAL	889,761	923,192	648,519	988,970	818,310	743,929	587,109	488,970	6,068,760	

Note:

1. From publications of the VMRC.

Labor

An adequate supply of labor has always been a major factor in growing and processing oysters. Labor is needed to man the dredge boats or oyster tongs. Labor is needed to plant shell and to pick and plant seed. A major requirement is the labor needed to shuck oysters.

As expected, the decline in oyster production in the last 10 years has resulted in a decline in the labor force associated with the oyster industry. The full impact of this decline cannot be given. For example, the crews necessary to man dredge boats, those required to pick and transplant oysters, managers of shucking houses, clerks, etc., cannot all be tabulated. However, there is not doubt that there has been a decline of at least 50% in the last 10 years. This statement is supported by a partial analysis of the employment situation shown in Table 25, which covers the period from 1960 to 1970. During this period, the number of persons applying for a tongers license has declined from 724 to 309. Of greater importance to the overall labor force is the decrease in processing facilities. Shucking house licenses declined from 29 to 16 in the ten year period; oyster buyers decreased from 52 to 22 in the last five years. The decline in number of processors has resulted in a reduction in jobs for shuckers; and, from 1960 to 1970, the average number of shuckers employed by each firm has declined from 33.2 to only 9.0 (Table 11).

Table 11

Number of oyster shuckers employed by Eastern Shore firms. (Data is from a survey of eight shucking firms conducted by VIMS personnel; two of the eight firms canvased were no longer shucking in 1970.)

Year	1960	1967	1970
Total Number of Shuckers	266	101	72
Mean Number of Shuckers per firms	33.2	12.6	9.0

The preceding review of the labor situation on the Eastern Shore clearly shows a reduction in numbers of persons employed in the oyster tonging and in the processing end of the industry. This would suggest that tongers and those formally employed by shucking houses would be looking for similar employment today. This is apparently not the case since interviews with growers and processors show general agreement on one fact. Today, an adequate supply of labor necessary to produce oysters is not available. There appears to be a large reservoir of persons unemployed on the Eastern Shore, so this last statement may seem to be a contradiction. However, the true fact seems to be that labor is not available at the price which will enable the grower to realize his desired level of profit. This is perhaps an over-simplification of a very complex problem. It is this author's conclusion that it approximates the true problem.

It is an unfortunate fact that while jobs are available in the oyster business they are seasonal; and, therefore, growers and processors cannot keep trained personnel employed year round. For example, shell is placed in the water in spring; seed is planted in fall; harvest is in late fall or winter. Shuckers are employed only in late fall or winter with little employment for them in spring or summer.

Problems of the Industry

Biologically, there are good reasons why the Bayside area is unproductive due to the recent presence of MSX which has added its mortalities to those which have always existed from Dermocystidium and oyster drills.

The problem of the oyster industry on the Seaside is clearly one of low production. The recent decline since 1960 in landings can not be attributed to any known changes in levels of disease or predators. The reason for this low production is a complex situation in which the sale price of the shucked oyster is not sufficient to permit the oyster processor to compete with other industries for labor.

A second problem of the Seaside is that private growing grounds on the Seaside produce a clumped oyster. That is, there may be from about 3 to 10 oysters attached to each other. The basic reason for this is the regular strike or set in that region each year. These oysters which may contain high quality meats are difficult to shuck and, consequently, may not sell well if large separate oysters are available from other regions.

A third problem of the Seaside if that the seed oyster which may be produced here no longer finds a market in Delaware due to an embargo on Seaside seed. This embargo is not a result of scientific findings and should be removed.

A fourth problem of the Eastern Shore and for all of Virginia is that techniques for dredging, planting, shucking and processing are antiquated and costly. There is a great potential for reducing production costs by adapting improved cultural techniques and technological improvements in processing. Some of these will be discussed later.

Regarding the low productivity of public rocks on the Seaside, there is evidence that they could be made more productive by an increase in quantity of shell planted by the State of Virginia. Such a program would cost more money than is presently spent in the area, and it doubted if funds for a large increase will be allocated in the foreseeable future. In the management of public grounds the concept has often been advanced that those areas would be more productive if leased to private individuals. To a limited extent this would be desirable especially in the Tangier and Pocomoke Sound area. This reassignment would not be a "cure all" for the industry since large areas of unused private grounds exist.

Recommendations

The principal aim of the industry should be to reduce production costs so that the final product is competitive with those produced in other regions. There are various ways of accomplishing this aim.

Dredging and tonging of oysters add to costs which might be

lowered by the use of the mechanical escalator harvester (Mac Phail 1960). This apparatus has been used to a limited extent in Canada to harvest oysters, but its use is not approved in Virginia. Its use could benefit Eastern Shore oyster growers by lowering productions costs.

Opening and shucking oysters is an important part of the total cost in producing the final product, and methods of opening oysters today are the same as they were one hundred years ago. Various attempts have been made to shuck oysters mechanically, but none have been developed to the point where they can be used commercially. One method of opening oysters, known as the Pringle heat-shock method, is widely used in South Carolina (Pringle 1964). This process should be investigated for use on the Seaside of Virginia since, if adopted, it would materially reduce shucking costs.

There is a potential market on the Eastern Shore for clumped oysters which has not been developed. That is, oysters may be steamed open in large pressure retorts and canned. Some Seaside oysters are sold for soup. The Seaside oyster is not ideally suited for this product, because it lacks the size uriformity the soup company requires. On the other hand, the canned oyster trade utilizes oysters of all sizes and a steam plant to supply this market is recommended for the Eastern Shore.

Other cultural techniques if adopted by the industry would be of benefit. Among these would be use of surf clam shells for

cultch and harrowing techniques to help rid growing bottoms of the oyster drill.

Efforts should be made to stimulate the processing of shucked oysters into processed frozen foods such as frozen breaded oysters, oyster casserole and similar foods which the modern housewife finds more attractive than the ordinary raw "canned" oyster. This would raise the selling price of oysters allowing more to be grown in the area with the added benefit that the processing plants would provide added employment.

Before the oyster disease MSX appeared in Delaware Bay, Seaside planters were using oyster grounds from Cape Henry to Rehoboth Bay according to their best utilization. The present embargo by Delaware on Seaside oysters is unrealistic and attempts to remove it should be made.

Certain places on the Seaside of the Eastern Shore are ideally suited for raising high quality oysters for the half-shell trade. The Chincoteague oyster with its high salt content and its "fat" meat has always been in demand. There appears to be an opportunity for growers to expand along this line. An integral aspect of this proposal would be that growers pay strict attention to quality control. Promotion by means of television and newspapers would help in increasing markets for this specialty. Cooperation within the industry would be necessary to raise the needed funds for a promotional campaign.

A recommendation often made by Virginia growers is that reassignment of Baylor grounds to private industry would greatly benefit Virginia oyster growers. While this suggestion has merit in other sections of Virginia it is doubtful if such reassignment on the Seaside would result in much of a benefit. The reason for this is that the low production seen today does not appear due to the absence of available land since many growers still hold appreciable acreages that are not now being used. An exception to this general statement might be the reassignment of public grounds in the Pocomoke Sound area. At present these areas are unproductive and since they receive little if any natural strike they might profitably be used for short time growing areas.

In recent years emphasis has been directed toward hatcheries for production of seed oysters. While production of hatchery seed may be of great benefit in areas where set is low, it is felt that oyster hatcheries have no place on Seaside as long as the natural strike remains at its present level. The research program at VIMS using hatcheries which is designed to develop disease resistant oysters must be continued, however, so that the Bayside growing areas can be placed back into cultivation.

Diversification in the oyster industry might solve the problem of keeping a labor force year round.

Summary and Conclusions

It is evident that production on the Bayside of the Eastern Shore may be depressed due to a combination of economic circumstances and increased mortalities associated with MSX. Because of these circumstances it is doubtful if production of oysters in this area may be increased until a means of coping with MSX is developed.

Conditions for improving oyster production seem best on the Seaside where disease and predators are unchanged from the early period in the 1950's when production was much higher. Emphasis should be directed toward developing cultural techniques which would reduce production costs. Among these would be use of escalator harvestors, better means of opening or shucking, the use of surf clam shell as cultch, and development of new and more efficient methods of operation.

Market development is needed to promote new oyster products which would be produced in the area. These would include frozen breaded oysters, and oyster stew. High quality oysters should be grown for the half shell trade. A much needed development is a canning plant which would utilize the clumped Seaside oyster.

A dependable supply of labor might be developed by growers and oyster processors if year-round employment was available.

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Chapter III

THE HARD CLAM INDUSTRY 3-77 003

by

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Introduction

The Eastern Shore has been and continues today to be the principal packing, shipping, and processing center for the hard clam or quahog, Mercenaria mercenaria. The largest clam packer in the world is located on Chincoteague, and the market is influenced and stabilized by this operation. Clams are purchased from New York to South Carolina on a regular basis and occasionally from as far as Florida to the south and Canada to the north. This packing and shipping phase of the clam industry probably has the greatest economic impact on the Eastern Shore, but harvesting is also important. A total of 65,970 bushels of clams were shipped from the Chincoteague area in 1969 and 44,611 bushels from the lower Eastern Shore. Also, 6,349 gallons of shucked clam meats were shipped from Chincoteague that same year. This was approximately 66% of the clams produced by the entire State. From 1950 to 1970, 35 to 86% of the State's total production came from the Eastern Shore (Tables 12 and 13).

Natural History

The quahog is endemic to the inshore waters of the Atlantic Coast of the U. S. from Maine to Florida. The clams ususally spawn in June or July expelling eggs or sperm into the water column. Since spawning of one clam will stimulate others to spawn and since clams are gregarious, there is a good chance of fertilization

TABLE 12

Hard Clam Catch on the Eastern Shore of Va. Compared with the Total State Catch[1]

Compiled by Paul Kendall

Calendar Year	STATE TOTAL Quantity (Va. bu)	STATE TOTAL Value ($)	EASTERN SHORE Quantity (Va. bu)	EASTERN SHORE Percent of Total
1929	81,592	336,516	36,893	45
1930	108,540	391,771	42,474	39
1	66,367	252,929	26,546	40
2	132,860	347,647		
3	104,649	264,258	66,781	64
4	233,508	364,370	175,268	75
5	147,129	370,647	75,332	51
6	234,955	406,895	88,211	38
7	145,984	270,782	74,258	51
8	351,127	375,048	247,014	70
9	252,999	337,802		
1940	220,436	359,460		
1	195,282	338,655		
2	208,940	554,157		
3				
4	104,214	378,140		
5	126,256	525,408	75,748	60
6	122,282	666,970		
7	89,879	439,300		
8	160,272	783,425		
9	153,091	641,355		
1950	141,001	689,250	105,068	74
1	129,596	626,431		
2	106,173	673,360	90,779	86
3	99,524	484,000	62,967	63
4	74,566	389,000	48,412	65
5	101,979	489,000	35,401	35
6	71,690	441,000	40,839	57
7	64,888	434,000	34,547	53
8	63,634	426,000	40,768	64
9	151,255	832,000	123,796	82
1960	148,660	756,000	95,192	64
1	166,560	865,000	104,688	63
2	152,206	812,000	80,736	53
3	187,592	1,012,000	97,573	52
4	219,553	1,219,000	113,530	52
5	218,724	1,316,461	130,984	60
6	166,392	994,046	110,998	67
7	147,496	925,000		
8	166,383	1,050,268	114,150	69
9	150,679	1,049,107	99,315	66
1970	119,097	871,595	71,722	60

Notes: 1. Data from Fisheries Statistics of the U.S. (USBCF) for 1929 through 1967. Data from "Va. Landings" 1968 - 1970. Data for the Eastern Shore were taken from the colum "Atlantic Ocean". Data were reported in pounds and converted to Va. bushels using factors in the publications. Blanks indicate that data were not available

TABLE 13

Hard Clam Production on the Seaside of the Eastern Shore, Virginia
in Virginia Bushels

Compiled by Paul Kendall

Calendar Year	LANDINGS[1] Chincoteague Area	Lower Eastern Shore Area	Total	CATCH[2] Total
1929				36,893
1930				42,474
1				26,546
2				
3				66,781
4				175,268
5				75,332
6				88,211
7				74,258
8				247,014
9				
1945				75,748
1950				105,068
1				
2				90,779
3				62,967
4				48,412
5				35,401
6		4,421		40,839
7		3,460		34,547
8		10,260		40,768
9		19,965		123,796
1960	48,798	10,443	59,241	95,192
1	53,597	17,546	71,143	104,688
2	35,402	17,728	53,130	80,736
3	45,812	26,236	72,048	97,573
4	54,971	38,029	93,000	113,530
5	53,605	41,934	95,539	130,984
6	39,505	37,489	76,994	110,998
7	34,094	27,986	62,080	
8	39,463	45,974	85,437	114,150
9	52,053	31,941	83,994	99,315
1970	REPORT NOT PUBLISHED YET			71,722

Notes:

1. Data are from "Production of Fishery Products in Selected Areas of Md., Va. & NC." (annual reports) compiled by the Hampton Market News Service Office and published by the USF & WS, BCF. The only areas for which data were available were the Chincoteague area (Chincoteague only) and the Lower Eastern Shore Area (Cape Charles, Oyster, Willis Wharf and Wachapreague). THE DATA SHOW THE QUANTITY OF HARD CLAMS FROM ALL PLACES UNLOADED AT THE ABOVE PORTS. Data were copied from the table "Production of certain shell fish in selected areas of Va." which reported quantity in U.S. bushels and in gallons. Data were converted form gallons by using a factor of 1.06 U.S. bu/gal; U.S. bu. were converted using a factor of .716 Va. bu/U.S. bu. Blanks and skipped years indicate that data were not available.

Notes (contd.) Table 13

2. Data from Fisheries Statistics of the U.S. (USBCF) through 1967 and from "Va. Landings" (USBCF) 1968 - 1970. Data are from column "Atlantic Ocean" and REPRESENT CLAMS TAKEN ALONG THE SEASHORE OF VA., PROBABLY ENTIRELY FROM THE EASTERN SHORE. Data were converted from pounds to U.S. bu using factors given in the publications and from U.S. bu to Va. bu. using a factor of .716. DATA PRIOR TO 1951 REPRESENT CLAMS TAKEN FROM WATERS IN NORTHAMPTON & ACCOMAC COUNTIES. Blanks and skipped years indicate that data were not available.

of the expelled eggs. After fertilization and subsequent hatching of the eggs, the free-swimming larvae pass through two major stages of development which takes approximately 8 to 21 days depending on temperature and other environmental conditions. At this point, provided it survives this very tenuous part of its life, the free-swimming larvae will be approximately 1/125th of an inch in size and will settle on the bottom. Here, it will spend some time creeping and swimming on or near the bottom until it sets and digs into the bottom. It will then spend the rest of its life burrowed in the bottom so only its short siphon protrudes. After about 6 to 18 months the clam will be sexually mature and can then start spawning. The average female spawns from approximately 10,000 to over 60 million eggs a year (Davis and Chanley, 1956). Hard clams are male or female but, like oysters, will sometimes reverse their sex (males will become females); however, this is not common. After setting the clam will often move by creeping using his foot or by pushing out of the bottom and allowing the current to transport him to a different area. As the size increases, the clam eventually settles in one place and will seldom move more than about a yard in any direction. Since clams are relatively sessile, they are unable to move away from unfavorable environmental conditions; however, they are able to close completely and remain closed for relatively long periods of time, therefore, avoiding temporary unfavorable environmental conditions such as low salinity. In about 3 years the clam reaches market size and will live for approximately 30 years, assuming it is allowed to do so. Major diseases of clams are unknown, but there are many predators. The blue crab is a major predator until the clams grow to about one inch

in diameter. Among the fish, puffers, drum, rays, and other bottom feeders are also major predators of this species. Rays can devastate a bed of clams in a short time. They are also preyed on by several of the predacious snails, such as Eupleura caudata and Polinices duplicatus. Sea gulls also prey on clams in intertidal or shallow areas. Man is also a major predator of wild clams and an occasional poacher of planted clams.

Heavy fishing pressure will apparently reduce populations below the level where it is economically feasible for commercial harvesting. The recovery of such an area is unpredictable; and, in fact, setting patterns within natural waters are poorly understood. Areas that are traditionally good clam areas tend to recover more quickly; but it is suspected that this is not necessarily due to recruitment as much as higher survival rates probably due to low predation or, better, more protective substrates in that area (Castagna, 1970).

Harvesting

Wild stocks of clams are harvested primarily on Seaside. They are also found on Bayside but not in as great a number. Harvesting is carried out from intertidal to about 50 foot depths. Clams are found in almost all of the Seaside bays and lagoons and along the Bayside in areas where the salinity averages 15‰ or higher. Harvesting is done year round with more harvesting taking place in the warmer months of the year. Most Eastern Shore clammers use small open outboard-powered scows (14 to 18 feet) occasionally carrying two or more men. Large numbers of clams are also harvested incidental to oyster and crab dredging operations; and, in fact,

long-tooth clam and oyster dredges are used specifically to catch clams. Harvesting is also done by the traditional methods of hand tonging, patent tonging, raking, and on the Seaside by treading or wading the clams out of the bottom, and signing in intertidal areas and harvesting with a clam pick. Recently, clammers have been harvesting clams by washing the clams out of the bottom with outboard motors. This is done by anchoring the boat near an oyster reef or shell reef and running the outboard motor which causes the wash of the propeller to blow the clams out of the bottom; then, after the mud resides, the clammer collects the exposed clams.

Hand tongers use tongs similar to oyster tongs, except the basket-like bottom is smaller (shorter) and the teeth are longer (Fig. 8). These devices are used from an anchored scow in depths of 4 to 12 feet. The tonger will bunch up clams, shells, mud, etc. with 3 to 5 opening and closing actions of the tongs; then with one more careful closure, the tongs are raised hand over hand to the side of the boat where they are opened, clams removed and shells, etc. are dropped back overboard. This method of harvesting clams can only be described as back-breaking work.

Patent tongs (Fig. 8) are large tong-like devices that are mechanically lifted and lowered using a power-driven winch. They are dropped to the bottom, and the jaws close as they are lifted. The contents are dumped onto a culling table. Clams are manually sorted and trash and debris dumped overboard. This device is

usually used aboard power boats about 35 to 45 feet in length and is operated by one man. The tongs are usually run by an air-cooled motor of about 4 to 6 horsepower, or by a power "take-off" on the boat propulsion engine. Some of the newer patent tongs use a hydraulic piston closing device which makes them more efficient. The patent tongs can be used at almost any depth that clams are found, but the operators prefer shallower areas which can be worked more efficiently.

Raking clams is occasionally done from a small scow using a Bull rake or Shinecock rake (Fig. 9). More commonly, a hand rake is used on intertidal flats and in shallow water (up to 3 feet). This method is also commonly used by recreational clammers since it is not too difficult and little skill is necessary.

Treading or wading clams requires a great deal of skill. Usually the clammer will wade in 2 to 4 foot depths holding the side of a small (12 to 16 foot) scow. He wears old clothes, or a small number wear a neoprene wet suit. On his feet he wears home-made canvas moccasins. He wades clams with a shuffling, running movement, feeling the clams with his feet. When the clammer finds a clam, he will dig it up with his toe and lifts it atop his foot to his hand and into the boat. As primitive, slow and exhausting as this looks, a good wader can bring in 1000 to 2500 per tide.

Signing is carried out on intertidal areas on Seaside. This method is only usable where a fairly wide tidal fluctuation exposes enough intertidal areas to support this type clamming. The clammer walks the flats or exposed oyster reefs during low tide looking for the peculiar siphon holes and fecal pellets of the clam. He carries a wire basket in one hand and a clam pick (Fig. 9) in the

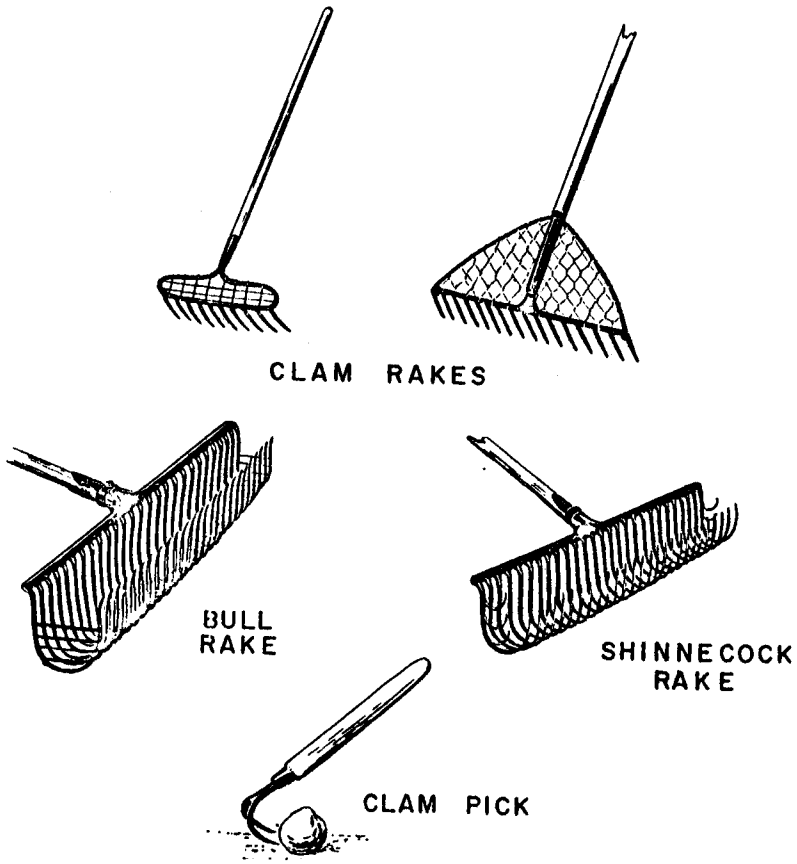


Figure 9. Clam rakes and pick used to harvest hard clams. (Illustrations from "Commercial Fishing Gear of the United States" by W. H. Dumont and G. T. Sundstrom, 1961. U. S. Fish and Wildlife Service, Circular No. 109).

other. Upon sighting a sign he quickly scratches with his pick, exposing the clam which he then lifts or flips into the basket with his pick. Here again, this appears to be a primitive and slow method; but the expert clammer can harvest from 1000 to 2000 per tide.

After the clammer finishes harvesting, he usually counts his clams (traditionally by fives) into a bag or basket and takes them to the nearest clam loading dock. No grading is done, and the clams are sold by count. The packer or his agent usually pays for the count stated by the clammer, but later will check the count while grading. Any discrepancies or breakage will be settled in the next payment for clams. During 1969 and 1970, clammers were paid 2.0¢ to 3.6¢ per clam by the buyers.

Clam buyers or packers will usually send a truck to each of the landings once a day. They generally do not openly compete with each other, and prices do not vary much between buyers. At times there is a glut of the larger size clams, and the buyer will either not buy this size or will buy them at a reduced price. Clams are unloaded by hand (after they have been counted into burlap bags) and placed on the truck.

Packing and Shipping

The buyer then returns the clams to the packing plant where they are again dumped on the floor, counted, and graded by size. If necessary, they are stored in a cool, dark room. No refrigeration is necessary since the clams have a relatively long shelf life. The packer then packs the graded clams in baskets or in bags to be

shipped to his markets. Clams are graded in three categories--nicks, cherrystones, and chowders. These are sometimes further divided. The greatest demand is for the two smaller sizes, and the chowders occasionally glut the market. Most clams (approximately 75%) shipped from the Eastern Shore are sent directly to retailers. The retailers are usually large chain stores or large markets that sell directly to the public. Only about 5% of the clams harvested are sold locally. Approximately 90% are shipped to large cities and about 5% to smaller cities and towns. Virtually all clams sold from the Eastern Shore are shipped by truck. Several trucking firms specialize in seafood shipping. The trucks are often cooled with ice but seldom refrigerated. Most clams are sold in the shell when retailed. A small amount of clams are shucked locally (between 6 and 7 thousand gallons per year) and usually sold to wholesale fish markets in New York and Baltimore. At present almost no clams are used in a prepared or processed form. Processed products such as clam chowder, fritters, etc., contain as the basic ingredient the more economical surf clam. Surf clam meats made up 62% of all clam meats used in U. S. in 1965 (Ropes, et al, 1969).

Many of the clam packers inventory or hold clams. Clams are often held until a market demand develops or to cleanse polluted clams which are purchased at a reduced rate. The clams are held on well-protected intertidal flats or in clam or oyster floats. The floats are large latticed wooden containers (approximately 8 x 12 x 2 feet) which are suspended by large wooden flotation boxes or by lifting tackle from four pilings. The tackle is used for lifting and lowering the box to and from the surface. The flats

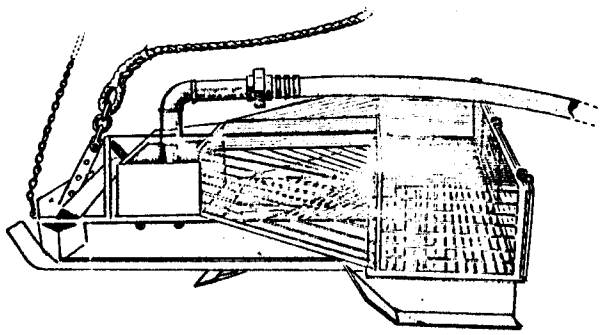
used for storage areas are easily accessible and relatively free from ice. The industry can purchase clams at a low price during summer gluts or from polluted or low salinity areas and, after a holding period, sell at a higher price during periods when many harvesting areas are iced in or clams are in greater demand. Since first priority is to older, regular customers, there is an incentive for retail outlets to deal with these wholesalers on a year-round basis.

When the packer is able to sell his clams, the clams are shoveled from the float into the boat. Clams held on the clam flats are usually harvested by hand using clam rakes, sawed off potato rakes, or clam picks. The clams are brought back to the clam house for grading, counting, packing, and loading for shipment.

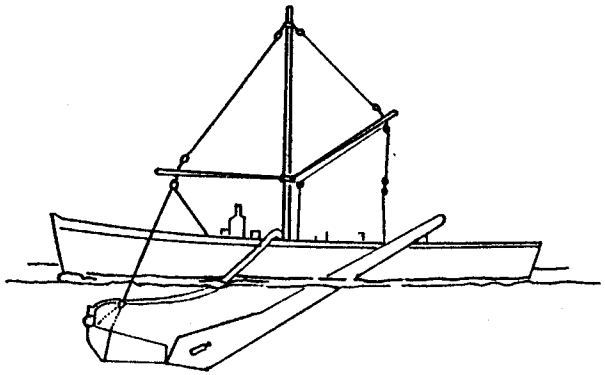
Labor and Mechanization

The number of watermen engaged in hard clam fisheries has dwindled over the years, but this fishery is not as hard hit as most of the others. This is probably because clam harvesting is often the off-season labor for fishermen engaged in other fisheries (crabbing, oystering, etc.). Clam packers are apparently able to hire enough labor to take care of packing operations, but most packers interviewed felt they could sell more clams if more were harvested. Perhaps a greater labor force involved in harvesting would improve this situation, but it could also cause the problem of over-harvesting in some areas.

Much of the clam industry can be mechanized. For instance, at present there are excellent hydraulic harvesters that are used in other states (Fig. 10). This type device with little or no modification



HYDRAULIC DREDGE — HARD CLAMS



HYDRAULIC ESCALATOR DREDGE

Figure 10. Hydraulic clam harvesters. (Illustrations from "Commercial Fishing Gear of the United States" by W. H. Dumont and G. T. Sundstrom, 1961. U. S. Fish and Wildlife Service, Circular No. 109).

could be successfully used in this area. It would be especially useful in reharvesting clams inventoried on flats. Much of the labor force in the packing operation is used for counting and grading. This could easily be mechanized since there are at least two types of mechanical clam graders in use. Clams could be bought and sold by weight, eliminating counting. This method is already used in several northern clam-producing areas. At present packers are willing to maintain this work force so they have manpower available for planting and harvesting clams in the holding areas. If that part of the operation is mechanized, then the packing operation could easily be modernized.

Problems of the Industry

The clam industry is a relatively healthy industry, but there are some problems. Probably the most important problem is supply. Every packer interviewed felt they could sell four times as many smaller size clams than they can now purchase. More clams could be supplied with the introduction of hydraulic, escalator-type harvesters. However, this would only furnish temporary help if the recruitment level is not great enough to stand the fishing pressure. It would probably be wise to introduce this method slowly, to restricted areas, until fishing pressures versus recruitment could be assessed.

Predators are a problem, but at present almost no predator control methods are used, except in inventory areas. The major predators of the small clams are crabs and various bottom-feeding fish. Crabs cannot crack the shell of larger clams, but these are preyed on by larger fish such as drum and rays. Methods are

presently being tested at Virginia Institute of Marine Science for protecting the smaller size clam. Larger clams are protected in inventory areas with wooden stake and hog wire fences which are replaced yearly. Cost analysis should be made to establish the value of this practice in other areas. With the advent of plastic-coated wire this type barrier should have a longer life. Watchmen are used to control poaching and reduce losses to sea gulls. Environmental changes sometimes cause catastrophic mortalities among clams, but only in areas that are rather marginal. Clams are able to dig out of a fairly deep covering of silt but cannot withstand an extremely high turbidity such as caused by dredging.

The quality and durability of the product is quite good under its present handling methods; however, these handling methods could be made more efficient by devising special containers for transporting clams that are more easily loaded and unloaded. At present most clams are shipped in burlap bags or in grain bushel baskets. Special wire cages have been tried very successfully by one of the major clam packers.

The price of clams is relatively stable as compared to other seafoods; however, this could be further stabilized by developing a market for chowder size clams and developing more inventory areas. Of course, neither of these would be any good without an increased supply of clams.

At present the by-products from a clam operation are some crushed clams and shell. Clam shell is in fairly high demand as containers for deviled clam so they do not present any problem for waste disposal. There is very little fresh water used in washing clams; and, therefore, waste water disposal is no great problem.

At present, the industry does not seem to have too many legal problems; however, the state has no legal method for a clam grower to lease lands specifically for growing or harvesting clams. These areas are covered by oyster lease laws. There is probably a need for recognized long-term leases of clam grounds so that better harvesting methods can be used on private leases. This would allow the individual clammer to harvest and control his own area with some thought to conservation for future harvesting. If the leases are relatively long term, it would behoove him to plan proper and careful harvesting allowing for recruitment. If leases were available, they would require policing. This would either require more manpower in the Marine Resource Commission or better utilization of manpower now available.

The practice of blowing clams with an outboard will probably become a problem. Beside reducing the number of clams, it destroys established oyster reefs, some of which take years to build. The loss of these reefs not only reduces oyster setting areas, but also areas where clams are able to set and survive in good numbers.

Recommendations

Research is needed on mechanical harvesters and their effect on existing stocks, habitat and recruitment. Assessment should be made on what level of production could be maintained without endangering the future of the industry.

It is important that more research be done on setting and culturing clams. Since the chowder market will probably remain depressed, due to the surf clam industry, it becomes important to develop a method of predicting or planting clams so they can be

harvested at smaller sizes. Work at the Virginia Institute of Marine Science has been underway for many years on mariculture of hard clams; and, at present, clams are being furnished to the industry to test methods devised by VIMS.

There is a need for increasing the efficiency and mechanizing the industry. For instance, most clams are counted and graded by hand although there are at least two machines presently on the market that will grade clams effectively. The clams could then be sold by weight eliminating the need for counting. This method is already in use in the Northeastern clam-producing areas.

Promotion and advertising of clams and development of new products are needed. New prepared foods using the large size clams should be developed.

The Commission of Marine Resources should plan legislation which would make long-term clam leases available. Plans should be made to allow mechanized harvesting and planting operations. Plans should also be made with industry for protecting these leases from poachers.

Predator protection methods should be devised and tested. Methods should be inexpensive enough to warrant their use in clam areas other than inventory areas.

Summary and Conclusions

The Eastern Shore is one of the most important clam-producing areas on the East Coast. Although this industry has shown a general decline, it is not as depressed as other commercial fishing industries.

The industry utilizes the hard clam or quahog, Mercenaria mercenaria. This species has a natural history typical of other marine pelecypods with external fertilization and free-swimming larvae. After the larvae settle, the clam spends its life burrowed into the bottom substrate. It is a common species in the inshore and high salinity estuarine environments of the Atlantic Coast of the U. S.

The methods used in the industry are fairly primitive. Mechanization and more efficient operating methods could be introduced and should be encouraged.

Methods of growing, protecting, and producing more smaller-sized clams are needed, since there is almost a chronic shortage of these sizes. Mariculture and better private leasing arrangements and legislation encouraging private clam production areas are needed. Development and promotion of new prepared products utilizing the larger chowder size clams would be most helpful. There is considerable potential for the improvement and expansion of this industry.

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Chapter IV

THE SURF CLAM INDUSTRY

by

M. Castagna

History of Fishery

The surf clam, Spisula solidissima (Dillwyn), has been commercially utilized since the 1870's (Yancey and Welch, 1968). The industry developed first as a bait fishery and then in the late 1940's developed as a food fishery. By 1965 less than 2% of the catch was used for bait, and the industry produced 62% of all clam meats used in the U. S. (Groutage and Barker, 1967). Probably the two most significant developments to cause this fishery to change and grow were an effective sand washer invented in 1943 and the development of the hydraulic dredge in late 1945. In 1949 the industry, located off the New England states, began exploring for clams off the coast of New Jersey, Delaware, and Maryland. Beds or streaks of clams large enough to be commercially exploited were found in depths of 90 to 100 feet. The original industry based in the northeast soon moved south to New York and New Jersey. In the early 1950's it expanded to Maryland, but by the early 1960's it was centered in New Jersey. Recently (1965) the Bureau of Commercial Fisheries (National Marine Fisheries Service) found additional beds off the Delmarva Peninsula, in 50 to 150 feet of water. Although these beds are not as rich as the beds off New Jersey were in the early days of the fisheries, they are, nevertheless, quite productive. Also important, some beds are close to shore and, therefore, are available in the winter when weather restricts fishing

the offshore beds. The beds closer to shore usually contain smaller clams, but they are still of adequate size for commercial use.

Natural History

The Atlantic surf clam, Spisula solidissima, is found along the Western Atlantic coast from Nova Scotia to South Carolina (Abbott, 1954). It is known as the bar clam in Canada; hen clam in Maine; sea clam in Massachusetts; and surf clam, beach clam, or skimmer clam in the Middle Atlantic States.

Surf clams inhabit gravel, sand, or muddy-sand bottoms in a few feet of water near the beaches to several hundred feet of water. Often vast numbers are washed ashore after severe storms (Ropes, Chamberlin, and Merrill, 1969).

The sexes of the surf clam are separate, and they reach sexual maturity in about one year. They usually spawn in July-August and again in September-October. Gonad ripening seems to coincide with warming of bottom water (Ropes, Chamberlin, and Merrill, 1969). During spawning, eggs and sperm are expelled into the water and fertilization is external; hatching of the eggs occurs in a few hours. Development proceeds through two major stages; and, after 10 to 20 days of planktonic existence, the free-swimming larvae are ready to set. The larvae are probably transported great distances by currents, and many of the larvae undoubtedly contribute to the basic food chain during their planktonic stages. After setting, the clams grow to 1-1/2 to 2 inch size the first year and to about 5 inches in four years. Four-year-olds are sometimes harvested, but most of the clams taken commercially are 5 and 6 years old. They can reach lengths of 7 to 9 inches, but most of those in the fishery

are 4 1/2 to 7 1/8 inches in length (Ropes, et al, 1969).

Surf clams are preyed on by moon snails, Lunatia heros and Polinices duplicatus, which bore holes in the shell and tear out the flesh with their rasp-like radulae. These snails along with starfish and crabs are the main predators of this species with birds and fish to a smaller degree.

Rate of recruitment of young is not known; but, because of the length of time before this species is utilized (5 to 6 years), the supply does not fluctuate greatly from year to year. The survival of a year class is usually assured after its third year and predictions can be made on yield.

Description of the Fishery

The fishing grounds are located from 8 to 40 miles offshore, so a fairly seaworthy vessel is necessary. Most of the boats used in the fishery are from 60 to 150 feet in length and are usually converted from other fisheries. Most of the converted vessels haul in the dredge over the side, but the industry is starting to use vessels that will haul the dredge over a stern ramp. Harvesting is usually a daytime activity with the boats returning the same day they go out.

Harvesting Method

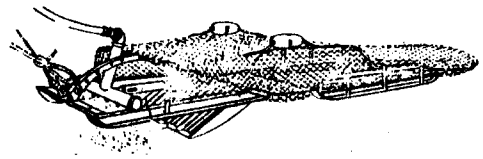
The clams are harvested by a hydraulic dredge. This box-shaped, steel-slated dredge has a series of water jets over the cutting bar in the front that washes the clams out of the bottom and into the dredge. This method not only greatly increases the clam catch but also reduces injury to clams. The dredges are from 40 inches to 84 inches wide and 8 to 12 feet long with jets supplied by pumps that

deliver 3,500 gpm at pressures over 130 psi (Fig. 11). The diesel-powered pumps are connected to the dredge by lengths of special 5 inch or 6 inch ID clam jetting hose (Parker, 1966). At deeper depths these are sometimes doubled. Due to the costs and problems of handling long lengths of hose, clams are seldom harvested below 100-foot depths. After making a haul the dredges are dumped on deck where the clams are manually sorted from shells and debris. They are bagged or, more commonly, placed in wire cages (30 bushel cages) on deck or below deck. No refrigeration is used, but if beds farther offshore are fished the industry will have to consider faster boats, refrigeration, or shucking on board (Parker, 1966).

The clam boats are usually owned or controlled by a packer. Independent boats make arrangements on selling clams before they leave port. Most boats are operated by a crew of 3 or more men who are paid on a traditional share basis, sometimes supplemented by a base salary. Boats will harvest between 300 and 1000 bushels per day. Most crews are semi-skilled to skilled watermen, and the boat captains and crews seem to change relatively often. The men working in this industry are relatively young, indicating good recruitment and a viable industry.

Virginia Eastern Shore Industry

The industry started on the Eastern Shore in 1967 and 1968, and in 1970-1971 there were six surf clam processing plants. They are located at Chincoteague, Atlantic, Saxis, Wachapreague, and two in Oyster. Four of the plants are locally owned. The primary reasons for development of the industry on the Eastern Shore were the low cost labor and the future potential of the industry. Six to eight boats, mostly New Jersey registered, are presently working



HYDRAULIC DREDGE — SURF CLAM

Figure 11. Hydraulic surf clam dredge. (Illustration from "Commercial Fishing Gear of the United States" by W. H. Dumont and G. T. Sundstrom, 1961. U. S. Fish and Wildlife Service, Circular No. 109).

out of Chincoteague. Two local boats and two or three New Jersey boats fish out of Oyster. Two boats from New Jersey fish out of Wachapreague; and, presently, two local boats are being outfitted to fish from there. Most of the boats are small draggers that can negotiate the relatively shallow channel during high tide. Some of the draggers restrict the number of bushels of clams carried to avoid hitting bottom in the inlet. The inlets are not deep enough to allow larger boats to land clams at local ports or to allow their use as harbors of refuge during storms. Chincoteague Inlet is to be improved so larger surf clam boats will be able to land at Chincoteague; and probably other inlets will be improved as more boats move into the area.

Harvesting

The beds off the Delmarva Peninsula are presently fished by approximately 16 boats from Ocean City and 6 to 12 from the Eastern Shore ports, making a total of 22 to 28 boats or about 1/5 of the Atlantic coast surf clam fleet. Most of the boats will harvest 3 to 4 hundred bushels of clams a day and will receive from $2 to $2.60 a bushel. Occasionally, catches of 600 to 1000 bushels are made.

Processing

Some of the clams processed on the Eastern Shore are trucked in by refrigerated trucks from Ocean City, Maryland, although an increasing amount are now being landed at local ports. Some of the clams presently landed from Delmarva beds are trucked to Delaware and New Jersey for processing. As the Eastern Shore plants

increase operation, more will be processed locally. The processing is briefly this: The clams are placed in fresh hot water (about 140 to 150°F) for 30 to 40 seconds. They are then sprayed with cold fresh water while being moved by conveyor to the shucking benches. They are shucked by hand. The meats go through a washer-tumbler device that removes much of the sand prior to a second processing line where the adductor muscle, viscera and liver are manually removed from the clam. The meats are then washed a second time and are chopped, diced, cut into strips, or left whole before refrigeration or freezing. The meats are usually frozen until ready for final processing into prepared dishes, such as chowders, casseroles, breaded, etc.

The frozen clam meats are most often sold by weight to restaurant chains or processors. Some of the packers distribute prepared foods under their own brand or pack for a chain store label. Frozen clams are shipped in plastic containers, in cardboard boxes, or in cans, by refrigerated trucks.

Future Potential

The future potential of the surf clam industry is excellent. If one or more of the Eastern Shore inlets is dredged to allow larger boats to unload or seek haven, more of the fleet will probably establish on the Eastern Shore. The National Marine Fisheries Service estimates that at the present fishing pressure the stocks should last 10 to 15 years. The demand for clam meats has increased in the past and should continue to increase as new markets are developed. The surf clam market is occasionally glutted, indicating a lag in market development.

Labor

Since the labor force is predominantly semi-skilled or unskilled, workers are readily available. As more plants establish on the Eastern Shore and competition increases between surf clam plants and other food processing and agricultural businesses, a scarcity of labor will likely develop.

Mechanization

Although processing is primarily done by hand, much of it can be mechanized. Some plants in New Jersey are using mechanical shucking techniques. Some segments of the industry are testing mechanical eviscerators for removing the bellies. As labor becomes scarce, mechanization will undoubtedly increase.

Problems of the Industry

Of course, some of the natural problems of this industry are the predators, especially of small-sized clams. Almost no control method is possible. Predators captured in the harvest are presently dumped back on the bed. This practice could not be considered helpful.

One of the main problems of the industry is waste disposal. At present most of the processing plants on the Eastern Shore must dispose of between 800 and 1000 gallons of bellies, viscera, sand and water per day. The moisture content of this by-product is too high for economical use in pet food or the fertilizer industry. Law forbids feeding to domestic animals, such as hogs. The law also forbids dumping into State waters or within the 3 mile limit. This wet waste has an exceedingly high BOD (Biological Oxygen Demand) and cannot be handled by the usual waste disposal methods and is too

wet for incineration. At present the plants are taking care of this problem by dumping it into the sea beyond the 3 mile limit or by trucking it to land disposal areas. Sanitary landfill type disposal appears to be the most economical for most plants.

Shells are presently a problem, but these can be easily utilized for roads, cultch, etc. Storage of shells could be a significant problem, because of odors and rats. As more clams are processed, utilization of shells will undoubtedly follow.

Recommendations

Further scientific survey of beds should be made to develop methods of predicting recruitment and survival in relation to harvesting pressures.

New products and promotion of products would be useful if demand does not cause overfishing.

It is imperative that one or more of the inlets be dredged and maintained if the Eastern Shore industry is to grow.

Summary and Conclusions

The surf clam industry is a healthy, growing one. It will undoubtedly continue to develop on the Eastern Shore if restrictions do not inhibit growth.

Harvesting is carried out offshore and shucking and packing is presently carried out locally in 6 packing plants.

The industry is mechanized and has potential for further mechanization as the need arises.

Potential Ocean Quahog Fishery

The Ocean Quahog or Mahogany Clam, Arctica islandica, occurs in approximately the same areas as the surf clam. It is harvested in the New England surf clam fishery incidental to the surf clams (Mendelsohn, et al, 1970). These clams were originally harvested for pet food. Methods are now used for bleaching and flavoring so they can be used for human consumption; and, at present, they are used in prepared clam chowders. As this new fishery develops, it will undoubtedly utilize clams harvested in the Delmarva beds. The potential of this market is speculative and at present no Mahogany Clams are landed on the Eastern Shore.

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Chapter V

THE CRAB INDUSTRY

2.72-005

by

W. A. Van Engel

Introduction

Blue crabs are abundant on the East and Gulf coasts of North America. A few occur south to Uruguay and have been reported from France, Holland, and Denmark, and the East Coast of the Mediterranean. In Chesapeake Bay, fishing has been intensive for over 80 years; in the last ten years, the average annual production has been about 75 million pounds, valued about six million dollars. This constitutes 55-60 percent of the weight and value of the entire United States blue crab harvest.

During the 90-year history of the Chesapeake Bay blue crab fishery, many types of fishing devices were tried. Only pots, trotlines, and dredges proved suitable; and they emerged as the primary types of gear for catching hard crabs. In the early years of the fishery, trotlines with their various modifications were used principally for catching hard crabs in the summer. The Chesapeake Bay crab pot, patented in 1938 and modified only slightly since, gradually replaced the trotline. Pots now account for two-thirds of the Virginia hard crab catch and more than half of the Maryland catch. The dredge, first used about 1900 and relatively unchanged with time, is still the primary winter gear.

Natural History

Mating of blue crabs begins in early May and continues into October; sperm live in the female receptacles for at least a year, and may be used as often as the female spawns, which may be two or more times. After mating, females migrate to the saltier waters of the southern end of the bay, some passing into the ocean. Spawning is delayed at least two months after mating, and occurs from early May through September. Eggs are carried on the abdomen of the female for about two weeks before hatching.

In the first month after hatching, the crab passes through seven larval stages and one post-larval stage, the megalopa. Large numbers of crabs reach the "first crab" stage early in August and begin migrating into the rivers and to the upper Bay. Adult size may be reached in one year to a year and a half, shedding 18 or more times after the last larval stage.

Two major migrations of adult females to the southern end of the bay occur, in October and November and the following May. None of these females spawned before migrating. Schools of "sea-run" or "ocean" crabs, that have spawned before, migrate from the ocean or the Virginia Capes area into the Bay in mid-summer. Adult males remain in the brackish river waters the year round.

Blue crabs eat mostly plant and animal matter, either live or dead. Young sets of clams and oysters may regularly be destroyed, but the blue crab is not generally considered a serious pest of oysters.

Production and Importance

Exact figures of landings of the blue crab fisheries of Accomack and Northampton counties of the Eastern Shore of Virginia are not available. It is estimated that the range of annual hard crab landings for 1960 to 1970 may have been from 10 to 25 million pounds (0.58 to 1.98 million dollars), and that of soft and peeler crabs may have been from 0.25 to over 0.6 million pounds (90 to 215 thousand dollars). These estimates are derived from data reported by the U. S. Fish and Wildlife Service in annual Statistical Digests and monthly Virginia Landings (Tables 14, 15, 16; Figures 12, 13, 14, 15). Virginia Atlantic Coast landings are reported monthly and annually, but county (Accomack and Northampton) landings are reported only at 10-year intervals. About two-thirds of the Shore's landings probably occur on the Chesapeake Bay side of the peninsula (and including Tangier Island), and the balance comes from bays and creeks draining into the Atlantic Ocean. During the last 11 years, the blue crab fisheries of the Eastern Shore probably contributed from 30 to 40% of the landings and value of blue crabs from all Virginia waters.

Stages in the production and processing of hard and soft crabs are presented in Figure 16.

Table 14. Virginia, Annual landings and value of blue crabs 1960-1967 data from Statistical Digest; 1968 and later data from Annual Landings."Atlantic" refers to Virginia seaside.

Year		Hard Crabs lbs.	Hard Crabs value	Soft and peeler crabs lbs.	Soft and peeler crabs value
1960	Atlantic	3,878,100	$ 237,449	213,800	$ 75,952
	Total Va.	39,270,000	1,994,026	1,590,200	449,808
1961	Atlantic	4,923,300	189,708	203,100	59,079
	Total Va.	43,976,200	1,944,528	1,568,200	422,141
1962	Atlantic	5,365,900	248,464	135,500	39,268
	Total Va.	53,671,000	2,522,585	1,347,300	428,819
1963	Atlantic	4,021,200	221,895	118,000	61,313
	Total Va.	46,138,500	2,545,537	948,800	328,798
1964	Atlantic	5,648,200	424,975	195,500	95,811
	Total Va.	51,572,000	3,385,029	997,700	452,163
1965	Atlantic	5,896,800	376,432	126,200	50,647
	Total Va.	50,562,600	3,723,253	1,079,400	445,202
1966	Atlantic	1,744,100	91,118	54,400	18,833
	Total Va.	63,731,200	3,638,309	1,028,000	377,999
1967	Atlantic	3,998,680	194,196	93,936	32,146
	Total Va.	54,823,300	2,954,156	1,217,200	452,346
1968	Atlantic	6,347,720	597,456	177,790	70,177
	Total Va.	44,740,398	4,946,648	804,961	313,004
1969	Atlantic	2,131,140	311,867	163,310	84,195
	Total Va.	34,306,018	3,063,145	1,588,916	571,850
1970	Atlantic	1,891,560	93,990	39,889	27,020
10 mos.	Total Va.	35,876,845	1,905,888	909,476	337,886
Total Atlantic		45,846,700	2,987,578	1,521,525	614,441
Total Va.		518,668,061	32,623,104	13,080,153	4,580,016
Av. Atlantic		4,167,882	271,598	138,320	55,858
Av. Va.		47,151,642	2,965,737	1,189,105	416,365

Table 15. Accomack and Northampton Counties, Virginia, landings and value of blue crabs, 1950 and 1960.

Year		Hard	Value	Soft & peelers	Value
1960	Accomack Co.	10,829,800	$567,523	587,600	$182,392
	Northampton Co.	3,977,900	$218,274	102,700	$ 30,611
	Total	14,807,700	$785,797	690,300	$213,003
Virginia Seaside % of county total		26	30	31	36
1950	Accomack Co.	7,667,400	$251,126	1,997,000	$319,085
	Northampton Co.	5,500,100	$313,616	170,100	$ 20,420
	Total	13,167,500	$564,742	2,167,100	$339,505
Virginia Seaside		Not available.			

Table 16. Accomack and Northampton Counties, Virginia landings and value of blue crabs, 1950 and 1960.

Counties landings and values, hard, soft and peeler crabs. Compared with state totals.

Year		Hard	Value	Soft & peelers	Value
1960	Counties	14,807,700	$785,797	690,300	$213,003
	State	39,270,000	$1,994,026	1,590,200	$449,808
Counties, % of state total		37.7	39.4	43.4	47.4
1950	Counties	13,167,500	$564,742	2,167,100	$339,505
	State	46,395,700	$1,861,715	3,230,000	$471,720
Counties, % of state total		28.4	30.3	67.1	72.0

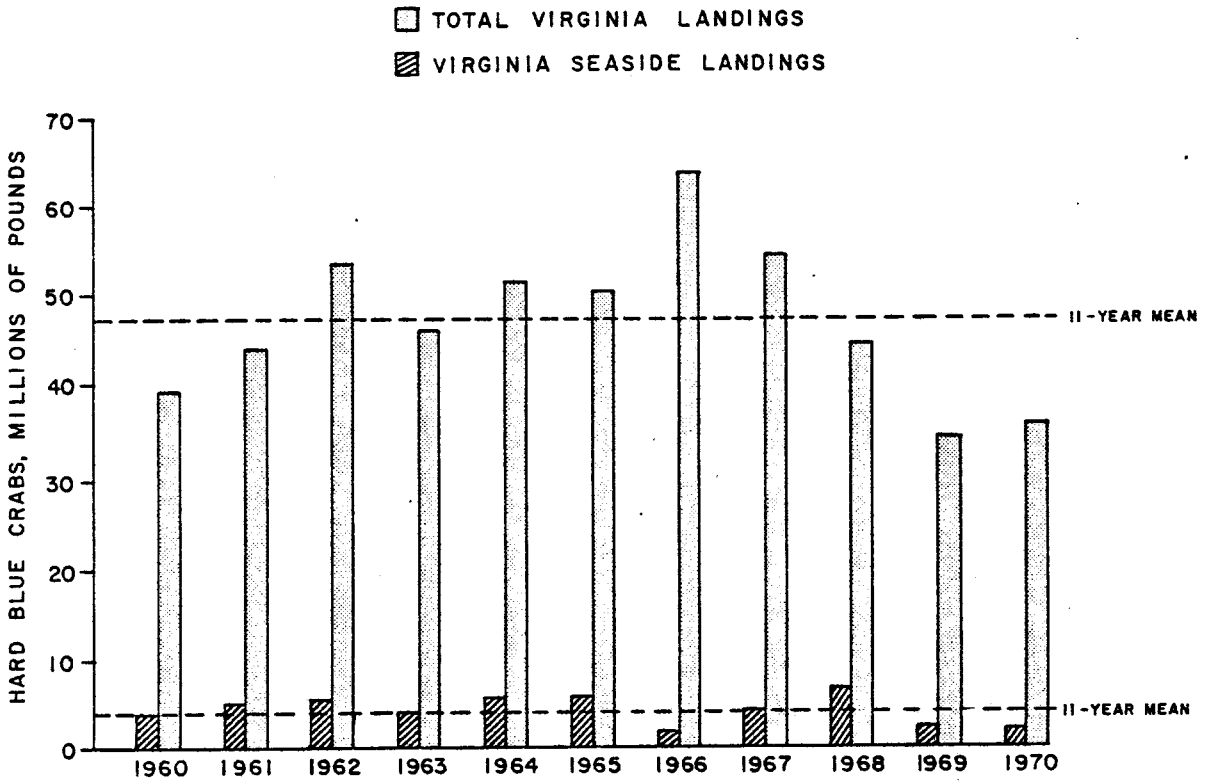


Figure 12. Annual Weight of Catch, 1960-1970, of Hard Blue Crabs on the Virginia Seaside Compared with the Total Pounds of Hard Crabs Landed in the State.

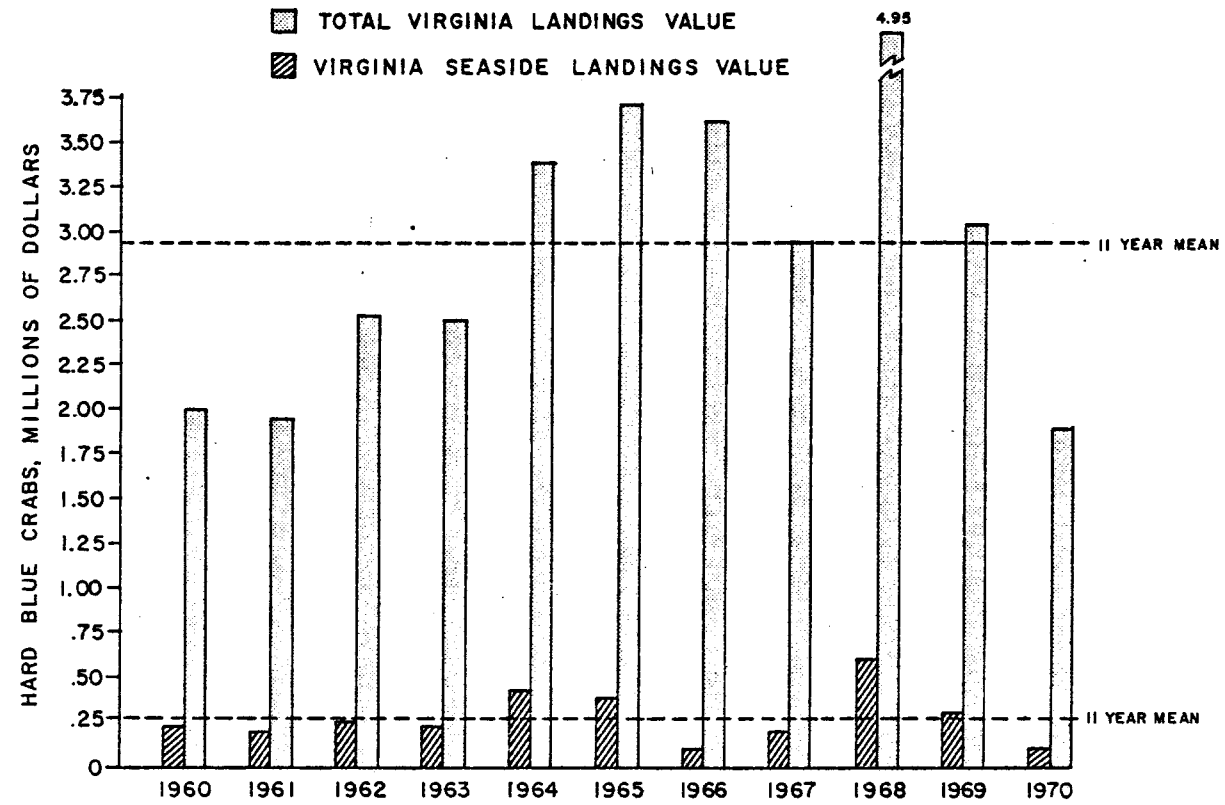


Figure 13. Annual Dollar Values, 1960-1970, of the Hard Blue Crab Catch on the Virginia Seaside Compared with the Value of the State Catch of Hard Crabs.

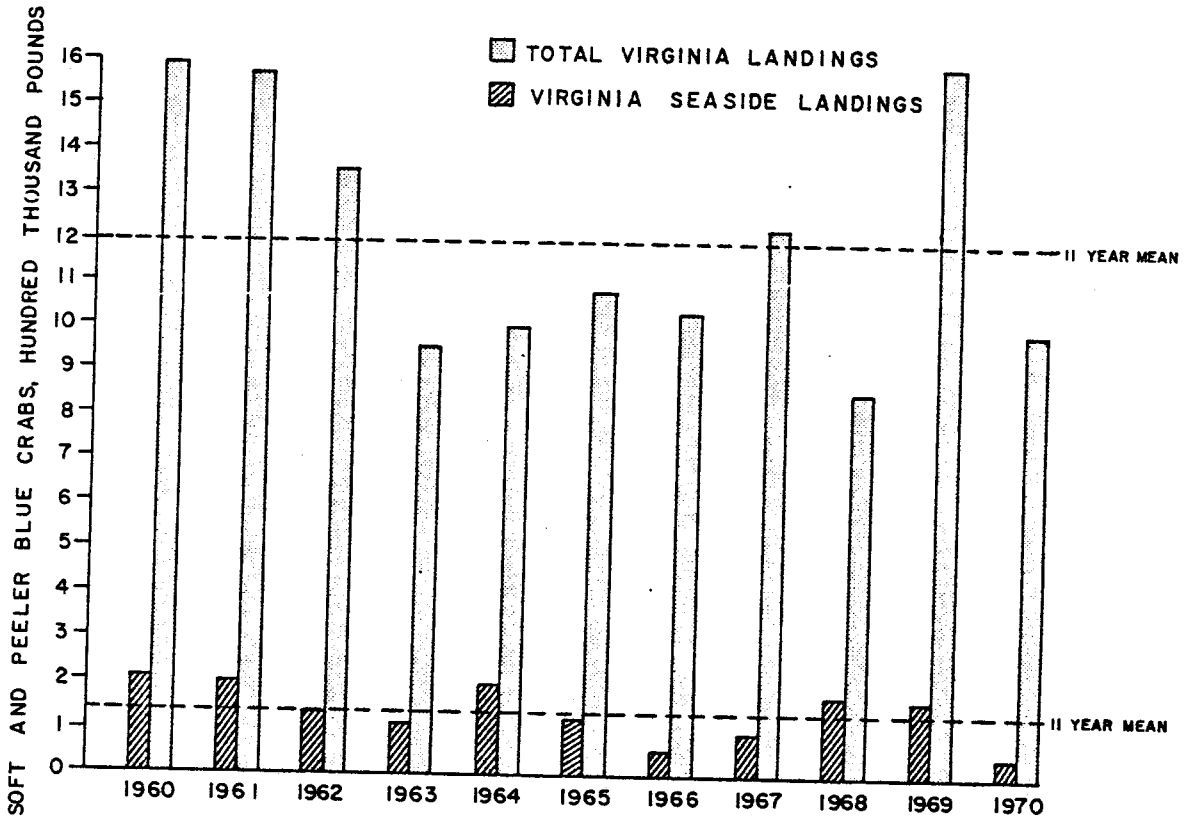


Figure 14. Annual Weight of Catch, 1960-1970, of Soft and Peeler Blue Crabs on the Virginia Seaside Compared with the Total Pounds of Soft and Peeler Crabs Landed in the State.

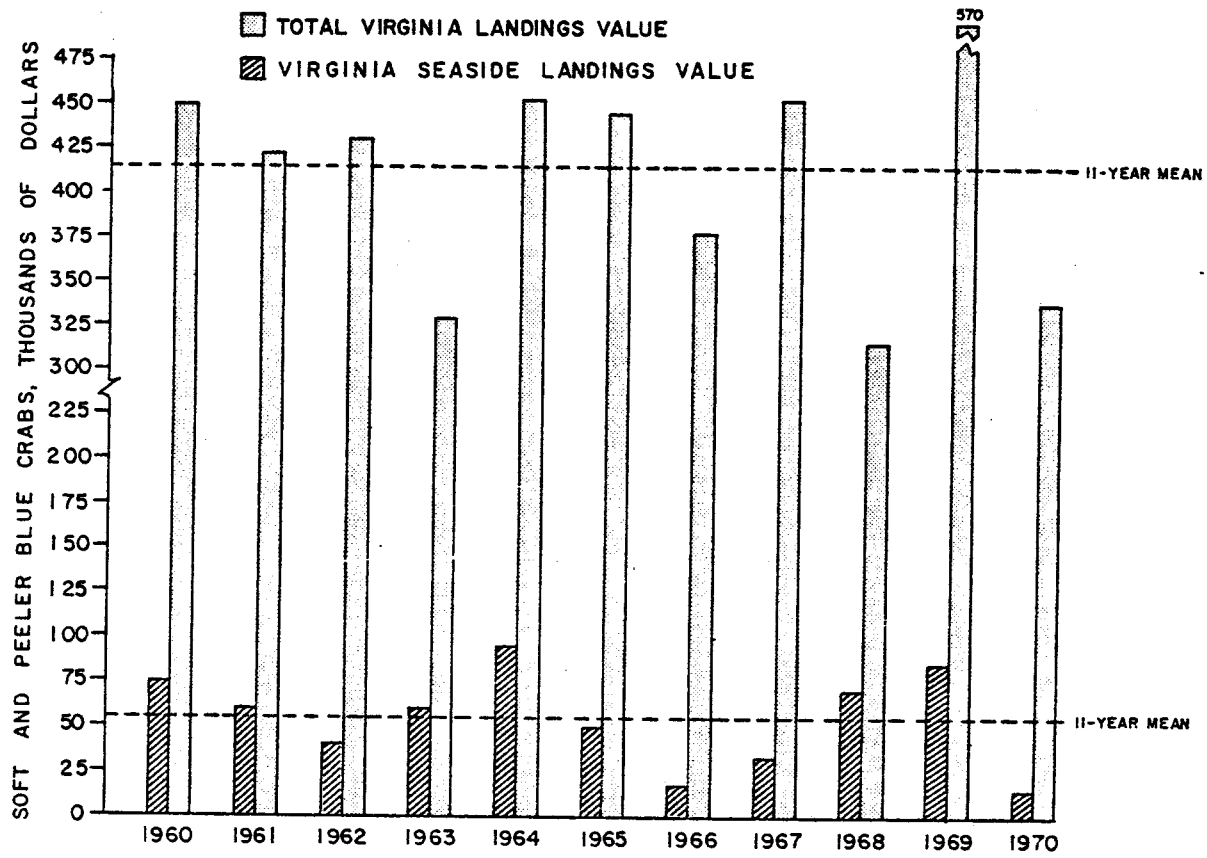


Figure 15. Annual Dollar Value, (1960-1970), of the Soft and Peeler Blue Crab Catch on the Virginia Seaside Compared with the Value of the State

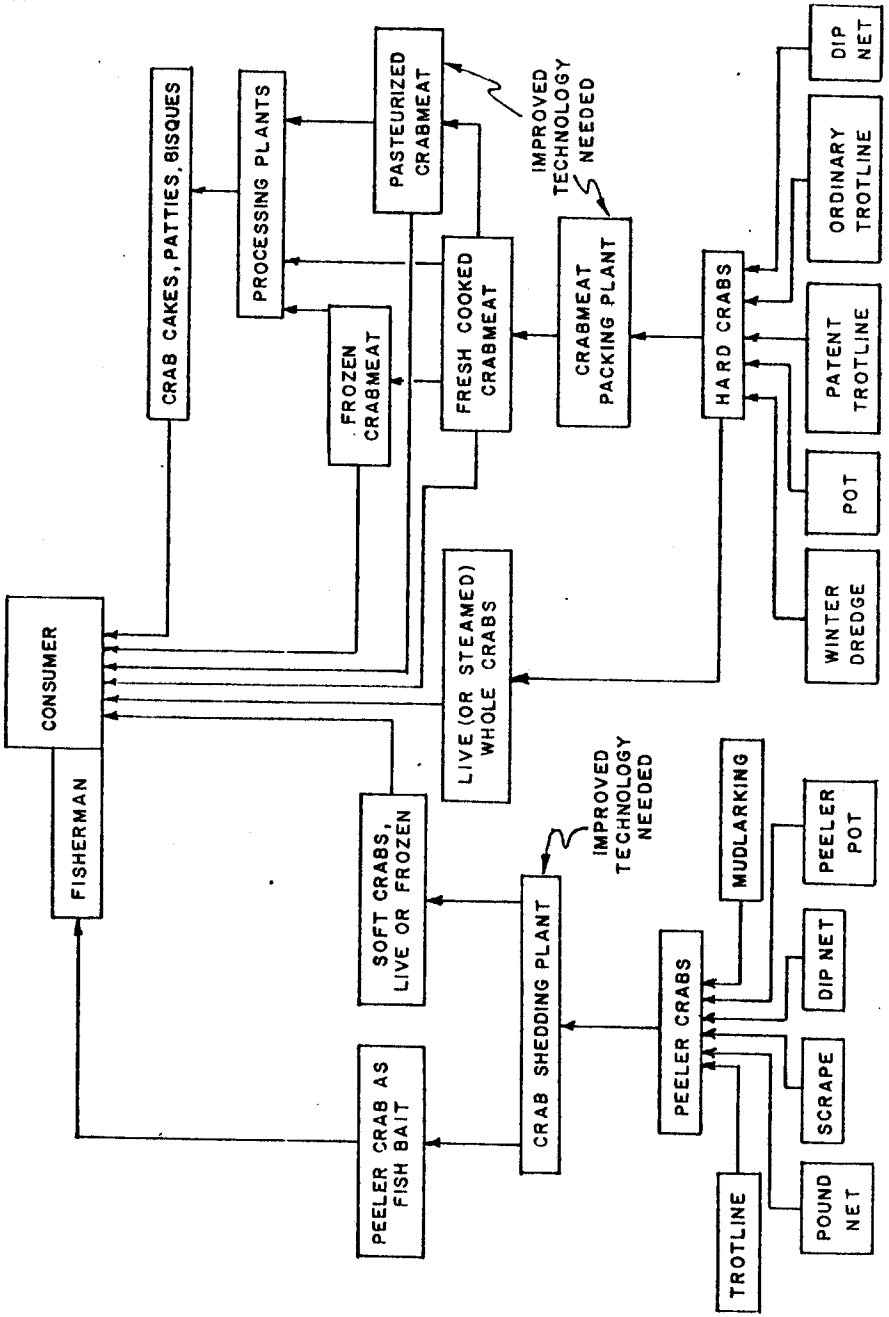


Figure 16. Stages in the harvesting, distribution, and processing of hard and soft blue crabs.

The Hard Crab Fisheries

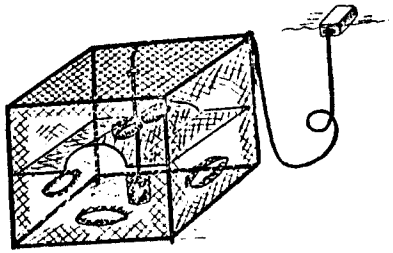
Hard crab landings are derived from four area and seasonal fisheries:

1) The pot and trotline fisheries in the Chesapeake Bay, in spring, summer and fall. It is estimated that on the average these fisheries account for about 5 million pounds, about two-fifths of the bicounty landings. Crabs are taken primarily between Kiptopeke and Saxis; almost none are caught between Kiptopeke and Fisherman Island. (See Figure 17 for an illustration of a crab pot and trotline.)

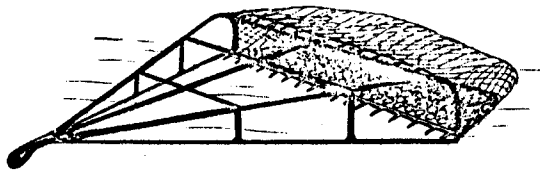
2) The pot fishery of the bays of the Seaside of the Eastern Shore, in spring, summer and fall. Catch is usually about one-fifth or less of total landings. Fishable areas are relatively few; crab stocks are seldom abundant; and crabs often are of smaller spine to spine width than bay-caught crabs (and therefore there is a higher percentage of illegal sizes) -- all of which make the fishery highly susceptible to economic pressures, and probably unprofitable unless light bay-side catches create high market demand.

3) The dredge fishery of the Chesapeake Bay, December through March. Forty or more percent of the dredging fleet lands its catch at Cape Charles City in early winter and some land near Deep Creek (Chesconnessex) later in the season. Landings probably average about 5 million pounds, two-fifths of the annual total counties catch. A crab dredge is illustrated in Figure 17.

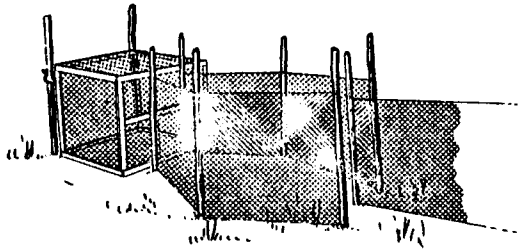
4) The dredge fishery of the Seaside bays. Landings are relatively small, probably less than five percent of the total annual counties landings. Dredgable areas are



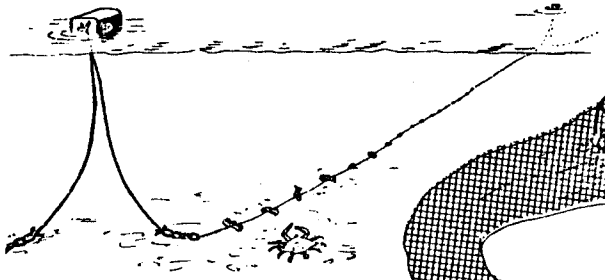
HARD CRAB POT



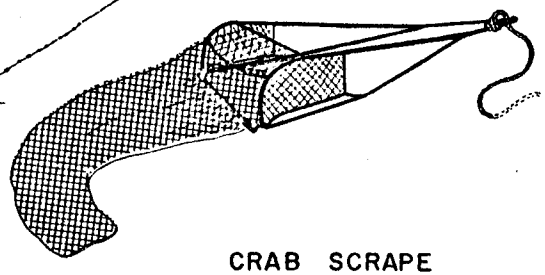
CRAB DREDGE



CRAB POUND NET



TROT WITH BAITS



CRAB SCRAPE

Figure 17. Blue crab harvesting gear. (Illustrations from "Commercial Fishing Gear of the United States" by W. H. Dumont and G. T. Sundstrom, 1961. U. S. Fish and Wildlife Service, Circular No. 109.)

few and crab stocks are seldom abundant. Dredging effort is increased when bay-side stocks are relatively scarce.

There have been no noticeable changes in the last 10 (or 20) years in methods or intensity of crabbing, in the location of fishing sites, in docking sites, or in the location and number of dealers in hard crabs (Table 17). Enlargement and repair of the Cape Charles City docking facilities is the only substantial improvement in Eastern Shore facilities.

Not shown in Table 17, because crab buyers are required to have the same license as purchasers of clams and oysters from public rocks and thus cannot be identified from Virginia Marine Resources Commission records, is the number of truckers (buyers) who take crabs from landing sites to crab picking houses.

During the winter, most of the dredged crabs landed at Cape Charles City are regularly hauled to Maryland dealers, and it is probably that large amounts of the summer pot and trotline catch reach these same destinations. It must be concluded that there are too few crab meat picking houses in the two Eastern Shore counties to handle all the hard crabs landed.

At one time it was believed that Eastern Shore crabbers were unnecessrily restrained from selling their hard crab catch because of minimum size limits imposed by Virginia law. It is commonly known that adult female crabs caught in Seaside bays are

Table 17. Wholesale Dealers in Fishery Products

	1962	1969
Crab Meat	--	1
Hard and soft crabs	17	16
Soft crabs	7	11
Soft crabs and crab meat	1	1
Hard crabs	5	3
Hard and soft crabs and crab meat	1	--
Total, exclusive of duplication	31	32
Total, picking crab meat	2	2
Total, shedding soft crabs, alone or in combination	26	28

Certified shippers of fresh, frozen and pasteurized crab meat, 1970

Eastern Shore Seafood Co., Onancock

Nandua Seafood Co., Hacks Neck

George D. Spence & Son, Quinby

often smaller in width (spine to spine) than Bayside crabs, but the difference is attributable to the fact that Seaside crabs have relatively short lateral spines. Actually, there are no differences in average length and "short width," the latter being the distance across the back between the bases of the lateral spines. Through 1961, the minimum size was 5 inches. Legislation in 1962 was enacted to permit Eastern Shore crabbers to sell more of their catch. This change was directed primarily toward male crab sizes, for in the same year (and since then) adult females were exempt from size limitation. From 1962 through 1965, the minimum size was 4 inches from tip to tip of spikes next to the longest spikes. From 1966 through 1969, the minimum size was returned to 5 inches, probably because of the difficulty of selling crabs in Maryland where a 5-inch minimum persists. In 1970 the law was revised to 4 3/4 inches between tips of the longest spines.

Some hard crabs, probably all large male crabs, are shipped alive in baskets to northern markets for use in "raw" seafood bars. Quantities shipped are unknown.

Soft and Peeler Crab Fishery

Soft and peeler crabs are caught from May to early October, in scrapes and crab pounds (traps) (Figure 17), by dip net, "peeler" pot and regular crab pot, and by "mud-larking."

Early in this century, most of the soft crabs shed in the State came from Tangier Island. Peeler crabs were caught from late April to early October with scrapes (Figure 17) and dipnets and some by trotline in adjacent waters. The first peelers each year usually were bought by Tangier men from Seaside crabbers who caught many rank peelers by mud-larking on the broad marshes. Later, in the 1930's the crab pound (trap) was developed and over the next 30 years slowly began to replace the scrape as a fishing device around Tangier. Extensive use of crab pounds in the Rappahannock and Piankatank rivers resulted in large peeler landings in April, May and June, and some small catches the remainder of the summer and fall.

Peeler crabs are also caught in crab pots, incidental to the catch of hard crabs. Generally the catch is small, but occasionally large catches are made when there is a run of "doublers" (pairs of crabs). In at least one year when the weather was unseasonably cold and windy in June, Tangier men were unable to catch peelers with scrapes on the shallow-water, eel grass flats, the usual scraping grounds. But they caught large numbers of peelers in crab pots set in the deep water of Tangier Sound.

Within at least the last decade there has been some use in the Seaside bays of a specially designed, small-mesh, wire pot -- a "peeler pot." The pot is "baited" with a live male crab. "Rank peeler" females (crabs nearing their final molt) are attracted to the males and enter the pot.

Until about 1950 almost all peeler crabs were held in floats anchored in shallow water in protected bays. This practice is still in common use in Tangier and in most other places. Since then a few shedding-house operators have set up tanks on land or over piers, and they keep the tanks supplied with an open flow of water from the nearest water source. At least three such installations are known, one of which has operated with a recirculating supply of water occasionally replenished with new water.

Peeler crabs are also sold as bait to sports fishermen but the extent of their market is unreported.

At least through 1950, Accomack County produced more than 62% of the state soft and peeler crabs (Tables 15 & 16), whereas in 1960 it produced only 37% of the total. The 1960 catch reported by Tangier dealers was 93% of the landings for Accomack County.

There has been further steady decline in total Virginia's soft and peeler crab landings since 1951. Tangier (and hence Accomack County) catches should also show this decline, if data were available.

Potential Value of the Blue Crab Fisheries

A better economic return could be made from the hard crab fishery if additional crab meat picking houses were available especially for handling the Bayside winter dredge catch which is now shipped primarily to Maryland firms.

It is believed that both the Bayside and Seaside stocks of crabs are sufficiently large to support substantial increases in catches of peeler crabs. Cause for the decline in catches in the last five years is not known, but could very well be due to a decrease in effort. At the same time, enlargement of shedding facilities can and should be undertaken. Considerable interest has been expressed in the possible use of more shore-based shedding plants.

Potential for Fisheries on Other Crustaceans

The rock crab, Cancer irroratus, is a winter inhabitant of the Chesapeake Bay. Commercial quantities of rock crabs were available to the blue crab dredge fishing fleet in the Chesapeake Bay during the winter of 1970-71. Dredge boat captains acknowledge that although rock crabs were caught in large quantities in other years, no market has ever existed in the Chesapeake Bay area and the crabs have been routinely culled from the catch.

A few rock crabs have been reported from the Seaside bays. Some were caught in crab pots in April 1971; crabs may have been

present earlier in the year but pots were not set until April. In Chincoteague Bay and other bays to the north, rock crabs occur only occasionally, the number varying considerably from year to year. They only occur in the bays in winter, apparently moving to ocean waters in summer when the inshore temperature rises (some say to 50°F and higher).

The absence of interest in the past in developing a market for rock crabs may stem from two conditions: 1) a strong reluctance to handle during the winter any crab product that could compete in sales with the blue crab, and 2) the observation that many rock crabs caught in January are papershells, and most are in that stage by late January. Papershells contain less muscle than hard crabs; but the meat is tasty, is easily removed, and is present in reasonably large amounts, especially in the claws and in the upper portion of the walking legs.

What seems to have been missed is the observation that most of the rock crabs caught in the Chesapeake Bay in December and early January are peelers and that they can produce an excellent supply of soft crabs. Soft crabs shedding plants could be reactiviated in winter to handle this virtually untapped resource.

Lobster Fisheries

The lobster, Homarus americanus, is taken incidental to finfish by trawlers and sea bass potters operating out of Chincoteague.

These lobsters which command a high price are sold locally or shipped to nearby markets. Stocks available to the fishermen using present methods are not known.

Problems of the Industry

Hard Crab Industry

Crab landings fluctuate greatly from year to year as is shown in Table 14. This creates a problem for the picking house in that a labor force adequate to process an average or under average supply cannot handle large catches characteristic of a bumper year. Buying from fishermen is restricted to the capacity of the house, and the fishermen are forced to cut back on effort in years of great abundance. Prices paid to the fishermen fluctuate greatly according to supply of raw product. Crab pickers are difficult to recruit and train; so, short term expansion of the work force has not been possible -- first because the work is tedious and second because it requires practice to become proficient enough to get top wages.

The average age of crab pickers on the Eastern Shore is above 40 which indicates the low numbers of new personnel entering this field.

Causes of fluctuations in abundance are not well known. Young crabs are vulnerable to extremely low temperatures and are preyed

upon by several species of fish. Fresh water and high temperatures appear to cause mortalities when crabs shed. The blue crab also may be infected with pathogenic bacteria and protozoans. Finally, agricultural pesticides have been responsible for "kills" in Bayside creeks. Success or failure of a year class however as yet cannot be attributed directly to any of these factors.

Fresh crabmeat has a short shelf life. In order to increase distribution and extend shelf life further processing is necessary. Pasteurizing is the most common means of improving keep quality at present. Canning and freezing as yet do not have the same customer acceptance as pasteurization.

Wastes from the crab picking operation are presently being dehydrated and sold as an additive to poultry feed.

Soft Crab Industry

Biggest problems facing this segment of the fishing industry are high mortality in the shedding operation and relatively short season of available peelers.

Recommendations

Operators of crab picking plants should be prepared to investigate investing in mechanical pickers when they become available.

Each machine should be evaluated from the following standpoints: 1. Sanitation requirements. 2. Economics. 3. How it may complement present operations.

Efforts should be made to expand local picking facilities to handle more of the Eastern Shore production. This would provide a better market for the short-spine Seaside crab as well as increasing the value of the product before it leaves the Eastern Shore.

Research on causes of wide fluctuations in year class strength of the blue crab should be increased.

Investigations presently under way at the Virginia Insitute of Marine Science designed to increase the yield of soft crabs from peelers should be continued. Shedders should investigate the possibility of using their facilities to shed rock crabs in winter.

Chapter VI

THE FINFISH INDUSTRY

by

Jackson Davis

Z-72-006

Introduction

The fisheries of the Eastern Shore of Virginia are based on some 40 species, about 15 of which occur regularly and in appreciable quantity. In the period since 1960 when essentially complete canvass of the fishery was instituted by the National Marine Fisheries Service and its predecessors, the annual catch of food fish has fluctuated between 2.2 and 3.9 million pounds (Table 18). Catch of the industrial fishery is excluded. Prior to 1960, catch records were obtained only from the lower Eastern Shore. Landings in the ports canvassed (Cape Charles, Oyster, Willis Wharf, and Wachapreague) ranged from 1.2 to 3.1 million pounds (Table 19). Statistical coverage of the fishery at Chincoteague added to the record not only more area but also more kinds of fisheries, the ocean trawl fishery and pot fishery being centered there.

Historically the fisheries of the Eastern Shore have been rather stable with the exception of the loss in the mid-1940's of a previously large Seaside pound-net fishery. Early in the century this fishery employed some 400 people in the primary fishing activity according to residents of the area who remember the fishery. Shore-based personnel directly involved in this fishery and those employed in ancillary industries added to the total. Thus the ocean pound-net fishery was a significant factor in the economy until competition from trawlers, decline in quantity of some kinds of fish, and decline in price began

Table 18. Landings of fish (thousands of pounds) in lower Eastern Shore* and Chincoteague, Virginia 1960-1970.

Species	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960
Alewives		37.5			238.1	57.2	93.5	27.1	17.1	13.8	19.7
Blackback	32.8	105.6	54.9	220.4	73.5	32.1	15.1	0.2	1.7	0.6	0.8
Bluefish	48.8	40.2	22.3	7.2	12.1	3.7	34.6	42.7	38.5	7.2	11.1
Butterfish	27.4	24.6	39.1	92.0	83.3	136.8	10.7	14.8	32.1	16.0	5.3
Cabio			0.5			0.1	3.0	11.9	17.4	20.3	11.9
Cod	0.3	1.9	2.5	0.3	0.7	0.7	18.6	36.9	32.1	27.7	4.5
Croaker	1.4	1.6	0.1	27.4	11.7	27.1	11.6	4.3	516.3	430.5	920.6
Drum, black	79.0	74.2	307.0	149.5	156.6	58.2	27.8	90.1	137.1	198.2	69.5
Drum, red		0.8			2.8	49.2	0.3	1.6	2.0	3.8	6.7
Eels, common	25.4	8.3	56.9	108.9	13.3			0.2	3.8	0.9	
Fluke	361.6	267.0	521.6	565.3	763.1	891.3	502.4	518.2	705.0	679.9	550.7
Gray fish	20.6	10.1	71.3	65.3	232.8	171.7	224.0	119.0	76.9	41.4	216.4
King whiting	11.4	10.1	35.8	3.4	17.4	19.5	22.2	26.5	46.3	30.9	8.5
Mackerel	104.2	109.3	380.2	614.7	643.1	323.0	325.5	36.5	126.0	325.7	450.9
Scup	0.4	1.3	6.8	16.2	31.0	17.8	10.0	41.5	20.5	21.8	21.1
Sea bass	299.4	209.6	158.3	183.3	277.1	334.5	318.7	569.1	221.8	202.1	221.3
Sea trout	249.7	169.7	312.3	103.5	82.5	156.1	103.8	96.0	122.5	60.7	17.6
Shad	6.5	6.0	14.2	10.9	19.1	7.4	3.4	7.2	4.4	3.4	4.7

Table 18 (Cont)

Species	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960
Spot	756.5	117.3	49.0	196.5	54.3	88.7	100.3	53.1	72.8	65.0	145.4
Striped bass	470.7	143.2	67.4	17.2	27.6	5.0	22.4	55.2	32.8	58.9	80.5
Sturgeon	13.8	17.1	14.9	11.2	24.6	14.5	7.7	1.4	3.9	5.9	1.0
Swellfish	367.5	1,173.5	768.8	773.4	920.8	1,440.9	766.0	363.7	80.7	51.9	206.3
Whiting	6.9	12.0	1.4	13.8	1.7	3.7	5.5	2.9	4.3	6.6	19.7
Unclassified	48.7	53.6	36.9	25.4	33.6	34.4	53.1	59.2	64.8	59.9	35.4
Miscellaneous	18.3	4.3	33.5	8.1	3.0	17.0	6.1	7.7	41.0	10.8	15.3
Total	2,951	2,599	2,956	3,214	3,724	3,891	2,686	2,187	2,422	2,344	3,045

* Cape Charles, Oyster, Willis Wharf, and Wachapreague.

Source: Production of Fishery Products in Selected Areas of Virginia, Maryland, and North Carolina as Reported to Hampton Fishery Market News Service 1960-1970. National Marine Fisheries Service.

Table 19. Landings of fish (thousands of pounds) in lower Eastern Shore, Virginia, 1949-1959.

Species	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949
Alewives	19.4	9.3	10.0	30.8	27.2	21.2	62.6	32.7	36.5	64.6	78.3
Bluefish	0.3	3.4	6.5	17.2	13.8	5.7	1.8	0.2	1.4	2.7	1.0
Butterfish	11.3	2.8	13.4	3.7	14.0	13.8	34.1	53.6	39.6	35.0	32.9
Cabio	30.9	12.8	51.2	21.1	7.4	13.6	1.5	2.4	1.2	2.6	
Croaker	1,371.0	584.6	763.7	657.1	1,044.3	206.5	176.2	308.5	604.3	458.8	362.5
Drum, black	90.2	32.6	68.8	70.3	30.9	277.7	74.8	98.5	12.4		8.5
Drum, red	17.6	8.7	13.1	7.0	10.9	15.8	27.0	34.6	44.2	112.7	8.6
Fluke	92.2	134.2	263.3	252.7	128.3	105.6	144.8	84.3	127.5	123.2	140.2
Gray fish	244.3	134.1	11.1	33.3	108.2	158.1	14.1	160.8	5.3	66.4	8.6
King whiting	0.6	5.6	29.1	55.5	16.3	19.5	6.6	5.1	3.1	6.5	2.2
Mackerel		9.2	90.1	14.5	180.1	228.2	978.7	1,366.8	1,349.5	1,619.0	500.9
Scup	0.2	6.2	1.6	6.9	17.5	3.5	39.5	6.8	81.1	58.1	128.0
Sea bass					1.5	1.0	39.4	6.1	40.2	2.9	22.0
Sea trout	25.7	46.1	117.1	394.4	331.9	257.7	226.9	160.8	258.8	207.4	282.4
Shad	5.1	14.5	24.9	1.6	0.9		2.0	3.1	1.0	7.4	1.8
Spot	51.5	147.4	285.3	253.5	247.3	387.6	151.0	392.9	153.6	75.0	249.5
Striped bass	38.3	20.1	25.9	26.7	16.9	12.3	20.8	89.8	59.5	115.3	18.2
Swellfish	38.6	24.7	35.2	38.9	11.2	12.8	2.5	22.9	12.7	34.3	189.3

Table 19. (Cont)

Species	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949
Unclassified	24.4	25.5	18.3	10.7	10.5	36.9	21.2	48.2	55.2	58.9	94.9
Miscellaneous	79.4	11.7	25.6	26.1	14.9	18.6	11.7	21.3	107.7	2.6	13.9
Total	2,130	1,234	1,854	1,922	2,234	1,796	2,037	2,899	2,995	3,053	2,144

Source: Production of Fishery Products in Selected Areas of Virginia, Maryland, and North Carolina as Reported to Hampton Fishery Market News Service 1949-1959. National Marine Fisheries Service.

forcing companies out of operation. Severe storms every four or five years inflicted heavy damage to nets and poles or carried away gear entirely. As costs of labor and fishing gear increased, replacement of the gear became impractical.

Description of the Fisheries

Several fishing methods are used to capture the approximately 40 species which now comprize the fishery. The industrial fishery depends almost entirely on purse seines to capture menhaden, its raw material. The food fishery employs pound nets, trawls, gill nets, haul seines and pots. In addition, some fish caught by hook and line enter the food-fish market. Pots and trawls are used only in the Atlantic Ocean. The other gears are, or have been employed along both coasts. Trawls are excluded from Chesapeake Bay by law; and pots have not been employed in Chesapeake Bay because black sea bass, the primary species sought, does not occur in the bay in adequate quantity to support a fishery.

The Pound Net Fishery

Pound nets (Fig. 18) are operated along the Bayside, with a dense concentration south of Cape Charles City. Pound nets have been counted annually through most of the fishing season since 1959. Table 20 indicates that fishermen set few or no nets each year until April. The number of nets quickly builds to a peak in May or June and then declines somewhat during the summer. In late summer and early fall the number again increases, usually to a larger number than during the early summer.

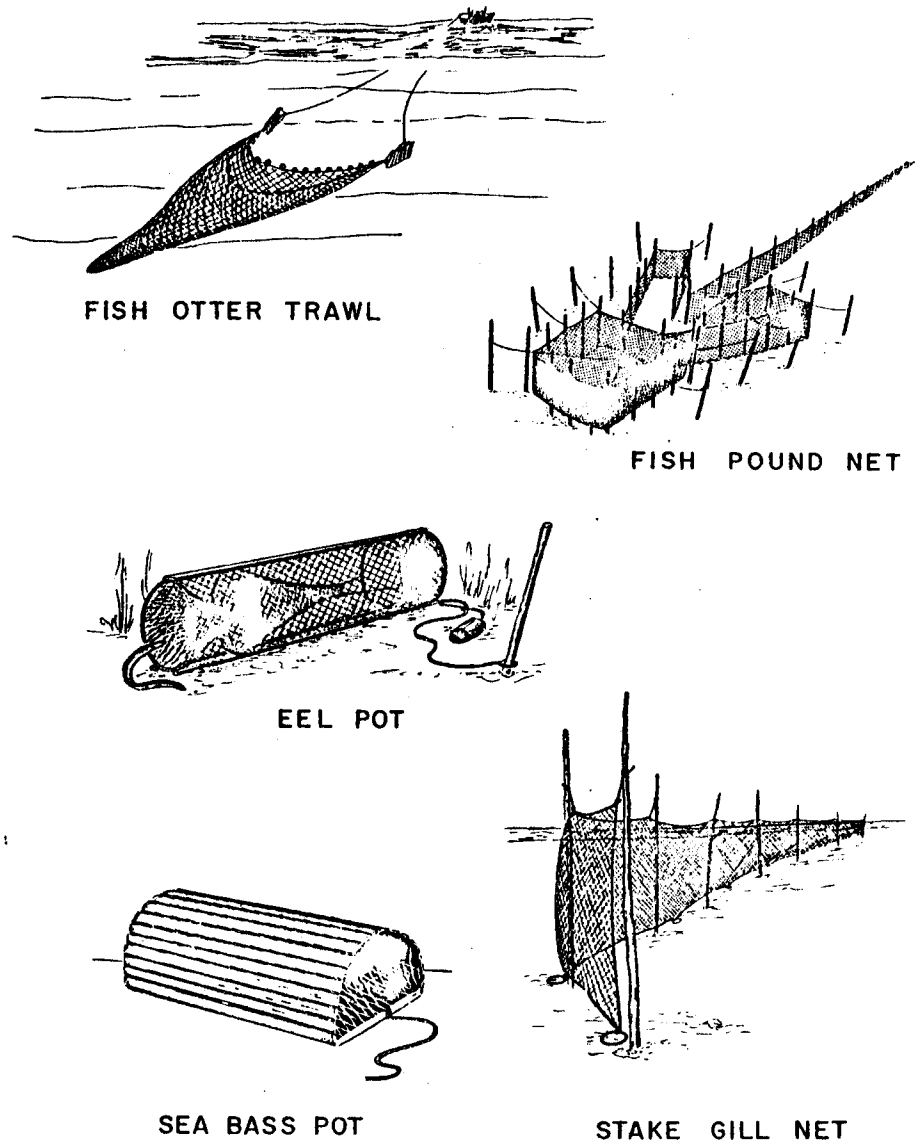


Figure 18. Finfish harvesting gear (illustrations from "Commercial Fishing Gear of the United States" by W.H. Dumont and G.T. Sundstrom, 1961. U.S. Fish and Wildlife Service, Circular No. 109).

Table 20. Summary of Aerial Pound Net Count on Eastern Shore 1959-1971

	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1959	DNC*	1	10	16	20	22	30	23	DNC	DNC	DNC
1960	DNC	DNC	2	20	32	28	31	41	10	20	DNC
1961	DNC	DNC	8	27	29	32	39	44	18	27	DNC
1962	DNC	0	14	36	38	35	50	45	25	DNC	DNC
1963	DNC	DNC	13	38	42	33	46	60	46	DNC	DNC
1964	DNC	DNC	DNC	DNC	46	33	39	37	30	DNC	DNC
1965	DNC	0	17	40	37	32	46	57	35	DNC	DNC
1966	DNC	2	23	41	36	32	48	50	47	DNC	DNC
1967	DNC	DNC	20	39	38	31	42	44	48	36	DNC
1968	DNC	5	19	31	33	8	12	40	36	37	21
1969	DNC	0	21	26	20	10	11	15	26	33	25
1970	0	1	5	20	19	9	3	19	25	36	31
1971	0	2	18	23	16	11	8	12	26	35	

* Did Not Count

At the outset of the season in April the catch consists of puffer, gray trout, flounder, black drum, croaker (in small quantity now, formerly abundant) butterfish, and lesser quantities of others. The largest catch of puffers usually is in May. June sees a large run of gray trout. After the spring run of fish, the catches usually decline somewhat during the summer, although a few additional species enter the catch. Notable in addition to the species comprizing the spring run are bluefish and spot. In late August or September when fishes begin their southward migration, the pound nets experience another surge of activity. Historically the croaker was caught in quantity at this time as it departed the bay to spawn. Before 1966 the pound net fishery terminated during November, but the season was extended into December by development of a market for eels which depart from Chesapeake Bay in late fall and early winter.

Fish caught in pound nets are brailed from the net either by hand or with the aid of a small winch. The catch is placed either in the open hold of the boat or in an open skiff and is taken to shore within one to three hours of the time it is removed from the water. Usually ice is not used, even in summer. Fish for which there is no demand in the food fish market because of their small size or for other reasons are sold as bait for crab pots.

Pound nets are licensed to fish at certain sites and the licenses are annually renewable by the holder. Law requires that pound nets in a row be spaced at least 200 feet apart and that rows be no closer than 300 yards. Although these provisions limit the number of pound nets that can be set, the limit is of no practical significance.

Return on investment has limited the number of nets to considerably fewer than could be fished under these spacial restrictions. In all probability the same quantity of fish could be caught with fewer units of gear than now operate.

The Pot Fishery

A pot fishery for black sea bass has been conducted in summer and fall of some years. The irregularity of this fishery seems to have been caused not by fluctuating supply of fish but by decisions of the operators. Despite the fact that black sea bass are scarce at this time relative to the long-term average population, the potential of the pot fishery appears to be greater than has been realized in the past several years. In the pot fishery for black sea bass the catch may or may not be iced depending on the time of year and the running time to port.

Lobsters and rock crabs are caught in sea bass pots along with the fish. The lobsters find a ready market and development of market for rock crabs is being explored. Puffers also are taken incidentally but in marketable quantity in pots. Pots are constructed of wood slats and are generally similar to the typical New England lobster pot (Fig. 18).

Haul Seine Fishery

Haul seines catch the same kinds of fish that are caught in pound nets. Up until the early 1960's there was a haul seine fishery for mullet, but in recent years sufficient quantities of mullet have not been present to support the fishery.

The Gill Net Fishery

The gill net fishery is seasonal, operating primarily on mackerel and striped bass as they come down the coast in the fall and go back north in late winter and spring. Gray trout, bluefish, and a few other species are also caught on occasion. The gill net fishery is to some extent an off-season activity for people and boats that operate in the recreational charter-boat fishery. Availability of fish to the gill netters is erratic. Mackerel characteristically fluctuate in abundance from year to year. In a year when mackerel are abundant a fisherman is likely to catch in one night as many fish as he catches in an entire season when fish are scarce.

Fish caught in gill nets are usually returned to port still entangled in the net and are removed from the net and placed on ice by shore-based personnel. The gill net fishery for most species operates during cold weather.

A gill net fishery for sharks has operated in some of the inlets from time to time. Probably the harvest could be increased if the market could be expanded. There is also a gill net fishery for shad in the spring. (Figure 18 depicts a gill net.)

The Trawler Fishery

The trawler fishery operates primarily out of the port of Chincoteague during the summer and fall. The catch consists of summer flounder during the summer and in the fall gray sea trout and striped bass in addition to summer flounder. Smaller quantities of a variety of other food fish are also taken. These trawlers

catch significant quantities of searobins and skates which in the recent past were sold to the reduction industry. At present there is no local market and these and other incidental species are shoveled overboard at sea.

The net (Fig. 18) is usually towed for an hour or more. At the end of a tow, the fish are emptied from the net onto the deck and the net is immediately reset. Once the net is again overboard and fishing, the crew then sorts the catch by species and ices down the food fish in the hold.

Vessels operating in this fishery are limited in size by the shallow inlets leading to the Seaside ports. The major Virginia trawler fleet lands in the ports of Hampton Roads. The number of trawlers operating from seaside ports is subject to minor change from year to year and from season to season. The recent development of the surf clam fishery has seen some vessels transferred from trawling to dredging clams. Also some fishermen move from port to port as the outlook for fishing success changes. As many as 12 to 15 trawlers fished out of Eastern Shore ports during the 60's. Licenses issued to trawl within the three-mile limit numbered 9 in 1960, 7 in 1965, and 10 in 1970 indicating reasonable stability in numbers of vessels, despite changes in activity of individual vessels.

Handling and Marketing

Typically the fisherman sells his catch in the round to a wholesaler. The fish are brought by boat to the wharf of the packing house. There they are unloaded either by the fishing crew or by

employees of the buyer. If the fishing crew has sorted the catch by species, as is usually the case with the trawl fishery, the buyer unloads and weighs the catch. If the catch has not been sorted, as is usually the case in the pound net fishery, the fishing crew unloads the boat and sorts the catch by species and by size category.

In both the pot fishery and the gill net fishery, little or no sorting is required as usually only one species is caught. Gill netters may either hire people to remove fish from the nets or do it themselves. If the catch is reasonably good, it is necessary to hire help. This picking operation is accomplished either at the fisherman's own wharf or at the packing house of the buyer. It should be noted that irregularity of landings both with regard to time of day and quantity presents some problems in obtaining labor.

Thus in the typical first sale of fish, the catcher delivers to the scales of the buyer a catch which has been sorted by species and by size category. Fish are bought by the pound with different species and different sizes bringing different prices. Usually three size categories are used, small, medium and large. In the case of species with a large size range, such as flounder, one or two additional categories may be used.

Unloading fish from the boats may be accomplished by means of a vacuum system which conveys the fish through large-diameter flexible steel tubing to a water bath and thence onto a conveyer belt where workers may sort them. At some wharfs unloading operations are somewhat more primitive. A man standing among the fish shovels

them into a bucket of perhaps 200 pounds capacity. The bucket is raised from the boat to the wharf by a simple electric hoist. The bucket of fish is dumped onto a table from which the crewmen sort the catch into boxes.

Watermen sell their fish to a wholesaler who may resell them immediately without additional handling or who may freeze them and store them for later sale. A fairly general practice is for the dealer to settle with the fishermen at the end of each week. Usually, prices are not agreed upon beforehand but are established by the dealer at the time of the settlement. By this time he will have sold the fish caught during most of the week. Therefore, most of the risk of fluctuating prices is taken by the fisherman.

Most of the fish are marketed in the round. Preparation for sending them to market involves weighing, boxing, and icing. Usually the fisherman sorts the catch by species and size. This series of simple operations is handled rather primitively with much hand labor involved.

Puffers and small quantities of other kinds of fish are dressed before being sold. Dressing fish is done by hand. Machines have been developed that will dress several kinds of fish efficiently; however, existing machinery will not behead and skin puffers. Conditions under which fish are processed range from primitive to quite modern. Atlantic (Boston) mackerel are filleted and salted when catches are greater than can be sold fresh. Efficient filleting machinery is available, but the irregular supply of mackerel and

especially the uncertain future supply have hindered mechanization of processing.

The geography of markets is complicated by the seasonal migrations of fishes. Irregularity of supply at any one point has led to a rather fluid marketing situation. Fish from the Eastern Shore are sold from New York to the Carolinas and inland to the Mississippi River. The mid-South has traditionally been a strong market for fish from Virginia. Distribution is by truck. Fish are packed on ice in wooden boxes containing 100 pounds of fish or in corregated cardboard cartons containing either 50 pounds or 25 pounds. Eels are being shipped to European markets. Live eels are sent by truck to New York, thence by air to Europe. Frozen eels are sent by ship. Others are shipped from the Eastern Shore to other points to be processed before being sent to European markets.

The Industrial Fishery

The industrial fishery is represented by a new, modern plant which produces oil and whole meal from menhaden. This plant is having difficulty in controlling odors to the satisfaction of nearby residents despite the installation and operation of stack incinerators to burn the volatile compounds and particulate material. The industrial fishery offers promise of extending its season to year-around operation if air pollution can be brought within acceptable limits. The plant did not operate in 1971, and its future is uncertain.

Perhaps the reduction plant could help alleviate the waste disposal problem of other segments of the fishing industry by

processing wastes from fish cleaning and shellfish (scallop and surf clam) packing operations. It seems unlikely that such processing would be self-sustaining financially. The high ratio of water to protein in the wastes would make evaporation more expensive than the value of the meal produced. Therefore, the reduction of wastes would have to be subsidized either by the seafood processors or by the communities which would otherwise have to pay for sewage treatment plants.

Labor

Those members of the industry who were queried indicated that, for the most part, getting and keeping labor was not a difficult problem. Apparently labor is more readily available for work ashore than on the water. Workers in packing plants are paid hourly wages, or a combination of wages and a piece-work bonus. Those working on the water are usually paid a percentage of the value of the catch. Thus income differs from week to week. Income of wage-earners also fluctuates somewhat with the catch because the amount of fish to be processed, and hence the number of hours of employment, differ from week to week and from season to season. Stabilizing income would make employment in the fisheries more attractive to job seekers.

The fisheries require a spectrum of abilities ranging from mechanical skills needed to maintain and operate plant equipment and boats, to netmaking, to dressing fish, to handling boxes of fish. Young people seem not to be attracted to the fisheries in proportion

to their numbers in the total work force. Probably the irregular earnings and period of apprenticeship needed to become skilled discourage many.

Finfish Industry Problems

The finfish resources available to the fishermen of the Eastern Shore are migratory. Therefore, damage or threats to these resources must be considered not only in the local context but also throughout the migratory range of each species. On the local scene the major threats would seem to be pollution by agricultural pesticides (a current problem), and modification of the environment by various construction projects or development schemes (a potential problem). On a broader geographic scale the threats are degradation of water quality by pollution and by development projects and competition for the resource by other fishermen, both domestic and foreign.

Locally, the major pollutional threat would seem to be the gradual accumulation of "hard" pesticides in the environment. As pesticides are applied to crop fields repeatedly, they find their way into the water which enters the creeks. Briefly stated, the effects in the environment are to kill one or more links in the food chain, thus making the area uninhabitable, or to be accumulated in food organisms which then poison the predatory fish or disrupt its reproductive physiology. Also pesticides can be accumulated in the flesh of fish to the point that the fish is unacceptable in the human diet.

More spectacular than the insidious accumulation of hard pesticides is the occasional fish kill resulting from accidental spill or misapplication of an agricultural pesticide (hard or soft). Such accidents kill fish, crabs, and other organisms in a small area and thus attract considerable notice. Such accidents will continue so long as pesticides are used, but it is unlikely that their impact on the resources and on the economy is potentially as harmful as gradual accumulation.

Dredging the inland waterway probably will change circulatory patterns somewhat. From the standpoint of the fisheries such changes could be beneficial, detrimental, or neutral. If dredge spoil is deposited on marsh, the probable effect will be a reduction of organisms which serve as fish food. Construction of a causeway from the mainland to provide access to one or more of the barrier inlands would also alter circulatory patterns and flushing rates. A bridge on pilings would have a lesser, perhaps negligible, effect.

The supply of many species of finfish has declined during the past 30 years. The extent of the decline is not precisely indicated by the available catch statistics. There exists no record of the recreational catch and number of fishermen during this period of very great expansion of the fishery. Even in the commercial fishery where records of landings are reasonably good, at least in some ports, it is impossible to ascertain whether a decline in catch stems from a decline in the supply of a species or from a decline in effort devoted to catching that kind of fish. Despite weaknesses in the

statistical record, there is general agreement among the fisheries community that populations of many species have declined. Included are croaker, gray trout, flounder, and black sea bass, all important in the fisheries of the Eastern Shore. Causes of the decline are not clearcut. Excessive fishing likely has contributed to declines in at least some populations, but existing records of fishing activity and environmental change are inadequate to shed much light on the part each played. Lack of knowledge of the migratory pathways of the species and of the geographic ranges of the stocks further complicates the supply situation. Most fishermen feel that the supply is inadequate for their needs.

Decline has not been universal, however. Striped bass have increased significantly during the last 30 years. Bluefish have increased somewhat recently. Other species such as puffer, spot and black drum have fluctuated irregularly without exhibiting a trend. Some species have only recently been exploited, for example eel and blackback flounder. Other species remain underexploited. Shortage of certain species exist, but all in all the available supply does not preclude a healthy industry.

Supply fluctuates from day to day, from season to season, and from year to year. These fluctuations present problems apart from the question of total supply. The day to day fluctuations are illustrated by Table 21. These wide and unpredictable fluctuations obviously present problems in having on hand a labor force of efficient size. They also present some problems in orderly marketing.

Table 21. Landings in hundreds of pounds of two species on a series of typical days in May and June 1971. Records of some days are missing from the series. Source: Fishery Market News Reports, National Marine Fisheries Service, Hampton, Virginia.

Puffer	Gray Trout	Puffer	Gray Trout
196	0	0	10
110	0	0	10
140	11	7	6
158	100	5	8
179	33	40	70
68	6	0	6
20	5	10	30
44	30	63	25
4	12	31	5
0	110	7	3
19	155		
1	60		
0	25		
11	585		
9	6		
10	5		
30	13		
13	152		
9	76		
6	35		
9	26		

Seasonal fluctuations (Table22) present similar problems. Usually more than 75% of the annual catch of puffers is landed in just three months, April, May and June. The flounder fishery usually gets underway in May and continues into October. Puffer is sold dressed, and part of the catch of summer flounder (fluke) is filleted before being shipped to markets. Therefore the need for labor to dress fish is greatest in late spring, slackens considerably during the summer and is nonexistant during fall and winter. The shellfisheries, however, provide employment during the fall and winter.

Availability of mackerel to the gillnet fishermen is somewhat of a special case, being determined not only by absolute numbers but by weather conditions, and by competition with other fishermen, especially the very large foreign fleet, predominantely Eastern Block, which fishes for mackerel and sea herring off the Middle Atlantic Coast. Weather influences the fishery in two respects. The small vessels are not capable of operating in rough seas, and gill nets are efficient only during the dark of the moon or on cloudy nights. If the major migration past the Eastern Shore occurs during a full moon or during a period of high winds and rough seas, the catch will be small.

Competition from foreign fishing vessels is likely to become more acute. Most fish stocks of the Eastern North Atlantic are fully exploited; therefore Europeans must go elsewhere to fill their protein requirements. In recent years fleets of up to 200 European vessels have fished for herring and mackerel off the Eastern Shore.

For example the USSR, the nation with the largest fleet, caught 37,000 tons of mackerel in 1969, 65,000 tons in the first eight months of 1970, and expects to catch 65,000 to 70,000 tons in 1971. Probably the stock will not be able to sustain such a harvest; and, irrespective of the effect of such a large catch on the reproductive potential of the stock, the availability of mackerel to the gill netters of the Eastern Shore will certainly be reduced.

Like mackerel, striped bass are caught during their annual southward migration in the fall and their return northward in the spring. The fishery is influenced by the same weather conditions that influence the mackerel fishery, but there is no foreign competition because striped bass remain within the 12-mile-wide exclusive fishing zone claimed by the U. S.

Seasonal availability influences marketing at two stages. The producer, or waterman, is paid a relatively high price when fish are scarce, but a low price when fish are plentiful. On occasion the market is so glutted that no buyer can be found. Wholesalers, on the other hand, maintain some level of control by freezing surplus fish and by refusing to buy more than they feel they can profitably dispose of.

Access to the ocean fishery is somewhat restricted by the shoal and shifting inlets leading to the harbors. The channel into Cape Charles City is adequate, but Seaside ports are less well endowed. Even at this time when many of the stocks of ocean fishes are being fully exploited or overfished, others remain practically unexploited.

Table 22. Monthly landings (thousands of pounds) of major species in the fishes of the Eastern Shore of Virginia in 1970.[1]

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blackback			0.1	9.2	22.4							1.1
Bluefish					14.5	11.9	3.4	0.5	7.4	7.5	3.6	
Butterfish			2.9		11.7	6.2		0.2	2.0	2.9	0.6	0.9
Black Drum					62.7	0.7			0.8			0.2
Eels											4.2	21.2
Fluke	0.8		2.5	0.3	29.3	22.8	104.2	78.0	65.3	54.9	3.4	0.1
Grayfish						18.0	0.3	0.1	1.9	0.1		
King Whiting				0.3	0.7	0.1		1.9	6.3	1.7	0.4	
Mackerel				55.0		0.1						
Sea bass			1.1	2.3	88.6	112.9	54.7	28.1	10.2	0.9	0.6	
Gray trout				2.2	11.7	34.0	27.1	2.1	29.9	28.3	83.9	30.5
Spot					1.2	43.9	206.6	246.9	220.9	37.0		
Striped bass	18.3	29.0	350.4	33.6	0.1					0.2	14.0	25.1
Swellfish				130.1	152.6	50.5	8.3	10.5	7.9	6.3	1.3	
Unclassified				1.2	5.0	4.3	4.6	13.1	13.0	2.7	2.6	1.2
Total	19.1	29.0	357.0	238.7	400.5	305.4	409.2	281.4	365.6	142.5	114.6	80.3

[1]Source: Production of Fishery Products in Selected Areas of Virginia, Maryland, and North Carolina as Reported to Hampton Fishery Market News Service, 1970. National Marine Fisheries Service.

Perhaps better access would encourage development of fisheries for spiny dogfish and searobins, species which are not being utilized

The waste disposal facilities are inadequate to handle waste from increased processing. The possibility of making satisfactory arrangements with the fish reduction industry should be investigated.

Ground water of acceptable quality is not plentiful and could become limiting. Electricity is adequate; truck transport is adequate in the opinion of processors queried. Air transport is available only at some distance; the closest airport having cargo service and frequent passenger service is at Norfolk.

Institutional barriers apparently do not prevent expansion of the fishing industry insofar as raw material is concerned; however, some members of the industry feel that regulations concerning sanitation, labor, and wages are unreasonably restrictive. The processors feel that the minimum wage law does not function well in an industry which has traditionally operated on a piece-work basis. Specifically, training new processing workers is expensive if they must be paid wages out of proportion with their output; and the trainees, having a guaranteed hourly wage, lack the incentive to develop proficiency that would exist if they were paid only on the basis of output. Under the present system, workers must be paid the minimum hourly wage. An additional bonus is paid each worker for each unit of production beyond an established minimum.

There are in Virginia few laws relating to finfishing in comparison with those relating to shellfishing. The important restrictions

prohibit capture of foodfish by purse seine and prohibit trawling in Chesapeake Bay and within the three-mile limit of the Virginia Atlantic shoreline except in the Atlantic Ocean between Cape Charles and the Maryland line, where trawling may be practiced during June, July, and August by permit. The economic impact of these restrictions is not known. It is doubtful that purse seining would be notably efficient in the food fishery because the species either do not travel in tight schools or, if they do school, the schools do not appear at the surface regularly. Trawling would be an efficient method of catching fish in Chesapeake Bay. Whether or not it would be more effective than the fishing methods now used is unknown.

Recommendations

Research Needs

Research is needed to identify stocks, to determine their geographic ranges, and to determine the maximum sustainable yield obtainable from each. Neither the wintering grounds nor the spawning grounds of some of the species are adequately defined. Knowledge of these would enhance management of fisheries. Better techniques of resource inventory are needed to detect and explain changes in populations.

Research is needed concerning the behavior of fishes in relation to fishing gears so that selective fishing gears can be developed. Fishing would be much more efficient if various kinds and sizes of fishes could be caught (or excluded from the catch) selectively.

Research is needed into the social and economic implications of various schemes of managing and using marine resources. Also research is needed to develop the governmental machinery to best take into account the complex array of factors impinging upon marine resources and influencing their users.

Research on health and environmental standards has lagged behind the necessity to establish regulatory criteria. Research on tolerance limits and on the flow of materials through communities should be accelerated.

Education and Training

Education and training to date has been accomplished by an informal apprentice system and continuation of many aspects of this system seems desirable. However, efficiency and level of proficiency attained could be increased by formal training in some of the skills needed in the industries. Formal tarining is desirable in navigation and piloting, in operation, care and maintenance of electronic navigational and communications equipment and in various skills needed to maintain vessels and processing equipment, such as carpentry, engine repair and maintenance, repair and maintenance of electrical systems, welding, and hydraulics. Training in these skills should be conducted both in high schools and in a community college or technical institute, which would make the training available to people beyond high-school age.

The processing industries are having some difficulty in obtainin proficient workers. The apprentice system of training, which was successful in the past, is not adequate in the milieu of today's

attitudes and laws. Therefore a training program to develop skills in dressing fish, shucking shellfish and picking crabs is needed. Perhaps training programs could be sponsored jointly by the industry and the community college. Training in proper handling of the products and in the rudiments of sanitation should be included.

Training in construction and repair of nets, pots, dredges and other harvesting gear would improve the efficiency of the industry. Such training could be offered in high school, in community college, or both.

Increasing Efficiency

Some inefficiencies in the use of space and processing labor result from the fluctuating supply of raw material. To smooth out the peaks and troughs resulting from changing local availability, raw material can be imported. Diversification would also lengthen the season of operation and reduce day-to-day variability in work load. A processor of fish, for example, might consider processing shellfish also. Shellfish, being less perishable than fish, could be held in storage to be processed after each day's catch of fish was processed. Thus the labor force could be stabilized to the mutual advantage of workers and management.

Efficiency of handling fish could be increased by unloading boats mechanically and by dressing the fish mechanically. Reliable machines exist to dress mackerel and black sea bass, but machines to behead and skin puffers have not been developed.

Improved electronic navigational aids would increase the efficiency of the ocean fishery. The Hastings-Raydist system now

prevent full use of the mixture of species now considered trash or bait in the food fishery. Nevertheless, searobins and perhaps skates would provide a continuous supply of fish. In winter, a very large quantity of spiny dogfish is available in the waters of the continental shelf.

Searobins would seem to be well-suited to this sort of processing. The flesh is white, of good flavor, not oily, and the fish are of a size that can be handled by machines. Spiny dogfish present some technological problems. It is questionable whether or not the machinery would handle their very tough hides and would separate the cartilaginous skeleton from the flesh. Perhaps the greatest problem presented by dogfish is the 5% urea content of the blood. Dogfish enjoy a good market in Europe, therefore, the technological problems obviously can be overcome. As a matter of fact, export to Europe is potentially a use for dogfish. At present the price does not quite repay handling and shipping (Holmsen, 1968), but continued scarcity in Europe could drive the price upward.

In addition to searobins and spiny dogfish, a few other species occur in sufficient abundance, at least seasonally, to be of economic significance in the fishery. Among them are spotted hake, skates, rays, goose fish, eelpout, fourspot flounder, smooth dogfish, sand shark, dusky shark, sandbar shark, and others in lesser quantity. At present these are either unused or harvested well below their potential yield.

If use of these species in the food fishery does not materialize, possibly they could be used in the manufacture of fish meal.

operational provides the level of accuracy needed, but its long-term status is uncertain. Governmental sponsorship of an electronic navigational aid providing a high level of accuracy both day and night at a reasonable price is recommended.

An inlet with a controlling depth of 12 feet should be dredged and maintained at one Seaside fishing center. This would permit the use of larger more powerful trawlers. These are more efficient because they can fish further offshore, in rougher seas, and use large modern-type nets. However, the economic outlook for expansion of the trawl fishery is not good unless new species are exploited.

New Product Development

Few of the species caught in the existing fishery lend themselves to the convenience food market. They are too small or the distribution of bones is such that neither machine handling nor portion control packaging is feasible. Both the species now utilized and several others which now enjoy little or no market offer promise for new techniques.

Production of fish sticks, portions, etc., from ground boneless fish is technologically feasible. Machines have been developed which mince dressed fish and remove bone and skin. The minced fish flesh can then be reconstituted into sticks, portions, or other portion-controlled preparations, and marketed frozen either precooked or raw. Application of such processing techniques would make possible the utilization of several kinds of fish not now marketed. FDA regulations requiring labeling by species probably would

In this potential use the problems are both economic and technical. The fish meal industry can profitably use only those species which can be caught cheaply in large quantity and handled in bulk by machinery. Because five tons of raw fish are required to produce one ton of meal valued at $150 to $170, processors can afford to pay only about $15 to $20 per ton for raw fish at the dock. A technical problem is that the existing machinery for unloading menhaden performs inefficiently on searobins and not at all on dogfish. Design and installation of efficient machinery would require some capital outlay. Additional machines would be required to shred the tough skins of dogfish, and either the urea would have to be removed from the meal or a market would have to be developed from meal containing urea.

Still another potential product is fish protein concentrate. However, neither spiny dogfish nor searobins, the most abundant species available, have been approved by FDA for use in FPC for domestic consumption. It is recommended that FDA accelerate its evaluation of suitability of these species.

Production of pet food and mink food is another possible use of the fish that are not now being used.

Promotion of Products

The products of the existing food fishery are sold fresh in the round for the most part. Before undertaking a program to attempt to increase consumer demand for fresh fish one should consider whether or not the product is antiquated. Perhaps the ready-to-cook convenience food trend throughout the food industry has rendered

impractical an attempt to expand the market for fresh fish in the round, and the fishery should instead attempt to develop and advertise convenience products. This question should be answered before an advertising campaign is undertaken. Some consolidation and vertical integration within the industry would expedite advertising and perhaps would make available a greater supply of money with which to buy advertising services, which are of demonstrable value in increasing consumer demand.

Management

Public management has suffered from lack of clearly defined goals and from geographic provinciality of authority. The goal of management should be harvest of the maximum biologically sustainable yield that is consistent with maintaining the various segments of the fishery in sound economic condition. Biological considerations require quotas on the quantity of each species that can be harvested each year. Economic considerations require quotas on the number of people (or units of gear) that can operate in each fishery. A management agency can be effective only if its authority extends over the entire geographic range of a fishery and over all of the participants in the fishery. Needed is an international management authority with effective police powers. Such an authority will not be developed in the immediate future. Therefore domestic agencies must be created which can progress toward the goal of sound fisheries management. Several species do not enter the international fishery. Sound management of these need not await better international arrangements.

Management requires improved inventory. New programs should be instituted to measure the quantities of fish available, and the existing programs to measure the quantities harvested and the number of participants should be improved in scope and accuracy. Inventory of economic activity generated by the fisheries is also necessary for management. Society must balance cost of management against value of fisheries and, in a broader context, must weight the values to be derived from various alternative uses of resources in order to reach sound decisions.

The major weakness in private management is fragmentation. Vertical integration and horizontal consoldation in the fishery should be encouraged. Greater centralization would provide more venture capital for advertisement, experimentation, innovation, and mechanization. It would aid in a minor way in ameliorating the problems stemming from fluctuating supply.

Legislation

Legislation is needed to improve managerial capability. Under existing law the states have authority to manage fisheries but the Federal Government does not (except in special cases). Yet many fisheries clearly transcend state boundaries. Therefore, either the states should jointly establish effective managerial bodies, or the Federal Government should manage the interstate and international fisheries in concert with each affected state. Of these two alternatives, Federal-State management would appear to have better chances of being effective. Therefore legislation establishing an effective Federal-State partnership in management of interstate fisheries should be sought.

Improving the economic structure of the common property fisheries requires limiting the number of participants. Legislation should be sought which provides equitable means of limiting the number of harvesters operating in the fisheries. Although constitutional questions are raised, these questions have been handled satisfactorily with regard to terrestrial common property resources, such as public forests. Therefore, it is reasonable to presume that satisfactory arrangements can be made in the fisheries. Legislation providing for limited entry should also provide for accrual of increased economic rent to society at large, the owners of the resources.

Management of fisheries cannot be significantly improved without greatly improved inventory of stocks and of harvesting activity. Legislation is needed requiring participants in the fisheries to report kinds and quantities of fish caught and other information needed for inventory and public management. Although existing law may empower the management agency to collect such information, specific legislative action requiring the industry to report it would be helpful.

Probably inspection and certification of fish products in a manner similar to that applied to meat and poultry would aid in marketing. Therefore, legislation establishing realistic inspection criteria and an inspection system should be sought.

The existing legislative restrictions on catching fish do not appear to be in need of revision at this time. However, regulations in the general fields of environmental protection and health

protection have, of legal necessity, been developed on short notice and in some cases without an adequate research basis. As research data become available these regulations should be reviewed and revised when revision is indicated.

Summary and Conclusions

For the past 10 years or longer the multi-gear, mixed species fishery of the Eastern Shore has been reasonably stable in terms of units of gear and of catch. Declines in abundance of some species have been compensated for by increased catches of other species. The supply of fish seems adequate to maintain the fishery in the immediate future; indeed some expansion would be possible by developing uses for species not now exploited. The problems confronting the Eastern Shore fishery are, in general, the same as confront much of the American fishing industry, namely: irregularity of supply, fragmentation of the industry, ineffective public management, failure to compete effectively in the market with other protein foods, and reliance on hand labor rather than machines. Steps to ameliorate these problems are discussed in the preceeding section. They can be briefly summarized as follows. Although underlying biological causes of irregular supply are beyond control, consolidation and diversification of seafood packing companies and importation of raw material would lessen the problem. Centralization of the industry also would provide venture capital to finance mechanization, development of new products, and advertisement. Public management suffers from lack of clearly defined goals and lack of

adequate inventory and scientific data base. The goal of public management should be harvest of the maximum yield consistent with economic health of the industry. Attaining this goal will require better data on stocks and users and retreat from the historic policy of unlimited access to the fisheries.

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Chapter VII

RECREATIONAL FISHING

2-72-007

by

C. E. Richards

Introduction

Virginia's Eastern Shore is internationally famous as a sport fishing area. International Game Fish Association world records for cobia, channel bass, and black drum are held by catches made in these waters. Diverse types of sport fishing are available to the novice and avid fisherman alike -- from offshore trolling for marlin to inshore bait and plug casting.

Sport fishing centers located at Chincoteague, Wachapreague, Quinby and Cape Charles City are well known. Many other landings and docks are also important to the sport fishery. The annual economic value generated by this fishery is estimated to have been between one and four million dollars in 1960. The Eastern Shore's value to Atlantic populations of fishes is primarily as a feeding and summering zone. It is not possible to measure the real value of this area without considering the value of the whole fish population system that extends at least from Florida to Massachusetts.

Attributes of a sport fishing center necessary to insure its stability as such include: (1) good fishing with large fish in abundance; (2) clean harbors and living facilities for visiting fishermen; (3) reliable charter captains, boats and equipment;

(4) easy access to base motels and hotels; (5) a long, diverse season. The stability or growth of a sport fishing center depends first and foremost upon availability of fish populations. If there was a seasonal abundance of tarpon, channel bass, marlin, large flounder and cobia (to name a few), then a sport fishery would thrive despite the accomodations. The key to economic development and growth depends upon building desired accomodations without destroying the necessary and vital environment balance.

General Trends

Detailed catch data from Virginia's sport fishery are not available. Thus insight to the abundance of fish is gained from an analysis of reported commercial landings (Table 23), but these data are also incomplete. Total landings indicate changes of a population directly if fishing effort has remained constant. An analysis of fish populations should include information on the number of units fishing, types of gear employed, relative efficiencies of the gear, and duration of fishing effort. Even without these information details, gross population trends are discernible. There has been a decline in commercial fishing effort and catch of food and game fishes on the Eastern Shore. The reasons for this decline are complex and relate to economics. A decrease in abundance of fish and increased operational costs have most probably led to decreased commercial effort, but there was an apparent increase in sport fishing catch and effort on the Eastern Shore. While sport fishery increases

offset some of the decline in the commercial fishery, there has been an overall decline in total effort, catch, and fish availability.

Data on the Virginia commercial landings of 12 food and game fish are summarized in Table 23. First inspection of this table reveals that the general trend in total catch for the 12 species combined has been downward. Some of this decline in commercial landings can be attributed to a decrease (66% for licensed pound nets, 1935-1970) in fishing effort. Annual catch per licensed pound net also shows decreases for eight of the twelve species shown. Species showing an increase in abundance are striped bass, bluefish, and black drum; but the indiction of an upward trend for these species does not approach one-tenth of the former magnitude of croaker catches.

In general, one would expect sport catch rates to stabilize or to increase if commercial catches and efforts decrease while fish populations remain stable. Since sport catches have decreased for some species and increased for others, the situation should be reassessed.

One factor -- pollution -- has probably played a most important role in this decline in landings of some species, but it is not believed to be significant in most waters of the Eastern Shore. It must be remembered that most of the sport fish important to this area are migratory and are, thus, exposed to pollution throughout their range.

Fish population magnitudes are affected by pollution factors that act as damps to the system. Species that are sensitive to a

Table 23

Total reported Virginia commercial landings for 12 species from 1935-1970 in thousands of pounds. Data from U. S. Fishery Statistics (Fiedler, 1936, 1943; Anderson and Power, 1949, 1957; Anderson and Peterson, 1953; Power, 1962; Lyles, 1967) and Kelly (1970).

	Species	1935	1938	1940	1945	1950	1955	1960	1965	1970
1.	Bluefish	340	303	15	121	311	220	130	205	636
2.	Black Drum	39	117	36	61	48	100	172	106	72
3.	Channel Bass	34	134	66	34	183	38	29	95	0
4.	Cobia	49	23	2	--	8	9	19	10	2
5.	Croaker	23,038	43,284	38,292	55,194	6,674	9,752	3,933	1,532	128
6.	Flounder	672	772	1,247	1,652	1,761	1,706	2,854	2,108	2,143
7.	Gray Sea Trout	13,443	12,547	12,306	22,379	4,011	3,831	810	2,007	2,122
8.	Spot	407	3,866	2,212	4,031	4,499	3,949	3,906	1,751	5,816
9.	Spotted Sea Trout	112	394	94	448	94	102	55	40	69
10.	Striped Bass (Rock)	375	1,155	659	2,119	2,796	894	2,278	2,213	1,787
11.	Mullet	37	23	6	125	117	74	88	17	0
12.	Whiting (Kingfish)	56	261	128	451	126	139	57	60	91
	TOTALS	38,602	62,879	55,062	86,615	20,628	20,814	14,331	10,144	12,866

given pollutant would be reduced in number while more tolerant species could build to population magnitudes not otherwise possible. A testing of specific tolerances and measures of diversity of species probably could be most important keys toward understanding changes in our fish population system. If environmental conditions can be stabilized at a level favorable to marine fishes then a stabilized commercial fishery and increasing effort by sport fishermen might result.

Value of Marine Sport Fishing to the Eastern Shore

Two studies of marine sport fishing in Virginia relate to the Eastern Shore. One report on bottom fishing within Chesapeake Bay (Richards, 1962) estimates the number of sport fishing boat trips for Eastern Shore waters to have been 13,590 for 1959 and 7,714 for 1960 or 4.9% and 6.9% of the Virginia total marine bottom sport fishing effort from May 1 to September 30, 1959 and 1960. This portion of the sport fishery was worth an estimated 361 and 208 thousand dollars in 1959 and 1960. A second report on charter boat activities (Richards, 1965) considers changes in catch by species where the fall in croaker and rise in flounder catch rates during the period 1955-1962 is shown. The data from this study also can be used for estimates of value. If it is assumed that these data are a 10% sample and that an average of $30 per charter boat

trip was spent per man, then the charter boat portion of the sport fishery was worth approximately 509 thousand dollars in 1959 and 362 thousand in 1960.

A limited interview survey of sport fishing during July and August, 1971, indicates that inshore and nearshore fishing activities are most important to the Eastern Shore economy, and account for 81.6% of the total dollar value generated by sport fishermen. Offshore fishing accounted for 18.4% of the dollar value generated by the fishermen interviewed. Equal numbers of trips were by Maryland and Virginia fishermen for 66% of the total. Local fishermen from the Eastern Shore made up 10% of the total trips. In decending order, other states represented were: Pennsylvania, 15%; New Jersey, 10%; Washington, D.C., Delaware, New York, 2.5%; Florida, Ohio, 1.2%. Table 24 summarizes pertinent data related to the value of sport fishing on the Eastern Shore.

Counts of cars, and cars with trailers at boat ramps and landings show higher numbers of Virginians, 53.9%; Maryland, 21.4%; Pennsylvania, 16.2%; New Jersey, 3.9%; Delaware and New York, 1.3%; Massachusetts, Connecticut, Tennessee, Quebec, Florida, and Ohio, one trip each for 1.8% of the total.

Sport fishing efforts have shifted more to oceanic and open bay waters. Aerial counts of private sport fishing boats operating on week days indicate that a 30% decrease in effort occurred in

Table 24

Mean dollar values, days, and people per trip in July-August, 1971
Eastern Shore Interviews

Fishing Type	Mean Value per Trip/day	Days Per Trip	Total Value	Mean number of People Per Trip
Inshore Charter Boats	83.37	1.71	142.56	4.12
Offshore Charter Boats	96.88	1.25	121.10	4.88
Surf Casting	19.68	5.6	110.21	2.50
Private Outboards	19.15	5.50	105.33	3.43
Private Inboards	26.75	3.50	93.62	2.00
Rented Outboards	24.54	3.39	83.19	3.17
Local Outboards	1.17+	1.3+	1.52+	1.67

Virginia's portion of Chesapeake Bay from 1955-60 to 1971. At the same time a 37% increase in effort occurred for private boats fishing within the Bay off the Eastern Shore. Charter boat activity dropped 90 to 100% in all areas within Chesapeake Bay on week days. Changes are at least partially due to easier availability of more seaworthy small boats and motors, but are also due to greater availability of fish in certain waters. Effort on weekends and holidays was approximately triple week day effort in 1955-1960 (Richards, 1962).

Activity on the Seaside of Virginia's Eastern Shore was not measured in the 1955-60 period, but accounts for 20% of private boat and 44% of charter boat effort estimated during 1971.

The Effects of Increased Sport Fishing Effort

Overfishing and pollution are dangers of an increase in sport fishing and related activities. If sport fishing effort increases, competition for land and water use will also increase. Such competition may be critical now in the Chincoteague area. Municipalities, sport and commercial fishermen, real estate developers, marinas and camp grounds all need land and water. Such competition is not expected to lessen to any degree in the future. Efforts to develop and increase sport

fishing on the Eastern Shore, and tourism in general, must consider the effects such increases will have upon the environment and fish populations present. It may become necessary to consider each area separately to set zones for the development of the sport fishery and other uses of the Eastern Shore.

Summary and Recommendations

As sport fishing on the Eastern Shore increases in importance, management of the fishery may prove to be a necessity. A first step toward management would be collection of sport-catch data, and it is recommended that a program to gather the necessary data be initiated. Such data, not regularly collected at present, would include economic and biological information. The biology of some species is fairly well known, but knowledge of other species is lacking. Information on distribution, migration, abundance, life history, and general ecology as related to sport fishes is needed.

Construction of artificial fishing reefs may assist expansive development of a sport fishery. These structures attract and concentrate fish (Turner, Ebert and Given, 1969) and can increase the natural productivity of otherwise barren areas. Reefs supply food and protection to fish with the result that many migratory and non-migratory species may take up seasonal or permanent residence where such reefs are constructed (Unger, 1966). Artificial reefs,

by providing more "hot spots" to supplement natural fishing grounds, could increase the number of successful fishermen. Reef construction, at least on a pilot scale, is recommended. Best materials, methods of placement, and areas where they should be constructed must be determined. The relationship of reef size to productivity and the amount of fishing pressure a given reef can withstand are other points to consider.

Sport fishing is not limited to finfish but may include crabbing, clamming, and oyster catching. Clamming activities are encouraged at some camp grounds by planting special clamming areas for campers. Put-and-take oystering and clamming may attract more vacationers to area camp grounds or parks in the future. Crabbing might be encouraged by selling or renting gear and bait. These activities should be encouraged to offer increased recreational opportunity to vacationers.

If sport fishing continues to increase on the Eastern Shore, access could become a limiting factor to expansion of the fishery. Many of the boat ramps lack parking space, and most are in need of some repair. Funds should be made available to periodically improve existing ramps and to construct new ramps. There are no fishing piers on the Eastern Shore and construction of piers, such as on the lower Bayside near Kiptopeke, could prove profitable. Access to Atlantic Ocean and Seaside drains and embayments is hampered by the intricate network of creeks which exists between the mainland and Barrier Islands. An enlarged marked waterway system is recom-

mended for these waters to facilitate access and egress by small boats.

The importance of maintaining a clean environment for highest levels of life cannot be overstressed. We are living in a closed loop system, and a degraded system may not support the existance of man's preferred species. Research to determine specific tolerances and the effect of pollutants on reproduction is needed. Levels of toxic elements in marine fishes of all age classes should be monitored at regular intervals. In conclusion; development and expansion of the sport fishery will be directly linked to the protection and survival of inshore and nearshore game fishes.

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Chapter VIII

TANGIER ISLAND

by

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2-72-008

Introduction

Tangier Island is a part of Accomack County and subject to Virginia laws and regulations; however, most of the commerce of this island goes through Crisfield, Maryland. Because of this, commercial fisheries here do not contribute significantly to the economy of the rest of the Eastern Shore of Virginia. All transportation to and from Tangier is by airplane or boat with the latter accounting for more than 99% of the total. The economy of this community is more closely related to water resources than any other area of Virginia; so, despite the small population in relation to the rest of the Eastern Shore and because of the ties with Maryland, a separate section is devoted to the seafood industry of Tangier.

As would be expected, fishing is the chief industry of the island. The local fishery is presently based primarily on a single resource -- the blue crab, Callinectes sapidus. Formerly oyster bars near the island provided employment for some of the residents, but these are no longer productive. The last pound net was fished in 1968, leaving a few gill nets as the only commercial type gear

still employed in the finfishery. The chief species caught by the nets are grey trout, Cynoscion regalis, bluefish, Pomatomus saltatrix, and striped bass, Morone saxatilis. Most of these fish are consumed locally with few marketed in Maryland. Hard clams are available, but Virginia law does not permit hydraulic dredging and Tangier men cannot compete with their Maryland neighbors who do use this rig.

The Fisheries

The blue crab fishery is divided into two parts, the hard crab fishery and soft crab fishery. Hard crabs are harvested in local waters in crab pots. The average potter working alone may fish up to 150 pots; with a helper this is increased to 200 or more. The crab pot fishery runs from April to November.

The crab potters then either enter the dredge crab fishery based at Hampton and Cape Charles City during the period December to March, or tong oysters in the Potomac River. In spring many of them tong for a week or two when the seed beds of the Great Wicomico and Piankatank Rivers are opened. This last fishery provides enough capital to refurbish the boats and buy equipment to start crab potting again. Many oyster tongers formerly worked on the James River beds in winter; however, few make this trip now since oysters have become less abundant.

The soft crab fishery is the most valuable fishery moneywise. Peeler crabs are caught in traps, scrapes, pots and dip nets. These are held in floats until they shed and are then sold as soft crabs. Formerly, the peelers were sold to large local shedding houses for the shedding operation, but now most of them are shed by the catchers thus cutting out one link in the market chain. All are marketed in Crisfield, Maryland.

Some of the Tangier Island men were employed in the menhaden purse net fishery located in New Jersey and elsewhere in Virginia prior to its decline in the early 1960's. This group and others sought and found employment with the U. S. Army Corps of Engineers, lighthouse service and tug boat firms. Many of them, after retirement, return to the Island and enter into some phase of the crab fishery.

The recreational fishery is very small. Sports fishermen come in the fall by plane or boat and cast from the beach, fish from their own boat or employ one of the local fishermen to carry them to the nearby fishing grounds.

Discussion and Recommendations

The fishermen of Tangier have successfully diversified. They move from fishery to fishery by the season. There is little unemployment, even men in their seventies fish every day. Income,

however, is low as compared to other Virginia areas. Using the figure for Accomack County contained in the U. S. Census Report for 1960, 53.7% of the families had an income below $3,000 in 1970 while Virginia as a whole only had 27.9% in this bracket. This discrepancy in income no doubt still exists though the median income has risen. Therefore, some means of improving the lot of these people should be sought. Inasmuch as the great majority of these people are fishermen, improvement in the fisheries will help the most.

The hard crab landings vary from year to year, with the fisherman receiving high prices when crabs are scarce and low prices in times of plenty. A means of mechanically picking crabs would improve market conditions when crabs are abundant; so efforts to develop such a machine should be encouraged. One crab picking plant is in operation on the Island now, providing jobs for some of the women of the Island, but labor for expansion for more picking plants is available and should be utilized.

The Virginia Marine Resource Commission in conjunction with the Virginia Institute of Marine Science should investigate the possibility of rejuvenating the public oyster rocks in the Tangier area. These rocks are too deep for hand tongs and licenses to dredge should be offered. These should be issued to Tangier residents on a limited basis since the areas are too small for

unrestricted harvesting by this means; or these beds should be made available for leasing by residents of Tangier. When oysters are again being produced and harvested, they should be landed and processed locally. A freezing and breading operation for oysters in winter could also be used to freeze soft crabs available in summer. This would provide maximum benefit to the community.

An advertising campaign to increase the recreational fishery should be initiated. The accessibility of the island by plane, mail boat and excursion boat needs to be made known to sports fishermen. Watermen should obtain licenses to carry people for hire and make some minor changes in their boats such as installing temporary sun shelters and chairs to make them more comfortable and attractive to the tourist. Accomodations for fishermen, presently sufficient, should grow as the popularity of the fishery grows. However efforts to mold Tangier into an attraction for tourists per se should be considered very carefully before proceeding. The problem of solid waste disposal is serious, and little land is available for summer homes. Thus, the number of vacationers would of necessity be small.

Effort should be made to develop a Virginia port as the islands shore base instead of Crisfield. A scheduled ferry service from Onancock would undoubtably become quite popular.

Chapter IX

SUMMARY

The commercial fishing industry of the Eastern Shore of Virginia has many problems. Common to all segments are 1) labor problems; 2) fluctuating supply; 3) an ingrained conservative attitude of both processors and fishermen. These problems are inter-related and improvement of any one of them will inturn result in improvement in the others.

In the past, cheap labor has made the fisheries profitable; but now competition from other industries, welfare, and the fishing industry itself has reduced the pool from whence labor has been drawn and has raised its price to a point that many operations are no longer profitable. Evidence of the shrinking supply of labor for the fisheries is the average age of Eastern Shore fishermen, 48.5 years (Figure 19) and above 50 years for oyster shuckers (for the state of Maryland, which probably is also true for Virginia) according to Wheaton (1970). Records of licenses issued (Table 25) do not appear to show a decline in number of harvesters when comparing the yearly totals. Upon analysis it becomes apparent that these records do indicate a smaller number of people in the fishing industry -- note a 50% decline in oyster shucking houses in the 5 year period 1965 to 1970. Using average number of shuckers per house from Table 11, this would be a loss of 124 persons based on the 1965 average and 556 based on the 1960 figure. The decrease in number of

Table 25

Numbers and types of licenses issued by the Virginia Marine Resources Commission to Eastern Shore fishermen. See figure 5 for VMRC district boundaries.

TYPE OF LICENSE	DISTRICTS 24			25			26			28			29			Tangier Island		TOTAL		
	1960	1965	1970	1960	1965	1970	1960	1965	1970	1960	1965	1970	1960	1965	1970	1965	1970	1960	1965	1970
OYSTERS																				
Patent Tonger							1											1		
Ordinary Tonger	14	4	2	247	273	77	92	25	34	228	89	38	153	202	95	51	63	724	640	309
Oyster Buyers					27	7		7	4		7	3		9	8	2			52	22
Barrel Shippers									1		3		1					1	3	1
Shucking House	4			9	11	9	6	9	4	7	10	3	3	3				29	33	16
Dredging-Public Ground							11											11		
CRABS																				
Ordinary Trot Line	5	3	3	8	2	2	10						3			35	32	26	40	37
Patent Trot Line				86									2					88		
Hard Crabs with Scrape	6	3	5		2		16	12	3	46	35			3		16	39	68	71	47
Crab Power Dredging	21	11	42	16	10	2		5	3	2	2			3	5	19	3	39	50	55
Picking, Crating or Shedding	5	3	1		1		4	5	4		1		2		3	5	1	11	15	9
Crab Buyers	18	2	8	2	2	1	2	3	7	5	6		1	2	6	1	2	28	16	24
Crab Traps	121	207	199				11	50	23						20	113	127	132	370	369
Crab Pots	71	43	41	3	51	52	50	77	66	59	56	51	23	41	53	107	90	206	375	353
Crab Pot Supplements		2	1		2			2				1			2	4	8		10	12
CLAMS and SCALLOPS																				
Patent Tongs				8	18			62	9		4	1		5		8	1	8	97	11
Ordinary Tongs, by Treading, or by Hand	1	1	4	35	33	112		3	16	34	60	67	2	3	63			72	100	262
License to Buy, Market and Ship	1			10	8	7		2	2	7	11	10	2	3	4		4	20	24	27
Clam Dredge with Boat						2						20			1					23
FISH																				
Pound Net	99	113	105	3	5	1	6	1		13	12	4				1		121	132	110
Float Net			47		11	40			8			39		3	11	2	6		16	151
Stake Gill Net	13	37		7	15		14	40	36	10	11		3	1		1	2	47	105	38
Trawl Net										9	7	10						9	7	10
Sturgeon Gill Net						3						6								9
Trot Line					9														9	
Haul Seine - under 500 yards	1	5	5	7	4									2	2			8	11	7
Haul Seine - over 500 yards	6	1	1	10			3						6					25	1	1
Purse or Menhaden Net	1																	1		
Catfish Pots			1																	1
TOTAL	387	435	465	451	484	315	216	307	220	420	314	253	201	280	273	365	378	1675	2185	1904

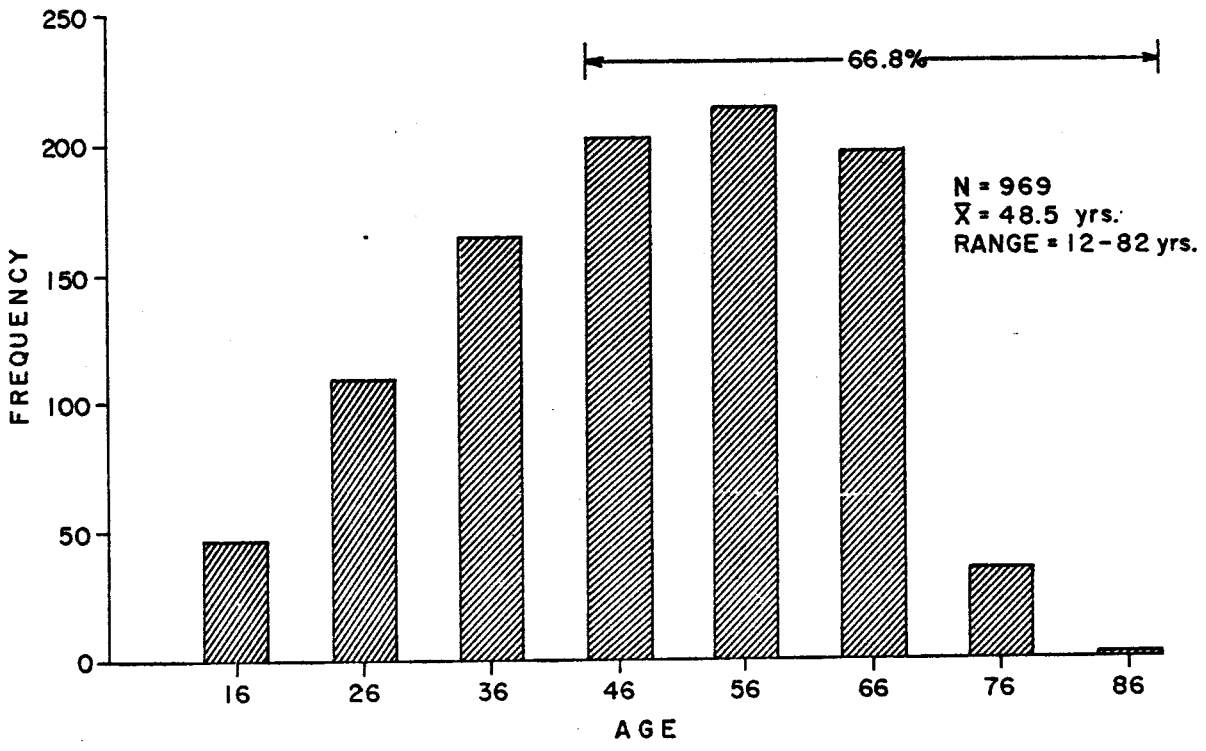

Figure 19. Age-frequency histogram of Eastern Shore fishermen for Fiscal Year 1970. (Data from Virginia Marine Resources Commission license records.)

Table 26

Wholesalers and processors of fishery products on the Eastern Shore of Virginia. Data from Wholesale Dealers in Fishery Products, Virginia. U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries, 1962 and 1969.

Products	Number 1962	1969
Oysters	33	17
Oysters and Clams	14	9
Oysters and Fish	1	1
Oysters and Crabs	8	3
Oysters, Clams, Fish	-	1
Oysters, Clams, Crabs	-	2
Oysters, Fish, Clams, Frozen Bait	1	1
Clams	8	3
Clams and Crabs	3	1
Fish	4	3
Fish and Miscellaneous	2	2
Crabs	19	28
Miscellaneous	2	2
Total	95	73

Total Number of Wholesalers and/or Processors of:	Number 1962	1969
Oysters	57	34
Clams	26	17
Crabs	30	34
Fish	8	8
Miscellaneous*	5	5

* includes dealers in frozen bait, steamed conchs, diamond-back terrapin, and sea organism plant foods.

pound net licenses would be indicative of a larger loss than just one individual per net. Further, while VMRC records do not show this, interviews with members of industry indicate that many more licenses are being held by casual fishermen, particularly float net and hard clam hand harvestors, than was the case in the past. Numbers of wholesale and processing firms have declined also (Table 26).

Present use of labor, by and large, is inefficient. This is a result of several factors such as restriction of the use of some types of equipment. This is not to say that restriction of catch on certain species or protection of the bottom does not have merit, but that often restrictions result from reasons other than conservation. The industry is fragmented and does not have the necessary research and development funds to develop machines to up-grade. Some in the industry are not willing to change their way of doing things; thus inefficiencies are perpetuated. Changes in the agricultural practices of the Eastern Shore have affected the labor supply in the fisheries. In the past, seasonal employees of the seafood industry were able to work in agriculture in the off-season; however, in the last 10 years the farm crops of the Eastern Shore changed from truck, dairy, and other types of farming with high labor demand, into grain farming which is greatly mechanized and requires less help. Social changes are also making an impact on the

labor market. It is no longer popular to work in a seasonal industry, and our entire economy is geared to a regular paycheck (for credit buying, etc.). Many have left the industry for more steady employment. Then, too, welfare programs have also made serious inroads into the labor force. The interaction of all these forces are important in understanding what is happening to the labor used in the seafood industry at present.

Fisheries have historically suffered from periods of famine and plenty. This has led to the loss of markets because of inability to supply the needs of customers in the first case and by shipping him over age product in the second. Further, this has reduced the market for fresh fish so that a large catch cannot be absorbed by the normal distribution chain; and fish are sacrificed at a very low price, usually with the fisherman coming out on the short end.

Conservatism is reflected in the number of crab potters who still pull their pots by hand when a relatively inexpensive power winch is available or by the oyster shucking operation that handles oysters by hand three of four times before the shells are carried to the shellpile in a wheelbarrow. Even more serious, many fishermen or processors are not willing to institute good business practices so that inefficiencies may be corrected. The attitude of many is that this system worked for Pa and 30 years for me so why bother to change.

Traditionally, fish, oysters and live crabs are shipped in iced wooden boxes, barrels and crates which at best leak water on everything around them, but often also spread a fishy odor about. Many carriers have stopped transporting seafood for this reason. The industry has been slow to accept the advances in containers, with a noteable exception being the eel industry (their package is so good that even airlines cater to their product).

Other problems that are present now on the Eastern Shore and will become more serious as any development takes place are competition between recreational interests and commercial fisheries, degradation of the environment and problems of waste disposal. Further, difficulty in recruiting labor is expected to increase; restrictive laws and conservative attitudes by regulating bodies will deter use of new harvesting gear and more modern processing methods.

Any program that leads to improved economic conditions in the seafood industry will place increased pressure on the resource and may be short lived. Competition by the buyer will raise prices and encourage more to enter the harvesting end, which in turn will increase the harvest initially. When maximum sustainable yields are exceeded often increased effort by the harvester will mask the dwindling supply until the stock has reached such a low level that recovery is difficult or impossible to achieve. This would result in an economic disaster to all levels of the fishery from the harvester to the final processor.

Therefore, basic to any efforts to improve an industry must be, first, a consideration of the effects of such action upon the resource -- its fate ultimately determines the fate of the entire industry.

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Chapter X

RECOMMENDATIONS

First, specific recommendations will be made for each segment of the fishing industry; and then general proposals will be set forth.

The Oyster Industry

The oyster industry of the lower Seaside must go to mechanization in order to survive, much less expand. The escalator dredge offers a means of efficient harvesting. The shell stock if loaded into large metal cages at the beds may be handled entirely by machinery throughout the rest of the processing by the use of fork lifts and conveyers except at the point of hand shucking. Also, hand shucking of clumped oysters might be phased out in favor of steaming the oyster open. Diverting the lower Seaside oyster to the steamed trade would offer the further advantage in that a small oyster can be used and a higher yield achieved by avoiding some predation and disease losses. A single steaming plant can utilize at least 200,000 bushels per year, and this increase in demand would encourage oystermen to return to the public rocks and small planters to again work their leases. Shuckers replaced by the steam process would have little difficulty in finding employment in a shucking house that used the larger, single Bayside oyster imported from Maryland and would receive more income because higher production

is achieved when opening this type of oyster. Sale of seed oysters from this area to Northern growers would increase the production of the beds and efforts should be made to negotiate a removal of the Delaware embargo on Virginia seed.

Improvement in the oyster production of the Bayside must await a breakthrough in disease control or a change in the mortality level caused by disease. Oyster rocks near Tangier Island should be investigated to assay the practicality of placing them back into production. If such an action is warranted, the possibility to divert most of the economical gain to Tangier Island must be considered. Two possible ways of achieving this are: one, permit leasing of these grounds only by Tangier residents, and two, issueing dredging permits to only Tangier residents. Landing of oysters in Virginia should also be encouraged.

Further processing of oysters on the Eastern Shore such as preparing stews, casseroles, breaded oysters or even freezing on the half shell would increase the value of the product as well as create more jobs.

The Hard Clam Industry

Mechanization is available to up-grade the hard clam industry. The escalator dredge should be evaluated as a harvesting and transplanting device, both from the standpoint of detriment to the resource and effect on the fishermen's market. Grading machines used in conjunction with selling be weight can save much hand labor.

Developing uses for chowder-size clams should have a high priority. Aquaculture has the greatest immediate potential in this fishery. Techniques for culture of larvae are well established, and this is enhanced by the fact that smaller (younger) clams are in greatest demand. Planting techniques developed by VIMS where aggregate is used to protect small laboratory reared clams from predators may prove to be profitable in some areas of the Eastern Shore. Recognized long term clam leases would increase interest in clam culture.

The Surf Clam Industry

Population studies of surf clams are needed to determine maximum sustainable yield, so that management practices may be instituted while there is a resource to preserve. One or more Seaside inlets should be dredged and maintained at such a depth that vessels large enough to fish in fairly heavy seas will be able to navigate the inlets with a full load of clams. Mohagany clams should be investigated as another source for products presently made entirely of surf clams. More mechanization should be investigated and developed while the industry is in good financial condition and labor is available, rather than waiting until desperation forces the industry to do so.

Utilization of waste, both viscera and shells, should be encouraged.

The harvesters should be encouraged to land all predators and their eggs.

The Blue Crab Industry

The problem of fluctuating supplies of hard crabs may be approached in two ways - the first is to freeze crab cores (cooked, debacked, eviscerated crab bodies) when supply is too great to process at once. These cores may be thawed and picked up to five months later with no decline in quality according to Ampola and Learson (1971). This would not only take care of a glut at one season but would provide crabs for slack seasons, such as in between potting and dredging season. A second approach to the problem is mechanization to handle greater amounts of crabs at the peak seasons. Presently available, a brine floatation system permits picking of one type of meat mechanically. Other machines are in late stages of development according to their inventors. A combination of hand picking to remove the premimum lump meat and machine picking for the rest of the crab seems to offer maximum utilization of labor and greater economic gain.

Development of better methods of freezing and pasturization to achieve longer shelf life would allow expansion of markets as well as even out fluctuation in stocks.

Research should be continued on methods of reducing mortality in soft crab shedding operations. Methods of extending the soft crab season by utilizing the rock crab or seeking ways of inducing

the blue crab to shed for a longer period during the year should be looked into. A study should be made to determine whether or not it is profitable and a good use of the resource to try to shed green peelers. Sale of peelers as bait to sport fishermen also may increase profits to soft crab operators.

Finfish Industry

Efforts should be made by the Virginia Institute of Marine Science in conjunction with scientific agencies of bordering states to obtain necessary data to recommend management practices for important finfish species. Regional agreements between states and the federal government would provide the management necessary to protect these species. Feasibility of federal protection of offshore stocks should be reassessed in view of increased pressure by foreign fleets.

A deep inlet such as noted in the surf clam section would permit use of larger trawlers in the finfishery. This would permit more days at sea as well as provide power to take advantage of more diverse types of gear.

New product development to increase the value of present species landed is necessary. Uses should be sought for species considered trash fish at present. Mechanization to reduce labor from the catching to the final packaging should be investigated and utilized where practical. Studies should be made on means of improving the efficiency of gear from the standpoint of increased catch and selectivity of catch.

Recreational Fishing

Recommendations pertaining to finfish in general would be applicable to the recreational fishing. Commercial fishermen should investigate off season use of gear and personnel in the sport fishing industry. Artificial reefs may increase the population of desired species in relatively accessible areas. Fishing piers might prove profitable in conjunction with inhanced fish environments. Sport fisheries of clams, crab, and oysters could add inducement for a whole family participation in a recreational outing to the Eastern Shore.

General Recommendations

Aquaculture, except for oyster farming and some parts of the hard clam operation, has not yet advanced technologically to a point where species that may be grown on the Eastern Shore can compete with wild stocks. Continued research in this field should be encourgaed however for the following reasons:

1. Species formerly native to the area may be reintroduced by laboratory spawned stocks. This is being attempted at present with Bay Scallops.

2. Genetically superior laboratory grown stocks may be added to native populations to make it more desirable. This may be the way that disease resistance will be achieved.

3. Improved culture techniques to provide know how for future aquaculture endeavors should be available. Improved technology and changed economic conditions will possibly make aquaculture practical.

It has been recommended in the past that a fisheries cooperative be established on Virginia's Eastern Shore (Bowden 1963). Denit (1970) suggested that such a cooperative would be more efficient if it included the entire Delmarva Peninsula which would cross state boundaries and encompass areas of Virginia, Maryland and Delaware. The Denit plan appears to offer greatest benefits and is endorsed. This organization should be open to all watermen and processors of the Delmarva Region. Each should subscribe to an amount of stock or an annual assessment commensurate with volumes and price of product produced. These monies should be invested in providing a marketing program which would include establishment and promotion of a regional trademark. Quality standards must be set and adhered to by all members of such a group. Harvesters and buyers must revise their methods of transacting business so that supplies will be available when needed and prices paid to the harvester will be based on a more current market. The cooperative might provide some services not practical for individual firms such as packaging facilities, freezer warehousing and a broker network. This cooperative could provide production statistics so vital to good management by regulatory agencies. Finally recruitment and training of people for the fisheries could be a most important function of such a group.

Waste disposal is becoming a serious problem to the seafood processor as other uses of the waterways increase. Practical methods other than the traditional dumping over the side at the plant must be developed. Any type of development on or adjacent to wetlands must be evaluated individually to determine the impact on the fisheries prior to issueing enabling permits. Better control of pesticides in agriculture operations is needed. Hard pesticides must not be permitted to reach waterways even if this means a complete ban on their use in certain areas.

Fishery operators should be encouraged to diversify thus allowing use of personnel and equipment throughout the year. This would make employment in the fisheries more attractive to the labor force.

Training for fishermen, processors, and those interested in possibly entering these fields should be provided. This could be at the fishing centers, in the high schools, community colleges or technical centers. Instruction should be on such widely divergent subjects as seamanship, engine repair, sanitation practices, management practices, marine biology, navigation, net mending, engineering, and others. Programs should be designed to recruit people into the fishery such as providing training for housewives for jobs in the processing houses as a part time occupation.

A better means of collecting production statistics is needed throughout the fisheries. The desirability of making this mandatory by law or through fisheries associations must be determined. Product quality control must be improved. Whether this be on a

voluntary or compulsary basis by state or federal agencies or fisheries association, it is necessary to maintain and up-grade quality of seafood if markets are to be expanded.

Nearly all of these recommendations involve expenditure of money. It has been brought out that the fishing industry is highly fragmented therefore other sources of funding are suggested. First the regional organization should be able to manage certain programs from monies derived from members. More important it can be the recipient of state and federal grants for improvement of certain areas of the fisheries such as setting up an insurance fund for fishing boats as provided for by HR153 and serving as administrator of Office of Economic Opportunity Funds for training programs in economically depressed areas.

The Merchant Marine Act, 1936, as amended (46 U. S. C.1101) provides a method of putting profits into a fund for new vessels with a tax write off. Further, the Farm and Rural Development Act (H. R. 9650 and S 2223) includes provisions which will aid development of fisheries. Small Business Administration and the Office of Economic Development also have programs being of potential aid to the fisheries.

Federal funds specifically earmarked for research and development in fisheries are available through the following legislation: PL 89-688, The Sea Grant Act; PL 88-304, the Anadromous Fish Act; and PL 88-309, Commercial Fisheries Research and Development Act. Research agencies may seek other funding from the programs listed

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In closing, a word of caution is necessary before considering the recommendations put forth in this report. While each recommendation is valid in itself, the long term goal -- improvement of the Industry -- can be realized only if the biological, social, and economic factors are closely scrutinized. Some major questions which need to be answered before inovative actions are taken are outlined below.

1. What effect will attempts to increase production of, and demand for, a product have upon the resource? Is depletion of the resource a possibility? If so, how probable is this and how can it be avoided?

2. What will be the biological and social consequences of the encouragement of mechanization to reduce operational costs? What will be the fate of the people that are displaced by a "machine"? If the efficiency of harvesting is increased, what danger does this pose to the resource?

3. If it is found that management of the resource is necessary, should the ultimate goal be maximum sustainable yield or maximum economic yield -- the two are not synonomous? Should you manage for maximum employment or maximum efficiency?

Answers to these questions are difficult, but they must be considered if any developmental program is to be of true benefit to the Industry. Obviously, an interdisciplinary approach must be taken to solve these problems. Only with the aid of scientists, economists, sociologists, and engineers, to name a few, can any major contribution be made.