

COMMERCIAL FISHERIES REVIEW

May 1955

Washington 25, D.C.

Vol. 17, No. 5

THE POUND-NET FISHERY IN VIRGINIA

Part I - History, Gear Description, and Catch^{1/}

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ABSTRACT

The pound net is one of the most important fishing gears in Virginia. Recent declines in the catch of certain economically-important species have pointed to the need for study of the fishes and the fishery and its methods. The General Assembly of Virginia has requested that the Virginia Fisheries Laboratory conduct experiments to determine the proper size mesh for nets in fixed fishing devices.

A preliminary study of the pound net, embodying historical development, construction and methods of operating, and the catch trends from 1930 through 1951, was undertaken during the summer of 1953.

Although the introduction of the pound net into Virginia waters about 1870 was marked by opposition and conflict, the gear was adopted and has gained importance. Little change has been made in the basic design and method of fishing, although materials and preservatives have been improved.

Studies of the effects of preservatives and use of the component nets indicate variation in stated mesh sizes and the resultant need for further appraisal of definitions relative to mesh sizes and legal sizes of fishes.

Of the fish species taken in pound nets, a few comprise the bulk of the catch and constitute the economically-important fishes. Alewives, gray sea trout, croaker, spot, shad, and butterfish have long been the principal food species, and menhaden the important nonfood item, in the catch.

BACKGROUND

Of all the fishing gears employed in the coastal waters of Virginia, pound nets land the greatest weight of food fishes. More pounds of fish are caught by purse



Fig. 1 - Fishing a pound net. These fishermen have placed their boat over the funnel of the head (fig. 6) and are raising the floor of the net. This will result in the pocketing of the net on the opposite side of the head (fig. 7). The hedging, little bay, and big bay are seen in the background.

^{1/} Contributions from the Virginia Fisheries Laboratory, No. 57.

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seines, but the catch consists almost entirely of menhaden, which are not used as food. Of the 89.6 million pounds of fishes landed in Virginia in 1951 by gear other than purse seines, pound nets accounted for 45.5 million pounds, or slightly more than 50 percent of the total catch.

Recent declines in the availability of the major migratory food fishes in Chesapeake Bay, notably the croaker or hardhead (*Micropogon undulatus*) and the gray sea



Fig. 2 - The catch is concentrated in a pocket of the head prior to brailing.

"The Commission of Fisheries and the Virginia Fisheries Laboratory shall conduct experiments to determine the proper size mesh for nets in fixed fishing devices. In making such determination the Commission and Laboratory shall balance the interest of conservation and a suitable catch."

Although the Legislature failed to realize the magnitude of this problem and failed to appropriate additional funds to conduct the investigation, the Virginia Fisheries Laboratory was able, in the summer of 1953, to provide funds for a preliminary study of the problem. This report covers some historical aspects of the pound-net fishery, describes the present construction of the nets and methods of fishing, and surveys the available records of the catch since 1920.

HISTORICAL

The origin of the pound net is doubtless obscured in the antiquity of man's desire for food. Refinements of the original impounding device in order to increase the catch were certain to be added as the barter value of fishes increased.

However early the pound net or its forerunner might have been used, it was not introduced into Virginia waters until about 1870. R. Edward Earll in his description (1887) of the Spanish mackerel fishery has given an interesting account of the introduction of the pound net into Virginia.

trout or weakfish (*Cynoscion regalis*), have affected the pound-net fishery in Virginia seriously. Associated with the catastrophic declines in availability of these species has been a marked reduction in the average size of fishes in the catch, so that now a large fraction of the catch consists of small, immature fishes. In recent years alarm has been expressed that by catching immature fishes in large numbers the present nets may be hindering recovery of the fishery, and perhaps may be contributing to its ultimate collapse. Many of the pound-netters themselves have expressed misgivings as to the future effects of the fishery of the mesh-sizes currently in use, and are willing to subject themselves to drastic curtailment of their fishing operations, if necessary, to rehabilitate the industry.

At the 1952 session of the General Assembly of Virginia the following law was passed (Title 28-25.1 of the Code of Virginia):

Pound nets apparently were first used in the fisheries of New England at Westbrook, Conn., in 1849, and from that area their use spread rapidly to other regions. They were introduced at Sandy Hook, N. J., by George Snediker of Gravesend, L. I., about 1855. It was from Snediker that the fishermen of New Jersey and the Chesapeake and Delaware Bays obtained their first idea of pound nets.

The first pounds fished in New Jersey were small, and, being placed along the inner shore of Sandy Hook, were hardly successful, as the fishes were much less abundant there than along the outer shore. Similarly styled pounds were, however, fished with varying success until about 1873, when larger devices were placed along the ocean shore; then, for the first time, their importance in connection with the Spanish mackerel fishery was discovered. Most of the mackerel secured about Sandy Hook were taken in this way. One hundred fish constituted an average daily catch for the fishing season of 1879, and 100 to 140 for 1880, although much larger catches were occasionally made. The best day's fishing for a pound net in that locality took place in the summer of 1879, when Robert Potter took 3,500 pounds, valued at \$700, in a single lift.

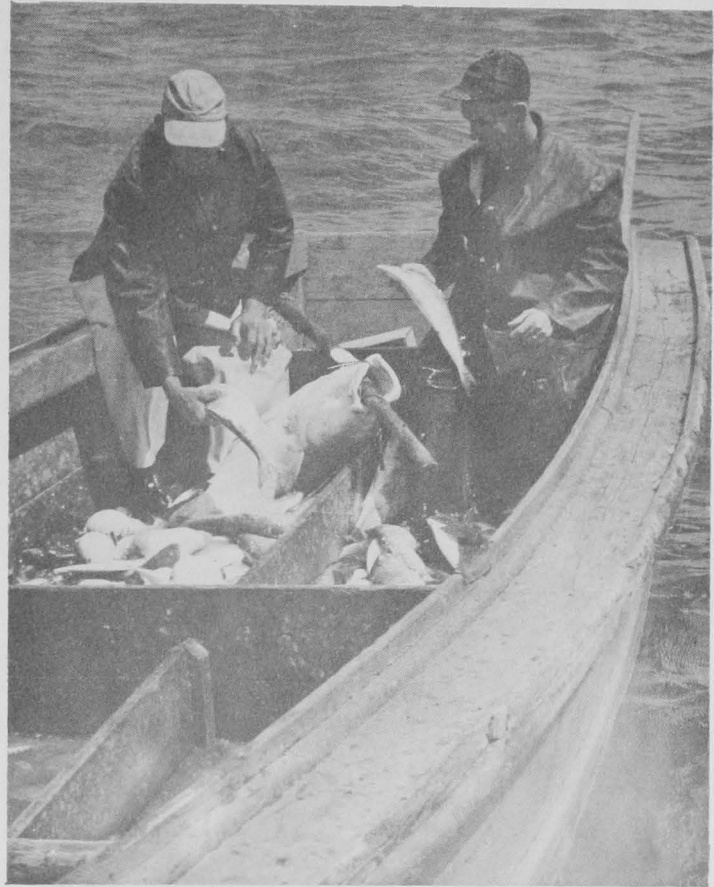


Fig. 3 - Fishes of all sizes make up the pound-net catch, including occasional monsters, like this huge channel bass.

Captain Henry Fitzgerald made an effort as early as 1858 to introduce the pound net into the waters of Chesapeake Bay, but his net was not properly constructed and was so unsuccessful that it was soon taken up. No other attempt was made to use pound nets in this region until about 1870, when Snediker and Charles Doughty of Fairhaven, N. J., came to the area and located on the banks of the James River, a few miles above its mouth. They fished primarily for shad and alewives, and continued their work for about three years, after which they disposed of their property and returned to the North. In 1875 Snediker went to New Point Comfort, Va., and constructed a large pound in the waters of Mobjack Bay for the purpose of taking shad and other species.

As described by Earll (*op. cit.* Sec. V., p. 548), "The fishermen of the neighborhood, being wholly unacquainted with the pound-net, were very jealous of the stranger that came among them with such destructive apparatus. They watched Mr. Snediker's movements closely for several weeks, and, after seeing the enormous quantities of fish taken by him, at once informed him that he must take his 'traps' and leave the country. Refusing to comply with their demands, a number of them sawed off the stakes of the pound even with the water and carried the netting to the shore, assuring Mr. Snediker that if he attempted to put it down again they would destroy it. Seeing it was useless to continue the fishery here, he decided to seek some more favorable locality."

Prior to leaving, he sold the stakes that remained in the water to a local fisherman, who secured from the stakes the design of the pound, and in a short time had one properly arranged for fishing. This was also destroyed by the local fishermen, but not until enough had been learned to convince them that pound nets could be used with great profit, and within a year from that time 12 pounds were fished in Mobjack Bay. In 1879 the number had been more than doubled, and by 1880 every available site was taken up. Often three, or even four, nets were placed in line, the leader of one being attached to the outer end of another, for the purpose both of economizing on space and of securing the fish that might be passing at a distance from the shore.

Snediker, on leaving New Point Comfort, went to the eastern shore of the Chesapeake, and became associated with one of the most popular fishermen of the region, in this way hoping to prevent any organized opposition on the part of the resident fishermen against the use of the pound. By this means he avoided any open hostilities, and soon others became interested in the use of pounds.



Fig. 4 - The pound-net catch is sorted according to species, and each kind of fish is weighed separately.

Although the pound net was introduced into the Chesapeake against the prejudice of the fishermen, it revolutionized the fisheries of Virginia. Before 1870 the fisheries of the region were of little importance, the business being largely in the hands of the farmers who fished with hand lines and drag seines for a few weeks in the spring and fall. The main purpose of the farmer-fishermen was to secure a supply of fish for themselves and their neighbors. Today the Chesapeake is the center of one of the most important shore fisheries in the United States. The pound net not only more than doubled the catch of ordinary fishes, but also brought to the attention of the fishermen many commercially-valuable species which were previously almost unknown to them, the most important of these being the Spanish mackerel. In 1880, 162 pound nets were fished in Virginia waters, with two others located at Crisfield, Md., just above the Virginia line; by 1952 the number had reached 1,216, although this is considerably less than the 2,262 nets reported for 1930.

Interviews with some of the fishermen of long experience in Virginia revealed that there have been few changes in the construction or methods of operating pound nets within the past 30 to 40 years. The use of copper paint somewhat replaced tarring as a preservative and antifouling compound. During the early part of the century and subsequently, the spacing of stakes which support the nets has been increased, resulting in savings on the costs of the supports. A continuous length of net in the hedge has replaced the use of many single panels hung from stake to stake. A refined funnel opening into the impounding "head" of the pound net also represents a change and advance in pound-net construction, and appears to have been introduced about 40 years ago.

MATERIALS USED IN THE FISHERY

MESH SIZES: The openings enclosed by knotted twine of net fabric are referred to as the mesh (locally pronounced "mash") of the net.

Mesh is measured and defined in terms of bar, or square, and/or stretched measure. Bar, or square measure, is the linear dimension of one side of a square mesh, being measured between the knots. Stretched measure is the distance between two diagonally-opposite knots of a mesh when the mesh is closed under tension applied to these opposite knots. The measure may be from the center of one knot to the center of its opposite, or may be the "inside measure" between the knots. Virginia State law is stated in stretched measure, although it is not defined to whether measured inside or from the centers of the knots. In some nets this difference could amount to one-eighth of an inch and more. The inside measure provides a true measure of the escapement area for small fishes regardless of the size of the twine used in the manufacture of the net.



Fig. 5 - Biologists from the Virginia Fisheries Laboratory examine samples of the pound-net catch at regular intervals, to follow trends in length and age of croakers, sea trout, shad, and other fishes.

The actual working measure of a net in use involves several rather intricate factors. Tension applied to a new cotton net may increase the stated mesh size by stretching the twine and tightening the knots. Opposing the stretch factors, however, are the effects of treatment of the net with various preservatives. Tanning, dipping into hot tar, and other methods cause shrinkage of the twine, thereby decreasing the mesh size. Where accurate dimensions are desired, these stretch and shrinkage factors must be considered. Actually, the manner of use of the net may influence the mesh size and cause variation within a single net. The differing amounts of strain on different parts of the net while in use, frequency of treatment with preservatives, and mending are some of such "use factors."

In one new laboratory net of No. 15 untreated cotton twine of two-inch stretched measure, the stretched dimension shrunk four-sixteenths of an inch after 48 hours of submergence in salt water. In measurements of random pieces of unused net listed as two-inch mesh, and treated with copper paint, the stretched measure was, on the average, one and one-half inches. Two-inch-mesh tarred net when examined measured, on the average, one and eleven-sixteenths of an inch stretched measure. Untreated, used cotton net showed an average stretching of from three-sixteenths to four-sixteenths of an inch, which somewhat offsets the early shrinkage described previously.

TWINE SIZES: All of the pound-net fabrics examined were made of cotton twine. The twine is composed of cotton threads which have been twisted together to form a "strand." Three strands are then twisted together to form a cord, or twine. "Hardness" or "lay" of the twine depends upon the degree of twist in the threads and strands. Net manufacturers recognize four grades of lay: soft, medium, medium hard, and

hard, although the grade most widely used locally is medium lay. The size of twine is determined by the number of threads used. From size 6 to size 36 the increase is in intervals of three threads, one to each of the strands. From twine size 42 to size 60, the increase is in increments of six, or two threads per strand.

The twist of the strands in cotton-net twine is usually right-handed or "plain-laid." Cable-laid twine is twisted toward the left. The intricacies of the lay of the strands and yarn become more involved, however, as the twist of the strands may be opposite to that of the yarn.

Cotton fibers are graded as to the diameter of the fiber and then gauged. Gauge 10 is quite widely used, although frequently a finer 20 gauge is utilized. The gauged

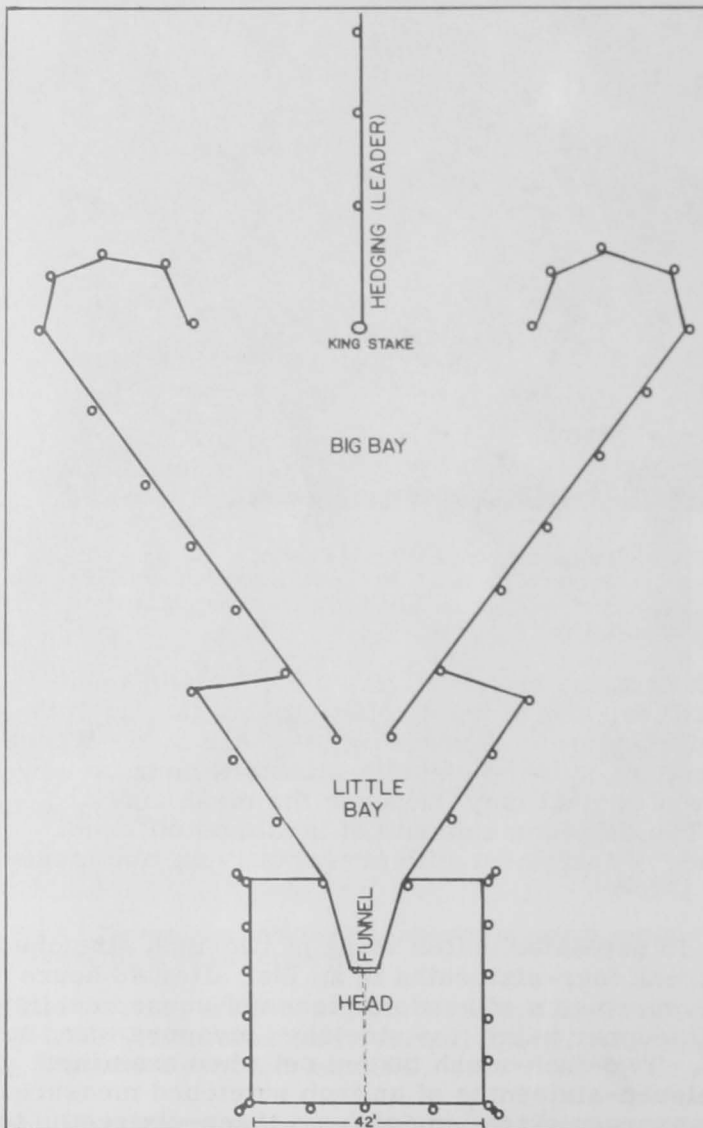


Fig. 6 - Schematic representation of pound net of the size and design used at present in the lower Chesapeake Bay. Based on personal observations and on dimensions given by local pound-net fishermen.

fibers are then twisted into strands and three strands twisted together form the finished twine. In describing the twine, the form 20/6 or 20-6 is used, indicating the twine is composed of 20-gauge fibers with two threads in each of the three strands. The gauge has become standardized to the extent that local fishermen seldom refer to it and frequently are unfamiliar with the designation, referring to the twine simply as "number twelve," etc., and writing it as #12.

PRESERVATIVES: The use of thinned copper paint as both a preservative and antifouling compound is quite widespread among the pound-net fishermen. There appear to be variances in opinions, however, as to the preserving quality. The paint used is basically the same as that used in painting boats and other gear used in salt water. Although used primarily during the summer months to inhibit fouling by marine organisms, it was found that the paint also prolonged the life of the net. All of the nets in the components of the pound nets fished during the warm months are thus treated with the paint. After from four to six weeks in the water, the nets are taken up and allowed to dry and then given another application of paint.

In cooler weather, nets are preserved by tarring. In pound nets set for shad in the spring, the head is usually tarred although the other components may be left untreated.

It might be added that copper naphthenate, a treating compound developed during World War II, has been given some trial in this area but apparently has not been accepted by the fishermen.

CONSTRUCTION AND OPERATION OF POUND NETS

The principle of construction of the pound net is simply that of providing some sort of device for the entrapment of fishes and a means of directing the fishes into the impounding structure. Throughout the years since the introduction of the pound net into Virginia, the basic pattern or design has remained rather constant. The fundamental principle is that of a large bag of netting for impounding, and a series of nets hung from poles to divert the fish into the pound. Most of the refinements of the early pound have consisted of improved techniques for hanging the various components, with economy as the primary factor, or modifying the components toward greater efficiency in capturing fish. Adaptations have also been made to the bottom contours, currents, etc., of the area in which the nets are used.

The basic components of a pound net (fig. 6) consist of a rectangular or squared bowl, or "head," which is the actual impounding structure, heart-shaped "bays" which concentrate and direct the fish toward the head, and finally, a leader, or "hedging," which turns the fish toward the bays and head.

The head is constructed of small-mesh net suspended from poles or "stakes" usually set in a square pattern ranging from 20-42 feet on the side, although frequently the head may be rectangular and approximately 40 x 42 feet. A single opening formed by an inwardly directed "funnel" permits the fish to enter and inhibits their escape. The size of the head varies, depending on the water or other factors. The broad bowl-shaped net is made fast to upright stakes by ropes which may be loosened to permit working the net or removing it. In the pound nets examined by the author, the mesh size generally used in the head ranged from 2 inches to $2\frac{1}{2}$ inches ($4\frac{1}{2}$ inches in shad pounds) stretched measure. It was found that frequently nets of different twine size were used in the construction of the head. Usually nothing smaller than #12 twine is used in the funnel, #15 in the bottom, and #18 in the walls. These differences are doubtless out of consideration for areas of strain differential. The area of the head varied with the location of the net and the personal ideas of the builder, although, in most of the nets visited, the head approximated 36 feet square or 40 by 42 feet in the rectangular heads.

Fishes are directed into the head through a funnel which projects inwardly approximately one-third of the side dimension of the head. The funnel is usually constructed of net of three-inch stretched mesh. Where the funnel enters the head, its width is nearly one-third the side dimension. At the free end, inside the head, the funnel tapers to about 3 by 6 feet, the 6-foot dimension being the vertical distance.



Fig. 7 - Boating the catch. The crew has concentrated the catch along the back wall of the head and now empties the catch into the skiff.

In pound nets set for shad, the funnel is frequently made of net with six-inch stretched-measure mesh. The funnel is held in place and in shape by lines attached to horizontal poles on the upper and lower sides of the small end. The lines are secured to a single line made fast to the vertical stake opposite the mouth of the funnel.

Leading toward the funnel opening in the head may be one or two roughly heart-shaped bays. The bays are constructed of nets of heavier twine and larger mesh (6 to 12 inches stretched measure). The twine size varies from #30 to #42. This net is suspended from stakes sunk or driven into the bottom of the river. One or two bays may be used, and their dimensions vary considerably. Some single bays project approximately 150 feet from the head. The greatest width of a single bay (or of the outer bay when double) is approximately 125 feet.

The leader, or hedging, consists of a net of heavy twine and large mesh hung from stakes in line with the openings of the head and the bay or bays. The stakes are set approximately 18 feet apart and may cover a linear distance as great as 1,000 feet, depending upon the location of the net. The mesh size of the hedging net approximates 16 inches stretched, although considerable diversity, from 14 to 18 inches, was observed. Twine sizes #30, #36, or #42 may be used in the net of the hedging. In some localities, a "string" hedging is used in shad pounds. This hedging consists of an upper (surface) and lower (bottom) rope with twine tied vertically between at intervals of approximately six inches, and reaching from the surface to the bottom. In addition to the vertical twines, longitudinal twines, spaced from 4 to 6 feet across the vertical elements, are frequently employed. The number of horizontal twines depends upon the depth of the water.

To date, all of the net used in the construction of pound nets is made of cotton. The twine is described as medium and cable-laid.

The entire assembly is usually placed with the head in deeper areas or along the edges of channels, with the bay and hedging directed toward shallow water, or at a right angle to the direction of shoreline or channel. Thus, fishes moving along shore or in shallow water would encounter the hedging and be directed toward the head.

The initial cost of a pound net, such as those used in the vicinity of the mouth of the James River, ranges from \$2,000 to \$3,000. This figure includes the net, stakes, ropes, and labor. Naturally, a boat and crew must be considered also in the capital outlay. Although there is a prohibitive law, once the stakes are in place they are left from one season to the next, thus subsequent costs are considerably lower than the original outlay.

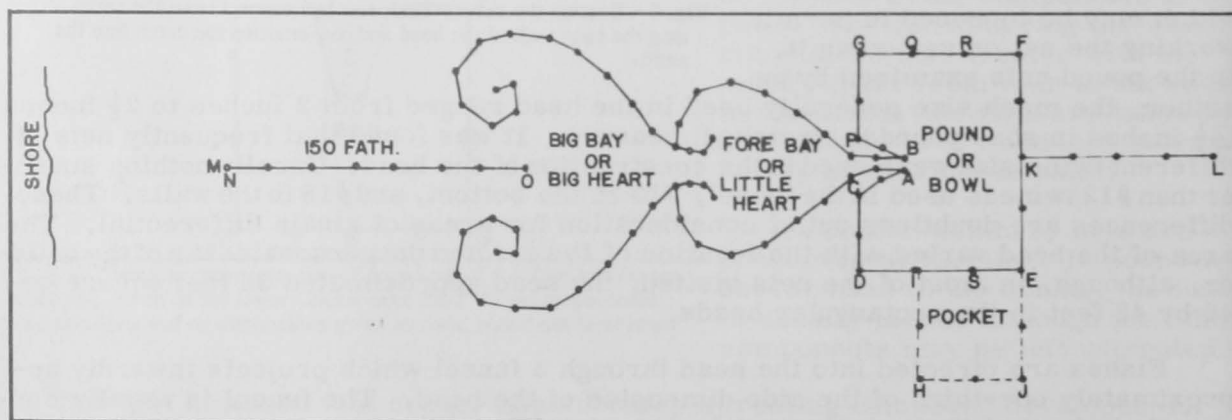


Fig. 8 - Design of early pound net (from Earll 1887).

In working the pound net, a crew, usually of five or six men, approaches the head in a skiff which has been towed behind a larger boat. The crew in the skiff

makes the rounds of the stakes, slacking off the downhauls, or lines, which hold down the bowl-shaped net. After the net lines have been loosened, the boat is made fast in a position lengthwise across the opening from the bay. The funnel, or opening, is then drawn up by men working from one side of the boat. After the funnel end has been raised, blocking the escape of the fishes, the end is secured and the raising of the floor begins. All the crew members pull the net onto the gunwale of the skiff. Minor mends of net damage are made during the raising operation. As the floor is raised, the boat, having been untied, is pulled toward the side opposite the entrance to the head, where the larger boat is tied up. The continued raising of the floor and accompanying movement of the skiff have formed a pocket in the head on the side opposite the funnel. In this pocket the fish are concentrated and are then

scooped, or brailed, from the pocket into the skiff or the larger boat. The brailing is generally done by means of a dip net, although one operating unit observed had a winch-lifted brailer with purse rings, similar to the brailers used by purse seiners, which greatly facilitated the removal of fishes from the head of the pound net and their transfer to the boat. After the fishes have been removed, the head of the net is allowed to sink and the crew again makes the rounds of the stakes, securing the head, lining up the funnel, and securing the line which holds the funnel open. On three occasions, the time required by a five-man crew to complete the entire operation, using the winch-lifted scoop, was ten minutes for each net. Obviously the greatest time-consuming process is that of removing the fishes from the head, and where small dip nets are handled manually, or the catch is large, or rough weather prevails, the time required is increased.

The pound-net fishermen actively engaged in the work normally visit the nets once every 24 hours when fishing is good. These visits are made on the slack of

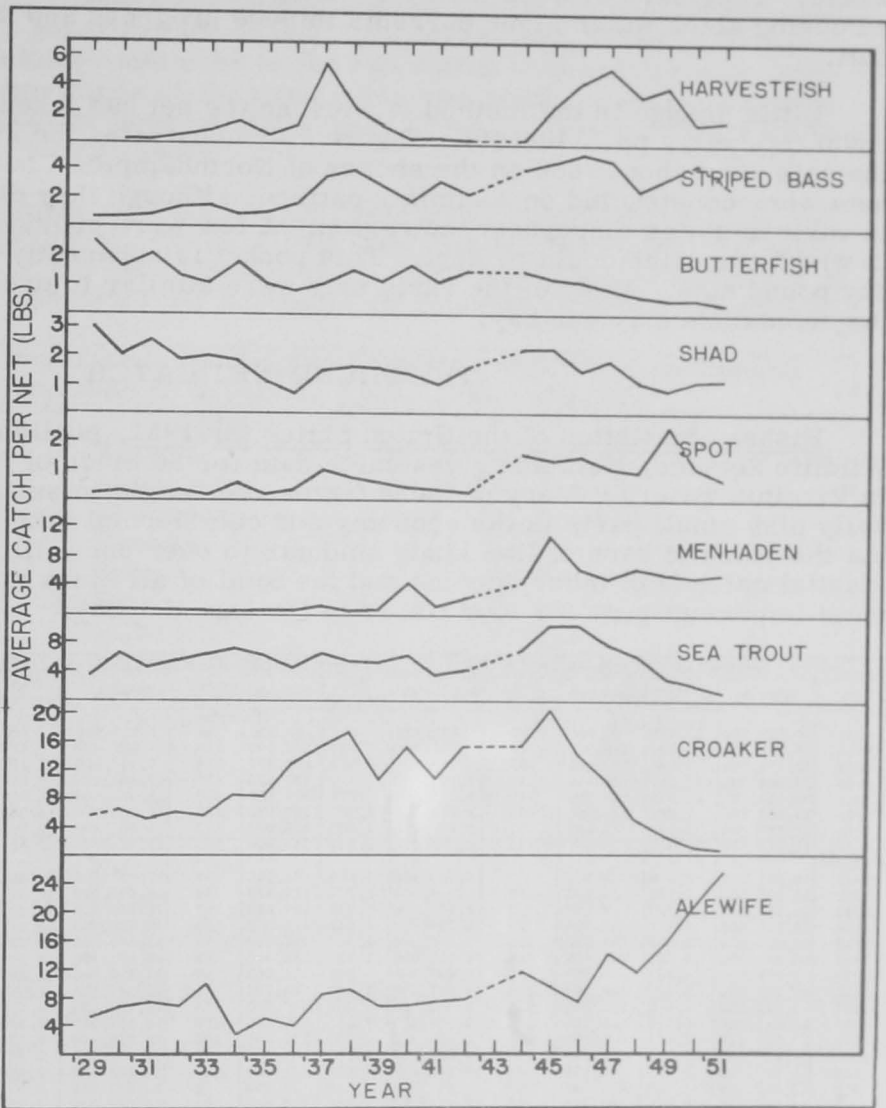


Fig. 9 - Average annual catch of nine species per licensed pound net, 1929-1951. Catch shown in thousands of pounds except for harvestfish and striped bass which are shown in hundreds. Dotted lines indicate no data.

low tides occurring between about 4:00 a. m. and about 9:00 a. m. As the time of low water slack passes 9:00 a. m. the fishermen start again at the earlier slack water. They seldom work the nets during later daylight hours. The nets are worked during slack water since currents impede progress and make the handling difficult.

Little change in the method of working the net has taken place since Earll's account (*op. cit.*, pp. 548-549). Figure 2 demonstrates the general construction of the nets used about 1890 on the shores of Northhampton County, Va. All the early nets were constructed on a similar pattern, although they differed in size and shape in various states throughout the region. A few were provided with pockets (fig. 2) in which the catch could be kept. This pocket is apparently omitted from present-day pound nets. Many of the early nets were similar to present-day models in that they contained only one bay.

THE POUND-NET CATCH

Fishery Statistics of the United States for 1951, published by the U. S. Fish and Wildlife Service, lists and gives catch data for 36 kinds of fishes taken in pound nets in Virginia waters. Many of these fishes are caught in small quantities and individually play small parts in the economy and commercial take of the pound-net fisheries, but the catch of each of five kinds amounts to over one million pounds yearly. Substantial catches of other species and the total of all kinds make the pound net the most important gear for food fishes in Chesapeake Bay.

Table 1 - Quantity Landed and Average Catch Per Net for Twelve of the Most Abundant Fishes in Virginia Pound-Net Catches in Recent Years

Year	Alewife		Bluefish		Butterfish		Catfish		Croaker		Flounder		Harvestfish	
	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net
1951	30,738,700	25,446	91,800	76	503,100	416	48,900	40	1,170,400	969	279,000	231	194,500	151
1950	26,994,300	20,404	179,900	136	758,200	573	153,600	116	1,938,700	1,465	343,800	260	185,700	140
1949	20,591,300	15,925	200,400	155	765,200	592	224,700	174	4,103,800	3,174	447,400	346	525,300	406
1948	17,209,500	11,550	169,200	120	1,102,000	740	169,400	114	7,983,100	5,358	413,900	278	576,100	387
1947	20,153,700	14,385	167,000	119	1,371,400	979	327,000	233	15,369,600	10,970	417,500	298	732,600	523
1946	10,043,600	7,661	125,500	96	1,582,400	1,207	137,900	105	18,397,900	14,033	396,000	302	554,600	423
1945	12,685,200	9,523	88,900	67	1,686,200	1,266	229,900	173	27,601,700	20,721	399,700	300	368,400	277
1944	16,113,500	11,822	22,500	16	2,068,000	1,517	245,600	180	21,168,200	15,531	249,300	183	14,200	10
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	9,071,200	7,916	7,600	7	1,780,400	1,554	61,100	53	17,937,800	15,652	125,000	109	38,400	33
1941	11,696,000	7,720	18,100	12	1,914,500	1,264	113,400	74	16,478,600	10,877	220,500	146	60,900	40
1940	11,263,200	6,927	7,500	5	2,881,600	1,772	109,000	67	24,865,600	15,292	193,100	119	65,400	40
1939	14,715,800	7,617	51,600	27	2,399,800	1,242	157,500	81	29,938,200	10,211	188,700	98	260,400	135
1938	17,504,900	9,356	193,000	103	2,850,900	1,524	177,900	95	33,080,800	17,681	298,200	159	448,500	240
1937	14,399,600	8,695	344,000	208	1,866,000	1,127	159,200	96	25,133,300	15,177	313,100	189	1,076,600	650
1936	7,875,700	4,141	256,900	140	1,607,700	845	74,600	39	21,316,400	11,207	153,400	80	235,600	124
1935	10,299,000	5,149	308,700	154	2,241,200	1,120	122,700	61	16,567,400	8,283	239,400	119	126,200	63
1934	5,540,300	3,060	786,200	434	3,308,500	1,827	210,700	116	15,700,100	8,674	472,200	260	262,800	145
1933	19,071,306	10,144	595,160	316	2,220,455	1,181	202,855	108	10,881,977	5,788	281,890	149	160,056	85
1932	13,768,672	6,819	460,389	228	2,887,760	1,430	213,741	106	12,358,846	6,121	557,599	276	93,988	47
1931	17,128,015	7,757	306,043	138	4,808,106	2,177	40,000	18	11,542,648	5,227	625,510	283	400	18
1930	15,220,718	6,728	206,166	91	3,668,698	1,621	32,300	14	14,492,421	6,406	258,450	114	400	18
1929	12,369,106	5,647	443,943	202	5,519,892	2,502	34,600	16	13,079,985	5,972	277,648	127	-	-
1920	14,998,345	7,969	109,475	58	3,012,997	1,600	137,025	73	14,628,950	7,773	235,430	125	-	-

Year	Menhaden		Gray Sea Trout		Shad		Spot		Striped Bass		White Perch		Nets
	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	Quantity Landed	Avg. Per Net	
1951	7,019,800	5,811	1,252,100	1,036	1,650,800	1,366	931,800	771	364,500	302	96,100	79	1,208
1950	6,925,200	5,234	2,980,700	2,253	1,573,700	1,189	1,468,600	1,110	619,900	468	133,300	101	1,323
1949	77,330,800	5,670	4,501,000	3,481	1,220,600	944	3,246,900	2,511	481,200	372	139,800	108	1,293
1948	9,591,800	6,437	9,121,000	6,121	1,763,100	1,183	1,466,600	984	418,500	281	121,900	82	1,490
1947	7,239,100	5,167	11,063,100	7,783	2,708,700	1,933	1,573,900	1,123	696,500	497	191,100	136	1,401
1946	8,659,600	6,605	13,449,000	10,258	1,994,700	1,521	2,035,100	1,552	701,700	535	148,800	113	1,311
1945	14,819,600	11,126	13,436,000	10,087	3,068,900	2,304	1,952,500	1,466	635,000	477	149,800	112	1,332
1944	5,598,700	4,108	8,857,600	6,499	3,250,900	2,385	2,206,600	1,619	576,300	423	63,600	47	1,363
1943	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	2,569,400	2,242	4,768,500	4,161	2,032,900	1,774	337,300	294	293,200	256	120,800	105	1,146
1941	1,948,300	1,286	5,583,400	3,685	1,652,700	1,091	590,000	389	519,000	343	88,700	58	1,515
1940	7,158,100	4,402	10,344,600	6,362	2,435,100	1,498	782,200	481	311,300	191	86,100	53	1,626
1939	1,016,400	526	10,389,800	5,377	3,183,100	1,648	1,263,900	654	610,800	316	84,600	44	1,932
1938	1,408,500	753	10,577,400	5,653	3,242,100	1,733	1,601,200	856	774,400	414	167,500	89	1,871
1937	2,202,000	1,330	11,108,000	6,708	2,782,400	1,680	1,702,000	1,028	624,100	377	98,900	60	1,656
1936	1,661,700	873	8,987,800	4,725	1,374,700	723	643,700	338	335,200	176	74,500	39	1,902
1935	1,850,000	925	12,660,900	6,330	2,490,800	1,245	277,800	138	227,900	114	103,300	52	2,000
1934	869,200	480	12,950,800	7,155	3,543,300	1,957	1,101,400	609	181,800	100	147,000	81	1,810
1933	647,400	344	11,754,540	6,252	3,902,955	2,076	358,595	190	303,151	161	82,069	44	1,880
1932	1,565,000	775	11,336,817	5,615	3,818,541	1,891	606,994	300	327,037	162	102,047	50	2,019
1931	1,537,975	696	9,996,040	4,527	6,122,383	2,772	307,395	139	218,427	99	56,240	25	2,208
1930	888,000	393	14,660,362	6,481	4,639,844	2,051	589,235	260	192,550	85	58,100	26	2,262
1929	1,002,850	458	-	-	6,672,034	3,046	481,424	219	147,900	67	41,050	19	2,190
1920	6,233,920	3,312	-	-	5,524,823	2,935	490,476	260	221,773	118	59,966	32	1,882

1/ Not available.

Alewives (Pomolobus pseudoharengus and P. aestivalis) have for many years been one of the most important items taken in pound nets, and since 1947 they have been the most important fish in terms of total catch; the decline in croaker and sea trout catch probably being responsible for the rise in position, although the catch of alewives has in itself, generally increased. Alewives, processed mostly for canning, salting, and pickling, and used in the extraction of pearl essence, constituted approximately two-thirds of the total pound-net catch for 1951, although they represented only about 30 percent of the total value. Table 1 indicates a fairly steady increase in the alewife catch.

The only nonfood component of any importance in the pound-net catch is the menhaden (Brevoortia tyrannus). In 1951 this fish was second in quantity taken, representing 15 percent of the total pound-net catch but only about 2.5 percent of the total value. Table 1 indicates the increased importance of menhaden during

Table 2 - Order of Importance by Weight of the Principal Species Landed from Pound Nets in Virginia, 1929, 1949, and 1951

1951	1949	1929
1. Alewife	1. Alewife	1. Croaker
2. Menhaden	2. Menhaden	2. Alewife
3. Shad	3. Sea trout	3. Sea trout
4. Sea trout	4. Croaker	4. Shad
5. Croaker	5. Spot	5. Butterfish
6. Spot	6. Shad	6. Menhaden
7. Swellfish	7. Butterfish	7. Spot
8. Butterfish	8. Harvestfish	8. Bluefish
9. Striped bass	9. Striped bass	9. Flounder
10. Flounder	10. Flounder	10. Striped bass
11. Harvestfish	11. Catfish	11. Bonito, etc.
12. Hickory shad	12. Bluefish	12. Scup, porgies, etc.
13. White perch	13. White perch	13. Mackerel
14. Bluefish	14. Mackerel	14. White perch
15. Eels	15. Bonito, etc.	15. Catfish
16. Mullet	16. Drum	16. Drum
17. Carp	17. Scup, porgies, etc.	17.

and following World War II. As for alewives, the gain in prominence of menhaden may be a reflection of the decline in catches of sea trout and croakers. Table 1 shows an over-all increase in the menhaden catch from 1929 to 1951, with a peak during 1945. Table 2 indicates the rise in position of the catch from 1929 to 1951.

Gray sea trout or weakfish (Cynoscion regalis) and the spotted sea trout (Cynoscion nebulosus) are both taken in pound nets, although the first is by far the more abundant and important of the two. In 1951 the catch of gray sea trout was reported as 1,252,100 pounds, while only 37,900 pounds of spotted sea trout were caught. The gray sea trout catch remained generally constant and high (except 1941-1944) until a decline began in 1948 (table 1). The decrease in catch has been rapid, and in 1951 the catch was the lowest in the history of the fishery. It is interesting that in 1929 gray sea trout ranked third in quantity taken by pound nets and held the same position in 1949, despite the conspicuous decline in catch (table 2). In 1951 gray sea trout had been replaced by shad in order of importance. In the same year, gray sea trout made up approximately 3 percent of the total pound-net catch and yet represented 13 percent of the commercial value of the catch for that year.

The catch of croaker (Micropogon undulatus) in pound nets has been irregular but showed considerable over-all increase from 1929 to 1945. The decline in catch since 1946 has been sharp, from 18,397,900 pounds in 1946 to 1,170,400 pounds

for 1951. Although in 1951 the croaker catch amounted to only about 2.5 percent of the total pound-net catch, the value of the species represented approximately 13 percent of the total worth.

The catch of spot (*Leiostomus xanthurus*) showed a conspicuous increase from 1944 to 1949. Table 1 demonstrates that prior to 1935 the catch usually amounted

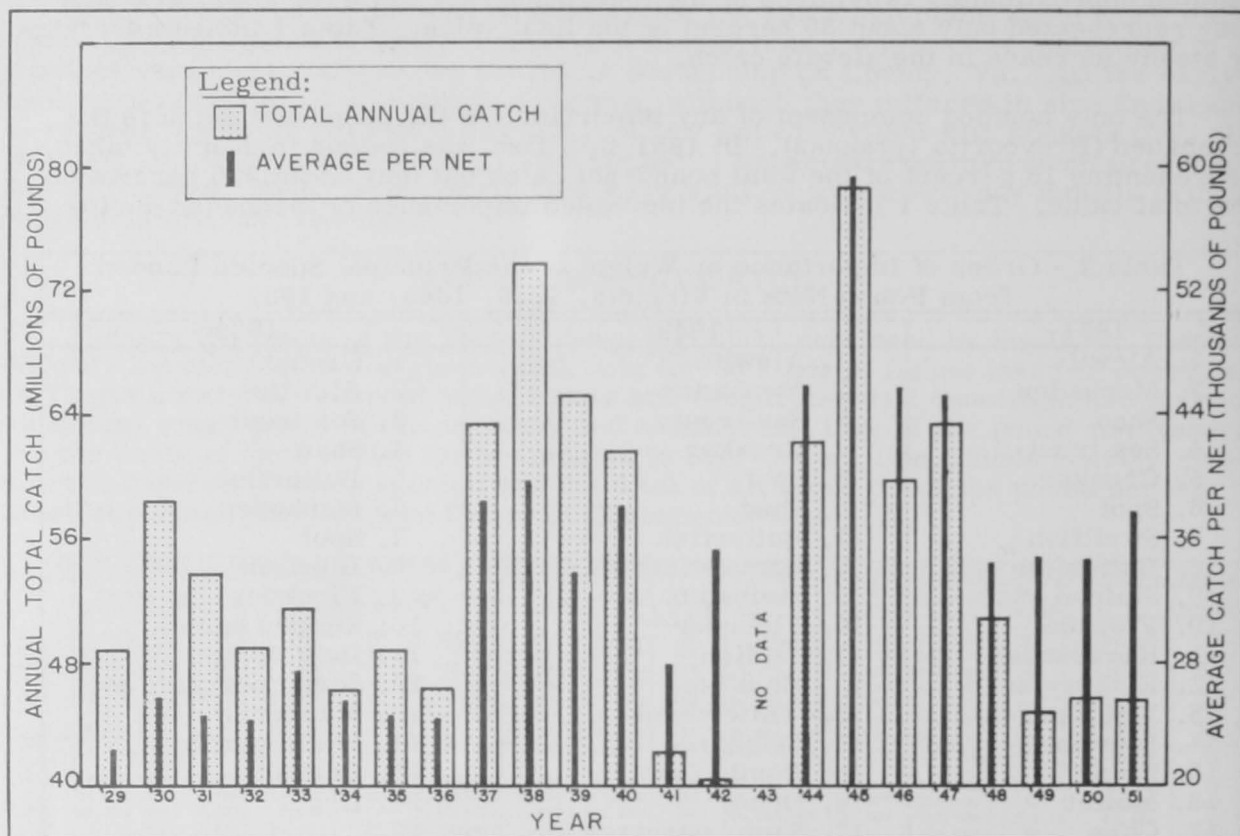


Fig. 10 - Total annual fish catch and average catch per pound net in Virginia, 1929-1951.

to approximately 500,000 pounds or less, whereas in 1944 the catch was 2,206,600 pounds, and in 1949 over 3 million pounds. However, the 1951 catch of spot was only 931,800 pounds.

In 1951 the catch of swellfish (*Sphoeroides maculatus*) increased significantly. Table 2 shows that this species was ranked seventh in order of importance by weight landed during 1951--515,400 pounds were reported.

Although the catch of butterfish (*Poronotus triacanthus*) has declined considerably since 1948, it has been an important part of the pound-net catch--503,100 pounds were caught in 1951. *Fishery Statistics* presents data separately for the butterfish and a similar species, the harvestfish (*Peprilus alepidotus*), yet personal observations in local fish houses revealed that both are lumped together in receiving the fishes from the fishermen.

Striped bass (*Roccus saxatilis*), flounders (mostly *Paralichthys dentatus*), catfishes (*Ictalurus catus* and *I. punctatus*), and bluefish (*Pomatomus saltatrix*) complete a list of the more important species in the pound-net catch. Each of these was represented by less than 500,000 pounds in 1951.

Figure 9 illustrates graphically the average pound-net catch of the nine species taken in greatest quantities, based on the yearly catch data from table 1 and the number of pound nets reported in Fishery Statistics. The over-all trends and fluctuations follow closely the total catch data from table 1 and again point up the decline in the catches of croaker, sea trout, and shad since about 1945. The reliability of the figures in terms of catch per unit of effort is open to conjecture, however, and such interpretation should be approached cautiously. The number of nets per year are those reported by Fishery Statistics and are based on licenses granted by the State. Obviously, some of the nets are used solely for shad in the spring of the year and perhaps contribute little to the take of other fishes. Also, although the license may be granted, the nets may be fished with varying degrees of intensity.



Fig. 11 - Making fast the down-haul lines at the end of a day's fishing.

By way of providing a test of the results indicated from the Fishery Statistics data, information on the catches of three species and the numbers of nets fished was obtained from a local fisherman (table 3). These data may present a more reliable picture of the catch per unit of effort of pound-net fishing. The local catches often are considerably greater than the averages in table 1 and figure 4. Again, various factors such as local abundance of the species, skill of the fishermen, location and construction of the nets, and like elements may account for the differences between Fishery Statistics data and the local report rather

Table 3 - Quantity Landed and Average Catch Per Net for Three Species, from Personal Records of a Virginia Fisherman

Year	Croaker		Spot		Sea Trout		Number of Nets
	Total Catch	Catch Per Net	Total Catch	Catch Per Net	Total Catch	Catch Per Net	
	(Pounds)						
1951	5,091	1,697	6,627	2,209	26,728	8,909	3
1950	5,908	1,477	16,041	4,010	43,265	10,816	4
1949	952	238	4,954	1,238	11,814	2,953	4
1948	15,800	3,950	9,276	2,319	81,680	20,420	4
1947	141,205	35,201	5,017	1,254	59,408	14,852	4
1946	174,274	43,568	8,220	2,055	89,188	22,297	4
1945	162,214	32,443	13,641	2,728	112,639	22,528	5
1944	190,329	38,066	9,882	1,986	100,469	20,094	5
1943	263,973	65,993	3,213	803	74,982	18,746	4

than the general nature of the reported numbers of nets mentioned earlier. The fluctuations in yearly catch, shown in the local records, correspond rather closely to those shown in table 1, particularly in depicting the decrease in trout and croaker catches. The local data do not agree, however, with table 1 in showing an increase in the catch of spot in 1949.

Figure 10 illustrates the total annual catch in pounds of fish with the average catch per net superimposed. The raw data are given in table 4. It appears that, since 1941, the catch per unit of effort has increased and that fewer nets are catching more fish. Such a trend may be a reflection of increased efficiency of the gear,



Fig. 12 - Unloading the day's catch. In April, shad are an important item.

fluctuations in abundance of fishes, more intensive and sustained fishing, the manner in which statistical data are compiled and reported, competition between units of gear, or combination of these and other factors; at any rate a most interesting question is posed.

The size ranges of the different fishes taken in 8 pound nets in July 1953 in Virginia waters appeared, in general, to be rather consistent. Obviously the size range of a given species caught in the pound net is, to some extent, representative of seasonal and local size variations. Thus, the length frequencies presented in table 5 are those of fishes taken in a particular locality and in July; such data are not necessarily representative of the total seasonal catch. From these data it appears that, in this catch at least, the smallest fishes caught ranged from 108 mm., total length, upward. In table 5 it is seen that the smallest sizes (standard lengths) of commercially-important species were about 170 mm. for trout, 110 mm. for spot, 115 mm. for butterfish, 205 mm. for croaker, and 135 mm. for menhaden.

One method by which the selectivity of the gear could be examined would be to compare the sizes of fishes in the pound nets with sizes of fishes caught by trawl or other gears in the vicinity. For example, it was established by exploratory collecting that spot smaller than 108 mm. were abundant in the general vicinity of the pound nets examined, yet the small fish did not appear in the pound-net catch. This might mean that fish smaller than 108 mm. escaped through the pound-net mesh, or that the smaller individuals did not react in the same manner as larger fish to the different types of gear. Similarly, croakers much smaller than those in the pound-net catch were present in various parts of the Bay. Most of the trout in the catch ranged from 168 mm. to 342 mm. in total length. Where the legal size limit for trout is

Year	Number of Nets	Total Catch		Value
		Lbs.	Average Per Net	
1951	1,208	45,612,100	37,758	1,440,664
1950	1,323	45,758,700	34,587	1,822,838
1949	1,293	44,888,600	34,716	2,093,306
1948	1,490	50,966,300	34,205	2,651,221
1947	1,401	63,142,000	45,069	3,612,293
1946	1,311	59,654,900	45,503	3,875,896
1945	1,332	78,750,300	59,121	6,329,996
1944 ^{1/}	1,363	62,170,900	45,613	2,575,154
1943 ^{1/}	-	-	-	-
1942	1,146	40,171,100	35,053	909,638
1941	1,515	42,246,900	27,885	917,032
1940	1,626	61,884,900	38,059	1,067,306
1939	1,932	65,260,500	33,778	1,203,126
1938	1,871	73,923,900	39,510	1,265,750
1937	1,656	63,418,600	38,296	1,117,732
1936	1,902	46,328,500	24,357	662,258
1935	2,000	48,892,900	24,446	784,050
1934	1,810	46,103,200	25,471	963,924
1933	1,880	51,405,955	27,343	991,771
1932	2,019	48,966,629	24,252	1,103,661
1931	2,208	53,900,463	24,411	1,669,155
1930	2,262	58,526,725	25,873	2,136,738
1929	2,190	48,848,188	22,305	2,405,507
1920	1,882	59,554,037	31,644	2,448,853

^{1/} Not available.
 Note: Data for 1920, 1929-1938, from *Fishery Industries of the U. S.*, U. S. Bureau of Fisheries, Washington, D. C.
 Data for 1939-1962, from *Fishery Statistics*, U. S. Fish and Wildlife Service, Washington, D. C.

nine inches (229 mm.), it would appear that many undersized fish were being caught. The legal size for butterfish is six inches (152 mm.), thus the catch generally appeared to be in order. The seven-inch (178 mm.) limit for croaker was well observed in the pound-net catch examined.

Table 5 - Length-Frequency Distributions of Five Species Caught by Three Pound Nets in July 1953 in the Lower York River, Virginia

Sea Trout		Croaker		Menhaden		Spot		Butterfish	
Lengths (mm.)	Number of Fish	Lengths (mm.)	Number of Fish	Lengths (mm.)	Number of Fish	Lengths (mm.)	Number of Fish	Lengths (mm.)	Number of Fish
168-72	2	203-07	1	133-37	1	108-12	1	113-17	1
178-82	1	208-12	3	183-87	1	198-02	1	143-47	1
183-87	1	213-17	1	188-92	3	203-07	1	148-52	3
188-92	1	218-22	6	193-97	4			153-57	3
193-97	4	223-27	4	198-02	3			158-62	6
198-02	1	228-32	5	203-07	8			163-67	8
203-07	3	233-37	7	208-12	8			168-72	4
208-12	2	238-42	10	213-17	1			173-77	3
213-17	2	243-47	3	218-22	2			178-82	3
223-27	1	248-52	9	223-27	3			183-87	2
233-37	2	253-57	7	233-37	2			188-92	1
243-47	2	258-62	4	243-47	2			193-97	1
323-27	1	263-67	2	248-52	1				
338-42	1	278-82	1	253-57	4				
		283-87	1	263-67	1				
				268-72	1				

Note: All lengths are total lengths.

ACKNOWLEDGMENT

Grateful acknowledgment is expressed to the staff of the Virginia Fisheries Laboratory, Gloucester Point, Va., for their cooperation and help. Particular appreciation is expressed to Dr. J. L. McHugh, Director, and to William Massmann, for editorial criticisms. Dexter Haven generously gave of his time in introducing the author to the area.

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SEAL HUNTING BY AIR

A veteran sealing captain is the eyes of Newfoundland's sealing expeditions. From an airplane he searches the ice floating southward from the Arctic waters for seals. Upon sighting the seals and their pups he broadcasts their position to the ships of the sealing fleet, saving hours of search by the vessels themselves. The captain has been sealing for 60 years, since he first joined the fleet at the age of 12.

--Trade News, March 1954