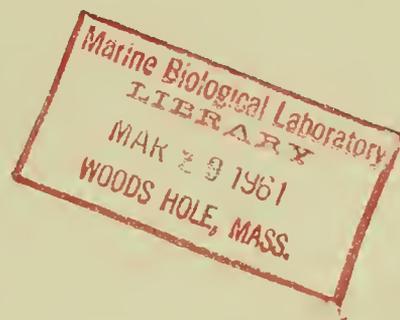


**AGE AND SIZE COMPOSITION OF THE
MENHADEN CATCH ALONG THE ATLANTIC COAST
OF THE UNITED STATES, 1957**

WITH A BRIEF REVIEW OF THE COMMERCIAL FISHERY



SPECIAL SCIENTIFIC REPORT-FISHERIES No. 373

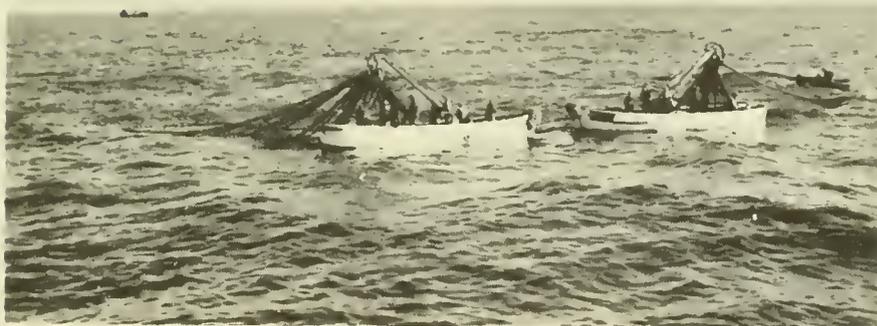
United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner
Bureau of Commercial Fisheries, Donald L. McKernan, Director

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by

Fred C. June



United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 373

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ABSTRACT

The 1957 purse-seine catch of Atlantic menhaden (*Brevoortia tyrannus*) amounted to 632,000 tons, 91 percent of which was taken in the "summer" fishery. Landings in the Middle Atlantic Area accounted for the greatest share (54 percent) of the total for the coast. Total fishing effort (31,600 sets) was the highest in 3 years, and average catch per unit of effort amounted to 20 tons per set as compared with 26 tons in 1955 and 1956.

Samples from the catches showed that the 1955 and 1956 year classes (fish of ages 2 and 1) were about equally represented and together constituted over four-fifths of the total catch of 3.6 billion fish. The 1956 year class (age-1 fish) provided most of the catch in the South Atlantic and Chesapeake Bay Areas; the 1955 year class (age-2 fish), accounted for the greatest share of the catch in the Middle and North Atlantic Areas; and the 1957 year class (age-0 fish) contributed the greatest number of fish to the fall catch off the coast of North Carolina. Fish of the dominant age groups in the summer catches in the various areas were shorter in length and lighter in weight than those of the same ages in the previous 2 years. Variations in the contributions of recent year classes are discussed.

INTRODUCTION

This is the third in a series of reports which summarizes data resulting from an annual catch-sampling program conducted by the Bureau of Commercial Fisheries on the menhaden

stocks¹ along the Atlantic coast of the United States. The Gulf menhaden fishery is not treated in this paper. The immediate objective of the catch-sampling program is to furnish data for measuring variations in composition

Note.--Fred C. June, Fishery Research Biologist, Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Beaufort, North Carolina.

¹A stock, as used in this report, is defined as a group of fish belonging to a single species which occurs in a fishable concentration in a given area of the coast during a given period of the year.

of the catch. The work constitutes the primary phase of an investigation aimed at determining the effects of fishing and natural factors on the menhaden resource.

This report includes a review of the 1957 purse-seine fishery; measures of total catch, fishing effort, and catch per unit of effort, together with information on the geographical distribution of fishing effort; summary data on the number, age, length, weight, and sex of Atlantic menhaden (*Brevoortia tyrannus*) caught by purse seines in 1957; and a brief discussion of the observations. The review of fishing activities and summaries of data pertaining to the "summer" fishery are referred to the four geographical areas

shown in figure 1; the North Carolina "fall" fishery is treated separately.

The continued cooperation of menhaden reduction plant owners and operators who provided space and facilities for processing of the catch samples and furnished records of vessel landings is gratefully acknowledged. Thanks are due to the vessel captains and pilots who furnished logbooks of their daily fishing activities; without these records, most of the information on the location and amount of fishing would have been lacking.

Catch samples were obtained by temporary field assistants stationed at the various reduction plant locations. Joseph R. Higham was responsible for the age determinations and assisted in the supervision of the catch-sampling program. George Rawlings compiled the fishing effort data from vessel log records. Mary K. Hancock was responsible for the compilation of the biostatistical data and assisted in their analysis.

THE 1957 PURSE-SEINE FISHERY

The 1957 purse-seine catch of Atlantic menhaden, 632,000 tons, was the smallest produced in the past 3 years (table 1)²; 576,000 tons were taken in the "summer" fishery (late March to mid-October) and 56,000 tons in the North Carolina "fall" fishery (mid-November to mid-January 1958).³ In the summer fishery, catches were

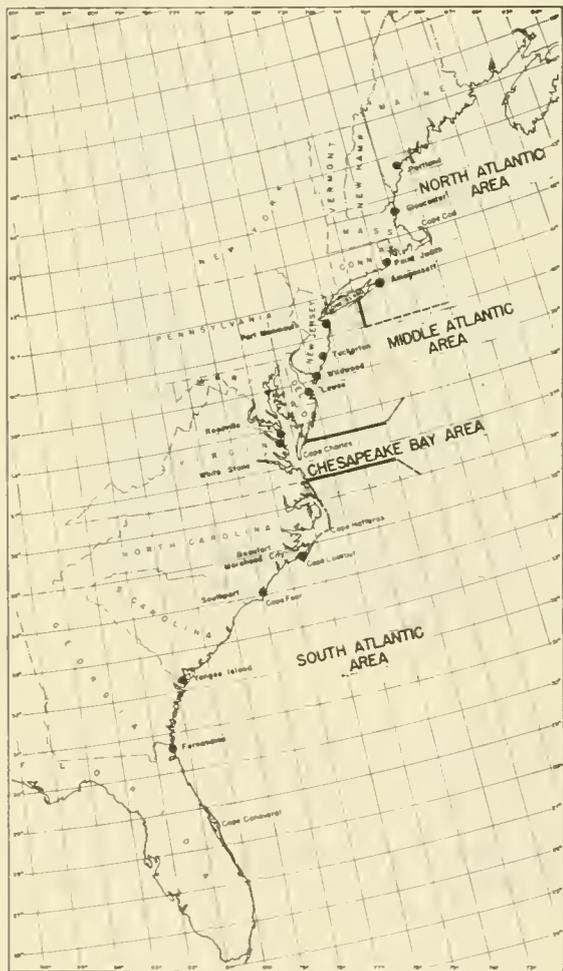


Figure 1.--Areas used in summarizing Atlantic menhaden catch data.

²The pound-net catch of Atlantic menhaden in 1957 amounted to about 25,000 tons; miscellaneous gears, including gill nets, haul seines, fyke nets, and otter trawls, accounted for an additional 2,000 tons. Because of the lack of adequate statistics, the pound-net fishery was not discussed as in previous reports in this series.

³For convenience, the activities of the menhaden purse-seine fishery have been grouped into two arbitrary time periods. The "summer" fishery or season is considered to commence with the appearance of schools in the surface waters along the coast, generally, sometime between April and June and terminates with their disappearance from the surface waters, usually in October. The "fall" fishery or season begins with the reappearance of large, migrating schools in the surface waters off Cape Hatteras, N. C., in November and terminates when the fish vanish off Cape Fear, N. C., in late December or early January.

TABLE 1.--Catch, total fishing effort, and catch per unit of effort of the Atlantic menhaden purse-seine fishery, 1955-57

Season and area	Catch in thousands of tons			Total fishing effort (number of sets) ¹			Average catch per purse-seine set (tons)		
	1955	1956	² 1957	1955	1956	1957	1955	1956	1957
SUMMER FISHERY									
South Atlantic.....	48	73	38	2,526	3,042	2,375	19	24	16
Chesapeake Bay.....	153	89	118	5,667	6,357	8,428	27	14	14
Middle Atlantic.....	328	402	342	13,120	14,357	15,545	25	28	22
North Atlantic.....	83	95	78	2,862	2,714	3,250	29	35	24
Subtotal.....	612	659	576	24,480	26,360	30,316	25	25	19
FALL FISHERY									
North Carolina.....	73	81	³ 56	1,872	2,531	1,474	39	32	38
Total.....	685	740	632	26,346	28,462	31,600	26	26	20

¹ Slight discrepancies in numbers as given in previous reports and in subtotals and totals due to rounding off of figures.

² Source: Fishery Statistics of the United States, 1957. By Edward A. Power, U. S. Fish and Wildlife Service, Statistical Digest No. 44, 429 pp.

³ The North Carolina fall fishery normally extends into January, therefore, catch total includes January 1958, but not January 1957. Seasonal breakdown of the catch obtained from U. S. Fish and Wildlife Service. C.F.S. Nos. 1742 and 1991.

below those of the previous year in all areas except Chesapeake Bay, and in the North Carolina fall fishery the catch reached the lowest level in three seasons. As in previous years, the Middle Atlantic Area provided the greatest share of the total catch (54 percent), while the South Atlantic Area contributed the least (7 percent).

Total fishing effort amounted to 31,600 sets, an 8 percent increase over that in 1956 (table 1).⁴ Effort in the summer fishery (30,316 sets) was 15 percent greater than that in 1956, but in the North Carolina fall fishery (1,474 sets), it was 42 percent less than that in the previous year. Catch per unit of effort averaged 20 tons per set as compared with 26 tons in 1955 and in 1956. Average catch per unit

of effort in the summer fishery was below that of the previous 2 years in all areas except Chesapeake Bay, but in the North Carolina fall fishery it exceeded that in 1956 and nearly equaled that in 1955.

There were 133 vessels engaged in the summer fishery (130 vessels in 1956) and 63 in the fall fishery off North Carolina (59 vessels in 1956). Thirty-eight airplanes, or an average of about one airplane for every three vessels, were employed for locating fish and directing the setting of the seine around a school.

As a result of tests conducted during 1956, the "power block", a mechanical gear for hauling the seine aboard the purse boats, was adopted by about half of the fleet operating in Chesapeake Bay in 1957. Crews aboard those vessels equipped with the "power block" were reduced from 28 to an average of 13 men. It was estimated

⁴ Logbook data upon which catch per unit of effort calculations were based represented 52 percent of the purse-seine catch; adjustments were made to account for the total catch.

that use of this gear also shortened the time required in "drying up" the net by about 6 minutes per set.

South Atlantic Area

Purse-seine fishing in the South Atlantic Area began on March 23 off Fernandina Beach, Fla., but only occasional catches were made in this locality during the remainder of the month and through most of April. Numerous schools were encountered in the inshore waters between Jacksonville, Fla., and Brunswick, Ga., during May, but they were reported to be small and difficult to catch. Stormy weather further impaired fishing during this period. Between April 24 and June 5, there were only 15 days on which vessels were able to go to sea. In late May, 3 of the 14 vessels fishing out of Fernandina shifted to Yonges Island, S. C., and in early June additional vessels left for the Gulf of Mexico. Only 4 vessels remained at Fernandina after June 8, and most of the landings during the month were contributed by a single vessel. Fishing during July was concentrated in St. Simon Sound, Ga., and St. Helena Sound, S. C., and catches in these localities were the heaviest of the season. Catches progressively declined during August and September, and fishing terminated on October 9 at Fernandina and on October 17 at Yonges Island.

Fishing by the North Carolina fleet (17 vessels) began during the last week in April off Southport and during the following week off Beaufort. Southport vessels encountered numerous schools in the vicinity of Cape Fear during the first 2 weeks of the season, but adverse weather interrupted fishing during the second week in May, and total landings during the month were unusually light. On June 3, Southport vessels shifted to South Carolina waters, and during the following 3 weeks, productive fishing occurred from Myrtle Beach to Georgetown, S. C. Schools became scarce in this locality during the last week of June, and the vessels returned to North Carolina waters. Adverse weather prevailed in the vicinity of Cape Fear

during the last 3 weeks in July, and only five landings were made at Southport during this period. Except for 2 weeks of moderately good fishing in this locality in August, landings through the remainder of the season were small and infrequent. The last landing at Southport was made on October 18. The first catches of the summer season in the vicinity of Beaufort were made on May 6 when schools appeared in abundance from New Topsail Inlet to Cape Lookout. Four days later the fish vanished, and few schools were encountered in ocean waters off Beaufort through the remainder of the summer. With the absence of the schools in "outside" waters, the Beaufort fleet began fishing in Core and Bogue Sounds (primarily in Core Sound). Although catches were small, they were recorded almost daily from June 1 through September 26. The schools disappeared following a period of heavy rainfall in late September and early October, and few fish were encountered in these waters again until November when the appearance of the large, migrating schools marked the beginning of the fall fishing season.

The summer catch in the South Atlantic Area amounted to 38,000 tons as compared with 73,000 tons in 1956 and 48,000 tons in 1955. June provided the greatest share of the summer catch (37 percent), followed by July (19 percent), May and August (14 percent each), September (10 percent), April (4 percent), October (2 percent), and March (1 percent). Catch per unit of effort averaged 16 tons per set as compared with 19 tons in 1955 and 24 tons in 1956.

Chesapeake Bay Area

The purse-seine season in Chesapeake Bay officially opened on May 27,⁵ with fishing by 24 vessels concentrated in the lower Bay in the vicinity of Cape Charles. Relatively small schools were encountered in abundance along the eastern shore and in the central part of the Bay through most

⁵ Virginia law prohibits purse-seining in Virginia waters prior to the last Monday in May.

of the season. The schools began to disappear in these localities during the second week in October, and, except for sporadic catches, most of the fishing through the closing weeks of the season was conducted from Cape Charles northward to southern Long Island. The last landings of the season were made on October 25.

The purse-seine catch in the Chesapeake Bay Area amounted to 118,000 tons as compared to 89,000 tons in 1956 and the recent record of 153,000 tons in 1955. July landings accounted for 26 percent of the season's total, while June, August, and September respectively accounted for 22, 20, and 24 percent. Catch per unit of effort averaged 14 tons per set, the same as in the previous year, but this was considerably less than that in 1955 (27 tons per set).

Middle Atlantic Area

Fishing began in the Middle Atlantic Area on May 22 when small, scattered schools were located simultaneously in Delaware and Raritan Bays. During the following 3 weeks a fleet of 47 vessels scouted the waters from Long Island to Cape Charles, but catches were spotty throughout the area. In mid-June, schools suddenly appeared in abundance along the coast from Ocean City, Md., to Sandy Hook, N. J. After a week of productive fishing, the schools became scarce, but reappeared in abundance during the first week in July. As the season advanced, schools often would disappear in the inshore waters and occur far offshore, but fishing in the deeper waters was relatively unproductive. As a result, catches during most of July and August were highly variable. Catches were small through most of September, but during the second week in October, large schools of migrating fish appeared along the coast of southern Long Island and individual vessel catches sharply increased. From October 8 through October 25, fishing by the entire Middle Atlantic fleet, together with vessel from Amagansett, N. Y., and Chesapeake Bay, was concentrated between Seaside Park, N. J.,

and Fire Island, N. Y. Landings from these waters during the last 2 weeks of the season amounted to over 75,000 tons, the largest recorded for any similar period during the season. The large, migrating schools were last encountered about 25 miles offshore, between Townsends Inlet and Asbury Park, N. J., on October 25. One additional purse-seine set was made on a school of young-of-the-year fish off Beach Haven, N. J., on October 29.

A catch of 342,000 tons was 60,000 tons below that of the previous year, but 14,000 tons greater than that in 1955. Twenty-eight percent of the catch was taken in July; May, June, August, September, and October respectively accounted for 2, 17, 20, 14, and 19 percent. Catch per unit of effort averaged 22 tons per set, the lowest in 5 years.

North Atlantic Area

The purse-seine fishery in the North Atlantic Area got underway during the second week in June, with 10 vessels fishing out of Amagansett, N. Y.; 2 out of Point Judith, R. I.; and 4 out of Gloucester, Mass. By the first week in July, 2 additional vessels had entered the fishery at Point Judith, and 10 vessels were added to the fleet at Gloucester. In late July, 3 vessels began fishing in the vicinity of Portland, Maine.⁶

Fishing by the Amagansett vessels was conducted along the eastern end of Long Island during the first 5 weeks of the season, and catches were highly variable. The fish disappeared in this locality during the second week in July, and the fleet shifted to Massachusetts waters where numerous schools had been reported in Nantucket Sound. The heaviest catches of the season were made in the vicinity of Cape Cod during the week of July 15-20, but in the following week the schools

⁶With one exception, vessels employed in the menhaden fishery at Point Judith, R. I.; Gloucester, Mass.; and Portland, Maine, were small to medium-size otter trawlers which converted to purse-seining during the summer months.

were scattered and difficult to catch. The Amagansett fleet returned to New York waters where schools again were encountered off the eastern end of Long Island. Fishing continued in Long Island waters through the close of the season (October 23).

Fishing in Narragansett Bay by Point Judith vessels was relatively unproductive until the second week in July. Schools which subsequently congregated in the upper reaches of the Bay provided consistently good catches through the remainder of the summer. The last landings at Point Judith were made on October 23.

Early season landings at Gloucester were extremely light, with fishing restricted to the eastern end of Cape Cod. During the first week in July, however, schools became increasingly abundant in Massachusetts and Plymouth Bays, and during the following 4 weeks good catches were made almost daily in these localities. Schools became scarce in early August, and, except for a week of fair fishing on several large schools of migrating fish encountered off the eastern end of Cape Cod in early September, landings during the remainder of the season were generally poor. Fishing terminated in this locality on September 24.

Although schools appeared to be fairly numerous in Maine waters from late July through late August, vessel captains reported that they were deep and difficult to catch. Only eleven landings were recorded at Portland during the entire season, all of which originated in the vicinity of Casco Bay.

The purse-seine catch in the North Atlantic Area amounted to 78,000 tons. This was a decrease of 17,000 tons from that of the previous year and 5,000 tons below that in 1955. The July fishery provided the greatest share of the catch (29 percent), followed by August (25 percent), September (22 percent), June (13 percent), and October (11 percent). Catch per unit of effort amounted to 24 tons per set, the lowest in the past 3 years (36 tons in 1956 and 29 tons in 1955).

North Carolina Fall Fishery

The fall fishing season in North Carolina extended from November 14 through January 12, 1958, but 98 percent of the catch was taken in only 16 days of fishing between November 16 and December 28. Fishing during the first 2 weeks of the season was restricted to several huge schools of large fish which traveled slowly along the coast between Drum Inlet and Cape Lookout. Schools of smaller fish were present at the same time in the in-shore waters west of Cape Lookout, but these were largely ignored by the fleet. Adverse weather interrupted fishing during the first and second weeks in December when fish were reported by airplane pilots to be in greatest abundance on the grounds. When fishing resumed on December 16, most of the large fish had already migrated beyond the range of the fleet, and the catch from December 18 through the end of the season was contributed exclusively by young-of-the-year which had first appeared inside Cape Lookout in early December. A catch of 56,300 tons was only about two-thirds that of the previous year (81,000 tons) and the lowest since 1953. December landings accounted for 52 percent of the total for the season; November accounted for 45 percent, with the remainder contributed in January 1958. Catch per unit of effort, 38 tons per set, was about the same as in 1955 (39 tons per set), but greater than that in 1956 (32 tons per set).

Distribution of Fishing Effort

The geographical distribution of fishing effort by the purse-seine fleet in 1957 is shown in figures 2, 3, and 4 where the calculated number of purse-seine sets was plotted within 10-minute unit areas. It may be seen that fishing was conducted from the northeast coast of Florida northward to the central Gulf of Maine, with most of the catches made inside the 20-fathom contour. Unit areas in which fishing was concentrated (200 sets and over) were located in the vicinity of Fernandina, Fla., and Cape Fear, N. C.; in Chesapeake Bay and coastal waters

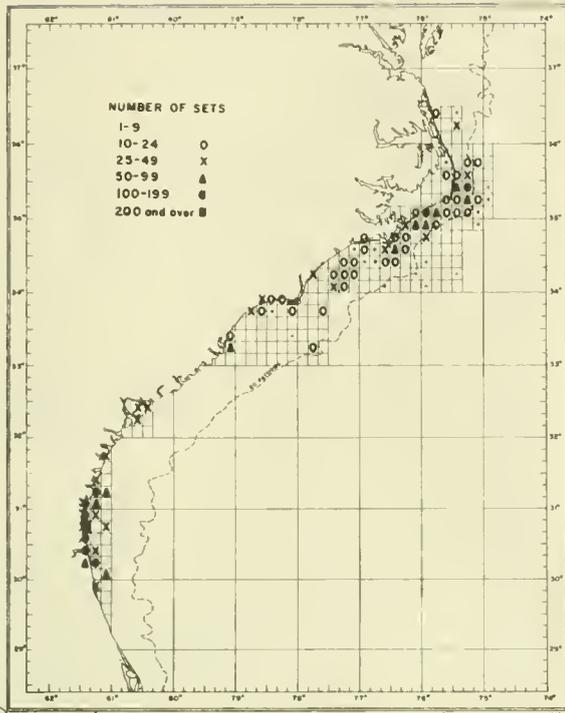


Figure 2.--Distribution of fishing effort in the South Atlantic Area, 1957.

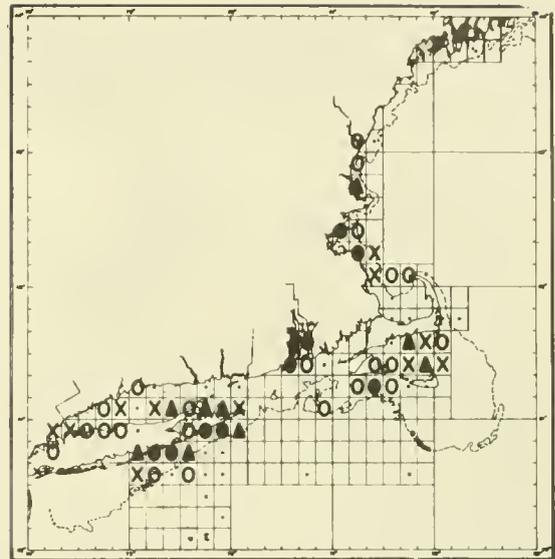


Figure 4.--Distribution of fishing effort in the North Atlantic Area, 1957.

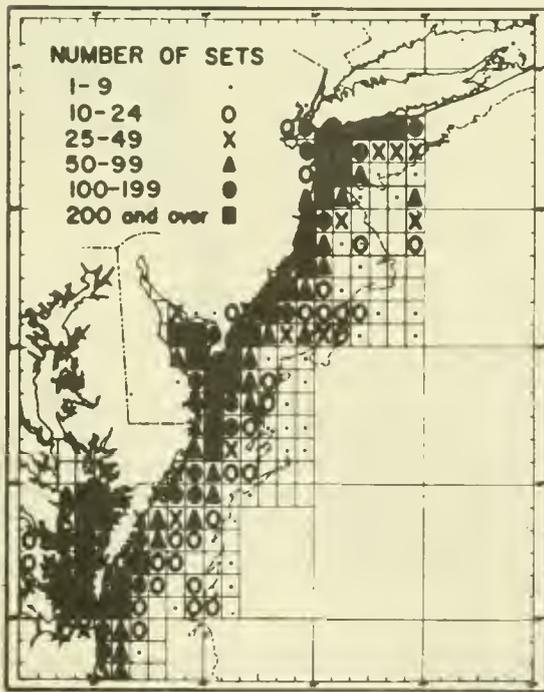


Figure 3.--Distribution of fishing effort in the Chesapeake Bay and Middle Atlantic Areas, 1957.

immediately north of Cape Charles; within a 10-mile wide coastal band extending from lat. $38^{\circ}10'$ N. (off Ocean City, Md.) northward (including Delaware Bay) to Fire Island on the southern coast of Long Island; and Narragansett Bay. About 65 percent of the total fishing effort was expended within these unit areas. Compared with the previous year, there were fewer sets made near the ends of the range, and the greatest reduction occurred in the vicinity of Fernandina, Fla., and in Massachusetts Bay. Other noteworthy changes from 1956 were (1) an increase in the amount of fishing inside Delaware Bay and (2) an offshore extension of fishing in the Middle Atlantic Area.

SAMPLING OF THE CATCH

The 1957 catch-sampling program was conducted throughout the range and season of the purse-seine fishery. The number of samples obtained at the various plant locations is given in table 2. While an attempt was made to sample the catch in the same proportion in each plant locality, practical limitations precluded close adherence to this objective. One sample was obtained for every 674 tons of fish

caught during the summer season and for every 1,000 tons during the North Carolina fall season. Methods of collecting and processing the samples followed those described in the first

report in this series (June and Reintjes, 1959).

Age Composition

TABLE 2.--Number of samples taken from purse-seine catches, 1957

Season and locality	Number of samples
SUMMER FISHERY	
Fernandina, Fla.	63
Southport, N. C.	25
Beaufort, N. C.	75
Reedville, Va.	165
Lewes, Del.	117
Wildwood, N. J.	85
Port Monmouth, N. J.	154
Amagansett, N. Y.	121
Gloucester, Mass.	42
Portland, Maine	7
Subtotal.....	854
FALL FISHERY	
Beaufort - Morehead City, N. C.	56
Total.....	910

In table 3 are given the calculated percentage age composition and the number of fish at each age in the 1957 Atlantic coast purse-seine catch, together with comparable data for 1955 and 1956.

The 1955 and 1956 year classes (fish of ages 2 and 1) contributed almost equally to the 1957 purse-seine catch and together accounted for over four-fifths of the total calculated number of individuals. Although fish of the 1956 year class (age 1) were most numerous in the catch, their contribution (1.5 billion) was less than that of the previous year class at age 1 in 1956 (2.1 billion). This was the second year in succession, however, that fish of age 1 exceeded in number those of any other age group. The 1955 year class (age 2) furnished 1.4 billion fish to the 1957 catch. This represented the largest contribution by fish of age 2 in the past 3 years. The 1957 year class (age 0) ranked third in number of fish caught in 1957 (0.3 billion). Its contribution exceeded by tenfold that of the 1956 year class at age 0 in 1956, but

TABLE 3.--Age composition (in percent) and calculated number of fish (in millions) at each age in purse-seine catches, 1955-57

(Numerically dominant year class underscored)

AGE COMPOSITION

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
1955.....	24.71	20.68	<u>34.21</u>	8.73	10.01	1.23	0.35	0.06	0.02	100.00
1956.....	1.00	<u>57.16</u>	<u>25.97</u>	9.61	1.26	4.18	0.67	0.12	0.02	99.99
1957.....	8.46	<u>41.97</u>	41.00	3.26	2.52	1.40	1.22	0.12	0.04	99.99

NUMBER OF FISH

1955.....	761.01	636.86	<u>1,053.47</u>	268.87	308.21	37.95	10.75	1.88	0.59	3,079.59
1956.....	36.37	<u>2,072.95</u>	<u>941.71</u>	348.42	45.60	151.49	24.38	4.47	0.88	3,626.27
1957.....	300.77	<u>1,491.13</u>	1,456.63	115.96	89.72	49.66	43.43	4.34	1.27	3,552.91

it was less than one-half that furnished by the 1955 year class at the same age in 1955. Older year classes (fish of ages 3-10) contributed only one-half as many fish to the catch in 1957 (0.3 billion) as those at comparable ages in the previous 2 years (0.6 billion).

The percentage age composition (based on numbers of fish) of the summer catches in the different areas and of the fall catch in North Carolina waters is shown in figure 5. Tables 4 and 5 furnish comparative data for the years 1955-57.

In the South Atlantic Area, age-2 fish (1955 year class) furnished over two-thirds of the summer catch, and age-1 fish (1956 year class) accounted for most of the remainder. The contribution by age-1 fish in 1957 was only about one-tenth that of the previous year class at the same age in 1956, and for the first time in the past

3 years, age-2 fish formed the largest share of the catch in the area. Age-0 fish (1957 year class) also were represented in the catch in greater number in 1957.

The number of age-1 fish (1956 year class) in the Chesapeake Bay catch was nearly three times that in the previous year, and almost five times that in 1955. This age group accounted for over four-fifths of the 1957 catch, and age-2 fish (1955 year class) accounted for most of the remainder. As in the previous 2 years, fish of older ages contributed little or nothing to the Bay fishery.

The Middle Atlantic catch was dominated by age-2 fish (1955 year class), although age-1 fish (1956 year class) accounted for nearly one-quarter of the calculated number of individuals. This was the largest representation of age-1 fish in the catch in this area in recent years. Age-1 fish did not appear in the Middle Atlantic catches until June, but their numbers gradually increased thereafter and reached a peak in September when they accounted for over one-half the catch (table 6). Older age groups were presented in the area early in the season, but as the summer progressed, their numbers in the catches diminished. Older fish, however, provided the greatest share of the catch in October when they were encountered in large schools off southern Long Island.

For the first year on record, fish of age 2 also dominated the catch in the North Atlantic Area in 1957, and this also was the first year that age-1 fish appeared in the catches in this area. Fish of ages 3 and 4 (1954 and 1953 year classes) were about equally represented in the catch as were those of ages 5 and 6 (1952 and 1951 year classes). As in the previous four summers, older fish were encountered in greatest numbers in this area.

In the North Carolina fall fishery, fish of age 0 (1957 year class) accounted for nearly three-fourths of the number of fish caught in 1957. Most of the remainder was furnished

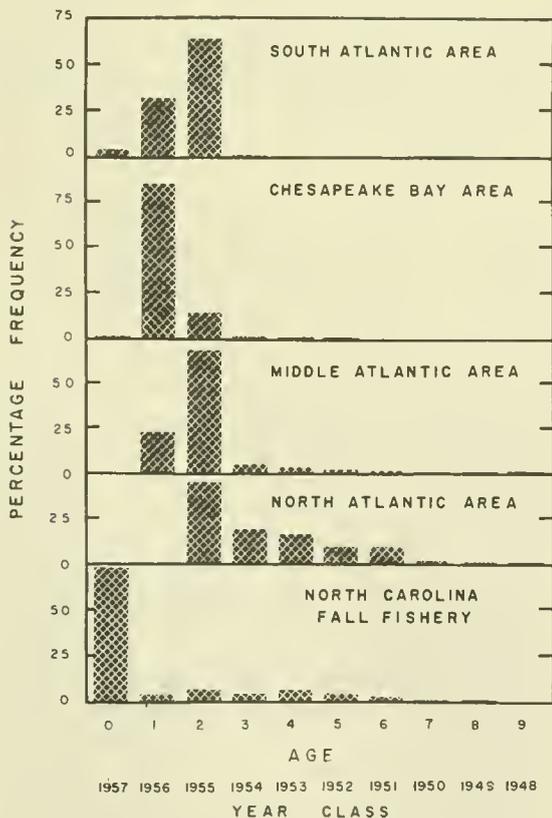


Figure 5.--Age composition of purse-seine catches, 1957.

TABLE 4.--Age composition (in percent) of purse-seine catches, by area and season, 1955-57

[Numerically dominant year class underscored]

Area, year and season	Age								
	0	1	2	3	4	5	6	7	8-10
SUMMER FISHERY									
South Atlantic:									
1955.....	1.66	<u>65.22</u>	27.02	3.32	2.77	--	--	--	--
1956.....	--	<u>98.98</u>	0.94	0.05	0.02	--	--	--	--
1957.....	3.65	<u>32.47</u>	<u>63.76</u>	0.12	--	--	--	--	--
Chesapeake Bay:									
1955.....	1.63	44.77	<u>51.30</u>	1.54	0.69	0.06	--	--	--
1956.....	--	<u>90.91</u>	<u>9.02</u>	0.07	--	--	--	--	--
1957.....	0.25	<u>85.22</u>	14.25	0.26	0.02	0.01	--	--	--
Middle Atlantic:									
1955.....	--	1.81	<u>55.79</u>	23.18	17.43	1.40	0.26	0.10	0.01
1956.....	--	14.78	<u>63.96</u>	18.08	1.44	1.41	0.26	0.06	0.01
1957.....	--	22.24	<u>68.51</u>	4.26	2.62	1.26	1.02	0.03	0.05
North Atlantic:									
1955.....	--	--	0.25	13.94	<u>67.55</u>	12.84	4.65	0.54	0.22
1956.....	--	--	6.41	36.35	<u>8.22</u>	<u>40.96</u>	6.42	1.29	0.36
1957.....	--	0.91	<u>45.00</u>	18.79	16.06	<u>8.59</u>	8.95	1.45	0.24
FALL FISHERY									
North Carolina:									
1955.....	<u>87.19</u>	3.61	6.00	0.86	1.96	0.32	0.04	--	0.01
1956.....	<u>16.12</u>	<u>26.78</u>	11.95	16.61	4.15	20.61	3.31	0.46	--
1957.....	<u>74.20</u>	<u>3.24</u>	6.08	4.07	5.40	3.84	2.89	0.25	0.02

by fish of ages 1 through 6, each of which was represented in roughly the same proportion.

Length Composition

The percentage length distributions of fish in samples from the summer purse-seine catches in each area and from the fall catch off North Carolina in 1957 are shown in figure 6 (see also appendix tables 1-5).

Fish caught during the summer in the South Atlantic Area ranged from about 110 to 245 mm., and those of age 2 (1955 year class) furnished the principal modal length group (160 to

245 mm.). Fish of age 1 (1956 year class) showed considerable variation in length and ranged from about 110 to 215 mm. Furthermore, their lengths virtually overlapped those of age-2 fish, and the only suggestion of a distinct mode in the length-frequency polygon of age-1 fish occurred at the same length (192 mm.) as in age-2 fish. The larger age-1 fish came mostly from northern Florida waters where age-1 fish taken in late summer were similar in length to age-2 fish caught in early summer (age-1 fish ranged from 155 to 200 mm. with a median length of 187.1 mm., and age-2 fish ranged from 160 to 210 mm. with a median length of 188.5 mm.).

TABLE 5.--Calculated number of fish (in millions) at each age in purse-seine catches, by area and season, 1955-57

[Numerically dominant year class underscored]

Area, year and season	Age									Total
	0	1	2	3	4	5	6	7	8-10	
SUMMER FISHERY										
South Atlantic:										
1955.....	6.51	255.20	105.74	13.01	10.83	--	--	--	--	391.29
1956.....	--	<u>1,147.88</u>	10.91	0.63	0.23	0.02	--	--	--	1,159.67
1957.....	13.27	<u>117.91</u>	<u>231.56</u>	0.42	--	--	--	--	--	363.16
Chesapeake Bay:										
1955.....	12.18	334.24	<u>382.92</u>	11.52	5.17	0.43	--	--	--	746.46
1956.....	--	<u>674.37</u>	66.90	0.49	--	--	--	--	--	741.76
1957.....	3.12	<u>1,056.16</u>	176.58	3.22	0.22	0.08	--	--	--	1,239.38
Middle Atlantic:										
1955.....	--	16.66	<u>513.31</u>	312.26	160.40	12.90	2.34	0.96	0.12	1,018.95
1956.....	--	190.28	<u>823.35</u>	232.82	18.60	18.19	3.31	0.71	0.13	1,287.39
1957.....	--	302.78	<u>932.53</u>	58.05	35.72	17.15	13.92	0.40	0.69	1,361.24
North Atlantic:										
1955.....	--	--	0.42	23.76	<u>115.10</u>	21.88	7.93	0.92	0.37	170.38
1956.....	--	--	13.58	77.00	17.41	<u>86.78</u>	13.59	2.73	0.75	211.84
1957.....	--	1.87	<u>92.66</u>	38.68	33.07	17.69	18.44	2.99	0.50	205.90
FALL FISHERY										
North Carolina:										
1955.....	<u>742.32</u>	30.76	51.08	7.32	16.71	2.74	0.39	--	0.10	851.42
1956.....	<u>36.37</u>	60.42	26.97	37.48	9.36	46.50	7.48	1.03	--	225.61
1957.....	<u>284.39</u>	<u>12.41</u>	23.30	15.60	20.72	14.74	11.07	0.95	0.08	383.26

TABLE 6.--Age composition (in percent) of purse-seine catches in the Middle Atlantic Area, by month, 1957

Month	Age							
	1	2	3	4	5	6	7	8-10
May.....	-	84.74	8.34	2.72	1.88	2.27	0.05	-
June.....	6.89	87.26	5.34	0.34	0.04	0.12	-	-
July.....	12.34	84.45	2.15	0.52	0.16	0.32	-	0.05
August.....	40.38	56.88	1.79	0.60	0.06	0.29	-	-
September.....	50.41	45.15	2.49	1.36	0.29	0.15	0.07	0.07
October.....	16.70	30.72	15.57	19.06	10.42	7.13	0.18	0.22

In Chesapeake Bay the lengths of fish in the samples ranged from 130 to 270 mm. The length curve for age-1 fish showed a prominent mode at 177 mm., while that for age-2 fish showed a peak at 227 mm.

Lengths of fish in the Middle Atlantic Area ranged from about 125 to 365 mm. with three distinct size groups evident. The first two length

groups, for the most part, represented fish of ages 1 and 2 which supported the catch through most of the summer, while the most advanced group included mainly older fish which appeared in the late-season catches off southern Long Island.

In the North Atlantic Area, two major length groups were apparent in the 1957 catches--age-2 fish which

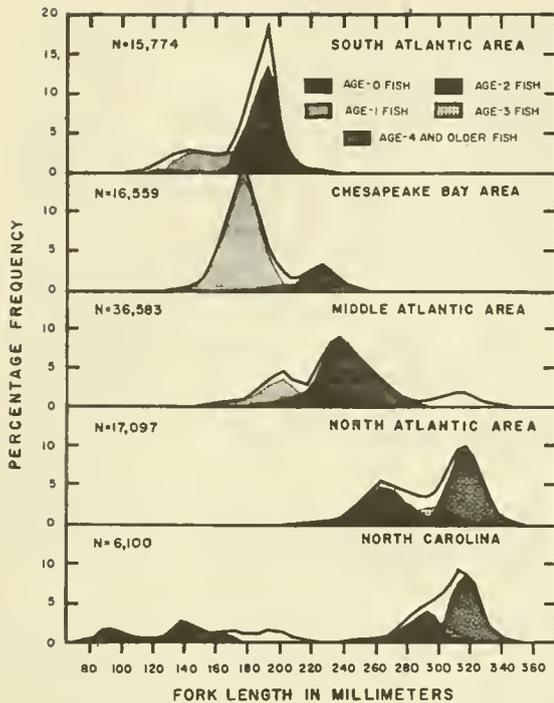


Figure 6.--Length composition of samples from purse-seine catches, 1957.

ranged from about 200 to 300 mm. and fish of age 4 and older ages, which ranged from about 280 to 360 mm. Fish of age 3 were completely obscured in the total length distribution.

The lengths of fish in samples from the North Carolina fall fishery ranged from about 75 to 355 mm., with those of older ages represented by a dominant mode at 312 mm. Age-0 fish accounted for the greatest portion of the length curve below 230 mm. and comprised two size groups, one with a peak at 92 mm. and the other with a peak at 142 mm.

As noted for previous years (June and Reintjes, 1959 and 1960), the most obvious features of the 1957 length-frequency curves were (1) the heterogeneity of the length-age groups in the various areas, (2) the complete absence of larger, older fish in the summer purse-seine catches in South Atlantic and Chesapeake Bay waters, (3) the paucity of small fish in northern waters, (4) the gradual increase from south to north in lengths of fish com-

prising the youngest age groups, (5) the occurrence in the fall fishery off North Carolina of homologous length groups represented in the summer catches farther northward, and (6) the recruitment of small, young-of-the-year fish during the fall season off North Carolina.

Since differences in the mean size of males and females have been noted in the previous reports in this series (June and Reintjes, 1959 and 1960), it is of interest to examine the 1957 length distributions of each sex to determine whether such differences were sufficiently great to affect the position of the modes in the unsexed samples and thus, perhaps, make conclusions regarding changes in length misleading.

The curves in figure 7 show a parallel size differential between the sexes which became more pronounced as length increased. With the exception

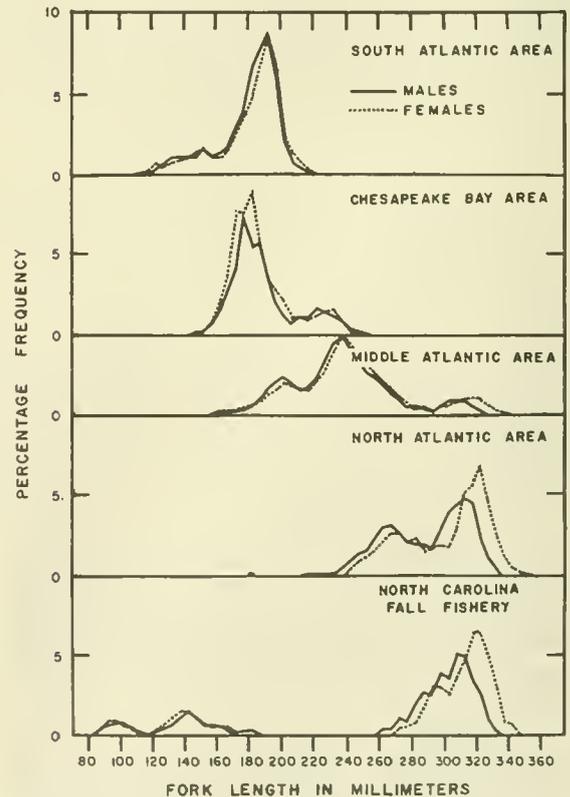


Figure 7.--Length frequencies of males and females in samples from purse-seine catches, 1957.

of data derived from Chesapeake Bay,⁷ the dominant peaks in the length-frequency distributions were identical up to about 265 mm., and the slight discrepancies between the sexes are not considered serious. Above this size, however, the difference between the sexes was sufficiently great to indicate that any marked changes in sex ratio could shift the position of the modes in unsexed samples. It is also evident from the curves and appendix tables 1-5 that female Atlantic menhaden not only attained a larger size, but apparently grew faster (since the female curves were displaced to the right of the males) and showed a tendency to live longer than the males.

The predominance of females in the catches with respect to both numbers and length is shown in tables 7 and 8. In table 7 it is seen that the males were more numerous in the South Atlantic summer catches, while in every other area, the females predominated. If, however, the total number of fish in each $\frac{1}{2}$ -centimeter length class is considered for the coast as a whole, it may be judged from table 8 that the females accounted for a greater proportion of the catch over virtually the entire size range. The unequal representation of sexes in the catch may have resulted from the selectivity of purse-seine gear and the apparent differential growth of the females.

Weight Composition

Percentage weight-frequency distributions of fish in samples from the purse-seine catches in the different areas in 1957 are shown in figure 8 (see also appendix tables 6-10). The most noticeable aspects of the graphs are the marked differences in the shape of the curves and the positions and/or lack of dominant modes. The curve for the South Atlantic Area shows a range in weight from 20 to 230 g. and

⁷The irregularities in the length-frequency curves and sex-ratio data (table 7) for Chesapeake Bay in 1957 are believed to be the result of the difficulty in sex determinations of immature males in samples taken in late July and August when fish frequently were partially decomposed upon reaching the reduction plant.

TABLE 7.--Sex ratio of fish in purse-seine catches, by area and season, 1957

Area and season	Males	Females	Ratio of females to males (percent)
SUMMER FISHERY			
South Atlantic..	1,545	1,519	0.98
Chesapeake Bay ¹ .	1,248	1,724	1.38
Middle Atlantic.	3,408	3,516	1.03
North Atlantic..	1,557	1,749	1.12
FALL FISHERY			
North Carolina..	496	586	1.18

See footnote 7 in left column.

a prominent mode at 110 g. which is preceded by a secondary peak at 50 g. In Chesapeake Bay samples, a dominant mode occurs between 80 and 90 g., with the suggestion of a secondary peak between 160 and 170 g., while in those from the Middle Atlantic Area, two prominent peaks are evident, one between 130 and 140 g. and the second at 220 g. The latter curve is markedly skewed to the right and emphasizes both the concentration of weights of younger fish at the left and the comparatively larger sizes of a few fish at the right. With minor variations, the weight curves for the South Atlantic, Chesapeake Bay, and Middle Atlantic Areas are similar in shape to the length-frequency curves shown in figure 6 and, in general, show relatively the same disparity in size of fish of the same age, both within and between the three areas.

In contrast to other areas, fish taken during the summer in the North Atlantic Area were highly variable in weight, ranging from about 160 to 900 g., and the weight curve shows no concentration of fish in any one weight class. This probably was the result of a combination of factors, including a proportionately greater increase in

TABLE 8.--Length frequencies of males and females in samples from purse-seine catches, 1957

Fork length (mm.)	Males		Females		Fork length (mm.)	Males		Females	
	Number	Cumulative total	Number	Cumulative total		Number	Cumulative total	Number	Cumulative total
75-79...	--	--	1	1	225-229..	274	4,151	228	4,433
80-84...	1	1	1	2	230-234..	353	4,504	327	4,760
85-89...	4	5	3	5	235-239..	376	4,880	360	5,120
90-94...	6	11	9	14	240-244..	308	5,188	335	5,455
95-99...	7	18	9	23	245-249..	273	5,461	286	5,741
100-104..	7	25	5	28	250-254..	234	5,695	264	6,005
105-109..	2	27	5	33	255-259..	238	5,933	222	6,227
110-114..	2	29	2	35	260-264..	227	6,160	204	6,431
115-119..	1	30	7	42	265-269..	190	6,350	205	6,636
120-124..	17	47	22	64	270-274..	160	6,510	168	6,804
125-129..	22	69	16	80	275-279..	104	6,614	121	6,925
130-134..	39	108	34	114	280-284..	118	6,732	110	7,035
135-139..	46	154	41	155	285-289..	109	6,841	92	7,127
140-144..	55	209	52	207	290-294..	105	6,946	109	7,236
145-149..	51	260	65	272	295-299..	165	7,111	121	7,357
150-154..	60	320	74	346	300-304..	226	7,337	113	7,470
155-159..	62	382	106	452	305-309..	259	7,596	194	7,664
160-164..	99	481	158	610	310-314..	261	7,857	281	7,945
165-169..	146	627	229	839	315-319..	214	8,071	329	8,274
170-174..	238	865	337	1,176	320-324..	120	8,191	359	8,633
175-179..	349	1,214	355	1,531	325-329..	45	8,236	247	8,880
180-184..	402	1,616	440	1,971	330-334..	16	8,252	127	9,007
185-189..	475	2,091	418	2,389	335-339..	2	8,254	51	9,058
190-194..	478	2,569	453	2,842	340-344..	--	--	20	9,078
195-199..	378	2,947	396	3,238	345-349..	--	--	10	9,088
200-204..	249	3,196	282	3,520	350-354..	--	--	4	9,092
205-209..	174	3,370	193	3,713	355-359..	--	--	--	--
210-214..	151	3,521	164	3,877	360-364..	--	--	2	9,094
215-219..	153	3,674	145	4,022					
220-224..	203	3,877	183	4,205					
					Total...	8,254	8,254	9,094	9,094

weight than in length as the fish grow older; sexual dimorphism referred to earlier in this section; the simultaneous occurrence in the catches of both sexually maturing and spawned-out fish; variations in feeding conditions; a mixing in northern waters of faster-growing, younger fish with older fish whose growth in length has diminished, etc.

Fish weights in the North Carolina fall fishery formed two separate curves, one ranging to roughly 180 g. and the second from 330 to 790 g. The first curve shows two equally prominent peaks, one at 10 and the other at 40 g. From appendix table 10

it may be seen that young-of-the-year fish (age-0) accounted for the greatest proportion of the first curve. It is of interest to note that the heavier fish in this age group (20 to 110 g.) were represented in the catch samples through most of December, whereas the lighter fish of this age (0-20 g.) did not appear in the catches until late December and subsequently formed the greatest portion of the catch. The second curve in the North Carolina weight distribution shows a mode at 560 g. and except for the absence of fish in the extreme weight classes, is of the same general asymmetric shape as that depicting the North Atlantic summer catch.

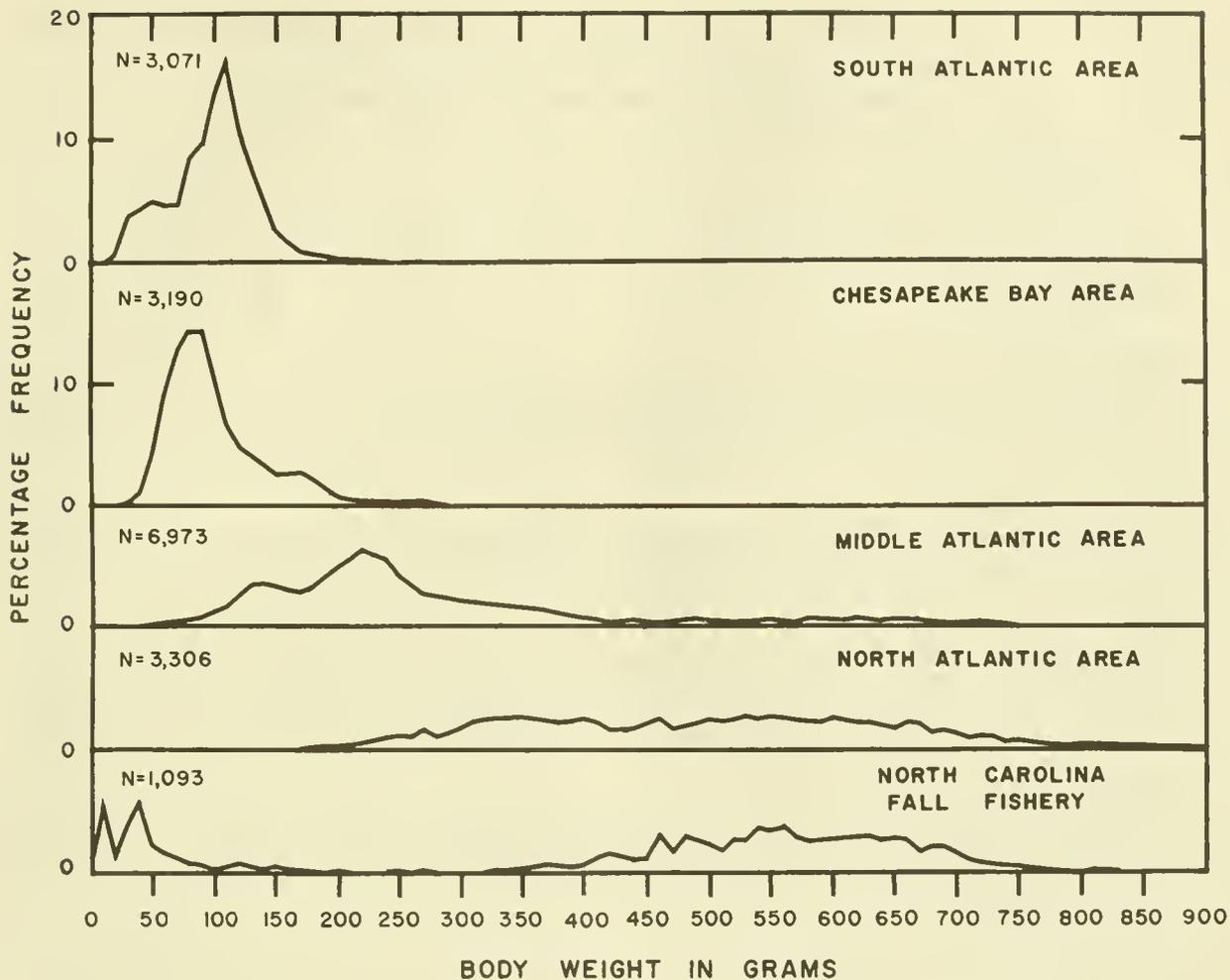


Figure 8.--Weight composition of samples from purse-seine catches, 1957.

Average Length and Weight

The average lengths and weights of fish at each age, by sex, in the 1957 catches are given in appendix tables 11-15. Summary data for the past 3 years (tables 9 and 10) show that fish of the numerically dominant age group in the summer catches in the different areas were shorter, and lighter, on the average, in 1957 than those of the same age in the previous 2 years; however, in all areas this difference

was restricted almost entirely to fish of ages 1 and 2 (1956 and 1955 year classes respectively). The predominance of these age groups thus was reflected in a reduction in the average size of fish in the summer catches in all areas (last column in tables 9 and 10). Among the middle age groups (ages 3 to 6) there was a tendency for fish to be slightly larger in 1957, although in those age classes represented by adequate numbers of fish, the difference probably

TABLE 9.--Mean fork length (in millimeters) of fish at each age in samples from purse-seine catches, by area and season, 1955-57

[Numerically dominant year class underscored]

Area, year and season	Age											Mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955.....	128	168	195	208	212	--	--	--	--	--	--	177
1956.....	--	<u>159</u>	198	214	224	234	--	--	--	--	--	160
1957.....	129	167	<u>190</u>	218	--	--	--	--	--	--	--	180
Chesapeake Bay:												
1955.....	152	199	<u>236</u>	244	251	242	--	--	--	--	--	219
1956.....	--	<u>187</u>	<u>222</u>	293	--	--	--	--	--	--	--	191
1957.....	158	<u>180</u>	221	223	267	252	--	--	--	--	--	186
Middle Atlantic:												
1955.....	--	228	<u>259</u>	279	290	300	314	333	310	--	--	274
1956.....	--	221	<u>252</u>	286	302	311	317	321	332	--	--	264
1957.....	--	200	<u>240</u>	279	309	314	317	306	324	327	--	240
North Atlantic:												
1955.....	--	--	277	287	<u>301</u>	316	323	330	336	347	344	303
1956.....	--	--	277	290	<u>307</u>	315	322	328	336	340	--	306
1957.....	--	218	<u>266</u>	292	309	<u>317</u>	321	322	321	332	--	295
FALL FISHERY												
North Carolina:												
1955.....	<u>123</u>	209	259	282	304	317	321	--	338	--	--	215
1956.....	<u>118</u>	<u>182</u>	262	298	308	312	318	325	--	--	--	253
1957.....	<u>129</u>	<u>181</u>	285	302	314	319	322	323	334	--	--	269

is not significant. Fish comprising the oldest age groups (ages 7-9), in general, were smaller in the summer catches than in the previous year, but this may be due to the relatively small numbers of fish represented in these age classes. Compared with the previous 2 seasons, fish taken in the North Carolina fall fishery were larger, on the average, at most ages in 1957.

As was found in previous years (June and Reintjes, 1959 and 1960), the data in tables 9 and 10 also show that in the summer fishery there was a

progressive increase in the average length and weight of fish of the same age from south to north, and, except for the two youngest age-classes, fish taken in the fall fishery off North Carolina were larger and heavier than those taken in the summer catches. The smaller and lighter fish of age 1 in the North Carolina fall catches could have been the remains of the local, summer stock, since they occurred only in the early fall catches and were most similar in length and weight to age-1 fish taken in the final weeks of the summer season at Beaufort.

TABLE 10.--Mean weight (in grams) of fish at each age in samples from purse-seine catches, by area and season, 1955-57

[Numerically dominant year class underscored]

Area, year and season	Age											Mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955.....	35	<u>82</u>	125	155	157	--	--	--	--	--	--	98
1956.....	--	<u>67</u>	134	176	217	224	--	--	--	--	--	69
1957.....	32	<u>83</u>	<u>117</u>	190	--	--	--	--	--	--	--	102
Chesapeake Bay:												
1955.....	60	142	<u>222</u>	262	278	235	--	--	--	--	--	185
1956.....	--	<u>118</u>	<u>196</u>	388	--	--	--	--	--	--	--	125
1957.....	68	<u>97</u>	171	181	257	327	--	--	--	--	--	108
Middle Atlantic:												
1955.....	--	225	<u>317</u>	404	457	505	596	712	543	--	--	385
1956.....	--	206	<u>305</u>	448	522	582	629	643	688	--	--	359
1957.....	--	149	<u>257</u>	429	589	608	621	535	630	634	--	270
North Atlantic:												
1955.....	--	--	401	426	<u>494</u>	589	641	691	732	760	774	514
1956.....	--	--	395	444	<u>521</u>	<u>565</u>	615	658	725	766	--	522
1957.....	--	190	<u>352</u>	471	566	<u>607</u>	638	660	706	612	--	497
FALL FISHERY												
North Carolina:												
1955.....	<u>31</u>	166	356	460	566	648	690	--	806	--	--	256
1956.....	<u>28</u>	<u>116</u>	346	516	563	582	642	643	--	--	--	373
1957.....	<u>35</u>	94	452	540	606	636	646	664	784	--	--	450

DISCUSSION

The 1957 purse-seine catch of Atlantic menhaden was the lowest in the past 3 years, and despite improvements in the efficiency of fishing--resulting from the introduction of the "power block", larger vessels, refrigerated holds, and the increased use of aircraft and fish pumps--catch per unit of effort from most summer stocks declined.

Although details of the general recruitment pattern are still largely unknown, the relative contributions by

various year classes offer at least a partial explanation for the observed variations in the catch in the different areas in 1957.

Judging from its contribution to the catch at age 1 in 1957 (1.5 billion fish), the 1956 year class appeared to be relatively abundant. The catch per unit of effort of this year class (42,000 fish) in 1957, for example, was only about a third less than that of the 1955 year class at age 1 in 1956 (65,000 fish) and nearly double that of the 1954 year class at age 1 in 1955 (23,000 fish). Its contribution to the summer

catch in the South Atlantic Area in 1957, however, was only about one-tenth that of the 1955 year class at age 1 in 1956 and only about one-half that of the 1954 year class at age 1 in 1955. Thus the reduced summer catch in the South Atlantic Area in 1957 appears to have resulted from the below-average recruitment of the 1956 year class to the summer stock in the area. In contrast, the contributions of this year class to the fishery in the Chesapeake Bay and Middle Atlantic Areas exceeded those of the previous two year classes at comparable age in 1955 and 1956, and its high level of abundance in the former area was directly responsible for the large catch. It also is noted that for the first time on record, fish of age 1 occurred in the catches in the North Atlantic Area. In the North Carolina fall fishery this year class accounted for a relatively small share of the catch. However, because adverse weather curtailed fishing during the period when schools were present in greatest concentrations and because of selective fishing by the fleet on schools of larger fish, the younger age-groups probably were not represented in the catches in proportion to their actual abundance on the fishing grounds. As was to be expected, our records show that the 1956 year class made a significant contribution to the catch in 1958.

Based on its contributions during the first 3 years of life (4.3 billion fish), the 1955 year class appears to be the largest to enter the fishery in recent years. It was first encountered in abundance at age 0 during the 1955 fall fishing season in North Carolina, although the significance of their number in the catch was unknown (June and Reintjes, 1959, p. 16). In the following year at age 1 this year class was heavily recruited to the summer stocks in the South Atlantic and Chesapeake Bay Areas and accounted for well over one-half of the total purse-seine catch. The possibility that at age 2 it would contribute substantially to the 1957 catch was mentioned (June and Reintjes, 1960, p. 6). This year class accounted for about two-fifths of the number of

fish caught in 1957. Although variable in availability, it was the main support of the summer fishery in all areas except Chesapeake Bay and, next to the newly recruited 1957 year class, contributed the greatest number of individuals to the fall catch off the coast of North Carolina. Furthermore, this was the first year since initiation of the catch-sampling program in the North Atlantic Area (1953) that fish of age 2 formed such an important share of the catch in northern waters. From the foregoing it would appear that, if the catch per unit of effort of age-1 fish is a reliable measure of the relative success of a year class, the prospect of two relatively strong year classes occurring in succession are good.

In contrast to the evidence pointing to a high level of abundance of both the 1955 and 1956 year classes, pertinent data relating to the 1954 year class indicate that it was comparatively weak. It also is evident that over the past several years there has been a noticeable decrease in the proportions of older fish in the catches in both the Middle and North Atlantic Areas. For example, there were only about one-half as many fish of age 4 and older ages caught per unit of effort in 1957 as in 1955. This, of course, was due partly to the influence on the 1955 catch of the very abundant 1951 year class (age 4 in 1955), but it also is noted that for the first time in the past 5 years, fish younger than age 3 contributed substantially to the catch in northern waters in 1957. Thus the decline in the summer catch in the North Atlantic Area could have resulted from the relatively weak contribution of the 1954 year class, coupled with a reduced abundance of older year classes. The extent to which reduced availability of schools on the inshore fishing grounds was responsible for the low catch in the North Atlantic Area is unknown. It is noted, however, that nearly as many fish of age 4 and older were caught off southern Long Island during the closing weeks of the season in the Middle Atlantic Area as were taken during the entire summer in the North Atlantic Area.

SUMMARY

The size of fish in the catches also had an important bearing on the summer yield in most areas in 1957. The data presented in tables 9 and 10 showed that the average size of fish in the dominant age groups contributing to the summer catches was the smallest in the past 3 years. The significance of this finding perhaps is most evident from an example provided by the fishery in the Middle Atlantic Area. In 1956 an estimated 1.3 billion fish produced a catch of 402,000 tons, whereas in 1957, 1.4 billion fish contributed a catch of only 342,000 tons.

A possible explanation for the smaller size of fish of ages 1 and 2 in the 1957 summer catches is that prevailing drought conditions may have reduced the available plankton food supply in the inshore waters where these age groups normally are congregated in greatest abundance. Precipitation during June, July, and August generally was less than 50 percent of normal from the Carolinas to southern New England (U. S. Weather Bureau, 1958). It also was pointed out (p. 5) that in contrast to previous summers, schools in the Middle Atlantic Area occurred farther offshore where they were less accessible to capture in the deeper waters. The larger fish in the younger age groups, therefore, may not have been represented in the catches in proportion to their actual abundance in the stock, resulting in a reduction in size of fish caught. An alternative hypothesis is that the relatively greater number of fish in the 1955 and 1956 year classes increased competition for food--i.e., less food was available to the individual--and growth consequently was reduced.

It also should be pointed out that the decrease in average size of fish in the younger age groups in the summer catches could have resulted from increased fishing effort. Along this line, it is of interest to note that the greatest relative decrease in average size of fish occurred in the Chesapeake Bay and Middle Atlantic Areas where increases in fishing effort have been proportionately greatest. Further investigation of this apparent relationship appears to be highly desirable.

1. This, the third in a series of reports, summarizes and discusses data obtained from the catch-sampling program conducted by the Bureau of Commercial Fisheries on the menhaden stocks along the Atlantic coast of the United States in 1957. The purpose of the sampling program is to furnish data for determining the relation between fluctuations in the catch and changes in the composition of the Atlantic menhaden (*Brevoortia tyrannus*) population.
2. The 1957 purse-seine catch of Atlantic menhaden amounted to 632,000 tons, of which 576,000 tons were taken in the "summer" fishery. The catch was 14 percent below that of the previous year, and the fishing effort expended in taking it (31,600 sets) was 8 percent greater. The Middle Atlantic Area furnished the greatest portion of the catch (54 percent), while the South Atlantic Area furnished the least (7 percent). Catch per unit of effort in the summer fishery declined from that of the previous 2 years in all areas except Chesapeake Bay, while in the North Carolina fall fishery it was greater than that of the previous year and nearly equalled that of 1955.
3. The 1957 fishery could be characterized as spotty. In the South Atlantic Area, adverse weather was partly responsible for the sporadic fishing off Fernandina, Fla., and Southport, N. C. In Chesapeake Bay, numerous small schools provided productive fishing through the entire summer. Drought conditions during June, July, and August may have been responsible for the shifty availability of schools in the inshore coastal waters of the Middle and North Atlantic Areas. Large schools which congregated off southern Long Island in October produced the heaviest vessel catches of the entire summer fishery. Although fish were present in abundance on the North Carolina

fall fishing grounds, unfavorable weather limited the number of fishing days.

4. The most productive unit fishing areas (200 sets and over) in 1957 were located (a) in the vicinity of Fernandina, Fla., and Cape Fear, N. C.; (b) in Chesapeake Bay and coastal waters immediately north of Cape Charles; (c) along the coasts of Delaware, New Jersey, and western Long Island; and (d) Narragansett Bay.
5. Samples from the catch showed that the 1955 and 1956 year classes (fish of ages 3 and 2 respectively) shared almost equally in providing over four-fifths of the catch. The 1956 year class constituted the greatest portion of the summer catches in the South Atlantic and Chesapeake Bay Areas, whereas the 1955 year class dominated the summer catches in Middle and North Atlantic Areas. The 1957 year class (age 0) accounted for about three-fourths of the number of fish in the fall catch off North Carolina. There was a decline in the proportion of fish in older year classes in 1957.
6. Data on length and weight showed that fish of the dominant age group

in the summer catches in all areas were smaller in 1957 than fish of the same ages in the previous 2 years.

LITERATURE CITED

JUNE, FRED C., AND JOHN W. REINT-JES.

1959. Age and size composition of the menhaden catch along the Atlantic Coast of the United States, 1952-55; with a brief review of the commercial fishery. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 317, 65 pp.

1960. Age and size composition of the menhaden catch along the Atlantic Coast of the United States, 1956; with a brief review of the commercial fishery. U.S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 336, 38 pp.

U. S. WEATHER BUREAU.

1958. Climatological data. National summary. U. S. Weather Bureau, Annual Summary 1957, vol. 8, no. 13, 138 pp.

APPENDIX TABLES

Appendix Table 1.--Length-frequency distributions in samples from purse-seine catches, South Atlantic Area, excluding the North Carolina fall fishery, 1957 (M= male, F= female, T= total, including specimens for which sex was not determined)

Fork length (mm.)	Age												Total			
	0			1			2			3						
	M	F	T	M	F	T	M	F	T	M	F	T				
110-114	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	2
115-119	-	3	3	1	2	3	-	-	-	-	-	-	-	-	-	6
120-124	10	12	22	3	9	12	-	-	-	-	-	-	-	-	-	34
125-129	11	11	22	7	3	10	-	-	-	-	-	-	-	-	-	32
130-134	8	2	10	25	20	46	-	-	-	-	-	-	-	-	-	56
135-139	-	1	1	33	23	57	-	-	-	-	-	-	-	-	-	58
140-144	-	-	-	37	32	70	-	-	-	-	-	-	-	-	-	71
145-149	-	-	-	35	47	83	-	-	-	-	-	-	-	-	-	83
150-154	-	-	-	48	47	97	-	-	-	-	-	-	-	-	-	97
155-159	-	-	-	35	38	76	-	-	-	-	-	-	-	-	-	76
160-164	1	-	1	37	32	72	-	-	2	-	-	-	-	-	-	80
165-169	-	-	-	41	34	78	-	-	11	13	24	-	-	-	-	102
170-174	-	-	-	48	35	84	-	-	47	54	102	-	-	-	-	186
175-179	-	-	-	33	30	63	-	-	82	76	159	-	-	-	-	222
180-184	-	-	-	56	39	95	-	-	148	104	252	-	-	-	-	347
185-189	-	-	-	58	40	98	-	-	179	167	347	-	-	1	-	446
190-194	-	-	-	60	50	110	-	-	205	211	416	-	-	-	-	526
195-199	-	-	-	28	38	66	-	-	146	176	322	-	-	-	-	388
200-204	-	-	-	14	12	26	-	-	48	61	109	-	-	1	-	136
205-209	-	-	-	1	-	1	-	-	20	40	60	-	-	-	-	61
210-214	-	-	-	1	2	3	-	-	11	23	34	-	-	-	-	37
215-219	-	-	-	-	1	1	-	-	5	11	16	-	-	-	-	17
220-224	-	-	-	-	-	-	-	-	4	8	12	-	-	-	-	12
225-229	-	-	-	-	-	-	-	-	1	2	3	-	-	-	-	3
230-234	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	2
235-239	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1
240-244	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2
Total . . .	31	29	60	601	536	1153	912	951	1866	1	3	4	3083			

Appendix Table 2.--Length-frequency distributions in samples from purse-seine catches,
Chesapeake Bay Area, 1957

(M = male, F = female, T = total, including specimens for which sex was not determined)

Fork length (mm.)	Age												Total										
	0			1			2			3				4			5						
	M	F	T	M	F	T	M	F	T	M	F	T		M	F	T	M	F	T				
130-134	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
135-139	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
140-144	-	-	-	1	5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
145-149	1	-	1	2	6	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
150-154	-	2	2	6	15	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35
155-159	-	2	2	20	59	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	101
160-164	1	-	1	42	105	178	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	181
165-169	1	3	4	78	162	274	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	279
170-174	-	-	-	124	226	385	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	387
175-179	-	-	-	216	218	464	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	468
180-184	-	-	-	158	260	434	-	-	3	5	-	-	-	-	-	-	-	-	-	-	-	-	439
185-189	-	-	-	170	155	339	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	343
190-194	-	-	-	85	95	183	-	-	9	14	-	-	-	-	-	-	-	-	-	-	-	-	197
195-199	-	-	-	55	72	129	-	-	3	6	9	-	-	-	-	-	-	-	-	-	-	-	139
200-204	-	-	-	29	51	81	-	-	5	7	18	-	-	-	-	-	-	-	-	-	-	-	100
205-209	-	-	-	14	12	26	-	-	7	14	21	-	-	-	-	-	-	-	-	-	-	-	48
210-214	-	-	-	17	11	28	-	-	17	20	37	-	-	-	-	-	-	-	-	-	-	-	65
215-219	-	-	-	15	4	19	-	-	17	19	36	-	-	-	-	-	-	-	-	-	-	-	57
220-224	-	-	-	3	4	7	-	-	44	31	75	-	-	-	-	-	-	-	-	-	-	-	82
225-229	-	-	-	5	1	6	-	-	38	44	84	-	-	-	-	-	-	-	-	-	-	-	90
230-234	-	-	-	5	2	7	-	-	30	42	73	-	-	-	-	-	-	-	-	-	-	-	82
235-239	-	-	-	1	1	2	-	-	19	21	41	-	-	-	-	-	-	-	-	-	-	-	43
240-244	-	-	-	-	-	-	-	-	2	7	9	-	-	-	-	-	-	-	-	-	-	-	10
245-249	-	-	-	-	-	-	-	-	2	3	7	-	-	-	-	-	-	-	-	-	-	-	8
250-254	-	-	-	-	-	-	-	-	3	4	7	-	-	-	-	-	-	-	-	-	-	-	4
255-259	-	-	-	-	-	-	-	-	1	2	3	-	-	-	-	-	-	-	-	-	-	-	1
260-264	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
265-269	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total . . .	3	8	11	1046	1464	2722	197	243	446	9	7	2	7	9	1	1	1	1	1	1	1	1	3190

Appendix Table 4.--Length-frequency distributions in samples from purse-seine catches, North Atlantic Area, 1957

(M = male, F = female, T = total, including specimens for which sex was not determined)

Fork length (mm.)	Age																		Total					
	1		2		3		4		5		6		7		8		9							
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F		T				
200-204	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1			
205-209	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5			
210-214	2	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2			
215-219	3	6	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6			
220-224	3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4			
225-229	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4			
230-234	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5			
235-239	-	-	17	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20			
240-244	1	-	35	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50			
245-249	1	-	40	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70			
250-254	-	-	48	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90			
255-259	-	-	71	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129			
260-264	-	-	89	63	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168			
265-269	-	-	89	77	11	6	-	3	-	1	-	-	-	-	-	-	-	-	-	-	189			
270-274	-	-	59	77	24	9	2	1	1	1	-	-	-	-	-	-	-	-	-	-	172			
275-279	-	-	45	51	19	16	3	3	4	1	1	-	-	-	-	-	-	-	-	-	138			
280-284	-	-	33	49	23	23	6	6	8	2	2	-	-	-	-	-	-	-	-	-	139			
285-289	-	-	20	24	36	21	57	4	7	2	2	-	-	-	-	-	-	-	-	-	110			
290-294	-	-	16	18	31	34	34	7	9	1	1	-	-	-	-	-	-	-	-	-	109			
295-299	-	-	10	14	28	38	66	38	43	11	12	-	-	-	-	-	-	-	-	-	150			
300-304	-	-	6	4	28	31	60	68	17	11	15	3	-	-	-	-	-	-	-	-	189			
305-309	-	-	-	4	14	33	47	61	85	38	48	2	-	-	-	-	-	-	-	-	258			
310-314	-	-	1	1	9	24	33	48	120	54	79	4	-	-	-	-	-	-	-	-	326			
315-319	-	-	1	1	1	18	19	20	96	48	84	3	-	-	-	-	-	-	-	-	335			
320-324	-	-	-	-	1	6	7	6	78	48	86	13	-	-	-	-	-	-	-	-	297			
325-329	-	-	-	-	1	3	3	2	57	18	77	13	-	-	-	-	-	-	-	-	191			
330-334	-	-	-	-	1	1	2	2	25	8	45	9	-	-	-	-	-	-	-	-	94			
335-339	-	-	-	-	-	-	-	-	8	4	26	4	-	-	-	-	-	-	-	-	39			
340-344	-	-	-	-	-	-	-	-	2	-	10	3	-	-	-	-	-	-	-	-	12			
345-349	-	-	-	-	-	-	-	-	1	1	2	6	-	-	-	-	-	-	-	-	8			
350-354	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	3			
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1			
Total . . .	9	12	595	521	1110	244	516	265	356	623	197	211	408	211	314	527	441	58	99	4	7	11	1	3316

Appendix Table 5.--Length-frequency distributions in samples from purse-seine catches, North Carolina fall fishery, 1957
(M = male, F = female, T = total, including specimens for which sex was not determined)

Fork length (mm.)	Age																		Total									
	0			1			2			3			4			5				6			7			8		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T		M	F	T	M	F	T	M	F	T
75-79	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
80-84	1	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
85-89	3	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
90-94	7	9	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
95-99	9	9	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
100-104	5	5	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
105-109	5	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
110-114	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
115-119	4	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
120-124	4	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
125-129	4	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
130-134	6	12	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
135-139	13	16	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
140-144	15	15	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
145-149	11	12	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
150-154	5	7	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
155-159	5	4	9	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
160-164	2	6	8	2	1	3	1	3	5	2	4	1	1	2	4	3	2	3	2	3	2	2	1	1	2	2	2	10
165-169	2	1	3	4	1	5	1	1	2	4	1	1	2	4	3	2	3	2	3	2	3	2	1	1	2	2	2	11
170-174	1	1	2	1	1	2	1	1	2	4	1	1	2	4	3	2	3	2	3	2	3	2	1	1	2	2	2	8
175-179	1	1	2	1	2	3	1	2	4	3	2	3	2	4	3	2	3	2	3	2	3	2	1	1	2	2	2	6
180-184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
185-189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
190-194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
195-199	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
200-204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
205-209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
210-214	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4

Appendix Table 6.--Weight-frequency distributions in samples from purse-seine catches South Atlantic Area, excluding the North Carolina fall fishery, 1957

(M = male, F = female, T = total, including specimens for which sex was not determined)

Weight (g.)	Age												Total		
	0			1			2			3					
	M	F	T	M	F	T	M	F	T	M	F	T			
20-29	6	14	20	2	5	7	-	-	-	-	-	-	-	-	27
30-39	22	15	37	40	37	79	-	-	-	-	-	-	-	-	116
40-49	2	-	2	74	55	131	-	-	-	-	-	-	-	-	133
50-59	-	-	-	64	86	152	-	-	-	-	-	-	-	-	152
60-69	-	-	-	70	59	134	5	-	5	-	-	-	-	-	139
70-79	1	-	1	52	39	94	27	22	49	-	-	-	-	-	144
80-89	-	-	-	44	43	88	95	83	178	-	-	-	-	-	266
90-99	-	-	-	38	32	71	125	98	225	-	-	-	1	1	297
100-109	-	-	-	38	37	75	185	167	352	-	-	-	-	-	427
110-119	-	-	-	73	39	112	160	183	343	-	-	-	-	-	455
120-129	-	-	-	53	40	93	109	127	236	-	-	-	-	-	329
130-139	-	-	-	25	28	53	97	85	183	-	-	-	-	-	236
140-149	-	-	-	17	23	40	46	74	120	-	-	-	-	-	160
150-159	-	-	-	5	5	10	21	42	63	-	-	-	-	-	73
160-169	-	-	-	1	1	2	15	21	36	-	-	-	1	1	39
170-179	-	-	-	-	2	2	10	17	27	-	-	-	-	-	29
180-189	-	-	-	-	-	-	4	13	17	-	-	-	-	-	17
190-199	-	-	-	-	-	-	7	10	17	-	-	-	-	-	17
200-209	-	-	-	-	1	1	3	3	6	-	-	-	-	-	7
210-219	-	-	-	-	-	-	1	1	2	-	-	-	-	-	2
220-229	-	-	-	-	-	-	1	1	1	-	-	-	-	-	1
230-239	-	-	-	-	-	-	-	2	2	-	-	-	-	-	2
240-249	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250-259	-	-	-	-	-	-	-	-	-	-	-	1	1	2	2
260-269	-	-	-	-	-	-	-	1	1	-	-	-	-	-	1
Total . . .	31	29	60	596	532	1144	910	950	1863	1	3	4	3071		

Appendix Table 7.---Weight-frequency distributions in samples from purse-seine catches, Chesapeake Bay Area, 1957

(M = male, F = female, T = total, including specimens for which sex was not determined)

Weight (g.)	Age												Total						
	0			1			2			3				4			5		
	M	F	T	M	F	T	M	F	T	M	F	T		M	F	T	M	F	T
30-39	-	-	-	1	-	8	-	-	-	-	-	-	-	-	-	-	-	-	8
40-49	-	1	1	3	12	33	-	-	-	-	-	-	-	-	-	-	-	-	34
50-59	-	1	2	20	86	136	-	-	-	-	-	-	-	-	-	-	-	-	138
60-69	-	4	4	60	182	284	-	-	1	2	4	-	-	-	-	-	-	-	290
70-79	-	1	1	128	226	408	-	-	4	2	4	-	-	-	-	-	-	-	413
80-89	-	2	2	178	245	451	-	-	2	2	2	-	-	-	-	-	-	-	455
90-99	-	-	1	194	225	441	-	-	4	8	13	-	-	-	-	-	-	-	455
100-109	-	-	-	138	176	323	-	-	2	3	5	-	-	-	-	-	-	-	328
110-119	-	-	-	96	96	193	-	-	4	6	10	-	-	1	1	-	-	-	204
120-129	-	-	-	75	65	141	-	-	8	4	12	-	-	-	-	-	-	-	153
130-139	-	-	-	52	55	107	-	-	7	15	22	-	-	1	1	-	-	-	130
140-149	-	-	-	35	38	73	-	-	14	22	36	-	-	-	-	-	-	-	109
150-159	-	-	-	15	16	31	-	-	31	24	55	-	-	-	-	-	-	-	86
160-169	-	-	-	16	13	29	-	-	31	28	59	-	-	2	1	3	-	-	91
170-179	-	-	-	16	14	30	-	-	21	35	58	-	-	1	1	1	-	-	89
180-189	-	-	-	2	8	10	-	-	26	31	59	-	-	1	1	1	-	-	70
190-199	-	-	-	7	2	9	-	-	16	24	40	-	-	-	-	-	-	-	49
200-209	-	-	-	1	-	1	-	-	12	8	20	-	-	-	-	-	-	-	21
210-219	-	-	-	1	-	1	-	-	6	7	13	-	-	-	-	-	-	-	14
220-229	-	-	-	1	-	1	-	-	5	6	11	-	-	-	-	-	-	-	12
230-239	-	-	-	1	1	2	-	-	2	3	5	-	-	-	-	-	-	-	7
240-249	-	-	-	3	1	4	-	-	3	3	6	-	-	-	-	-	-	-	10
250-259	-	-	-	3	1	4	-	-	2	1	4	-	-	-	-	-	-	-	8
260-269	-	-	-	-	1	1	-	-	2	2	4	-	-	-	1	1	-	-	6
270-279	-	-	-	-	-	-	-	-	1	2	4	-	-	-	1	1	-	-	6
280-289	-	-	-	-	-	-	-	-	1	3	4	-	-	-	-	-	-	-	1
290-299	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
300-309	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310-319	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
320-329	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	1	2
330-339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
340-349	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1
Total ...	3	8	11	1046	1464	2722	197	243	446	2	7	9	0	1	1	0	1	1	3190

Appendix Table 8.--Weight-frequency distributions in samples from purse-seine catches, Middle Atlantic Area, 1957
(M = male, F = female, T = total, including specimens for which sex was not determined)

Weight (g.)	Age																								Total
	1		2		3		4		5		6		7		8		9								
	M	F	M	F	M	T	M	F	M	T	M	F	M	T	M	F	M	T	M	F	T				
40-49	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
50-59	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
60-69	9	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
70-79	2	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
80-89	12	42	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44
90-99	18	43	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45
100-109	34	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
110-119	50	98	3	1	4	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112
120-129	87	148	10	10	10	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	171
130-139	118	192	13	18	22	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	232
140-149	96	195	21	20	20	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	236
150-159	88	169	21	33	33	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	223
160-169	64	126	39	35	35	74	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	201
170-179	36	77	72	53	53	125	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	202
180-189	33	27	96	61	61	157	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	218
190-199	12	26	145	101	101	246	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	286
200-209	10	18	175	142	142	317	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	347
210-219	5	6	209	166	166	376	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	391
220-229	11	16	27	197	202	399	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	401
230-239	5	4	9	187	203	390	-	-	-	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	428
240-249	8	12	16	153	218	372	-	-	-	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	401
250-259	8	5	13	118	146	264	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	393
260-269	2	1	3	109	112	221	-	-	-	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	279
270-279	3	2	5	87	84	171	-	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	232
280-289	1	1	4	61	80	141	-	-	-	4	8	-	-	-	-	-	-	-	-	-	-	-	-	-	181
290-299	2	1	1	65	82	148	-	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	160
300-309	2	1	3	56	67	123	-	-	-	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-	158
310-319	1	1	2	71	52	123	-	-	-	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	140
320-329	-	-	-	45	60	105	-	-	-	10	5	-	-	-	-	-	-	-	-	-	-	-	-	-	137
330-339	-	-	-	40	53	93	-	-	-	10	5	-	-	-	-	-	-	-	-	-	-	-	-	-	122
340-349	-	-	-	45	43	88	-	-	-	7	14	-	-	-	-	-	-	-	-	-	-	-	-	-	111
350-359	-	-	-	46	38	84	-	-	-	3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	114
360-369	-	-	-	30	31	61	-	-	-	7	9	-	-	-	-	-	-	-	-	-	-	-	-	-	96
370-379	-	-	-	31	41	72	-	-	-	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	80
380-389	-	-	-	26	31	57	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	89
390-399	-	-	-	15	28	43	-	-	-	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	65
400-409	-	-	-	18	24	42	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	55
410-419	-	-	-	16	14	30	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	49
420-429	-	-	-	2	12	14	-	-	-	11	5	-	-	-	-	-	-	-	-	-	-	-	-	-	47
430-439	-	-	-	9	4	13	-	-	-	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	23
440-449	-	-	-	7	15	22	-	-	-	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	24
450-459	-	-	-	4	5	9	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	19
460-469	-	-	-	6	7	7	-	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	13
470-479	-	-	-	6	6	15	-	-	-	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	24
480-489	-	-	-	6	4	10	-	-	-	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	20
490-499	-	-	-	2	7	9	-	-	-	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	25

Appendix Table 8.--Weight-frequency distributions in samples from purse-seine catches, Middle Atlantic Area, 1957
(M = male, F = female, T = total, including specimens for which sex was not determined)

Weight (g.)	Age																		Total							
	1		2		3		4		5		6		7		8		9									
	M	T	M	F	M	F	M	F	M	T	M	F	M	T	M	F	M	T								
500-509	-	-	3	4	4	1	5	3	6	1	2	1	1	1	1	1	1	1	20							
510-519	-	-	2	3	5	1	11	3	7	2	2	3	2	1	2	1	1	1	27							
520-529	-	-	1	1	3	5	8	5	11	2	1	1	1	1	1	1	1	1	18							
530-539	-	-	1	2	4	8	10	9	10	3	3	4	1	1	1	1	1	1	28							
540-549	-	-	-	1	2	4	14	14	8	6	1	1	1	1	1	1	1	1	28							
550-559	-	-	-	2	4	10	5	5	10	3	1	1	1	1	1	1	1	1	35							
560-569	-	-	-	2	2	5	3	3	7	2	1	1	1	1	1	1	1	1	23							
570-579	-	-	-	1	2	2	1	9	2	4	2	1	1	1	1	1	1	1	17							
580-589	-	-	1	1	1	2	6	15	6	6	3	2	1	1	1	1	1	1	44							
590-599	-	-	1	-	-	5	11	8	21	6	3	3	3	3	3	3	3	3	33							
600-609	-	-	-	-	-	3	6	7	13	6	3	3	3	3	3	3	3	3	42							
610-619	-	-	-	-	-	5	8	7	18	6	6	6	6	6	6	6	6	6	48							
620-629	-	-	1	2	3	5	7	9	12	6	4	4	4	4	4	4	4	4	41							
630-639	-	-	-	1	1	5	9	17	15	6	1	1	1	1	1	1	1	1	24							
640-649	-	-	-	1	1	1	3	6	24	4	2	2	2	2	2	2	2	2	33							
650-659	-	-	-	2	2	2	3	5	11	4	1	1	1	1	1	1	1	1	26							
660-669	-	-	1	1	1	2	9	11	14	3	2	2	2	2	2	2	2	2	33							
670-679	-	-	-	-	-	2	9	11	14	4	1	1	1	1	1	1	1	1	11							
680-689	-	-	-	1	1	1	2	4	11	1	1	1	1	1	1	1	1	1	7							
690-699	-	-	-	1	1	1	2	4	4	2	1	1	1	1	1	1	1	1	9							
700-709	-	-	-	-	-	-	4	4	2	1	1	1	1	1	1	1	1	1	6							
710-719	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	11							
720-729	-	-	-	-	-	-	1	2	4	1	1	1	1	1	1	1	1	1	10							
730-739	-	-	-	-	-	-	2	4	2	1	1	1	1	1	1	1	1	1	5							
740-749	-	-	-	-	-	1	2	2	4	2	1	1	1	1	1	1	1	1	3							
750-759	-	-	-	-	-	-	2	2	2	1	1	1	1	1	1	1	1	1	1							
760-769	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1							
770-779	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
780-789	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
790-799	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
800-809	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
810-819	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
820-829	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
830-839	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
840-849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
850-859	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
860-869	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
870-879	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
880-889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
890-899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
900-909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
910-919	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
920-929	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
930-939	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
940-949	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
950-959	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
960-969	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Total . . .	718	682	1445	2338	4634	399	108	149	257	58	75	133	47	59	106	4	1	5	1	2	1	1	1	1	2	6973

Appendix Table 9.--Weight-frequency distributions in samples from purse-seine catches, North Atlantic Area, 1957
(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight (g.)	Age																		Total										
	1			2			3			4			5			6				7			8			9			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T		M	F	T	M	F	T	M	F	T	
140-149	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
150-159	2	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
160-169	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
170-179	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
180-189	1	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
190-199	2	2	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
200-209	1	1	2	2	2	4	13	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
210-219	-	-	-	11	2	13	24	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
220-229	-	-	-	17	7	24	32	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
230-239	-	-	-	21	8	29	38	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
240-249	1	-	1	11	17	28	35	22	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
250-259	-	-	-	13	22	35	45	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
260-269	-	-	-	22	22	44	66	44	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
270-279	-	-	-	18	15	33	49	35	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
280-289	1	-	1	19	16	35	53	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39
290-299	-	-	-	31	18	49	68	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
300-309	-	-	-	39	27	66	93	74	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
310-319	-	-	-	36	32	68	100	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
320-329	-	-	-	36	32	68	100	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
330-339	-	-	-	40	28	68	108	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
340-349	-	-	-	32	34	66	100	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83
350-359	-	-	-	40	29	69	109	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80
360-369	-	-	-	40	33	73	113	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
370-379	-	-	-	31	28	59	89	77	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
380-389	-	-	-	23	29	52	82	72	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
390-399	-	-	-	24	23	47	70	64	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
400-409	-	-	-	16	31	47	68	58	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69
410-419	-	-	-	13	19	32	51	44	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54
420-429	-	-	-	12	12	24	36	30	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
430-439	-	-	-	12	13	25	38	31	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57
440-449	-	-	-	8	8	16	24	16	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
450-459	-	-	-	8	8	16	24	16	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
460-469	-	-	-	5	6	11	17	12	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
470-479	-	-	-	4	4	8	12	8	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
480-489	-	-	-	4	5	9	14	10	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
490-499	-	-	-	4	4	8	12	8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57
500-509	-	-	-	4	5	9	14	10	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
510-519	-	-	-	3	3	6	9	6	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65
520-529	-	-	-	3	2	5	7	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
530-539	-	-	-	2	2	4	6	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
540-549	-	-	-	2	2	4	6	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88
550-559	-	-	-	1	1	2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	77
560-569	-	-	-	1	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86
	-	-	-	1	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87

Appendix Table 10.--- Weight-frequency distributions in samples from purse-seine catches, North Carolina fall fishery, 1957
(M = male, F = female, T = total, including specimens for which sex was not determined)

Weight (g.)	Age																		Total	
	0		1		2		3		4		5		6		7		8			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F		T
0-9	4	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
10-19	23	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
20-29	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
30-39	19	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
40-49	28	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
50-59	10	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
60-69	3	8	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
70-79	3	1	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
80-89	1	1	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
90-99	1	1	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
100-109	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
110-119	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
120-129	-	-	2	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
130-139	-	-	1	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
140-149	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
150-159	-	-	2	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	4
160-169	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
170-179	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
180-189	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
190-199	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
200-209	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
210-219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220-229	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230-239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240-249	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250-259	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
260-269	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
270-279	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
280-289	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
290-299	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300-309	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
310-319	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
320-329	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
330-339	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
340-349	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
350-359	-	-	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	2
360-369	-	-	-	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	2
370-379	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
380-389	-	-	-	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	2
390-399	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
400-409	-	-	-	-	11	11	-	-	-	-	-	-	-	-	-	-	-	-	-	3
410-419	-	-	-	-	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	6
420-429	-	-	-	-	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	7
430-439	-	-	-	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	3
440-449	-	-	-	-	13	13	-	-	-	-	-	-	-	-	-	-	-	-	-	6
450-459	-	-	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	7
460-469	-	-	-	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	3
470-479	-	-	-	-	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	6

Appendix Table 11.--Mean fork length and weight in samples from purse-seine catches, South Atlantic Area, excluding North Carolina fall fishery, 1957

(Numbers of fish in parentheses)

FORK LENGTH (mm.)						
Age	Males		Females		Both sexes	
0	128.7	(31)	129.0	(29)	128.8	(60)
1	167.5	(601)	166.6	(536)	167.0	(1137)
2	188.7	(912)	190.8	(951)	189.8	(1863)
3	241.0	(1)	210.7	(3)	218.2	(4)

WEIGHT (g.)						
0	34.5	(31)	30.2	(29)	32.4	(60)
1	83.2	(596)	82.4	(532)	82.8	(1128)
2	113.8	(910)	119.2	(950)	116.6	(1860)
3	251.0	(1)	170.0	(3)	190.2	(4)

Appendix Table 12.--Mean fork length and weight in samples from purse-seine catches, Chesapeake Bay Area, 1957

(Numbers of fish in parentheses)

FORK LENGTH (mm.)						
Age	Males		Females		Both sexes	
0	160.0	(3)	156.8	(8)	157.6	(11)
1	182.0	(1046)	178.5	(1464)	180.0	(2510)
2	222.2	(197)	220.1	(243)	221.0	(440)
3	217.5	(2)	224.4	(7)	222.9	(9)
4	-	-	267.0	(1)	267.0	(1)
5	-	-	252.0	(1)	252.0	(1)

WEIGHT (g.)						
0	73.3	(3)	66.2	(8)	68.2	(11)
1	101.8	(1046)	93.2	(1464)	96.8	(2510)
2	171.4	(197)	170.4	(243)	170.8	(440)
3	161.0	(2)	187.0	(7)	181.2	(9)
4	-	-	257.0	(1)	257.0	(1)
5	-	-	327.0	(1)	327.0	(1)

Appendix Table 13.--Mean fork length and weight in samples from purse-seine catches, Middle Atlantic Area, 1957

(Numbers of fish in parentheses)

FORK LENGTH (mm.)			
Age	Males	Females	Both sexes
1	199.2 (718)	200.1 (682)	199.6 (1400)
2	239.2 (2291)	241.6 (2339)	240.4 (4630)
3	275.5 (180)	282.7 (209)	279.4 (389)
4	303.8 (108)	312.6 (149)	308.9 (257)
5	309.4 (58)	316.6 (75)	313.5 (133)
6	310.7 (47)	321.7 (59)	316.8 (106)
7	311.5 (4)	282.0 (1)	305.6 (5)
8	321.0 (1)	327.0 (1)	324.0 (2)
9	328.0 (1)	326.0 (1)	327.0 (2)

WEIGHT (g.)			
1	147.7 (718)	150.7 (682)	149.2 (1400)
2	252.5 (2291)	261.6 (2338)	257.1 (4629)
3	408.8 (180)	446.3 (209)	428.9 (389)
4	559.0 (108)	611.2 (149)	589.2 (257)
5	584.2 (58)	625.9 (75)	607.7 (133)
6	580.4 (47)	653.6 (59)	621.1 (106)
7	557.5 (4)	443.0 (1)	534.6 (5)
8	622.0 (1)	639.0 (1)	630.5 (2)
9	662.0 (1)	605.0 (1)	633.5 (2)

Appendix Table 14.--Mean fork length and weight in samples from purse-seine catches, North Atlantic Area, 1957
(Numbers of fish in parentheses)

FORK LENGTH (mm.)					
Age	Males		Females		Both sexes
1	222.1	(9)	215.1	(12)	218.1 (21)
2	264.0	(585)	268.6	(521)	266.2 (1106)
3	287.0	(244)	296.2	(270)	291.8 (514)
4	304.0	(265)	313.4	(356)	309.4 (621)
5	312.3	(197)	321.0	(211)	316.8 (408)
6	315.1	(211)	324.4	(314)	320.7 (525)
7	317.4	(41)	325.6	(58)	322.2 (99)
8	328.8	(4)	316.7	(7)	321.1 (11)
9	332.0	(1)	-	-	332.0 (1)

WEIGHT (g.)					
1	200.0	(9)	182.4	(12)	190.0 (21)
2	343.0	(585)	362.0	(521)	352.0 (1106)
3	444.1	(243)	495.5	(270)	471.2 (513)
4	529.0	(265)	593.6	(355)	566.0 (620)
5	573.6	(196)	639.0	(210)	607.4 (406)
6	592.0	(210)	669.7	(312)	638.4 (522)
7	618.3	(41)	689.9	(58)	660.2 (99)
8	694.5	(4)	712.4	(7)	705.9 (11)
9	612.0	(1)	-	-	612.0 (1)

Appendix Table 15.--Mean fork length and weight in samples from purse-seine catches, North Carolina fall fishery, 1957

(Numbers of fish in parentheses)

FORK LENGTH (mm.)					
Age	Males		Females		Both sexes
0	129.4	(98)	129.0	(111)	129.1 (209)
1	178.9	(20)	184.9	(9)	180.8 (29)
2	280.9	(112)	289.0	(112)	285.0 (224)
3	297.6	(71)	306.8	(83)	302.5 (154)
4	308.2	(73)	317.1	(119)	313.7 (192)
5	314.2	(71)	324.0	(76)	319.2 (147)
6	314.7	(48)	327.2	(66)	321.9 (114)
7	311.0	(3)	327.1	(8)	322.7 (11)
8	-	-	334.5	(2)	334.5 (2)

WEIGHT (g.)					
0	35.7	(98)	35.0	(111)	35.3 (209)
1	88.8	(20)	105.0	(9)	93.8 (29)
2	429.8	(112)	474.0	(112)	451.9 (224)
3	512.4	(71)	563.9	(83)	540.1 (154)
4	561.8	(73)	632.8	(119)	605.8 (192)
5	600.5	(71)	668.7	(76)	635.8 (147)
6	596.6	(48)	682.0	(66)	646.0 (114)
7	596.0	(3)	688.9	(8)	663.5 (11)
8	-	-	783.5	(2)	783.5 (2)

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