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AGE AND SIZE COMPOSITION OF THE 1960 MENHADEN CATCH ALONG THE U.S. ATLANTIC COAST

WITH A BRIEF REVIEW OF THE COMMERCIAL FISHERY

by William R. Nicholson and Joseph R. Higham, Jr.

SPECIAL SCIENTIFIC REPORT–FISHERIES No. 479

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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Washington, D. C.
August, 1964

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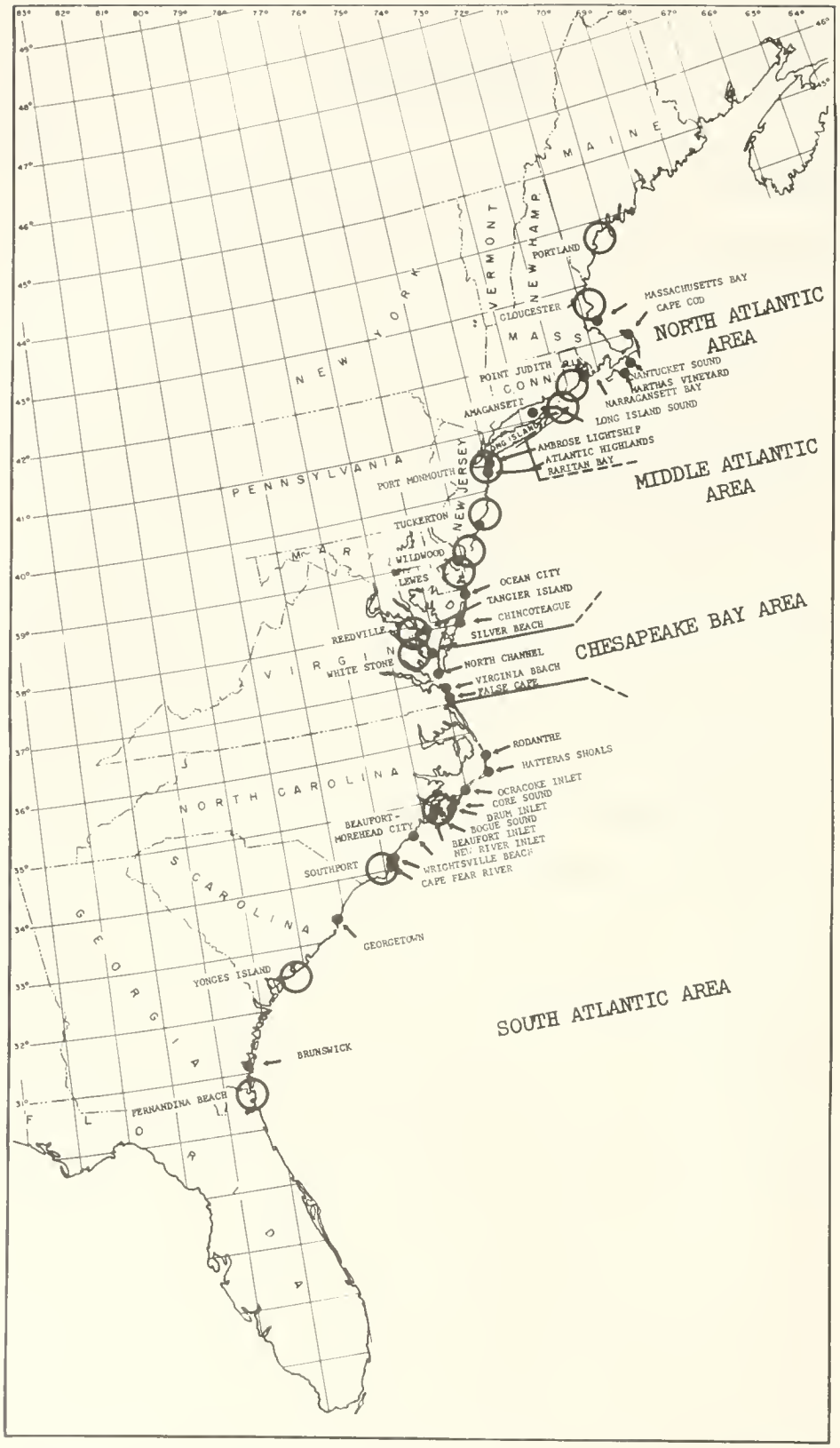

Figure 1.--Map showing areas used in summarizing Atlantic menhaden catch data, locations of menhaden reduction plants, and locations of places mentioned in the text.

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ABSTRACT

The 1960 purse seine catch of Atlantic menhaden, *Brevoortia tyrannus*, was the second smallest since 1955. In the summer fishery, 501,000 tons were landed; in the North Carolina fall fishery, 68,000 tons. The total estimated number of purse seine sets was 27,052 and the mean catch per set 21 tons, as compared with a mean of 28,810 sets and 23 tons per set for the period 1955-59. There were fewer vessels than in 1959 in all areas except the Middle Atlantic Area.

The catch was dominated by age-2 fish of the 1958 year class. This age group accounted for 69 percent of the catch in the South Atlantic Area, 82 percent in the Chesapeake Bay Area, 95 percent in the Middle Atlantic Area, 45 percent in the North Atlantic Area, and 21 percent in the North Carolina fall fishery. Mean length and weight of age-2 fish were less than in the previous 5 years.

INTRODUCTION

This is the sixth report of a series summarizing the annual catch-sampling data collected by the Bureau of Commercial Fisheries as part of a continuing investigation of the Atlantic menhaden, *Brevoortia tyrannus*. This report summarizes the 1960 purse seine fishery, and includes measures of the total catch and the distribution of fishing activity as well as summary data on the number, age, length, weight, and sex of Atlantic menhaden caught in the purse seine fishery. As in previous reports, the review of the "summer" fishery is referred to four geographical areas (fig. 1), while the North Carolina fall fishery is treated separately.

THE 1960 PURSE SEINE FISHERY

The 1960 purse seine catch was next to the smallest since 1955 in both the summer

fishery and the fall fishery, and below average for the period 1955-59 (table 1). While the catch in the Middle Atlantic Area increased over that in 1959, the catch in all other areas decreased.

The number of purse seine sets in the summer fishery was less than the 5-year average in all areas except the Middle Atlantic Area (table 1). The number was less than for any of the previous 5 years in the South Atlantic Area and next to the smallest in the North Atlantic Area. In the Chesapeake Bay Area, the number of sets was greater than in 1955 and 1956, but less than in other years; in the Middle Atlantic Area, it was less than in 1956 and 1957, but greater than in other years. The number of sets in the North Carolina fall fishery was less than for any of the previous 5 years.

The mean catch per set in the summer fishery in all areas except the Middle Atlantic Area was approximately the same as the mean for the 5-year period, 1955-59. The greatest difference occurred in the Middle Atlantic Area where the mean catch per set was 5 tons per set less than the 5-year mean. In the North Carolina fall fishery, however, the mean catch per set was 8 tons above the mean for the 5-year period (table 1).

There were 146 vessels in the fishery, with 114 in the summer fishery and 32 in the

Table 1.--Mean annual catch, mean number of purse seine sets, and mean catch per set, 1955-59; and the catch, number of sets, and catch per set, 1960, Atlantic menhaden purse seine fishery

Season and area	Catch		Purse seine sets[1]		Mean catch per purse seine set	
	Mean 1955-59	[2] 1960	Mean 1955-59	1960	Mean 1955-59	1960
	Thousand tons	*Thousand tons*	*Number*	*Number*	*Tons*	*Tons*
South Atlantic.....	56	40	3,349	2,353	17	17
Chesapeake Bay.....	141	112	8,086	6,588	17	17
Middle Atlantic.....	317	286	12,674	14,300	25	20
North Atlantic.....	71	63	2,624	2,423	27	26
Summer Fishery.....	585	501	26,802	25,664	22	20
North Carolina Fall Fishery..	76	[3] 68	2,054	1,388	37	49
Summer and Fall.....	660	569	28,810	27,052	23	21

[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, 1960. By Edward A. Power, U.S. Fish and Wildlife Service, Statistical Digest No. 53, 529 p.

[3] The North Carolina fall fishery normally extends into January; therefore, catch total includes January 1961, but not January 1960. Seasonal breakdown of the catch obtained from U.S. Fish and Wildlife Service, C.F.S. Nos. 2252 and 2521.

North Carolina fall fishery. The number of vessels fishing decreased from 1959 in every area except the Middle Atlantic Area.

South Atlantic Area

Although large numbers of Atlantic menhaden were reported in April off Fernandina Beach, Fla., poor market conditions and large inventories of fish meal delayed commencement of the fishery until May 9. Only three vessels fished out of Fernandina Beach during the season. Landings were good in May, but fish became scarce by the middle of June. In July, numerous schools appeared between Brunswick, Ga., and Fernandina Beach, and fishing continued good through August. During this time, however, catch quotas were imposed, and each vessel also was limited to a 5-day week. In September, hurricane "Donna" restricted fishing, and fish also became scarce. Two vessels made only six landings during the month. One vessel fished sporadically in October, and landed the last catch of the season on November 3.

Four vessels from Southport, N.C., began fishing at the mouth of the Cape Fear River on May 31. Fish were so scarce, however, that the vessels quit after only 2 days of fishing and remained idle for 3 consecutive weeks. On June 20, fish were located off Georgetown, S.C., but disappeared after 3 days. Only 12 landings were made in June. Four additional vessels joined the fleet in July, but fishing was poor and few landings were made. On August 2, fish were reported off Georgetown, S.C. Fishing in that area continued to be good for the next 3 weeks. During this time some good catches also were made off Wrightsville Beach, N.C. Hurricane "Donna" interrupted fishing in September, and fish also became scarce. Fish were landed on only 2 days in September and 1 day in October. Fishing ended on October 17.

Nine vessels constituted the fleet at Beaufort, N.C. Fishing began in Core Sound on May 24 and continued in Core and Bogue Sounds throughout the season. Fishing in outside waters was sporadic and generally poor through most of the summer. On June 16, some large schools appeared between Ocracoke and Cape Hatteras, N.C. Three vessels made good catches of these fish until they disappeared a few days later. Occasionally, catches were made in the vicinity of Cape Lookout, N.C., in July, and during the first 2 weeks in August schools were abundant in ocean waters off Wrightsville Beach and Bogue Inlet, N.C. Between September 9 and November 7, only sporadic landings were made.

The catch in the South Atlantic Area was 40,000 tons, 35,000 tons less than in 1959. The largest part of the catch was landed in August (39 percent), followed by July (25 percent), June (13 percent), October (9 percent), May (7 percent), September (6 percent), and November (1 percent).

Chesapeake Bay Area

Thirteen vessels began fishing on May 30, and seven more followed on June 6. In July, four additional vessels joined the fleet, but seven others stopped fishing. The fleet comprised 22 vessels in August, but 5 of these fished only 2 weeks. In September and October, 22 vessels fished intermittently. During the first week in October, 18 vessels stopped fishing but 1 vessel continued until October 27.

Fish were abundant all season throughout the bay, but were concentrated in the lower bay around Silver Beach and North Channel. In September, scattered landings were made outside the bay in the vicinity of False Cape and Virginia Beach, and in the upper bay around Tangier Island, but most fishing was done in the lower bay around North Channel. Fish began moving out of the lower bay in early October, and catches declined thereafter.

The purse seine catch in Chesapeake Bay was 114,000 tons, approximately 53 percent of the catch in 1959. The largest percentage of the catch was landed in June (28 percent), followed by August (22 percent), July (21 percent), September (15 percent), October (12 percent), and May (2 percent).

Middle Atlantic Area

On June 6 a fleet of 53 vessels began purse seine fishing. Initially, good catches were made in Raritan Bay and in the vicinity of Ambrose Lightship, but fish soon became scarce. Weather was bad during most of the month, and catches were small. On July 5, numerous schools were located off Atlantic Highlands, N.J. Fishing in this locality was good throughout July. Excellent catches were made off the southern shore of western Long Island in August. At the same time, schools of small fish were abundant between Chincoteague, Va., and Ocean City, Md. In mid-September, these smaller fish disappeared from the vicinity of Ocean City during a period of bad weather, and catches for the rest of the month were sporadic throughout the area. In early October, the migratory schools of older fish appeared off the southern shore of Long Island, and smaller fish reappeared off Ocean City. Fishing in these localities continued until October 21, when the season ended.

The purse seine catch was 286,000 tons, 5,000 tons more than in 1959. Landings in July accounted for 28 percent of the season's total, while landings in August, June, September, and October accounted for 27, 16, 16, and 13 percent, respectively.

North Atlantic Area

Fewer vessels participated in the fishery than in previous years. None fished out of Portland, Maine, and the Gloucester, Mass., fleet was reduced to seven vessels. The numbers in the Amagansett, N.Y., and Point Judith, R.I., fleets were the same as in previous years--10 at Amagansett and 4 at Point Judith.

The first catch of the season was taken from Narragansett Bay on June 2 by a Point Judith vessel. Three more vessels from Point Judith began fishing in the bay a few days later. Throughout the season, fishing by the Point Judith fleet was confined almost entirely to Narragansett Bay. Fishing by this fleet ended on October 10.

The Gloucester fleet began fishing on June 16 in Massachusetts Bay. Over 4,600 tons, representing approximately 51 percent of the season's catch, was taken from this area in July. In August, schools were reported as numerous, but they usually occurred where fishing was prohibited (e.g., Boston Bay), and catches were poor. Sporadic fishing continued until September 20.

The Amagansett fleet began fishing on June 6 off Marthas Vineyard. Excellent catches were made in that locality until mid-June, when bad weather occurred and the fish disappeared. Fish appeared during the last week of June in Nantucket Sound and in the waters off Cape Cod, and fishing was concentrated in these areas through July. In August, large schools appeared in western Long Island Sound and off the southern shore of Long Island. Fishing in these localities and in Nantucket Sound continued through August. In September and October, fishing was concentrated in Nantucket Sound and off the southern shore of Long Island. Fishing terminated on October 22.

The purse seine catch in the North Atlantic Area was 63,000 tons, 1,000 tons less than in 1959. The largest percentage of the catch was made in August (30 percent), followed by July (29 percent), June (18 percent), September (12 percent), and October (11 percent).

North Carolina Fall Fishery

There were 32 vessels in the fishery, 30 less than in 1959. Fishing began on November 9, when schools were spotted in the vicinity of Rodanthe, N.C. Strong winds and heavy seas prevented fishing from November 10 to 13, but on November 14 catches were made off Cape Hatteras, Ocracoke Inlet, and Beaufort, N.C. Good catches were made the following day, but bad weather restricted fishing from November 16 to 20. Fishing on a single, large school of fish resumed on November 21 and terminated on November 26 when the school disappeared off New River Inlet, N.C. On November 27, another large school of fish was spotted off Ocracoke Inlet. The entire fleet

followed this school as the fish moved southward, but fishing was interrupted by stormy weather, and the last catches were made on December 8 off Bogue Inlet, N.C. A few catches of young-of-the-year fish were made thereafter, but as in 1959 little effort was expended on these smaller fish by vessels from Beaufort and Morehead City, N.C. Vessels from Southport, however, caught, these fish on several days in early January, and while the tonnages landed were relatively small, the number of fish was actually quite large.

The total catch was 68,000 tons, 23,000 tons less than that in the previous year and 8,000 less than the 5-year average 1955-59. Bad weather was primarily responsible for the smaller catch.

Distribution of Purse Seine Sets

The estimated numbers of purse seine sets within 10-minute unit areas are shown in figure 2. Fishing was distributed over substantially the same range as in previous years, with most sets being made within the 20-fathom contour between latitudes 30° N. and 43° N. The greatest fishing activity occurred, as in previous years, in Chesapeake Bay and in coastal waters northward to Long Island.

The major changes from previous years included (1) an absence of fishing north of Massachusetts Bay (fishing in this locality has been decreasing since 1956), and (2) fewer sets in waters lying between northern Florida and southern North Carolina (this decrease in part reflected the decrease in the number of vessels in the fleet and the catch restrictions imposed at Fernandina Beach, Fla., but largely resulted from a scarcity of fish from Georgetown, S.C., to Wrightsville Beach, N.C.).

SAMPLING OF THE CATCH

Sampling methods in 1960 were the same as those described by June and Reintjes (1959). The number of samples taken at each plant location is given in table 2. No landings were made at Portland, Maine, or Yonges Island, S.C. The number of tons of fish landed per sample was 797 for the summer fishery and 1,115 for the North Carolina fall fishery.

Table 2.--Number of samples of Atlantic menhaden taken from purse seine catches, 1960

Season and locality	Number of samples
SUMMER FISHERY	
	Number
Fernandina Beach, Fla. . .	14
Southport, N. C.	14
Beaufort, N. C.	24
Reedville, Va.	102
Lewes, Del.	131
Wildwood, N. J.	86
Port Monmouth, N. J. . . .	118
Amagansett, N.Y.	128
Pt. Judith, R. I.	6
Gloucester, Mass.	6
Subtotal	629
FALL FISHERY	
Beaufort-Morehead City, N. C.	61
Total	690

Age Composition

The age composition (in percent) and the calculated numbers of fish at each age in the purse seine catches from 1955 to 1960 are listed in table 3.

The catch declined from a record 5.5 billion fish in 1959 to 2.9 billion in 1960, the second smallest in the 6-year period 1955-60. The small number of fish resulted from the disproportionate contribution by the unusually strong 1958 year class, which dominated the 1960 fishery as 2-year olds, and from the exceptionally poor contribution by the 1959 year class (age-1 fish). In 1959, age-1 fish (1958 year class) accounted for 75 percent of the catch and 4.1 billion fish, but in 1960, age-1 fish (1959 year class) accounted for only 24 percent of the catch and 0.7 billion fish. The 1958 year class set a record in 1960 for the number of age-2 fish contributed, with 1.9 billion. Age-4 fish (1956 year class)

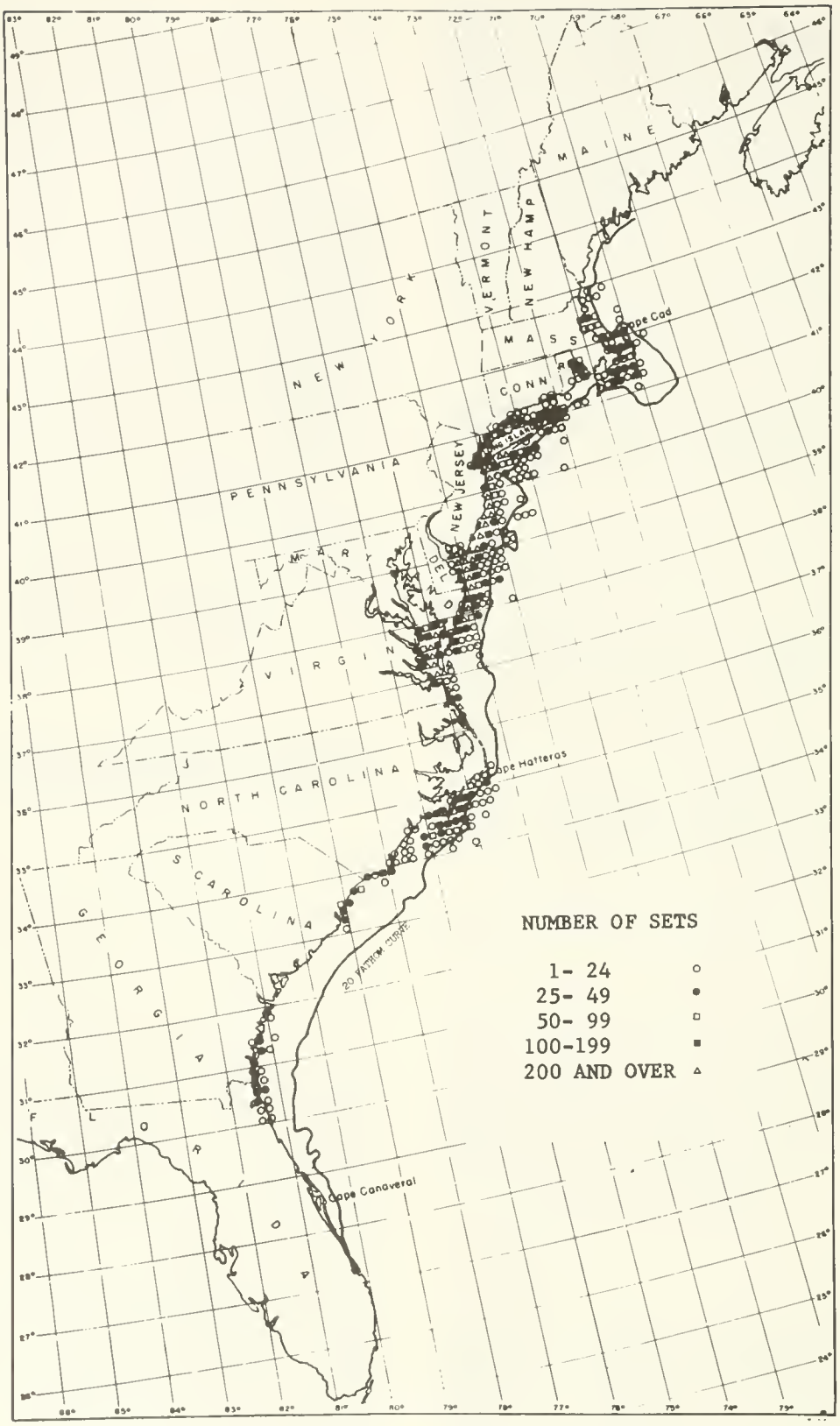

Figure 2.--Distribution of purse seine sets for Atlantic menhaden, 1960.

Table 3.--Age composition (in percent) and calculated number of Atlantic menhaden (in millions) at each age in purse seine catches, 1955-60

(Most numerous age group underscored)

AGE COMPOSITION

Year	Age									
	0	1	2	3	4	5	6	7	8-10	Total
1955 . . .	24.71	20.68	34.21	8.73	10.01	1.23	0.35	0.06	0.02	100.00
1956 . . .	1.00	57.16	25.97	9.61	1.26	4.18	0.67	0.12	0.02	99.99
1957 . . .	8.46	41.97	41.00	3.26	2.52	1.40	1.22	0.12	0.04	99.99
1958 . . .	3.81	30.85	60.93	2.72	0.62	0.56	0.32	0.17	+	99.98
1959 . . .	0.21	74.69	16.27	7.58	00.67	0.22	0.24	0.08	0.03	99.99
1960 . . .	2.47	16.98	72.78	2.77	3.72	0.86	0.31	0.08	0.03	100.00

NUMBER OF FISH

1955 . . .	761.01	636.86	1,053.47	268.87	308.21	37.95	10.75	1.88	0.59	3,079.59
1956 . . .	36.37	2,072.95	941.71	348.42	45.60	151.49	24.38	4.47	0.88	3,626.27
1957 . . .	300.77	1,491.13	1,456.63	115.96	89.72	49.66	43.43	4.34	1.27	3,552.91
1958 . . .	106.06	858.29	1,694.99	75.75	17.31	15.61	9.01	4.69	0.10	2,781.81
1959 . . .	11.40	4,120.10	897.34	418.42	37.15	12.35	13.06	4.71	1.82	5,516.35
1960 . . .	72.17	495.82	2,125.45	80.85	108.63	25.26	9.07	2.48	0.68	2,920.41

accounted for a larger part of the catch than in any year except 1955. As in previous years, the catch included only a small percentage of fish older than age 4. Age-0 fish (1960 year class) constituted a slightly greater percentage of the catch than in 1959 but generally less than in prior years.

The percentage age composition of the catches in different areas for 1960 is shown in figure 3 and listed in table 4, and the calculated numbers of fish in the different age groups is listed in table 5.

The catch in the South Atlantic Area comprised fish of age 0 through age 2. Age-2 fish (1958 year class) constituted the largest percentage of the catch for the second time in the period 1955-60. The number of fish caught was 399 million, about equal to that in 1955, 1957, and 1958, but much smaller than the 1.1 billion caught in both 1956 and 1959. In the latter 2 years, age-1 fish from exceptionally strong year classes (1955 and 1958 year classes respectively) accounted for most of the catch.

In the Chesapeake Bay Area, age-2 fish (1958 year class) constituted the largest percentage of the catch (82 percent) and age-1 fish the smallest percentage (18 percent) in the 6 years beginning with 1955. The number of fish (0.81 billion) was less than 1 billion for the first time since 1956.

In the Middle Atlantic Area, the catch also was dominated by age-2 fish (1958 year class). The number of age-2 fish (1.28 billion) was the largest contributed by a single year class in the 6-year period, 1955-60, but the numbers of age-1 (13.6 million) and age-3 (16.6 million) fish were the smallest in that period. Age-4 fish contributed 24.2 million, and all older age groups 8.5 million. The entire catch of 1.3 billion fish was the third largest in the 6-year period.

The trend towards dominance of the catch by age-2 fish (1958 year class) continued in the North Atlantic Area. This age group

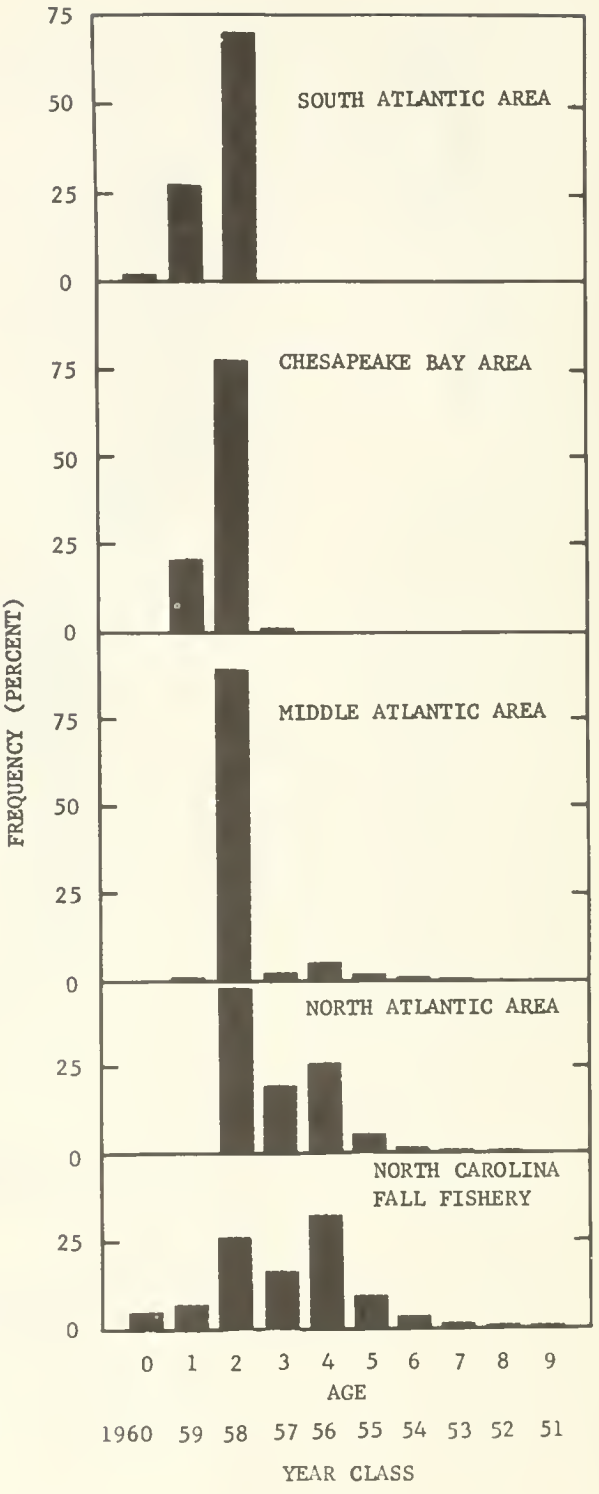

Figure 3.--Age composition of Atlantic menhaden from purse seine catches, 1960.

Table 4.--Age composition (in percent) of Atlantic menhaden purse seine catches, by area and season, 1955-59

(Most numerous age group underscored)

Area, year and season	AGE								
	0	1	2	3	4	5	6	7	8-10
SUMMER FISHERY									
South Atlantic:									
1955	1.66	65.22	27.02	3.32	2.77	--	--	--	--
1956	--	98.98	0.94	0.05	0.02	--	--	--	--
1957	3.65	32.47	63.76	0.12	--	--	--	--	--
1958	0.32	68.44	29.40	1.79	0.06	--	--	--	--
1959	--	90.90	8.95	0.15	--	--	--	--	--
1960	3.47	28.00	68.53	--	--	--	--	--	--
Chesapeake Bay:									
1955	1.63	44.77	51.30	1.54	0.69	0.06	--	--	--
1956	--	90.91	9.02	0.07	--	--	--	--	--
1957	0.25	85.22	14.25	0.26	0.02	0.01	--	--	--
1958	0.04	46.32	53.01	0.50	0.08	0.04	--	--	--
1959	0.47	90.12	8.76	0.65	--	--	--	--	--
1960	--	17.55	82.12	0.33	--	--	--	--	--
Middle Atlantic:									
1955	--	1.81	55.79	23.18	17.43	1.40	0.26	0.10	0.01
1956	--	14.78	63.96	18.08	1.44	1.41	0.26	0.06	0.01
1957	--	22.24	68.51	4.26	2.62	1.26	1.02	0.03	0.05
1958	--	2.54	95.08	2.21	0.12	0.03	0.02	--	--
1959	--	57.94	30.27	11.31	0.30	0.06	0.07	0.04	--
1960	--	1.01	95.29	1.24	1.82	0.41	0.17	0.04	0.02
North Atlantic:									
1955	--	--	0.25	13.94	67.55	12.84	4.65	0.54	0.22
1956	--	--	6.41	36.35	8.22	40.96	6.42	1.29	0.36
1957	--	0.91	45.00	18.79	16.06	8.59	8.95	1.46	0.24
1958	--	0.16	52.58	24.47	8.43	6.75	5.13	2.36	0.11
1959	--	4.62	21.13	57.90	7.56	3.11	3.20	1.77	0.71
1960	--	--	44.92	21.39	26.93	4.90	1.48	0.36	0.01
FALL FISHERY									
North Carolina:									
1955	87.19	3.61	6.00	0.86	1.96	0.32	0.04	--	0.01
1956	16.12	26.78	11.95	16.61	4.15	20.61	3.31	0.46	--
1957	74.20	3.24	6.08	4.07	5.40	3.84	2.89	0.25	0.02
1958	38.07	10.73	35.86	7.18	2.63	3.14	1.48	0.91	--
1959	0.39	3.84	20.11	58.00	10.30	3.21	3.40	0.44	0.30
1960	31.37	7.70	20.86	12.18	18.92	5.87	2.17	0.71	0.22

Table 5.--Calculated number of Atlantic menhaden (in millions) at each age in purse seine catches, by area and season, 1955-60

(Most numerous age group 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	--	1,147.88	10.91	0.63	0.23	0.02	--	--	--	1,159.67
1957	13.27	117.91	231.56	0.42	--	--	--	--	--	363.16
1958	1.47	315.20	135.39	8.25	0.26	--	--	--	--	460.57
1959	--	1,051.86	103.53	1.72	--	--	--	--	--	1,157.11
1960	13.86	111.84	273.73	--	--	--	--	--	--	399.43
Chesapeake Bay:										
1955	12.18	334.24	382.92	11.52	5.17	0.43	--	--	--	746.46
1956	--	674.37	66.90	0.49	--	--	--	--	--	741.76
1957	3.12	1,056.16	176.58	3.22	0.22	0.08	--	--	--	1,239.38
1958	0.48	490.88	561.76	5.25	0.90	0.39	--	--	--	1,059.66
1959	10.71	2,058.36	200.20	14.78	--	--	--	--	--	2,284.05
1960	--	142.58	666.94	2.64	--	--	--	--	--	812.16
Middle Atlantic:										
1955	--	16.66	513.31	312.26	160.40	12.90	2.34	0.96	0.12	1,018.95
1956	--	190.28	823.35	232.82	18.60	18.19	3.31	0.71	0.13	1,287.39
1957	--	302.78	932.53	58.05	35.72	17.15	13.92	0.40	0.69	1,361.24
1958	--	22.73	850.63	19.75	1.07	0.31	0.17	--	--	894.66
1959	--	994.72	519.71	194.19	5.13	1.02	1.22	0.75	--	1,716.74
1960	--	13.57	1,277.75	16.64	24.42	5.45	2.33	0.51	0.23	1,340.90

(Continued)

Table 5.--Calculated number of Atlantic menhaden (in millions) at each age in purse seine catches, by area and season, 1955-60 (con't)

(Most numerous age group underscored)

Area, year and season	Age									Total
	0	1	2	3	4	5	6	7	8-10	
SUMMER FISHERY										
North Atlantic:										
1955	--	--	0.42	23.76	115.10	21.88	7.93	0.92	0.37	170.38
1956	--	--	13.58	77.00	17.41	86.78	13.59	2.73	0.75	211.84
1957	--	1.87	92.66	38.68	33.07	17.69	18.44	2.99	0.50	205.90
1958	--	0.14	49.13	22.87	7.88	6.31	4.80	2.21	0.10	93.44
1959	--	8.28	37.92	103.91	13.58	5.59	5.75	3.18	1.28	179.48
1960	--	--	81.78	38.93	49.04	8.91	2.70	0.65	0.03	182.04
FALL FISHERY										
North Carolina:										
1955	742.32	30.76	51.08	7.32	16.71	2.74	0.39	--	0.10	851.42
1956	36.37	60.42	26.97	37.48	9.36	46.50	7.48	1.03	--	225.61
1957	284.39	12.41	23.30	15.60	20.72	14.74	11.07	0.95	0.08	383.26
1958	106.06	29.34	98.08	19.63	7.20	8.60	4.04	2.48	--	273.48
1959	0.69	6.87	35.99	103.81	18.44	5.75	6.09	0.78	0.54	178.96
1960	58.31	14.32	38.76	22.63	35.17	10.90	4.03	1.32	0.42	185.86

constituted 21 percent or more of the catch for the fourth consecutive year. Age-1 fish (1959 year class) were absent from the catch for the first time in 4 years. The percentage of age-4 fish (27 percent) was the largest since 1955, but there was a further decline in the contributions by fish of ages 6 to 10.

Excluding the catch of age-1 fish, the North Carolina fall fishery was dominated by age-2 fish (1958 year class). While accounting for 21 percent of the catch, the latter age group did not contribute to the fall fishery in proportion to its contribution to the summer catches in different areas. Contribution by age-4 fish (35 million) was the highest in 6 years. The catch of age-0 fish (1960 year class) was made almost entirely by vessels fishing out of Southport, N.C., in early January. The total catch of 185 million was only slightly greater than in 1959 but substantially less than in any of the previous 4 years. Although the tonnage was less in 1960 than in 1959, the number of fish was greater because of the greater number of age-0 fish.

Length Composition

The length-frequency distributions (in percent) of fish in samples from the summer fishery and from the North Carolina fall fishery are shown in figure 4 (see also appendix tables 1-5).

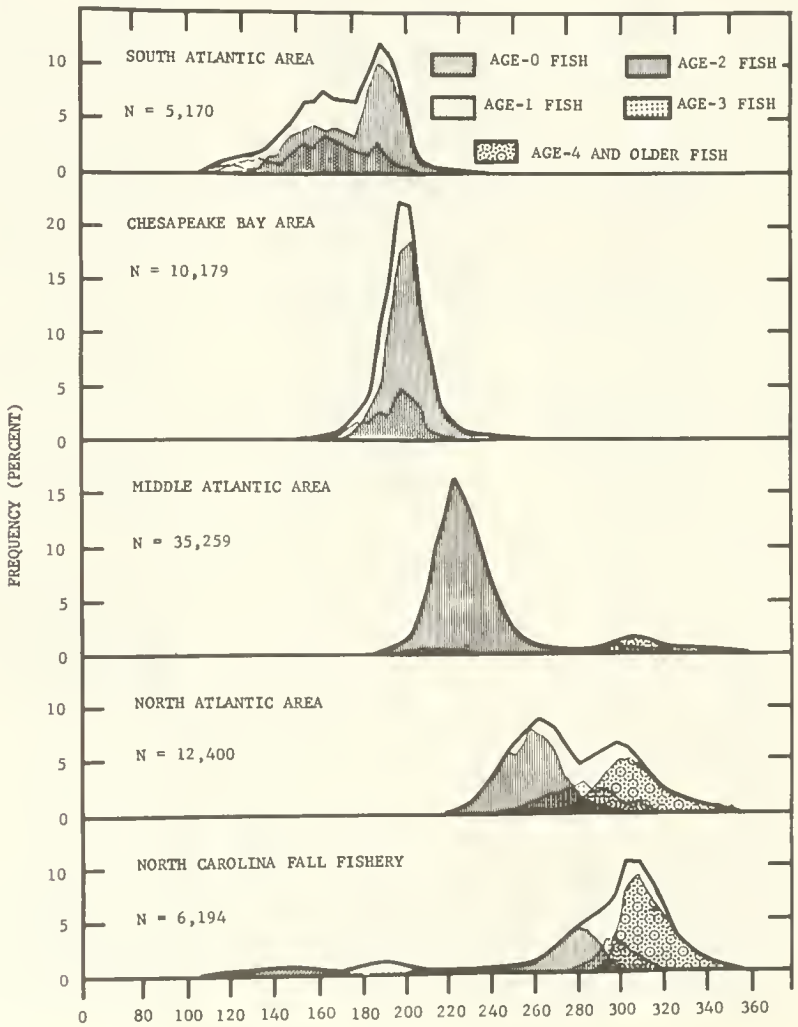

Figure 4.--Length composition of samples of Atlantic menhaden from purse seine catches, 1960.

The lengths of fish caught in the South Atlantic Area ranged from 110 to 240 mm. Age-2 fish furnished the principal modal group and showed greater variation than any other age group, ranging from 125 to 240 mm. There was almost a complete overlap in the lengths of age-1 and age-2 fish. Age-2 fish were smaller than in any other area.

Fish caught in the Chesapeake Bay Area ranged from 160 to 240 mm. The frequency distribution was unimodal (197 mm.). Although age-2 fish were slightly larger than age-1 fish, the two age groups could not be separated from each other by length.

In the Middle Atlantic Area, the lengths ranged from 175 to 350 mm. A mode, representing age-2 fish, occurred at 222 mm., followed by a minor peak, representing age-4 fish, at 307 mm. Age-2 fish were larger than those in either the Chesapeake Bay or the South Atlantic Areas.

The length-frequency distribution of fish caught in the North Atlantic Area was bimodal and ranged from 220 to 355 mm. The primary mode at 257 mm. represented age-2 fish, and the secondary mode at 297 mm. represented age-4 and older fish. Age-2 fish were larger than those in any of the other areas during the summer season.

The length-frequency distribution of fish taken in the North Carolina fall fishery was negatively skew, due to the occurrence of age-0 and age-1 fish, but unimodal, with lengths ranging from 70 to 354 mm. The mode at 302 mm. resulted from the relatively large percentage of fish age-4 and older.

As in previous years, the females were larger than the males (fig. 5), and the difference was greater among the older and larger fish in the North Atlantic Area and the North Carolina fall fishery. Among age-1 and age-2 fish caught in the other areas, the difference was less evident. There was no significant change from previous years in the ratio of females to males (table 6).

Table 6.--Sex ratio of Atlantic menhaden in purse seine catches, by area and season, 1960

Area and season	Males	Females	Ratio of females to males
SUMMER FISHERY	*Number*	*Number*	
South Atlantic . .	512	461	0.90
Chesapeake Bay . .	951	1018	1.07
Middle Atlantic. .	3502	3301	0.94
North Atlantic . .	1240	1276	1.03
FALL FISHERY			
North Carolina . .	572	636	1.11

Weight Composition

The weight-frequency distributions (in percent) of fish in catch samples from each area and from the North Carolina fall fishery are shown in figure 6 (see also appendix table 6-10).

The predominance of age-2 fish was reflected in each distribution except that for the North Carolina fall fishery. In the South Atlantic Area, the presence of age-1 fish of a smaller size range resulted in a bimodal distribution. In the Chesapeake Bay Area, the distribution was unimodal, and individual age groups were indistinguishable. The distribution in the Middle Atlantic Area was unimodal and due to the occurrence of older fish, positively skew. In the North Atlantic Area, the bimodal distribution reflected the predominance of age-2 and age-4 fish, and the wide range reflected the occurrence of several age groups. The wide range and the absence of any dominant mode in the frequency curve for the North Carolina fall fishery resulted from the occurrence, in relatively equal numbers, of all age groups.

Mean Length and Weight

The mean lengths and weights of fish in purse seine catches for the years 1955 to 1960

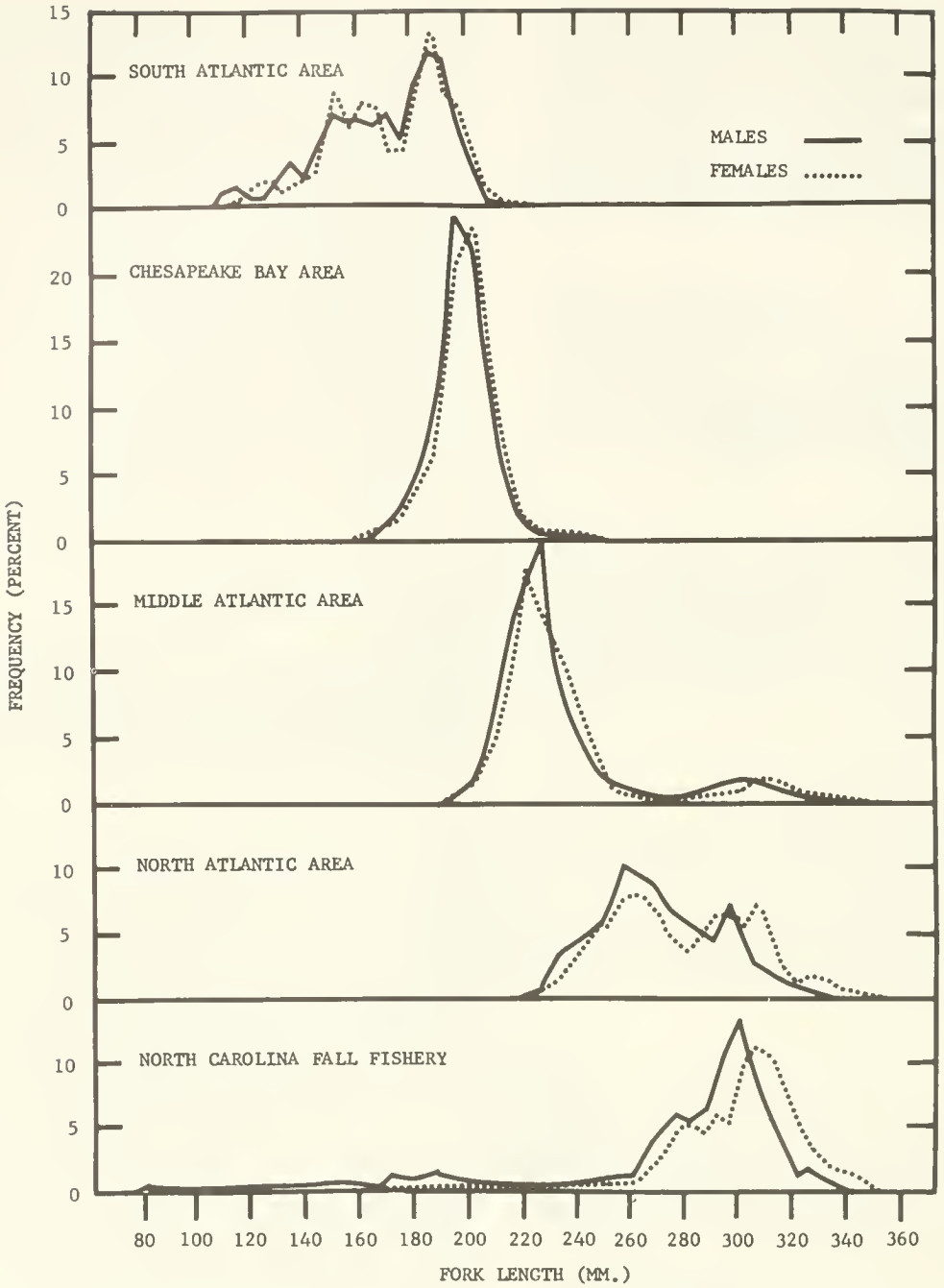

Figure 5.--Length frequencies of male and female Atlantic menhaden in samples from purse seine catches, 1960.

are summarized in tables 7 and 8, and the mean lengths and weights of each age group in the 1960 catches are given by sex in appendix tables 11-15.

In the South Atlantic, Chesapeake Bay, and Middle Atlantic Areas, the mean lengths and weights were greater than in 1959; in the North Atlantic Area, both means were less; and in the North Carolina fall fishery, the mean weight was greater while the mean length was unchanged. The increases in the South Atlantic, Chesapeake Bay, and Middle Atlantic Areas resulted from increases in the

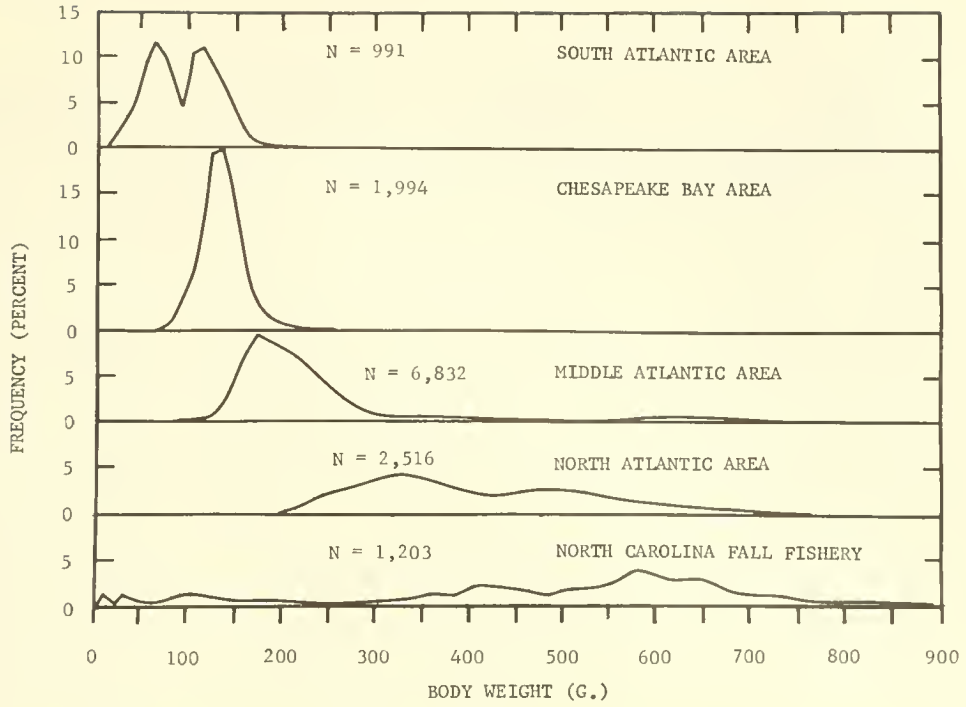

Figure 6.--Weight composition of samples of Atlantic menhaden purse seine catches, 1960.

proportion of age-2 fish and concomitant decreases in the proportion of age-1 fish in the catches. The decrease in the North Atlantic Area resulted from an increase in the proportion of age-2 fish and a decrease in the proportion of older fish, as well as a decrease in the mean length and weight of fish in most age groups. Changes in the mean length and weight of fish in the North Carolina fall fishery simply reflected changes in the proportions of various age groups.

The mean lengths and weights of age-1 and age-2 fish also changed from previous years. In the South Atlantic Area, the mean length of age-1 fish was larger than in 1956 and 1959, but smaller than in 1955, 1957, and 1958. The mean length of age-1 fish was the second largest in the Chesapeake Bay Area, and the third largest in the Middle Atlantic Area for the 6-year period. In the South Atlantic, Chesapeake Bay, and Middle Atlantic Areas, the mean lengths and weights of age-2 fish were the smallest of the period 1955-60. In the Chesapeake Bay and Middle Atlantic Areas, the mean length of age-2 fish has decreased every year since 1955. For each older age group, the mean length and weight in the Middle Atlantic Area was generally larger than for most previous years; in the North Atlantic Area, little change in mean length and weight was observed. In the North Carolina fall fishery, however, the mean lengths of individual age groups were either slightly smaller, or were relatively unchanged from previous years, but the weights were all substantially greater, indicating an increased weight-length ratio in 1960.

DISCUSSION

The purse seine catch of Atlantic menhaden was the second smallest in the past 6 years, despite the occurrence, as age-2 fish, of what unquestionably was the largest year class (1958) in recent years. Suggested reasons for the smaller catch in 1960 are (1) the scarcity of age-1 fish, (2) the smaller size of age-2 fish, (3) self-imposed catch limits in some localities, and (4) decreased availability of older fish.

The scarcity of age-1 fish undoubtedly was reflected in reduced catches in the South

Table 7.--Mean fork length (in millimeters) of Atlantic menhaden at each age in purse seine catches, by area and season, 1955-60

(Most numerous age group 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	--	159	198	214	224	234	--	--	--	--	--	160
1957	129	167	190	218	--	--	--	--	--	--	--	180
1958	132	168	190	202	211	--	--	--	--	--	--	175
1959	--	153	199	218	--	--	--	--	--	--	--	158
1960	118	162	177	--	--	--	--	--	--	--	--	172
Chesapeake Bay:												
1955	152	199	236	244	251	242	--	--	--	--	--	219
1956	--	187	222	293	--	--	--	--	--	--	--	191
1957	158	180	221	223	267	252	--	--	--	--	--	186
1958	118	189	213	230	307	311	--	--	--	--	--	202
1959	155	162	215	234	--	--	--	--	--	--	--	169
1960	--	194	200	244	--	--	--	--	--	--	--	199
Middle Atlantic:												
1955	--	228	259	279	290	300	314	333	310	--	--	274
1956	--	221	252	286	302	311	317	321	332	--	--	264
1957	--	200	240	279	309	314	317	306	324	327	--	240
1958	--	214	239	253	300	313	323	--	--	--	--	239
1959	--	180	234	255	308	302	319	327	--	--	--	211
1960	--	218	227	283	305	316	327	332	334	--	--	234

(Continued)

Table 7.--Mean fork length (in millimeters) of Atlantic menhaden at each age in purse seine catches, by area and season, 1955-60 (Con't)

(Most numerous age group underscored)

Area, year and season	Age											Mean
	0	1	2	3	4	5	6	7	8	9	10	
North Atlantic:												
1955	--	--	277	287	301	316	323	330	336	347	344	303
1956	--	--	277	290	307	315	322	328	336	340	--	306
1957	--	218	266	292	309	317	321	322	321	332	--	295
1958	--	223	255	292	310	321	328	330	344	--	--	281
1959	--	210	260	280	312	320	328	333	339	335	--	280
1960	--	--	257	280	299	317	331	337	341	--	--	276
FALL FISHERY												
North Carolina:												
1955	123	209	259	282	304	317	321	--	338	--	--	215
1956	118	182	262	298	308	312	318	325	--	--	--	253
1957	129	181	285	302	314	319	322	323	334	--	--	269
1958	116	202	264	304	315	324	328	330	--	--	--	244
1959	141	177	262	290	312	323	327	331	341	--	--	283
1960	144	188	268	294	307	316	326	333	347	337	--	283

Table 8.--Mean weight (grams) of Atlantic menhaden at each age in purse seine catches, by area and season, 1955-60

(Most numerous age group underscored)

Area, year and season	Age											Mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955	35	82	125	155	157	--	--	--	--	--	--	98
1956	--	67	134	176	217	224	--	--	--	--	--	69
1957	32	83	117	190	--	--	--	--	--	--	--	102
1958	40	84	120	143	157	--	--	--	--	--	--	96
1959	--	62	138	179	--	--	--	--	--	--	--	70
1960	29	76	100	--	--	--	--	--	--	--	--	92
Chesapeake Bay:												
1955	60	142	222	262	278	235	--	--	--	--	--	185
1956	--	118	196	388	--	--	--	--	--	--	--	125
1957	--	97	171	181	257	327	--	--	--	--	--	108
1958	28	119	162	214	469	480	--	--	--	--	--	142
1959	66	70	164	204	--	--	--	--	--	--	--	81
1960	--	128	136	227	--	--	--	--	--	--	--	135
Middle Atlantic:												
1955	--	225	317	404	457	505	596	712	543	--	--	385
1956	--	206	305	448	522	582	629	643	688	--	--	359
1957	--	149	257	429	589	608	621	535	630	634	--	270
1958	--	183	260	319	506	578	617	--	--	--	--	262
1959	--	100	231	314	543	531	599	606	--	--	--	181
1960	--	179	207	479	602	673	730	755	782	--	--	244

(Continued)

Table 8.--Mean weight (grams) of Atlantic menhaden at each age in purse seine catches, by area and season, 1955-60 (con't)

(Most numerous age group underscored)

Area, year and season	Age											Mean
	0	1	2	3	4	5	6	7	8	9	10	
North Atlantic:												
1955	--	--	401	426	494	589	641	691	732	760	774	514
1956	--	--	395	444	521	565	615	658	725	766	--	522
1957	--	190	352	471	566	607	638	660	706	612	--	497
1958	--	181	317	493	588	661	693	711	833	--	--	448
1959	--	169	331	421	583	631	684	720	750	740	--	429
1960	--	--	320	423	513	605	680	701	849	--	--	410
FALL FISHERY												
North Carolina:												
1955	31	166	356	460	566	648	690	--	806	--	--	256
1956	28	116	346	516	563	582	642	643	--	--	--	373
1957	35	94	452	540	606	636	646	664	784	--	--	450
1958	26	155	360	573	668	722	741	756	--	--	--	344
1959	46	107	343	466	586	642	678	703	737	--	--	449
1960	46	112	387	527	609	665	737	773	767	713	--	497

Atlantic, Chesapeake Bay, and Middle Atlantic Areas. This age group, in the past, usually constituted a large percentage of the catch in these areas, but in 1960 its contribution to the catch in each area was the smallest in the past 6 years. To some extent, the overwhelming abundance of age-2 fish compensated for the scarcity of age-1 fish in the Chesapeake Bay and Middle Atlantic Areas. In the South Atlantic Area, however, where the catch normally consists of only two age groups, the abundance of age-2 fish was not sufficient to compensate for the scarcity of age-1 fish, and the catch declined by nearly 50 percent from that in the previous year.

The numbers of age-2 fish in the South Atlantic, Chesapeake Bay, and Middle Atlantic Areas were greater than in any of the previous years for which there are data, but the average weight in each area was the smallest during the period. In the South Atlantic Area, it was 17 g. less; in the Chesapeake Bay Area, 26 g. less; and in the Middle Atlantic Area, 24 g. less than the smallest mean weight in any previous year.

Because of poor market conditions and large inventories of meal, restrictions were imposed on fishing in 1960. In the South Atlantic Area (Fernandina, Fla.), daily and weekly quotas were placed on individual vessels when fish were abundant, and in the Chesapeake Bay Area many vessels stopped fishing for extended periods during the middle of the season. Had these restrictions not been imposed, the catch undoubtedly would have been much greater than it was in the Chesapeake Bay Area, and slightly greater in the South Atlantic Area.

A more fundamental reason for the reduced catch in 1960 probably was the decreased abundance of older fish in the catches in the Middle and North Atlantic Areas. The trend toward proportionally greater numbers of younger and smaller fish in the catches in these areas was noted in previous reports in this series. One of the principal reasons suggested for this decline was the over-exploitation of age-1 and age-2 fish (June and Nicholson, 1963). The number, size, and efficiency of vessels exploiting these ages has increased continually since about 1950 (Nicholson).[1] Although the 1958 year class was unquestionably large, the amount of effort expended on age-1 fish of this year class was greater than that expended on age-1 fish of any previous year class, and the effort on age-2 fish also was exceptionally great.

The high rate of exploitation of the younger age groups, and the small size of the 1959 year class make it unlikely that the catch of Atlantic menhaden will increase in the next few years. It will more likely decrease unless strong year classes appear in 1960 or 1961. Regardless of the size of any year class in the next few years, however, the 1958 year class probably will contribute a sizable portion of the catch at least through the 1963 season.

SUMMARY

1. The 1960 purse seine catch of Atlantic menhaden, *Brevoortia tyrannus* was next to the smallest for the period 1955-60. Only 501,000 tons were landed in the summer fishery, and 68,000 tons in the North Carolina fall fishery. The largest portion of the catch was made in the Middle Atlantic Area, the smallest in the South Atlantic Area.

2. The number of vessels and the number of purse seine sets increased over 1959 in the Middle Atlantic Area and decreased in all other areas. The mean catch per set did not change greatly in any one area.

3. The most productive fishing grounds were in Chesapeake Bay and the coastal waters northward to the southern shore of Long Island. Fish were unusually scarce in coastal waters from northern Florida to Cape Hatteras, N.C., and in waters north of Massachusetts Bay.

4. The 1960 catch was dominated by age-2 fish (1958 year class). This age group accounted for the greatest percentage of the catch in all areas except the North Carolina

[1] William R. Nicholson. Measurement of effort, and changes in the catch, effort, and catch per unit of effort in the Atlantic menhaden fishery, 1940-1962. Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C. [Unpublished manuscript.]

fall fishery. The number of age-2 fish in the catch was greater and the number of age-1 fish (1959 year class) fewer than in any previous year in the South Atlantic, Middle Atlantic, and Chesapeake Bay Areas.

5. The trend of fewer fish among the older age groups in catches in the Middle and North Atlantic Areas continued.

6. The mean lengths and weights of age-2 fish were smaller than in any previous year.

ACKNOWLEDGMENT

The cooperation of the menhaden plant owners and operators, who furnished the records of vessel landings and provided facilities for processing the catch samples, is gratefully acknowledged. Special thanks are also due to those vessel captains and pilots who kept detailed records of their daily fishing activities.

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APPENDIX TABLES

Appendix Table 1.--Length-frequency distributions of Atlantic menhaden in samples from purse seine catches, South Atlantic Area, excluding the North Carolina fall fishery, 1960

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

Fork length (mm.)	Age									Total
	0			1			2			
	M	F	T	M	F	T	M	F	T	
110-114	6	-	6	-	-	-	-	-	-	6
115-119	5	1	7	4	1	5	-	-	-	12
120-124	1	3	5	3	5	8	-	-	-	13
125-129	1	1	2	2	7	10	1	1	3	15
130-134	-	-	-	7	6	13	4	-	4	17
135-139	-	-	-	6	4	10	11	4	15	25
140-144	-	-	-	2	6	8	10	4	14	22
145-149	-	-	-	8	5	13	16	15	32	45
150-154	-	-	-	14	12	26	23	27	50	76
155-159	-	-	-	14	8	22	20	21	41	63
160-164	-	-	-	17	16	33	18	20	38	71
165-169	-	-	-	12	16	28	20	19	40	68
170-174	-	-	-	15	7	22	21	14	36	58
175-179	-	-	-	10	8	18	17	13	30	48
180-184	-	-	-	5	11	16	45	32	79	95
185-189	-	-	-	12	13	25	49	51	101	126
190-194	-	-	-	5	7	12	52	34	91	103
195-199	-	-	-	2	2	4	32	34	70	74
200-204	-	-	-	1	1	2	15	19	34	36
205-209	-	-	-	-	-	-	3	8	11	11
210-214	-	-	-	-	-	-	1	2	3	3
215-219	-	-	-	-	-	-	1	1	2	2
220-224	-	-	-	-	-	-	-	2	2	2
225-229	-	-	-	-	-	-	-	-	-	-
230-234	-	-	-	-	-	-	-	-	-	-
235-239	-	-	-	-	-	-	-	-	-	-
240-244	-	-	-	-	-	-	1	-	1	1
Total .	13	5	20	139	135	275	360	321	697	992

Appendix Table 2.--Length-frequency distributions of Atlantic menhaden in samples from purse seine catches, Chesapeake Bay Area, 1960

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

Fork length (mm.)	Age									Total
	1			2			3			
	M	F	T	M	F	T	M	F	T	
160-164	-	1	1	-	-	-	-	-	-	1
165-169	2	3	5	1	-	1	-	-	-	6
170-174	10	8	18	3	3	7	-	-	-	25
175-179	9	21	30	8	7	16	-	-	-	46
180-184	17	16	33	29	23	55	-	-	-	88
185-189	23	28	51	49	32	85	-	-	-	136
190-194	22	27	49	110	109	225	-	-	-	274
195-199	54	40	94	176	173	353	-	-	-	447
200-204	37	37	75	171	201	375	-	-	-	450
205-209	24	25	49	106	122	229	-	-	-	278
210-214	6	8	14	51	80	132	-	-	-	146
215-219	1	1	2	25	22	47	-	-	-	49
220-224	-	-	-	9	14	23	-	1	1	24
225-229	-	-	-	2	6	8	-	-	-	8
230-234	-	-	-	3	3	6	-	-	-	6
235-239	-	-	-	1	3	4	-	-	-	4
240-244	-	-	-	-	1	1	-	1	1	2
245-249	-	-	-	-	-	-	-	1	1	1
250-254	-	-	-	-	-	-	2	1	3	3
Total . .	205	215	421	744	799	1567	2	4	6	1994

Appendix Table 3.--Length-frequency distribution of Atlantic menhaden in samples from purse seine catches, Middle Atlantic Area, 1960

(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		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
175-179	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
180-184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185-189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190-194	-	-	-	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
195-199	-	-	-	18	9	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
200-204	3	1	4	60	38	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	102
205-209	2	3	5	151	114	265	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270
210-214	5	2	7	320	224	544	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	551
215-219	10	5	15	486	335	821	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	836
220-224	7	4	11	571	568	1139	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1150
225-229	4	1	5	519	470	990	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	996
230-234	-	1	1	387	415	802	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	806
235-239	-	-	-	247	338	585	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	591
240-244	-	2	2	166	194	360	5	2	7	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	371
245-249	-	-	-	80	114	194	2	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	202
250-254	-	-	-	55	54	109	3	2	5	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	115
255-259	-	1	1	27	32	59	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
260-264	-	-	-	16	26	42	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
265-269	-	-	-	6	13	19	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
270-274	-	-	-	6	7	13	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
275-279	-	-	-	9	6	15	1	3	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	20

(continued)

Appendix Table 3.--Length-frequency distribution of Atlantic menhaden in samples from purse seine catches, Middle Atlantic Area, 1960 (continued)

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
280-284	-	-	-	8	7	15	6	4	10	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	28
285-289	-	-	-	8	5	13	14	6	20	10	4	14	-	-	-	-	-	-	-	-	-	-	-	-	47
290-294	-	-	-	1	2	3	19	7	26	18	5	23	2	1	3	-	-	-	-	-	-	-	-	-	55
295-299	-	-	-	1	-	1	10	3	13	37	15	52	1	-	1	-	-	-	-	-	-	-	-	-	67
300-304	-	-	-	-	1	1	10	9	19	41	17	58	3	3	6	-	-	-	-	-	-	-	-	-	84
305-309	-	-	-	-	-	-	3	14	17	40	35	75	8	6	14	-	-	-	-	-	-	-	-	-	106
310-314	-	-	-	-	-	-	2	4	6	17	47	64	9	11	20	2	-	2	-	-	-	-	-	-	92
315-319	-	-	-	-	-	-	-	2	2	6	34	40	11	8	19	2	2	4	1	-	1	-	-	-	66
320-324	-	-	-	-	-	-	1	-	1	1	13	14	6	6	12	4	4	8	-	1	1	-	-	-	36
325-329	-	-	-	-	-	-	-	-	-	2	5	7	3	8	11	-	6	6	2	1	3	-	-	-	27
330-334	-	-	-	-	-	-	-	-	-	-	2	2	-	3	3	3	8	11	-	-	-	1	1	2	18
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-	4	4	-	1	1	-	-	-	9
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	-	1	1	-	1	1	5
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total . .	32	20	52	3143	2974	6118	90	74	164	179	178	357	43	52	95	11	25	36	3	6	9	1	2	3	6834

Appendix Table 4.--Length-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Atlantic Area, 1960

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
220-224	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
225-229	-	-	-	5	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
230-234	-	-	-	36	15	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
235-239	-	-	-	47	29	76	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78
240-244	-	-	-	54	44	98	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	99
245-249	-	-	-	61	70	131	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	140
250-254	-	-	-	67	64	131	9	3	12	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	146
255-259	-	-	-	115	81	196	12	13	25	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	226
260-264	-	-	-	101	84	185	16	15	31	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	218
265-269	-	-	-	79	71	150	30	16	46	4	5	9	-	-	-	-	-	-	-	-	-	-	-	-	205
270-274	-	-	-	34	50	84	25	22	47	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	134
275-279	-	-	-	32	30	62	35	21	56	10	5	15	-	-	-	-	-	-	-	-	-	-	-	-	133
280-284	-	-	-	7	13	20	41	27	68	22	7	29	-	-	-	-	-	-	-	-	-	-	-	-	117
285-289	-	-	-	7	7	14	17	32	49	40	22	62	-	-	-	-	-	-	-	-	-	-	-	-	125
290-294	-	-	-	1	4	5	16	37	53	44	39	83	-	-	-	-	-	-	-	-	-	-	-	-	141
295-299	-	-	-	1	-	1	16	28	44	63	53	116	9	-	9	-	-	-	-	-	-	-	-	-	170
300-304	-	-	-	1	-	1	5	10	15	56	54	110	8	6	14	-	-	-	-	-	-	-	-	-	140
305-309	-	-	-	-	-	-	3	18	21	24	71	95	6	6	12	1	-	1	-	-	-	-	-	-	129
310-314	-	-	-	-	-	-	-	5	5	16	51	67	10	11	21	2	-	2	-	-	-	-	-	-	95
315-319	-	-	-	-	-	-	-	1	1	7	23	30	6	10	16	-	-	-	-	-	-	-	-	-	47
320-324	-	-	-	-	-	-	-	-	-	4	6	10	6	10	16	1	2	3	1	-	1	-	-	-	30
325-329	-	-	-	-	-	-	-	-	-	2	4	6	3	15	18	3	4	7	1	1	2	-	-	-	33
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	14	14	2	6	8	1	-	1	-	-	-	23
335-339	-	-	-	-	-	-	-	1	1	-	1	1	-	3	3	1	7	8	-	1	1	-	-	-	14
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6	1	2	3	-	2	2	-	1	1	12
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total .	-	-	-	650	563	1213	232	254	486	297	349	646	48	81	129	11	22	33	3	6	9	-	1	1	2517

Appendix Table 5.—Length-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Carolina fall fishery, 1960

(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			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	M	F	T	
70-74	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
75-79	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
80-84	4	5	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
85-89	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
90-94	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
95-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100-104	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
105-109	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
110-114	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
115-119	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
120-124	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
125-129	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
130-134	3	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
135-139	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
140-144	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
145-149	2	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
150-154	2	1	3	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
155-159	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
160-164	1	2	3	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
165-169	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
170-174	1	-	1	7	3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
175-179	-	-	-	4	6	10	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
180-184	-	-	-	5	6	11	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
185-189	-	-	-	6	3	9	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
190-194	-	-	-	6	6	12	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
195-199	-	-	-	3	5	8	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
200-204	-	-	-	3	1	4	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
205-209	-	-	-	1	1	2	4	4	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
210-214	-	-	-	1	3	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
215-219	-	-	-	2	1	3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6

(Continued)

Appendix Table 5.--Length-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Carolina fall fishery, 1960 (con't)

(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			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	M	F	T	
220-224	-	-	-	½	-	½	½	-	½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
225-229	-	-	-	-	-	-	2	1	3	-	-	-	-	-	-	-	-	-	-	½	½	-	-	-	-	-	-	-	-	-	4
230-234	-	-	-	-	-	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
235-239	-	-	-	-	-	-	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
240-244	-	-	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
245-249	-	-	-	-	-	-	2	2	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
250-254	-	-	-	-	-	-	6	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
255-259	-	-	-	-	-	-	4	3	7	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
260-264	-	-	-	-	-	-	4	7	11	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
265-269	-	-	-	-	-	-	17	7	24	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
270-274	-	-	-	-	-	-	23	15	38	2	-	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
275-279	-	-	-	-	-	-	27	21	48	6	9	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
280-284	-	-	-	-	-	-	22	27	49	8	5	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65
285-289	-	-	-	-	-	-	13	25	38	17	6	23	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	89
290-294	-	-	-	-	-	-	5	17	22	21	15	36	24	5	29	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	99
295-299	-	-	-	-	-	-	3	5	8	19	19	38	40	7	47	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	137
300-304	-	-	-	-	-	-	1	3	4	12	21	33	57	27	84	6	8	14	1	1	2	-	-	-	-	-	-	-	-	-	121
305-309	-	-	-	-	-	-	-	4	4	5	14	19	37	50	87	7	3	10	1	-	1	-	-	-	-	-	-	-	-	-	97
310-314	-	-	-	-	-	-	-	-	-	2	10	12	19	47	66	8	10	18	-	1	1	-	-	-	-	-	-	-	-	-	73
315-319	-	-	-	-	-	-	-	-	-	1	1	2	9	41	50	7	8	15	2	4	6	-	-	-	-	-	-	-	-	-	38
320-324	-	-	-	-	-	-	-	-	-	-	-	-	1	13	14	4	14	18	1	4	5	1	-	1	-	-	-	-	-	-	32
325-329	-	-	-	-	-	-	-	-	-	-	1	1	-	6	6	5	10	15	6	2	8	-	2	2	-	-	-	-	-	-	20
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	1	6	7	1	4	5	3	2	5	-	-	-	-	1	1	12
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	4	4	-	2	2	1	2	3	-	-	-	-	-	-	8
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	3	3	-	2	2	-	1	1	-	-	-	2
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	1
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	
Total	28	32	60	39	37	76	152	161	313	100	103	203	192	201	393	44	67	111	12	24	36	5	8	13	-	2	2	-	1	1	1208

Appendix Table 6.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches South Atlantic Area, excluding the North Carolina fall fishery, 1960

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

Weight (g.)	Age									Total
	0			1			2			
	M	F	T	M	F	T	M	F	T	
20-29	10	1	11	4	3	7	-	-	-	18
30-39	3	4	9	10	11	22	3	1	4	35
40-49	-	-	-	10	12	22	21	9	30	52
50-59	-	-	-	19	16	35	33	27	61	96
60-69	-	-	-	19	24	43	31	42	73	116
70-79	-	-	-	24	18	42	26	32	59	101
80-89	-	-	-	16	10	26	29	13	43	69
90-99	-	-	-	6	8	14	17	15	33	47
100-109	-	-	-	10	10	20	50	30	82	102
110-119	-	-	-	9	9	18	45	44	93	111
120-129	-	-	-	3	9	12	40	34	79	91
130-139	-	-	-	5	1	6	31	33	64	70
140-149	-	-	-	-	-	-	22	19	42	42
150-159	-	-	-	2	1	3	7	10	17	20
160-169	-	-	-	-	1	1	3	3	6	7
170-179	-	-	-	-	-	-	1	3	4	4
180-189	-	-	-	2	-	2	-	3	3	5
190-199	-	-	-	-	-	-	1	1	2	2
200-209	-	-	-	-	1	1	-	1	1	2
210-219	-	-	-	-	-	-	-	1	1	1
Total. .	13	5	20	139	134	274	360	321	697	991

Appendix Table 7.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, Chesapeake Bay Area, 1960

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

Weight (g.)	Age									Total
	1			2			3			
	M	F	T	M	F	T	M	F	T	
70-79	1	2	3	-	-	-	-	-	-	3
80-89	6	9	15	6	5	13	-	-	-	28
90-99	18	22	40	17	13	35	-	-	-	75
100-109	22	20	42	40	34	78	-	-	-	120
110-119	22	23	46	96	84	185	-	-	-	231
120-129	35	34	69	173	142	320	-	-	-	389
130-139	37	32	69	147	182	331	-	-	-	400
140-149	34	32	66	114	138	252	-	-	-	318
150-159	19	28	47	75	93	169	-	1	1	217
160-169	6	7	13	33	46	79	-	-	-	92
170-179	3	3	6	22	29	51	-	-	-	57
180-189	1	3	4	7	16	23	-	1	1	28
190-199	1	-	1	8	9	17	-	-	-	18
200-209	-	-	-	2	3	5	-	-	-	5
210-219	-	-	-	2	2	4	-	-	-	4
220-229	-	-	-	2	1	3	-	-	-	3
230-239	-	-	-	-	1	1	-	1	1	2
240-249	-	-	-	-	1	1	-	-	-	1
250-259	-	-	-	-	-	-	1	-	1	1
260-269	-	-	-	-	-	-	1	1	2	2
Total .	205	215	421	744	799	1567	2	4	6	1994

Appendix Table 8.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, Middle Atlantic Area, 1960

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
90-99	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
100-109	-	-	-	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
110-119	-	-	-	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
120-129	1	-	1	14	10	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
130-139	1	1	2	59	45	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106
140-149	-	1	1	142	88	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	231
150-159	5	2	7	247	176	423	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	430
160-169	8	5	13	318	238	556	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	569
170-179	3	4	7	349	303	652	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	659
180-189	5	1	6	300	293	593	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	599
190-199	3	1	4	282	287	569	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	574
200-209	3	-	3	279	261	540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	543
210-219	2	1	3	235	248	484	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	487
220-229	-	1	1	227	210	437	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	439
230-239	-	-	-	167	153	320	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	322
240-249	-	-	-	136	161	297	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	301
250-259	-	1	1	90	143	233	6	2	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	242
260-269	-	-	-	58	92	150	1	3	4	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	155
270-279	-	-	-	39	57	96	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98
280-289	-	1	1	29	42	71	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
290-299	-	-	-	17	29	46	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	47
300-309	-	-	-	18	14	32	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
310-319	-	1	1	22	16	38	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
320-329	-	-	-	15	15	30	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
330-339	-	-	-	15	5	20	-	1	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	22
340-349	-	-	-	3	10	13	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
350-359	-	-	-	12	9	21	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
360-369	-	-	-	14	9	23	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
370-379	-	-	-	5	5	10	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
380-389	-	-	-	5	16	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
390-399	-	-	-	3	3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
400-409	-	-	-	6	6	12	2	-	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	15
410-419	-	-	-	6	5	11	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
420-429	-	-	-	3	3	6	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
430-439	-	-	-	7	4	11	4	-	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	16
440-449	-	-	-	2	4	6	1	1	2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	10
450-459	-	-	-	2	1	3	-	4	4	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	8
460-469	-	-	-	3	1	4	2	3	5	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	12
470-479	-	-	-	3	1	4	5	-	5	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	10
480-489	-	-	-	1	1	2	3	2	5	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	9
490-499	-	-	-	-	-	-	2	2	4	6	-	6	-	-	-	-	-	-	-	-	-	-	-	-	10

(continued)

Appendix Table 8.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, Middle Atlantic Area, 1960 (continued)

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
500-509	-	-	-	2	1	3	4	1	5	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	14
510-519	-	-	-	1	1	2	5	2	7	6	4	10	1	-	1	-	-	-	-	-	-	-	-	-	20
520-529	-	-	-	1	1	2	6	2	8	9	1	10	-	1	1	-	-	-	-	-	-	-	-	-	21
530-539	-	-	-	-	-	-	8	3	11	11	2	13	-	-	-	-	-	-	-	-	-	-	-	-	24
540-549	-	-	-	-	-	-	4	1	5	6	6	12	1	-	1	-	-	-	-	-	-	-	-	-	18
550-559	-	-	-	-	-	-	4	-	4	10	3	13	1	1	2	-	-	-	-	-	-	-	-	-	19
560-569	-	-	-	1	1	2	2	2	4	16	5	21	-	-	-	-	-	-	-	-	-	-	-	-	27
570-579	-	-	-	-	-	-	6	2	8	15	6	21	2	-	2	-	-	-	-	-	-	-	-	-	31
580-589	-	-	-	-	-	-	1	3	4	12	6	18	3	-	3	-	-	-	1	-	1	-	-	-	26
590-599	-	-	-	-	1	1	2	2	4	13	10	23	2	-	2	-	-	-	-	-	-	-	-	-	30
600-609	-	-	-	-	-	-	2	1	3	15	10	25	-	1	1	-	1	1	-	-	-	-	-	-	30
610-619	-	-	-	-	-	-	-	4	4	14	13	27	1	1	2	-	-	-	-	-	-	-	-	-	33
620-629	-	-	-	-	-	-	3	3	6	10	18	28	-	2	2	-	-	-	-	-	-	-	-	-	36
630-639	-	-	-	-	-	-	-	2	2	9	15	24	4	3	7	1	1	2	1	-	1	-	-	-	36
640-649	-	-	-	-	-	-	-	3	3	4	7	11	1	6	7	-	2	2	-	-	-	-	-	-	23
650-659	-	-	-	-	-	-	-	2	2	1	12	13	4	6	10	1	-	1	-	-	-	-	-	-	26
660-669	-	-	-	-	-	-	1	1	2	3	6	9	4	5	9	-	1	1	-	-	-	-	-	-	21
670-679	-	-	-	-	-	-	1	1	2	1	4	5	3	-	3	-	2	2	-	-	-	-	-	-	12
680-689	-	-	-	-	-	-	-	1	1	2	15	17	3	5	8	1	-	1	-	-	-	-	-	-	27
690-699	-	-	-	-	-	-	-	1	1	1	9	10	1	4	5	2	-	2	1	-	1	-	-	-	19
700-709	-	-	-	-	-	-	-	2	2	-	4	4	2	-	2	1	-	1	-	-	-	-	-	-	9
710-719	-	-	-	-	-	-	-	-	-	-	3	3	1	-	1	2	2	4	-	-	-	-	-	-	8
720-729	-	-	-	-	-	-	-	-	-	-	4	4	2	4	6	-	2	2	-	-	-	-	-	-	12
730-739	-	-	-	-	-	-	-	-	-	2	2	4	3	2	5	-	3	3	-	-	-	-	-	-	12
740-749	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	1	1	-	-	-	-	1	1	5
750-759	-	-	-	-	-	-	-	-	-	-	2	2	1	1	2	-	2	2	-	-	-	-	-	-	6
760-769	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-	1	1	-	-	-	3
770-779	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	-	1	1	-	1	1	4
780-789	-	-	-	-	-	-	-	-	-	-	3	3	1	6	7	1	2	3	-	-	-	-	-	-	13
790-799	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1	-	1	2
800-809	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	2	2	-	-	-	3
810-819	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
820-829	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	3	-	-	-	-	-	-	3
830-839	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	2
840-849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
850-859	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
860-869	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
870-879	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
880-889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
890-899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
Total.	32	20	52	3141	2974	6116	90	74	164	179	178	357	43	52	95	11	25	36	3	6	9	1	2	3	6832

Appendix Table 9.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Atlantic Area, 1960

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
200-209	-	-	-	7	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
210-219	-	-	-	7	3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
220-229	-	-	-	20	6	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
230-239	-	-	-	24	20	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44
240-249	-	-	-	32	22	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54
250-259	-	-	-	30	19	49	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
260-269	-	-	-	30	30	60	5	1	6	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	67
270-279	-	-	-	28	26	54	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
280-289	-	-	-	37	33	70	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
290-299	-	-	-	37	35	72	5	4	9	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	83
300-309	-	-	-	50	35	85	4	6	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	95
310-319	-	-	-	50	46	96	5	5	10	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	110
320-329	-	-	-	52	26	78	8	7	15	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	96
330-339	-	-	-	38	38	76	12	6	18	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	97
340-349	-	-	-	43	40	83	12	2	14	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	100
350-359	-	-	-	28	33	61	9	10	19	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	81
360-369	-	-	-	30	31	61	9	11	20	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	85
370-379	-	-	-	19	23	42	14	10	24	3	3	6	-	-	-	-	-	-	-	-	-	-	-	-	72
380-389	-	-	-	22	18	40	13	3	16	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	63
390-399	-	-	-	17	17	34	9	8	17	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	57
400-409	-	-	-	14	16	30	14	11	25	9	2	11	-	-	-	-	-	-	-	-	-	-	-	-	66
410-319	-	-	-	5	10	15	22	11	33	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	53
420-429	-	-	-	10	8	18	11	7	18	6	4	10	-	-	-	-	-	-	-	-	-	-	-	-	46
430-439	-	-	-	7	5	12	8	10	18	7	3	10	-	-	-	-	-	-	-	-	-	-	-	-	40
440-449	-	-	-	1	7	8	10	12	22	18	10	28	-	-	-	-	-	-	-	-	-	-	-	-	58
450-459	-	-	-	4	4	8	11	16	27	20	8	28	-	-	-	-	-	-	-	-	-	-	-	-	63
460-469	-	-	-	1	5	6	10	20	30	11	7	18	2	-	2	-	-	-	-	-	-	-	-	-	56
470-479	-	-	-	3	1	4	9	9	18	20	16	36	1	-	1	-	-	-	-	-	-	-	-	-	59
480-489	-	-	-	3	1	4	6	11	17	20	22	42	2	-	2	-	-	-	-	-	-	-	-	-	65
490-499	-	-	-	-	2	2	2	10	12	21	21	42	1	2	3	-	-	-	-	-	-	-	-	-	59
500-509	-	-	-	-	1	1	3	6	9	28	12	40	4	1	5	-	-	-	-	-	-	-	-	-	55
510-519	-	-	-	-	1	1	1	8	9	14	30	44	2	1	3	-	-	-	-	-	-	-	-	-	57

(continued)

Appendix Table 9.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Atlantic Area, 1960 (continued)

(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			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
520-529	-	-	-	-	-	-	4	10	14	19	25	44	2	1	3	-	-	-	-	-	-	-	-	-	61
530-539	-	-	-	-	-	-	4	8	12	10	16	26	3	2	5	-	-	-	-	-	-	-	-	-	43
540-549	-	-	-	-	-	-	2	3	5	16	19	35	2	4	6	-	-	-	-	-	-	-	-	-	46
550-559	-	-	-	-	-	-	1	8	9	10	17	27	3	3	6	-	-	-	1	-	1	-	-	-	43
560-569	-	-	-	-	-	-	1	1	2	9	15	24	5	1	6	1	-	1	-	-	-	-	-	-	33
570-579	-	-	-	1	-	1	1	3	4	3	19	22	6	1	7	-	1	1	-	-	-	-	-	-	35
580-589	-	-	-	-	-	-	-	4	4	12	17	29	2	4	6	1	-	1	-	-	-	-	-	-	40
590-599	-	-	-	-	-	-	-	4	4	2	13	15	2	2	4	1	-	1	-	-	-	-	-	-	24
600-609	-	-	-	-	-	-	1	2	3	4	12	16	1	1	2	-	1	1	-	-	-	-	-	-	22
610-619	-	-	-	-	-	-	-	1	1	7	7	14	5	5	10	-	-	-	-	-	-	-	-	-	25
620-629	-	-	-	-	-	-	-	1	1	2	3	5	2	12	14	-	1	1	-	-	-	-	-	-	21
630-639	-	-	-	-	-	-	-	-	-	3	6	9	1	3	4	3	2	5	-	-	-	-	-	-	18
640-649	-	-	-	-	-	-	-	-	-	1	9	10	-	5	5	-	1	1	-	-	-	-	-	-	16
650-659	-	-	-	-	-	-	-	1	1	-	4	4	-	4	4	-	-	-	-	2	2	-	-	-	11
660-669	-	-	-	-	-	-	-	-	-	-	4	4	-	3	3	-	-	-	1	-	1	-	-	-	8
670-679	-	-	-	-	-	-	-	1	1	-	1	1	-	7	7	2	-	2	-	-	-	-	-	-	11
680-689	-	-	-	-	-	-	-	-	-	-	4	4	-	7	7	-	3	3	-	-	-	-	-	-	14
690-699	-	-	-	-	-	-	-	-	-	-	1	1	1	3	4	2	4	6	-	-	-	-	-	-	11
700-709	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	1	1	-	-	-	-	-	-	5
710-719	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	3	3	-	1	1	-	-	-	6
720-729	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	1	-	1	-	-	-	3
730-739	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	3
740-749	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
750-759	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
760-769	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1
770-779	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	-	-	-	3
780-789	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
790-799	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
800-809	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
810-819	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
820-829	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
830-839	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
840-849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Total . .	-	-	-	650	563	1213	232	254	486	296	349	645	48	81	129	11	22	33	3	6	9	-	1	1	2516

Appendix Table 10.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Carolina fall fishery, 1960

(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			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	M	F	T	
0-9	3	5	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10-19	7	4	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
20-29	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
30-39	8	8	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
40-49	1	8	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
50-59	3	3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
60-69	3	2	5	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
70-79	-	1	1	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
80-89	2	-	2	7	4	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
90-99	-	-	-	8	8	16	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
100-109	-	-	-	3	6	9	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
110-119	-	-	-	6	5	11	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
120-129	-	-	-	5	3	8	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
130-139	-	-	-	3	3	6	2	5	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
140-149	-	-	-	-	1	1	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
150-159	-	-	-	2	-	2	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
160-169	-	-	-	2	1	3	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
170-179	-	-	-	1	3	4	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
180-189	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
190-199	-	-	-	1	-	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
200-209	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
210-219	-	-	-	-	-	-	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
220-229	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
230-239	-	-	-	-	-	-	2	-	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
240-249	-	-	-	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
250-259	-	-	-	-	-	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
260-269	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
270-279	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
280-289	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
290-299	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
300-309	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
310-319	-	-	-	-	-	-	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
320-329	-	-	-	-	-	-	4	2	6	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
330-339	-	-	-	-	-	-	3	-	3	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
340-349	-	-	-	-	-	-	4	4	8	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
350-359	-	-	-	-	-	-	9	5	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
360-369	-	-	-	-	-	-	6	5	11	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
370-379	-	-	-	-	-	-	6	6	12	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
380-389	-	-	-	-	-	-	2	7	9	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
390-399	-	-	-	-	-	-	12	6	18	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
400-409	-	-	-	-	-	-	19	8	27	-	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
410-419	-	-	-	-	-	-	9	7	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
420-429	-	-	-	-	-	-	6	7	13	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
430-439	-	-	-	-	-	-	8	13	21	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
440-449	-	-	-	-	-	-	7	10	17	2	6	8	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
450-459	-	-	-	-	-	-	7	8	15	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
460-469	-	-	-	-	-	-	5	10	15	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
470-479	-	-	-	-	-	-	2	6	8	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
480-489	-	-	-	-	-	-	1	4	5	4	1	5	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11

Appendix Table 10.--Weight-frequency distributions of Atlantic menhaden in samples from purse seine catches, North Carolina fall fishery, 1960 (continued)

(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			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	M	F	T	
490-499	-	-	-	-	-	-	3	6	9	7	3	10	3	-	3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	23
500-509	-	-	-	-	-	-	3	5	8	5	5	10	5	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
510-519	-	-	-	-	-	-	3	1	4	7	5	12	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
520-529	-	-	-	-	-	-	-	4	4	5	4	9	8	-	8	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	22
530-539	-	-	-	-	-	-	1	3	4	6	4	10	9	2	11	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	27
540-549	-	-	-	-	-	-	1	-	1	8	4	12	10	3	13	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	27
550-559	-	-	-	-	-	-	1	1	2	9	9	18	12	6	18	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	40
560-569	-	-	-	-	-	-	1	1	2	6	6	12	14	6	20	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	37
570-579	-	-	-	-	-	-	-	1	1	4	6	10	24	12	36	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	51
580-589	-	-	-	-	-	-	-	1	1	4	6	10	18	6	24	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	36
590-599	-	-	-	-	-	-	-	2	2	5	4	9	16	16	32	3	3	6	1	-	1	-	-	-	-	-	-	-	-	-	50
600-609	-	-	-	-	-	-	-	-	-	1	6	7	14	9	23	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	37
610-619	-	-	-	-	-	-	-	-	-	1	2	3	6	9	15	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	20
620-629	-	-	-	-	-	-	-	-	-	1	2	3	10	17	27	1	2	3	-	1	1	-	-	-	-	-	-	-	-	-	34
630-639	-	-	-	-	-	-	-	-	-	-	4	4	11	16	27	6	3	9	-	1	1	-	-	-	-	-	-	-	-	-	41
640-649	-	-	-	-	-	-	-	1	1	-	1	1	6	15	21	5	2	7	-	-	-	-	-	-	-	-	-	-	-	-	30
650-659	-	-	-	-	-	-	-	-	-	1	4	5	6	19	25	3	3	6	2	1	3	-	-	-	-	-	-	-	-	-	39
660-669	-	-	-	-	-	-	-	-	-	-	1	1	4	12	16	3	3	6	1	-	1	1	-	1	-	-	-	-	-	-	25
670-679	-	-	-	-	-	-	-	-	-	-	1	1	3	8	11	1	3	4	1	-	1	1	-	1	-	-	-	-	-	-	18
680-689	-	-	-	-	-	-	-	-	-	-	-	-	1	7	8	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	11
690-699	-	-	-	-	-	-	-	-	-	-	1	1	-	8	8	1	7	8	-	1	1	-	-	-	-	1	1	-	-	-	19
700-709	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6	-	5	5	1	-	1	-	-	-	-	-	-	-	-	-	12
710-719	-	-	-	-	-	-	-	-	-	-	-	-	2	5	7	2	2	4	-	1	1	-	-	-	-	-	-	-	1	1	13
720-729	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	2	6	8	2	2	4	1	-	1	-	-	-	-	-	-	16
730-739	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-	4	4	1	3	4	-	-	-	-	-	-	-	-	-	11
740-749	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	1	2	3	1	2	3	-	-	-	-	-	-	-	-	-	9
750-759	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	1	3	4	-	2	2	-	-	-	-	-	-	8
760-769	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	3	-	2	2	-	-	-	-	-	-	-	-	-	6
770-779	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	-	-	-	-	1	1	2	1	3	-	-	-	-	-	-	6
780-789	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	3
790-799	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	2
800-809	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	1	2	-	-	-	-	-	-	-	-	-	4
810-819	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	2	2	-	-	-	-	-	-	3
820-829	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	-	-	2
830-839	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
840-849	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	-	-	-	-	1	1	-	-	-	4
850-859	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	-	-	-	3
860-869	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
870-879	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
880-889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
890-899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900-909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
910-919	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
920-929	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
Total. .	28	32	60	39	37	76	152	159	311	100	102	202	190	201	391	44	67	111	12	24	36	5	8	13	-	2	2	-	1	1	1203

Appendix Table 11.--Mean fork length and weight of Atlantic menhaden in samples from purse seine catches, South Atlantic Area, excluding North Carolina fall fishery, 1960

Age Group	Sex 1/		
	Males	Females	Both
Fork Length (mm.):			
0	116.3 (13)	121.8 (5)	117.8 (18)
1	161.3 (139)	161.9 (135)	161.6 (274)
2	176.2 (360)	178.1 (321)	177.1 (681)
Weight (g.):			
0	28.0 (13)	32.0 (5)	29.1 (18)
1	76.6 (139)	75.6 (135)	76.2 (274)
2	98.2 (360)	102.0 (321)	100.0 (681)

1/ Numbers of fish in parentheses.

Appendix Table 12.--Mean fork length and weight of Atlantic menhaden in samples from purse seine catches, Chesapeake Bay Area, 1960

Age Group	Sex 1/		
	Males	Females	Both
Fork Length (mm.):			
1	193.9 (205)	193.0 (215)	193.5 (420)
2	199.4 (744)	200.8 (799)	200.1 (1543)
3	251.0 (2)	240.2 (4)	243.8 (6)
Weight (g.):			
1	127.9 (205)	127.7 (215)	127.8 (420)
2	134.5 (744)	138.0 (799)	136.3 (1543)
3	257.5 (2)	211.0 (4)	226.5 (6)

1/ Numbers of fish in parentheses.

Appendix Table 13.--Mean fork length and weight of Atlantic menhaden in samples from purse seine catches, Middle Atlantic Area, 1960

Age Group	Sex 1/					
	Males		Females		Both	
Fork Length (mm.):						
1	215.2	(32)	221.4	(20)	217.5	(52)
2	225.6	(3143)	227.9	(2974)	226.7	(6117)
3	282.0	(90)	284.6	(74)	283.1	(164)
4	300.4	(179)	309.5	(178)	304.9	(357)
5	312.9	(43)	318.8	(52)	316.1	(95)
6	322.5	(11)	329.2	(25)	327.2	(36)
7	322.7	(3)	337.0	(6)	332.2	(9)
8	331.0	(1)	336.0	(2)	334.3	(3)
Weight (g.):						
1	172.2	(32)	188.7	(20)	178.6	(52)
2	203.6	(3141)	209.9	(2974)	206.7	(6115)
3	470.4	(90)	488.9	(74)	478.7	(164)
4	574.0	(179)	629.3	(178)	601.6	(357)
5	654.6	(43)	687.4	(52)	672.6	(95)
6	716.4	(11)	736.4	(25)	730.3	(36)
7	634.7	(3)	815.7	(6)	755.3	(9)
8	794.0	(1)	775.5	(2)	781.7	(3)

1/ Numbers of fish in parentheses.

Appendix Table 14.--Mean fork length and weight of Atlantic menhaden in samples from purse seine catches, North Atlantic Area, 1960

Age Group	Sex 1/		
	Males	Females	Both
Fork Length (mm.):			
1	- -	- -	- -
2	255.6 (650)	257.8 (563)	256.6 (1213)
3	276.1 (232)	283.4 (254)	279.9 (486)
4	295.6 (297)	301.0 (349)	298.5 (646)
5	309.8 (48)	321.5 (81)	317.2 (129)
6	325.0 (11)	333.2 (22)	330.5 (33)
7	326.3 (3)	342.2 (6)	336.9 (9)
8	- -	341.0 (1)	341.0 (1)
Weight (g.):			
1	- -	- -	- -
2	315.6 (650)	325.8 (563)	320.4 (1213)
3	400.8 (232)	443.1 (254)	422.9 (486)
4	493.6 (296)	528.9 (349)	512.7 (645)
5	561.9 (48)	630.7 (81)	605.1 (129)
6	645.0 (11)	697.2 (22)	679.8 (33)
7	647.7 (3)	728.2 (6)	701.3 (9)
8	- -	849.0 (1)	849.0 (1)

1/ Numbers of fish in parentheses.

Appendix Table 15.--Mean fork length and weight of Atlantic menhaden in samples from purse seine catches, North Carolina fall fishery, 1960

Age Group	Sex 1/					
	Males		Females		Both	
Fork Length (mm.):						
0	124.6	(28)	126.2	(32)	125.5	(60)
1	189.0	(39)	187.7	(37)	188.4	(76)
2	265.1	(152)	270.3	(161)	267.8	(313)
3	290.3	(100)	296.8	(103)	293.6	(203)
4	301.9	(192)	310.8	(201)	306.5	(393)
5	311.3	(44)	319.2	(67)	316.1	(111)
6	322.4	(12)	324.0	(24)	323.4	(36)
7	330.0	(5)	335.1	(8)	333.2	(13)
8	-	-	346.5	(2)	346.5	(2)
9	-	-	337.0	(1)	337.0	(1)
Weight (g.):						
0	35.0	(28)	34.4	(32)	34.7	(60)
1	113.6	(39)	110.8	(37)	112.2	(76)
2	373.6	(152)	399.0	(159)	386.6	(311)
3	512.5	(100)	542.1	(102)	527.4	(202)
4	580.8	(190)	635.5	(201)	608.9	(391)
5	629.1	(44)	688.0	(67)	664.7	(111)
6	701.6	(12)	754.0	(24)	736.5	(36)
7	721.4	(5)	805.0	(8)	772.8	(13)
8	-	-	766.5	(2)	766.5	(2)
9	-	-	713.0	(1)	713.0	(1)

1/ Numbers of fish in parentheses.

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