NOAA Technical Report NMFS SSRF-684

Age and Size Composition of the Atlantic Menhaden, *Brevoortia tyrannus*, Purse Seine Catch, 1963-71, with a Brief Discussion of the Fishery

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SEATTLE, WA
June 1975

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ERRATA SHEET

"Age and size composition of the Atlantic menhaden, Brevoortia tyrannus, purse seine catch, 1963-71, with a brief discussion of the fishery. By William R. Nicholson. NOAA Technical Report NMFS SSRF-684, June 1975. 28 p.

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should read .....from Middle Atlantic plants..

Page 8. (Table 6 has incorrect heading ....from North Atlantic plants.....
should read .....from Chesapeake Bay plants.....

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Age and Size Composition of the Atlantic Menhaden, *Brevoortia tyrannus*, Purse Seine Catch, 1963-71, with a Brief Discussion of the Fishery

WILLIAM R. NICHOLSON[1]

ABSTRACT

The catch of Atlantic menhaden, *Brevoortia tyrannus*, estimates of numbers of fish caught by age, fishing effort, age and size distribution, and changes in the fishery are summarized and briefly discussed for the five areas of the Atlantic coast of the United States for 1963-71. Appended are tables of seasonal length frequency distributions and mean lengths by age and port and tables of monthly mean lengths by sex, age, and port. The purse seine fishery declined after 1962. North of Chesapeake Bay, plants closed or reduced fishing as fish became scarce. Of eight plants that processed menhaden in 1962 only two operated in 1971. The catch and catch per unit of effort in Chesapeake Bay declined as effort increased. South of Cape Hatteras, N.C. the fishery, which had been small compared to the fishery in other areas, showed little change. The average age and size of fish in the total catch declined as the fishery north of Chesapeake Bay, which mainly caught older and larger fish, declined. Age-1 and -2 fish, which constituted most of the catch from Florida to Chesapeake Bay, increased in average length and weight.

INTRODUCTION

In this report routine data collected from 1963 to 1971 on population dynamics of Atlantic menhaden, *Brevoortia tyrannus*, and major changes in the purse seine fishery are discussed. Included are length and weight statistics of individual age groups in samples taken at ports from Florida to New York, the annual catch, estimates of the number of fish caught at each age in the five divisions of the fishery, the number of vessel weeks (fishing effort), and catch per unit of effort.

Reports titled, "Age and size distribution of the Atlantic menhaden catch along the Atlantic coast of the United States, with a brief review of the fishery," have been published for the following years: 1952-55 (June and Reintjes 1959); 1956 (June and Reintjes 1960); 1957 (June 1961); 1958 (June and Nicholson 1964); 1959-62 (Nicholson and Higham 1964a, 1964b, 1965, 1966).

In previous reports data were summarized and discussed for five divisions of the fishery: the North, Middle, and South Atlantic areas; the Chesapeake Bay area; and the North Carolina fall fishery. These divisions described in the first report in the series (June and Reintjes 1959) have been retained, with one modification: the boundary between the Chesapeake Bay and South Atlantic areas has been changed from lat. 36°35'N to lat. 35°20'N because no vessels from South Atlantic ports fish above lat. 35°N (Fig. 1).

Some major changes in the format have been made. Length frequencies of each age group are summarized by port rather than by division of the fishery; mean lengths and total number of males and females of each age are shown instead of frequencies for each sex; mean lengths are shown by port and month rather than by area and season; and only mean weights of all ages combined for each port are shown. Because there is no suitable method of determining the amount of effort expended in each area by vessels from a particular port, the estimated numbers of fish of each age are summarized by port of landing rather than by area of capture, as in previous reports. The distribution and estimated numbers of purse seine sets have been omitted because this information has been discussed in another publication (Nicholson 1971).

To facilitate some text table and all appendix table headings, the following numeric codes are used for the various ports:

Fernandina Beach, Fla.	1
Southport, N.C.	2
Beaufort, N.C. summer fishery	3
Reedville and Cape Charles, Va.	4
Lewes, Del.	5
Wildwood, N.J.	6
Port Monmouth, N.J.	7
Amagansett, N.Y.	8
Point Judith, R.I.	9
North Carolina fall fishery	10

Plants at Yonges Island, S.C. and Portland, Maine did not operate and plants at Gloucester, Mass. and Tuckerton, N.J. were not sampled. In this report the North Carolina fall fishery, while technically not a port, is treated as one.

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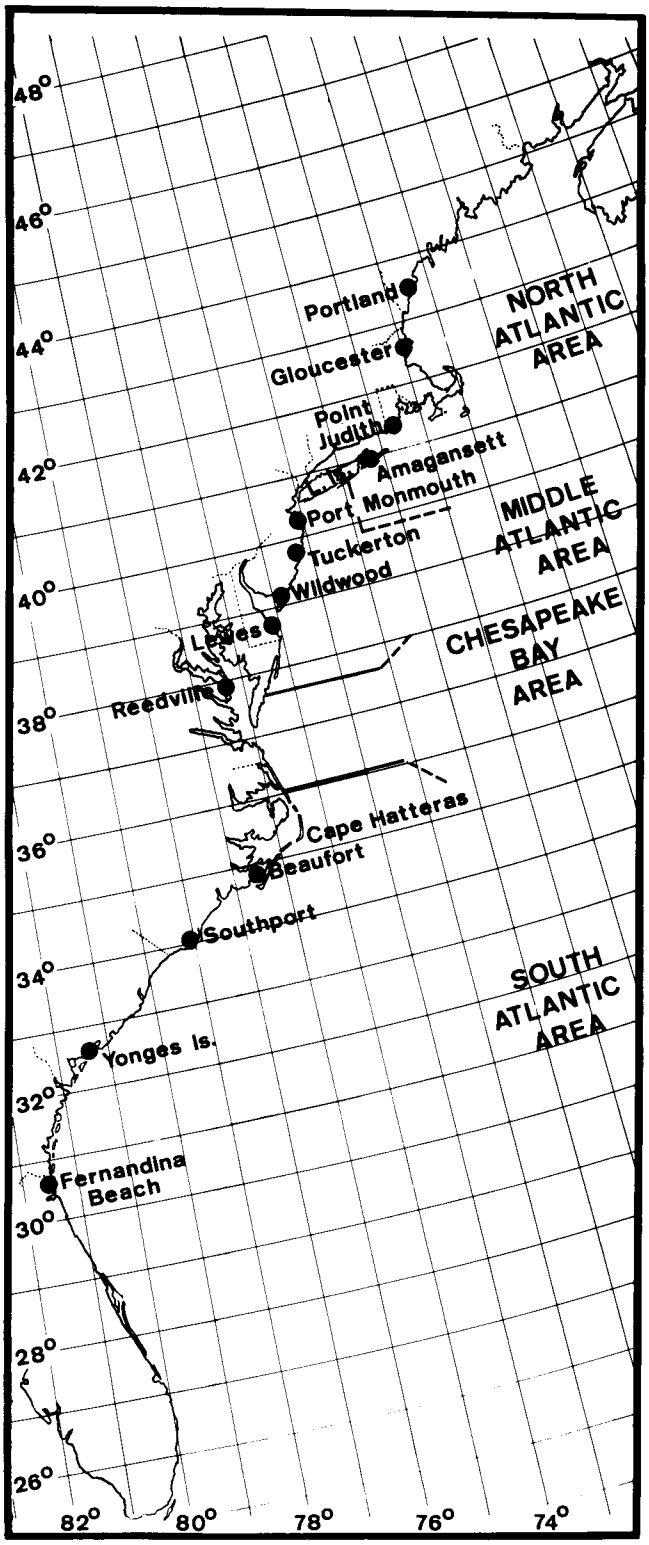

Figure 1.—Location of plants and fishing areas, Atlantic menhaden fishery.

CHANGES IN THE FISHERY

Because landings in the North and Middle Atlantic areas after 1962 declined and many plants closed or reduced fishing, the fisheries are discussed as a single area rather than separately as in previous reports. In 1963 the 1958 year class, which had supported the fishery for 4 yr in the Middle Atlantic and for 3 yr in the North Atlantic, ceased to contribute substantially to the catch. Plants at Gloucester, Mass. and Pt. Judith, R.I. ceased processing menhaden from purse seiners in 1963 and 1964, respectively. By 1966 the number of vessels at Amagansett, N.Y. and Port Monmouth, N.J. had fallen to about 2% of the number in 1962. The Tuckerton, N.J. plant closed after the 1964 season. One plant at Lewes, Del. closed after the 1964 season and the other during the middle of the 1966 season. The plant at Wildwood, N.J. operated only a part of each season from 1964 to 1969 and closed in 1970. The Amagansett plant, which did not open in 1967, operated only two vessels in the following years and closed again in 1970. The Port Monmouth plant in 1970 processed only menhaden caught in pound nets or by small trawlers converted to purse seining until one regular purse seine vessel began fishing in early September.

While plants in the North and Middle Atlantic areas either closed or reduced fishing in the years following 1962, plants in the Chesapeake Bay area increased fishing effort through 1966, despite a downward trend in catches that continued through 1969. Consolidation and acquisition reduced the number of companies from four to two, although three to five plants continued to operate. The fishing season, which formerly ceased by mid-October, extended to late November by 1964 as larger and faster vessels, which could range farther from port, exploited migrating schools passing in ocean waters off the mouth of the bay. In many instances, fish which formerly would have been landed in the North Carolina fall fishery were transported to Virginia plants for processing.

In the South Atlantic area, one plant which had operated at Fernandina Beach, Fla. from 1948 to 1957 reopened in 1965 but fished only four seasons. A plant which operated at Southport, N.C. from 1952 to 1961 was sold in 1963. It processed only during the 1963 fall fishery, the 1964 summer and fall fishery, and May 1964. A large refrigerated vessel fished from the other plant at Southport, but otherwise the size and number of vessels operating from South Atlantic plants changed little from previous years.

TOTAL CATCH

In previous reports the estimated numbers of fish landed were broken down by areas of capture on the basis of the percentage of catch samples from different areas. Because of minor changes in estimating the number of fish caught, some of the numbers published in previous reports for 1955-62 have been revised and are included.

Table 1.--Percentages of Atlantic menhaden captured by purse seines in areas other than where ports were located.

Year	Chesapeake Bay	Middle Atlantic	North Atlantic	Year	Chesapeake Bay	Middle Atlantic	North Atlantic
1955	0.00	1.18	3.06	1964	0.00	7.16	24.41
1956	0.00	0.00	24.46	1965	0.00	2.67	55.24
1957	0.00	2.16	18.77	1966	0.00	7.27	0.00
1958	0.00	1.67	9.02	1967	2.75	10.37	--
1959	2.79	1.03	11.40	1968	0.04	0.00	15.83
1960	0.00	1.68	18.89	1969	0.00	17.56	0.00
1961	0.07	2.60	12.25	1970	6.55	42.23	0.00
1962	0.09	3.54	24.68	1971	9.43	81.70	0.00
1963	0.00	5.71	13.59				

In this report the catch, in metric tons and in estimated millions of fish, is credited to the area in which the plants are located, even though the fish may have been caught in another area. The catch is reported this way because: 1) except for some years when catches for ports in the North and Middle Atlantic were exceptionally small, fish caught outside an area in which a plant is located constitute only a small percentage of the total catch (Table 1); 2) the area in which catches are made cannot always be identified; and 3) the units of fishing effort (vessel weeks) can be associated only with the total catch landed at a plant.

Vessels fished mainly in the area in which the plant was located, occasionally in adjacent areas, but never in areas not adjacent. Chesapeake Bay vessels occasionally fished in the Middle Atlantic; Wildwood and Lewes vessels sometimes fished in a portion of the coast included in the Chesapeake Bay area. Port Monmouth vessels often fished in the western end of Long Island Sound. Amagansett vessels fishing off the northern New Jersey coast accounted for the fish caught outside the North Atlantic. In some years after 1963, the catch landed at Chesapeake Bay plants in November included migrating fish caught either off the mouth of the bay or in North Carolina waters. Although these catches were more closely associated with the North Carolina fall fishery, there was no way of identifying them. No fish landed in the South Atlantic or North Carolina fall fishery were taken in other areas.

Total landings dropped sharply in 1963 as the strong 1958 year class phased out of the fishery, and plants in the North and Middle Atlantic closed or reduced their amount of fishing (Table 2). After another sharp drop in 1964 to 269,000 metric tons, landings in the following years fluctuated between 162,000 and 273,000 metric tons.

The estimated total number of actual fish landed is shown for all areas combined and for each area, individually (Tables 3-8). For all areas combined, it continued to decline after 1962, reaching a low of 868.16 million in 1969 (Table 3). It increased to 1,399.87 million in 1970, partly as a result of a fairly strong 1969 year class, but declined again in 1971. Fish older than age 2 continued to decrease after 1962 as the strong 1958 year class phased out of the fishery and as the catches from the North and Middle Atlantic and the North Carolina fall fishery dwindled.

FISHING EFFORT

Because observed effort and effective effort are often confused, I wish to stress that in this report observed effort is the basis for all discussions of catch, effort, and catch per unit of effort. In the Atlantic menhaden fishery the observed unit of effort, the

Table 2.--Atlantic menhaden purse seine catch, in thousands of metric tons by year and area.

Year	North Atlantic	Middle Atlantic	Chesapeake Bay	South Atlantic	North Carolina Fall fishery	Total
1940	16.8	91.1	35.3	37.9	36.6	217.7
1941	33.5	104.1	60.2	45.2	34.9	277.9
1942	14.6	77.7	21.9	32.9	20.1	167.2
1943	9.8	96.8	42.1	59.7	28.8	237.2
1944	27.5	122.6	32.2	46.9	28.7	257.9
1945	34.0	136.4	35.1	58.5	31.9	295.9
1946	42.9	183.8	57.6	40.8	37.3	362.4
1947	44.2	185.8	81.2	34.2	32.9	378.3
1948	44.4	137.4	68.3	55.8	40.6	346.5
1949	52.2	149.8	62.8	59.3	39.7	363.8
1950	49.3	143.0	63.1	20.0	21.8	297.2
1951	51.0	168.6	56.1	54.6	31.1	361.4
1952	58.1	193.7	45.7	86.0	26.4	409.9
1953	59.7	363.2	77.8	52.8	39.7	593.2
1954	64.9	335.7	126.0	39.6	41.9	608.1
1955	83.3	317.6	132.7	43.4	64.4	641.4
1956	98.5	378.3	94.0	68.6	72.7	712.1
1957	83.5	304.5	126.4	36.4	52.0	602.8
1958	36.0	211.1	151.3	41.3	70.3	510.0
1959	66.0	250.9	196.8	63.1	82.3	659.1
1960	66.4	256.0	108.5	36.7	62.7	529.8
1961	58.6	274.6	128.7	44.1	69.9	575.9
1962	64.7	249.9	155.1	42.2	25.8	537.7
1963	35.2	111.7	104.0	34.2	62.8	346.9
1964	15.0	35.2	134.1	46.5	38.4	269.2
1965	11.9	45.8	126.1	36.7	52.9	273.4
1966	1.8	6.0	115.6	24.5	71.7	219.6
1967	0	17.1	91.1	34.1	51.2	193.5
1968	6.7	26.2	115.5	33.6	52.8	234.8
1969	2.9	12.5	72.0	32.9	41.3	161.6
1970	4.3	11.4	182.9	42.4	18.3	259.3
1971	10.4	23.0	170.7	38.3	7.9	250.3

vessel week,[2] cannot be adjusted directly to units of effective effort. Why it cannot are discussed in detail by Schaaf and Huntsman (1972), who estimated changes in effective effort indirectly.

[2]A vessel week is 1 vessel fishing for 1 wk.

CATCH, EFFORT, AND CATCH PER UNIT OF EFFORT

North and Middle Atlantic Areas

The annual catch in these areas prior to 1963 constituted up to 65% of the total catch, but by 1966 it

Table 3.--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels, 1955-71

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
1955	761.01	674.15	1,057.68	267.31	307.21	38.07	10.53	1.84	.64	3,118.44
1956	36.37	2,073.26	902.72	319.60	44.78	150.68	28.70	6.72	1.99	3,564.82
1957	299.58	1,599.98	1,361.77	96.73	70.80	40.52	36.93	4.26	1.10	3,511.67
1958	106.06	858.16	1,635.35	72.05	17.25	15.94	9.09	4.88	.43	2,719.21
1959	11.40	4,038.72	851.29	388.27	33.41	11.87	12.36	4.55	1.77	5,353.64
1960	72.17	281.01	2,208.63	76.37	102.20	23.77	7.95	2.36	.65	2,775.11
1961	0.25	832.42	503.60	1,209.57	19.18	29.38	2.86	.81	.24	2,598.31
1962	51.58	514.11	834.52	217.25	423.37	30.75	24.60	2.98	.70	2,099.86
1963	96.89	724.23	709.20	122.53	44.97	52.38	10.42	3.33	.56	1,764.51
1964	302.59	703.95	604.98	83.50	17.94	7.85	6.62	1.31	.32	1,729.06
1965	249.12	739.28	417.55	77.75	12.17	1.81	1.22	.74	.07	1,499.71
1966	349.46	550.83	404.11	31.70	3.88	.37	.11	.11	.04	1,340.61
1967	6.95	633.20	265.68	72.76	5.09	.49	.01	--	--	984.18
1968	154.61	376.28	535.52	65.68	10.67	.98	.06	--	--	1,143.80
1969	158.08	372.37	284.31	47.81	5.44	.14	.01	--	--	868.16
1970	24.19	861.67	468.58	38.14	6.77	.52	--	--	--	1,399.87
1971	73.97	258.80	525.82	89.33	16.77	2.70	--	--	--	967.39

accounted for less than 4%. The decline reflected a decrease in the population of older fish which normally accounted for the major portion of the catch in both areas.

The estimated number of fish caught dropped sharply in 1964 and remained low thereafter (Tables 4, 5). Age-1 fish supplied a relatively large percentage of the catch in the Middle Atlantic up to 1965, and a relatively small percentage after 1965 as the Lewes and Wildwood plants, which landed mostly age-1 and -2 fish, closed or reduced fishing. Age-2 and -3 fish, which usually compose most of the Port Monmouth catches, accounted for a larger percentage as the Lewes and Wildwood catches declined.

Fishing effort was 961 to 1,254 vessel weeks per year prior to 1963. It had dropped to 166 by 1966 and reached a low of 19 in 1970 (Table 9). The largest reduction—551 vessel weeks—was in 1964 as the plant operators cut back in the numbers of vessels following the extremely low catch in 1963. Also, fish were so scarce in 1964 that those vessels which did not stop fishing in August quit by the beginning of October. In 1965 one plant at Lewes and the Tuckerton plant remained closed, while most Wildwood vessels shifted to plants in Chesapeake Bay. In 1966 the Port Monmouth plant, and the remaining Lewes plant, which has never reopened, closed in late July, and Wildwood vessels fished a total of only 12 calendar weeks in Middle Atlantic waters. Since 1966 three to five vessels have fished at Port Monmouth, except in 1970 when only one regular purse seiner operated a few weeks in September, and two to five vessels have fished at Wildwood for short periods each year as fish became available, except in 1970 and 1971 when the plant remained closed.

The CPUE (catch per unit of effort) from 1963 to 1970 was generally about 50% or less of the CPUE in years prior to 1963 (Table 10). Both effort and CPUE were exceptionally low in 1966, indicating the extreme scarcity of older fish that year. The increase in the CPUE in following years probably reflected a decrease in vessel competition rather than any significant increase in menhaden abundance. One or two vessels at Amagansett and three to four vessels at Port Monmouth divided the available fish between them, and two to three vessels operated at Wildwood only when fish became locally abundant.

Chesapeake Bay Area

Except for 1959, when the large 1958 year class entered the fishery, catches from 1954 to 1968 remained fairly steady, fluctuating between 91,000 and 155,000 metric tons. By contrast, catches from 1945 to 1953 fluctuated between 35,000 and 81,000 metric tons. The relatively large catches from 1954 to 1968 resulted primarily from an increase in fishing effort caused by increased fishing efficiency, more vessels, and a longer season. Following the poor season in 1969, catches in 1970 rose sharply as the relatively large 1969 year class entered the fishery.

Although age-1 and -2 fish continued to constitute the major part of the catch after 1962, age-0 and -3 fish provided a greater proportion of it than in

Table 4--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels fishing from North Atlantic plants, 1955-71.

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
1955	--	--	.42	23.74	114.62	21.94	7.94	.93	.38	169.97
1956	--	--	11.79	69.51	15.89	81.25	12.91	2.50	.72	194.57
1957	--	2.01	83.87	35.03	29.42	16.15	17.13	2.83	.46	186.90
1958	--	.13	44.18	20.59	7.08	5.76	4.36	2.00	.09	84.19
1959	--	8.37	37.13	95.97	10.59	4.06	4.27	2.08	.90	163.37
1960	--	--	88.64	34.87	40.53	6.52	2.39	.60	.11	173.66
1961	--	--	5.11	107.15	6.76	12.27	1.35	.49	.14	133.27
1962	--	--	3.04	29.25	77.72	9.88	8.94	1.25	.62	130.70
1963	--	--	1.34	10.58	14.48	23.54	5.94	1.64	.30	57.82
1964	--	--	1.92	5.86	4.12	5.17	4.59	.99	.17	22.82
1965	--	--	2.89	10.72	3.34	1.40	1.02	.58	.07	20.02
1966	--	--	.10	1.28	1.09	.15	.11	.11	.04	2.88
1967	--	--	--	--	--	--	--	--	--	--
1968	--	--	2.43	6.42	2.41	.28	.02	--	--	11.56
1969	--	--	.26	2.38	1.63	.06	--	--	--	4.33
1970	--	--	.69	5.95	2.87	.40	--	--	--	9.91
1971	--	--	1.92	12.78	2.95	.99	--	--	--	18.64

previous years (Table 6). In some years age-0 fish began entering the fishery in July. The reasons for these age classes providing a greater share of the catch are not clear. Increased growth rate of juveniles, resulting from a decrease in numbers and a consequent decrease in competition for food, is one probable explanation for the increased catch of juveniles. The increase in age-3 fish is more difficult to explain. Although fishing increased on migrating schools passing the mouth of the bay as the season was extended into November, age-3 fish did not compose a larger percentage of the catch than during the summer. A probable explanation is that greater numbers of age-3 remained in the bay as the total number of fish decreased and competition for food diminished.

Table 5.--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels fishing from North Atlantic plants, 1955-71.

Year	Age								Total
	0	1	2	3	4	5	6	7	8-10	
1955	--	16.31	510.22	211.26	159.33	12.96	2.20	.91	.16	913.35
1956	--	190.59	786.15	211.23	19.53	22.93	8.31	3.19	1.27	1,243.20
1957	--	410.30	846.46	42.46	20.44	9.55	8.73	.48	.56	1,338.98
1958	--	22.61	795.94	18.33	1.81	1.19	.69	.40	.34	841.31
1959	--	875.53	448.11	168.08	4.38	2.06	2.00	1.69	.33	1,502.18
1960	--	12.27	1,140.56	16.23	26.50	6.35	1.53	.44	.12	1,204.00
1961	--	3.47	164.16	741.82	6.04	6.95	.89	.32	.10	923.75
1962	--	11.77	193.37	145.80	288.26	16.45	13.84	1.23	.08	670.80
1963	--	157.90	232.62	39.94	21.56	19.41	2.95	1.24	.15	475.77
1964	--	3.74	37.91	32.64	10.15	2.04	1.86	.23	.15	88.72
1965	--	22.89	50.16	42.69	6.89	.41	.12	.16	--	123.32
1966	--	4.53	10.43	3.50	1.16	.05	--	--	--	19.67
1967	--	1.78	9.51	18.22	2.31	.29	.01	--	--	32.12
1968	--	.43	29.25	19.27	5.29	.29	.04	--	--	54.57
1969	--	.03	6.35	13.28	2.29	.08	.01	--	--	22.04
1970	--	--	25.17	1.30	.19	--	--	--	--	26.66
1971	--	--	6.29	21.85	8.61	.80	--	--	--	37.55

Fishing effort, while declining in the Middle and North Atlantic areas after 1962, increased substantially in Chesapeake Bay. Increases resulted not only from increases in the number of vessels, but also from increases in the length of the season. From 1963 to 1967 effort fluctuated between 666 and 803 vessel weeks compared to 410 to 668 from 1955 to 1962. It then dropped to about 500 vessel weeks in 1969-71, by which time larger, faster vessels had replaced nearly all of the older, smaller vessels, and the number of spotter planes was about double the number prior to 1963 (Nicholson 1971).

In 1962 the CPUE dropped sharply and until 1970 remained at the levels prevailing from 1945 to 1952

Table 6.--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels fishing from North Atlantic plants, 1955-71.

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
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	1.92	1,057.35	176.58	3.22	0.22	0.08	--	--	--	1,239.37
1958	0.48	490.88	561.76	5.25	0.90	0.39	--	--	--	1,059.66
1959	10.71	2,124.56	281.10	19.57	--	--	--	--	--	2,435.94
1960	--	142.58	666.94	2.64	--	--	--	--	--	812.16
1961	--	327.80	214.20	204.34	0.32	0.16	--	--	--	746.82
1962	42.40	204.08	370.64	32.78	35.29	0.27	--	--	--	685.46
1963	51.54	318.64	192.83	45.43	.75	--	--	--	--	609.19
1964	227.28	170.58	314.05	27.90	.64	--	--	--	--	740.45
1965	71.96	504.57	108.11	13.84	.37	--	.08	--	--	698.93
1966	214.15	267.33	231.06	11.16	.65	.17	--	--	--	724.52
1967	6.62	228.65	155.81	18.42	.27	--	--	--	--	409.77
1968	41.55	150.39	235.42	26.24	.38	.09	--	--	--	454.07
1969	46.39	66.19	125.96	15.87	.97	--	--	--	--	255.38
1970	2.74	503.62	259.18	24.27	1.42	.08	--	--	--	791.31
1971	39.75	100.90	312.32	53.30	4.83	.88	--	--	--	511.98

(Nicholson 1971). Although part of the decrease probably was due to a decrease in menhaden abundance, part also was due to the increase in the number of vessels and the concomitant increase in fishing effort and vessel competition. From 1955 to 1961 the number of vessels generally was less than 25 each year, but from 1962 to 1968 the number ranged from 25 to 38 and generally was greater than 31 (Nicholson 1971). Since vessel competition from 1963 to 1969 was intense (Nicholson 1972), fewer fish were apportioned among a greater number of vessels, and a drop in the catch per vessel week was inevitable.

The low CPUE in 1969, following a decline in effort to 500 vessel weeks, probably reflects a scarcity of fish,

Table 7.--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels fishing from North Atlantic plants, 1955-71.

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
1955	6.51	292.84	113.04	13.47	11.38	--	--	--	--	437.24
1956	--	1,147.88	10.91	.89	--	--	--	--	--	1,159.68
1957	13.27	117.91	231.56	.42	--	--	--	--	--	363.16
1958	1.47	315.20	135.39	8.25	.26	--	--	--	--	460.57
1959	--	1,023.39	48.96	.84	--	--	--	--	--	1,073.19
1960	13.86	111.84	273.73	--	--	--	--	--	--	399.43
1961	--	490.44	74.96	54.36	.30	--	--	--	--	620.06
1962	2.21	297.55	250.30	1.81	--	--	--	--	--	551.87
1963	--	178.22	220.55	.33	--	--	--	--	--	399.10
1964	1.66	510.22	184.55	--	--	--	--	--	--	696.43
1965	--	172.50	186.43	--	--	--	--	--	--	358.93
1966	--	206.97	46.49	--	--	--	--	--	--	253.46
1967	.33	319.61	54.27	.03	--	--	--	--	--	374.24
1968	.26	210.55	203.28	.09	--	--	--	--	--	414.18
1969	--	257.37	112.94	.32	--	--	--	--	--	370.63
1970	--	337.13	165.55	--	--	--	--	--	--	502.68
1971	1.54	143.48	195.60	.17	--	--	--	--	--	340.79

while the high CPUE in 1970, with about the same amount of effort, reflects the relatively strong 1969 year class, which entered the fishery at age-1.

Part of the large increase in the CPUE in 1970 may have resulted from an increase in the number of age-2 fish (1968 year class). Usually a year class contributes the greatest number of fish at age-1, but the 1968 year class contributed 66 million fish to the Chesapeake Bay catch in 1969 and over 259 million in 1970. A large number of this 1968 year class, caught as age-2 fish in 1970, probably spent the 1969 season in the South Atlantic, where the catch of age-1 fish in 1969 was much greater than the catch of age-2 fish in 1970.

Table 8.--Calculated numbers of Atlantic menhaden (in millions) caught by purse seine vessels fishing from North Carolina plants during fall fishery, 1955-71.

Year	Age									Total
	0	1	2	3	4	5	6	7	8-10	
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	104.11	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
1961	0.25	10.71	45.17	101.90	5.76	10.00	0.62	--	--	174.41
1962	6.97	0.71	17.17	7.61	22.10	4.15	1.82	0.50	--	61.03
1963	45.35	69.47	61.86	26.25	8.18	9.43	1.53	.45	.11	222.63
1964	73.65	19.41	66.55	17.10	3.03	.64	.17	.09	--	180.64
1965	177.16	39.32	69.96	10.50	1.57	--	--	--	--	298.51
1966	135.31	72.00	116.03	15.76	.98	--	--	--	--	340.08
1967	--	83.16	46.09	36.09	2.51	.20	--	--	--	168.05
1968	112.80	14.91	65.14	13.66	2.59	.32	--	--	--	209.42
1969	111.69	48.78	38.80	15.96	.55	--	--	--	--	215.78
1970	21.45	20.92	17.99	6.62	2.29	.04	--	--	--	69.31
1971	32.68	14.42	9.69	1.23	.38	.03	--	--	--	58.43

South Atlantic Area

The annual catch in metric tons from 1963 to 1971 was of about the same magnitude as in previous years and age-1 and -2 fish continued to supply over 99% of the catch (Table 7).

The number of vessel weeks, while fluctuating over the years, showed no substantial change. Although vessel size did not increase, efficiency probably did, as more fish pumps, power blocks, aluminum purse boats, and nylon nets were employed after 1962 (Nicholson 1971).

With the exception of 1965 and 1966 the CPUE was greater from 1963 to 1971 than in previous years, and

Table 9.--Number of vessel weeks in the Atlantic menhaden purse seine fishery, by area, 1955-71.

Year	North Atlantic	Middle Atlantic	Chesapeake Bay	South Atlantic	N.C. fall fishery	
1955	334	890	451	475	342	2,492
1956	298	888	466	530	391	2,573
1957	262	949	527	412	311	2,461
1958	227	734	559	354	380	2,254
1959	301	897	668	474	312	2,652
1960	280	854	410	292	163	1,999
1961	249	946	482	395	224	2,296
1962	264	990	582	327	97	2,260
1963	238	823	666	264	286	2,277
1964	134	376	803	277	249	1,839
1965	96	300	786	359	259	1,800
1966	79	87	795	254	220	1,435
1967	0	124	757	253	212	1,346
1968	23	113	601	245	246	1,228
1969	39	119	519	173	160	1,010
1970	5	14	501	174	140	834
1971	20	43	507	175	120	865

Table 10.--Catch per vessel week, in metric tons, Atlantic menhaden purse seine fishery, by area, 1955-71.

Year	North Atlantic	Middle Atlantic	Chesapeake Bay	South Atlantic	N.C. fall fishery
1955	249	357	294	91	188
1956	330	426	201	130	186
1957	319	320	239	88	167
1958	159	288	270	117	185
1959	219	279	295	133	263
1960	237	299	265	126	381
1961	235	290	267	111	312
1962	245	253	267	129	266
1963	148	135	156	130	220
1964	112	93	167	168	154
1965	124	152	161	102	203
1966	23	69	145	96	326
1967	0	138	121	135	241
1968	292	323	192	137	215
1969	74	105	139	180	269
1970	860	814	365	244	131
1971	520	535	337	219	66

reached a record 244 metric tons per vessel week in 1970. Much of the increase probably was due to fewer vessels and greater efficiency rather than any increase in the abundance of fish.

North Carolina Fall Fishery

Landings from 1963 to 1968, while slightly smaller than landings from 1955 to 1962, were generally over 50,000 metric tons, but from 1969 to 1971 they dropped sharply, amounting to only 7,900 in 1971. The age composition of the catches also changed, with fish younger than age-3 composing an increasingly higher percentage after 1963. Age-4 and older fish practically disappeared from catch samples after 1964 (Table 8).

From 1964 to 1968 effort fluctuated between 212 and 259 vessel weeks, somewhat less than from 1955 to 1963, but greater than from 1969 to 1971. In recent years poor prospects for fish abundance have contributed to the decline in the number of vessels, and the failure of fish to appear until late November has contributed to a shortening of the season.

Because the amount of time a vessel can fish during the fall season is dependent on weather, which can be quite variable from year to year, the vessel week is not a particularly good measure of effort and the catch per vessel week is not as sensitive an index of abundance as it is in the major areas of the "summer" fishery. Nevertheless, the low CPUE in 1970 and 1971 reflects an unusual scarcity of fish. Weather during both years was ideal for fishing; yet on many days spotter pilots reported no concentrations of fish and vessels never left the dock. Some vessel operators declined to fish on small age-0 fish that were temporarily abundant at various times.

LENGTH AND WEIGHT

Length statistics are presented for the years 1963-71 in Appendix tables 1-18. In Appendix tables 1-10 frequency distributions are omitted for ages that contain less than 20 fish, or less than 1% of the number of fish in the annual sample. The mean lengths and the number of fish in the monthly samples at each port are shown in Appendix tables 11-18.

Several significant changes indicate an increased growth rate since 1963. Age-0 fish that began appearing in Chesapeake Bay catches in 1964 have been larger than age-0 fish caught in previous years in the North Carolina fall fishery. Age-0 fish caught in the North Carolina fall fishery since 1964, while not averaging as large as those caught in Chesapeake Bay, have been larger than those caught in previous years. Age-1 and -2 fish, although showing no appreciable change in mean length in samples from South Atlantic ports, have shown an increase in mean length in samples from Chesapeake Bay and Middle Atlantic ports. Mean lengths of age-3 fish from Chesapeake Bay samples since 1963 have been 30-50 mm greater than they were prior to 1963. Mean length of age-3 and -4 fish from samples at Port Monmouth and Amagansett also have been greater since 1963. Fish older than

Table 11.--Mean length (mm) of Atlantic menhaden in samples from purse seine catches, by port.

Year	Port 1	2	3	4	5	7	8	10
1955	173	172	186	219	260	286	297	215
1956	157	157	167	191	240	285	300	253
1957	186	183	174	186	217	260	287	269
1958	159	170	182	202	233	251	280	244
1959	149	165	156	168	207	216	273	281
1960	172	174	170	199	224	252	275	280
1961	168	162	187	218	251	266	290	261
1962	161	173	174	224	266	286	305	277
1963	155	175	171	208	216	292	315	239
1964	141	153	170	215	229	293	324	222
1965	172	173	188	221	245	284	312	195
1966	192	163	174	227	227	288	315	220
1967	170	195	194	238	--	293	--	245
1968	150	177	189	233	--	292	300	244
1969	--	179	191	226	--	310	317	205
1970	155	171	182	234	--	--	--	248
1971	175	195	193	263	--	--	--	218

Table 12.--Mean weight (g) of Atlantic menhaden in samples from purse seine catches, by port.

Year	Port 1	2	3	4	5	7	8	10
1955	95	89	113	185	319	443	475	256
1956	64	60	80	125	264	447	484	373
1957	110	101	96	108	185	340	443	450
1958	65	88	109	142	235	313	440	344
1959	55	82	68	81	167	201	389	449
1960	92	97	89	135	202	321	405	489
1961	84	76	115	181	286	372	475	383
1962	77	98	97	221	360	431	531	436
1963	69	90	91	169	209	503	620	301
1964	50	64	82	196	247	519	700	263
1965	90	98	128	185	281	463	623	215
1966	120	85	96	192	247	475	639	243
1967	86	128	137	259	--	523	--	303
1968	62	97	122	272	--	538	552	334
1969	--	108	126	274	--	607	667	229
1970	72	94	107	254	--	451	--	339
1971	97	111	125	353	--	641	--	232

age-4 have been too scarce to permit meaningful conclusions to be drawn.

Mean lengths for all ages combined also reflect the increased growth rates (Tables 11, 12). There are slight increases for fish in samples at South Atlantic ports, but large increases for fish at Chesapeake Bay, Middle Atlantic, and North Atlantic ports. The largest increase in mean lengths is for fish in Chesapeake Bay samples. Mean length of fish from North Carolina fall fishery samples generally were smaller from 1965 to 1971 than from 1955 to 1962. This change has resulted from the decrease in the average age of fish in the catch. Since weight increases at a much greater rate than length for fish over 200 mm, the length increases for fish caught during the summer north of Cape Hatteras represent a relatively large increase in biomass.

YEAR CLASS STRENGTH

Relative strength of year classes can be inferred by following the catch of each year class as it passes through the fishery. Because of the age and size distribution of Atlantic menhaden, variation in fishing effort in different areas can distort the relative importance of different age groups in the catch and make assessments difficult. If only the Chesapeake Bay catch, which has accounted for the major share of the catch since 1964, and the combined catch of ages 0-4 from all areas are considered, some meaningful inferrences can be drawn.

The 1951, 1953, 1955, 1956, and 1958 year classes appear to have been strong. Whether they were unusually stronger than year classes prior to 1951 is not certain. The 1958 year class, however, was certainly the most abundant since 1951 and may have been one of the largest ever produced, although there is no way of knowing.

Evidence of the strength of the 1959 year class is conflicting. Although the catch of age-1 fish was poor, the catch of ages 2 to 4 was relatively good. Perhaps the 1959 year class did not appear as abundant at age-1 because the catches were dominated by the age-2 fish of the super abundant 1958 year class. Also, 1960 was a year of poor market conditions, and Chesapeake Bay plants, which account for most of the age-1 catch, established quota restrictions on the catch.

All of the year classes from 1960 to 1970 appear to have been smaller than any from 1951 to 1958. Although the total number of fish from the first three age groups after 1959 was not much less than the total number from these age groups prior to 1960, the effort against these age groups was much greater. In Chesapeake Bay, effort nearly doubled from 1955 to 1964.

The 1964, 1966, and 1969 year classes appear to have been the largest produced between 1959 and 1970. Since fishing effort in Chesapeake Bay was exceptionally high, particularly from 1964 to 1968, these year classes were smaller than the catches indicate and probably did not equal the abundance of any of the year classes from 1951 to 1959.

The 1969 year class, while apparently stronger than any year class since 1958 did not appear nearly as strong as those prior to 1958. It provided enough age-1 fish in 1970 to sustain only the South Atlantic and Chesapeake Bay fisheries, and not nearly enough to sustain also a fishery from the Virginia Capes to Delaware Bay, where age-1 fish from strong year classes prior to 1959 were usually abundant. In 1971, where age-1 fish from the 1970 year class were not abundant, the 1969 year class supplied barely enough fish to sustain the Chesapeake Bay fishery, and not enough to support even a small fishery from Delaware Bay to northern New Jersey, where age-2 fish are usually the most important age group.

LITERATURE CITED

JUNE, F. C.

1961. 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. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 373, 39 p.

JUNE, F. C., and W. R. NICHOLSON.

1964. Age and size composition of the menhaden catch along the Atlantic coast of the United States, 1958, with a brief review of the commercial fishery. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 446, 40 p.

JUNE, F. C., and J. W. REINTJES.

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 Wildl. Serv., Spec. Sci. Rep. Fish. 317, 65 p.

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 Wildl. Serv., Spec. Sci. Rep. Fish. 336, 38 p.

NICHOLSON, W. R.

1971. Changes in catch and effort in the Atlantic menhaden purse-seine fishery 1940-68. Fish. Bull., U.S. 69:765-781.

1972. Fishing pressure and its influence on Monday catches of Atlantic menhaden in the Chesapeake Bay purse-seine fishery. Chesapeake Sci. 13:215-218.

NICHOLSON, W. R., and J. R. HIGHAM, JR.

1964a. Age and size composition of the menhaden catch along the Atlantic coast of the United States, 1959, with a brief review of the commercial fishery. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 478, 34 p.

1964b. Age and size composition of the 1960 menhaden catch along the U.S. Atlantic coast, with a brief review of the commercial fishery. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 479, 41 p.

1965. Age and size composition of the menhaden catch along the Atlantic coast of the United States, 1961, with a brief review of the commercial fishery. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 495, 28 p.

1966. Age and size composition of the menhaden catch along the Atlantic coast of the United States, 1962, with a brief review of the commercial fishery. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 527, 24 p.

SCHAAF, W. E., and G. R. HUNTSMAN.

1972. Effects of fishing on Atlantic menhaden stock:1955-1969. Trans. Am. Fish. Soc. 101:290-297.

Appendix Table 1.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by port and age, 1963.

Fork Length (mm)	Port 1				Port 2				Port 3				Port 4				Port 5					Port 7					Port 8				
	Age				Age				Age				Age				Age					Age					Age				
	1	2			1	2			1	2			0	1	2	3	1	2	3	4	5	2	3	4	5	6	2	3	4	5	6
90-94	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
95-99	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100-104	22	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105-109	39	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110-114	58	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115-119	60	-	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120-124	38	-	1	-	1	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125-129	22	-	1	-	7	-	14	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130-134	20	-	2	-	21	-	6	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135-139	20	2	6	-	20	-	24	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140-144	13	3	-	-	32	-	55	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145-149	11	9	3	-	43	-	66	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-154	17	13	2	-	64	-	65	41	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155-159	13	11	2	1	91	1	44	39	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160-164	16	26	3	6	89	6	26	55	5	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
165-169	10	19	7	17	70	19	19	74	3	-	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-174	9	48	5	29	47	48	10	75	9	-	18	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175-179	7	50	3	29	24	40	9	84	26	-	23	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180-184	7	56	2	16	22	38	2	110	35	-	25	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185-189	6	61	-	8	13	35	1	107	44	-	55	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190-194	2	58	-	14	5	40	1	117	45	-	67	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
195-199	2	32	2	12	7	33	1	117	53	-	102	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200-204	-	26	-	7	2	40	-	136	59	-	119	106	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
205-209	-	3	-	-	2	20	-	104	50	-	85	127	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210-214	-	1	-	-	1	11	-	119	53	2	71	133	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
215-219	-	-	-	-	1	10	-	111	43	2	44	100	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220-224	-	-	-	-	-	4	-	86	55	-	47	75	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
225-229	-	-	-	-	-	5	-	79	43	1	41	50	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230-234	-	-	-	-	-	2	-	62	42	2	33	54	-	-	-	-	18	1	-	-	-	-	-	-	-	-	-	-	-	-	-
235-239	-	-	-	-	-	-	-	61	54	1	23	37	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240-244	-	-	-	-	-	-	-	31	35	3	8	15	-	-	-	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
245-249	-	-	-	-	-	-	-	19	36	2	3	12	-	-	-	-	11	2	-	-	-	1	-	-	-	-	-	-	-	-	-
250-254	-	-	-	-	-	-	-	14	43	7	1	12	-	-	-	-	16	6	-	-	-	2	-	-	-	-	-	-	-	-	-
255-259	-	-	-	-	-	-	-	8	34	9	-	11	1	-	-	-	13	6	-	-	-	1	1	-	-	-	-	-	-	-	-	-
260-264	-	-	-	-	-	-	-	3	39	18	-	13	1	-	-	-	31	17	-	-	-	6	8	-	-	-	-	-	-	-	-	-
265-269	-	-	-	-	-	-	-	3	48	25	-	5	6	-	-	-	41	20	-	-	-	3	6	2	-	-	-	-	-	-	-	-
270-274	-	-	-	-	-	-	-	-	48	37	-	1	7	-	-	-	56	49	2	1	-	9	11	-	-	-	-	-	-	-	-	-
275-279	-	-	-	-	-	-	-	1	44	32	-	6	5	1	-	-	33	56	5	2	-	10	19	2	1	-	-	-	-	-	-	-
280-284	-	-	-	-	-	-	-	-	32	29	-	3	8	-	-	-	26	63	8	5	-	4	23	14	1	-	-	-	-	-	-	-
285-289	-	-	-	-	-	-	-	1	27	29	-	3	4	-	-	-	17	69	12	3	-	5	41	4	74	-	-	-	-	-	-	-
290-294	-	-	-	-	-	-	-	-	17	13	-	1	2	-	-	-	3	56	19	8	2	3	48	20	8	-	-	-	-	-	-	-
295-299	-	-	-	-	-	-	-	-	2	8	-	-	5	1	2	-	1	36	17	11	-	3	49	29	13	1	-	-	-	-	-	-
300-304	-	-	-	-	-	-	-	-	1	5	-	-	2	2	-	-	4	31	51	20	-	1	31	43	46	1	-	-	-	-	-	-
305-309	-	-	-	-	-	-	-	-	-	3	-	-	1	7	-	-	-	11	26	19	-	1	24	45	78	7	-	-	-	-	-	-
310-314	-	-	-	-	-	-	-	-	-	4	-	1	1	3	2	-	-	17	40	31	2	1	28	95	115	20	-	-	-	-	-	-
315-319	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2	-	-	13	34	33	6	1	34	94	172	30	-	-	-	-	-	-
320-324	-	-	-	-	-	-	-	-	-	-	-	-	2	5	1	-	-	9	30	41	6	2	17	80	177	53	-	-	-	-	-	-
325-329	-	-	-	-	-	-	-	-	-	-	-	-	3	2	4	-	-	3	24	46	16	2	5	75	149	66	-	-	-	-	-	-
330-334	-	-	-	-	-	-	-	-	-	-	-	-	1	2	5	-	-	1	20	30	10	-	5	37	111	62	-	-	-	-	-	-
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	8	22	13	-	2	12	64	53	-	-	-	-	-	-
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	10	11	-	-	6	19	32	-	-	-	-	-	-
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	5	6	-	-	-	5	14	-	-	-	-	-	-
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	3	-	-	-	-	2	-	-	-	-	-	-
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	410	418	39	139	564	352	365	1,712	1,027	232	783	930	51	28	22		371	467	266	287	77		57	352	558	963	343
Mean	129	180	159	179	160	189	149	198	230	275	204	215	288	315	327		257	286	311	319	332		280	297	314	320	329
Male	220	230	21	61	279	360	139	812	458	92	394	475	31	13	5		188	240	114	118	26		28	185	271	435	160
Mean	129	180	152	177	158	188	146	195	225	269	203	213	282	312	322		257	283	306	311	322		276	293	311	316	323
Female	190	188	18	78	285	192	226	900	569	140	389	455	20	15	17		183	227	152	169	51		29	167	287	528	183
Mean	128	181	167	181	161	190	151	200	234	279	205	217	299	317	329		258	290	315	324	338		284	301	318	324	334

Appendix table 2.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by port and age, 1964.

Fork Length (mm)	Port 1 Age 1	Port 1 Age 2	Port 2 Age 1	Port 2 Age 2	Port 3 Age 1	Port 3 Age 2	Port 4 Age 0	Port 4 Age 1	Port 4 Age 2	Port 4 Age 3	Port 5 Age 1	Port 5 Age 2	Port 5 Age 3	Port 7 Age 2	Port 7 Age 3	Port 7 Age 4	Port 7 Age 5	Port 7 Age 6	Port 8 Age 2	Port 8 Age 3	Port 8 Age 4	Port 8 Age 5	Port 8 Age 6
105-109	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110-114	6	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115-119	7	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120-124	25	-	2	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125-129	23	-	5	1	-	-	35	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130-134	18	-	5	1	1	-	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135-139	15	1	18	-	4	-	52	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140-144	11	1	36	1	18	-	75	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145-149	10	-	43	2	29	2	95	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-154	8	1	31	1	49	6	104	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155-159	2	7	24	5	54	11	80	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160-164	4	6	9	3	37	24	62	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
165-169	6	9	2	4	41	20	46	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-174	-	6	2	4	27	29	30	15	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175-179	-	5	2	2	13	24	12	18	9	-	1	5	-	-	-	-	-	-	-	-	-	-	-
180-184	1	2	1	6	17	37	3	34	22	-	9	15	-	-	-	-	-	-	-	-	-	-	-
185-189	-	1	1	7	15	34	2	70	28	-	19	15	-	-	-	-	-	-	-	-	-	-	-
190-194	-	-	1	6	7	30	1	75	47	-	10	26	-	-	-	-	-	-	-	-	-	-	-
195-199	-	-	1	3	4	19	-	76	64	-	15	27	-	-	-	-	-	-	-	-	-	-	-
200-204	-	-	-	1	1	11	-	72	66	-	14	38	-	-	-	-	-	-	-	-	-	-	-
205-209	-	-	-	-	-	5	-	62	61	-	10	43	-	-	-	-	-	-	-	-	-	-	-
210-214	-	-	-	-	-	1	-	83	75	-	7	52	-	-	-	-	-	-	-	-	-	-	-
215-219	-	-	-	-	-	-	-	65	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220-224	-	-	-	-	-	-	-	73	64	-	4	28	-	4	-	-	-	-	-	-	-	-	-
225-229	-	-	-	-	-	-	-	53	48	-	4	34	-	6	1	-	-	-	-	-	-	-	-
230-234	-	-	-	-	-	1	-	51	73	1	2	29	-	4	1	-	-	-	3	-	-	-	-
235-239	-	-	-	-	-	-	-	47	55	1	1	19	-	10	4	-	-	-	1	-	-	-	-
240-244	-	-	-	-	-	-	-	52	63	2	-	14	-	9	6	-	-	-	4	-	-	-	-
245-249	-	-	-	-	-	-	-	34	69	3	-	22	-	8	4	1	-	-	3	-	-	-	-
250-254	-	-	-	-	-	-	-	18	75	3	-	24	4	14	12	-	-	-	1	-	-	-	-
255-259	-	-	-	-	-	-	-	9	69	5	-	24	15	26	12	2	-	-	1	-	1	-	-
260-264	-	-	-	-	-	-	-	6	92	10	-	23	13	36	9	1	-	-	9	1	-	-	-
265-269	-	-	-	-	-	-	-	4	96	7	-	28	7	43	31	2	-	-	7	6	-	-	-
270-274	-	-	-	-	-	-	-	3	88	11	-	21	17	64	42	4	-	-	9	8	-	-	-
275-279	-	-	-	-	-	-	-	2	84	18	-	14	12	68	66	10	-	-	16	9	3	1	-
280-284	-	-	-	-	-	-	-	3	70	21	-	8	14	89	104	10	-	-	15	26	5	-	-
285-289	-	-	-	-	-	-	-	1	72	8	-	1	11	73	101	13	-	1	14	20	8	1	-
290-294	-	-	-	-	-	-	-	1	24	13	-	2	10	65	93	23	1	-	7	27	7	1	-
295-299	-	-	-	-	-	-	-	-	8	4	-	-	2	34	82	14	1	2	3	28	8	1	-
300-304	-	-	-	-	-	-	-	-	4	2	-	-	2	11	60	30	1	1	-	42	13	4	-
305-309	-	-	-	-	-	-	-	1	-	1	-	-	-	14	65	25	3	2	2	31	12	2	1
310-314	-	-	-	-	-	-	-	-	1	1	-	-	1	5	38	25	1	1	2	34	14	1	3
315-319	-	-	-	-	-	-	-	-	-	-	-	-	-	5	29	15	3	1	1	24	22	-	8
320-324	-	-	-	-	-	-	-	-	-	-	-	-	-	2	22	14	2	-	1	35	27	18	12
325-329	-	-	-	-	-	-	-	-	-	-	-	-	-	2	17	12	12	4	1	35	49	38	27
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	1	16	15	4	16	1	38	38	54	45
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	16	25	21	-	25	48	70	54
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	14	23	29	-	14	38	82	79
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	14	23	28	-	8	35	67	99
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	5	24	30	-	1	17	70	64
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	21	15	-	-	10	30	41
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	13	-	-	3	10	28
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-	-	2	2	9
370-374	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	1
Total	138	39	185	47	317	254	656	960	1,485	110	96	512	108	594	839	269	149	169	101	412	357	454	471
Mean	134	166	148	174	162	180	149	211	241	276	199	225	269	272	287	306	337	339	272	305	324	336	339
Male	89	26	94	23	158	122	362	518	787	57	43	268	60	319	411	124	55	80	62	208	152	191	193
Mean	135	166	148	176	162	179	149	211	240	274	196	226	268	269	283	302	334	336	269	300	316	329	332
Female	49	13	91	24	159	132	294	442	698	53	53	244	48	275	428	145	94	89	39	204	205	263	278
Mean	133	165	148	172	163	181	149	212	242	277	201	225	270	276	291	310	339	343	276	311	330	341	343

Appendix table 3.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by port and age, 1965.

Fork Length (mm)	Port 1 Age 1	Port 1 Age 2	Port 2 Age 1	Port 2 Age 2	Port 3 Age 1	Port 3 Age 2	Port 4 Age 0	Port 4 Age 1	Port 4 Age 2	Port 4 Age 3	Port 5 Age 1	Port 5 Age 2	Port 5 Age 3	Port 5 Age 4	Port 7 Age 2	Port 7 Age 3	Port 7 Age 4	Port 8 Age 2	Port 8 Age 3	Port 8 Age 4	Port 8 Age 5	Port 8 Age 6
95-99	-	-	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100-104	-	-	8	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105-109	2	-	1	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110-114	8	-	4	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115-119	18	-	-	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120-124	33	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125-129	93	-	3	1	1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130-134	126	-	9	-	2	-	13	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135-139	133	2	7	1	4	-	20	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140-144	125	5	15	1	10	-	39	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145-149	103	5	18	1	26	-	38	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-154	124	19	18	1	38	1	55	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155-159	118	55	17	-	47	1	49	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160-164	149	73	12	2	35	2	62	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-
165-169	193	140	3	3	25	2	39	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-174	249	183	4	11	28	7	47	96	2	-	-	-	-	-	-	-	-	-	-	-	-	-
175-179	287	153	2	19	26	27	39	114	1	-	-	-	-	-	-	-	-	-	-	-	-	-
180-184	286	182	6	34	25	48	39	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185-189	282	195	6	39	16	51	11	161	-	-	2	-	-	-	-	-	-	-	-	-	-	-
190-194	251	179	12	48	30	44	9	221	2	-	4	-	-	-	-	-	-	-	-	-	-	-
195-199	132	146	4	34	28	52	4	200	7	-	18	1	-	-	-	-	-	-	-	-	-	-
200-204	44	53	-	18	61	53	1	254	13	-	43	8	-	-	-	-	-	-	-	-	-	-
205-209	6	12	-	3	39	45	-	211	11	-	84	9	-	-	-	-	-	-	-	-	-	-
210-214	1	8	-	1	26	46	-	324	16	-	106	27	-	-	1	-	-	-	-	-	-	-
215-219	1	1	-	-	19	28	-	289	12	-	119	35	-	-	1	-	-	-	-	-	-	-
220-224	1	-	-	-	10	10	-	415	12	-	133	55	2	-	-	-	-	1	-	-	-	-
225-229	-	-	-	-	2	7	-	332	20	1	103	66	6	-	2	-	-	-	-	-	-	-
230-234	-	1	-	-	3	2	-	342	21	3	90	83	7	-	11	3	-	2	-	-	-	-
235-239	-	-	-	-	1	2	-	258	32	2	91	99	18	-	12	7	-	3	-	-	-	-
240-244	-	-	-	-	-	-	-	197	43	-	56	114	19	-	33	11	-	8	2	-	-	-
245-249	-	-	-	-	-	-	-	166	55	4	28	98	34	2	35	13	1	5	3	-	-	-
250-254	-	-	-	-	-	-	-	136	73	6	16	78	38	-	38	17	-	7	2	-	-	-
255-259	-	-	-	-	-	-	-	68	87	5	4	86	32	-	35	37	3	13	3	-	-	-
260-264	-	-	-	-	-	-	-	39	113	13	1	96	39	4	40	40	1	11	6	-	-	-
265-269	-	-	-	-	-	-	-	21	123	10	-	79	57	5	72	57	4	13	7	-	-	-
270-274	-	-	-	-	-	-	-	12	153	15	1	86	58	7	58	81	2	22	17	-	-	-
275-279	-	-	-	-	-	-	-	10	116	8	-	76	45	2	82	76	9	18	29	2	-	-
280-284	-	-	-	-	-	-	-	7	99	13	-	52	47	-	62	87	11	23	45	3	1	-
285-289	-	-	-	-	-	-	-	4	46	9	-	21	31	4	51	112	18	19	56	8	-	1
290-294	-	-	-	-	-	-	-	1	35	21	-	6	28	4	36	131	24	19	71	13	-	-
295-299	-	-	-	-	-	-	-	-	22	15	-	2	23	4	23	132	29	14	117	12	-	-
300-304	-	-	-	-	-	-	-	-	14	14	-	1	14	3	16	92	23	14	125	23	-	-
305-309	-	-	-	-	-	-	-	-	1	17	-	-	11	3	2	59	21	6	113	23	2	-
310-314	-	-	-	-	-	-	-	-	3	5	-	1	6	-	4	52	14	6	97	35	2	1
315-319	-	-	-	-	-	-	-	-	1	4	-	-	1	-	4	31	15	6	72	26	3	-
320-324	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	10	10	-	57	29	2	2
325-329	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	4	2	2	39	18	6	2
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	6	-	27	32	17	2
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	-	23	19	9	10
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	8	27	30	24
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	8	19	19	23
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	15	26	22
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	15	9	28
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	10	24
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	9
370-374	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	4
Total	2,765	1,412	152	218	503	430	489	4,190	1,133	157	899	1,179	517	38	621	1,061	203	212	936	325	143	152
Mean	168	181	152	187	181	197	159	215	262	281	223	250	270	280	270	287	300	278	304	323	344	350
Male	1,309	707	68	105	262	203	221	2,021	580	69	492	609	265	18	362	630	118	121	426	146	60	47
Mean	168	179	150	185	178	196	161	215	262	276	223	249	267	282	270	285	299	271	297	317	339	342
Female	1,441	702	80	108	232	224	240	2,140	550	88	403	563	250	20	259	431	85	88	508	177	82	105
Mean	167	182	153	189	185	198	159	216	262	285	223	252	272	279	271	288	302	289	310	328	348	354

Appendix table 4.--Length frequency distribution of Atlantic menhaden in samples from purse seine catches, by port and age, 1966.

Fork Length (mm)	Port 1 Age 1	1 Age 2	2 Age 1	2 Age 2	3 Age 1	3 Age 2	4 Age 0	4 Age 1	4 Age 2	4 Age 3	5 Age 1	5 Age 2	5 Age 3	7 Age 2	7 Age 3	7 Age 4	7 Age 5	8 Age 3	8 Age 4	10 Age 0	10 Age 1	10 Age 2	10 Age 3
70-74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
75-79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-84	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
85-89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
90-94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
95-99	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-
100-104	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-
105-109	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-
110-114	-	-	4	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
115-119	1	1	11	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
120-124	7	-	15	-	1	-	5	7	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
125-129	14	-	25	-	1	-	22	11	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-
130-134	28	-	38	-	5	-	49	19	-	-	-	-	-	-	-	-	-	-	-	7	3	-	-
135-139	15	-	20	-	30	-	71	16	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-
140-144	35	-	19	-	59	-	147	15	-	-	2	-	-	-	-	-	-	-	-	18	13	-	-
145-149	48	1	9	-	58	-	144	22	-	-	7	-	-	-	-	-	-	-	-	22	19	-	-
150-154	51	1	4	-	96	-	211	51	1	-	19	-	-	-	-	-	-	-	-	22	42	-	-
155-159	70	1	5	1	143	3	190	54	4	-	17	-	-	-	-	-	-	-	-	38	37	-	-
160-164	90	1	5	-	185	1	170	92	7	-	15	-	-	-	-	-	-	-	-	30	46	-	-
165-169	117	7	2	-	179	4	116	70	18	-	7	1	-	-	-	-	-	-	-	55	26	-	-
170-174	156	4	2	-	242	5	120	117	27	-	7	3	-	-	-	-	-	-	-	48	25	-	-
175-179	177	18	1	1	210	8	56	132	48	-	10	10	-	-	-	-	-	-	-	41	28	-	-
180-184	178	27	3	4	195	13	59	168	58	-	5	8	-	-	-	-	-	-	-	25	26	-	-
185-189	188	40	3	5	92	5	24	190	75	-	6	17	-	-	-	-	-	-	-	8	19	1	-
190-194	192	65	4	15	60	6	12	220	73	-	8	18	-	-	-	-	-	-	-	5	21	-	-
195-199	302	107	10	24	39	8	6	130	54	-	5	22	-	-	-	-	-	-	-	-	7	2	-
200-204	407	233	6	28	32	12	2	166	61	-	14	21	-	-	-	-	-	-	-	-	5	9	-
205-209	313	191	3	16	30	15	-	81	33	-	4	15	-	-	-	-	-	-	-	-	11	3	-
210-214	203	144	-	7	25	19	-	83	40	-	6	11	-	-	-	-	-	-	-	-	13	9	-
215-219	58	40	2	3	9	13	-	51	38	-	3	5	-	-	-	-	-	-	-	-	12	9	-
220-224	7	3	-	-	9	18	-	39	28	-	2	1	-	-	-	-	-	-	-	-	11	7	-
225-229	-	1	-	-	-	3	-	45	35	-	1	-	-	-	-	-	-	-	-	-	9	4	-
230-234	-	1	-	-	5	8	-	41	33	2	-	2	-	-	-	-	-	-	-	-	18	20	-
235-239	-	-	-	-	1	3	-	37	40	2	-	2	-	-	-	-	-	-	-	-	19	16	1
240-244	-	-	-	-	-	1	-	55	50	3	-	1	-	-	-	-	-	-	-	-	10	18	-
245-249	-	-	-	-	-	-	-	37	56	1	-	8	-	-	1	-	-	-	-	-	12	13	-
250-254	-	-	-	-	-	-	-	44	77	3	-	10	-	-	1	-	-	-	-	-	3	6	1
255-259	-	-	-	-	-	-	-	38	125	9	-	14	-	6	4	2	-	1	-	-	6	6	1
260-264	-	-	-	-	-	-	-	27	199	7	-	16	4	26	16	1	-	-	-	-	2	11	1
265-269	-	-	-	-	-	-	-	18	252	11	-	30	5	33	36	6	1	1	-	-	3	25	3
270-274	-	-	-	-	-	-	-	10	329	21	-	37	8	44	53	12	1	-	-	-	4	59	6
275-279	-	-	-	-	-	-	-	5	260	23	-	27	9	24	54	23	3	1	-	-	-	82	5
280-284	-	-	-	-	-	-	-	-	223	11	-	16	6	23	88	36	1	3	-	-	2	122	13
285-289	-	-	-	-	-	-	-	1	128	7	-	9	5	14	106	36	4	2	1	-	-	130	11
290-294	-	-	-	-	-	-	-	-	86	16	-	3	5	10	99	64	6	4	1	-	1	94	16
295-299	-	-	-	-	-	-	-	-	40	3	-	1	6	5	69	35	5	9	7	-	-	48	10
300-304	-	-	-	-	-	-	-	-	18	13	-	-	1	3	70	41	-	10	5	-	-	23	6
305-309	-	-	-	-	-	-	-	-	4	3	-	1	3	1	26	24	-	7	2	-	-	3	2
310-314	-	-	-	-	-	-	-	-	-	2	-	-	1	-	18	19	2	15	14	-	-	3	2
315-319	-	-	-	-	-	-	-	-	1	-	-	-	-	-	11	7	3	7	6	-	-	3	6
320-324	-	-	-	-	-	-	-	-	-	-	-	-	2	-	9	14	2	7	7	-	-	-	-
325-329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	7	3	6	6	-	-	-	1
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	1	1	9	-	-	-	1
335-339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	3	5	-	-	-	-
340-344	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3	-	-	-	-
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	1	-	-	-	-
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2,658	886	193	104	1,706	145	1,406	2,093	2,521	137	138	309	55	189	666	338	32	79	70	445	453	726	87
Mean	188	202	144	199	171	203	157	195	252	277	175	237	283	274	288	296	299	309	319	149	187	275	290
Male	1,317	358	83	47	768	68	671	963	1,202	53	93	185	28	125	377	177	19	38	38	185	239	326	34
Mean	187	199	148	198	173	201	157	198	252	275	173	236	281	272	285	291	296	303	314	158	187	272	283
Female	1,328	527	73	44	779	75	680	1,078	1,291	82	45	123	26	63	286	158	13	41	32	178	214	399	53
Mean	189	203	145	199	172	206	157	194	253	278	181	239	286	278	292	301	303	313	326	159	187	277	294

Appendix table 5.--Length frequency distributions of Altantic menhaden in samples from purse seine catches, by port and age, 1967.

Fork Length (mm)	Port 1 Age 1	1 Age 2	2 Age 1	2 Age 2	3 Age 1	3 Age 2	4 Age 0	4 Age 1	4 Age 2	4 Age 3	7 Age 1	7 Age 2	7 Age 3	7 Age 4	7 Age 5	10 Age 1	10 Age 2	10 Age 3	10 Age 4
100-104	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105-109	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110-114	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115-119	196	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120-124	222	-	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-
125-129	232	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
130-134	156	2	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
135-139	116	2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
140-144	109	1	-	-	3	-	1	2	-	-	-	-	-	-	-	1	-	-	-
145-149	109	-	-	-	4	-	3	4	-	-	-	-	-	-	-	-	-	-	-
150-154	148	1	5	-	13	1	7	6	-	-	-	-	-	-	-	1	-	-	-
155-159	174	-	7	-	11	3	6	10	-	-	-	-	-	-	-	12	-	-	-
160-164	186	5	9	-	23	4	14	16	3	-	-	-	-	-	-	14	-	-	-
165-169	230	12	6	-	28	9	13	24	6	-	-	-	-	-	-	31	-	-	-
170-174	210	15	10	-	42	17	14	43	17	-	-	-	-	-	-	70	-	-	-
175-179	180	11	7	-	60	14	12	71	25	-	-	-	-	-	-	89	-	-	-
180-184	176	31	7	-	69	20	3	80	20	-	-	-	-	-	-	72	-	-	-
185-189	163	46	7	1	75	18	6	97	34	-	-	-	-	-	-	82	1	-	-
190-194	223	73	19	1	57	30	3	153	60	-	-	-	-	-	-	48	1	-	-
195-199	212	79	21	4	43	34	1	130	56	-	-	-	-	-	-	41	4	-	-
200-204	206	56	23	4	64	42	-	203	79	-	-	-	1	-	-	30	6	-	-
205-209	188	40	25	8	45	54	-	157	60	-	-	-	-	-	-	19	6	-	-
210-214	138	53	24	9	46	66	-	192	76	-	-	-	-	-	-	18	3	-	-
215-219	86	46	12	3	28	42	-	125	42	-	-	-	-	-	-	10	7	-	-
220-224	46	24	3	3	19	43	-	162	79	-	-	2	-	-	-	9	6	-	-
225-229	20	6	2	-	10	23	-	176	81	-	1	1	-	-	-	13	11	-	-
230-234	4	1	1	-	9	12	-	228	87	1	3	4	-	-	-	7	5	-	-
235-239	3	-	-	-	3	3	-	225	88	-	-	4	1	-	-	17	11	-	-
240-244	-	-	-	-	1	4	-	259	135	-	8	12	1	-	-	23	9	-	-
245-249	-	-	-	-	1	1	-	178	95	2	8	8	1	-	-	19	16	2	-
250-254	-	-	-	-	1	2	-	141	84	3	6	12	6	-	-	30	6	-	-
255-259	-	-	-	-	-	-	-	87	68	5	5	10	4	-	-	13	9	3	-
260-264	-	-	-	-	-	-	-	68	71	4	6	29	4	-	-	9	14	2	-
265-269	-	-	-	-	-	-	-	69	77	5	4	31	6	-	-	7	10	1	-
270-274	-	-	-	-	-	-	-	55	83	13	2	51	25	1	-	2	5	3	-
275-279	-	-	-	-	-	-	-	33	75	15	-	42	23	1	-	1	15	3	1
280-284	-	-	-	-	-	-	-	18	109	19	-	53	67	5	-	10	22	7	-
285-289	-	-	-	-	-	-	-	13	106	31	-	50	93	6	1	2	34	17	3
290-294	-	-	-	-	-	-	-	7	134	41	-	44	172	9	2	-	34	24	3
295-299	-	-	-	-	-	-	-	5	119	41	-	38	178	9	2	-	44	32	1
300-304	-	-	-	-	-	-	-	3	98	54	-	18	145	14	2	-	56	51	3
305-309	-	-	-	-	-	-	-	1	54	37	-	11	120	14	1	-	38	59	5
310-314	-	-	-	-	-	-	-	-	35	38	-	11	117	10	3	-	25	40	-
315-319	-	-	-	-	-	-	-	-	13	12	-	4	36	7	2	-	6	29	1
320-324	-	-	-	-	-	-	-	-	-	4	-	2	43	10	2	-	1	10	2
325-329	-	-	-	-	-	-	-	-	3	3	-	-	15	12	1	-	-	4	-
330-334	-	-	-	-	-	-	-	-	-	1	-	-	10	8	1	-	-	3	-
335-339	-	-	-	-	-	-	-	-	-	-	-	-	4	7	-	-	-	1	-
340-344	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1	-	-	2	-
345-349	-	-	-	-	-	-	-	-	-	-	-	-	3	6	3	-	-	-	-
350-354	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
Total	3,844	505	189	33	658	442	83	3,047	2,172	329	43	437	1,077	128	22	702	405	293	20
Mean	166	197	193	208	190	204	169	223	252	295	251	279	298	313	317	199	278	303	303
Male	1,255	197	97	14	267	187	45	1,630	1,104	155	27	268	560	55	9	331	196	114	7
Mean	175	195	195	206	189	202	166	223	250	293	252	275	293	307	304	201	274	295	290
Female	2,241	307	91	19	387	255	38	1,411	1,059	174	14	158	503	73	13	371	209	178	13
Mean	167	198	193	209	191	206	171	224	254	297	250	286	304	318	325	197	281	308	310

Appendix table 6.--Length frequency distributions of Altantic menhaden in samples from purse seine catches, by port and age, 1968.

Fork Length (mm)	Port 1				2			3				4				6					7				8				10			
	Age				Age			Age				Age				Age					Age				Age				Age			
	1		2		1		2	1		2	0	1		2	3	1	2	3	4		2	3	4	5	2	3	4	0	1	2	3
100-104	6		-		-		-	-		-	-	1		-	-	-	-	-	-		-	-	-	-	-	-	-	10	-	-	-
105-109	15		-		-		-	2		-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	10	-	-	-
110-114	48		-		-		-	3		-	-	14		-	-	-	-	-	-		-	-	-	-	-	-	-	8	-	-	-
115-119	74		-		-		-	6		-	1	27		-	-	-	-	-	-		-	-	-	-	-	-	-	2	-	-	-
120-124	88		-		-		-	6		-	6	34		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
125-129	87		-		-		-	4		-	16	31		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
130-134	117		-		1		-	11		-	25	24		-	-	-	-	-	-		-	-	-	-	-	-	-	2	-	-	-
135-139	105		-		3		1	9		-	38	41		-	-	-	-	-	-		-	-	-	-	-	-	-	3	-	-	-
140-144	91		2		18		-	7		1	65	71		-	-	-	-	-	-		-	-	-	-	-	-	-	4	-	-	-
145-149	95		4		22		1	15		5	86	113		1	-	-	-	-	-		-	-	-	-	-	-	-	13	-	-	-
150-154	140		6		31		3	9		1	76	111		1	-	-	-	-	-		-	-	-	-	-	-	-	20	-	-	-
155-159	203		22		22		6	9		2	63	88		2	-	-	-	-	-		-	-	-	-	-	-	-	26	-	-	-
160-164	194		30		48		16	5		-	99	95		-	-	-	-	-	-		-	-	-	-	-	-	-	35	1	-	-
165-169	161		39		49		46	4		1	89	66		1	-	-	-	-	-		-	-	-	-	-	-	-	36	-	-	-
170-174	108		41		63		146	14		13	131	84		2	-	-	-	-	-		-	-	-	-	-	-	-	21	1	-	-
175-179	55		7		44		283	30		35	105	72		6	-	-	-	-	-		-	-	-	-	-	-	-	15	3	-	-
180-184	17		3		67		397	45		64	62	84		12	-	-	-	-	-		-	-	-	-	-	-	-	9	2	-	-
185-189	1		4		31		269	55		95	41	98		28	-	-	-	-	-		-	-	-	-	-	-	-	4	11	-	-
190-194	4		4		6		147	64		62	30	149		48	-	-	-	-	-		-	-	-	-	-	-	-	10	4	2	-
195-199	1		4		5		55	35		46	15	123		48	-	-	-	-	-		-	-	-	-	-	-	-	4	9	-	-
200-204	1		3		-		8	26		60	6	125		91	-	-	-	-	-		-	-	-	-	-	-	-	1	7	-	-
205-209	2		1		-		3	8		32	2	65		53	-	-	-	-	-		-	-	-	-	-	-	-	2	7	5	-
210-214	2		-		-		-	9		49	-	84		74	-	-	-	-	-		-	-	-	-	-	-	-	-	6	11	-
215-219	-		1		-		1	5		27	1	54		63	1	1	1	-	-		-	-	-	-	-	-	-	-	8	13	-
220-224	-		-		-		1	5		30	-	75		82	1	-	8	1	-		1	-	1	-	-	-	-	-	8	18	-
225-229	1		-		-		1	6		11	-	101		85	1	-	14	2	-		-	-	-	-	-	-	-	-	11	21	-
230-234	-		1		-		1	1		6	-	89		116	4	4	19	1	-		3	-	-	-	-	-	-	-	8	11	-
235-239	-		-		-		-	1		1	-	56		142	2	6	47	3	-		2	2	-	-	-	-	-	-	3	8	-
240-244	-		-		-		-	-		1	-	71		165	3	7	60	4	-		2	3	-	-	-	-	-	-	-	-	-
245-249	-		-		-		-	1		1	-	56		156	3	9	61	13	-		8	2	-	-	-	-	-	-	1	3	-
250-254	-		-		-		-	-		-	-	56		188	8	6	60	12	-		12	5	-	-	-	-	-	-	5	2	-
255-259	-		1		-		-	-		-	-	44		156	10	5	71	12	-		14	8	3	-	-	-	-	-	1	5	-
260-264	-		-		-		-	-		-	-	26		203	21	8	60	18	-		31	18	-	-	1	5	1	-	3	18	1
265-269	-		-		-		-	-		-	-	17		170	15	6	63	22	1		59	36	3	-	3	6	1	-	4	28	2
270-274	-		-		-		-	-		-	-	12		218	16	1	58	18	-		1'8	82	7	-	7	19	1	-	5	36	2
275-279	-		-		-		-	-		-	-	7		202	25	-	60	35	1		169	91	12	-	9	24	2	-	6	28	2
280-284	-		-		-		-	-		-	-	8		260	33	-	63	37	3		240	103	16	-	29	51	2	-	8	27	3
285-289	-		-		-		-	-		-	-	2		223	44	-	64	35	5		252	145	21	-	34	49	7	-	4	25	4
290-294	-		-		-		-	-		-	-	3		310	62	-	54	19	5		212	114	22	3	39	56	9	-	3	35	9
295-299	-		-		-		-	-		-	-	-		208	56	-	26	18	3		147	154	36	5	30	61	10	-	2	38	15
300-304	-		-		-		-	-		-	-	2		245	53	-	17	19	3		114	131	54	2	17	52	7	-	-	60	11
305-309	-		-		-		-	-		-	-	-		198	55	-	5	5	2		58	106	59	3	10	47	22	-	-	42	15
310-314	-		-		-		-	-		-	-	-		133	31	-	-	3	1		31	109	61	2	7	57	31	-	-	30	9
315-319	-		-		-		-	-		-	-	-		43	12	-	-	1	-		8	61	55	7	1	36	23	-	-	15	4
320-324	-		-		-		-	-		-	-	-		13	3	-	3	2	-		5	37	45	3	3	28	11	-	-	3	2
325-329	-		-		-		-	-		-	-	-		6	2	-	-	1	-		3	24	23	1	3	11	16	-	-	4	3
330-334	-		-		-		-	-		-	-	-		-	1	-	2	-	-		1	12	19	2	-	4	14	-	-	1	2
335-339	-		-		-		-	-		-	-	-		3	1	-	-	-	-		-	1	6	1	1	1	5	-	-	-	-
340-344	-		-		-		-	-		-	-	-		-	-	-	-	-	-		-	1	1	1	-	-	5	-	-	-	-
345-349	-		-		-		-	-		-	-	-		-	-	-	-	-	-		-	-	-	1	-	-	-	-	-	-	-
350-354	-		-		-		-	-		-	-	-		-	-	-	-	-	-		-	1	-	-	-	-	-	-	-	-	-
Total	1,616	173	409	1,385	395	543	958	2,278	3,955	463	53	816	280	24	1,490	1,246	444	31	194	507	167	237	131	489	84								
Mean	148	169	167	180	180	196	163	192	266	290	250	265	277	292	285	294	306	313	292	298	312	157	229	278	300								
Male	267	56	184	679	196	272	403	978	1,919	252	30	447	136	12	871	629	199	16	128	261	79	63	55	205	25								
Mean	154	171	169	179	182	194	163	202	265	288	248	261	275	293	282	287	299	304	289	292	304	160	221	272	293								
Female	799	80	201	642	176	270	545	945	1,980	206	23	346	142	12	619	616	244	15	66	246	88	73	76	284	58								
Mean	156	172	166	181	179	197	163	197	266	292	253	270	280	290	290	301	312	322	297	305	319	166	234	282	303								

Appendix table 7.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by port and age, 1969.

Fork Length (mm)	Port 2		3		4					6			7				8		10			
	Age		Age		Age					Age			Age				Age		Age			
	1	2	1	2	0	1	2	3	4	2	3	4	2	3	4	5	3	4	0	1	2	3
90-94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-
95-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-
100-104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-
105-109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	-	-	-
110-114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46	-	-	-
115-119	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-
120-124	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-
125-129	2	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
130-134	10	1	1	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1	-	-
135-139	24	-	3	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2	-	-
140-144	55	-	7	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	11	10	-	-
145-149	52	-	6	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	6	7	-	-
150-154	77	3	13	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	10	8	-	-
155-159	93	1	12	-	61	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7	-	-
160-164	120	10	32	1	85	-	-	-	-	-	-	-	-	-	-	-	-	-	14	8	-	-
165-169	87	16	59	2	98	-	-	-	-	-	-	-	-	-	-	-	-	-	9	7	-	-
170-174	107	27	76	1	106	-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-
175-179	72	37	120	15	115	4	1	-	-	-	-	-	-	-	-	-	-	-	22	5	-	-
180-184	121	112	126	47	105	6	1	-	-	-	-	-	-	-	-	-	-	-	18	8	-	-
185-189	107	153	135	115	101	26	3	-	-	-	-	-	-	-	-	-	-	-	15	11	1	-
190-194	85	256	118	169	60	35	16	-	-	-	-	-	-	-	-	-	-	-	11	12	1	-
195-199	40	160	91	203	34	75	30	-	-	-	-	-	-	-	-	-	-	-	11	37	2	-
200-204	29	135	61	170	12	122	99	-	-	-	-	-	-	-	-	-	-	-	3	28	1	-
205-209	8	48	37	116	2	95	94	-	-	-	-	-	-	-	-	-	-	-	-	31	5	-
210-214	7	13	14	64	4	106	137	-	-	-	-	-	-	-	-	-	-	-	-	17	7	-
215-219	-	5	2	38	-	112	122	-	-	-	-	-	-	-	-	-	-	-	-	18	7	-
220-224	-	1	1	18	-	109	122	-	-	9	-	-	-	-	-	-	-	-	-	11	3	-
225-229	-	2	4	9	-	96	134	1	-	8	-	-	1	-	-	-	-	-	-	17	3	-
230-234	-	-	-	3	-	113	117	-	-	15	-	-	-	-	-	-	-	-	-	5	5	-
235-239	-	-	-	1	-	116	143	-	-	18	-	-	-	1	-	-	-	-	-	9	2	-
240-244	-	-	-	-	-	111	167	-	-	14	2	-	3	-	-	-	-	-	-	2	3	-
245-249	-	-	-	2	-	111	181	3	-	11	-	-	2	-	-	-	-	-	-	2	3	-
250-254	-	-	-	-	-	91	217	3	-	21	3	-	2	-	-	-	-	-	-	1	3	-
255-259	-	-	-	1	-	68	208	3	-	24	6	-	4	-	-	-	-	-	-	3	5	-
260-264	-	-	-	-	-	59	213	3	-	29	7	-	3	-	-	-	-	-	-	4	7	-
265-269	-	-	-	-	-	47	192	1	-	36	11	-	4	1	1	-	-	-	-	7	9	-
270-274	-	-	-	-	-	34	165	4	-	32	17	2	4	5	-	-	-	-	-	7	19	-
275-279	-	-	-	-	-	26	175	9	-	38	21	-	10	4	-	-	-	-	-	3	23	-
280-284	-	-	-	-	-	19	152	13	-	31	31	4	17	19	1	1	1	-	-	4	22	-
285-289	-	-	-	-	-	13	121	16	-	34	77	5	9	30	4	-	3	-	-	3	20	3
290-294	-	-	-	-	-	4	99	28	1	31	94	6	18	75	16	-	8	-	-	1	17	2
295-299	-	-	-	-	-	-	82	35	1	30	141	5	9	74	24	-	13	1	-	3	12	2
300-304	-	-	-	-	-	1	46	57	-	25	163	15	11	110	55	-	26	6	-	1	18	6
305-309	-	-	-	-	-	-	44	41	3	14	131	12	4	138	60	1	20	8	-	-	6	6
310-314	-	-	-	-	-	-	12	46	2	2	136	12	6	173	74	1	19	6	-	-	11	14
315-319	-	-	-	-	-	-	5	44	6	2	102	18	3	154	70	1	32	8	-	-	12	17
320-324	-	-	-	-	-	-	4	29	5	-	65	18	1	120	74	2	14	23	-	-	6	12
325-329	-	-	-	-	-	-	2	14	5	-	26	9	-	66	40	3	16	15	-	-	2	18
330-334	-	-	-	-	-	-	-	13	-	-	5	6	-	35	44	5	9	18	-	-	2	10
335-339	-	-	-	-	-	-	-	1	1	-	6	4	-	11	25	3	3	8	-	-	-	7
340-344	-	-	-	-	-	-	-	2	1	-	-	1	-	3	14	3	3	11	-	-	-	2
345-349	-	-	-	-	-	-	-	-	-	-	1	-	-	1	5	2	1	1	-	-	-	-
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	1	-	3	-	-	-	-
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Total	1,096	980	919	975	885	1,599	3,104	366	25	424	1,045	117	111	1,021	512	25	168	108	394	301	237	99
Mean	170	190	184	198	173	230	252	304	318	272	302	311	285	309	316	331	313	325	133	206	276	318
Male	502	468	411	463	477	929	1,771	187	10	245	546	53	63	592	274	8	96	38	72	112	107	34
Mean	172	189	183	197	171	226	249	300	310	270	299	306	280	304	309	319	307	316	160	210	273	314
Female	511	508	486	508	406	666	1,324	179	15	178	499	64	48	427	238	17	72	70	120	187	129	65
Mean	172	192	186	200	175	236	256	308	323	273	306	315	291	317	324	337	320	330	160	204	279	321

Appendix table 8.--Length frequency distribution of Atlantic menhaden in samples from purse seine catches, by port and age, 1970.

Fork Length (mm)	Port 1 Age 1	Port 1 Age 2	Port 2 Age 1	Port 2 Age 2	Port 3 Age 1	Port 3 Age 2	Port 4 Age 0	Port 4 Age 1	Port 4 Age 2	Port 4 Age 3	Port 7 Age 2	Port 7 Age 3	Port 10 Age 0	Port 10 Age 1	Port 10 Age 2	Port 10 Age 3	Port 10 Age 4
90-94	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-
95-99	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-
100-104	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-
105-109	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-
110-114	1	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-
115-119	15	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-
120-124	42	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
125-129	46	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
130-134	115	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
135-139	132	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
140-144	188	-	7	-	6	-	-	-	-	-	-	-	1	-	-	-	-
145-149	143	1	7	-	21	-	-	-	-	-	-	-	1	-	-	-	-
150-154	128	1	26	-	46	1	-	-	-	-	-	-	1	-	-	-	-
155-159	38	-	30	-	62	3	-	-	-	-	-	-	-	-	-	-	-
160-164	32	13	29	-	69	2	1	-	-	-	-	-	-	-	-	-	-
165-169	12	18	14	1	61	4	-	1	-	-	-	-	-	3	-	-	-
170-174	21	51	7	3	53	11	-	1	-	-	-	-	-	4	-	-	-
175-179	16	67	4	3	53	19	8	-	-	-	-	-	-	4	-	-	-
180-184	17	96	3	18	46	51	7	20	-	-	-	-	-	19	-	-	-
185-189	7	31	5	29	47	113	4	34	-	-	-	-	-	23	-	-	-
190-194	5	24	6	27	46	125	-	62	7	-	-	-	-	32	-	-	-
195-199	5	6	1	14	34	120	-	90	18	-	-	-	-	32	1	-	-
200-204	8	12	-	1	14	62	-	125	27	-	-	-	-	47	-	-	-
205-209	8	2	-	-	6	25	-	171	61	-	-	-	-	36	3	-	-
210-214	15	6	-	1	2	10	-	201	83	-	-	-	-	55	18	-	-
215-219	2	2	-	-	1	9	-	233	80	-	-	-	-	43	16	-	-
220-224	1	-	-	1	-	2	-	276	103	-	-	-	-	23	22	-	-
225-229	-	-	-	-	-	1	-	256	99	-	-	-	-	11	17	-	-
230-234	-	-	-	-	-	-	-	258	110	2	-	-	-	8	11	-	-
235-239	-	-	-	-	-	1	-	209	78	1	-	-	-	9	13	-	-
240-244	-	-	-	-	-	-	-	151	91	-	3	-	-	8	8	-	-
245-249	-	-	-	-	-	-	-	133	61	1	1	-	-	7	13	-	-
250-254	-	-	-	-	-	-	-	72	64	5	16	-	-	7	5	-	-
255-259	-	-	-	-	-	-	-	54	62	2	9	-	-	7	1	-	-
260-264	-	-	-	-	-	-	-	50	60	3	23	1	-	8	10	-	-
265-269	-	-	-	-	-	-	-	58	62	8	3	1	-	5	10	-	-
270-274	-	-	-	-	-	-	-	49	61	5	45	1	-	9	19	-	-
275-279	-	-	-	-	-	-	-	42	48	5	32	2	-	7	12	-	-
280-284	-	-	-	-	-	-	-	25	31	9	60	2	-	3	13	1	-
285-289	-	-	-	-	-	-	-	8	28	3	39	3	-	4	24	6	-
290-294	-	-	-	-	-	-	-	3	23	13	26	5	-	3	21	1	-
295-299	-	-	-	-	-	-	-	1	19	16	24	5	-	-	15	7	-
300-304	-	-	-	-	-	-	-	1	8	21	10	2	-	1	28	10	-
305-309	-	-	-	-	-	-	-	-	9	10	5	1	-	-	28	17	-
310-314	-	-	-	-	-	-	-	-	7	16	5	2	-	-	28	22	1
315-319	-	-	-	-	-	-	-	-	1	8	2	1	-	-	26	27	9
320-324	-	-	-	-	-	-	-	-	-	8	1	2	-	-	19	23	4
325-329	-	-	-	-	-	-	-	-	-	4	1	-	-	-	12	21	9
330-334	-	-	-	-	-	-	-	-	-	1	2	-	-	-	5	9	6
335-339	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	3	7
340-344	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	2	7
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	6
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
370-374	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
375-379	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Total	977	331	143	98	569	559	20	2,584	1,301	143	337	29	87	418	400	152	52
Mean	147	180	160	188	172	192	180	228	242	295	279	295	106	215	276	316	332
Male	426	143	61	39	263	244	8	1,237	638	43	161	12	8	230	147	36	4
Mean	149	180	161	188	170	191	181	226	240	291	277	294	115	217	263	310	323
Female	422	156	78	59	304	315	8	1,345	660	100	175	17	12	174	239	111	44
Mean	148	182	160	189	174	193	181	229	244	296	281	296	122	214	283	318	333

Appendix table 9.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by port and age, 1971.

Fork Length (mm)	Port 1 Age 1	Port 1 Age 2	Port 2 Age 1	Port 2 Age 2	Port 3 Age 1	Port 3 Age 2	Port 4 Age 0	Port 4 Age 1	Port 4 Age 2	Port 4 Age 3	Port 4 Age 4	Port 7 Age 2	Port 7 Age 3	Port 7 Age 4	Port 9 Age 3	Port 9 Age 4	Port 10 Age 0	Port 10 Age 1	Port 10 Age 2	Port 10 Age 3
100-104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
105-109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
110-114	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	5	-	-	-
115-119	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-
120-124	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	26	-	-	-
125-129	5	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	17	-	-	-
130-134	13	-	1	-	-	-	29	-	-	-	-	-	-	-	-	-	33	-	-	-
135-139	18	-	1	-	-	-	48	-	-	-	-	-	-	-	-	-	17	-	-	-
140-144	38	-	-	-	-	-	54	-	-	-	-	-	-	-	-	-	14	-	-	-
145-149	46	-	2	-	1	-	40	-	-	-	-	-	-	-	-	-	4	-	-	-
150-154	61	1	-	-	-	-	20	3	-	-	-	-	-	-	-	-	7	-	-	-
155-159	79	4	3	-	-	-	7	2	-	-	-	-	-	-	-	-	5	1	-	-
160-164	75	5	2	-	1	-	10	10	-	-	-	-	-	-	-	-	2	5	-	-
165-169	49	21	9	3	1	-	3	4	-	-	-	-	-	-	-	-	4	5	-	-
170-174	64	44	23	9	1	3	-	4	-	-	-	-	-	-	-	-	5	17	-	-
175-179	95	114	54	32	5	17	-	1	-	-	-	-	-	-	-	-	3	11	1	-
180-184	77	119	40	66	27	62	-	1	-	-	-	-	-	-	-	-	4	23	-	-
185-189	67	112	37	89	52	175	-	-	-	-	-	-	-	-	-	-	2	19	1	-
190-194	43	83	23	47	71	187	-	2	6	-	-	-	-	-	-	-	1	17	1	-
195-199	22	30	12	30	34	154	-	7	9	-	-	-	-	-	-	-	-	25	2	-
200-204	10	18	2	10	17	70	-	17	19	-	-	-	-	-	-	-	-	21	4	-
205-209	1	10	1	2	6	26	-	29	37	-	-	-	-	-	-	-	-	15	5	-
210-214	1	-	-	3	2	14	-	39	43	-	-	-	-	-	-	-	-	22	15	-
215-219	-	1	-	-	1	8	-	53	78	1	-	-	-	-	-	-	-	24	18	-
220-224	1	-	-	-	1	6	-	62	81	-	-	-	-	-	-	-	-	11	22	-
225-229	-	1	-	-	1	-	-	83	92	2	-	-	-	-	-	-	-	10	15	-
230-234	-	-	-	-	-	2	-	87	94	2	-	-	-	-	-	-	-	5	14	-
235-239	-	-	-	-	-	-	-	74	80	2	-	-	-	-	-	-	-	3	4	-
240-244	-	-	-	-	-	1	-	67	89	6	-	-	-	-	-	-	-	1	3	-
245-249	-	-	-	-	-	-	-	77	82	9	-	-	-	-	-	-	-	3	4	-
250-254	-	-	-	-	-	-	-	47	90	15	-	-	-	-	-	-	-	3	9	-
255-259	-	-	-	1	-	-	-	38	71	7	-	-	-	-	-	-	-	2	1	-
260-264	-	-	-	-	-	-	-	38	72	2	-	-	-	-	-	-	-	3	3	-
265-269	-	-	-	-	-	-	-	24	67	6	-	-	-	-	-	-	-	1	2	-
270-274	-	-	-	-	-	-	-	20	93	8	-	-	2	-	-	-	-	3	1	1
275-279	-	-	-	-	-	-	-	15	105	16	1	-	1	-	2	-	-	2	-	-
280-284	-	-	-	-	-	-	-	13	133	40	-	-	-	-	1	1	-	-	2	-
285-289	-	-	-	-	-	-	-	14	170	30	1	2	2	1	8	1	-	-	3	1
290-294	-	-	-	-	-	-	-	12	220	53	4	-	8	-	10	1	-	-	5	-
295-299	-	-	-	-	-	-	-	15	263	62	2	6	10	3	17	2	-	-	14	1
300-304	-	-	-	-	-	-	-	7	206	53	10	9	12	2	10	5	-	-	33	6
305-309	-	-	-	-	-	-	-	6	219	50	10	8	17	4	10	3	-	-	32	5
310-314	-	-	-	-	-	-	-	6	180	49	6	7	24	10	14	6	-	-	25	7
315-319	-	-	-	-	-	-	-	1	69	21	5	5	18	8	6	5	-	-	18	3
320-324	-	-	-	-	-	-	-	-	61	12	3	10	15	10	10	8	-	-	3	3
325-329	-	-	-	-	-	-	-	1	22	7	1	5	13	9	-	6	-	-	3	2
330-334	-	-	-	-	-	-	-	-	8	5	1	3	16	13	5	5	-	-	1	3
335-339	-	-	-	-	-	-	-	-	6	2	-	2	11	6	1	1	-	-	-	1
340-344	-	-	-	-	-	-	-	-	5	3	-	-	5	3	-	1	-	-	-	-
345-349	-	-	-	-	-	-	-	-	3	-	-	-	5	3	-	-	-	-	-	-
350-354	-	-	-	-	-	-	-	-	-	1	-	-	2	2	-	-	-	-	-	1
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
360-364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
365-369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
370-374	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Total	765	563	210	282	221	725	238	880	2,773	464	44	57	162	75	94	45	167	252	264	34
Mean	168	184	180	186	191	193	141	239	275	294	307	312	316	323	305	316	135	202	268	313

Appendix table 10.--Length frequency distributions of Atlantic menhaden in samples from purse seine catches, by age.

port 10, 1963-1965

Fork Length (mm)	1963 Age 0	1	2	3	4	5	6	1964 Age 0	1	2	3	4	1965 Age 0	1	2	3
80-84	1	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
85-89	1	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
90-94	-	-	-	-	-	-	-	16	-	-	-	-	12	-	-	-
95-99	-	-	-	-	-	-	-	22	-	-	-	-	29	-	-	-
100-104	7	-	-	-	-	-	-	39	-	-	-	-	38	-	-	-
105-109	8	-	-	-	-	-	-	16	-	-	-	-	24	-	-	-
110-114	10	-	-	-	-	-	-	9	-	-	-	-	9	-	-	-
115-119	14	-	-	-	-	-	-	13	-	-	-	-	22	-	-	-
120-124	14	-	-	-	-	-	-	10	-	-	-	-	33	-	-	-
125-129	16	-	-	-	-	-	-	6	-	-	-	-	40	-	-	-
130-134	26	-	-	-	-	-	-	6	-	-	-	-	66	-	-	-
135-139	19	2	-	-	-	-	-	13	-	-	-	-	65	-	-	-
140-144	33	9	-	-	-	-	-	23	-	-	-	-	95	5	-	-
145-149	20	11	-	-	-	-	-	36	3	-	-	-	65	9	-	-
150-154	33	11	-	-	-	-	-	43	1	-	-	-	31	16	-	-
155-159	22	18	-	-	-	-	-	31	8	-	-	-	23	18	-	-
160-164	15	25	-	-	-	-	-	22	12	-	-	-	10	16	-	-
165-169	18	31	-	-	-	-	-	20	14	1	-	-	8	13	-	-
170-174	7	44	-	-	-	-	-	16	22	7	-	-	7	14	-	-
175-179	4	18	-	-	-	-	-	10	9	5	-	-	5	12	-	-
180-184	2	20	-	-	-	-	-	3	19	9	-	-	-	6	1	-
185-189	2	18	-	-	-	-	-	-	20	29	-	-	-	3	-	-
190-194	1	12	-	-	-	-	-	1	33	34	-	-	-	5	-	-
195-199	-	7	-	-	-	-	-	-	21	42	-	-	1	19	3	-
200-204	-	6	6	-	-	-	-	-	11	41	-	-	-	31	7	-
205-209	-	2	4	-	-	-	-	-	10	31	-	-	-	25	3	-
210-214	-	-	3	-	-	-	-	-	2	22	-	-	-	28	4	-
215-219	-	13	5	-	-	-	-	-	1	16	-	-	-	21	3	-
220-224	-	27	8	-	-	-	-	-	3	6	-	-	-	18	3	-
225-229	-	18	10	-	-	-	-	-	4	8	1	-	-	6	1	-
230-234	-	12	10	2	-	-	-	-	1	14	-	-	-	9	5	-
235-239	-	20	26	3	-	-	-	-	2	7	-	-	-	8	1	-
240-244	-	19	24	-	-	-	-	-	3	4	-	-	-	22	2	-
245-249	-	9	14	1	-	-	-	-	2	6	1	-	-	20	5	-
250-254	-	8	17	3	-	-	-	-	-	5	4	-	-	27	8	-
255-259	-	5	14	-	-	-	-	-	7	20	7	-	-	12	18	-
260-264	-	2	12	1	1	-	-	-	2	15	12	-	-	16	13	2
265-269	-	1	21	4	-	-	-	-	1	10	7	-	-	11	25	2
270-274	-	-	24	4	-	1	-	-	-	21	6	-	-	5	23	3
275-279	-	1	40	13	-	-	-	-	1	54	6	1	-	1	37	5
280-284	-	2	59	27	1	-	-	-	-	70	18	1	-	4	53	2
285-289	-	-	52	35	-	-	-	-	-	86	27	5	-	3	39	6
290-294	-	-	65	31	3	7	-	-	-	80	23	6	-	3	34	5
295-299	-	-	44	39	4	2	-	-	-	55	27	1	-	-	15	5
300-304	-	-	15	14	5	5	-	-	-	24	21	4	-	-	13	5
305-309	-	-	3	17	5	1	-	-	-	7	10	4	-	-	6	4
310-314	-	-	4	11	12	8	-	-	-	4	6	4	-	-	4	2
315-319	-	-	-	7	6	15	-	-	-	-	2	1	-	-	-	3
320-324	-	-	2	6	15	12	2	-	-	-	1	2	-	-	-	4
325-329	-	-	1	2	8	14	5	-	-	-	2	-	-	-	1	2
330-334	-	-	1	2	9	4	5	-	-	-	-	2	-	-	-	-
335-339	-	-	-	-	4	10	5	-	-	-	-	1	-	-	-	-
340-344	-	-	-	1	2	9	3	-	-	-	-	-	-	-	-	-
345-349	-	-	-	-	1	2	1	-	-	-	-	-	-	-	-	-
350-354	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-
Total	272	371	492	223	77	90	22	360	209	733	181	33	587	406	327	50
Mean	141	194	271	292	317	321	334	136	190	253	287	304	132	211	273	294
Male	151	216	273	134	45	51	16	181	116	401	95	13	295	195	162	16
Mean	141	199	268	290	314	317	333	135	196	253	283	303	132	217	267	285
Female	121	155	219	89	32	39	6	179	93	332	86	20	276	209	165	34
Mean	142	188	274	296	321	326	336	137	183	254	292	305	131	206	279	299

Appendix table 11.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 1.

Year	Number and mean	April Age 1	April Age 2	May Age 1	May Age 2	June Age 1	June Age 2	July Age 1	July Age 2	August Age 1	August Age 2	September Age 1	September Age 2	October Age 1	October Age 2	November Age 1	November Age 2
1963	Number	76	103	184	95	48	30	26	92	14	61	38	22	7	12	17	3
	Mean	122	189	116	177	121	163	153	175	176	185	156	180	180	186	161	180
1964	Number	15	5	43	16	41	18	39	-	-	-	-	-	-	-	-	-
	Mean	142	156	140	164	133	170	125	-	-	-	-	-	-	-	-	-
1965	Number	75	103	481	588	455	120	709	279	737	232	237	62	71	28	-	-
	Mean	167	173	151	172	143	182	174	189	180	190	185	192	190	195	-	-
1966	Number	53	157	226	67	118	120	628	148	854	227	588	139	171	28	20	-
	Mean	168	193	160	195	190	200	187	203	192	204	193	207	194	211	211	-
1967	Number	414	41	703	167	260	36	809	208	945	53	371	-	342	1	-	-
	Mean	136	189	138	191	133	202	182	205	176	191	191	-	189	163	-	-
1968	Number	128	107	437	63	285	3	136	-	436	-	194	-	-	-	-	-
	Mean	134	160	136	169	141	179	148	-	160	-	170	-	-	-	-	-
1969	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	Number	64	120	61	135	239	57	258	-	236	-	103	17	36	2	-	-
	Mean	164	174	165	181	132	185	142	-	146	-	149	207	207	197	-	-
1971	Number	-	-	99	316	134	201	245	15	287	31	-	-	-	-	-	-
	Mean	-	-	162	182	159	185	157	176	184	197	-	-	-	-	-	-

Appendix table 12.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 2.

Year	Number and mean	April Age 1	April Age 2	May Age 1	May Age 2	June Age 1	June Age 2	July Age 1	July Age 2	August Age 1	August Age 2	September Age 0	September Age 1	September Age 2	October Age 1	October Age 2
1963	Number	-	-	2	38	5	54	-	-	14	26	-	-	-	18	21
	Mean	-	-	135	170	160	184	-	-	145	176	-	-	-	172	187
1964	Number	-	-	3	17	65	15	83	15	34	-	-	-	-	-	-
	Mean	-	-	190	189	151	161	145	170	146	-	-	-	-	-	-
1965	Number	-	-	17	23	9	51	56	62	70	27	-	-	38	-	17
	Mean	-	-	105	171	181	184	158	188	155	188	-	-	193	-	195
1966	Number	-	-	-	-	75	19	87	58	3	15	-	28	12	-	-
	Mean	-	-	-	-	131	198	148	200	189	195	-	165	199	-	-
1967	Number	-	-	-	-	80	33	39	-	32	-	-	18	-	20	-
	Mean	-	-	-	-	189	208	204	-	202	-	-	201	-	167	-
1968	Number	-	-	2	208	10	236	83	306	58	280	-	233	322	23	33
	Mean	-	-	160	177	163	177	165	179	161	183	-	169	183	173	180
1969	Number	-	-	28	290	98	318	310	246	320	76	-	169	27	171	23
	Mean	-	-	175	190	176	190	167	187	168	197	-	166	195	180	197
1970	Number	-	-	34	46	28	30	25	18	34	3	-	22	1	-	-
	Mean	-	-	159	188	169	190	157	190	159	172	-	158	180	-	-
1971	Number	3	17	10	49	27	113	33	66	77	22	4	60	15	-	-
	Mean	176	178	176	184	181	185	179	187	184	196	127	177	197	-	-

Appendix table 13.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 3.

Year	Number and mean	April Age 1	April Age 2	May Age 1	May Age 2	May Age 3	June Age 1	June Age 2	June Age 3	July Age 1	July Age 2	July Age 3	August Age 0	August Age 1	August Age 2	September Age 0	September Age 1	September Age 2	October Age 0	October Age 1	October Age 2	November Age 1	November Age 2	November Age 3
1963	Number	23	37	80	99	-	96	64	-	115	65	-	-	111	48	-	139	40	-	-	-	-	-	-
	Mean	134	188	154	178	-	157	184	-	158	192	-	-	166	204	-	165	199	-	-	-	-	-	-
1964	Number	-	-	20	58	-	100	97	-	71	48	-	-	96	41	-	30	10	-	-	-	-	-	-
	Mean	-	-	176	186	-	162	174	-	158	179	-	-	163	183	-	163	188	-	-	-	-	-	-
1965	Number	-	-	14	82	-	48	104	-	43	71	-	-	185	80	-	72	38	-	141	55	-	-	-
	Mean	-	-	186	191	-	180	192	-	181	193	-	-	173	205	-	189	203	-	187	206	-	-	-
1966	Number	-	-	62	17	-	275	18	-	227	9	-	-	465	29	-	361	54	-	316	18	-	-	-
	Mean	-	-	172	189	-	163	192	-	163	202	-	-	169	205	-	177	206	-	182	215	-	-	-
1967	Number	-	-	64	56	-	72	179	-	86	25	-	-	164	38	-	62	35	19	174	106	36	3	-
	Mean	-	-	169	177	-	178	205	-	192	204	-	-	196	203	-	191	210	123	197	216	187	197	-
1968	Number	41	54	22	206	-	9	104	1	33	90	-	-	3	16	1	93	23	-	170	38	24	12	-
	Mean	132	198	186	200	-	173	192	251	167	191	-	-	179	191	111	181	176	-	191	204	195	199	-
1969	Number	-	-	15	62	-	227	320	5	158	331	3	1	196	156	-	183	71	-	140	35	-	-	-
	Mean	-	-	184	195	-	188	202	232	178	195	255	103	181	198	-	186	198	-	186	202	-	-	-
1970	Number	-	-	30	148	-	189	219	-	160	57	-	-	87	66	-	58	54	-	45	15	-	-	-
	Mean	-	-	178	194	-	172	188	-	164	193	-	-	178	193	-	182	200	-	178	196	-	-	-
1971	Number	5	54	9	89	1	58	296	-	71	169	-	-	42	55	-	33	47	-	3	17	-	-	-
	Mean	184	185	191	191	230	189	191	-	191	193	-	-	188	195	-	197	203	-	203	215	-	-	-

Appendix table 14.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 4.

Year	Number And mean	May Age 1	May Age 2	May Age 3	May Age 4	June Age 1	June Age 2	June Age 3	June Age 4	July Age 0	July Age 1	July Age 2	July Age 3	July Age 4	August Age 0	August Age 1	August Age 2	August Age 3	August Age 4
1963	Number	58	63	38	1	352	268	43	-	18	490	229	34	1	94	406	194	55	1
	Mean	163	224	259	262	171	209	266	-	125	192	219	278	298	145	206	238	277	323
1964	Number	13	56	11	-	104	200	15	-	20	308	375	26	-	40	284	356	12	-
	Mean	157	234	266	-	189	234	263	-	123	201	226	273	-	138	217	233	269	-
1965	Number	35	5	-	-	604	336	63	-	-	761	361	43	1	20	1,143	118	8	-
	Mean	202	215	-	-	187	258	275	-	-	193	265	277	331	142	218	253	269	-
1966	Number	30	10	-	-	631	448	30	2	-	313	808	44	3	165	500	409	14	3
	Mean	194	199	-	-	179	230	278	277	-	196	248	276	272	141	185	250	272	293
1967	Number	69	74	15	-	420	351	54	-	-	452	278	27	2	-	667	387	11	-
	Mean	186	209	285	-	195	220	290	-	-	202	230	278	298	-	226	241	279	-
1968	Number	63	53	1	-	210	530	48	-	1	487	681	70	1	-	476	862	57	3
	Mean	134	219	275	-	171	235	263	-	117	169	267	280	294	-	199	259	275	311
1969	Number	87	133	52	6	222	874	76	1	20	474	589	23	-	40	441	674	59	4
	Mean	212	234	295	309	219	237	295	305	134	217	241	298	-	153	237	257	305	318
1970	Number	155	42	3	-	357	274	34	-	-	606	232	25	3	-	482	253	36	-
	Mean	203	216	272	-	211	232	273	-	-	220	235	295	314	-	226	247	296	-
1971	Number	-	33	6	-	106	565	138	5	-	183	539	54	4	-	217	531	90	7
	Mean	-	282	287	-	218	256	286	300	-	232	256	285	306	-	245	278	294	309

Appendix table 14.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 4--continued.

Year	Number and Mean	September Age 0	1	2	3	4	5	October Age 0	1	2	3	4	5	November Age 0	1	2	3	4	5
1963	Number	21	187	118	10	-	-	172	210	146	50	-	-	60	9	9	2	-	-
	Mean	148	225	248	275	-	-	155	224	261	289	-	-	147	241	257	287	-	-
1964	Number	118	104	243	20	4	-	222	147	240	21	1	-	256	-	15	5	-	-
	Mean	148	224	263	285	295	-	151	232	257	283	266	-	152	-	284	296	-	-
1965	Number	178	710	101	4	-	-	134	547	156	26	5	-	157	390	56	13	1	1
	Mean	153	226	252	267	-	-	162	235	280	300	305	-	165	245	267	302	297	331
1966	Number	464	244	157	11	-	-	258	301	573	33	2	-	519	74	116	5	-	-
	Mean	153	205	258	268	-	-	158	220	273	282	287	-	165	254	268	272	-	-
1967	Number	-	629	391	37	-	-	83	536	460	118	-	-	-	274	231	67	1	-
	Mean	-	233	266	293	-	-	169	253	275	300	-	-	-	262	286	304	340	-
1968	Number	243	568	766	78	1	-	521	223	792	180	3	-	193	251	271	29	1	1
	Mean	151	201	268	291	300	-	173	212	294	302	305	-	151	219	263	303	314	331
1969	Number	448	243	404	24	3	-	260	101	421	132	11	-	117	31	9	-	-	-
	Mean	171	243	260	304	322	-	177	269	285	312	323	-	182	234	351	-	-	-
1970	Number	-	379	257	10	2	-	20	374	197	34	9	1	-	231	46	1	-	-
	Mean	-	234	252	310	333	-	180	243	253	312	327	341	-	257	245	304	-	-
1971	Number	40	234	466	40	3	1	100	83	323	75	10	4	98	57	316	61	15	3
	Mean	148	250	286	300	305	335	142	243	295	307	312	311	136	223	301	299	304	301

Appendix table 15.--Mean length and number of fish at each age in samples from Atlantic purse seine fishery, by month, port 5 (1963-66) and port 6 (1968-69).

Year	Number and Mean	June Age 1	2	3	4	5	July Age 1	2	3	4	5	August Age 1	2	3	4	5	6	September Age 1	2	3	4	October Age 1	2	3	4	5	6
1963	Number	88	304	23	1	-	210	259	-	-	-	316	213	13	5	3	1	144	87	1	-	25	67	14	22	20	5
	Mean	180	210	277	309	-	196	207	-	-	-	204	214	282	299	296	301	226	232	325	-	233	248	309	219	331	333
1964	Number	50	269	89	6	-	46	243	19	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	191	226	267	289	-	207	225	279	298	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	Number	42	209	160	16	3	462	438	188	14	-	369	483	149	7	-	-	26	49	20	1	-	-	-	-	-	-
	Mean	211	248	273	284	302	216	246	268	275	-	232	254	268	281	-	-	238	256	271	287	-	-	-	-	-	-
1966	Number	2	45	21	10	-	136	264	34	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	211	258	281	284	-	175	234	284	301	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	Number	-	56	24	-	-	14	312	73	5	-	39	399	157	15	-	-	-	49	26	4	-	-	-	-	-	-
	Mean	-	263	264	-	-	239	259	272	301	-	254	269	280	288	-	-	-	274	288	293	-	-	-	-	-	-
1969	Number	-	89	239	27	-	2	164	545	68	3	5	171	261	22	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	276	301	305	-	229	271	302	312	330	248	270	304	316	-	-	-	-	-	-	-	-	-	-	-	-

Appendix table 16.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 7.

Year	Number and mean	May Age 1	2	3	4	5	6	June Age 1	2	3	4	5	6	July Age 1	2	3	4	5	6
1963	Number	-	1	38	39	20	2	1	132	207	60	67	8	1	181	121	57	57	74
	Mean	-	264	288	299	309	330	206	258	283	302	308	330	223	254	282	309	322	326
1964	Number	-	-	-	-	-	-	-	46	128	57	3	4	6	277	337	73	10	10
	Mean	-	-	-	-	-	-	-	275	288	295	314	313	228	267	279	293	315	336
1965	Number	-	1	13	5	-	-	-	216	454	73	1	-	4	174	302	68	14	13
	Mean	-	305	288	302	-	-	-	260	285	295	357	-	237	269	286	305	335	344
1966	Number	-	-	-	-	-	-	-	116	364	171	20	1	-	73	302	167	12	2
	Mean	-	-	-	-	-	-	-	274	287	292	296	326	-	275	289	299	304	346
1967	Number	-	-	-	-	-	-	-	39	270	16	1	1	-	85	386	47	15	-
	Mean	-	-	-	-	-	-	-	289	295	296	290	307	-	279	297	306	309	-
1968	Number	-	-	-	-	-	-	-	216	112	26	-	1	-	562	418	142	6	-
	Mean	-	-	-	-	-	-	-	273	278	294	-	293	-	284	291	305	306	-
1969	Number	-	-	-	-	-	-	-	26	404	194	11	1	-	36	381	265	14	2
	Mean	-	-	-	-	-	-	-	279	306	314	329	331	-	389	309	316	333	347
1970	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	9	48	21	2	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	308	308	322	322	-

Appendix table 16.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 7--continued.

Year	Number	August Age 1	2	3	4	5	6	September Age 1	2	3	4	5	6	October Age 1	2	3	4	5	6
	mean																		
1963	Number	-	44	48	24	47	13	-	2	14	41	45	15	-	11	39	45	51	25
	Mean	-	261	288	313	320	337	-	303	316	323	325	335	-	282	303	322	326	333
1964	Number	3	190	238	91	89	98	3	81	117	39	31	43	-	-	19	9	16	14
	Mean	256	276	290	314	339	340	257	283	298	323	338	342	-	-	324	335	340	340
1965	Number	4	218	272	52	4	-	-	12	20	5	-	1	-	-	-	-	-	-
	Mean	268	280	289	300	293	-	-	286	301	312	-	355	-	-	-	-	-	-
1966	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	Number	16	182	302	57	5	-	20	114	108	7	1	-	7	17	11	1	-	-
	Mean	250	279	303	325	345	-	251	276	300	312	320	-	256	265	295	291	-	-
1968	Number	-	566	495	159	12	-	-	110	157	99	12	1	-	36	64	18	1	-
	Mean	-	290	296	307	311	-	-	292	300	308	318	324	-	300	311	312	311	-
1969	Number	-	49	236	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	285	314	320	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	Number	-	-	-	-	-	-	-	162	8	1	-	-	-	155	21	1	-	-
	Mean	-	-	-	-	-	-	-	275	295	322	-	-	-	283	296	311	-	-
1971	Number	-	4	39	17	-	-	-	23	62	32	3	-	-	21	13	5	1	-
	Mean	-	296	311	318	-	-	-	316	326	328	348	-	-	312	321	319	313	-

Appendix table 17.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 8.

	Number and mean	June Age 2	3	4	5	6	July Age 2	3	4	5	6	August Age 2	3	4	5	6	September Age 2	3	4	5	6	October Age 2	3	4	5	6
1963	Number	23	128	121	170	45	12	42	90	201	91	10	48	145	245	111	7	55	105	204	67	3	35	69	120	28
	Mean	271	287	304	313	326	273	297	312	317	327	292	306	318	322	328	282	306	322	324	332	326	318	323	327	334
1964	Number	29	107	56	20	21	62	111	65	106	112	8	98	129	164	172	2	74	90	146	144	-	22	17	18	22
	Mean	273	291	302	320	331	266	293	317	333	336	301	316	329	337	339	317	324	332	339	342	-	325	336	339	242
1965	Number	67	232	35	10	4	42	234	93	38	58	84	359	128	47	56	19	111	69	48	34	-	-	-	-	-
	Mean	261	294	304	336	341	280	303	324	342	351	285	305	321	346	350	309	327	336	344	352	-	-	-	-	-
1966	Number	1	37	30	8	1	3	42	40	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	319	309	321	314	347	300	308	318	320	342	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	Number	-	-	-	-	-	64	164	44	5	-	126	334	117	7	2	4	9	6	1	-	-	-	-	-	-
	Mean	-	-	-	-	-	290	297	313	320	-	293	298	312	328	330	308	310	307	320	-	-	-	-	-	-
1969	Number	4	27	9	-	-	5	89	57	7	-	2	45	31	2	-	2	7	11	-	-	-	-	-	-	-
	Mean	299	304	318	-	-	297	313	328	331	-	298	315	321	325	-	317	324	330	-	-	-	-	-	-	-

Appendix table 18.--Mean length and number of fish at each age in samples from Atlantic menhaden purse seine fishery, by month, port 10.

Year	Number and mean	October Age 1	2	November Age 0	1	2	3	4	5	6	December Age 0	1	2	3	4	5	6	January Age 0	1	2	3	4
1963	Number	19	1	155	260	321	122	27	33	6	110	79	170	101	50	57	16	10	10	-	-	-
	Mean	169	220	140	202	264	289	316	320	334	144	178	283	296	318	321	334	157	173	-	-	-
1964	Number	29	47	32	129	448	99	23	4	2	328	51	238	82	10	3	1	-	-	-	-	-
	Mean	190	201	167	193	245	288	306	321	351	133	183	280	286	300	311	340	-	-	-	-	-
1965	Number	-	-	93	251	156	24	3	-	-	317	75	158	21	2	-	-	177	80	13	5	-
	Mean	-	-	137	212	268	289	301	-	-	128	246	279	297	307	-	-	137	178	269	308	-
1966	Number	-	-	-	280	502	63	5	-	-	275	50	224	24	-	-	-	170	123	-	-	-
	Mean	-	-	-	197	272	291	306	-	-	143	190	282	288	-	-	-	158	163	-	-	-
1967	Number	-	-	-	447	232	146	5	-	-	-	255	173	147	15	1	-	-	-	-	-	-
	Mean	-	-	-	202	270	303	301	-	-	-	194	289	302	304	339	-	-	-	-	-	-
1968	Number	-	-	16	102	333	37	9	1	-	170	21	156	47	7	1	-	51	8	-	-	-
	Mean	-	-	105	227	271	303	312	308	-	160	247	292	298	309	332	-	165	203	-	-	-
1969	Number	-	-	136	257	100	28	-	-	-	164	40	135	71	4	-	-	94	4	2	-	-
	Mean	-	-	151	205	264	322	-	-	-	116	215	285	317	327	-	-	136	203	258	-	-
1970	Number	-	-	20	195	120	41	13	-	-	67	223	280	111	39	2	-	-	-	-	-	-
	Mean	-	-	119	205	261	319	336	-	-	101	224	282	315	331	342	-	-	-	-	-	-
1971	Number	-	-	26	134	32	4	2	-	-	116	96	143	11	6	1	-	25	22	89	19	2
	Mean	-	-	123	191	245	308	342	-	-	133	218	251	314	334	334	-	161	205	303	314	331

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