Forecast for the 2018

Gulf and Atlantic Menhaden Purse-Seine Fisheries and

Review of the 2017 Fishing Season

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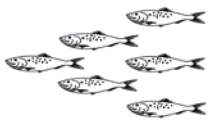
INTRODUCTION

The 2017 fishing year marks the forty-fifth year that the National Marine Fisheries Service has made quantitative forecasts of purse-seine landings of menhaden. The forecasts are based on a multiple regression equation that relates landings and fishing effort over a series of years. Landings forecasts are conditioned on estimates of expected fishing effort for the upcoming fishing year. Fishing effort estimates are vessel-specific and are derived from 1) industry input regarding the number of vessels that companies expect to be active during the upcoming fishing year, and 2) historical performance (catch and effort) of the vessels expected to participate in the fishery. In the Atlantic Menhaden fishery, actual purse-seine landings have differed an average of 13% from those forecasted for the forty year period, 1973-2012 (pre-TAC years; see page 4). Landings in the Gulf Menhaden fishery have differed from those forecasted by an average of 13% for the forty-five year period, 1973-2017. In this forecast report, we review the 2017 Gulf and Atlantic Menhaden fishing seasons in terms of:

- landings and fleet size
- age composition of the catch
- status of the most recent forecast

Finally, we will forecast estimated landings for the 2018 menhaden fishing season.



GULF MENHADEN FISHERY

Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2017

Final purse-seine landings of Gulf Menhaden for reduction in 2017 totaled 460,707 metric tons (mt; 1,516 million standard fish). This is a decrease of 5.2% from total landings in 2016 (485,857 mt), and 7.5% less than the previous 5-year mean (497,853 mt; Figure 1).

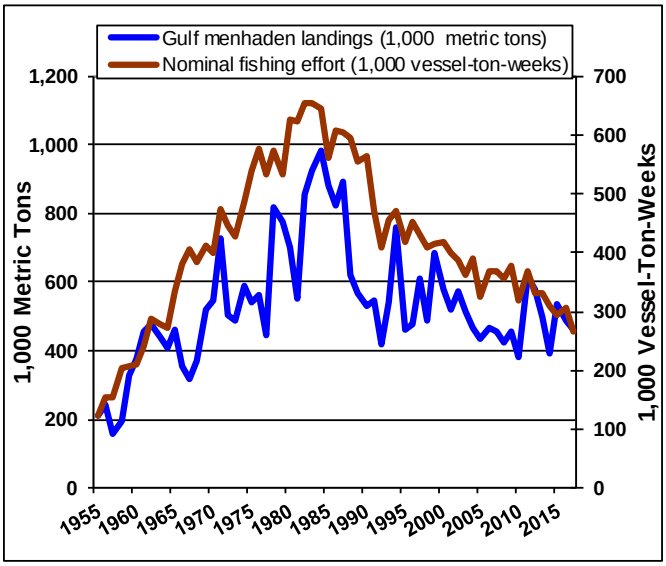


Figure 1. Gulf Menhaden landings in 1,000s of metric tons (mt) and nominal fishing effort in 1,000s of vessel-ton-weeks (VTW), 1955–2017.

Winter 2016-2017 across much of the Mississippi Basin was close to average with above-average precipitation in portions of the Great Plains.

Beginning in early spring, the southern Mississippi River Basin began to experience three times the amount of normal precipitation, a pattern that would continue until June, when it reduced to only twice the normal level.

The 2017 Gulf Menhaden fishing season opened on April 17th. Landings in April (31,422 mt) were the highest since 2012, and therefore higher than the previous 5-year average; however, landings in May (55,882 mt) were lower than the 5-year average and the lowest landings for that month since 2008.

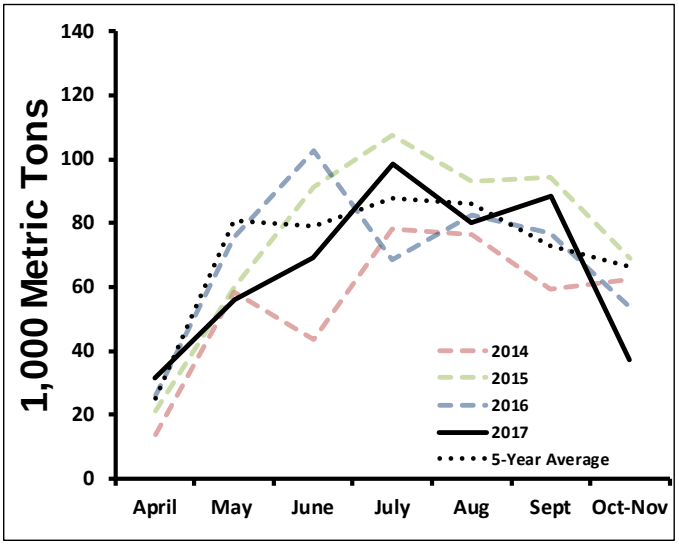


Figure 2. Gulf Menhaden landings by month, 2014-2017.

During June, Tropical Storm Cindy made landfall on the Texas/Louisiana border on June 19th. Despite the tropical storm affecting fishing for that week, landings rebounded in June (69,242 mt) and to finish slightly below the five-year average for the month.

Landings in July increased to 98,585 mt, well above both 2016 and the five-year average. The Gulf of Mexico hypoxic zone measured over 8,776 square miles at this point in 2017, an area larger than the state of New Jersey. Researchers suggest that the large size of the hypoxic zone is linked to the abnormally large May discharge from the Mississippi River, related to the Spring's heavy rains.

In late August, Hurricane Harvey made landfall on the eastern portion of the Texas coast as a category 4 storm. Harvey was the first category 4 storm to make landfall on the United States coast since Wilma in 2005 and was the wettest tropical cyclone in United States history. Landings decreased to below the five-year average and slightly below 2016 landings in August (79,909 mt).

Hurricane Irma followed Harvey, but despite having the highest sustained winds since Hurricane Wilma, it had little impact on fishing. After Irma, September conditions were favorable and the third year in a row, September concluded above the 5-year average (88,353 mt).

The second week of October was impacted by Hurricane Nate, the fastest-moving hurricane observed in the Gulf of Mexico, and the last tropical cyclone of the hyperactive 2017 season to affect fishing in the Gulf. Menhaden landings amounted to 37,314 mt, the lowest value for the month since 2009. All plants "cut-out" for the fishing season at the end of the month.

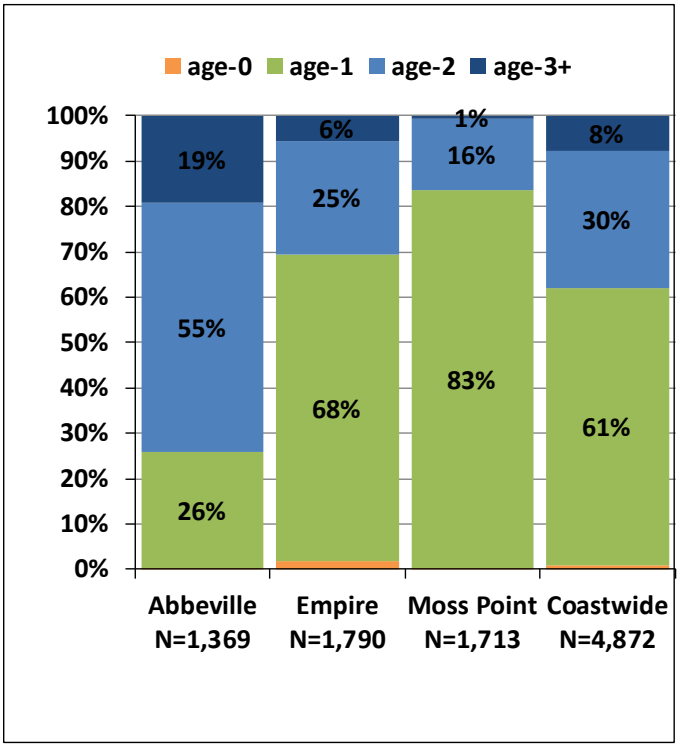


Figure 3. Percent estimated numbers-at-age of Gulf menhaden by port in 2017.

Age Composition of Gulf Menhaden in 2017

Approximately 5,233 Gulf Menhaden have been aged from the 2017 port samples to date (Fig. 3). From the preliminary catch-at-age matrix, coastwide age-1 fish (61%) outnumbered age-2 fish (30%) by a wide margin (Table 1). On closer examination, this pattern was exhibited mostly east of the Mississippi River with age-1 fish making up 68% of Empire's catch and 83% of Moss Point's catch (Figure 3). There were also fewer age-3+ fish east of the Mississippi, with less than 1% of Moss Point's landings. The pattern was inverted west of the Mississippi River, with age-2 fish making up 55% of the catch in Abbeville and a relatively higher percentage of age 3+ fish at 19% (Figure 3).

Fishing Effort and Review of the 2017 Forecast for Gulf Menhaden

Nominal fishing effort for the Gulf Menhaden fishery during 2017 was estimated at 269,200 vessel-ton-weeks; this is 13% less than nominal fishing effort in 2016 (307,700 vessel-ton-weeks).

Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the Gulf Menhaden fishery, 2013-2017; 2017 data are preliminary.

Year	Age-0	Age-1	Age-2	Estimated total number of fish caught (billions)	Landings (1,000 metric tons)
2017	1%	61%	30%	5.49	460.7
2016	<1%	47%	44%	4.95	485.8
2015	-	56%	35%	6.20	535.7
2014	1%	26%	60%	3.51	391.9
2013	<1%	25%	73%	4.54	497.5

In March 2017, we anticipated that nominal fishing effort during 2017 could amount to 301,000 vessel-ton-weeks with 33 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2017 Gulf Menhaden landings of 436,000 mt with 80% confidence levels of 424,000 and 447,000 mt. A "hindcast" using our forecast model and actual nominal fishing effort in 2017 produced a post-season forecast of 396,500 mt with 80% confidence levels of 276,000 and 517,000 mt. Actual landings of 460,707 mt were 6% higher than our forecast and 16% greater than our post-season estimate.

Forecast for the 2018 Gulf Menhaden Fishing Season

As in 2018, we expect that three menhaden factories (Moss Point, MS, and Empire and Abbeville, LA) will process Gulf Menhaden for the season. Our best estimate of vessel participation is for 33 vessels: 27 regular steamers, as many as five run boats, and one bait boat. Based on average nominal fishing effort for recent years by the vessels expected to be active in 2018, we estimate that nominal fishing effort in 2018 may be about 301,000 vessel ton weeks; with this level of nominal fishing effort, we forecast 2018 Gulf Menhaden landings of 423,000 mt, with 80% confidence levels of 305,000 and 552,000 mt.

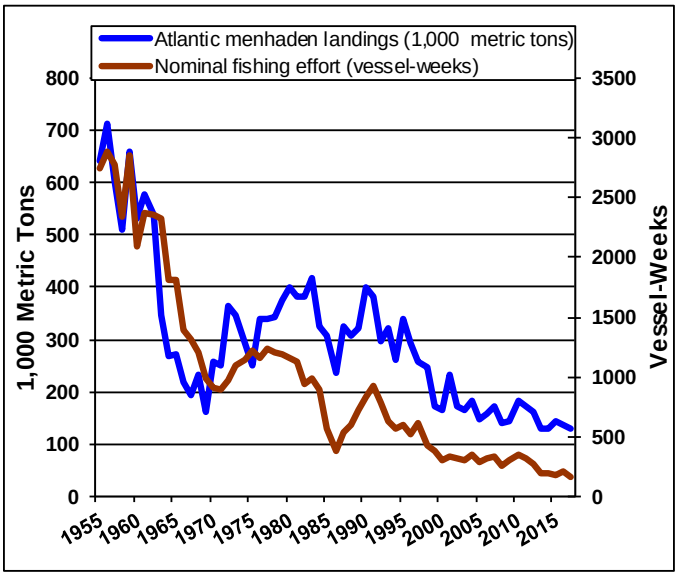


Figure 4. Atlantic Menhaden landings in 1,000s of metric tons (mt) and nominal fishing effort in vessel-weeks (VW), 1955–2017.

ATLANTIC MENHADEN FISHERY

Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2017

Final catch information indicated that 2017 landings of Atlantic Menhaden for reduction amounted to 128,923 mt (424 million standard fish; Fig. 4). This is 23% less than purse-seine landings for the 2012 season (160,627 mt), the last season before implementation of the coastwide total allowable catch (TAC). It is also 20% less than average landings for the years 2008-12 (160,524 mt). As has been the case since 2005, only one menhaden factory, the Omega Protein plant at Reedville, VA, operated on the Atlantic coast in 2017.

In December 2012, the Atlantic States Marine Fisheries Commission (ASMFC) approved Amendment 2 to the Fishery Management Plan for Atlantic Menhaden, which established a TAC for the reduction and bait fisheries combined of 170,800 mt beginning in 2013, this TAC was subsequently raised to 187,880 mt in 2015, and 200,000 mt for 2017. The menhaden reduction fishery was allocated about 152,112 mt of the TAC for 2017.

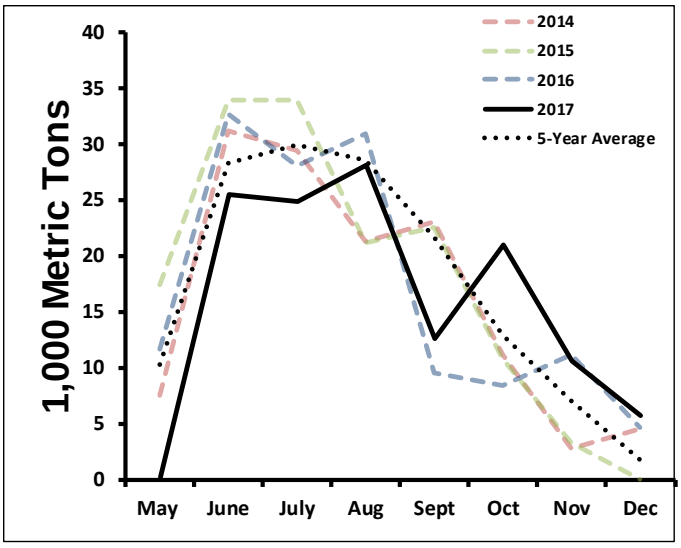


Figure 5. Atlantic Menhaden landings by month, 2014–2017.

For the second year in sequence, menhaden were observed to be more abundant than usual in New England waters. Reported landings from New England states indicated an overage, so there was no unused set-aside quota to be reallocated to the reduction fishery in 2017.

The mid-Atlantic region experienced an unusually stormy beginning to the season. Atlantic Menhaden landings for reduction during May 2017 very low (287 mt, Fig. 5). Landings rebounded to approach average in June with 25,539 mt, and remained at approximately average level until July (24,878 mt).

In August, landings rose to 28,140 mt, very close to the 5-year average for that month. September brought with it Hurricanes Irma, Jose, and Maria. Irma made continental landfall within two weeks of Harvey, its residual moisture sustained Hurricane Jose, which persisted almost until Hurricane Maria formed in late September. September landings (12,687 mt) for the Atlantic, therefore, were almost as low as the record set last year.

In October, there were relatively few weather-related disruptions to fishing and landings increased to 20,966 mt, the highest landings recorded since 2010 for that month. The fishing season continued above average into November with 10,646 mt of landings. December landings were also higher than the five-year average with 5,781 mt of landings before all reduction vessels cut out in mid-December.

The coastwide TAC for Atlantic Menhaden also included the bait fisheries. Bait allocations by state were assigned based on landings histories during 2009-11. The snapper rig purse-seine fishery for bait in Virginia started the week of May 17th and continued through early December.

The abundance of menhaden in northern waters was evident from early closing times of the various fisheries. Maine's episodic event fishery closed July 5th, allowing incidental take of menhaden up to a 6,000-pound limit until it was reduced to 5,000-pounds on September 30. Massachusetts reduced their trip limit to 6,000 pounds on September 13. Rhode Island closed their fishery on September 8, and New York closed on May 8.

New Jersey's purse-seine fishery closed in mid-July and re-opened for a short time in early August until their TAC was reached. The TAC for gears other

than purse seine in New Jersey was closed March 5.

Age Composition of Atlantic Menhaden in 2017

Approximately 1,800 Atlantic Menhaden were sampled for length and weight and approximately 900 have been aged to date from the reduction fishery in 2017. From the preliminary catch-at-age matrix, coastwide age-1 fish (81%) outnumbered age-2 fish (17%) and age-3+ fish (1%) by a large margin (Fig. 6 and Table 2).

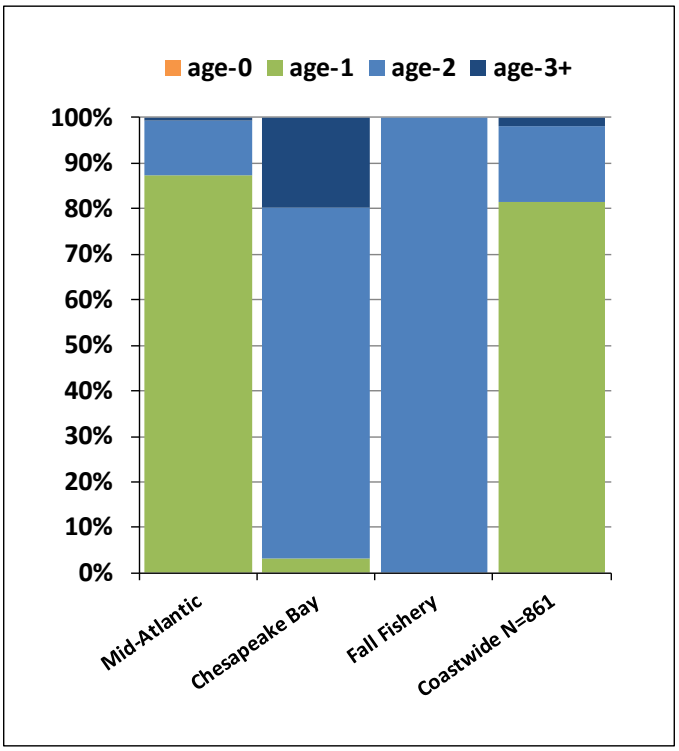


Figure 6. Preliminary estimated percent at age of Atlantic Menhaden by area in 2017.

Fishing Effort in 2017 Atlantic Menhaden Season

Nominal fishing effort in 2017 was estimated at 185 vessel weeks, decreasing from 213 vessel weeks expended in 2016.

Table 2. Percent age composition of the reduction catch in the Atlantic Menhaden fishery, 2013–2017.
***Results are preliminary for 2017**

Year	Age-0	Age-1	Age-2	Age-3+
2017*	0%	81%	17%	2%
2016	0%	26%	50%	24%
2015	0%	14%	70%	16%
2014	1%	40%	41%	18%
2013	3%	38%	45%	14%

Forecast for the 2018 Atlantic Menhaden Fishing Season

Amendment 2 to the Fishery Management Plan for Atlantic Menhaden specified an annual coastwide TAC of about 129,900 mt for the purse-seine reduction fishery. This TAC was to be revisited every three years and was raised to 142,894 mt in 2015 and 152,112 mt starting in 2017. Amendment 3 of the Interstate Fishery Management Plan for Atlantic Menhaden was completed in November. The Atlantic Menhaden Management Board reexamined the landings and recent shifts in the fishery and demand and was concerned that the allocation may not provide a balance between current needs of the fishery and future growth. The board set the coastwide TAC for 2018, and adjusted allocations resulting in approximately 151,000 metric tons for reduction.

Combined 2017 Gulf and Atlantic Menhaden Landings

Combined landings by the Gulf and Atlantic Menhaden purse-seine fisheries for reduction during 2017 year amounted to 1.3 billion pounds, a decrease from landings during the 2016 calendar year, which amounted to 1.37 billion pounds.

Fishing effort and landings in the Gulf Menhaden purse-seine fishery,1955-2017					
Year	**Fishing effort 1,000 vessel-ton-weeks**	**Landings 1,000 metric tons**	**Year**	**Fishing effort 1000 vessel-ton-weeks**	**Landings 1,000 metric tons**
1955	122.9	213.3	***1987***	604.2	894.2
1956	155.1	244.0	***1988***	594.1	623.7
1957	155.2	159.3	***1989***	555.3	569.6
1958	202.8	196.2	***1990***	563.1	528.3
1959	205.8	325.9	***1991***	472.3	544.3
1960	211.7	376.8	***1992***	408.0	421.4
1961	241.6	455.9	***1993***	455.2	539.2
1962	289.0	479.0	***1994***	472.0	761.6
1963	277.3	437.5	***1995***	417.0	463.9
1964	272.9	407.8	***1996***	451.7	479.4
1965	335.6	461.2	***1997***	430.2	611.2
1966	381.3	357.6	***1998***	409.3	486.2
1967	404.7	316.1	***1999***	414.5	684.3
1968	382.8	371.9	***2000***	417.6	579.3
1969	411.0	521.5	***2001***	400.6	521.3
1970	400.0	545.9	***2002***	386.7	574.5
1971	472.9	728.5	***2003***	363.2	517.1
1972	447.5	501.9	***2004***	390.5	468.7
1973	426.2	486.4	***2005***	326.0	433.8
1974	485.5	587.4	***2006***	367.2	464.4
1975	538.0	542.6	***2007***	369.2	453.8
1976	575.8	561.2	***2008***	355.8	425.4
1977	532.7	447.1	***2009***	377.8	457.5
1978	574.3	820.0	***2010***	320.3	379.7
1979	533.9	777.9	***2011***	367.2	613.3
1980	627.6	701.3	***2012***	332.7	578.4
1981	623.0	552.6	***2013***	332.5	497.5
1982	653.8	853.9	***2014***	312.9	391.9
1983	655.8	923.5	***2015***	294.2	535.7
1984	645.9	982.8	***2016***	307.7	484.8
1985	560.6	881.1	***2017***	269.2	460.7
1986	606.5	822.1			

Fishing effort and landings in the Atlantic Menhaden purse-seine fishery, 1955-2017					
Year	**Fishing effort vessel-weeks**	**Landings 1,000 metric tons**	**Year**	**Fishing effort vessel-weeks**	**Landings 1,000 metric tons**
1955	2748	641.4	***1987***	531	327.0
1956	2878	712.1	***1988***	604	309.3
1957	2775	602.8	***1989***	725	322.0
1958	2343	510.0	***1990***	826	401.2
1959	2847	659.1	***1991***	926	381.4
1960	2097	529.8	***1992***	794	297.6
1961	2371	575.9	***1993***	626	320.6
1962	2351	537.7	***1994***	573	260.0
1963	2331	346.9	***1995***	600	339.9
1964	1807	269.2	***1996***	528	292.9
1965	1805	273.4	***1997***	616	259.1
1966	1386	219.6	***1998***	437	245.9
1967	1316	193.5	***1999***	382	171.2
1968	1209	234.8	***2000***	311	167.2
1969	995	161.6	***2001***	334	233.7
1970	906	259.4	***2002***	318	174.0
1971	897	250.3	***2003***	302	166.1
1972	973	365.9	***2004***	345	183.4
1973	1099	346.9	***2005***	291	146.9
1974	1145	292.2	***2006***	322	157.4
1975	1218	250.2	***2007***	333	174.5
1976	1163	340.5	***2008***	262	141.1
1977	1239	341.1	***2009***	300	143.8
1978	1210	344.1	***2010***	356	183.1
1979	1198	375.7	***2011***	324	174.0
1980	1158	401.5	***2012***	279	160.6
1981	1133	381.3	***2013***	196	131.0
1982	948	382.4	***2014***	201	131.1
1983	995	418.6	***2015***	182	143.5
1984	892	326.3	***2016***	213	137.4
1985	577	306.7	***2017***	185	128.9
1986	377	238.0			