# Forecast for the 2019

# Gulf and Atlantic Menhaden Purse-Seine Fisheries and

# Review of the 2018 Fishing Season

*March 2019*

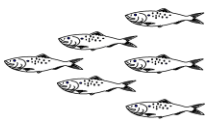
*Sustainable Fisheries Branch, NMFS Beaufort, NC*

## INTRODUCTION

The 2019 fishing year marks the forty-sixth 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 2018 Gulf and Atlantic Menhaden fishing seasons in terms of:

- landings and fleet size
- status of the most recent forecast

Finally, we will forecast estimated landings for the 2019 menhaden fishing season.



## GULF MENHADEN FISHERY

### Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2018

Final purse-seine landings of Gulf Menhaden for reduction in 2018 totaled 525,635 metric tons (mt; 1,729 million standard fish). This is an increase of 14.1% from total landings in 2017 (460,707 mt), and 10.8% more than the previous 5-year mean (474,322 mt; Figure 1).

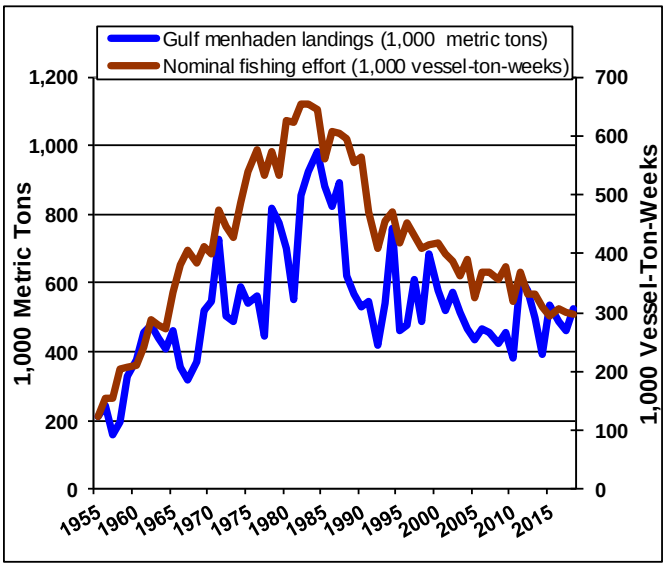



**Figure 1. Gulf Menhaden landings in 1,000s of metric tons (mt) and nominal fishing effort in 1,000s of vessel-ton-weeks (VTW), 1955–2018.**

Winter 2017-2018 across much of the Mississippi Basin was warmer than average with above-average precipitation in portions of the Great Plains. Beginning in early spring, the Mississippi River

began to experience over twice the median amount of river flow, a pattern that would continue until May, when flow reduced to median levels.

The 2017 Gulf Menhaden fishing season opened on April 16th. Landings in April (42,293 mt) were the highest since 2000, and therefore higher than the previous 5-year average. Fair weather continued in May so that landings (108,041 mt) continued to be much higher than average.

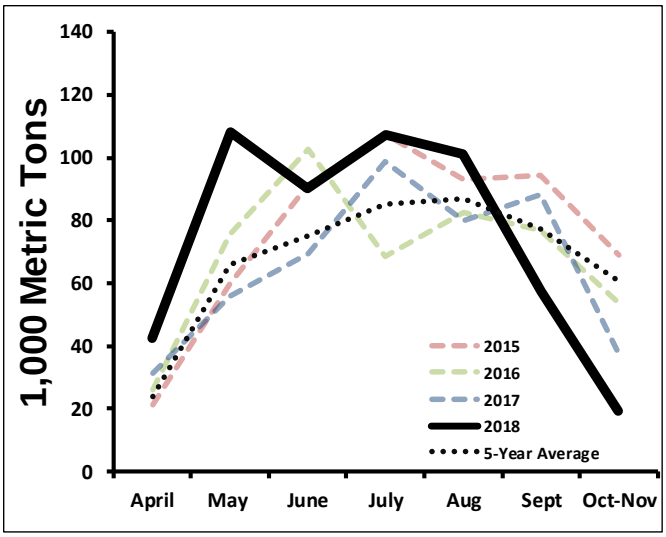



**Figure 2. Gulf Menhaden landings by month, 2015-2018.**

Mostly fair weather continued through June, and although landings decreased (90,348 mt), they remained well above average for the month of June.

Landings in July increased to 107,153 mt, continuing above both 2017 values and the five-year average. The Gulf of Mexico hypoxic zone was estimated to be approximately 5,780 square miles at this point in 2018, an area approximating the size of the state of Connecticut. This estimate is a decrease from last year's estimate, and similar to the 33-year average since measurements began in 1985.

Landings continued well above the five-year average and higher than 2017 landings for the month of August (101,233 mt).

With the exception of Tropical Storm Alberto, tropical cyclones left the Gulf of Mexico relatively untouched for the season until Tropical Storm Gordon entered the Gulf in early September. Gordon kept vessels in port for about a week, and in a departure from the pattern formed over the three previous years, September landings were much lower than the previous 5-year average; for 2018 September landings (57,423 mt) were the lowest since 2010.

In the second week of October Hurricane Michael formed off the Yucatan Peninsula before rapidly intensifying into a major hurricane exceeding forecasts to become the most powerful hurricane of the 2018 season. Michael swept northward and made landfall in the Gulf Coast before passing over the mid-Atlantic states to eventually dissipate over the Iberian Peninsula. Menhaden landings for October amounted to 19,144 mt, the lowest value for the month in decades. All plants "cut-out" for the fishing season at the end of the month.

## Age Composition of Gulf Menhaden in 2018

Prior to the beginning of the 2018 fishing season, an irreplaceable piece of equipment used in the ageing process failed. Samples were collected as usual during the 2018 fishing season, but have not yet been aged. During this time, the menhaden program has been developing and testing replacement equipment for consistency with the equipment used to date by the program.

## Fishing Effort and Review of the 2018 Forecast for Gulf Menhaden

Nominal fishing effort for the Gulf Menhaden fishery during 2018 was estimated at 296,700 vessel ton weeks; this is 11% more than nominal fishing effort in 2017 (269,200 vessel ton weeks).

In March 2018, we anticipated that nominal fishing effort during 2018 could amount to 301,000 vessel ton weeks with 33 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2018 Gulf Menhaden landings of 423,000 mt with 80% confidence levels of 305,000 and 552,000 mt. A "hindcast" using our forecast model and actual nominal fishing effort in 2018

produced a post-season forecast of 441,300 mt with 80% confidence levels of 321,000 and 561,000 mt. Actual landings of 525,635 mt were 24% higher than our forecast and 19% greater than our post-season estimate.

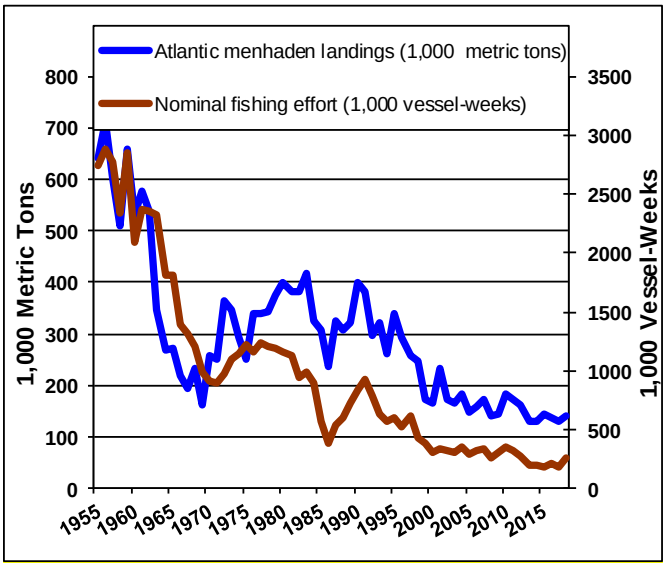



**Figure 3. Atlantic Menhaden landings in 1,000s of metric tons (mt) and nominal fishing effort in vessel-weeks (VW), 1955–2018.**

## Forecast for the 2019 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 occasionally landing for reduction. Based on average nominal fishing effort for recent years by the vessels expected to be active in 2019, we estimate that nominal fishing effort in 2019 may be about 291,600 vessel-ton-weeks; with this level of nominal fishing effort, we forecast 2019 Gulf Menhaden landings of 454,000 mt, with 80% confidence levels of 334,000 and 574,000 mt.

# ATLANTIC MENHADEN FISHERY

## Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2018

Final catch information indicated that 2018 landings of Atlantic Menhaden for reduction amounted to 141,314 mt (465 million standard fish; Fig. 4). This is 12% 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 2018.

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, 200,000 mt for 2017, and 216,000 mt for the 2018 and 2019 seasons. The menhaden reduction fishery was allocated about 151,382 mt of the TAC for 2018 and 2019.

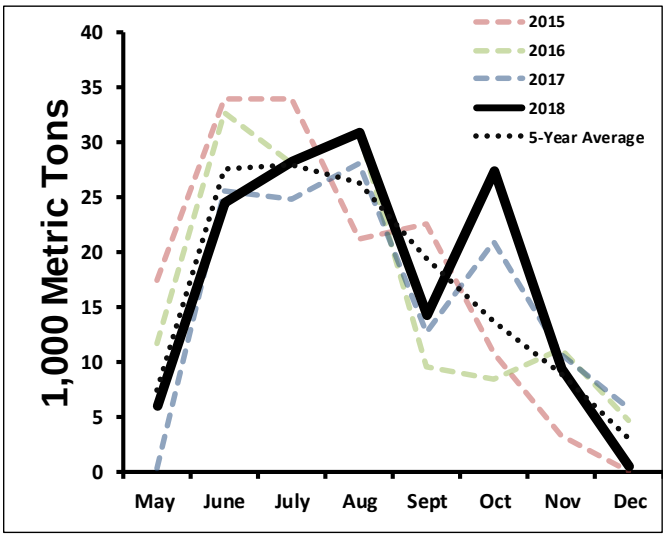



**Figure 4. Atlantic Menhaden landings by month, 2014–2018.**

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 consumed the set-aside, so there was no unused quota to be reallocated to the reduction fishery in 2018.

Atlantic Menhaden landings for reduction during May 2018 were close to the five-year average (6,044 mt, Fig. 5). Landings increased to close to the 2017 value, but below the five-year average in June with 24,562 mt, and remained approximating the average level through July (28,213 mt).

In August, landings increased above the five-year average for the month to 30,923 mt, the highest August landings since 2012. For the third year in a row, September fishing was affected by hurricanes. This season, the slow-moving Hurricane Florence made continental landfall on September 14 before moving slowly north and overflowing rivers along the way. September landings (14,264 mt) for the Atlantic, therefore, remained well below landings in previous years.

In October there were relatively few weather-related disruptions to fishing and landings increased to 27,432 mt, surpassing 2017 as the highest landings recorded since 2010 for that month. The fishing season continued until all reduction vessels cut out in mid-December with November (9,320 mt) and December (556 mt) landings being near, but below average for those months.

The coastwide TAC for Atlantic Menhaden also included the bait fisheries. Bait allocations by state were allotted based on landings histories during 2009-11, but readjusted beginning with the 2018 season so that the minimum allocation to each state was 0.5% of the total TAC. The abundance of menhaden in northern waters meant that the portion of the quota reserved for such episodic events was not available for reallocation. Maine's episodic event fishery closed August 11th, but reopened after receiving additional, unused quota from neighboring states on September 17th. Massachusetts reduced their trip limit to 25,000 pounds after landing 85% of their quota on July 30. New Jersey's purse-seine bait fishery closed in early February before re-opening on April 26th and remaining open until September 21 when their quota was reached.

## Age Composition of Atlantic Menhaden in 2018

Prior to the beginning of the 2018 fishing season, an irreplaceable piece of equipment used in the ageing process failed. Samples were collected as usual during the 2018 fishing season, but have not yet been aged. During this time, the menhaden program has been developing and testing replacement equipment for consistency with the equipment used to date by the program.

## Fishing Effort in 2018 Atlantic Menhaden Season

Nominal fishing effort in 2018 was estimated at 256 vessel weeks, a 38% increase from the 185 vessel weeks expended in 2017.

## Forecast for the 2019 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 retained the TAC, but reallocated the quota, resulting in approximately 151,392 mt to be available for reduction in 2018. The apparent expansion of the stock and reconsideration of the landings during the allocation time period raised concerns that the allocation may not provide a balance between current needs of the fishery and future growth.

## Combined 2018 Gulf and Atlantic Menhaden Landings

Combined landings by the Gulf and Atlantic Menhaden purse-seine fisheries for reduction during 2018 amounted to 1.47 billion pounds, an increase over landings during the 2017 fishing year, which amounted to 1.29 billion pounds.

| Fishing effort and landings in the Gulf Menhaden purse-seine fishery, 1955-2018 | | | | | |
|---|---|---|---|---|---|
| **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*** | 301.3 | 460.7 |
| ***1986*** | 606.5 | 822.1 | ***2018*** | 296.7 | 525.6 |

| Fishing effort and landings in the Atlantic Menhaden purse-seine fishery, 1955-2018 | | | | | |
|---|---|---|---|---|---|
| **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 | ***2018*** | 256 | 141.3 |