Forecast for the 2015

Gulf and Atlantic Menhaden Purse-Seine Fisheries and

Review of the 2014 Fishing Season

March 2015

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INTRODUCTION

The 2015 fishing year is the forty-third year for which quantitative forecasts of purse-seine landings of menhaden have been made by the National Marine Fisheries Service. The forecasts are based on a multiple regression equation that relates landings and fishing effort over a series of years. Forecasts of landings are conditioned on estimates of expected fishing effort for the upcoming fishing year. Estimates of fishing effort 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 15% for the forty-two year period, 1973-2014. In this forecast report, we review the 2014 gulf and Atlantic menhaden fishing seasons in terms of:

- landings and fleet size,
- age composition of the catch,
- status of the 2014 forecasts, and

we forecast landings for the 2015 menhaden fishing season.

GULF MENHADEN FISHERY

Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2014

Final purse-seine landings of gulf menhaden for reduction in 2014 totaled 391,854 metric tons (1,289 million standard fish). This is down 21% from total landings in 2013 (497,503 t), and down 23% from the previous 5-year mean (505,262 t) (Fig. 1).

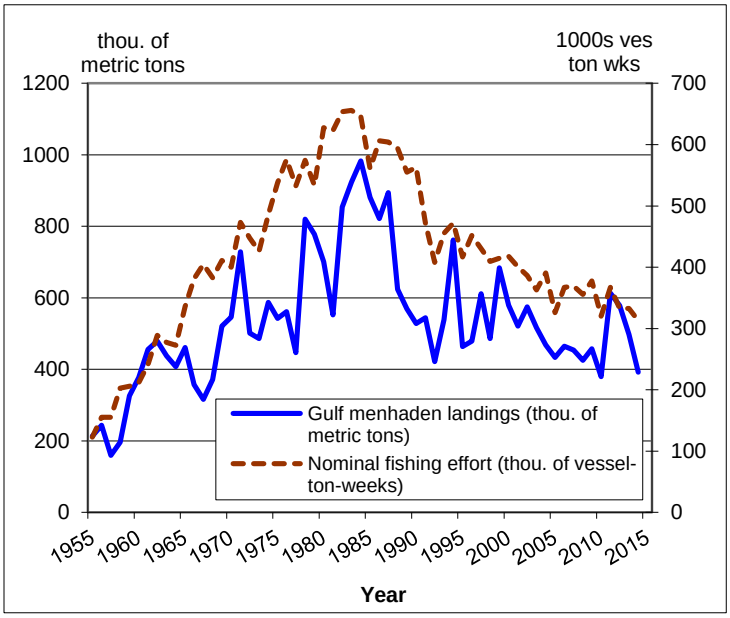


Figure 1. Gulf menhaden landings and nominal fishing effort, 1955-2014.

Winter 2013-14 across the northern tier of U.S. states was cold with above average snow pack in most areas. Cold weather spread into the southeastern U.S. during late January through March with several snow and ice events reaching into the Gulf states. Cold and wet weather persisted through spring 2014 with the northern Gulf experiencing below average temperatures. Spring rains deluged the mid-West and Northern

Plains; run-off from rains and snow melt caused many rivers in the central U.S. to exceed flood stage.

The 2014 gulf menhaden fishing season opened on April 21st. Fishing was fair during the first week of the season, then windy weather set in and persisted through most of May. Catches east of the Mississippi River were generally of small fish, while catches west of the River were of larger fish. Landings of 13,752 t in April were the lowest since 2009 (9,775 t).

During May fish were difficult to spot from the air because of turbidity and wind; riverine input of fresh water into the northern Gulf may have moved gulf menhaden schools farther offshore than normal. Fishing in May was especially poor west of the Mississippi River as vessels from the Abbeville fish factory fished less than 50 percent of their available vessel-days. Landings of 58,464 t in May were the least since 2008 (54,587 t).

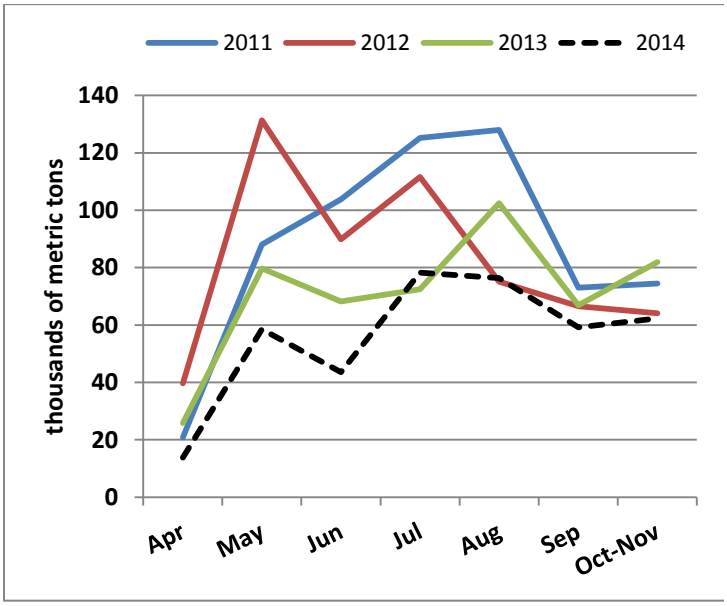


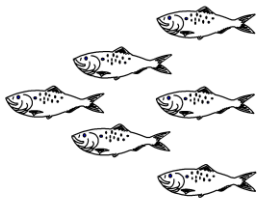
Figure 2. Gulf menhaden landings by month, 2011-2014.

Windy conditions continued through late June across the Gulf. Only scattered signs of small fish were spotted west of Vermillion Bay, LA, during most of June, while catches in Breton, Chandeleur, and Mississippi sounds were poor. Accordingly, landings declined in June to 43,596 t, the least since June 1958 (42,396 t).

After July 4th and through August catches improved at the three gulf menhaden ports. Fair weather prevailed and best concentrations of fish occurred west of the Mississippi River. Fish oil yields were reported as close to "normal". Landings peaked for the season in July at 78,242 t; landings in August of 76,390 t were comparable.

During most of September catches remained fair and landings for the month amounted to 59,151 t. Weather during October was moderate and landings for the month actually increased slightly from September to 62,258 t. Vessel crews and spotter pilots reported that large numbers of fish schools tended to remain in estuarine waters through late October rather than making their traditional fall migration into the Gulf of Mexico proper. All fish plants "cut-out" for the fishing season by October 31st. Similar to summer 2013, there was no significant tropical cyclone activity in the northern Gulf during 2014.

In December 2013 Omega Protein Corporation announced that it was closing its fish factory in Cameron, LA. Thus, unlike the past fourteen years when four fish factories operated in the northern Gulf, in 2014 only three fish plants were active – one each in Moss Point, MS, and Empire and Abbeville, LA. Three vessels from Cameron were transferred to Abbeville, while one was moved to Moss Point. In 2014 the factory at Abbeville ranked first in terms of number of vessels with 13, followed by Empire with 11 and Moss Point with seven. Moss Point also employed a run boat in 2014; run boats do not fish, but rather transfer menhaden from vessels on the fishing grounds to the factory. A start-up, menhaden-for-bait company opened recently near the fish factory at Abbeville; its bait purse-seiner unloaded minor amounts of menhaden for reduction at the Abbeville factory. In 2014, 33 vessels unloaded gulf menhaden for reduction - 31 regular steamers, one run boat, and one bait vessel - four less than in 2013.



Age Composition of Gulf Menhaden in 2014

About 6,000 gulf menhaden were aged from the 2014 port samples (Fig. 3). From the preliminary catch-at-age matrix, coastwide age-2 fish (60%) outnumbered age-1 fish (26%) by a wide margin (Table 1); accordingly, age-2 gulf menhaden predominated at all ports, but by different margins. At Moss Point age-2 menhaden (76%) far outnumbered age-1s (15%). At Empire the difference between age-2s (51%) and age-1s (36%) was much less pronounced. At Abbeville age-2s (61%) outnumbered age-1s (19%) by a wider margin.

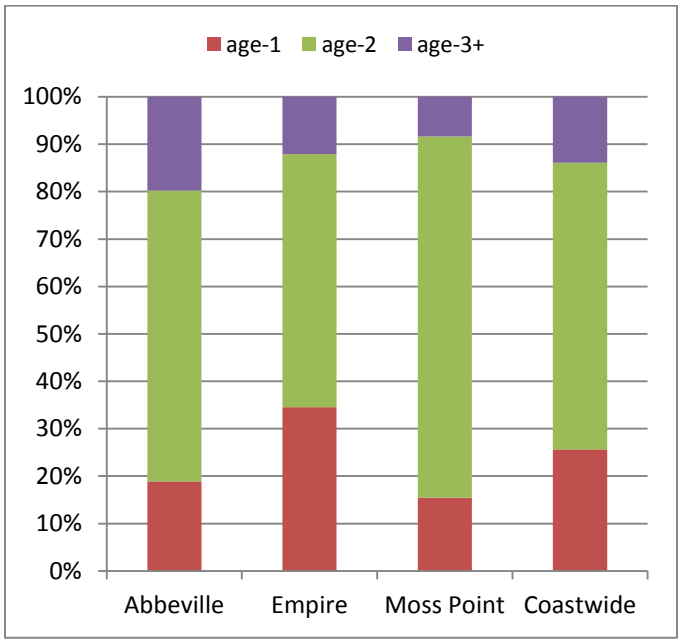


Figure 3. Percent estimated numbers-at-age of gulf menhaden by port in 2014.

Fishing Effort in 2014 and Review of the 2014 Forecast for Gulf Menhaden

Nominal fishing effort for the gulf menhaden fishery during 2014 was estimated at 312,900 vessel ton weeks; this is 3% less than nominal fishing effort in 2013 (332,500 vessel ton weeks).

In March 2014, we anticipated that nominal fishing effort during 2014 could amount to 300,000 vessel ton weeks with 32 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2014 gulf menhaden landings of 428,000 t with 80% confidence levels of 308,000 and 548,000 t. A "hindcast" using our forecast model and actual nominal fishing effort in 2014 produced a post-season forecast of 438,000 t with 80% confidence levels of 318,000 and 557,000 t. Actual landings of 391,854 t were 11% less than our post-season forecast.

Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the gulf menhaden fishery, 2010-2014; 2014 data are preliminary.

Year	Age-0	Age-1	Age-2	Est. total number of fish caught in billions	Landings in thou. of metric t
2014	1%	26%	60%	3.51	391.9
2013	<1%	25%	73%	4.54	497.5
2012	<1%	31%	66%	6.78	578.4
2011	1%	63%	32%	7.21	613.3
2010	-	53%	40%	3.89	379.7

Forecast for the 2015 Gulf Menhaden Fishing Season

As in 2014, we expect that only three menhaden factories (Moss Point, MS, and Empire and Abbeville, LA) will process gulf menhaden in 2015. Our best estimate of vessel participation is for 33 vessels: 31 regular steamers, one run boat, and one bait boat. Based on average nominal fishing effort for recent years by the vessels expected to be active in 2015, we estimate that nominal fishing effort in 2015 may be about 310,000 vessel ton weeks; with this level of nominal fishing effort, we forecast 2015 gulf menhaden landings of 401,000 t, with 80% confidence levels of 282,000 and 519,000 t.

ATLANTIC MENHADEN FISHERY

Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2014

Final catch information indicated that 2014 landings of Atlantic menhaden for reduction amounted to 131,065 t (431 million standard fish) (Fig. 4). This is 18% less than purse-seine landings for the 2012 season (160,627 t), and 18% less than average landings for the years 2008-12 (160,524 t). As has been the case since 2005, only one menhaden factory, the Omega Protein plant at Reedville, VA, operated on the Atlantic coast in 2014.

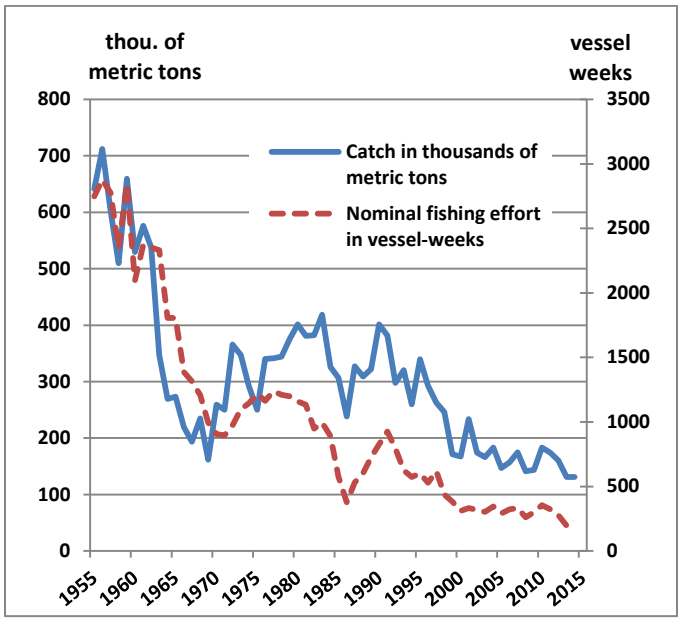


Figure 4. Atlantic menhaden landings and nominal fishing effort, 1955-2014.

In December 2012, the Atlantic States Marine Fisheries Commission (ASMFC) approved Amendment 2 to the Fishery Management Plan for Atlantic menhaden which established a total allowable catch (TAC) for the reduction and bait fisheries combined of 170,800 t beginning in 2013.

The TAC represents a 20% decrease from average landings (bait and reduction fisheries combined) during 2009-11. As in 2013, the menhaden reduction fishery was allocated about 129,900 t of the TAC for 2014. In early November 2014, the ASMFC redistributed an unused portion of the coastwide TAC that had been reserved for any unanticipated abundance of menhaden in New England waters during summer ("episodic event"). Virginia was allocated about 1,500 t of this unused reserve, hence total landings of Atlantic menhaden for reduction in 2014 were 131,065 t.

Saddled with a TAC for the second year in a row and faced with an abundance of menhaden in Virginia waters throughout summer 2014, Omega Protein chose to limit catches via company-imposed weekly catch quotas, and thus extend their fishing season into fall 2014.

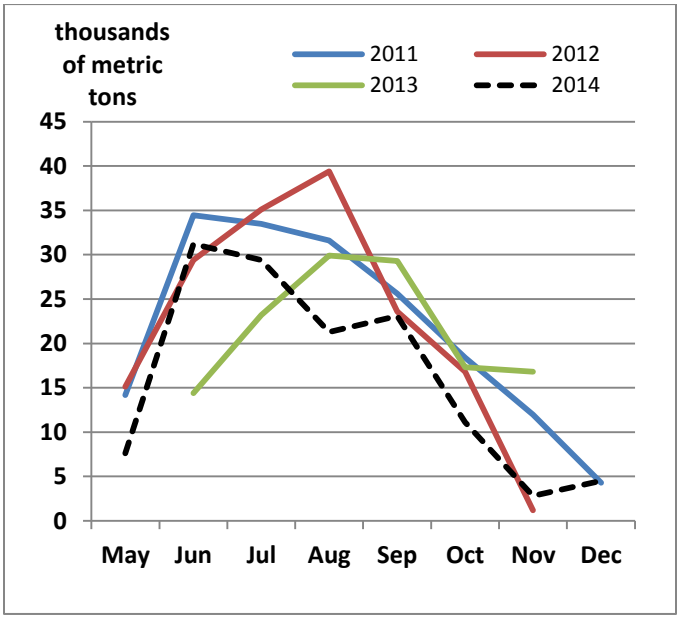


Figure 5. Atlantic menhaden landings by month, 2011-2014.

Menhaden landings for reduction during May 2014 were fair (7,570 t)(Fig. 5). Landings improved considerably in June (31,208 t), which was the month for peak landings in 2014. Landings declined slightly in July (29,407 t) and August (21,295 t), then rebounded in September (23,087 t). Landings dropped sharply in October (11,133) and November (2,834 t) and the reduction fishery ended in early December (4,531 t).

January through early March 2014 along the U.S. East Coast was unusually cold with several snow and ice storms. A warming trend began in early April and by mid-month pound nets in the Rappahannock River (VA) made good catches of menhaden. By the first week of May, Virginia bait purse-seiners, or snapper rigs, landed good catches from the Virginia portion of Chesapeake Bay near Smith Point and Pocomoke Sound. Omega Protein vessels began fishing on May 19th and spotter pilots reports good signs of menhaden schools throughout Chesapeake Bay. By late May, best catches occurred mostly near the mouth of Chesapeake Bay and also near Smith Point and in the Rappahannock River. Throughout June pilots continued to reports large numbers of menhaden in

Chesapeake Bay, although smaller fish tended to concentrate "up Bay" while larger fish occurred closer to the Bay mouth. In mid-June spotters reported large bodies of menhaden along Virginia's Eastern Shore barrier islands, particularly from Cape Charles to Machipongo Inlet.

In late June Omega Protein restricted weekly catches by their vessels because of an abundance of fish in Virginia waters and in an effort to extend the TAC-limited fishing season; company restrictions lasted through most of summer. During July and August most fishing effort and best catches of larger and older fish remained near the Bay mouth and along the ocean beaches of Virginia's Eastern Shore (61% age-2s vs 19% age-1s); smaller and younger fish tended to occur in the Bay proper (52% age-1s vs 38% age-2s). Weather was good for fishing operations during summer 2014 and fish oil yields were reported as average. Hurricane Arthur made landfall near Cape Lookout, NC, on July 4th weekend, but had little effect on the fishery in Chesapeake Bay.

By early September Omega Protein removed company-imposed vessel quotas. Fishing continued to be good off Virginia's Eastern Shore and spotter pilots reported large concentrations of fish along most of the Delmarva coastline, despite the fleet losing several fishing days to rain and large offshore sea swells. In mid-September a few Virginia vessels fished off the New Jersey coast; fish oil yields improved throughout the month. In mid-October the Virginia fleet lost a week of fishing to bad weather from Hurricane Gonzalo that struck Bermuda. Fishing, mostly in ocean waters, was fair in late October, but northeast winds hampered fishing throughout November. The Virginia fleet remained active during the first week of December; final purse-seine sets occurred off Quinby Inlet, VA, on December 6th when the TAC for reduction purposes was reached.

The coastwide TAC for Atlantic menhaden included the bait fisheries also. 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 5th. Catches were good most of summer near Smith Point and Pocomoke Sound, as well as along the bayside of Eastern Shore, but the fish were generally small.

In New Jersey, mid-water trawl landings of menhaden in February at Cape May quickly filled the Garden State's TAC allocation for gears other than purse seines, and this facet of the bait fishery in New Jersey closed. Purse-seine landings of menhaden in New Jersey began in mid-May with most catches coming from Delaware Bay; catches later switched to ocean waters. As during the previous summer, New Jersey's purse-seine TAC was reached in late June and the fishery closed, despite pilots reporting large bodies of menhaden off the New Jersey coast throughout summer.

Also similar to 2013, Maryland's pound net fishery reached its TAC by mid-August and was limited to a 6,000-lb daily bycatch allowance thereafter. Menhaden bait prices were high again in 2014 no doubt because of quotas established in Amendment 2.

Age Composition of Atlantic Menhaden in 2014

About 2,000 Atlantic menhaden were sampled for size and age from the 2014 reduction fishery. From the catch-at-age matrix, coastwide age-2 fish (41%) and age-1 fish (40%)(Fig. 6 and Table 2) were nearly equivalent. Age-3 fish (14%) ranked a distant third followed by age-4 fish (5%); age-0s, or "peanuts" accounted for only 1% of the catch.

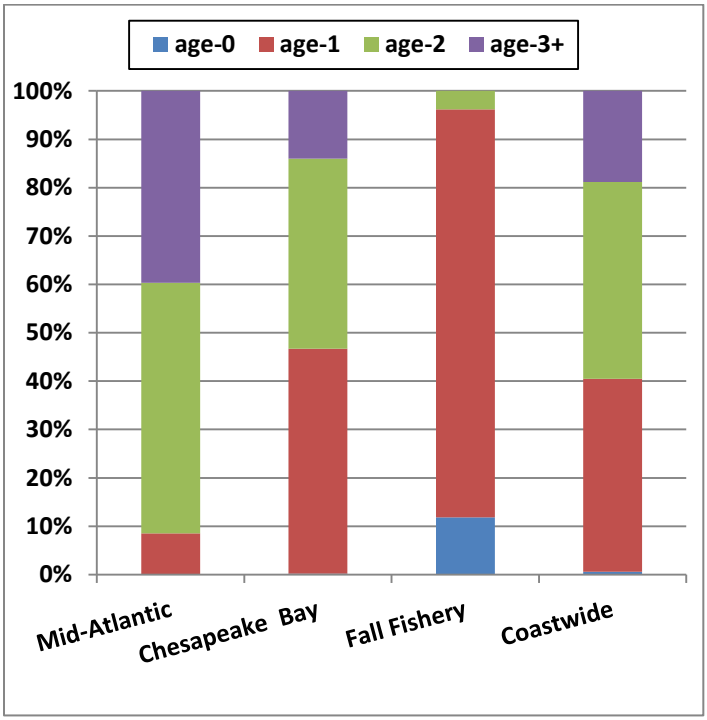


Figure 6. Percent estimated numbers-at-age of Atlantic menhaden by area in 2014.

Table 2. Percent age composition of the reduction catch in the Atlantic menhaden fishery, 2010-2014.

Year	Age-0	Age-1	Age-2	Age-3+
2014	1%	40%	41%	18%
2013	3%	38%	45%	14%
2012	1%	16%	79%	4%
2011	-	42%	50%	8%
2010	2%	40%	49%	9%

Catches for reduction off New Jersey and the Delmarva Peninsula during 2014 consisted mostly of age-2s (52%), followed by age-3+s (40%) and age-1s (8%). Catches from Chesapeake Bay and ocean areas near the mouth of the Bay during summer slightly favored age-1 (46%) Atlantic menhaden over age-2 fish (39%), while age-3+ fish accounted for about 15% of the catch. During the fall fishery off the Virginia coast, age-1 fish (84%) swamped the catches over age-0s (12%) and age-2s (4%).

About 600 samples of Atlantic menhaden have been aged from the bait fisheries on the East coast during 2014. Bait samples from snapper boats in Chesapeake Bay consisted mostly of age-1s (54%) and age-2s (31%). Preliminary bait samples from off the New Jersey coast were mostly age-3 (45%) and age-4 (48%) fish.

Two signals point to a relatively good 2013 year class of menhaden in the fishery: the relatively high proportion of age-1 Atlantic menhaden in the catch-at-age matrix for the Chesapeake Bay area (46%) and also in the Mid-Atlantic area (8%). Similarly in 2013, high proportions of age-1 fish (51%) in the Chesapeake Bay area foretold a favorable 2012 year class. With two consecutive good year classes of menhaden in the coastal stock, age-2 (2013 year class) and age-3 (2012 year class) Atlantic menhaden should be in good abundance in Chesapeake Bay and the Mid-Atlantic areas during summer 2015.

Fishing Effort in 2014

Nominal fishing effort in 2014 was estimated at 201 vessel weeks, up slightly from 196 vessel weeks expended in 2013. The decline in observed effort in the past two years (for example, from 279 vessel weeks in 2012) is due to the TAC and the decrease in number of steamers at the Reedville factory to seven.

Forecast for the 2015 Atlantic Menhaden Fishing Season

Amendment 2 to the Fishery Management Plan for Atlantic menhaden specifies an annual coastwide TAC of about 129,900 t for the purse-seine reduction fishery. This TAC is to be in place "until completion of, and [Atlantic Menhaden Management] Board action on, the next benchmark assessment [completed in December 2014]". The 2014 Benchmark Assessment found that "the Atlantic menhaden stock status is not overfished and overfishing is not occurring". The Board met in early February 2015; they accepted the assessment, but deferred any action on the TAC for 2015 until its Spring Meeting in May. If the Board decides to keep the existing TAC in place, then 2015 landings for reduction will be about 129,900 t. If the Board decides to relax the TAC, then landings will rise accordingly.

Combined 2014 Gulf and Atlantic Menhaden Landings

Combined landings by the gulf and Atlantic menhaden purse-seine fisheries for reduction during 2014 year amounted to 1.15 billion pounds, down from landings during the 2013 calendar year which amounted to 1.39 billion pounds.

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

Fishing effort and landings in the Atlantic menhaden purse-seine fishery, 1955-2014					
Year	**Fishing effort vessel-weeks**	**Landings 1000 metric tons**	**Year**	**Fishing effort vessel-weeks**	**Landings 1000 metric tons**
1955	2748	641.4	***1985***	577	306.7
1956	2878	712.1	***1986***	377	238.0
1957	2775	602.8	***1987***	531	327.0
1958	2343	510.0	***1988***	604	309.3
1959	2847	659.1	***1989***	725	322.0
1960	2097	529.8	***1990***	826	401.2
1961	2371	575.9	***1991***	926	381.4
1962	2351	537.7	***1992***	794	297.6
1963	2331	346.9	***1993***	626	320.6
1964	1807	269.2	***1994***	573	260.0
1965	1805	273.4	***1995***	600	339.9
1966	1386	219.6	***1996***	528	292.9
1967	1316	193.5	***1997***	616	259.1
1968	1209	234.8	***1998***	437	245.9
1969	995	161.6	***1999***	382	171.2
1970	906	259.4	***2000***	311	167.2
1971	897	250.3	***2001***	334	233.7
1972	973	365.9	***2002***	318	174.0
1973	1099	346.9	***2003***	302	166.1
1974	1145	292.2	***2004***	345	183.4
1975	1218	250.2	***2005***	291	146.9
1976	1163	340.5	***2006***	322	157.4
1977	1239	341.1	***2007***	333	174.5
1978	1210	344.1	***2008***	262	141.1
1979	1198	375.7	***2009***	300	143.8
1980	1158	401.5	***2010***	356	183.1
1981	1133	381.3	***2011***	324	174.0
1982	948	382.4	***2012***	279	160.6
1983	995	418.6	***2013***	196	131.0
1984	892	326.3	***2014***	201	131.1