Forecast for the 2013

Gulf and Atlantic Menhaden Purse-Seine Fisheries and

Review of the 2012 Fishing Season

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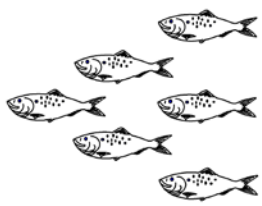
INTRODUCTION

The 2013 fishing year is the forty-first year for which quantitative forecasts of purse-seine landings of gulf and Atlantic 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. Our 2013 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 forecast for the forty year period, 1973-2012. Landings in the gulf menhaden fishery have differed from those forecast by an average of 15% for the same period. In this forecast report, we review the 2012 gulf and Atlantic menhaden fishing seasons in terms of:

- landings and fleet size,
- age composition of the catch,
- status of the 2012 forecasts, and

we forecast landings for the 2013 gulf menhaden fishing season.



GULF MENHADEN FISHERY

Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2012

Final purse-seine landings of gulf menhaden for reduction in 2012 totaled 578,362 metric tons (1,903 million standard fish). This is down 6% from total landings in 2011 (613,261 t), but up 24% from the previous 5-year mean (465,944 t) (Fig. 1). Landings in 2012 were the second best since 2000 when 579,315 t were unloaded at gulf menhaden factories.

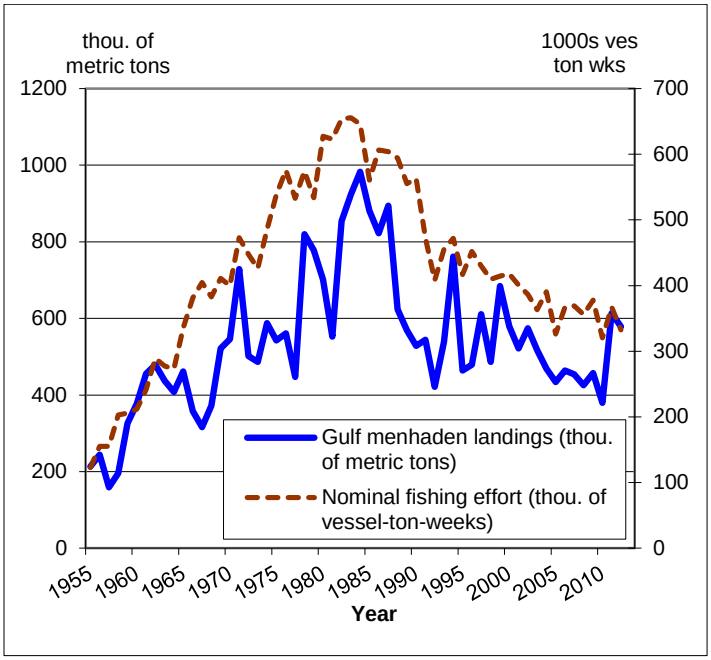


Figure 1. Gulf menhaden landings and nominal fishing effort, 1955-2012.

The 2012 gulf menhaden fishing season opened on April 16th. Despite a windy start mainly at the western Louisiana ports of Abbeville and Cameron, landings for April (39,723 t) were the best in over a decade (51,766 t in April 2000). Weather in May was fair and fish schools "showed" very well east of

the Mississippi River. Indeed, spotter pilots reported high abundances of fish schools from Mississippi Sound to Breton Sound in numbers not normally seen until mid-summer. West of the Mississippi River, best catches occurred off Morgan City, Louisiana, and vicinity. Landings in May (131,306 t)(Fig. 2) followed suit and were the best monthly totals for May in 25 years (166,344 t in 1987).

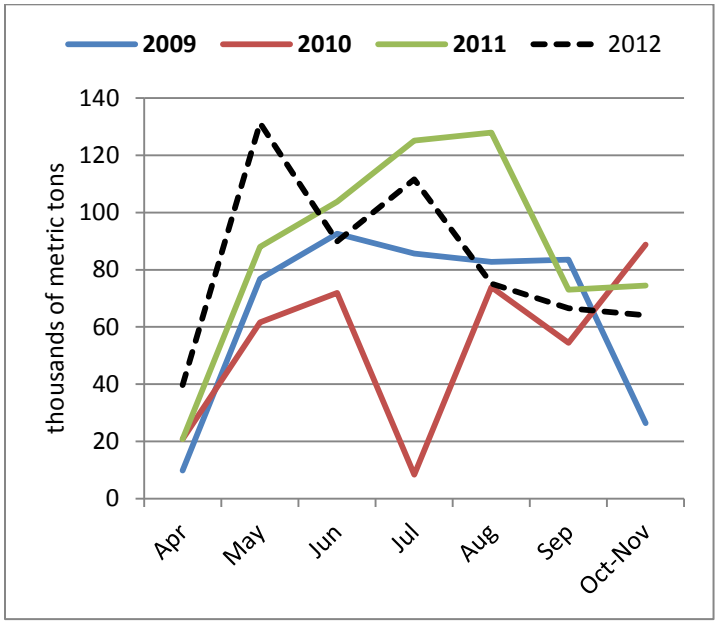


Figure 2. Gulf menhaden landings by month, 2009-2012.

Fair weather continued in June, although catches declined (89,947 t) as the fleet lost some fishing time to a low pressure system that drenched the Florida Panhandle in early June and Tropical Storm Debby that entered the eastern Gulf of Mexico in late June.

Fair weather and good catches resumed in July (111,598 t), and the tropics were unusually quiet in terms of cyclonic systems. Notwithstanding, Tropical Strom Ernesto made landfall in the Yucatan in early August and windy conditions persisted in the northwest Gulf through mid-month. Hurricane Issac started brewing in the Caribbean during the week of August 20th and as it entered the Gulf, spotter pilots reported fish were difficult to locate. The slow-moving Hurricane Issac made landfall the week of August 27 near the mouth of the Mississippi River and west of New Orleans. No major damage was reported to any of the fish factories or vessels from the storm; however, the fleet lost two weeks of fishing time in the wake of Issac. Landings in August declined accordingly (75,067 t).

The late summer weather moderated again and by mid-September good catches resumed at all ports. Landings in September amounted to 66,512 t. Weather in the northern Gulf at the outset of October was wet and windy; by the latter half of the month fair conditions prevailed and catches improved (64,209 t).

As during the previous fishing season, menhaden industry managers reported historical low fish oil yields in 2012, as well as low protein content of the processed fish meal. Reasons for these conditions are uncertain, although the drought of summer 2012 may have exacerbated the situation.

A total of 37 vessels reported unloading gulf menhaden for reduction in 2012 - 35 regular steamers, one run boat, and one small bait vessel which unloaded a small quantity of fish for reduction at the Abbeville fish factory. The run boat does not fish, but rather transfers menhaden from steamers on the fishing grounds to the factory.

Age Composition of Gulf Menhaden in 2012

About 7,900 gulf menhaden were aged from the 2012 port samples (Fig. 3). From the preliminary catch-at-age matrix, coastwide age-2 fish (67%) outnumbered age-1 fish (27%) by a wide margin (Table 1); age-2 gulf menhaden predominated at all ports. At Moss Point age-2 gulf menhaden (61%) outnumbered age-1s (38%) by a wide margin. At Empire age-2s (48%) barely edged out age-1s (42%). At Abbeville age-2s (89%) overwhelmed age-3+s (7%) and age-1s (4%).

The age profile at Cameron was perplexing and unprecedented where age-2s (92%) swamped age-1s (7%). Normally, the reverse is true at Cameron, that is, age-1s usually comprise >70% of the catch. Cause for this reversal maybe that the 2010 year class of gulf menhaden is a dominant one, whose numbers and distribution have deluged even the catches off western Louisiana. Plant personal and vessel captains at Cameron commented that the average size of menhaden in the catches during 2012 was noticeably larger. Also, the Cameron fleet did not fish as frequently in Texas waters during 2012, where younger and smaller fish tend to occur.

Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the gulf menhaden fishery, 2008-2012; 2012 data are preliminary.					
Year	**Age-0**	**Age-1**	**Age-2**	**Est. total number of fish caught in billions**	**Landings in thou. of metric t**
2012	<1%	27%	67%	6.57	578.4
2011	1%	63%	32%	7.21	613.3
2010	-	53%	40%	3.89	379.7
2009	-	13%	73%	3.62	457.5
2008	-	27%	68%	3.61	425.4

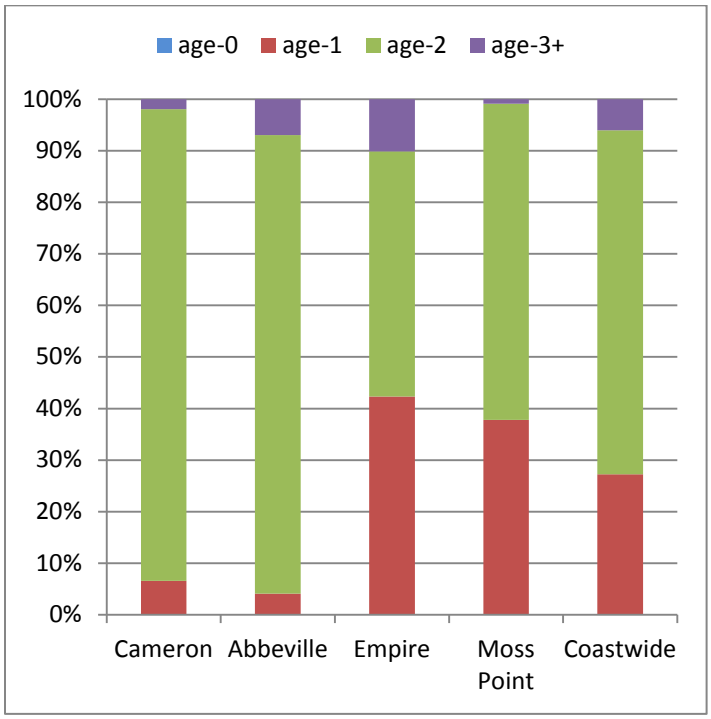


Figure 3. Percent estimated numbers-at-age of gulf menhaden by port in 2012.

Fishing Effort in 2012 and Review of the 2012 Forecast for Gulf Menhaden

Nominal fishing effort for the gulf menhaden fishery during 2012 is estimated at 332,700 vessel ton weeks. This is down 9% from nominal fishing effort in 2011 (367,200 vessel ton weeks).

In March 2012, we anticipated that nominal fishing effort during 2012 could amount to 330,000 vessel ton weeks with 38 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2012 gulf menhaden landings of 482,000 t with 80% confidence levels of 359,000 and 605,000 t. A "hindcast" using our forecast model and actual nominal fishing effort in 2012 produced a post-season forecast of 485,000 t with 80% confidence levels of 362,000 and 608,000 t. Actual landings of 578,362 t were 19% greater than our post-season forecast.

Forecast for the 2013 Gulf Menhaden Fishing Season

We expect that four menhaden factories (Moss Point, MS, and Empire, Abbeville, and Cameron, LA) will process gulf menhaden in 2013. Our best estimate of vessel participation is for 35 vessels: 34 regular steamers and one run boat. Based on average nominal fishing effort for recent years by vessels expected to be active in 2013, we estimate that nominal fishing effort in 2013 may be about 315,000 vessel ton weeks; with this level of nominal fishing effort, we forecast 2013 gulf menhaden landings of 475,000 t, with 80% confidence levels of 352,000 and 597,000 t. Given the number of age-2 fish caught last year, age-3 gulf menhaden should be in good abundance from Morgan City to Abbeville in 2013. Likewise, age-1s were fairly abundant in landings at Moss Point and Empire last year, despite the apparent strength of the 2010 year class as age-2s; thus, age-2s should also be abundant in 2013 off the central Louisiana coast.

ATLANTIC MENHADEN FISHERY

Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2012

Final catch information indicated that 2012 landings of Atlantic menhaden for reduction amounted to 160,627 t (529 million standard fish) (Fig. 4). This is 8% less than purse-seine landings for the 2011 season (174,021 t), and 2% less than average landings for the previous five years (163,289 t). As has been the case since 2005, only one menhaden factory, the plant at Reedville, Virginia, operated on the Atlantic coast in 2012.

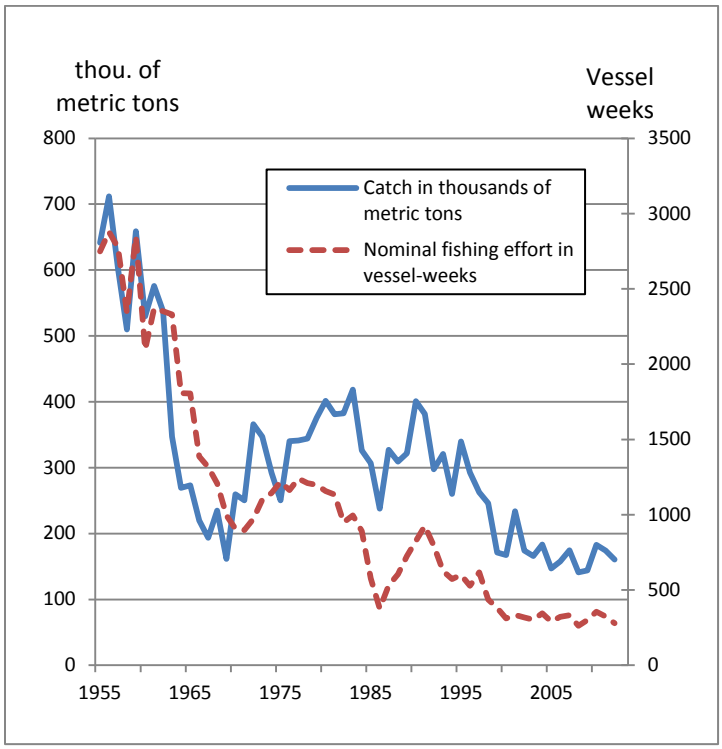


Figure 4. Atlantic menhaden landings and nominal fishing effort, 1955-2012.

Landings of Atlantic menhaden for reduction during May 2012 were good (15,142 t) and rivaled those for May of recent years (Fig. 5). Landings for the 2012 fishing season increased gradually in June (29,377 t) and July (35,066 t), peaked in August (39,350 t), then declined in September (23,640 t), October (16,829 t), and November (1,222 t).

The winter of 2011-2012 was remarkably warm and mild. Large schools of menhaden were reported in Long Island Sound in early April. Virginia pound nets in the Northern Neck area had good catches of large menhaden throughout April. Spotter pilots reported good signs of menhaden schools off the New Jersey coast in early May.

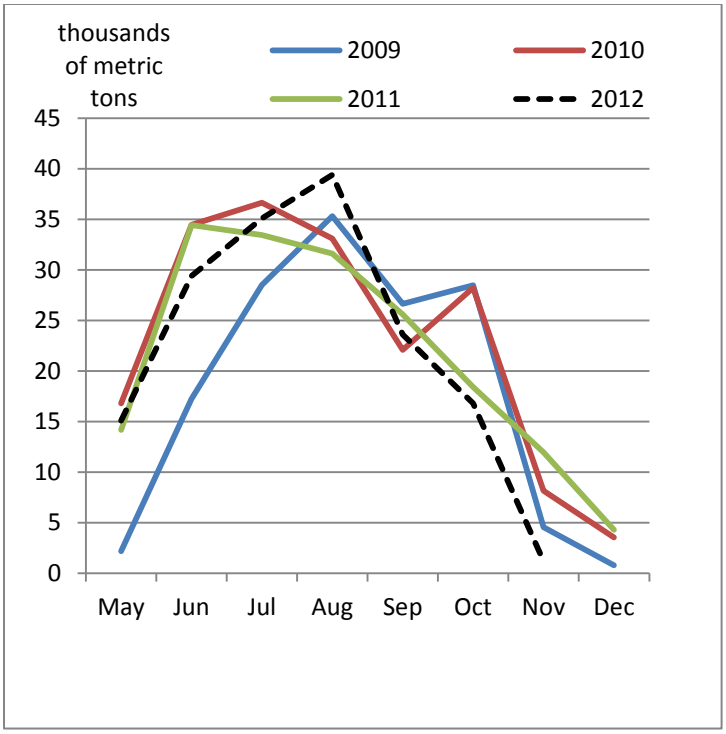


Figure 5. Atlantic menhaden landings by month, 2009-2012.

Virginia reduction vessels, also known as steamers, and snapper boats, purse-seine vessels fishing for bait, made initial sets on menhaden schools in Chesapeake Bay during the week of May 7th. Catches were fair in May with most occurring near the mouth of the Rappahannock River and in mid-Bay. Fish remained scattered in Chesapeake Bay during early June and a few steamers from Reedville made good catches off the New Jersey coast.

By mid-June menhaden schools were abundant in near-shore ocean waters from Virginia to New Jersey, as well as in Chesapeake Bay. Best catches during late June through August occurred in lower Chesapeake Bay and off Virginia's Eastern Shore barrier islands. As was the case the previous summer, spotter pilots reported good concentrations of menhaden schools off the New Jersey coast, but reduction vessels were reluctant to fish farther north when fish were so abundant in Virginia waters. Landings in summer 2012 often exceeded factory capacity and vessels often "rafted" at the dock for a day waiting to unload. One reduction vessel had an engine room fire in early July and was tied-up for repairs for about a month. Virginia snapper boats made good catches for bait in Chesapeake Bay June through September, then "cut out" in late October.

Fair weather prevailed during September through mid-October and catches remained good especially in lower Chesapeake Bay. The Reedville fleet began catching migratory roe menhaden off the Delmarva Peninsula from mid- to late October. During the last week of October Hurricane Sandy passed off the North Carolina coast, then slammed into the Mid-Atlantic coast on October 29th. The fish factory in Reedville experienced minor flooding, but no major damage. After Sandy's passage ocean waters remained turbid for several weeks. A series of nor'easters in November made fish spotting and purse seining challenging through Thanksgiving; a few sets were made in mid-month off Smith Point near the fish factory at Reedville. Final purse-seine sets for reduction in 2012 occurred 5-8 miles off Surf City, North Carolina, on November 28th. The factory at Reedville "cut out" for the year on December 3rd.

Bait purse-seining for menhaden off the New Jersey coast was very good throughout summer 2012. Bait purse-seiners made some early sets in May in Delaware Bay, then fished mostly in ocean waters for the remainder of summer. Spotter pilots reported concentrations of large schools throughout summer. Logbooks from bait purse-seiners noted that at one point in August spotter pilots had difficulty finding schools small enough to set on.

As occurred in 2011 in Narragansett Bay, Rhode Island, a few purse-seine sets for bait were made on menhaden schools in May, however, these fishermen moved their operations to the New Jersey coast by June to fish on the abundance of menhaden off the coast of the Garden State.

Periodically during winter 2012-2013 large aggregations of menhaden schools have been reported along the shoals of Cape Hatteras and Cape Lookout, North Carolina.

Several fish kills were reported in 2012 and early 2013. Large numbers of menhaden died in the Quinapac River near New Haven, Connecticut, in early August and in the Neuse River, North Carolina, in early to mid-October. Large kills of small menhaden (probably large age-0s and small age-1s) occurred on consecutive weeks in January 2013 near Masonboro Inlet, North Carolina (~January 11), and off Pawleys Island, Sullivans Island, and Isle of Palms, South Carolina (~January 14-15). Low dissolved oxygen levels in the water column were suspected at several of the kills.

During 2012, thirteen purse-seine vessels (eight regular steamers and five snapper boats) unloaded Atlantic menhaden for reduction at Reedville, Virginia.

Table 2. Percent age composition of the reduction catch in the Atlantic menhaden fishery, 2008-2012; 2012 data are preliminary.

Year	Age-0	Age-1	Age-2	Age-3+
2012	<1%	15%	79%	5%
2011		42%	50%	8%
2010	2%	40%	49%	9%
2009	1%	49%	31%	18%
2008	1%	10%	71%	18%

Age Composition of Atlantic Menhaden in 2012

About 2,400 Atlantic menhaden were sampled for size and age from the 2012 reduction fishery. From the preliminary catch-at-age matrix, coastwide age-2 fish (79%) outnumbered age-1 fish (15%) by 5:1 (Fig. 6 and Table 2). Age-3+ fish (5%) ranked a distant third.

Catches for reduction off the coasts of New Jersey and Delaware during 2012 consisted mostly of age-2 (84%) Atlantic menhaden, followed by age-3+ (15%). Catches from Chesapeake Bay and ocean areas near the mouth of the Bay during summer were similar to the coastwide proportions with age-2 fish (79%) swamping age-1 menhaden (17%). During the fall fishery off Virginia and North Carolina, age-3 fish (70%) outnumbered age-2s (30%) in the catch.

Almost 1,000 Atlantic menhaden were sampled for size and age from the bait fisheries on the East coast during 2012. Bait samples from snapper boats in Chesapeake Bay consisted of age-2s (83%), age-3+s (10%), and age-1s (7%). Preliminary bait samples from off the New Jersey coast were mostly age-3 (47%) and age-2 (40%) fish, with a smaller proportion of age-4+ fish (13%).

The high proportion of age-2 Atlantic menhaden in the catch-at-age matrix for the reduction fishery (79%) was not unexpected given the high proportion of age-1s in the catch in 2011. This suggests that the 2010 may be a relatively strong year class. Similar circumstances two years ago, suggest good recruitment for the 2009 year class also. With consecutive good year classes of Atlantic menhaden in 2009 and 2010, age-3 and -4 fish should be abundant in the Mid-Atlantic and southern New England in summer 2013.

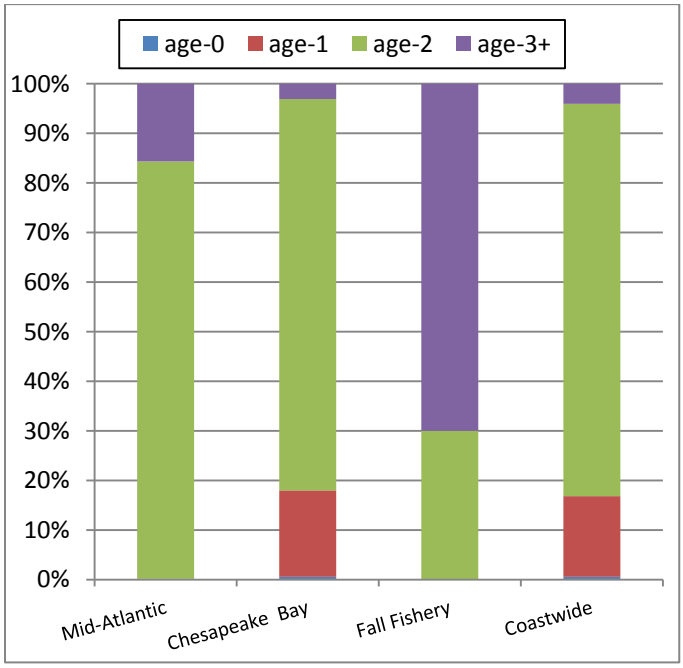


Figure 6. Percent estimated numbers at-age of Atlantic menhaden by area in 2012.

Fishing Effort in 2012 and Review of the 2012 Forecast for Atlantic Menhaden

Nominal fishing effort in 2012 was estimated at 279 vessel weeks, down from 324 vessel weeks expended in 2011. The decrease in nominal effort is primarily because of the reduction in number of steamers at the factory (from nine in 2011 to eight in 2012) and the poor weather conditions in November.

Last March, we anticipated that nominal fishing effort in 2012 could amount to 300 vessel weeks, and we forecasted 2012 Atlantic menhaden landings of 182,000 t with 80% confidence levels of 115,000 and 249,000 t. Nominal fishing effort in 2012 (279 vessel weeks) was 7% less than we expected at the beginning of the fishing season. A "hindcast" using our forecast model and actual nominal fishing effort in 2012 produced a post-season forecast of 178,000 t with 80% confidence levels of 111,000 and 245,000 t. Actual landings of 160,627 t were 10% less than our post-season forecast.

Forecast for the 2013 Atlantic Menhaden Fishing Season

Unfortunately given the management actions of recent months, forecasting Atlantic menhaden landings for reduction in 2013 would be strictly an academic exercise. In December 2012, the Atlantic States Marine Fisheries Commission approved Amendment 2 of the Fishery Management Plan for Atlantic menhaden. As an *ad hoc* approach to reducing fishing mortality and increasing spawning stock biomass, the Commission chose to cap coastwide landings of Atlantic menhaden with a TAC (total allowable catch) – the reduction and bait fisheries combined – at 80% of the previous three-year average, or about 170,800 t. Allocation is to be on a state-by-state basis, which is also based on the previous three-year mean of each state's landings. Virginia's portion is about 85% of the coastwide TAC. Within the Commonwealth, allocation between Virginia's reduction versus bait fisheries is still pending passage of a bill in Richmond, which would assign about 129,900 t to the state's reduction fishery for 2013.

In 2013 the factory at Reedville, VA, will field seven vessels; it may also accept some landings for reduction from a few snapper rig vessels. Given this fleet size, the factory should be capable of processing its 2013 allocation. If age-3 and -4 Atlantic menhaden are again abundant in the Mid-Atlantic area, Virginia vessels may steam farther north to waters offshore of New Jersey more frequently than in recent years to fish on these larger and more oily menhaden.

Combined 2012 Gulf and Atlantic Menhaden Landings

Combined landings by the gulf and Atlantic menhaden purse-seine fisheries for reduction during the 2012 calendar year amounted to 1.63 billion pounds, down slightly from landings during the 2011 calendar year which amounted to 1.74 billion pounds.

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

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