

# Forecast for the 2010 Gulf and Atlantic Menhaden Purse-Seine Fisheries and Review of the 2009 Fishing Season

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## INTRODUCTION

The 2010 fishing year is the thirty-eighth 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 2010 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, that is, 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 thirty-six year period, 1973-2009. 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 2009 gulf and Atlantic menhaden fishing seasons in terms of:

- landings and fleet size,
- age composition of the catch,
- status of the 2009 forecasts, and

we forecast landings for the 2010 gulf and Atlantic menhaden fishing seasons.



## GULF MENHADEN FISHERY

### Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2009

Final purse-seine landings of gulf menhaden for reduction in 2009 amounted to 457,457 metric tons (1,505 million standard fish). This is up 8% from total landings in 2008 (425,442 t), and up 2% from the previous 5-year mean (449,237 t) (Fig. 1).

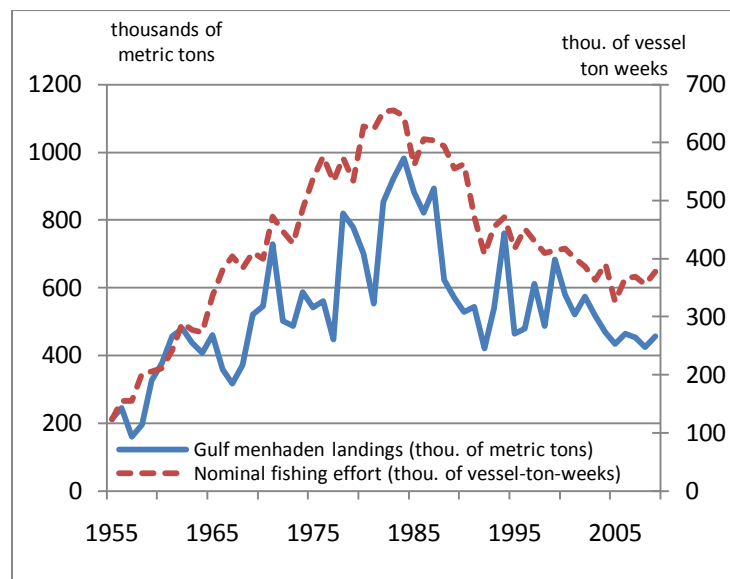


Figure 1. Gulf menhaden landings and nominal fishing effort, 1955-2009.

Gulf menhaden landings by month during 2009 were plateau-like (Fig. 2). Landings in April (9,775 t) were among the lowest for that month in recent years. Landings in May (76,779 t) rose dramatically, stayed above the 80,000 t level through September, then fell in October (26,397 t). Peak landings for the fishing season occurred in June (92,597 t).

The 2009 gulf menhaden season opened on April 20<sup>th</sup> with four fish factories active. Catches were poor April through early May because of persistent

windy weather across the northern Gulf. Fish were generally small at the start of the fishing season, fish oil yields were low, and river flows were high because of spring rains in the Mid-West and Northern Plains. By June fair and warm weather prevailed; landings improved substantially at most ports as did fish oil yields, however, catches continued to lag in the western Gulf.

Good landings continued at Moss Point, Empire, and Abbeville during July and August. Vessels at Empire lost some fishing time because Baptiste Collette Bayou had silted-in forcing fully loaded vessels to take an alternate and longer route back to the fish factory. Landings at Cameron finally improved in August.

Summer 2009 was notable for the lack of major tropical activity in the northern Gulf, and also the drought conditions that plagued southern Texas. Wind and rain from Tropical Storm Claudette, which made landfall along the Florida Panhandle in mid-August, stirred nearshore waters in the northern Gulf and helped depress landings during the latter half of August. Good landings resumed at most ports in September, although onshore winds dampened catches in mid-month. Landings were fair in October, although southerly winds affected fishing operations during the first half of the month.

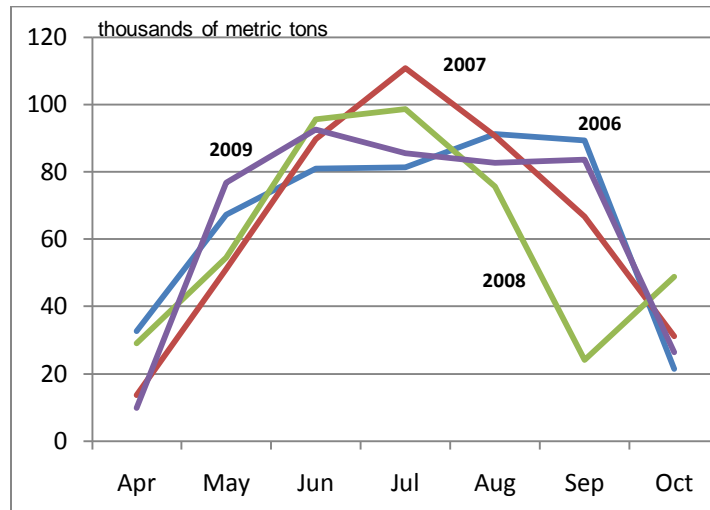


Figure 2. Gulf menhaden landings by month, 2006-2009.

A total of 41 vessels reported unloading gulf menhaden for reduction in 2009 - 39 regular steamers and two run boats. The run boats do not fish, but rather transfer menhaden from the fishing grounds to the factory.

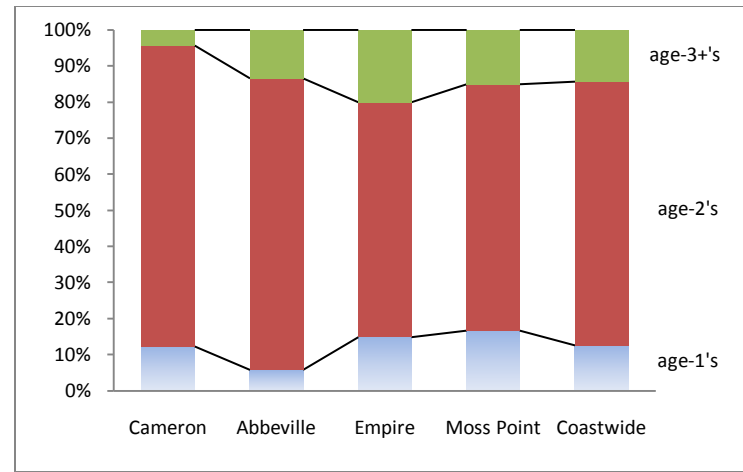


Figure 3. Percent estimated numbers-at-age of gulf menhaden by port in 2009.

### Age Composition of Gulf Menhaden in 2009

About 6,200 gulf menhaden were aged from the 2009 port samples (Fig. 3). From the preliminary catch-at-age matrix, coastwide age-2 fish (73%) swamped age-1 fish (13%) more than 5-to-1 Table 1). This predominance by age-2 fish occurred at each of the Gulf ports. At Moss Point age-2 gulf menhaden (68%) far outnumbered age-1's (17%). At Empire age-2 (64%) trumped age-1 fish (15%), as well as at Abbeville where the number of age-2's (81%) in the catch dwarfed age-1's (6%). At Cameron, a port that is historically heavily weighted toward age-1 gulf menhaden, age-2 fish (83%) outnumbered age-1 fish (12%).

Relative to the 46-year period that the NMFS has collected fishery-dependent data from the gulf menhaden fishery (1964-2009), data from the 2009 fishing season show age-1 gulf menhaden with the least representation (13%) for that age class in the catch-at-age matrices for the entire time series; average representation for age-1 fish over the period is 57%. Presumably, the 2008 year class as age-1 fish in 2009 is relatively weak as compared to the 2007 year class (age-2 fish in 2009). By the same token, the 2007 year class was thought to be relatively weak as age-1 fish during the 2008 fishery (27% of the catch-at-age), yet fishing was generally good and age-2 gulf menhaden (the 2007 year class) were abundant and dominated the landings (73%) in 2008 also.

Reasons for the decline of age-1 fish in the landings over time are not well understood. Surely, recruitment of juveniles into estuarine areas, which is believed to be largely driven by environmental factors, plays a major role. However, several

additional hypotheses have been suggested such as: 1) contraction of the fishery over time from the extremes of the species' range (Texas and Florida) towards the center of the species' range (Louisiana and Mississippi); 2) re-distribution over time of age-1 fish toward more 'inside' waters (where they become unavailable to the fishery) because marsh habitat loss across the Gulf (this is somewhat supported by data from systematic gill net surveys in Louisiana and Texas); and, 3) a "corralling-effect" which hypoxic waters of the Gulf may have on the distribution of gulf menhaden. Thus, the strength of the 2008 year class of gulf menhaden, and its relative abundance as age-2 fish in 2010, remains uncertain.

**Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the gulf menhaden fishery, 2005-2009 (\* 2009 data are preliminary).**

Year	Age-1	Age-2	Est. total number of fish caught in billions	Landings in thou. of metric t
<b>2009*</b>	13%	73%	3.62	457.5
<b>2008</b>	27%	68%	3.61	425.4
<b>2007</b>	46%	51%	4.75	453.8
<b>2006</b>	46%	47%	4.90	464.4
<b>2005</b>	44%	52%	4.51	433.8

### Fishing Effort in 2009 and Review of the 2009 Forecast for Gulf Menhaden

Nominal fishing effort for the gulf menhaden fishery during 2009 is estimated at 377,800 vessel ton weeks. This is up 6% from nominal fishing effort in 2008 (355,800 vessel ton weeks). The 2009 fishing season was the eighth consecutive year in which nominal fishing effort was less than 400,000 vessel ton weeks.

In March 2009, we anticipated that nominal fishing effort during 2009 could amount to 355,000 vessel ton weeks with 41 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2009 gulf menhaden landings of 443,000 t with 80% confidence levels of 323,000 and 564,000 t. Nominal fishing effort in 2009 (377,800 vessel ton weeks) was 6% greater than

we expected at the beginning of the fishing season. A "hindcast" using our forecast model and actual nominal fishing effort in 2009 produced a post-season forecast of 471,000 t with 80% confidence levels of 350,000 and 591,000 t. Actual landings of 457,457 t were 3% less than our post-season forecast.

### Forecast for the 2010 Gulf Menhaden Fishing Season

We expect that four menhaden factories (Moss Point, MS, and Empire, Abbeville, and Cameron, LA) will process gulf menhaden in 2010. Our best estimate of vessel participation is for 43 vessels: 40 regular steamers and three run boats. Based on average nominal fishing effort for recent years by vessels expected to be active in 2010, we estimate that nominal fishing effort in 2010 may be about 370,000 vessel ton weeks. With 370,000 vessel ton weeks of effort, we forecast 2010 gulf menhaden landings of 463,000 t, with 80% confidence levels of 344,000 and 582,000 t.

If the 2008 year class of gulf menhaden is indeed a weak one (representing only 13% of the catch-at-age matrix in 2009), then the harvest of age-2 fish in 2010 may be down from recent years. Overall landings may in turn suffer. On an optimistic note, the juvenile menhaden index developed by Louisiana Wildlife and Fisheries Department suggests that the 2009 year class of gulf menhaden may be above the long-term average. This would bode well for the harvest of age-1 menhaden in the 2010 fishery.

## ATLANTIC MENHADEN FISHERY

### Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2009

Final catch information indicated that 2009 landings of Atlantic menhaden for reduction amounted to 143,754 t (473 million standard fish) (Fig. 4). This is 2% greater than purse-seine landings for the 2008 season (141,133 t), but 11% less than average landings for the previous five years (160,641 t). As in the previous four years, only one menhaden factory, the plant at Reedville, VA (with 10 vessels), operated on the Atlantic coast in

2009. The fish factory in Beaufort, NC, closed after the 2004 fishing season.

Reduction fishing for Atlantic menhaden in 2009 started slowly, and landings during May were fair (2,184 t). Landings improved in June (17,244 t) and July (28,533 t), and peaked in August (35,335 t) (Fig. 5). Landings declined during September (26,639 t), rose slightly in October (28,486 t), then declined sharply in November (4,546 t) and December (786 t).

Despite a cool and wet spring, pound nets in Chesapeake Bay made good catches of Atlantic menhaden in March and April 2009. Virginia reduction vessels made initial purse-seine sets in Chesapeake Bay on May 19<sup>th</sup>. However, the weather was windy and cool, and fish schools were scattered and in small bunches. Through early June menhaden remained scarce in Chesapeake Bay. The Virginia fleet fished as far south as Cape Lookout on June 1<sup>st</sup>, as schools were abundant in North Carolina waters. By late June fishing was good in lower Chesapeake Bay, although Virginia vessels began making weekly trip to the central and northern coast of New Jersey where large bodies of menhaden schools were reported. The weather turned hot and humid in July and fish were abundant throughout the Bay.

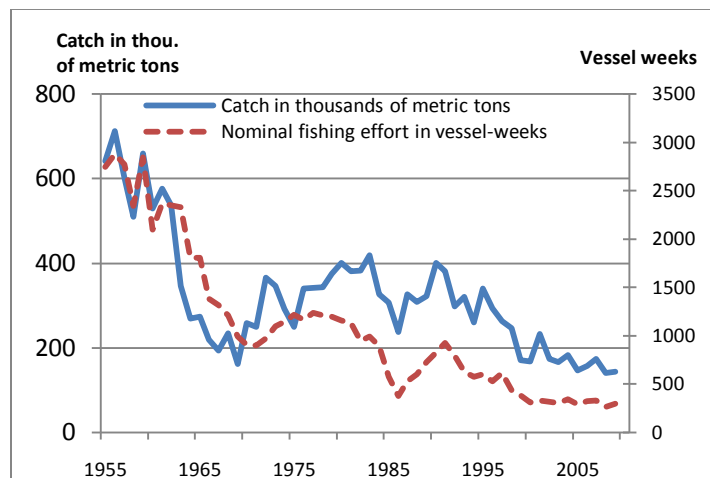


Figure 4. Atlantic menhaden landings and nominal fishing effort, 1955-2009.

Beginning in mid-July, the fish factory in Reedville began to have mechanical problems processing the catches. These problems persisted through early October. During many weeks vessels lay at the dock one to two days loaded with fish before the factory could accept their catch and the vessels could get back on the fishing grounds. Throughout most of summer, vessels fished under factory-

imposed daily and/or weekly limits, so as not to overload the factory.

Menhaden remained abundant in Chesapeake Bay through August, and the glut of fish continued to slow processing at the factory. Spotter pilots continued to report good concentrations of fish schools off the New Jersey coast. A tropical depression after Labor Day brought wind and up to 10 inches of rain to the Mid-Atlantic states, and landings declined commensurately. Catches improved in late September off Smith Point near Reedville in Chesapeake Bay, while the fleet began catching large migratory fish in the ocean off the Delmarva Peninsula during late September through mid-October.

During early November Virginia vessels made good catches of roe fish off Cape Henry, and briefly ranged as far south as Ocracoke Inlet. Tropical Storm Ida in mid-November brought high winds and flooding to the Mid-Atlantic and southern New England; winds persisted through the end of the month. Spotter pilots saw large concentrations of fish south of Cape Hatteras through mid-December, however, the Virginia vessels were unable to steam to North Carolina waters because of wind and wave conditions. Virginia menhaden boats made their final sets of the fishing season six to seven miles off Cape Henry on December 8<sup>th</sup>. The fish factory at Reedville 'cut out' for the year on December 11<sup>th</sup>.

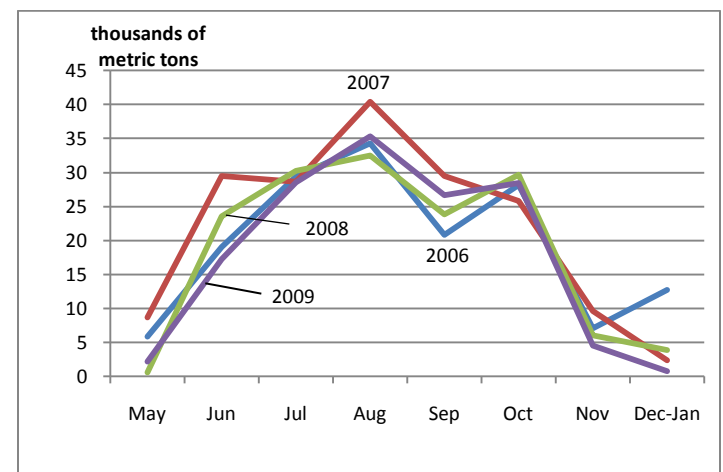


Figure 5. Atlantic menhaden landings by month, 2006-2009.

Weather along the New Jersey coast was generally cool through June. Persistent fog hampered spotter pilots' efforts to find fish. Conditions improved in July, and menhaden were generally abundant off New Jersey and Long Island, NY, through August. Catches for bait remained good



throughout summer, with some sets made in Delaware Bay in August. Most bait fishing for menhaden in New Jersey ended in mid-October.

In Long Island Sound and Narragansett Bay numerous schools of menhaden were reported by early May, and several menhaden catches for bait occurred in Narragansett Bay during late May. However, unrelenting wind and rain in June turned nearshore waters turbid. Consequently, spotter pilots were unable to locate menhaden schools from Rhode Island to Maine. In late June two bait vessels from Narragansett Bay moved their fishing operations to New Jersey for the remainder of summer.

Several fish kills were reported during 2009. The most notably occurred in the Neuse River, NC; it persisted from late August through October and was attributed to low oxygen conditions.

Twelve vessels reported landing Atlantic menhaden for reduction in 2009. Ten large purse-seine vessels, or steamers, fished regularly from the fish factory at Reedville. Two bait vessels, or “snapper” rigs, unloaded some of their catches at the reduction factory.

### Age Composition of Atlantic Menhaden in 2009

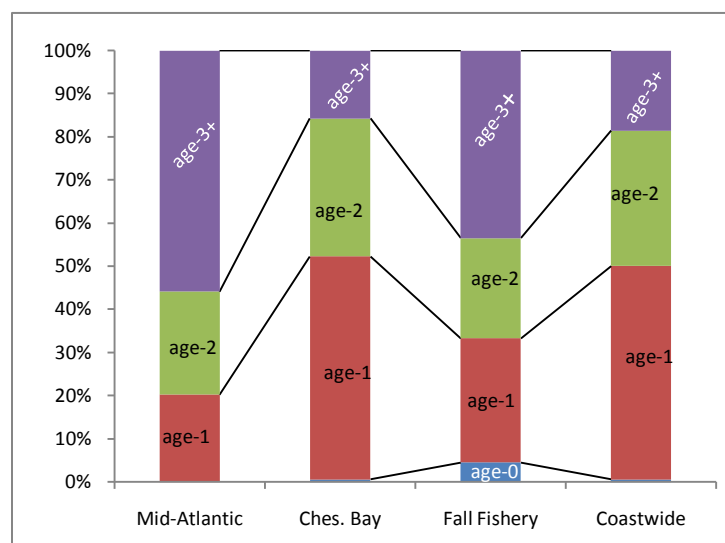
About 2,500 Atlantic menhaden were sampled for size and age from the 2009 reduction fishery.

**Table 2. Percent age composition of the reduction catch in the Atlantic menhaden fishery, 2005-2009\* (2009 data are preliminary).**

Year	Age-0	Age-1	Age-2	Age-3+
<b>2009*</b>	1%	49%	31%	18%
<b>2008</b>	1%	10%	71%	18%
<b>2007</b>	<1%	26%	65%	9%
<b>2006</b>	1%	40%	40%	19%
<b>2005</b>	2%	12%	59%	27%

From the catch-at-age matrix, coastwide age-1 fish (49%) outnumbered age-2 fish (31%) by a wide margin (Table 2 and Figure 6). Age-3+ fish (18%) ranked a distant third, while age-0 fish represented only 1% of the catch.

Catches for reduction off the coasts of New Jersey and Delaware during 2009 consisted mostly of age-3 (45%) Atlantic menhaden, followed by age-2's (24%), age-1's (20%), and age-4's (10%). Catches from Chesapeake Bay and ocean areas near the mouth of the Bay during summer were dominated by age-1 menhaden (52%), followed by age-2's (32%), age-3+'s (16%), and age-0's (1%). During the fall fishery off Virginia and North Carolina, age-3+ fish (45%) outnumbered age-1's (29%), age-2's (23%), and age-0's (4%) in the catch.



*Figure 6. Percent estimated numbers at-age of Atlantic menhaden by area in 2009.*

About 1,000 Atlantic menhaden were sampled for size and age from the bait fisheries on the East Coast during 2009. Overall bait samples were dominated by age-3 fish (46%), followed by age-2's (30%), age-1's (13%), and age-4+'s (11%). Age-2 (37%) and age-3 (34%) menhaden were nearly equally distributed in bait samples from Virginia; age-1 fish (24%) ranked third. Age-3 fish predominated in bait samples from New Jersey (62%) and Rhode Island (56%).

The high proportion of age-1 Atlantic menhaden in the reduction fishery's catch-at-age matrix for the coastwide samples (49%) and Chesapeake Bay (52%) suggests that the 2008 year class as age-1 fish in 2009 may be a relatively strong year class. The high percentage of age-1's in the Mid-Atlantic area (20%), an area traditionally dominated by age-2+ fish, tends to confirm the strength of the 2008 year class. Age-2 Atlantic menhaden (the 2008 year class) should be abundant in

Chesapeake Bay and the Mid-Atlantic area during summer 2010.

### **Fishing Effort in 2009 and Review of the 2009 Forecast for Atlantic Menhaden**

During 2009, twelve purse-seine vessels (10 regular steamers and two "snapper" boats) unloaded Atlantic menhaden for reduction; nominal fishing effort was estimated at 300 vessel weeks, up from 262 vessel weeks expended in 2008. The increase in nominal effort is primarily because one "snapper" boat made a majority of its landings in 2009 at the fish factory for reduction.

Last March, we anticipated that nominal fishing effort in 2009 could amount to 300 vessel weeks, and we forecasted 2009 Atlantic menhaden landings of 169,000 t with 80% confidence levels of 100,000 and 237,000 t. Thus, our post-season forecast is identical to our forecast. Actual landings of 143,754 t were 15% less than our forecast and post-season forecast.

### **Forecast for the 2010 Atlantic Menhaden Fishing Season**

In 2010, the fish factory in Reedville, VA, with ten vessels, will be the only active menhaden reduction plant on the Atlantic coast. A slight increase in nominal effort in 2010 is expected and will probably be attributable to "snapper" boats unloading at the fish factory for reduction. We estimate that nominal fishing effort in 2010 could amount to 315 vessel weeks. With this level of fishing effort, we forecast 2010 Atlantic menhaden landings of 167,000 t with 80% confidence levels of 99,000 and 235,000 t.

### **Combined 2009 Gulf and Atlantic Menhaden Landings**

Combined landings by the gulf and Atlantic menhaden purse-seine fisheries for reduction during the 2009 calendar year amounted to 1.33 billion pounds, up slightly from landings during the 2008 calendar year which amounted to 1.25 billion pounds.

**Fishing effort and landings in the gulf menhaden purse-seine fishery, 1955-2009**

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

**Fishing effort and landings in the Atlantic menhaden purse-seine fishery, 1955-2009**

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



