# Forecast for the 2011

# Gulf and Atlantic Menhaden Purse-Seine Fisheries and

# Review of the 2010 Fishing Season

*March 2011*

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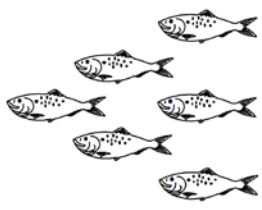
## INTRODUCTION

The 2011 fishing year is the thirty-ninth 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 2011 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-eight year period, 1973-2010. Landings in the gulf menhaden fishery have differed from those forecast by an average of 14% for the same period. In this forecast report, we review the 2010 gulf and Atlantic menhaden fishing seasons in terms of:

- landings and fleet size,
- age composition of the catch,
- status of the 2010 forecasts, and

we forecast landings for the 2011 gulf and Atlantic menhaden fishing seasons.



## GULF MENHADEN FISHERY

### Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2010

Final purse-seine landings of gulf menhaden for reduction in 2010 amounted to 379,727 metric tons (1,250 million standard fish). This is down 17% from total landings in 2009 (457,457 t), and down 15% from the previous 5-year mean (446,982 t) (Fig. 1).

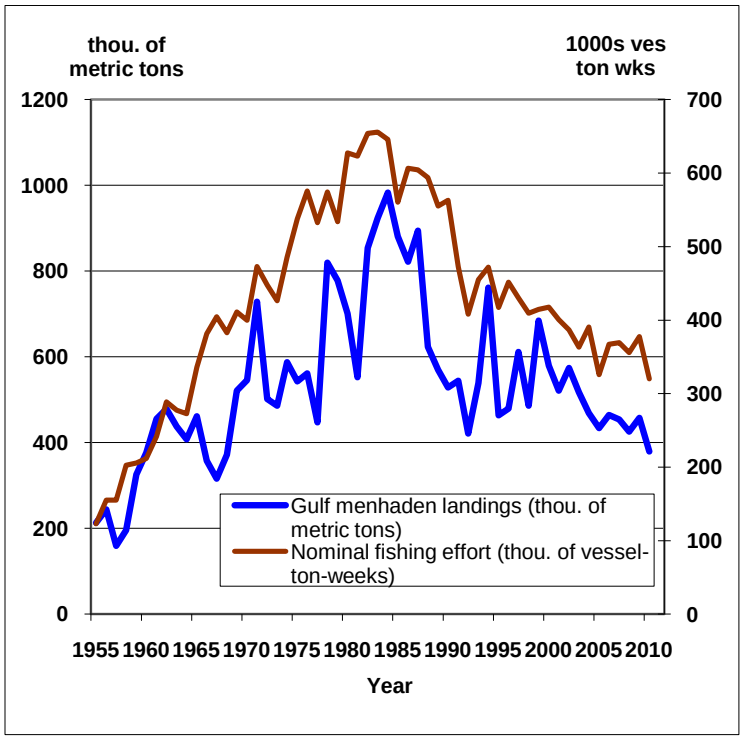



*Figure 1. Gulf menhaden landings and nominal fishing effort, 1955-2010.*

The 2010 gulf menhaden season opened on April 19th with four fish factories active. Coincidentally, British Petroleum's Deep Water Horizon (DWH) rig exploded and sank on the second day of the fishery, April 20th. Subsequent fishing area closures affected gulf menhaden fleet movements

and catches through the remainder of spring and summer 2010. Catches were fair for the first week of the fishery as light northeast winds prevailed. During the second week of the fishery (last week of April), winds switched to the south and oil from the DWH spill was pushed toward shore. State and Federal agencies responded by closing various nearshore and offshore areas to commercial fishing.

Although Mississippi Sound remained open to commercial fishing, by early May vessels from Moss Point, MS, moved to Abbeville, LA, fearing that the port of Pascagoula might close to all shipping traffic. By about May 2nd, the NMFS closed the Exclusive Economic Zone (EEZ) east of the Mississippi River to commercial fishing and the Louisiana Department of Wildlife and Fisheries (LDWF) closed state waters east of the River. LDWF followed shortly thereafter (about May 17th) by closing state waters to commercial fishing west of the Mississippi River to Point Au Fer. Thus, by about mid-May the entire gulf menhaden fleet was fishing west of about Morgan City, LA. Catches were good off western LA near Abbeville, but poor off Cameron. In late May a few vessels from Empire fished in Mississippi Sound.

Beginning in mid-June, the vessels attached to the factory in Moss Point began returning to Mississippi. Also, in mid-June LDWF re-opened Breton and Chandeleur sounds; vessels from Empire and Moss Point made good catches there. Areas east of the Mississippi River soon closed however. Mississippi Department of Marine Resources (MDMR) closed Mississippi Sound on about June 27th. LDWF again closed areas east of the River on about July 5th. Moreover, the NMFS extended area closures in the EEZ west to almost the LA-TX border by mid-July. Vessels at Moss Point lay idle all July; vessels at Empire fished as far west as Cameron. Hurricane Alex (south Texas) and Tropical Storm Bonnie (Florida Panhandle) visited the northern Gulf in July further hampering fishing operations.

Closed fishing grounds throughout the northern Gulf were gradually opened beginning in early August. MDMR reopened Mississippi Sound on about August 2nd. LDWF reopened many fishing areas east of the Mississippi River also in early August. Catches improved near Empire, Abbeville, and Cameron. Tropical Depression #5 stirred up Gulf waters in mid-August and catches were down for the remainder of the month.

In early September, the NMFS reopened the EEZ west of the Mississippi River to about the Morgan City area, but catches were only fair as Tropical Storm Hermine moved into south Texas and brought windy weather to the western Gulf. Low dissolved oxygen levels in shallow nearshore waters at Bayou Chaland, LA, purportedly caused a large fish kill of gulf menhaden in early September. Fair weather prevailed in mid-September through October and catches at all ports improved dramatically.

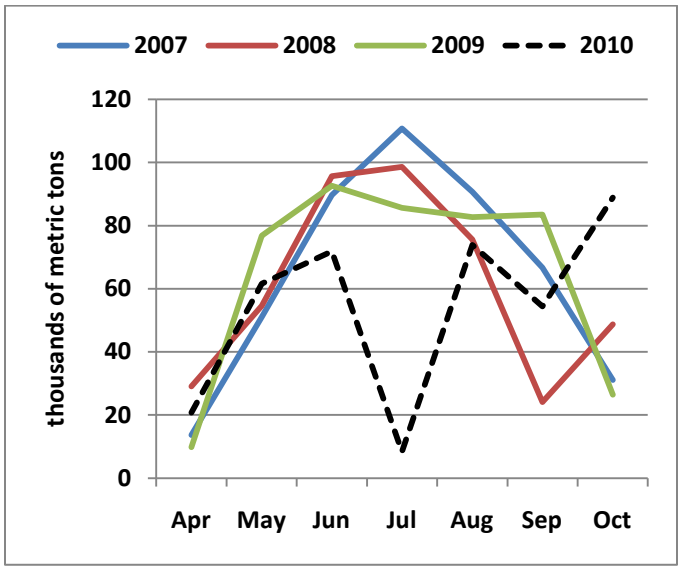



*Figure 2. Gulf menhaden landings by month, 2007-2010.*

Gulf menhaden landings by month during 2010 reflect the unprecedented area closures in midsummer (Fig. 2). Landings in April (20,790 t) and May (61,579 t) were fair relative to recent years. Landings in June (71,873 t) improved only slightly. Landings of gulf menhaden in July (8,340) were the lowest post-World War II landings for July on record. Landings improved in August (73,883 t), but dipped again in September (54,415 t). Landings climbed substantially in October (88,847 t), and were the best on record since 1983.

A total of 41 vessels reported unloading gulf menhaden for reduction in 2010 - 39 regular steamers and two run boats. The run boats do not fish, but rather transfer menhaden from the fishing grounds to the factory. A few of the steamers were “tied-up” in mid-season.

## Age Composition of Gulf Menhaden in 2010

About 3,600 gulf menhaden were aged from the 2010 port samples (Fig. 3). From the catch-at-age matrix, coastwide age-1 fish (53%) outnumbered age-2 fish (40%)(Table 1). At Moss Point age-2 gulf menhaden (60%) outnumbered age-1s (33%) almost two-to-one. At Empire age-1 gulf menhaden (53%) were more numerous than age-2 fish (41%). At Abbeville, age-2s (53%) outnumbered age-1s (36%). At Cameron, age-1 gulf menhaden (79%) swamped age-2 fish (18%).

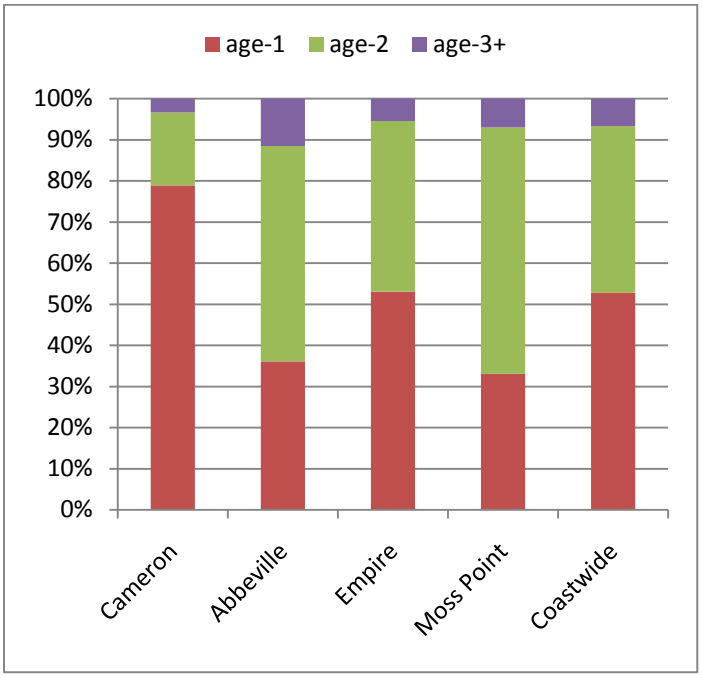



*Figure 3. Percent estimated numbers-at-age of gulf menhaden by port in 2010.*

**Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the gulf menhaden fishery, 2006-2010.**

| Year | Age-1 | Age-2 | Est. total number of fish caught in billions | Landings in thou. of metric t |
|---|---|---|---|---|
| **2010** | 53% | 40% | 3.89 | 379.7 |
| **2009** | 13% | 73% | 3.62 | 457.5 |
| **2008** | 27% | 68% | 3.61 | 425.4 |
| **2007** | 46% | 51% | 4.75 | 453.8 |
| **2006** | 46% | 47% | 4.90 | 464.4 |

## Fishing Effort in 2010 and Review of the 2010 Forecast for Gulf Menhaden

Nominal fishing effort for the gulf menhaden fishery during 2010 is estimated at 320,300 vessel ton weeks. This is down 15% from nominal fishing effort in 2009 (377,800 vessel ton weeks). The decline in nominal fishing effort in 2010 was primarily because of fishing area closures in the wake of the DWH oil spill.

In March 2010, we anticipated that nominal fishing effort during 2010 could amount to 370,000 vessel ton weeks with 43 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2010 gulf menhaden landings of 463,000 t with 80% confidence levels of 344,000 and 582,000 t. Nominal fishing effort in 2010 (320,300 vessel ton weeks) was 13% less than we expected at the beginning of the fishing season. A "hindcast" using our forecast model and actual nominal fishing effort in 2010 produced a post-season forecast of 404,000 t with 80% confidence levels of 282,000 and 526,000 t. Actual landings of 379,727 t were 6% less than our post-season forecast.

## Forecast for the 2011 Gulf Menhaden Fishing Season

We expect that four menhaden factories (Moss Point, MS, and Empire, Abbeville, and Cameron, LA) will process gulf menhaden in 2011. Our best estimate of vessel participation is for 40 vessels: 37 regular steamers and three run boats. Based on average nominal fishing effort for recent years by vessels expected to be active in 2011, we estimate that nominal fishing effort in 2011 may be about 350,000 vessel ton weeks. With 350,000 vessel ton weeks of effort, we forecast 2011 gulf menhaden landings of 437,000 t, with 80% confidence levels of 318,000 and 556,000 t.

# ATLANTIC MENHADEN FISHERY

## Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2010

Final catch information indicated that 2010 landings of Atlantic menhaden for reduction amounted to 183,085 t (602 million standard fish) (Fig. 4). This is 27% greater than purse-seine landings for the 2009 season (143,754 t), and 20% greater than average landings for the previous five years

(152,717 t). As in the previous five years, only one menhaden factory, the plant at Reedville, VA (with 10 vessels), operated on the Atlantic coast in 2010.

Reduction fishing for Atlantic menhaden in 2010 started early relative to recent years, and landings during May were exceptionally good (16,810 t; best landings in May since 2004). Landings more than doubled in June 2010 (34,484 t), peaked in July (36,652 t), then declined in August (33,117 t) and September (22,103 t)(Fig. 5). Landings rose slightly in October (28,224 t), then declined sharply in November (8,159 t) and December (3,536 t).

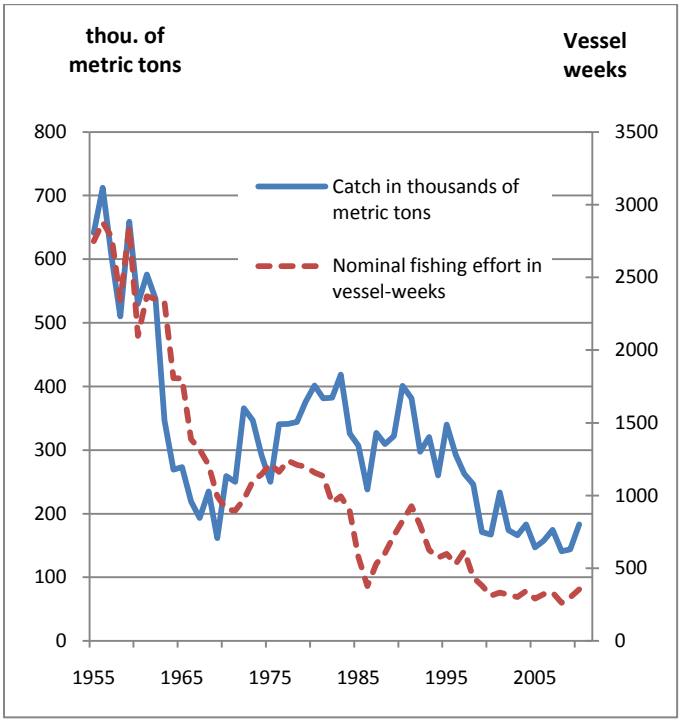



*Figure 4. Atlantic menhaden landings and nominal fishing effort, 1955-2010.*

After a cold winter of 2009-10 in the Mid-Atlantic and the Carolinas, spring 2010 came relatively early and coastal water temperatures climbed accordingly. Large numbers of menhaden schools appeared off the Virginia and North Carolina coasts in late April and early May. Menhaden were abundant in Chesapeake Bay during the first week of May. Virginia "snapper rig" vessels made initial sets on menhaden schools for bait on May 5th and 6th. The reduction fleet made initial purse-seine sets in Chesapeake Bay during the week of May 10th, nearly two weeks earlier than initial sets in recent years. Through mid-May, catches were best near the mouth of the Bay around Cape Charles. By late May, catches were best off the Rappahannock River.

During early June, menhaden were most abundant near Smith Point adjacent the Reedville factory and also at the Bay mouth. At this time the fish factory began experiencing a series of processing problems which were exacerbated by an abundance of menhaden in Chesapeake Bay and adjacent waters. During many weeks vessels lay at the dock one to two days loaded with fish before the factory could accept their catches and the vessels could get back on the fishing grounds. Consequently, factory managers placed limits on fish catches, restricting vessels which set in the Bay to daily unloads of no more than about one-half their carrying capacity. These limits lasted through early September. Good catches continued to be made through June near Smith Point, the Bay mouth, and also off Virginia Beach and Rudee Inlet.

In early July Virginia vessels began fishing off the New Jersey coast. Good catches occurred throughout summer off Delaware Bay north to about Shark River, NJ, up to 10-12 miles offshore, and also off Virginia's Eastern Shore barrier islands. Fish were scarce in Chesapeake Bay during late July, but were abundant again in August. Vessels fishing outside Chesapeake Bay in Virginia waters in August were also put on catch limits by plant managers to prevent overburdening the factory with their unloadings.

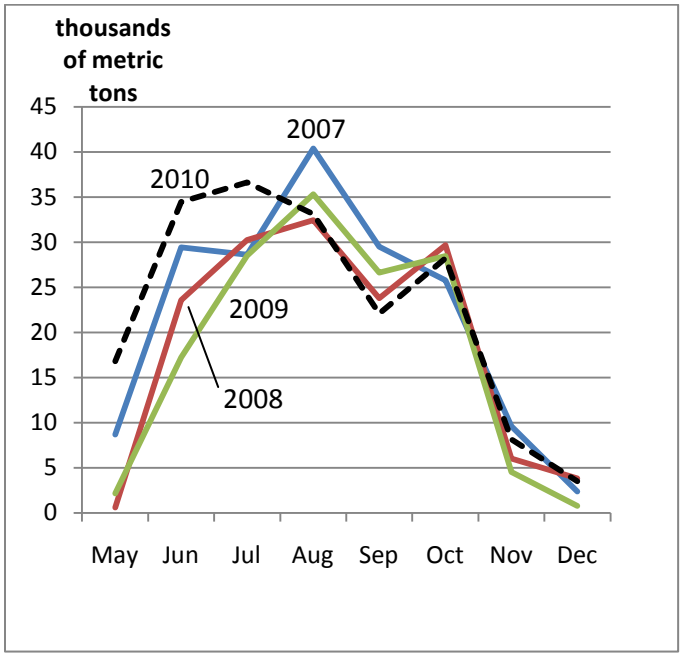



*Figure 5. Atlantic menhaden landings by month, 2007-2010.*

Hurricane Earl passed off the North Carolina and Virginia capes in early September and the fleet lost

some fishing time to rough seas. Although fish were scarce in Chesapeake Bay by mid-September, good catches occurred off Virginia's Eastern Shore, the Bay mouth, and south Jersey and Delaware. A low pressure system dropped up to 10-15 inches of rain on North Carolina and Virginia in late September, while high winds limited fishing in early October. Good catches were made in mid-October from Virginia Beach to Oregon Inlet. These were generally "summer size" fish that may have been flushed from Chesapeake Bay by the deluge of rain a few weeks prior. By late October the Virginia fleet made fair catches of roe fish along the northern Outer Banks.

Fishing in early November was limited because of strong northeast winds. A few sets occurred off Cape Henry in midmonth, and for two days in late November good catches occurred below Cape Hatteras at Ocracoke and Drum inlets. Poor weather kept the Virginia fleet from fishing in early December. Final sets for the year occurred outside the Bay mouth near Cape Charles on December 10th, after which the Reedville fish factory "cut out" for the season.

Weather along the New Jersey coast throughout summer 2010 was generally good for menhaden fishing operations. Spotter pilots saw good concentrations of fish schools by early May and throughout summer. Catches for bait off New Jersey were good throughout summer, with some sets made in Delaware Bay. Along with New Jersey-based bait vessels, numerous bait vessels from New England fished off the New Jersey coast in 2010.

In Narragansett Bay large schools of menhaden were reported by spotter pilots in early May. A few vessels from Rhode Island made sets on menhaden for bait in late May. However, fish schools then became scarce, state managers closed Narragansett Bay to menhaden fishing, and Rhode Island bait vessels moved their fishing operations to New Jersey for the remainder of summer.

Two bait vessels from Virginia moved to Beaufort, NC, in late November in an attempt to catch menhaden for bait off the central North Carolina coast during late fall and early winter. One vessel made about three successful sets through December; the other vessel did not fish. Both vessels returned to Virginia in early January.

Fifteen vessels reported landing Atlantic menhaden for reduction in 2010. Ten large purse-seine vessels, or steamers, fished regularly from the fish factory at Reedville. Five bait vessels, or "snapper rigs", unloaded some of their catches at the reduction factory. Bait fishermen lamented that, on average, the size of menhaden in the catches in Chesapeake Bay last summer were generally small and often unsuitable for the bait markets. Mean lengths and weights of Atlantic menhaden in port samples from the Bay in 2010 were indeed smaller that in recent years, which may be indicative of relative strong 2009 (age-1s in 2010) and 2008 (age-2s in 2010) year classes.

Numerous fish kills of Atlantic menhaden were reported during 2010 and early 2011:

- Severn River, MD about July 27th [because of an algal bloom?]
- Hampton, VA, August 4th [burst fishing net]
- Northern Neck, VA, September, [low dissolved oxygen]
- Wildwood, NJ, [burst fishing net]
- Folly Beach, SC, January 5-6 [low dissolved oxygen?]
- Sebastian Inlet and Vero Beach, FL, January 8-10 [low dissolved oxygen?]

## Age Composition of Atlantic Menhaden in 2010

About 2,500 Atlantic menhaden were sampled for size and age from the 2010 reduction fishery. From the preliminary catch-at-age matrix, coastwide age-2 fish (48%) slightly outnumbered age-1 fish (41%)(Figure 6 and Table 2). Age-3+ fish (9%) ranked a distant third, while age-0 fish represented only 2% of the catch.

Catches for reduction off the coasts of New Jersey and Delaware during 2010 consisted mostly of age-2 (43%) Atlantic menhaden, followed by age-3s (35%), and age-4s (20%). Catches from Chesapeake Bay and ocean areas near the mouth of the Bay during summer were primarily age-2 (50%) and age-1 menhaden (45%), followed by age-3+ fish (5%). During the fall fishery off Virginia and North Carolina, age-1 fish (44%) outnumbered age-2s (28%), age-0s (19%), and age-3+s (9%) in the catch.

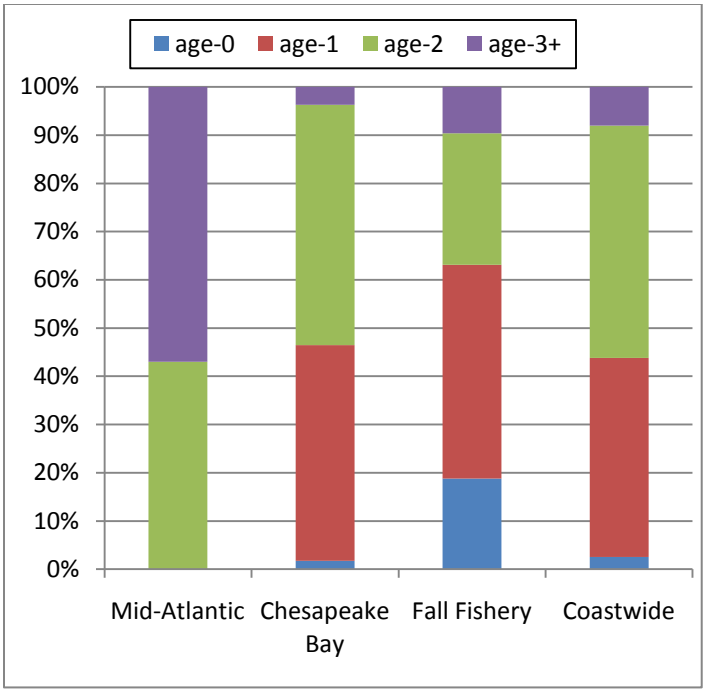



*Figure 6. Percent estimated numbers at-age of Atlantic menhaden by area in 2010.*

Over 1,500 Atlantic menhaden were sampled for size and age from the bait fisheries on the East Coast during 2010, however, only age compositions for bait samples from Virginia are available at this time. Bait samples from "snapper rigs" in Chesapeake Bay were dominated by age-2 fish (50%), followed by age-1s (39%), and age-3+s (11%).

**Table 2. Percent age composition of the reduction catch in the Atlantic menhaden fishery, 2006-2010* (2010 data are preliminary).**

| Year | Age-0 | Age-1 | Age-2 | Age-3+ |
|---|---|---|---|---|
| **2010*** | 2% | 41% | 48% | 9% |
| **2009** | 1% | 49% | 31% | 18% |
| **2008** | 1% | 10% | 71% | 18% |
| **2007** | <1% | 26% | 65% | 9% |
| **2006** | 1% | 40% | 40% | 19% |

The high proportion of age-1 Atlantic menhaden in the catch-at-age matrix for the reduction fishery from the coastwide samples (41%) and Chesapeake Bay (44%) suggests that the 2009 year class as age-1 fish in 2010 may be a relatively strong year class. Age-2 Atlantic menhaden (the 2009 year class) should be abundant in Chesapeake Bay and the Mid-Atlantic area during summer 2011.

## Fishing Effort in 2010 and Review of the 2010 Forecast for Atlantic Menhaden

During 2010, fifteen purse-seine vessels (10 regular steamers and five "snapper" boats) unloaded Atlantic menhaden for reduction at Reedville, VA; nominal fishing effort was estimated at 356 vessel weeks, up from 300 vessel weeks expended in 2009. The increase in nominal effort is primarily because of an early start to the 2010 fishing season in Chesapeake Bay and landings by "snapper" vessels at the fish factory for reduction.

Last March, we anticipated that nominal fishing effort in 2010 could amount to 315 vessel weeks, and we forecasted 2010 Atlantic menhaden landings of 167,000 t with 80% confidence levels of 99,000 and 235,000 t. Nominal fishing effort in 2010 (356 vessel weeks) was 13% greater than we expected at the beginning of the fishing season. A "hindcast" using our forecast model and actual nominal fishing effort in 2010 produced a post-season forecast of 175,000 t with 80% confidence levels of 107,000 and 243,000 t. Actual landings of 183,085 t were 5% greater than our post-season forecast.

## Forecast for the 2011 Atlantic Menhaden Fishing Season

In 2011, the fish factory in Reedville, VA, will reduce its fleet to nine vessels, down one from the past decade. It will be the only active menhaden reduction plant on the Atlantic coast. Because of the reduction in fleet size, we estimate that nominal fishing effort in 2011 could amount to about 300 vessel weeks. With this level of fishing effort, we forecast 2011 Atlantic menhaden landings of 184,000 t with 80% confidence levels of 117,000 and 251,000 t.

## Combined 2010 Gulf and Atlantic Menhaden Landings

Combined landings by the gulf and Atlantic menhaden purse-seine fisheries for reduction during the 2010 calendar year amounted to 1.24 billion pounds, down slightly from landings during the 2009 calendar year which amounted to 1.33 billion pounds.

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

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