North Carolina Department of Environment and Natural Resources

Beverly Eaves Perdue
Governor

Dee Freeman
Secretary

MEMORANDUM

TO: ENVIRONMENTAL REVIEW COMMISSION
The Honorable David Rouzer, Chair
The Honorable Mitch Gillespie, Co-Chair
The Honorable Ruth Samuelson, Co-Chair

FROM: Kari Barsness KKB
Director of Legislative and Intergovernmental Affairs

SUBJECT: 2012 Fishkill Annual Report

DATE: November 29, 2012

Pursuant to G.S. 143B-279.7 (c) the Department of Environment and Natural Resources to provide to the Environmental Review Commission each year a report on fish kills by December 1st of each year. Please consider the 2012 Fishkill Annual Report attached as the formal submission of this report.

If you have any questions or need additional information, please contact me by phone at (919) 707-8618 or via e-mail at Kari.Barsness@ncdenr.gov.

cc: Robin Smith, Assistant Secretary for Environment, NCDENR
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North Carolina Division of Water Quality
Annual Report of Fish Kill Events
2012

Dead menhaden – Pamlico River, 2012

North Carolina Department of Environment and Natural Resources
Division of Water Quality
Raleigh, NC

October 2012

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Introduction

The reporting of fish kill activity across North Carolina is based on protocols established by the North Carolina Division of Water Quality (DWQ) in 1996. The protocols were developed with assistance from DWQ Regional Office staff, North Carolina Wildlife Resources Commission biologists, and Division of Marine Fisheries personnel as a means to improve the tracking and reporting of fish kill events throughout the state. Fish kill and fish health investigation data are recorded on a standardized form and sent to the DWQ's Environmental Sciences Section (ESS), where the data is reviewed and compiled. Fish kill investigation forms, laboratory test results, and supplemental information sent to the ESS are entered into a central database where the information can be managed, queried and reported. The procedure also requires the notification of appropriate state officials and scientists associated with the investigation of such events. The protocols have proven successful in standardizing reporting methods and enhancing the quality and quantity of information reported from fish kill events.

Fish kill information for the current year is posted weekly from June to November on the DWQ fish kill website: http://portal.ncdenr.org/web/wq/ess/fishkillsmain. This report will also be available on the ESS website.

This document is a summary of fish kill events reported to the DWQ from January to October 2012. The report is mandated under G.S. 143B-279.7(c).

2012 Fish Kill Summary

As of Oct. 15, 2012, investigators have reported 16 fish kill events statewide for the 2012 season (Figure 1). Kill activity was documented during the year in six of the state's 17 major river basins. Kill events were reported in coastal waters as well as inland from Beaufort County westward to Mecklenburg County.

Significant events reported from inland waters included kills of striped bass and catfish on Lake Norman (Mecklenburg County), and kills involving yellow perch in White Lake and Bay Tree Lake (Bladen County).

Significant estuarine events included prolonged kills of Atlantic menhaden reported from the Neuse and Tar-Pamlico estuaries and associated tributaries in late September and early October 2012. After examination of lesion-covered fish collected at the events, experts from the NOAA marine lab in Beaufort reported the water mold *Aphanomyces invadans* as a primary factor.

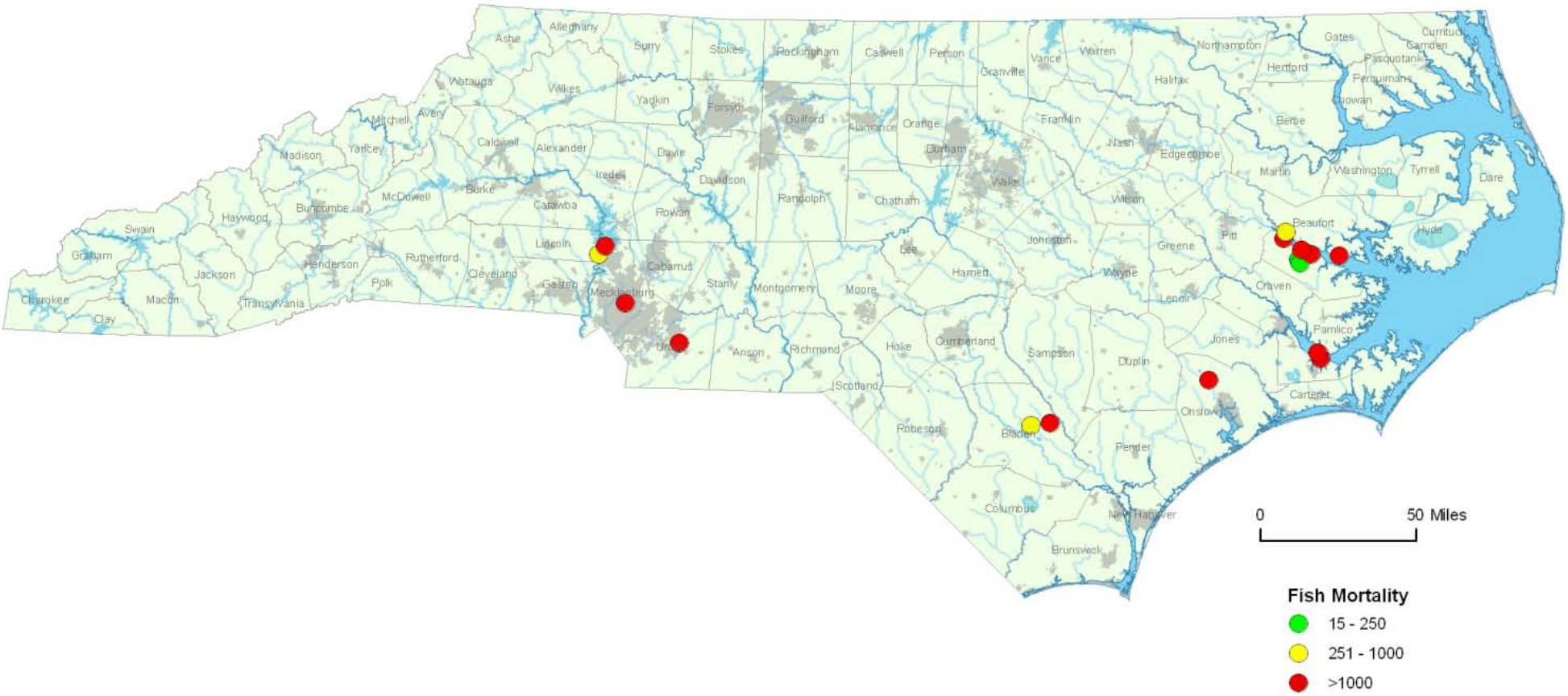
According to DWQ investigations, the total statewide mortality for the year was approximately 306,000 fish. It should be noted that the totals for the year's larger coastal events are likely underestimated due to limitations on the ability of field staff to formally document the scope of fish mortality. Reported mortality totals for individual events in 2012 ranged from 50 fish to about 100,000 fish.

ESS records fish kill events when at least 25 fish are affected and the event is confirmed by trained investigators from regional offices and cooperating agencies.

• **Total Reported Events for 2012**	**16**
• **Freshwater Kills**	**7**
• **Estuarine Kills**	**9**
• **Ocean Kills**	**0**
• **Reported Fish Mortality for 2012**	**306,250***
▪ ***Estuarine Mortality***	***224,900***
▪ ***Freshwater Mortality***	***81,350***
• **Report Mortality Range**	**50 to 100,000**
• **River Basins with Kill Activity**	**6 (of 17)**

**** Considered an underestimate.***

Figure 1: Fish kill events and observed mortality reported to NCDWQ during 2012



Basin Activity

Investigators reported fish kill events in six of the state's major river basins during the 2012 season (Figure 1, Table 1). Reports of kill activity in coastal waters were received from the Pamlico and Neuse River estuaries. The estuaries have historically experienced adverse environmental conditions during warm months such as stratification, low dissolved oxygen, and high water temperatures that act as major factors in fish kill activity. Activity in other river basins across the state remained sporadic or absent, however, events were reported from several inland lakes including Bay Tree Lake (Cape Fear), Lake Norman (Catawba) and Lake Twitty (Yadkin).

Table 1: Fish kill events by basin, 1996 – 2012*

***** *No fish kill reports have been received from the Hiwassee, Little Tennessee, and Savannah basins since 1996.*

Year	Broad	Cape Fear	Catawba	Chowan	French Broad	Neuse	Lumber	Pasquotank	Roanoke	Tar/Pamlico	New/Watauga	White Oak	Yadkin	Annual Totals
1996	None	21	None	2	None	14	4	10	2	3	None	3	1	**60**
1997	None	16	3	2	2	12	3	2	None	6	None	3	10	**59**
1998	None	23	1	1	3	8	5	8	1	5	None	1	2	**58**
1999	1	14	3	1	1	16	None	2	None	11	1	3	1	**54**
2000	None	12	2	None	None	23	2	None	None	14	None	3	2	**58**
2001	None	5	4	1	None	37	None	1	None	23	None	3	3	**77**
2002	None	8	1	2	1	9	None	6	None	8	None	3	8	**46**
2003	None	3	None	2	1	21	2	2	2	6	2	None	2	**43**
2004	None	1	None	1	None	8	1	None	1	2	None	None	3	**17**
2005	None	2	None	1	None	9	1	2	1	1	None	1	1	**19**
2006	1	5	2	None	None	10	2	None	2	2	None	None	1	**25**
2007	1	1	2	1	3	10	None	1	1	5	None	None	2	**27**
2008	None	10	2	2	2	21	None	4	None	16	None	None	4	**61**
2009	None	3	None	2	None	15	None	None	None	11	None	None	2	**33**
2010	None	7	5	1	1	2	None	1	None	1	2	1	1	**22**
2011	None	5	5	2	None	8	1	3	2	4	None	None	3	**33**
2012	None	2	3	None	None	2	None	None	None	7	None	1	1	**16**
Total	**3**	**138**	**33**	**21**	**14**	**225**	**21**	**42**	**12**	**125**	**5**	**22**	**47**	**708**

Fish Mortality

The 2012 season yielded a reported mortality total of more than 300,000 individual fish. Nearly two-thirds of the year's figure is composed of Atlantic menhaden observed in the Neuse and Tar-Pamlico estuaries during late September and early October 2012. These events were protracted and widespread. Anecdotal reports indicate the total mortality reported for 2012 represents an underestimation of the numbers of fish that actually perished during the time period.

Figure 2: Reported annual fish kill events, 1997 to 2012

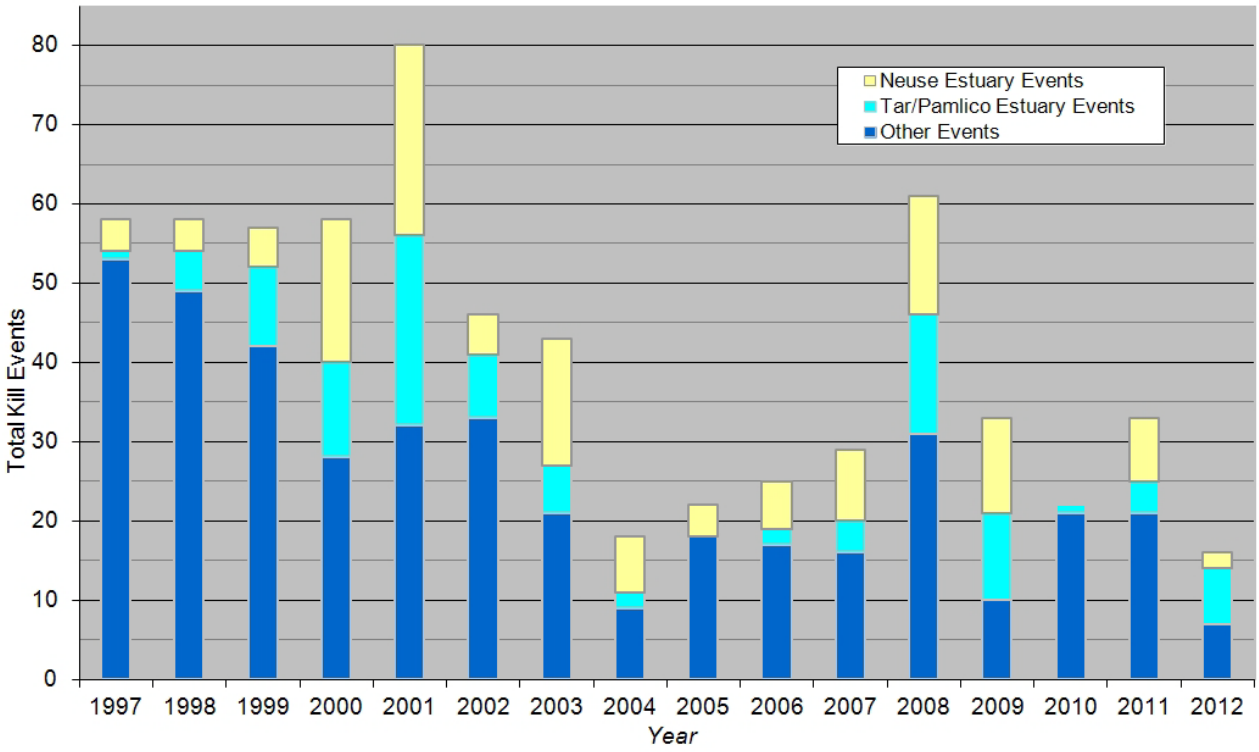


Figure 3: Reported annual fish kill mortality, 1997 to 2012

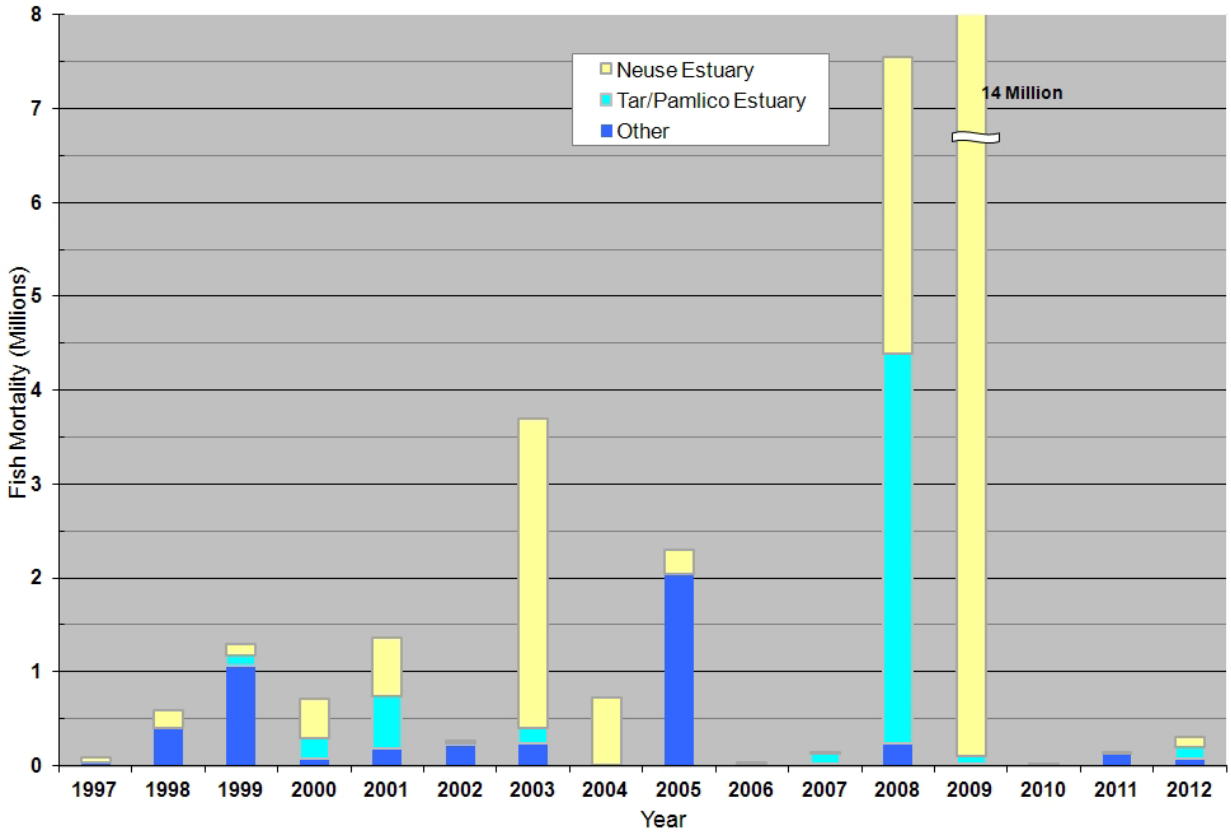


Table 2: Finfish species and observed frequencies reported for 2012 fish kill events

Species	Events Reported	Waterbody Type
CATFISH	6	Fresh
SUNFISH	6	Fresh
ATLANTIC MENHADEN	5	Estuary
LARGEMOUTH BASS	4	Fresh
FLOUNDER	3	Estuary
SHAD	3	Fresh
STRIPED BASS	3	Estuary
CARP	2	Fresh
CROAKER	2	Estuary
PERCH	2	Estuary
SPOT	2	Estuary
STRIPED MULLET	2	Estuary
YELLOW PERCH	2	Fresh
AMERICAN EEL	1	Fresh
CREEK CHUB	1	Fresh
DARTERS	1	Fresh
HOGCHOKER	1	Estuary
LONGNOSE GAR	1	Fresh
MINNOWS	1	Fresh
PINFISH	1	Estuary

Fish Species Reported

Fish kill events in 2012 involved at least 20 species of freshwater and estuarine fish. (Table 2). Freshwater species most frequently observed included sunfishes, largemouth bass and catfish. Significant striped bass and catfish mortality was observed in Lake Norman during July 2012. Striped bass are not native to southeastern lakes and are stocked by the N.C. Wildlife Resources Commission. This species is particularly susceptible to low dissolved oxygen levels and high water temperatures. Historical kills of striped bass related to dissolved oxygen depletion and summer heat have been well documented in several inland reservoirs. Striped bass kills were reported in North Carolina during 2004, 2010 and 2011.

White Lake and Bay Tree Lake (Bladen County) experienced kills of yellow perch during the early summer. A cause for the events was not reported. However, investigators and wildlife officials believe the die-offs may be related to factors involving stress, age and overpopulation. Historical reports show occasional kills of yellow perch have been observed in a number of lakes throughout southeastern North Carolina.

Atlantic menhaden were observed as the principle species of extended kills in the Neuse and Tar-Pamlico estuaries during September and October 2012. Menhaden have

historically been the principal species in coastal North Carolina fish kills and have often comprised the majority of the annual finfish mortality.

Harmful Algal Blooms Associated With Fish Kills

Investigators collected algal samples in conjunction with six fish kill events during 2012. Results indicated all algal species identified by DWQ staff were typical for local estuarine and fresh waters during the summer season and none were cited as a major factor in any kill events.

A number of algal species identified in North Carolina waters and in conjuction with fish kills have the potential to produce toxins capable of harming aquatic life. None of these toxins were identified, isolated or cited as a cause for fish kill events in North Carolina during 2012. Although lesions were reported on fish involved in kills on the Neuse and Tar-Pamlico estuaries, experts from the NOAA marine lab in Beaufort attributed the injuries to the water mold *Aphanomyces invadans.* Work by numerous investigators beginning in the 1980s has shown the majority of lesions in fish collected from North Carolina estuaries were due to *Aphanomyces invadans*. This conclusion has been confirmed since 2006 using an *Aphanomyces invadans* species-specific molecular assay developed by Vandersea et al. (2006).

2012 Summary

Freshwaters:

Kill activity reported from inland waterbodies was sporadic during the 2012 season. However, there were several notable events. Investigators witnessed the reoccurrence of a striped bass kill on Lake Norman (Mecklenburg County) during July 2012. Nearly 1,000 dead fish were recorded near the dam. Striped bass kills in North Carolina reservoirs are not unusual in summer months as high temperatures deplete oxygen in the middle and lower levels of the lakes, trapping bass that appear to be feeding or seeking refuge in lower depths. Lake Norman also experienced a similar kill of various catfish species in the same location in early August 2012 (1,200 fish). Based on underwater camera footage and recent lake testing, Duke Power investigators suspected catfish encountered low dissolved oxygen water while chasing and feeding on prey.

White Lake and Bay Tree Lake (Bladen County) experienced kills of yellow perch over an extended period in May and June 2012. Investigators reported 1,000 fish killed in May and 72,000 fish killed in June. Wildlife officials believe the die-offs may be related to factors involving stress, age and overpopulation. Historical reports show occasional kills of yellow perch have been observed in similar lakes throughout southeastern North Carolina.

Lake Twitty (Union County) was the site of a multispecies fish kill in July. Investigators reported the fish likely died from fluctuations in dissolved oxygen associated with a strong algal bloom. Lake Twitty is located in an urban area and suffers from frequent algal blooms and effects from stormwater.

Coastal Events:

Nearly two-thirds of the reported mortality for 2012 occurred within the Neuse and Tar-Pamlico estuaries beginning in late September. The lower Neuse, as well as the lower Pamlico estuary, have historically experienced adverse environmental conditions for fish populations such as low dissolved oxygen, high water temperatures, and fluctuating salinities.

Residents of the New Bern area and the local Neuse Riverkeeper reported various fish kills near the end of September and early October 2012. Initially these kills were small in number and located downstream on the Neuse River adjacent to Flanner's Beach and east towards the Ferry Terminal near Minnesott Beach. The kills predominately consisted of juvenile menhaden (100-400 mm). Lesions or red sores were observed on more than 50 percent of the fish.. Locations of these lesions were documented near the anal pore, dorsal fin and ventral areas. Fish samples submitted to the NOAA laboratory in Beaufort documented the presence of the slime mold *Aphanomyces invadans*. This species of fungus tends to reproduce more frequently as falling ambient temperatures begin to cool river temperatures. It is ubiquitous in fresher waters worldwide and has been documented as a significant factor in North Carolina’s coastal fish kills.

In October 2012, the DWQ Estuarine Monitoring Team continued to receive phone calls regarding dead, dying and/or distressed menhaden. Less than 50 percent of these fish were observed with lesions. The location of the kill seemed to continue upstream from the original areas into many major tributaries of the Neuse. These included Goose Creek, Broad Creek, Duck Creek, Northwest Creek and Beard Creek. Areas of severe salinity stratification were observed during the late summer and appeared to add to the complexity of seasonal environmental changes in the Neuse River estuary. Investigators further reported that although dissolved oxygen levels began to improve in some areas, afternoon rain showers produced runoff from adjacent riparian wetland areas into the headwaters of tributaries to the Neuse. These rain events resulted in low dissolved oxygen levels and another source of stress for local fish populations. These factors (*Aphanomyces invadans*, heavy precipitation) in concert with stratification and salt stress were suggested to be contributors to localized die-offs of menhaden and other species.

Similar conditions also were observed along the Pamlico and Pungo rivers in early October. Several Pamlico areas had experienced multispecies events earlier in the summer. The DWQ Estuarine Monitoring Team received calls in October 2012 regarding dead and/or distressed menhaden in tributaries of the Pungo River, including Pungo Creek, Tooley's Creek, Battilina Creek, Toms Creek and Upper Dowry Creek. Washington area tributaries of the Pamlico were also affected including Bath Creek,

Blounts Bay and Blounts Creek (upstream to Cotton Patch Landing). Atlantic menhaden of similar size and displaying lesions similar to those in the Neuse estuary were reported. Investigators also recorded similar environmental conditions as the Neuse events including water column stratification, and dissolved oxygen depletion due to riparian run-off after recent rains. Fish and water samples were collected from the Pamlico areas on Oct. 10, 2012 and delivered to the NOAA laboratory in Beaufort for analysis of pathogens, including *Aphanomyces invadans*.

As of Oct. 15, 2012, the events observed in the Neuse and Tar Pamlico waters are still considered to be ongoing. Updates for events occurring during the remainder of the year can be found at the DWQ website: http://portal.ncdenr.org/web/wq/ess/fishkillsmain**.**

Appendix: 2012 Fish Kill Summaries Listed by County

(see attached document)