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

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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 are 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 NC General Statutes §143B-279.7 (c).

2012 Fish Kill Summary

As of October 15, 2012, investigators have reported 16 fish kill events statewide for the 2012 season (Figure 1). Kill activity was documented during the year in 6 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 lesioned fish collected at the events, experts from the NOAA marine lab in Beaufort reported the water mold *Aphanomyces invadans* as a primary factor.

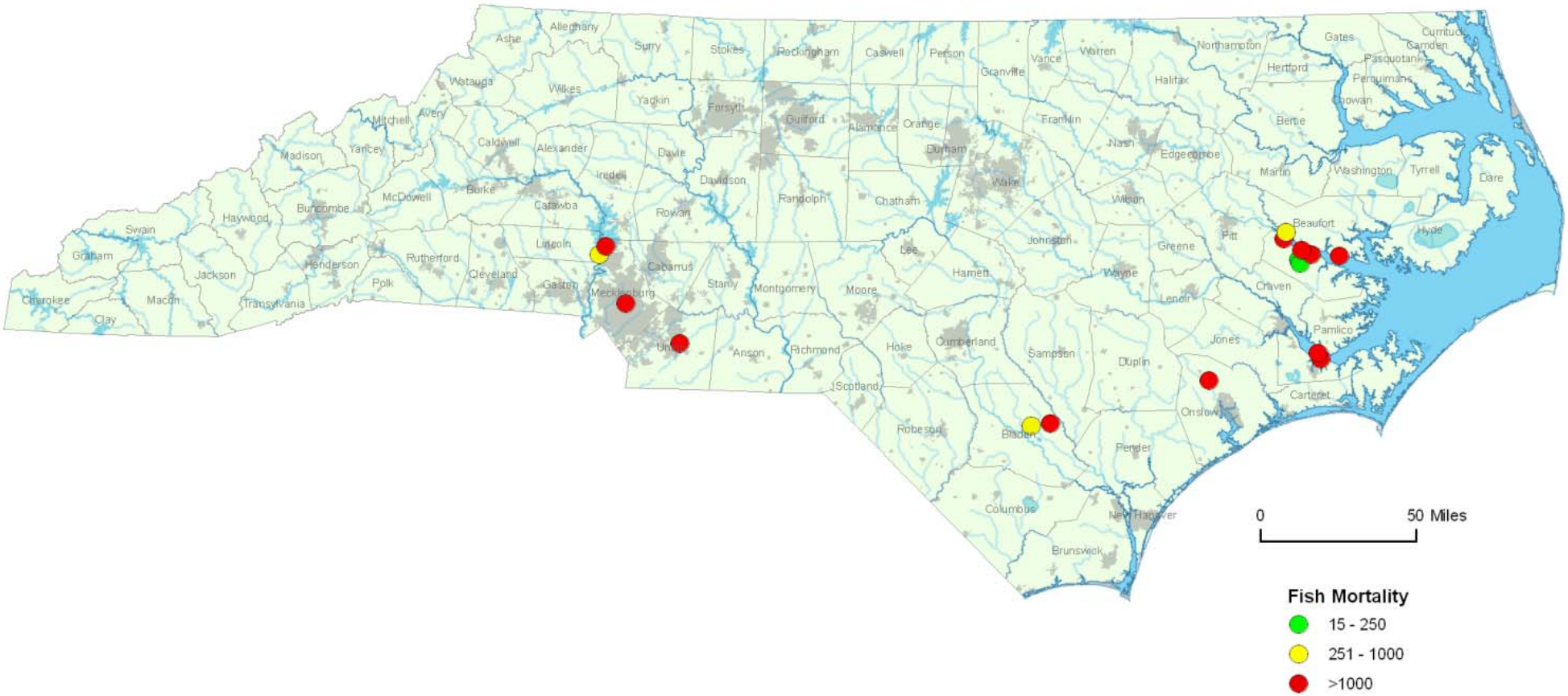
According to DWQ investigations, the total statewide mortality for the year was approximately 306,000 fish. It should be noted that the totals for the year's larger coastal events are likely underestimated due to limitations on the ability of field staff to formally document the scope of fish mortality.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

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 6 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 both 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 over 300,000 individuals. 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

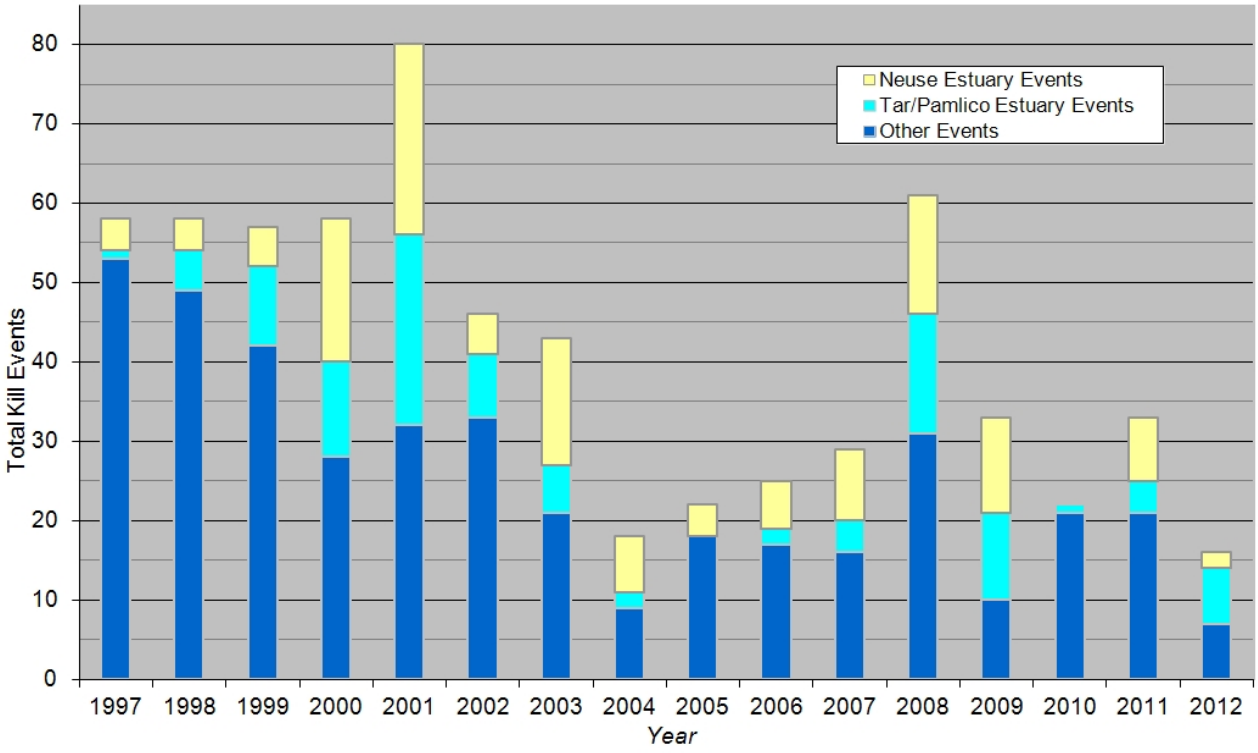


Figure 3: Reported annual fish kill mortality, 1997 to 2012

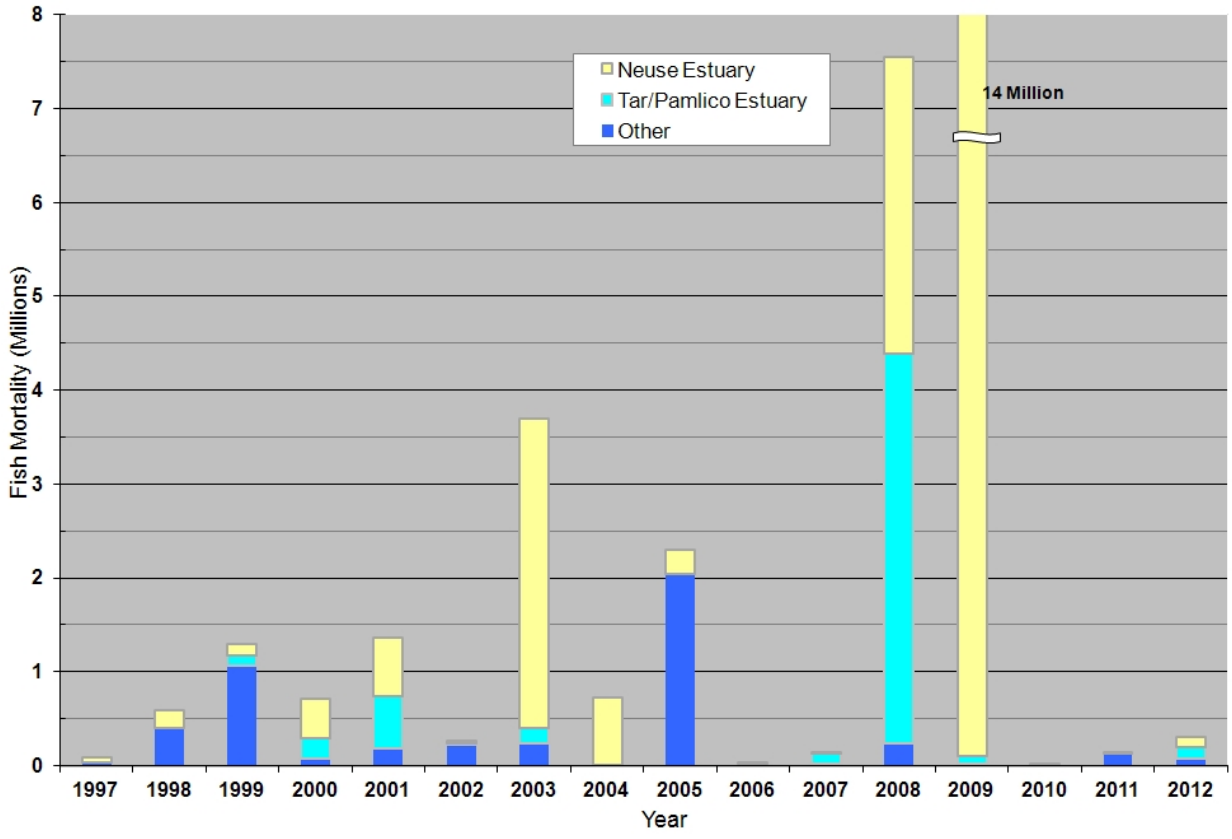


Table 2: Finfish species and observed frequencies reported for 2012 fish kill events

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 fish both freshwater and estuarine. (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 NC Wildlife Resource 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) both experienced kills of yellow perch during the early summer. A definitive 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 on both 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

Algal samples were collected by investigators 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 1000 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 (1200 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 and 72,000 fish respectively. 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.

Citizens of the New Bern area and the local Neuse Riverkeeper reported various fish kills near the end of September/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/red sores were observed on a high percentage of these fish (>50%). 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 coastal fish kills.

In October, 2012 the DWQ Estuarine Monitoring Team continued to receive phone calls regarding dead, dying and/or distressed menhaden. These fish were observed to have a slightly lower percentage of lesions (<50%). 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 were also 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 October 10, 2012 to be delivered to the NOAA laboratory in Beaufort for analysis of pathogens including *Aphanomyces invadans*.

As of October 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

Total 2012 Fish Kills: 16

Total 2012 Fish Mortality: 306258

2012 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
Beaufort					
7/10/2012	WA12001	Little Creek	Blounts Creek	100	DWQ EMT responded to a fish kill call July 10th, 2012. The first observation of dead fish was July 8th. Previous hot, calm weather strongly indicates DO drop from algal bloom or organic decomposition. Although the team did not calculate the fish, the official siting counted approximately 100 bream and sunfish of smaller size (100-200mm) in length. No lesions were observed. The past several days contained no precipitation, no wind, and hot/hazy days with temperatures exceeding over 100 degrees F.
7/11/2012	WA12002	Chocowinity Bay	Chocowinity	6500	Conversations with local residents indicated the event most likely occurred overnight. Over 12 different species were observed along approximately 1.5 square miles from the headwaters of Crawford Creek downstream throughout Chocowinity Bay. Physical data indicated very little dissolved oxygen (~0.7-3.1 mg/L) near the headwaters of the Bay. DO levels seem to be more elevated downstream towards Twin Lakes and Cypress Landing Docks. Surface salinities range from 7-9 ppt, bottom salinities (1.5 meters) range from 10-11 ppt. pH values range from 6.7 to 7.1 along the Bay proper, with the highest value near 8.1 at Twin Lakes (% DO near 134 at the Lakes). The Washington area had been enduring extreme heat indexes for several consecutive days. The Bay had bloom activity recorded in the past. It is likely that bloom activity and the overnight localized storm activity (heavy rains, strong NW winds) created unfavorable scenarios for local fish and crab populations. Water samples were sent to DWQ's Laboratory Section for further analysis. The sample contained a bloom of the green algal flagellate Nephroselmis and the dinoflagellate Gyrodinium instriatum. Small round diatoms and the raphidophyte Heterosigma were also present in the sample. Nephroselmis has been present in local estuarine rivers for the past several years, but blooms are rarely observed here. It is not known to be toxic or harmful anywhere. Gyrodinium instriatum and Heterosigma frequently bloom in local estuarine rivers. The former has been cited in the academic literature as a nuisance species in Japan. The later has been cited as causing fish kills in other parts of the world. Neither alga has been known to cause fish kills in North Carolina.
7/12/2012	WA12003	Jacks Creek	Washington	1000	EMT responded to a fish kill called in by the City of Washington at Jack's Creek, July 12, 2012. Approximately 1000 fish consisting of shad, largemouth bass, bream, sunfish, carp, and gar perished early in the morning, most likely as a result of hypoxic conditions. Physical data indicated bloom-like conditons on the surface waters (DO % saturation over 125 in the afternoon). Bottom DO was near 1.7mg/L. Water temperatures were around 30 degrees C during previous days. Scattered thunderstorms observed in the area late in the afternoon. Water samples were sent to the Environmental Sciences Section for further analysis. The sample contained a dense and diverse mix of algal taxa common in North Carolina's freshwaters during summer. The dominant taxa in the sample were small round diatoms and the filamentous bluegreen Anabaena spiroides. Opinions differ as to whether Anabaena spiroides produces toxins, and no health problems due to bluegreen algae have been reported in North Carolina.

2012 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
7/13/2012	WA12004	Blounts Creek	near Cotton Patch Landing	50	DWQ EMT responded to a fish kill called in by the Pamlico-Tar River Foundation July 13, 2012. Approximately 50 striped bass (200-500 mm) were counted along a 1.6 mile stretch upstream from Cotton Patch Landing on Blounts Creek. The kill may have occurred within the past 48 hours. Physical data recorded alon g the 1.6 mile stretch indicated water temperatures near 30 degrees C. Surface water oxygen levels were near 4.5 mg/L. DO fell below 2 mg/L at 1 meter below the surface. Salinities ranged from 9.3 - 11 ppt. No water samples were collected at the time.
9/10/2012	WA12006	Pamlico River	near Bayview Ferry	5256	The Estuarine Monitoring Team investigated a fish kill today Monday September 10, 2012. The EMT was notified of a fish kill Sunday evening at the Bayview Ferry Terminal on the north side of the Pamlico River. Approxiately 5,256 juvenile croaker and spot were found along a 3/4 mile stretch adjacent to the Ferry terminal. Although it was not observed by EMT staff , a local citizen did observe flounder, hogchokers, and mullet floating Sunday. Shorebirds were in large numbers, picking off remaining fish. Physical data recorded indicated less than 1.0 mg/L of oxygen near the kill area. Salinities were near 16 ppt. Dissolved oxygen began to increase to 7 mg/L within a mile from the shoreline. Salinities recorded at the center of the River were 11-20 ppt (surface to bottom). Weather data from the past 48 hours indicated heavy rain and winds from the North. It is likely that these winds may have caused a localized event that caused de-oxygenated waters to upwell along the shoreline. Samples were taken and sent to the DWQ's Laboratory Section and Environmental Sciences Section for further phytoplankton analysis. Results showed all taxa seen in the sample were typical in local estuarine rivers during summer. The most common taxa were small round diatoms, the green flagellate Nephroselmis, and the dinoflagellate Gyrodinium instriatum.
10/8/2012	WA12007	Pamlico River	Crystal Beach	10000	A fishkill was investigated by PTRF on October 8th, 2012 along the Pamlico River shoreline adjacent to Crystal Beach. An estimate of ~10,000 menhaden was calculated based on a 0.6 mile shoreline stretch. The fish were within 100-200 mm in length. Less than 50% of the fish had lesions. The fish were observed to be 3 - 4 days old based on the state of decay. Weather patterns during this time frame indicated heavy rainfall earlier in the week (Monday - Wednesday). Stormwater runoff may have been one of many stressors that caused this localized kill.
10/10/2012	WA12009	Pamlico River, Pungo River	tributaries of both rivers	100000	Citizens of Washington, Bath, Leechville, Belhaven, and Blounts Creek areas of the Pamlico and Pungo Rivers, along with the Pamlico Tar Riverkeeper called in various fish kills beginning in early October. The kills consisted of juvenile menhaden (100-400 mm). Lesions/red sores were also observed on a high percentage of these fish (>50%). Locations of these lesions were documented near the anal pore, dorsal fin, and ventral areas. The DWQ Estuarine Monitoring Team continued to receive phone calls regarding dead, dying and/or distressed menhaden. Affected areas documentation of decaying 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 river included the Pamlico River near, Bath Creek, Blounts Bay and Blounts Creek (upstream to Cotton Patch Landing). EMT staff recorded small algal blooms near Bath and Blounts Bay/Pamlico proper. Recent afternoon rainshowers produced run-off from adjacent riparian wetland areas into the headwaters of the Blounts Creek, as indicated by PTRF Riverkeeper's observations of highly turbid headwaters near Nancy and Herring run (which are just upstream of Cotton Patch Landing). Fish and water samples were taken October 10th , frozen and will be delivered to the NOAA laboratory for analysis of slime mold Aphanomyces invadens. Samples were taken October 10th , frozen and will be delivered to the NOAA laboratory for analysis of slime mold Aphanomyces invadens.

Total Kills for County: 7 **Total Mortality for County: 122906**

2012 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
Bladen					
5/16/2012	FA12001	White Lake		1000	Die off attributed to "natural causes". No other species involved. No lesions or sores observed on fish. Fish ranged in size from 5-9 inches.
6/26/2012	FA12002	Bay Tree Lake	east side	72000	Event estimated to have been occuring for days prior to investigation. Fish were in an advanced state of decomposition. All affected fish were identified as yellow (racoon) perch and located on the east side of the lake. Investigators reported no evidence of algal blooms or unusual water quality measurements. Similar die-offs of yellow perch were observe on White Lake during the Spring (see DWQ kill report FA12001 and DWQ Incident Report 201201663).
					Total Kills for County: 2 Total Mortality for County: 73000
Craven					
8/6/2012	WA12005	Neuse River	near Cherry Point Landing	2000	Several reports of a fish kill on the Neuse River near the mouth of Hancock Creek towards the ferry terminal were reported today Monday, August 06, 2012. The Riverkeeper indicated that the fish were several days old. His on-site investigation indicated that there was an on-going die-off that seemed to be localized in the location originally reported. The NC DWQ's Estuarine Monitoring Team received phone calls from the north side of the Neuse River near Camp Seafarer. These observations substantiated the weekend fish-kills from the south side, as the winds were continuously blowing the fish toward the north shore. Water quality data from UNC-CH's IMS indicated strong stratification, with surface salinities near 12ppt, bottom salinities over 20 ppt, and DO levels oscillating between 120% (top 2 meters) and 30% (below 2 meters). A local resident of the Cherry Point area indicated strong southerly winds Friday evening and some Saturday afternoon. He fishes the area frequently and did not see any dead or dying fish Friday, but did find some Saturday evening. Most of the flounder were over 13 inches. The menhaden, pinfish, and croaker were all under 10 inches. Estimates could be in the thousands. No samples were taken. No lesions were observed.
10/12/2012	WA12008	Neuse River	New Bern to Minnesott Beach	100000	Citizens of the New Bern area and local Riverkeeper called in various fish kills beginning near the end of September/early October. Initially these kills were smaller 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 consisted of juvenile menhaden (100-400 mm). Lesions/red sores were observed on a high percentage of these fish (>50%). Locations of these lesions were documented near the anal pore, dorsal fin, and ventral areas. Samples taken to NOAA laboratory for analysis documented the slime mold Aphanomyces invadens. This species of fungus tends to reproduce more frequently as falling ambient temperatures begin to cool the river temperatures down. It is ubiquitous in fresher waters worldwide and has been documented as a significant factor in NC coastal fish kills. In October, the Estuarine Monitoring Team continued to receive phone calls regarding dead, dying and/or distressed menhaden. These fish were observed to have a slightly lower percentage of lesion (<50%) coverage. The location of the kill seemed to continue upstream from the original areas into many major tributaries of the Neuse. This included Goose Creek, Broad Creek, Duck Creek, Northwest Creek, and Beard Creek. Heavy salinity stratification continued to add to the complexity of physical changes in the Neuse River estuary. Hypoxia began to attenuate in some areas as the water temperatures and sunlight became less problematic. However, recent afternoon rainshowers produced runoff from adjacent riparian wetland areas into the headwaters of the Neuse's major tribuataries. These factors (A. invadens, heavy precipitation) in concert with salt stress were determined to be a major reason for localized die-offs of menhaden and other species that were possibly compromised.
					Total Kills for County: 2 Total Mortality for County: 102000

2012 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
Mecklenburg					
5/21/2012	MO12001	Briar Creek	Charlotte	1275	Suspect Fish kill due to service work conducted by Atlantic Coast Contractors to a new sewer line (off line) located within the Charlotte Country Club adjacent to Briar Creek. They were using a water activated grout (Hydro Active Cut & Cut Activator) to fill holes and seal seams within the new sewer line. Product is very toxic to fish and other aquatic organisms. Some product was observed on the ground adjacent to the manhole a few feet from the stream.
7/27/2012	MO12003	Lake Norman	Near Cowans Ford Dam	873	The event involved mostly striped bass. Biologists believe striped bass chased bait fish (Alwifes) into an area of the lake where oxygen was depleted and became stressed. Once they became stressed they were unable to swim back into levels of the lake where suitable habitat existed and they perished.
8/2/2012	MO12004	Lake Norman	near Cowans ford Dam	1204	Dead catfish were observed near Cowans Ford Dam. Based on underwater camera footage and recent lake testing, investigators suspect catfish went deep chasing Alewives' and encountered low DO water (0.3 mg/l). They became stressed and some died before they could move out of the area. Duke had observed the catfish chasing the Alewives a few days ago on their underwater camera right before the die-off began. Fish tissue was collected and sent to Auburn University for analysis. Five channel and 10 blue catfish were sent for disease evaluation. The bacteria E. tarda was isolated from one of the channel catfish, but it was not thought to be significant, as no other bacterial infection was detected in the other fish examined. Gill tissue was fixed and histology revealed the presence of mild to moderate hyperplasia in six of the 15 fish presented. It was reported that the fish showed no clinical signs of disease and that the fish were in overall good health.
					Total Kills for County: 3 **Total Mortality for County: 3352**
Onslow					
6/25/2012	WL12001	Pond	Rock Creek Golf Course	3000	Kill likely due to DO fluctuations from algae bloom. Golf course maintance reported low DO on 6/24, but no time or values were provided. Kill happened overnight. Golf course said the last fertilizer or herbicide treatments had been over 2 months ago. Mats of algae seen along shoreline; water was fairly clear.
					Total Kills for County: 1 **Total Mortality for County: 3000**
Union					
7/11/2012	MO12002	Lake Twitty	near Monroe	2000	Water temperatures were 31-33, pH was 8.4-9.0, and DO was 4.5-5.0 mg/L on the surface but 0.0 mg/L five feet below the surface; consistent with an algal bloom. Lake Twitty suffers from algal blooms annually. City of Monroe personnel collected fish along the lake for disposal.
					Total Kills for County: 1 **Total Mortality for County: 2000**