

**North Carolina Division of Water Resources  
Annual Report of Fish Kill Events  
2018**

North Carolina Department of Environmental Quality  
Division of Water Resources  
Raleigh, NC

November 2018

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## 2018 Fish Kill Overview

As of November, 2018, the Division of Water Resources (DWR) investigated 29 fish kill events across North Carolina and provided reports under its investigation protocols. In addition, 48 sightings of fish kill activity were reported by the public to DWR via its online app. Some public sightings were accounted for in DWR reports but a majority of public information remained unconfirmed by DWR staff members. Confirmed and unconfirmed kill activity was reported during the year in 13 of the state's 17 major river basins and in 37 counties.

Fish kill information for the current year is posted weekly from June to November on the DWR fish kill website: <http://portal.ncdenr.org/web/wq/ess/fishkillsmain>.

- |  |                   |
|--|-------------------|
| • <b>Confirmed Kill Events investigated by DWR</b> | <b>29</b>         |
| • <b>Kill Events Reported by Public</b>            | <b>48</b>         |
| • <b>River Basins with Reported Kill Activity</b>  | <b>13 (of 17)</b> |
| • <b>Counties with Reported Kill Activity</b>      | <b>37</b>         |

## **Fish Kill Investigations**

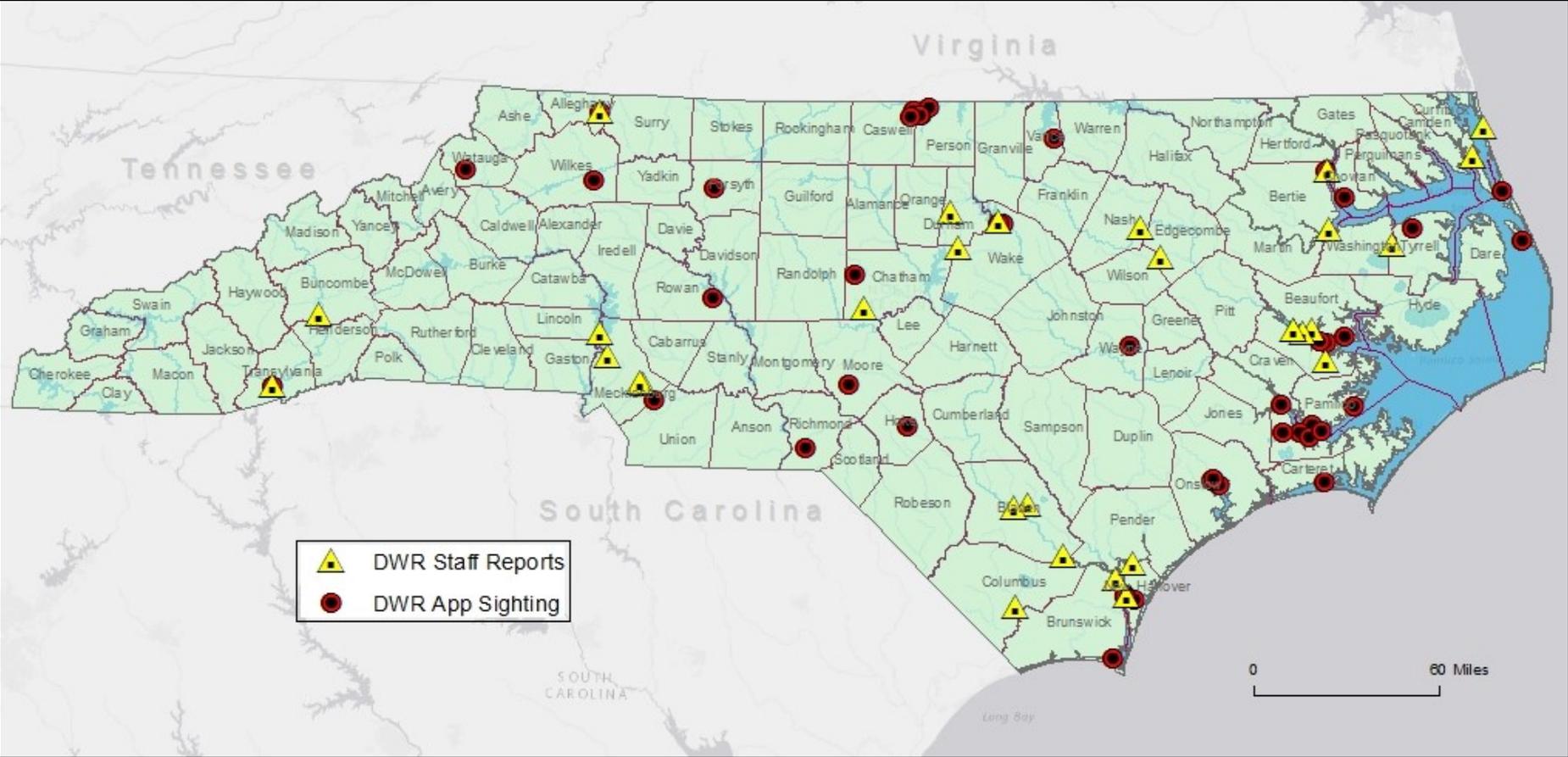
The reporting of fish kill activity across North Carolina is based on protocols established by the North Carolina Division of Water Resources (DWR) in 1996. The protocols were developed with assistance from DWR Regional Office staff, North Carolina Wildlife Resources Commission biologists, and Division of Marine Fisheries personnel 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 DWR's Water Sciences Section (WSS) where the data are compiled and reviewed. Fish kill investigation forms, laboratory test results, and supplemental information regarding fish kill events are sent to the WSS and entered into a central database where the information can be managed 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.

During 2016 DWR staff developed a mobile app that can be used by the general public to report fish kill activity across the state (see Appendix 2). The app can be accessed through a smart phone, tablet, or PC running Android or iOS platforms. It was developed so that the public could easily report locational and anecdotal information to DWR. Improved reporting of kill events will hopefully assist DWR staff with gaining a better understanding of the scale and magnitude of annual activity and thus develop a better and more complete response. The app is not designed to replace current DWR fish kill investigation procedures nor does it serve as a tool for the proper assessment of kill events. Information submitted via the app is to be passed to the appropriate regional office for follow up or further investigation under existing DWR fish kill investigation protocols, as would be the case if fish kill events were called in directly to regional offices. A link to the app is located on the DWR home page and the Water Sciences Section home page:

<https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page>.

This document is a summary of fish kill events reported to the DWR from January to October, 2018. The report is mandated under NC General Statutes §143B-279.7 (c).

Figure 1: DWR staff kill reports and fish kill app reports received during 2018



## **DWR Fish Kill Investigations.**

DWR and cooperating agency personnel provided formal reports for 29 events during 2018 (Figure 1, Appendix 1). Confirmed kills occurred throughout the state from the coast, across the Piedmont and in several western counties. Coastal events were mainly reported around Albemarle Sound, the Pamlico River, and lower Cape Fear River. Inland events occurred from Edgecombe county to as far west as Buncombe and Transylvania counties.

The year's most significant events (>100,000 fish) occurred in the Pamlico River during August and in the Roanoke and Waccamaw rivers following Hurricane Florence. A large kill was also observed in White Lake (Bladen county) following a prolonged algal bloom period coupled with environmental stressors. Summer fish kill activity in the Pamlico River follows a familiar historical pattern. The lower Neuse and Pamlico estuaries have frequently experienced adverse environmental conditions for fish populations such as low dissolved oxygen, high water temperatures, and fluctuating salinities. Consequently, these areas often produce some of the more severe kill events reported annually (Appendix 3).

## **Citizen Reports to DWR**

DWR received 48 reports of fish kill activity from the public during 2018, most often via the mobile app. The mobile reporting app has proven useful in notifying regional staff of possible fish kill activity and as a means for initial contact with regards to dead fish and related algal bloom sightings. Public reports were reviewed and forwarded as soon as possible to the appropriate regional office staff for further investigation. Reports were received from January to October and described events statewide in 27 counties (Appendix 4).

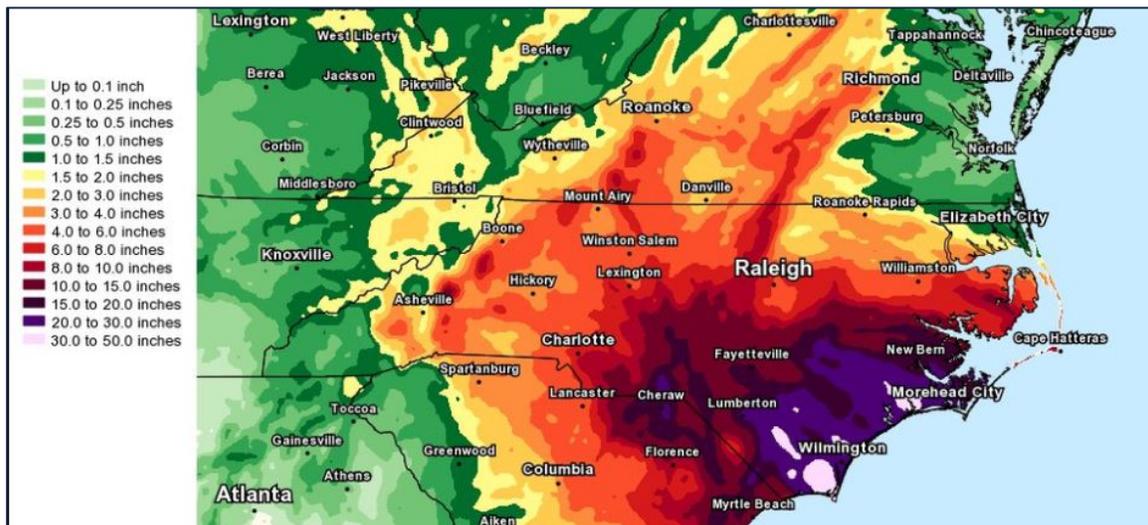
About 25 percent of public sightings were confirmed by DWR staff and reflected in formal investigations and reports. In many cases, through additional follow-up, DWR regional staff determined that the reported event did not warrant additional investigation and use of resources (i.e. few fish involved or the report was received too long after actual sighting). In other cases, DWR and cooperating agency personnel were unable to confirm anecdotal information provided by citizens through app reporting. The lack of DWR follow-up investigations in these instances was often a result of staffing and resource constraints. Proper investigations could therefore not occur or were performed too long after the fact. Discrepancies between app sightings and DWR reports were especially apparent in Hyco Lake (Person County) during May and the Lower Neuse River during August-September. Repeated app entries for both regions could not be verified by agency personnel due to constraints.

## **Hurricane Florence**

Hurricane Florence made landfall in Wrightsville Beach on September 14 as a category 4 storm. Heavy rains continued to affect the Carolinas after landfall and by September 17, Florence had dropped a maximum of 35.93 inches of rain (Elizabethtown, Bladen County) becoming the wettest tropical cyclone recorded in the state (Figure 2). As with past

hurricanes, the resulting floods flushed swamps and backwaters as well as urban areas and washed large quantities of oxygen consuming debris, and organic matter into streams. As the storm passed, dissolved oxygen (DO) levels in many systems were depleted to concentrations lethal to aquatic life. Monitoring in the wake of the storm revealed critically low DO levels (< 2.0 mg/L) and reports of fish kill activity in nearly all river basins from the Roanoke and Chowan to South Carolina. DWR staff confirmed at least eight events in the Roanoke, Cape Fear, and Waccamaw basins. Anecdotal reports, app entries, as well as reports from Wildlife Resource Commission biologists confirmed low DO levels and kill activity continued for several weeks following Florence. Many events could not be verified by DWQ due to the lack of safe access to local waterways, staff resource limitations, or the dispersal of fish carcasses by wind and currents. Investigators acknowledge that the true effects of Florence to North Carolina fisheries as well as the fish mortality associated with the storm are considerably greater than what could be documented and remain unknown.

**Figure 2: Storm Total Rainfall from Hurricane Florence (September 13 – 17, 2018)**



Map Courtesy NWS

### Algal Blooms Associated With Fish Kills

Algal samples were collected by investigators in conjunction with four fish kill events during 2018. On two occasions, cyanobacterial blooms were documented at the time of the fish kill investigation. However, the presence of an algal bloom could not be identified as the direct cause of the fish kill in either case.

A cyanobacteria bloom was also documented following a fish kill in a private pond in Edgecombe County. The pond is divided into two basins (eastern and western) which were connected by a narrow channel. The fish kill occurred in the eastern basin with an estimated fish mortality between 10,000-15,000. No visible indicators of an algal bloom

were recorded in the eastern basin at the time of the investigation. An active bloom was observed in the western basin with ~60% of the pond covered in a bright green algal scum.

Results indicated that algal bloom criteria were met in both basins, however the algal assemblage structure and densities in each basin were distinctly different. The algal density of the western basin was approximately 2.5 times greater than in the eastern basin where the fish kill occurred. The western basin showed nearly 100% dominance of the cyanobacteria, *Dolichospermum*. The algal population in the eastern basin was more diverse and dominated by the cyanobacteria, *Cylindrospermopsis*. Cyanotoxin testing from the western basin showed the presence of microcystin at a concentration of 35 ug/L (recreational guidelines from the World Health Organization cite microcystin concentrations >20 ug/L indicate high probably of acute health effects in humans). Unfortunately, cyanotoxin samples were not collected from the eastern basin during the initial investigation, and the effect of microcystins in the water on the fish is unknown. Algal blooms may cause large, diurnal fluctuations in the dissolved oxygen and pH of the water column. While hypoxic (low DO) conditions were not observed during the fish kill investigation, it's possible that respiration by the algal population outside the photo period consumed enough of the DO to cause fish distress.

Cyanobacterial blooms had been documented in White Lake beginning in November 2017 up to the time of a large fish kill which occurred in May 2018. The blooms were dominated by the cyanobacteria, *Planktolyngbya*. The algal assemblage structure and density were atypical for a Carolina Bay lake. It is believed that this bloom was one of many potential causes for the steady increase in pH observed since 2013. Prior to the fish kill event, pH measurements as high as nine was recorded in White Lake. While elevated pH may cause fish distress, this bloom could not be cited as the sole cause of the fish kill due to other documented impacts on the lake at the time.

## **2018 Fish Kill Season Summary**

Aside from the effects of Hurricane Florence, fish kill activity during the 2018 season remained relatively calm with only 29 official reports from DWR regions and cooperating agencies. The largest events were recorded in the Pamlico River during August and in White Lake (Bladen County) following the effects of an algal bloom and additional environmental stressors. Over half of the year's reports cited low DO as a major factor in the observed die-offs. Coastal waters followed a familiar historical pattern where nutrient and organic loading coupled with water column stratification depleted dissolved oxygen levels (hypoxia). Localized fish kills began to occur in the areas that exhibited continuous hypoxic conditions. These areas seemed to be clustered around the shores of the Pungo and Pamlico rivers, South River near Aurora as well as Blounts Bay.

Eight reports were received for fish kills in the wake of Hurricane Florence. Hurricane related activity was most prevalent in the Roanoke, Cape Fear and Waccamaw basins. In addition to confirmed events, DWR staff recorded numerous calls and anecdotal reports from nearly all basins stretching from the Chowan River to South Carolina.

Forty-eight fish kill sightings were reported via the DWR mobile app during the year. Public reports received through the app were forwarded to the appropriate regional staff as soon as possible, however, not all public sightings were verified by DWR personnel using standardized protocols. Only about 25 percent of mobile app reports were verified with formal investigations. The disparity was a result of decisions made within the regional offices based on time and staff resources. These decisions dictated what information received from the public could be further investigated. Staff resources are particularly limited with regards to fish kill investigations within the coastal regions. The Estuarine Monitoring Team (EMT) has acknowledged missing responses to fish kill reports despite efforts to investigate multiple simultaneous events while conducting their primary functions. Some coastal regions have experienced a marked increase in blue-green algal blooms in the past three years. Resources required to deal with the bloom complaints has increased significantly as EMT staff can receive up to four complaints a week. EMT resources have been further strained as a result of additional obligations involving assistance in sampling coal ash, emerging contaminants, and stormwater complaints.

Since its introduction in 2016, the DWR fish kill reporting app appears to provide an effective and simple web-based tool for the public to initiate contact and provide preliminary information to DWR staff regarding kill events across North Carolina. This tool provides an opportunity to gather more information on various events across the state, but does not necessarily provide guaranteed response and investigation by DWR. Comparison of data for reported versus investigated events may help to better quantify the number of events statewide and further develop appropriate response measures.

Appendix 1: Summaries of Confirmed 2018 Fish Kill  
Events Listed by County

**Total 2018 Fish Kills: 29**

**Total 2018 Fish Mortality: 487,720**

### 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
<b>Alleghany</b>					
5/29/2018	WS18001	Big Pine Creek	South of Barrett	300	Initial estimate of 300 dead fish, ranging 4" (minnows) to 10" trout were found floating in stream. No odor, discoloration, or foam present in the stream at time of fish kill. Stream parameters: pH, DO, % DO, specific conductance, temp, etc. were all normal and as expected for a mountain surface water on the date of investigation. No dead or burnt vegetation observed. Of note, NO live organisms were observed in the surface water for at least 5 miles upstream of investigation site.
<b>Total Kills for County: 1      Total Mortality for County: 300</b>					
<b>Beaufort</b>					
8/14/2018	WA18004	Pamlico River	Hawkins Beach	9,200	Citizen from Hawkins Beach noticed blue crabs gasping along the bulkhead near the entrance to the Beach boathouse. Within an hour, he saw menhaden washing up along the shoreline. It was a very localized, small event. Transects were made and a count totalled approximately 9,200 menhaden. Physical measurements indicated DO values near 6 mg/L, warm temperatures near 30 degrees C and salinities near 5 ppt. No samples were taken. Cause unknown.
8/17/2018	WA18006	Pamlico River	near Sparrow Bay	8,000	The Pamlico Riverkeeper sent along information regarding dead fish along the shoreline of Sparrow Bay Friday morning on 8/17/18. Spot, pinfish, croaker, flounder and blue carbs were observed along the shoreline of the Bay near Crystal Beach. Event was a very localized and small. Transects were made and a count totalled approximately 8000 fish. No samples were taken. The previous night's weather pattern indicated strong thunderstorms from the south, including 30 mph winds, heavy precipitation and some hail.
8/29/2018	WA18007	Pamlico River	Blounts Bay	192,050	DWR EMT received a call on 08-29-2018 from a homeowner at Gilead Shore on west side of Blounts Bay about a fish kill. EMT staff arrived 2 hrs later to find dead Spot, Croaker, and Flounder( <24hr old). No lesions were observed. The kill ran 0.25 mi down the shoreline and extended 100' out from the shoreline, totalling 192,050. Meter readings showed slightly elevated algal bloom activity. Schooling fish and feeding crabs were observed in the affected area. Homeowner said on 08-28-2018 the water was clear and no dead fish observed. On 8-29-2018 the water had a brownish color. Physical data recorded a slight bloom. Samples were collected and sent to the DWR Water Quality lab in Raleigh for further analyses.

**Total Kills for County: 3      Total Mortality for County: 209,250**

## 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
<b>Bertie</b>					
7/6/2018	WA18003	Chowan River	Colerain	2,000	On July 6, 2018 at 7:30 AM the DMF received a call from a member of the public reporting an active fish kill at Colerain Beach Club in Colerain, NC. DMF staff arrived at the site around 10:30 AM and took discrete water quality readings from the Colerain Beach Club pier (end and middle) and from the beach area. DO readings were poor (<2.0 mg/L) at all locations measured. Staff observed 100's of American eels washing in the little waves on the beach and swimming in inches of water. The water was very turbid and fish were floating out over 100 yards from shore, but scattered, mostly white perch and catfish. In the boat staff observed dead fish in all discrete sample locations.
9/20/2018	WA18008	Roanke R. , Cashie R.	Near Plymouth, Windsor	10,000	Event occurred in the wake of Hurricane Florence. Extremely low dissolved oxygen levels( <1 mg/l) were measured by investigators at multiple sites.
<b>Total Kills for County: 2      Total Mortality for County: 12,000</b>					
<b>Bladen</b>					
5/4/2018	FA18001	White Lake	Town of White Lake	115,000	At 1235 hours on May 4, 2018, NCWRC staff was notified of a fish kill in progress at White Lake. At 1335 hours District-4 Fisheries Biologist, arrived at White Lake and assessed water quality. Water quality samples indicated dissolved oxygen and pH were within the EPA's National Recommended Aquatic Life Criteria and sufficient to support freshwater aquatic life. On May 8, 2018 at approximately 1600 hours, NCDEQ requested the NCWRC conduct a formal enumeration of the fish kill. On May 9, 2018, NCWRC staff collected dead fish from six randomly selected 100-meter shoreline transects and six randomly-selected lake transects. Total hatchery production costs for the 114,770 fish from NCWRC transect sampling and removals by the Town of White Lake is \$634,132. The total administrative cost of the NCWRC investigation was \$6,257.
9/27/2018	FA18002	Cape Fear River	Lock and Dam 1	10,000	Event occurred in the wake of Hurricane Florence. Extremely low dissolved oxygen levels( <1 mg/l) were measured by investigators . Approximately 5,000-10,000 fish aggregated in boating access area parking lot. Many Blue Catfish and American Eel lethargic at edge of water. Kill likely occurred throughout river and fish aggregated in still water at boat ramp. Anoxic water observed for miles upstream and downstream.
9/27/2018	FA18003	Cape Fear River	Lock and Dam 2	1,000	Event occurred in the wake of Hurricane Florence. Low dissolved oxygen levels were measured by investigators. Several hundred fish observed along 1-km of bank at Lock and Dam 2. Fish were not aggregated. Hypoxic waters observed downstream.
<b>Total Kills for County: 3      Total Mortality for County: 126,000</b>					

## 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
<b>Buncombe</b>					
5/2/2018	AS18002	Clayton Creek	near Bent Creek	70	The construction company on site, indicated that water lines had been flushed the previous day; chlorine was used to disinfect the lines. On 5/3/18 ARO spoke with the property owner. The owner said the water was dechlorinated using dechlor tablets (Norweco bio-neutralizer tablets) prior to discharge. They placed tablets in the manholes of the storm drain network that discharges to Clayton Creek. It is unclear if there was sufficient contact with the chlorinated water and the dechlor tablets prior to discharge. The following water quality parameters at both collection sites were found to be in the acceptable range: pH, dissolved oxygen, water temperature and conductivity.
<b>Total Kills for County: 1      Total Mortality for County: 70</b>					
<b>Chatham</b>					
5/30/2018	RA18004	Private Pond	Bear Creek	250	Low dissolved oxygen levels observed at time of investigation (0.55 mg/L). No algal blooms, spills, or unusual odors observed.
<b>Total Kills for County: 1      Total Mortality for County: 250</b>					
<b>Columbus</b>					
10/1/2018	WL18004	Waccamaw River	near Old Dock	100,000	Event occurred in wake of Hurricane Florence. Fish observed from Crusoe to SC state line (45 river miles). Approximately 10 fish per 100 yards of shoreline, more fish aggregated at some bridge crossings and boating access areas (e.g., Dock Rd bridge, Pireway BAA). Total losses are incalculable but certainly exceed 100,000 fish.
<b>Total Kills for County: 1      Total Mortality for County: 100,000</b>					
<b>Currituck</b>					
2/26/2018	WA18001	Atlantic Ocean	Corolla	10,000	Kill occurred over several days involving mainly menhaden. Event appeared to be the result of fish schools getting too close to shore and predators chasing fish onshore. At the site of the kill, Marine Patrol Officers could see dense schools of live fish in the water just behind the breakers from Corolla to Kill Devil Hills and saw dolphin chasing the live fish in the waters. Event occurred from mile marker 13 to 17.
9/21/2018	WA18009	Canal to North River	near Grandy	400	Event occurred in the wake of Hurricane Florence. Extremely low dissolved oxygen levels (<1 mg/l) were measured by investigators.
<b>Total Kills for County: 2      Total Mortality for County: 10,400</b>					

## 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
<b>Durham</b>					
6/19/2018	RA18005	Ellerbe Creek	Durham	60	The fish kill was located in Ellerbe Creek between Hillandale Road and Indian Trail Park/Albany Street. Staff at the Williams Water Treatment Plant located a short distance upstream said that they have been draining their reservoir, which is their raw water primarily from Lake Michie. They discharge a couple of hundred feet west of where Hillandale Road crossed Ellerbe Creek. As far as plant staff was aware, they had no spills of any chemicals recently. The field water chemistry didn't indicate that their discharge was harmful. Cause was unknown.
<b>Total Kills for County: 1      Total Mortality for County: 60</b>					
<b>Edgecombe</b>					
5/11/2018	RA18003	Farm Pond	near Pinetops	15,000	Dead fish located in East Pond. Algal Bloom including high levels of Microcystis (35ug/L) observed in adjacent (West) pond. Ponds were reported as not being connected. Cause unknown.
<b>Total Kills for County: 1      Total Mortality for County: 15,000</b>					
<b>Lincoln</b>					
8/13/2018	MO18004	Lake Norman	Near Cowans Ford Dam	730	Duke Energy water quality data shows summertime oxygen squeeze was cause of the fish kill. Metalimnion became anoxic before hypolimnion. Fish became trapped in hypolimnion, which eventually became anoxic and resulted in the fish kill.
<b>Total Kills for County: 1      Total Mortality for County: 730</b>					
<b>Mecklenburg</b>					
4/23/2018	MO18001	Long Creek	Charlotte	150	Fish kill was caused by a drastic drop in DO due to a large sanitary sewer discharge caused by a broken pipe. Stream flooding due to a large rainfall event caused an incomplete count of deceased fish.
7/16/2018	MO18002	Timber Lake	Charlotte	2,000	The pond was being drained by a contractor hired by the city of Charlotte before constructing a new discharge weir in the corner of the dam. During the draw-down, insufficient water remained in the pond and almost all fish died. Before arrival by investigators, residents collected and disposed of the majority of fish that could be reached.
9/8/2018	MO18003	Guymanton Lake	Charlotte	750	Initial investigation determined the cause for the fish kill to be low oxygen. Low DO is believed to be due to a large stagnant body of water with one fountain for circulation.
<b>Total Kills for County: 3      Total Mortality for County: 2,900</b>					
<b>Nash</b>					
1/25/2018	RA18001	Quarry Pond	near Rocky Mount	150	Incident happened right after that very cold spell. About 150 dead largemouth bass and bluegill were observed. Investigator noticed very low DO in the pond both near the surface and at about 5 meters. Loss of DO due to reverse stratification was suspected as a cause.

## 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
					<b>Total Kills for County: 1      Total Mortality for County: 150</b>
<b>New Hanover</b>					
9/22/2018	WL18001	Greenfield Lake	Wilmington	3,000	Fish kill occurred in the wake of Hurricane Florence over multiple days. Riverwatch staff measured dissolved oxygen at less than 1.0 mg/l. Event was not investigated by DWR staff due to hazardous conditions during and after storm.
9/27/2018	WL18002	Sutton Lake	Wilmington	0	Event occurred in the wake of Hurricane Florence. Approximately 1 to 2 fish per acre in Duke Energy ponds 1, 3, and 5. Did not see any actively dying fish. Water was anoxic in ponds along Cape Fear River dam, Duke Energy reported higher dissolved oxygen in Duke Energy pond 8. Anticipate additional fish mortality due to anoxic/hypoxic conditions.
9/27/2018	WL18003	NE Cape Fear River	Castle Hayne	2,000	Event occurred in the wake of Hurricane Florence. Many American Eel lethargic at edge of water. Most fish were aggregated in parking lot of boating access area. Kill likely occurred throughout the river, yet fish aggregated here due to calm water. Anoxic conditions occur for miles upstream and downstream of this location.
					<b>Total Kills for County: 3      Total Mortality for County: 5,000</b>
<b>Pamlico</b>					
8/13/2018	WA18005	South Creek	Aurora	200	NCWRC investigated a fish kill in South Creek near Aurora Monday August 13th. The kill extended from the bridge in Aurora to Jacobs and Drinkwater Creeks. The bridge height restricted access to continue counting the striped bass. No gill net or any other marks were observed on the fish. The eyes were bulging however. This may have been due to quick decay in warm waters.
					<b>Total Kills for County: 1      Total Mortality for County: 200</b>
<b>Transylvania</b>					
7/3/2018	AS18001	French Broad River	Rosman	4,300	A valve left open in a chlorine tank at the Rosman Champion Park pool resulted in 250 gallons of chlorine spilling into the French Broad River. An estimated 4,279 fish were killed within the affected reach of the French Broad River from the Champion Park Pool in Rosman downstream to the confluence of the East Fork French Broad River. Species included Central Stoneroller, Warpaint Shiner, River Chub, Smallmouth Bass, Green Sunfish, Rock Bass, Chain Pickerel, Northern Hogsucker, Silver Shiner, Rainbow Trout, Brook Trout, Brown Trout, White Sucker, River Redhorse, and Greenside Darter. Commission staff was notified of the kill on the evening of July 3 and conducted a formal enumeration in the late afternoon of July 3. The kill incorporated approximately 1.2 miles of the river. Staff visually identified and counted dead fish from three 100-yard segments within the fish kill reach.
					<b>Total Kills for County: 1      Total Mortality for County: 4,300</b>

## 2018 Fish Kill Events (by County)

Date	Kill Number	Waterbody	Location	Mortality	Comments
<b>Tyrrell</b>					
6/1/2018	WA18002	UT to Scuppernong Creek	near Creswell	1,000	Creswell resident near 30 foot canal road noticed dead fish on 6/1/18. EMT staff arrived on site approximately 1300 in the afternoon. Canal water along 3.5 miles adjacent to the 30 foot canal road was turbid, warm, and had very little dissolved oxygen (2.6 mg/L). Staff traced the path of dead fish to where 30 foot canal road and South fork Creek Rd intersect. This canal leads straight to the headwaters of the Scuppernong river. Heavy rainfall during the previous 3 to 4 days was obvious as leaf sediment was visible where the water levels recently receded. A slight green sheen was observed near where the tributary crosses under the South fork Creek road bridge. Farmland was the majority land use in this area. Corn had been planted recently. Extent of the affected kill area was adjacent to unbuffered farmland. Canal waters that were heavily buffered were clear, not turbid, and had no casualites.
<b>Total Kills for County: 1      Total Mortality for County: 1,000</b>					
<b>Wake</b>					
2/9/2018	RA18002	Falls Lake	Barton Creek	50	Kill suspected to be the result of cold temperatures. No signs of spills or lake turnover at time of investigation.
6/22/2018	RA18006	Kit Creek	Morrisville/RTP	60	Low Dissolved oxygen and high water temps observed during investigation. Fish were trapped between lake outfall and culvert.
<b>Total Kills for County: 2      Total Mortality for County: 110</b>					

# Appendix 2: DWR Fish Kill Report App



## Report a fish kill to NC Division of Water Resources

Use this app to report a fish kill to Division of Water Resources staff for further investigation.

### 1. Enter Information

**Your Name**

Optional  
**How may we contact you?**

Optional  
**Date of fish kill**

**Waterbody where event occurred**

**Nearest town or landmark**

**County**

**Approximate area (river miles, acres)**

**How long did the event last?**

**Any other comments**

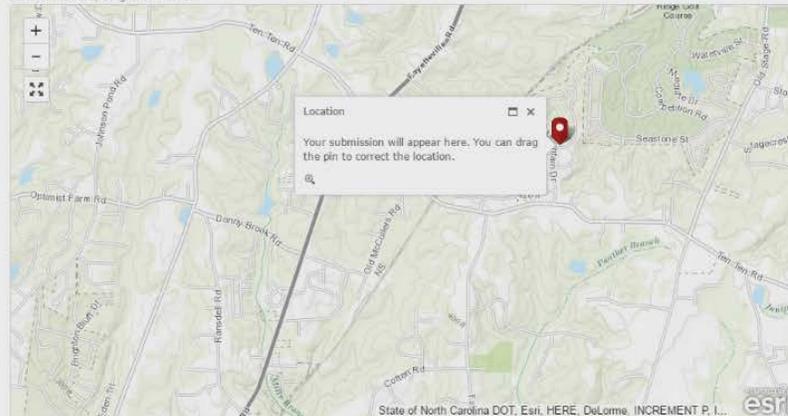
### 2. Select Location

Specify the location for this entry by clicking/tapping the map or by using one of the following options.

**Search** Lat/Lon USNG MGRS UTM

Find address or place

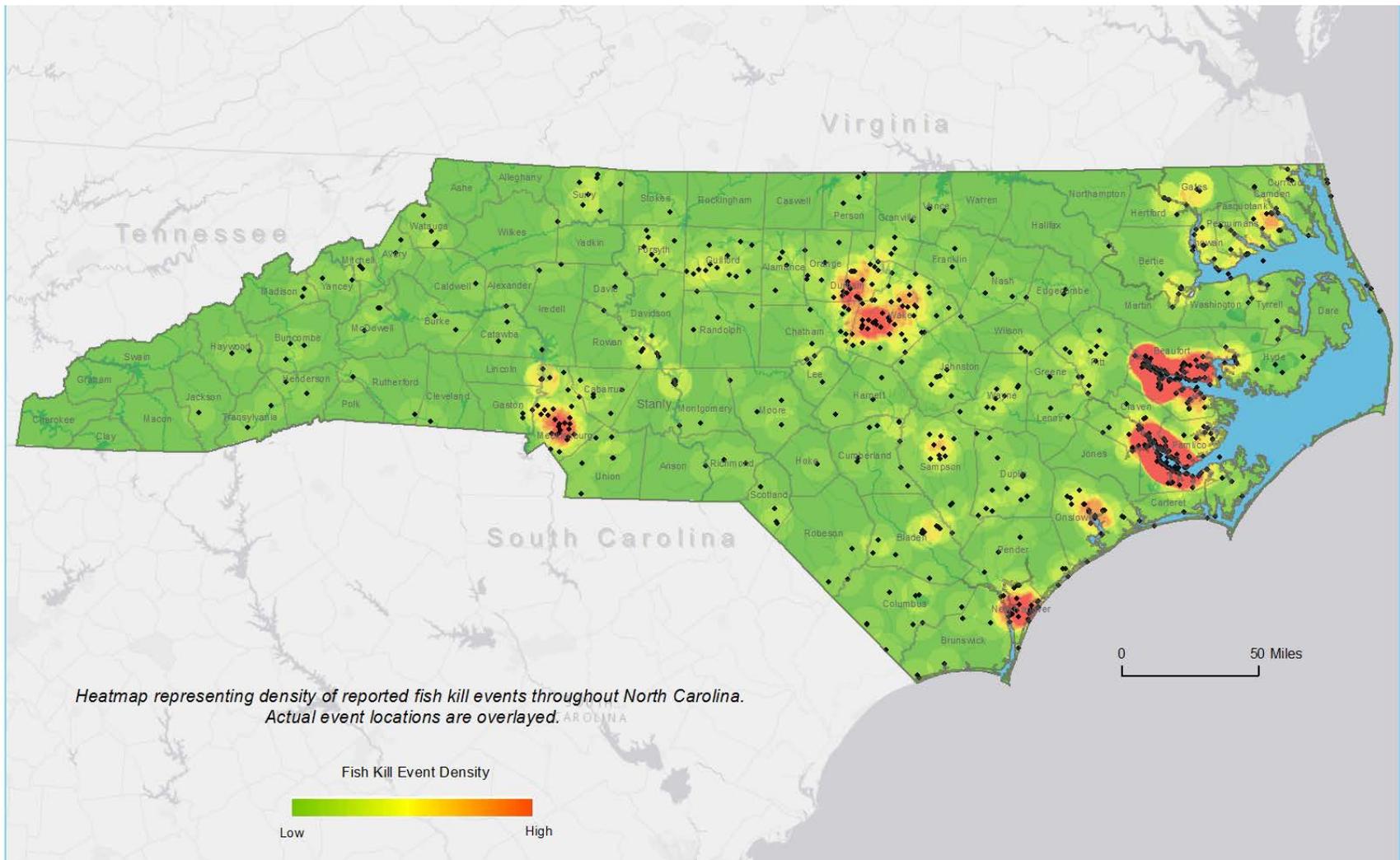
Latitude: 35.67032, Longitude: -78.85504



### 3. Complete Form

Add this information to the map.

# Appendix 3: Fish Kill Event Density in North Carolina 1996 - 2017



## Appendix 4: Public Fish Kill Sightings Reported to DWR

Date Reported	Waterbody	Location	County
1/1/2018	Scales creek	Camp Johnson	Onslow
2/6/2018	Falls Lake	Blue Jay Point County Park	Wake
2/7/2018	Falls Lake	HWY 98 and Six Forks boat ramp	Wake
2/22/2018	Private Pond	Raeford	Hoke
2/25/2018	Private Farm Pond	Siler City	Camden
5/1/2018	Hyco Lake	Roxboro and Semora	Person
5/1/2018	Bren Robin Lake	Winston Salem	Forsyth
5/4/2018	Private Pond	Pinehurst	Moore
5/5/2018	Hyco Lake	Close to Marina and Lake Authority	Person
5/9/2018	Hyco Lake	Roxboro	Person
5/12/2018	Hyco Lake	Roxboro	Person
5/12/2018	Hyco Lake	Semora	Person
5/12/2018	Hyco Lake	Semora	Person
5/13/2018	Hyco Lake	Semora	Person
5/17/2018	Hyco lake	Semora	Person
5/25/2018	Big Pine Creek	Bridge crossing on Shawtown Road	Allegheny
6/1/2018	High Rock Lake	Bringle Ferry Road	Rowan
6/20/2018	Brier Creek	Antioch	Wilkesboro
6/23/2018	Pamlico River	Aurora	Beaufort
6/23/2018	Pamlico River	Durham Creek	Beaufort
6/25/2018	Watauga River	Hwy 105 and Broadstone Road	Watauga
6/30/2018	Broad Creek	Oriental	Pamlico
7/3/2018	French Broad River	Rosman, NC: Champion Park Pool	Transylvania
7/5/2018	Private Pond	Henderson nc	Vance
7/7/2018	Neuse River and Baird Creek	Arapahoe	Pamlico
8/1/2018	Neuse River	Carlonia Pines, near Havelock	Craven
8/1/2018	Private pond	Rockingham	Richmond
8/7/2018	Wanchese Harbor	Wanchese	Dare
8/9/2018	Greenfield Lake	Spillway	New Hanover
8/11/2018	Ut to Goose Creek	Matthews	Union
8/12/2018	Chowan River	Colerain, NC	Bertie
8/16/2018	Neuse River	Kennels Beach	Pamlico
8/17/2018	Neuse River	Cherry Point	Craven
8/20/2018	Lake Norman	Cornelius -Denver area	Mecklenburg
9/1/2018	Neuse River	Minnesot	Pamlico
9/19/2018	Scuppernong River	Columbia	Tyrrell
9/20/2018	New river	Marina cafe Jacksonville nc	Onslow
9/20/2018	Jean Guite Creek	Kitty Hawk	Dare
9/21/2018	Greenfield Lake	Wilmington	New Hanover
9/21/2018	Bryan Street Pond	Morehead City	Carteret
9/22/2018	Private Pond	Wilmington	New Hanover
9/22/2018	New River	Jacksonville NC above uso bridge	Onslow
9/23/2018	Trent River	New Bern Grand Marina	Craven
9/23/2018	Cape Fear River	Southport	Brunswick
9/27/2018	Greenfield Lake	Wilmington	New Hanover
10/6/2018	North creek	Bath	Beaufort
10/8/2018	Bear Creek	Goldsboro	Wayne
10/11/2018	Pembroke Creek	Edenton	Chowan