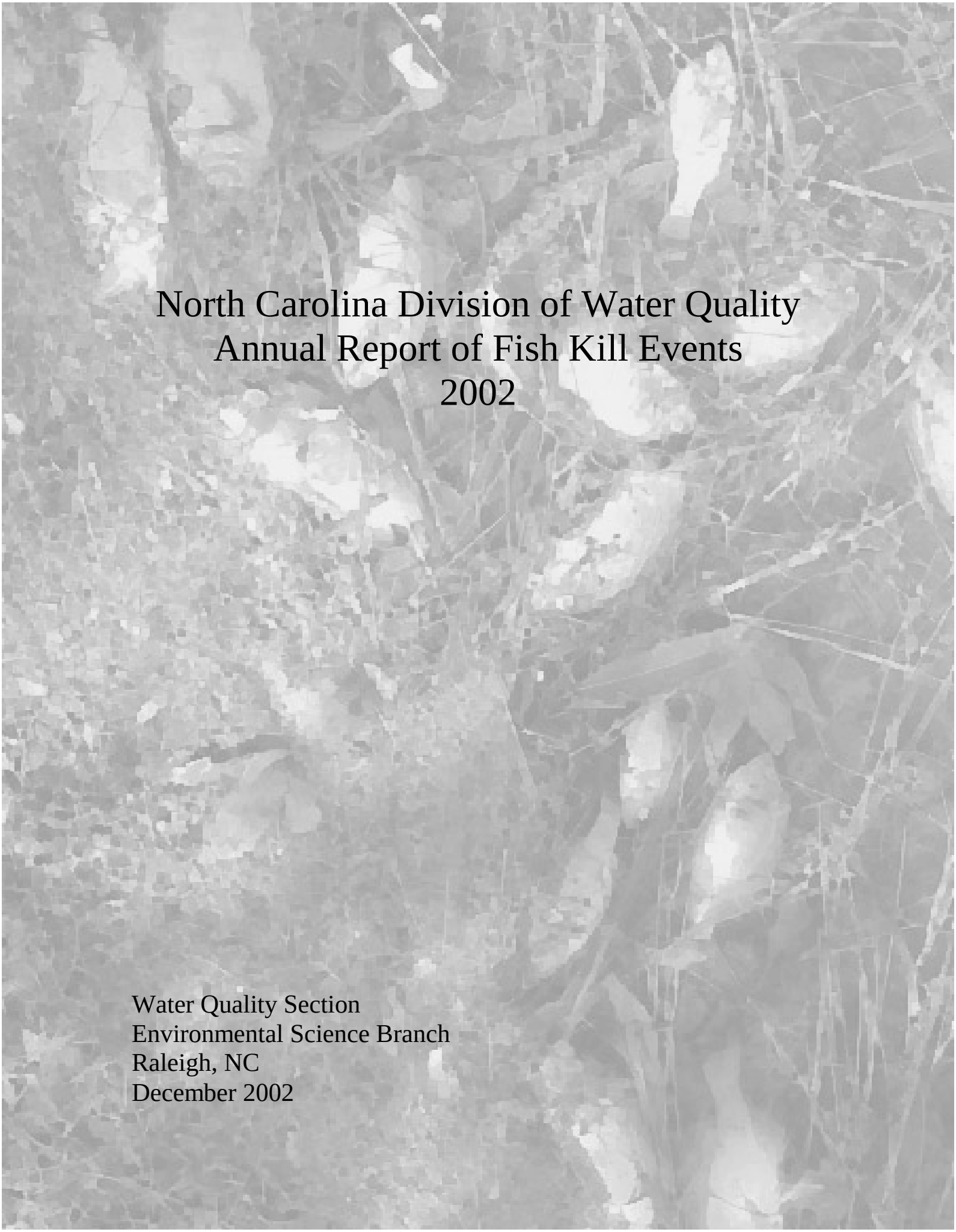


North Carolina Division of Water Quality
Annual Report of Fish Kill Events
2002

Water Quality Section
Environmental Science Branch
Raleigh, NC
December 2002

Introduction

The investigation of fish kill activity across the state currently involves protocols established by the North Carolina Division of Water Quality (DWQ) in 1996. The protocols were developed with assistance from 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 in North Carolina. Fish kill and fish health investigations are recorded on a standardized form and sent to the Division's Environmental Sciences Branch (ESB) where the data are reviewed and compiled. Data from fish kill investigation forms and supplemental information sent to the ESB are entered into a central database where the data can be managed and retrieved for use in reports to concerned parties. The procedure also requires the notification of appropriate state officials and scientists associated with the investigation of such events. In addition, reported kill information is updated weekly on the ESB website at: www.esb.enr.state.nc.us/Fishkill/fishkillmain.htm.

This document is a summary of fish kill events reported to the DWQ from January to mid December, 2002. The report is mandated under Section 4 of Chapter 633 of the 1995 North Carolina General Assembly Session Laws.

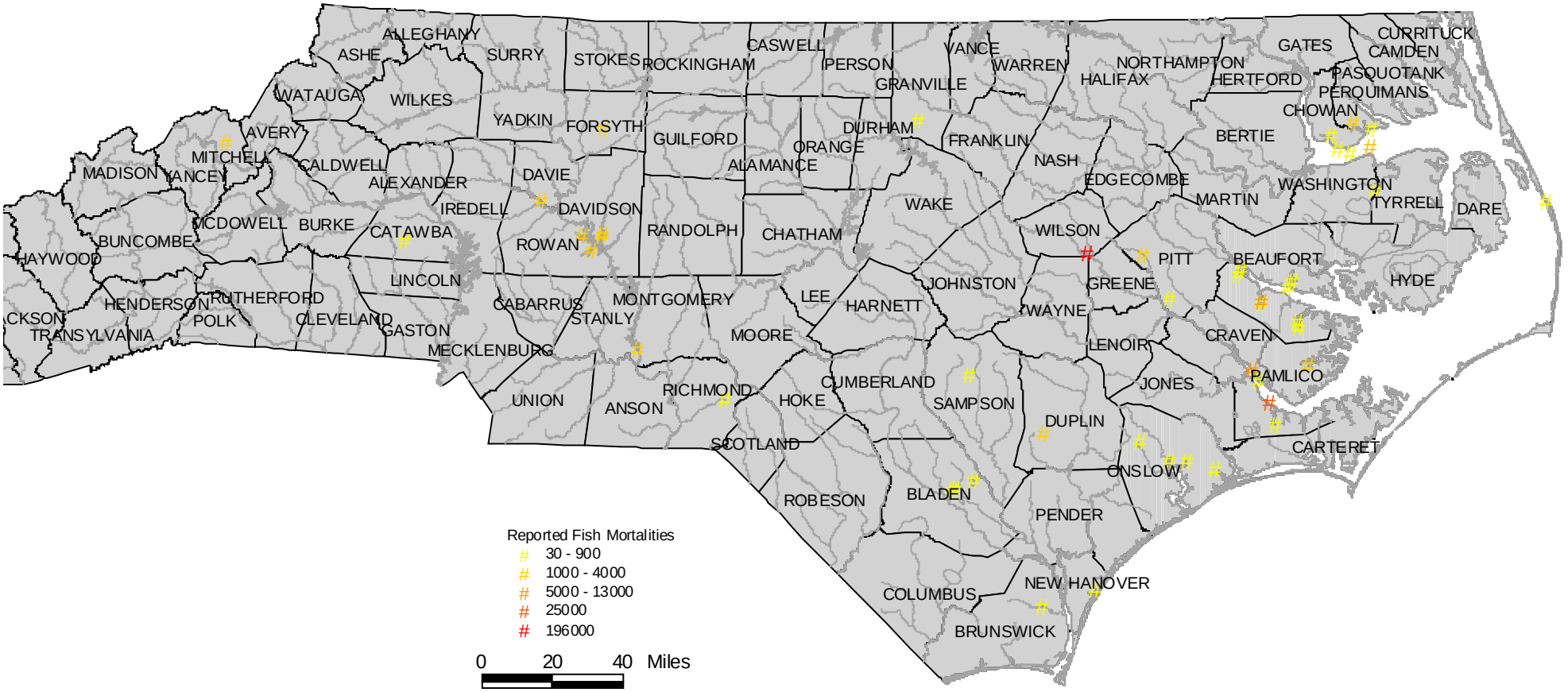
2002 Fish Kill Summary

Field investigators reported 46 fish kill events from January to December, 2002. Kill events were reported from the coast to as far west as Mitchell County in 9 of the state's 17 major river basins. The ESB tracks fish kill events when at least 25 fish are affected and when the event is confirmed by investigators.

The total fish mortality for all 2002 reports was 269,635. This figure represents a sharp drop from the 2001 figure and is the lowest total since systematic fish kill reporting began in 1996. Mortality totals for individual events ranged from 30 to 196,000 with a median mortality of 350. Two-thirds of the fish kill activity for 2002 was reported from freshwater locations leaving about one-third of reports from estuarine waters. No reports were received from the Atlantic Ocean.

Total Kill Events for 2001	46
Total Mortality for 2001	269,635 (229,796 Freshwater, 39839 Estuarine)
Report Mortality Range	30 to 196,000
Report Median Mortality	350
Basins with Activity	9 (of 17)
Freshwater Kills	30
Estuarine Kills	16

Figure 1 : Fish Kill Events Reported to NCDWQ - 2002



Basin Activity

Investigators reported fish kill events in 9 of the state's 17 major river basins during 2002 (Figure 1, Table 1). The Neuse River basin produced the most activity this year with nine events, followed by the Tar/Pamlico, Cape Fear and Yadkin River basins with eight events each. Clusters of events were reported around the lower Neuse and Pamlico estuaries, a trend common in previous year's investigations. A number of reports were also received from the Pasquotank River basin around the western end of Albemarle Sound. Kill reports from the Yadkin River basin were notable around High Rock Lake as a result of drought effects and low lake levels (see Drought Effects below).

Table 1: Fish kill reports by basin, 1996 - 2002

River Basin	1996	1997	1998	1999	2000	2001	2002
Broad	None	None	None	1	None	None	None
Cape Fear	21	16	23	14	12	5	8
Catawba	None	3	1	3	2	4	1
Chowan	2	2	1	1	None	1	2
French Broad	None	2	3	1	None	None	1
Neuse	14	12	8	16	23	37	9
Lumber	4	3	5	None	2	None	None
Pasquotank	10	2	8	2	None	1	6
Roanoke	2	None	1	None	None	None	None
Tar/Pamlico	3	6	5	11	14	23	8
Watauga	None	None	None	1	None	None	None
White Oak	3	3	1	3	3	3	3
Yadkin	1	10	2	1	2	3	8
Totals	**60**	**57**	**58**	**54**	**58**	**77**	**46**

Annual totals of statewide events have averaged around 60 since 1996 with a maximum of 77 reports in 2001. Only 46 reports were received in 2002. The decrease in 2002 was not expected, especially in light of poor environmental conditions across the state brought about by drought.

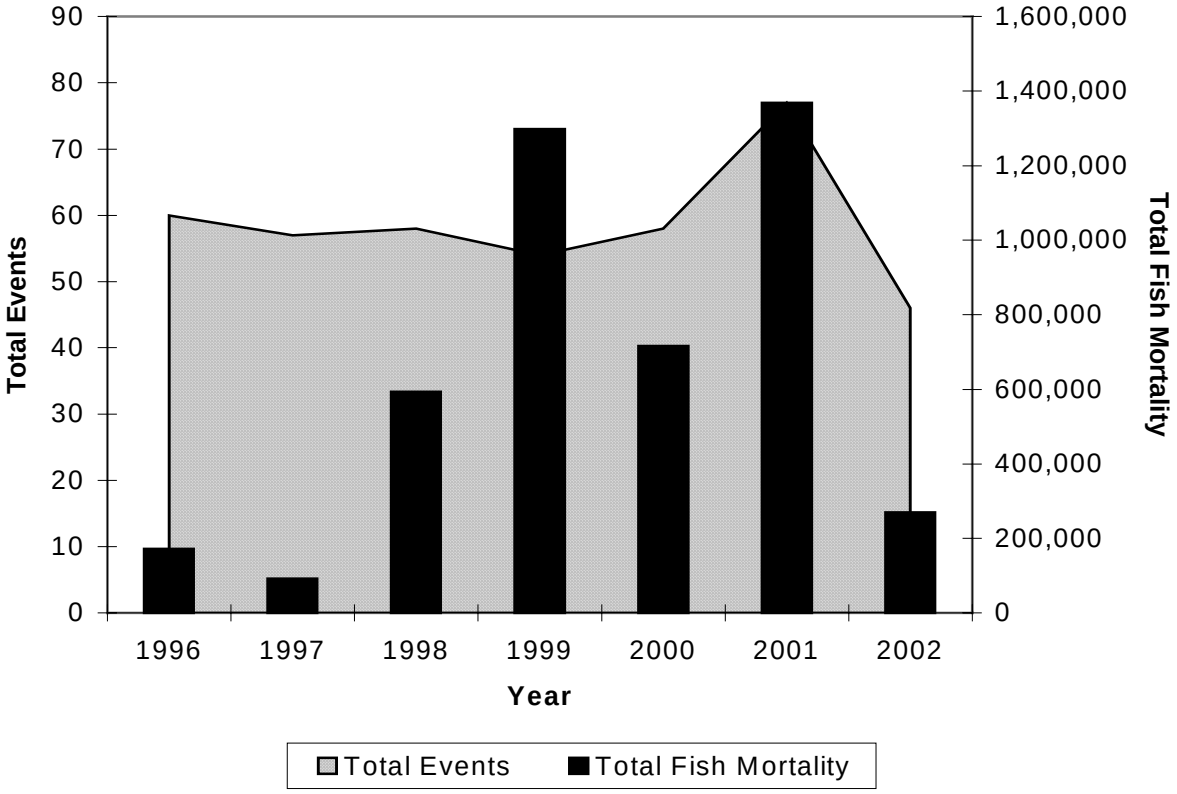
Most reports were received during the warmest months of the 2002 season – July and August. These months mark the period where fish stress is at a maximum from environmental factors such as low dissolved oxygen, high water temperatures, and fluctuating salinities.

Fish Mortality

Investigators reported a total of 269,635 fish killed during the 46 events of 2002. Nearly three-quarters of the year's fish mortality occurred at a single event in Wilson County. Fish mortality figures on reports ranged from 30 to 196,000 with a median mortality of 350 fish. Total annual mortality figures have ranged from about 92,000 (1997) to over 1.3

million (2001). The total for 2002 represents a sharp drop from yearly totals reported for the previous four years (Figure 2).

Figure 2: Reported annual fish kill events and mortality, 1996 to 2002



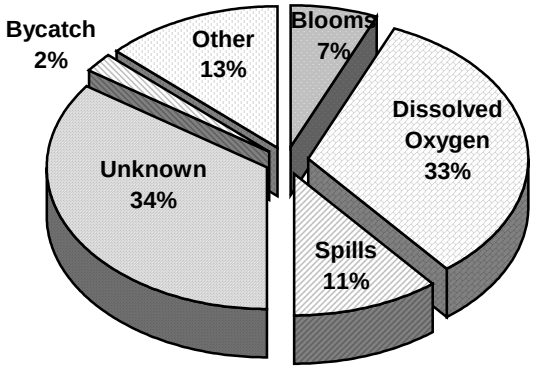
Suspected Causes of 2002 Events

Specific causes of fish kill events may or may not be obvious to investigators depending on a host of factors. Many causes may quickly be defined, but others remain unconfirmed or unclear due to an investigation occurring after the fact. Kill events often result from many environmental conditions, and sorting out the major reason(s) why fish are dieing is frequently a difficult and often subjective task. The NCDWQ reviews and tracks suspected causes of fish kills reported by field investigators. Suspected cause reports aid in evaluating potential water quality trends and problems, and assist scientists and decision-makers with formulating future courses of action. Suspected cause reports should not be viewed as a definitive label for a particular event.

Reported causes of 2002 kill events are summarized into six categories –dissolve oxygen (DO) induced events, algal bloom related events, spills, bycatch, and other (miscellaneous) causes. Those events where no specific causes could be determined were assigned as "unknown" (Figure 3).

Dissolved Oxygen Depletion: Poor dissolved oxygen (DO) was cited as a factor in 33 percent of the kill events during 2002. Unlike the trend in previous years, the majority of DO related kills were reported in fresh waters. Freshwater DO events were reported in conjuction with low flows and high water temperatures brought about by the state's ongoing drought conditions, most notably in July and August. Although several DO related events occurred in estuarine waters, the intense kill activity historically associated with DO problems in the lower Neuse and Pamlico Rivers was reduced in 2002.

Figure 3: Suspected causes for fish kills - 2002



Harmful Algal Blooms: Nutrient enrichment of waterbodies throughout North Carolina has resulted in eutrophication and algal blooms, common factors in fish kill events. Algal blooms cause dissolved oxygen (DO) and pH fluctuations as well as DO depletion through diurnal cycles and algal decomposition. These elements often precede fish kills events. Certain types of algae also release toxins during the course of a bloom that are detrimental to aquatic life. Blooms were suspected in 7 percent of the fish kill events for the year. A dense bloom of the blue-green alga *Oscillatoria geminata* occurred in High Rock Lake near Buddle Creek in October. The bloom depleted DO levels and was a factor in the death of 1,000 common carp and striped bass. Water samples from two estuarine fish kills contained dense blooms of dinoflagellates, ciliates, some euglenoids and cryptomonads (see Appendix B).

During 2002, the ESB staff routinely examined water samples associated with estuarine fish kills for the presence of *Pfiesteria* and *Pfiesteria*-like organisms. ESB examinations were performed using light and epifluorescent microscopy. Suspect samples warranting further confirmation for toxic *Pfiesteria* species were also forwarded to UNC-Greensboro and the NCSU Center for Applied Aquatic Ecology for further tests. These tests included fish bioassays, scanning electron microscopy, and an RNA probe that can discern the presence of actual *Pfiesteria* cells.

Pfiesteria-like cells examined by ESB staff during 2002 appeared as nontoxic obligate autotrophs and not forms historically associated with fish health events. At the time of this report, all confirmatory tests results have been reported as negative and all involved laboratories have reported that toxic *Pfiesteria* was not a causal factor in any of the 2002 events.

Spills: Toxic spills either deplete DO levels in receiving streams or induce kills outright through physical or chemical toxicity. Spills were reported as a cause in 11 percent of the kill events during 2002 (Table 2).

Table 2: Spill-induced fish kills during 2002.

Date	Waterbody	County	Mortality	Comments
1/10	Hitchcock Creek	Richmond	70	Kill caused by uncured concrete coming in contact with water below Lake McKinney spillway.
4/18	Cane Creek	Mitchell	1062	Kill event was caused by a petroleum spill into Cane Creek on 4/16/02.
4/19	Pete Dye Lake	New Hanover	200	Investigators suspected prior application of copper based algacide as cause for kill.
5/12	Village Creek	Chowan	500	Kill caused by discharge water from a fire at the Chowan Veneer facility.
7/30	Peter's Creek	Forsyth	1000	Kill caused by a fire at P&B distributors on Chatham Street in Winston Salem on 7/30/02. Chemicals from the fire migrated to Peter's Creek.

Bycatch: Discarded fish from nearby fishing operations was reported as a cause in only one kill event during 2002. A kill of 1,000 menhaden was reported on Albemarle Sound by Division of Marine Fisheries investigators in late October. Investigators suspected the fish were discarded eel pot bait.

Other: Miscellaneous causes were reported for 13 percent of the fish kills during 2002. Fish were reported killed by extremes in temperature in several reports both during the winter and summer. A bacterial infection of catfish in Catawba County and trauma in associated with a dam spillway affecting threadfin shad on the Pee Dee River were among other miscellaneous events.

Unknown Causes: Causes for kill events are listed as unknown when investigators fail to report specific reasons for an event. Investigations may not provide definitive causes when they are conducted too long after an event and no clear factors are determined, or when causes are suspected but not confirmed. Investigators failed to cite specific causes for an event in 34 percent of the year's reports. Reports with unknown causes were received from both estuarine and fresh waters. Investigators reported dead or decomposed fish even though water quality measurements and water samples failed to suggest a problem.

Drought Effects: North Carolina entered a fourth consecutive year of drought conditions in 2002. The entire state was affected with the center of the state experiencing the most severe conditions, and the far western and eastern sections generally experiencing moderate drought. During June and July, 80 percent of the monitored streams across the state were at less than 10 percent of normal flow for that time of year (www.ncwater.org). Some areas across the state reported rainfall levels from 40 to 60 inches below normal since the drought began.

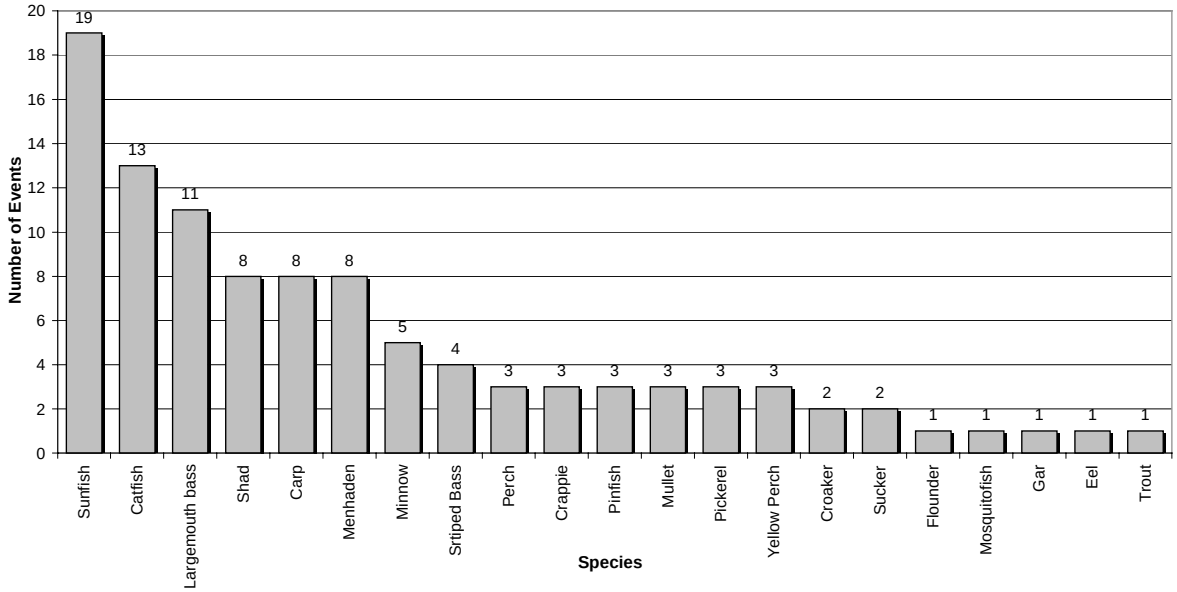
Drought conditions were evident in many fish kill reports submitted by investigators during 2002. Reports from the eastern sections of the state often mentioned low dissolved oxygen levels associated with low river flows and subsequent stagnation. Eastern investigations also revealed areas with extremely high salinities due to the lack of freshwater inflow. High salinities were blamed for the stress and mortality of freshwater fishes in a number of waterways around the Neuse and Pamlico estuaries. Investigators from the Piedmont often reported fish kills occurring simply from a lack of water. Numerous investigations as well as a number of anecdotal reports from citizens described extremely low river flows and lake levels that trapped fish in small pockets without adequate oxygen to sustain the schools.

The year's most high profile events occurred on High Rock Lake (Davidson and Rowan Counties) during a period from July to October. Record low stream-flows into High Rock Lake reduced water levels over 20 feet below full pool by September. The low water levels were a factor in the death of at least 5,000 fish most of which were common carp (see Appendix B). Reports from citizens during this time period suggested that many more fish may have perished on High Rock Lake, but were not observed by investigators due to access difficulties, scavenging, and limited manpower.

Fish Species

Fish kill reports in 2002 involved 21 different species of fish across the state (Figure 4). Freshwater species most commonly identified during investigations included sunfishes, catfishes, and largemouth bass. Estuarine species most commonly reported included menhaden. Menhaden, which have historically been involved in a majority of yearly kill events, were cited in only eight kills during 2002. Menhaden reports decreased as a result of reduced kill activity in the state's estuaries.

Figure 4: Fish species observed during 2002 fish kill events



Other animals were observed at about 15 percent of the year's kill events. These included blue crab, Rangia clams, scallops, Asian clams, crayfish, turtles, and ducks. A large kill of rangia clams was reported on the Yeopim River (Perquimans County) from unknown causes in August. Investigators also reported a significant kill of asian clams as a result of drought effects on the South Yadkin River (Davie County).

NCSU College of Veterinary Medicine Pathology Results

During 2002, Dr. Mac Law along with NCSU College of Veterinary Medicine staff and veterinary students, assisted DWQ investigators by performing gross and microscopic evaluations of fish found dead and fish found stressed and/or diseased in association with fish kill events. Dr. Mac Law is an American College of Veterinary Pathology (ACVP) board-certified veterinary pathologist at the North Carolina State University College of Veterinary Medicine.

The year was relatively quiet for fish kill activity in the state's estuaries, so Dr. Law's staff was asked to evaluate only a small number (less than 20) of Atlantic menhaden from only three kill events. Most of these fish had no remarkable gross or microscopic lesions, and the cause of the kills was not associated with a particular disease syndrome (i.e., some kills were attributed to low dissolved oxygen, which leaves no observable lesions behind). The few lesioned fish associated with fish kills had chronic symptoms and fungal infections consistent with ulcerative mycosis described by Noga, et al (1993). At present Dr. Law's staff has been unable to establish a solid link between the presence of lesioned menhaden or the presence of potentially harmful algal species (such as toxic *Pfiesteria*) with fish kill events that they have helped investigate.

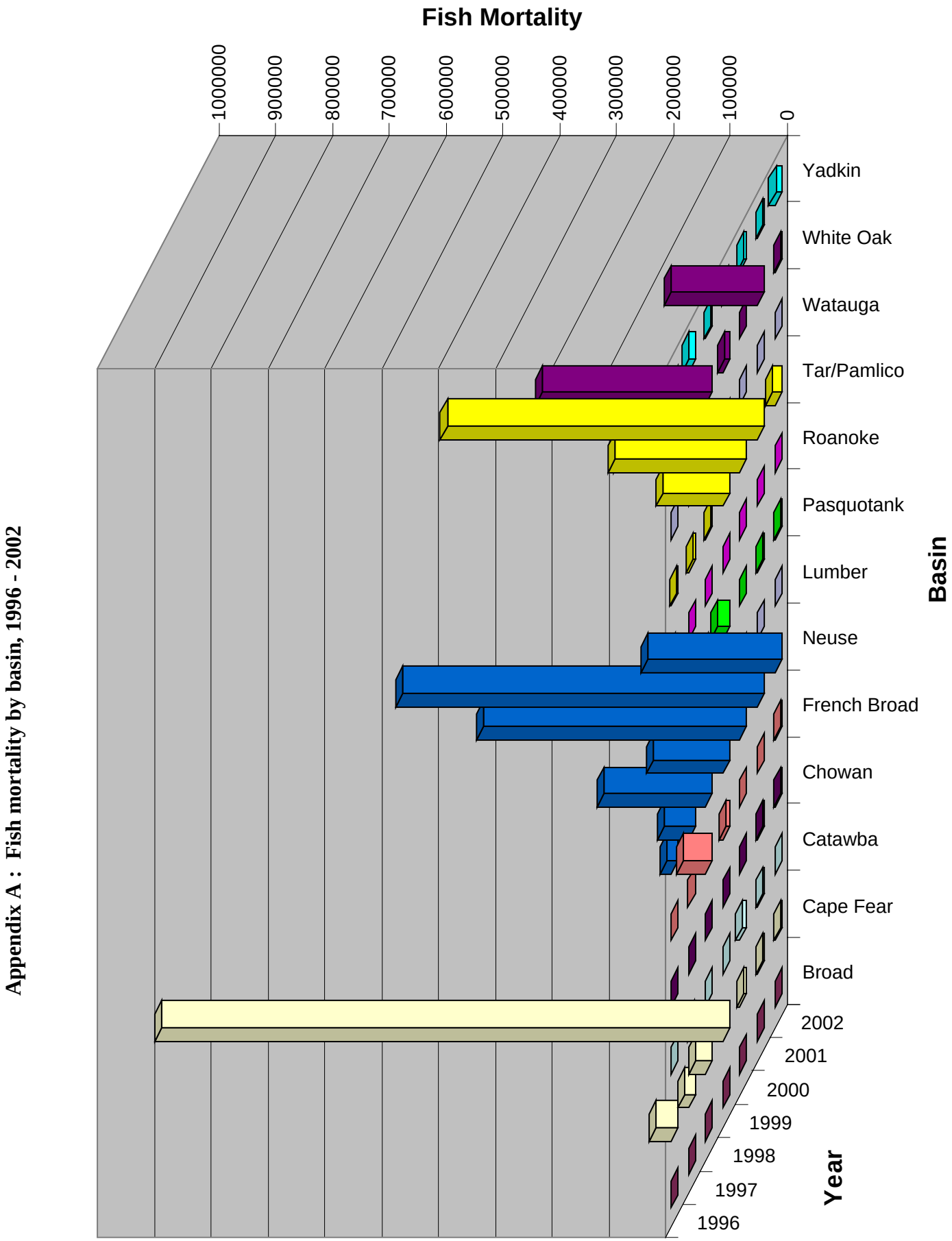
The NCSU laboratory also helped DWQ investigate a large kill of common carp in High Rock Lake, NC. Since carp were the only species affected, a viral agent was suspected and fish samples were submitted for virus isolation. No viruses were found in any of the samples. Lesions were, however, consistent with a bacterial infection that caused severe gill pathology.

2002 Summary

The number of fish kills reported across North Carolina during 2002 declined from previous yearly figures to 46. This is the lowest number of reports since the DWQ began systematically tracking fish kill activity in 1996. Reported fish mortalities were also low, totaling about 270,000 fish.

As North Carolina entered a fourth year of drought conditions in 2002, environmental conditions conducive to fish kills appeared to worsen. Severe conditions were experienced throughout the midsection of the state where most flows in monitored streams dropped below 10 percent of normal. These conditions further resulted in stream stagnation, depleted dissolved oxygen levels, and high salinities (coastal areas). The effects of the drought were common in reports from investigators throughout the season. Reports to ESB showed the worse kill activity shifted away from coastal estuaries where the most activity was reported in prior years, to inland streams and reservoirs where water levels were critically low. About 85 percent of the 2002 fish mortality was reported from freshwaters.

Although the drought played a role in many kill events during 2002, the drought effects surprisingly did not increase the total number of events or total fish mortality for 2002 over prior yearly figures. Investigators pointed to several conditions brought on by the drought that may have acted to suppress fish kills in 2002. Drought conditions drastically reduced freshwater flows into estuaries and coastal systems. Areas that typically experience water column stratification at the saltwater and freshwater interface were more saline in 2002 and thus less stratified. Water quality problems associated with stratification, such as hypoxia, were reported on a much smaller scale in coastal areas. Less freshwater input into reservoirs and estuaries also meant less input of the nutrients responsible for algal blooms often associated with fish kills. ESB staff received 31% fewer reports of algal blooms statewide when compared to 2001. It was anticipated that freshwater fish species in coastal areas would suffer from saltwater intrusion into creeks and rivers as a result of the drought. Investigators reported eight kill events where saltwater stress may have played a role, far fewer than the number expected. Some investigators concluded that freshwater species were able to move far enough upstream to avoid salty conditions, or they were more tolerant of those conditions than expected.



Appendix A : Fish mortality by basin, 1996 - 2002

Appendix B: Fish kills reported to DWQ

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
1/3/2002	030501	WL02002	Pasture Branch	near Molly's Landing	Onslow	Mullet	540	Water quality measurements were normal at time of investigation. Investigators suspected extreme cold mayy have induced kill.
1/3/2002	030502	WL02001	New River	US 17 in Jacksonville	Onslow	White perch	30	Water quality readings were normal at time of investigation. Marine patrol indicated fish looked fine with no sores or injuries. Investigators suspected cold temperatures induced kill.
1/10/2002	030716	FA02001	Hitchcock Creek	Lake McKinney	Richmond	Bluegill, Largemouth bass, Chain pickerel, Pirate perch, Catfish	70	Kill caused by uncured concrete coming in contact with water below Lake McKinney spillway. No fines or penalties assessed by NCWRC.
1/24/2002	030307	WA02001	Bay Lake		Beaufort	shad, sunfish, perch, catfish, gar	500	Cause of fish kill is unknown, fish found at event were severely decomposed and water conditions were within resonable expectations. The weather on the day the kill was reported was 70+ F and winds 20+ WSW, and there were multiple rainfall events within the last two weeks. Past several days were rainy with aprox. 1.5" rain. Fish had been reported dead one or two here and there within the last week or so, wind had pushed all of dead fish together in corner of canal and drawn the attention of residents. Salt was high and DO was low in some canals. Canals closest to outlet were fresher with normal DO those farthest from canal outlet were salter and had lower DO near the bottom.
1/25/2002	030407	WA02002	Private Pond	near Farmville	Pitt	shad, sunfish, perch	3800	Community fishing pond next to Farmville Waste Water Treatment Plant. Past several days were rainy with aprox. 1.5" rain. Most of fish were several days dead with a few that had died with in a day (still had color to scales). Area around pond was mostly swamp, readings at the time of investigation were with in normal range. Overflow from swamp could have caused pond to turn over.
4/4/2002	030623	WL02003	Floyd Lake		Onslow	sunfish	200	Lake level extremly low - pond had become 2 water bodies. Kill occurred in the larger, deeper pond. Two stations were sampled in the larger pond, one station in the smaller pond. A cold front came in overnight (after the kill) and it was overcast.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
4/12/2002	030307	WA02003	Canal	Middle Street Aurora	Beaufort	sunfish, largemouth bass, mosquito fish	50	Fish seen floating along the surface being pushed out toward main body of Pamlico river. Neighbor along the canal reported seeing dead fish on 4/11/02. Parameters were within normal ranges for south side of Middle St. with the exception of high DO % Sat., bloom suspected. Parameters on the north side of Middle St. had a low DO. Other canals were obseved in the area and a few dead fish were also found in them, again parameters for these canals were with in normal ranges. Water samples contained a dense algal bloom of dinoflagellates, ciliates, and some euglenoids and cryptomonads.
4/14/2002	030413	WA02004	Alligator Creek	NC 55 near Stonewall	Pamlico	Menhaden	3060	Fish kill took place in Pamlico Co. on Alligator Cr. The kill spanned for a quarter mile downstream from HWY55 bridge south of the town of Stonewall. Only menhaden were observed in the kill, none with lesions. The fish appeared to be around 24hrs old. The creek is very shallow and narrow and there were thunderstorms moving through the area for a couple of days. There was an algal bloom present and samples were taken.
4/18/2002	040306	AS02001	Cane Creek	at Bakersville	Mitchell	Trout, Northern hogsucker, sunfish, stoneroller, bluehead chub, shiners	1062	Kill event was caused by a petroleum spill into Cane Creek on 4/16/02. Most fish appeared to have died quickly from an acute event and did not show signs of disease. Many carcasses contained residues of petroleum. NCWRC requested a reimbursment from the responsible party of $1825.
4/19/2002	030617	WL02004	Pete Dye Lake		New Hanover	Carp, Bass, Sunfish, Eel	200	Investigators suspected prior application of copper based algaecide as cause for kill. 5 gallons of Cutrine Plus applied 3 days prior to event. Lake is also shallow and in the vicinity of golf course with no buffers. The lake has experienced fish kill events at numerous times in the past.
4/24/2002	030622	WL02005	Nash Johnson Lake		Duplin	Sunfish, Bass	1000	Water at time of investigation described as green with floating filamentous mats. Water samples analyzed by ESB didi not show evidence of bloom event.
5/9/2002	030307	WA02005	Pamlico River	Hawkins Beach	Beaufort	Menhaden	250	95 percent of affected fish had lesions. Increasing water temperatures and sudden changes in water conditions due to wind shifts may have caused a marked change in DO or salinity. Lesioned fish may not have been able to adjust to these changes, having difficulty in osmoregulating and moving to areas where oxygen, salinity, and temperatures would not have been at such stressful levels.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
5/12/2002	030104	WA02006	Village Creek	Edenton	Chowan	Shad, bluegill, Largemouth bass, White Catfish	500	Discharge water from a fire at the Chowan Veneer facility on Thursday, May 9, was observed running into the headwaters of Village Creek. Firefighters placed hay at the entry and exit outlets on a small impoundment on Village Creek to contain the runoff. No chemicals were known to be in the plant during the time of the fire, with the exception of wood dye (makeup unknown). The cause of the fire was traced to a faulty conveyor belt; the origin of the fire was not under suspicion.
5/22/2002	030710	FA02002	Pee Dee River	Below Tillery Dam	Montgomery	Treadfin Shad	3000	CP&L biologists investigated the kill. They suspect that shad were schooling near the dam and high wind and wave action forced them over the dam and into the tailrace. Mortalities appeared to be a result of falling over the dam and hitting the dam apron. Dam operators had noticed large schools of shad in the forebay area preceeding kill.
6/1/2002	030618	FA02003	Black Lake	behind Clubhouse	Bladen	Yellow perch	300	Hot weather days prior. No causes suggested by investigators.
6/5/2002	030409	WA02007	Weyerhaeuser Pond		Pitt	Sunfish, Carp, Largemouth bass	200	A fire occurred at the Weyerhaeuser saw mill on Saturday, June 1, 2002 around 5:00. After the fire, many aeriation pumps were turned off. The pond where the fish were dead is the last in a series before it discharges into Little Swift Creek. This pond is the last to receive flow and aeriation. The intense heat combined with shallow water is believed to be the reason for the low dissolved oxygen.
6/17/2002	030410	WA02008	Slocum Creek	Near Cherry Point	Craven	Channel catfish	62	Approximately 62 Channel catfish were found severely decomposed in the upper reaches of navigable waters of Slocum Cr. Dissolved oxygen levels were found to be less than 1 mg/L from 1 meter down to the bottom in the area of the fishkill. Heavy rains two days prior most likely caused a flushing type event, which pushed stagnant water from upstream areas containing very little if any dissolved oxygen into the area of the fishkill. Persistant drought conditions have caused many creeks along the neuse River estuary to become highly saline which could also stress freshwater fish species. Salinity levels at the site of the fishkill were higher than expected, and were found throughout most of the water column. In the area of the fishkill thousands of healthy Atlantic Menhaden were observed swimming in the uppermost layer of the water column. No other species were found dead in this fishkill, although several other were observed in the area after the event.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
7/2/2002	030153	WA02023	Albemarle Sound	Hwy 32, Mackeys side	Tyrrell	Menhaden	1000	Mr. Winslow called PRRT and reported that DMF had responded to a fish kill. Approximately 1000 menhaden 8-9" in length washed along shore. The fish had no signs of lesions and were decaying. DO levels 8 mg/L, salinity 4.1 ppt and water temp. 28.5-30.3°C. DMF officials believe the kill to be a release of eel pot bait.
7/3/2002	030410	WA02009	Neuse River	near Fairfield Harbor	Craven	Atlantic menhaden	400	A small kill comprised of Atlantic Menhaden with all fish showing lesions. This kill is most likely a result of high temperatures stressing lesioned fish. Many healthy schools were sampled in the area of the kill and those fish that were sampled showed less than 1% lesions. No algae bloom activity was found at the kill area and most fish were found in a small very shallow bay.
7/4/2002	030410	WA02010	Neuse River	Bridgeton	Craven	Atlantic menhaden, Striped Bass	6500	Approximately 6500 dead Atlantic Menhaden were found along a stretch of the Neuse River at Bridgeton. Fish appeared to be around 12 hours old, and had died in the area offshore of Bridgeton and were blown onto the shoreline, and into grass beds along the eastern shoreline of the Neuse River. Conditions in the area of the fishkill were stratified for several days prior to this event and, several smaller similar kills had also occured just downstream along the same shoreline. Hot conditions and a persistant salt wedge caused severe stratification in the Neuse River from Johnson Pt. to upstream of New Bern. These conditions most likely caused the death of lesioned fish swimming in that area due to added stress of high water temperatures, and low oxygen conditions.
7/7/2002	030502	WL02006	Little Northeast Creek	Jacksonville	Onslow	Largemouth bass, Pickerel, Sunfish, Atlantic menhaden	150	A fish kill was investigated by NRRT on 7/7/02 at 14:30. Upon investigation approximately 150 mixed species of fish were found in Little Northeast Creek , a trib. of the New River. The fish apeared to be about 48hrs old with no obvious signs of sores or lesions. There had been severe thunder storms in the area two days before the kill was reported. The salinity in the creek was high and the DO was very low.
7/8/2002	030407	RA02001	Private Pond	near Stantonsburg	Wilson	Largemouth Bass, Sunfish, Minnows	196000	Ben Smith, Stantonsburg Wastewater Plant ORC, reported seeing fish mortality at about 8 PM July 6, and by 10 AM July 7, all activity had ceased. He measured DO on Sunday AM at about 0.5 mg/l. Strongly suspect hot pond water had relatively low DO, then rainstorm went to the bottom and caused the pond to "turn over". Investigator certain fish died from lack of oxygen. Impacted all sizes and all species over a short period of time.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
7/9/2002	030155	WA02011	Pamlico Sound	near Oregon Inlet	Dare	Flounder, Houndfish, Pinfish, Mullet, Toadfish	54	Commercial gill netting for flounder and mullet occuring in area prior to kill. Fish looked dead for quite some time. Investigators unable to definitely conclude that fish were net discards.
7/11/2002	030307	WA02012	Back Creek	near Hwy 92 Bridge	Beaufort	Croaker, Pinfish	33	Juvenile croakers 3- 5 in. in length were found over a 200m stretch of Back Creek, a tributary of Bath Creek. The fish appeared to have been dead for 12 - 24 hrs. Low DO levels and recent heavy storms may have contributed to the kill.
7/19/2002	030704	MO02001	High Rock Lake	Second Creek arm near Bringle Ferry Road	Rowan	Shad, Crappie, Catfish	2000	Water had receeded due to drought trapping fish in a shallow, isolated pool near the Bringle Ferry Rd. bridge. Fish most likely succumbed due to low dissolved oxygen levels.
7/29/2002	030704	MO02002	High Rock Lake	Crane Creek Arm	Rowan	Carp, Crappie, Catfish	1000	Water had receeded trapping fish in a shallow, isolated pool near the Goodman Lake Rd Bridge. Fish most likely succumbed due to low dissolved oxygen levels.
7/30/2002	030410	WA02013	Neuse River	between Stately and Carolina Pines	Craven	Croaker, Silver perch, Pinfish, Menhaden	25330	It is likely that these fish did not die in the area where they were counted. Northwest winds were blowing them into the Stately Pines/Carolina Pines area. Just upriver at CM# 11 and Flanner's Beach the water column was very stratified with very little if any DO in the lower layers. Water temperatures were over 32° C (90° F) throughout the area where dead fish were found. Nearly all of the fish found were juvenile, and were most likely killed by stress related to extremely high water temperatures/low DO.
7/30/2002	030704	WS02001	Peters Creek	Winston Salem	Forsyth	Sunfish, Suckers, Minnow Sp.	1000	Kill caused by a fire at P&B distributors on Chatham Street in Winston Salem on 7-30-02. Chemicals from the fire migrated to Peter's Creek
8/1/2002	030104	WA02014	Albemarle Sound	near Sandy Point	Beaufort	striped bass	150	NC DMF personnel discovered 150 dead striped bass in the Albemarle Sound from the Hwy 32 bridge west to the Chowan River bridge, a distance of approximately 7.6 mi. Although gill nets were present in the area, no apparent net marks were found on the fish. Dissolved Oxygen levels were within normal ranges, however high water temperatures throughout the kill zone may have been a contributing factor in the kill.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
8/3/2002	030152	WA02019	Yeopim River	near Bethel	Perquimans	none	2000	Approximately 1,000 dead clams in vicinity of boat ramp at Bethal Fishing Center on the Yeopim River. Most clams on shore were without shell. Several more clams floating in shell in water around boat ramp.
8/7/2002	030307	WA02015	Blounts Creek	below Hwy 33 Bridge	Beaufort	Catfish	50	Water was green in color . Several phyto samples were sent to ESB for analysis. Stress from high salinity and low Do were suspected as factors in the death of the fish. The phyto samples were dominated by a benign Peridinium dinoflagellate, and euglenoids were common.
8/8/2002	030152	WA02016	Canal off Albemarle Sound	near Holiday Island	Perquimans	Menhaden	300	300 menhaden observed floating on surface of water. Grayish film on water with thick mats of green algae and spots of duckweed. Homeowner reported that there has been no water movement since December. Fish are believed to have swam into area where the number of fish quickly reduced the amount of oxygen in the water to anoxic levels, thus killing the menhaden. No other fish species were present. There were also reports of approximately 75 canadian geese utilizing the area frequently, but no signs of fecal matter that could have affected the water.
8/9/2002	030401	RA02002	Private pond	Creedmore	Granville	Sunfish, Catfish, Carp, Largemouth bass	300	Rain and low pond levels prior to kill. Fish samples showed no signs of disease or lesions.
8/14/2002	030619	FA02004	Rice's Run	near Beaman Crossroads	Sampson	Warmouth	100	Fish apparently died from the lack of dissolved oxygen. The kill is a pool located beside SR 1335 on Rice's run which is a small trib. to Great Coharrie. DO was 0.33 mg/L. The pool had no flow associated with it. Weather conditions were hot, humid and dry.
8/21/2002	030706	WS02002	South Yadkin River	near Cooleemee	Davie	Clam Kill	1000	Investigators believe kill was caused by manipulation of pool area behind the run of the river water supply dam at Cooleemee. Two weeks prior to the event the dam gates were closed to raise pool levels above the dam . Except for seepage, no water was allowed to flow downstream from the dam during this time. Clams were reported killed from a lack of water flow.
8/22/2002	030153	WA02020	Albemarle Sound	Hwy 32 Bridge	Washington	Striped bass, White catfish	120	Most striped bass showed no signs of disease or lesions. Most fish seen on shore and decomposed. Water temperature was high and was suspected as a cause.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
8/23/2002	030307	WA02017	Blounts Creek	near Cotton Patch Landing	Beaufort	Catfish	13024	Extremely elevated salinity levels and low dissolved oxygen levels were the cause of the kill. Salinity readings of 12 ppt in a creek with an average reading of 3 ppt or below created stressful conditions too difficult for the fish to overcome. Some fish are still in distress, prolonging the kill.
8/23/2002	030307	WA02018	Chocowinity Creek	Hwy 33 Bridge	Beaufort	Catfish	500	Combination of high salinities and low DO stressed fish. At time of investigation there were approx. 3000 fish gasping for air upstream of bridge. Expected these fish to perish in next few days. Fish very visible from Hwy 33 bridge.
8/26/2002	030307	WA02021	South Creek	near Idalia	Beaufort	Carp, Catfish, Sunfish, Largemouth bass	850	Investigators responded to a call from a concerned citizen regarding dead carp in South Creek. The kill was several days old and the majority of fish were in advanced stages of decay. Low DO's and high salinity levels appeared to be the cause of the kill.
9/12/2002	030616	FA02005	White Lake		Bladen	Yellow perch	300	Water quality parameters within normal range at time of investigation.
9/16/2002	030616	FA02006	White Lake		Bladen	Largemouth bass, Yellow perch	200	Fish reported dead near marina on the downwind side of the lake.
9/27/2002	030704	WS02003	High Rock Lake	Abbotts Creek arm	Davidson	Carp, Sunfish, Crappie, Shad	1000	Investigators reported strong wastewater and sulfur smell in area. Water color reported as very dark.
10/2/2002	030617	WL02007	Rice Creek, Town Creek	At confluence	Brunswick	Striped mullet, Largemouth bass, Pickerel, Sunfish, Shad	50	Low dissolved oxygen levels reported throughout the sample area. Aquatic weed (Elodea?) very prevalent throughout the creeks.

Date	Subbasin	Kill Number	Waterbody	Location	County	Fish Species	Mortality	Comments
10/3/2002	030704	WS02004	High Rock Lake	Abbotts Creek Arm	Davidson	Carp, Striped bass	1000	Investigators reported ph and DO levels indicative of an algal bloom. Fish kill attributed to low DO levels. Water reported dark and turbid in some areas. Green surface film also observed in Abbotts Creek. Results of ESB analysis indicated that High Rock Lake (near Buddle Creek) experienced a extremely dense algal bloom (> 140,000 units/ml). The bloom was dominated by filamentous blue greens, primarily (36%) Oscillatoria geminata. O. geminata is a common bloom former and found in many waters throughout the state. The alga is known to discolor water and cause taste and odor problems.
10/15/2002	030153	WA02022	Thirty Foot Canal	between Phelps Lake and Scuppernong R.	Washington	Sunfish, Shad, Carp, Largemouth bass	200	none
10/31/2002	030835	MO02003	Ut to Clark Creek	near Newton	Catawba	Catfish	200	Most fish removed and buried before investigators arrived. Carp and sunfish were abundant in the pond and not affected. the Surface water samples contained filamentous bluegreen microalga Anabaena, a common species in North Carolina. Investigators suspected a bacterial infection of the catfish caused by environmental stress.