2014 Fish Kill Summary

Maryland Department of the Environment
Science Services Administration
Fish Kill Investigation Section

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Purpose

A special responsibility mandated by Environmental Article Section 4-405C requires management and control agencies to investigate the occurrence of damage to aquatic resources, including, but not limited to, mortality of fish and other aquatic life. The investigations should determine the nature and extent of each occurrence and endeavor to establish the cause and sources of the occurrence. If appropriate, findings shall be acted upon to require the reparation of any damage done and the restoration of the water resources affected, to a degree necessary to protect the best interest of the state.

Until 1984, fish kill investigations in the state were the responsibility of the Department of Natural Resources. In 1984, this function was transferred to the Office of Environmental Program's Division of Water Quality Monitoring within the Department of Health and Mental Hygiene. Effective July 1, 1987, the Office of Environmental Programs became part of the Maryland Department of the Environment (MDE).

The MDE Field Evaluation Division coordinates an on call interagency staff to ensure that all reports of fish kills in the state are promptly addressed. While MDE attempts to investigate all reported events, reports with fewer than 25 dead fish, those for which there is a priori information or incidents that are reported more than 72 hours after they occurred are not always investigated.

A summary report of fish kills is prepared annually. A database has been established and is available for all reported incidents occurring since 1984.

Acknowledgements

Many organizations and individuals contribute to the efforts necessary in the field and office to bring this report to completion each year. To those inadvertently not cited, your efforts are greatly appreciated.

2014 After Hours fish kill duty roster: Nick Kaltenbach, Chris Luckett, and Charles Poukish.

Others who participated in 2014 investigations:
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Cooperating agencies:

MDE- Environmental Assessment and Standards Program
Field Operations Program
Emergency Response Division
Office of Communications and Digital Strategy
Science Services Administration
Water Management Administration- Compliance Program
DNR- Fisheries Service
Natural Resources Police
Oxford Cooperative Lab, Fish & Wildlife Health Program
Tidewater Ecosystem Assessment Division
MANTA-Annapolis Field Office
Wildlife and Heritage Program
MDA- Animal Health Laboratory
Pesticide Regulation Division
University of Maryland
Institute for Marine and Environmental Technology
Veterinary Services
USGS-Fish Health Branch
Montgomery County Department of Environmental Protection

Thanks also go to the concerned citizens of Maryland for alerting us to and providing vital initial information regarding fish kills throughout the state; and to any individual or agency inadvertently omitted from this list.

February 1, 2015

Summary

This report contains a summary of fish kills reported to Maryland Department of the Environment in calendar year 2014. The data presented were gathered from field investigations and discussions with reporting persons. Findings are divided into the following categories: investigated kills, non-investigated kills, confirmed kills, probable non-confirmed kills, and non-kills.

Number of Events

A total of 51 fish kills were reported in 2014, of which 31 were considered significant enough to warrant on-site investigations. This represents the lowest number of reports received for a year since 1985. It was 46% below the historic average of 113 reports per year. Typically most fish kills occur in tidal waters during warmer months of the year when waters become warm and stratified, and hypoxia becomes more common. Fifty-five percent of reported kills occurred between May 1 and July 31 (Figure 1). Eighty-four percent occurred during the seven month period of April 1 through October 31.

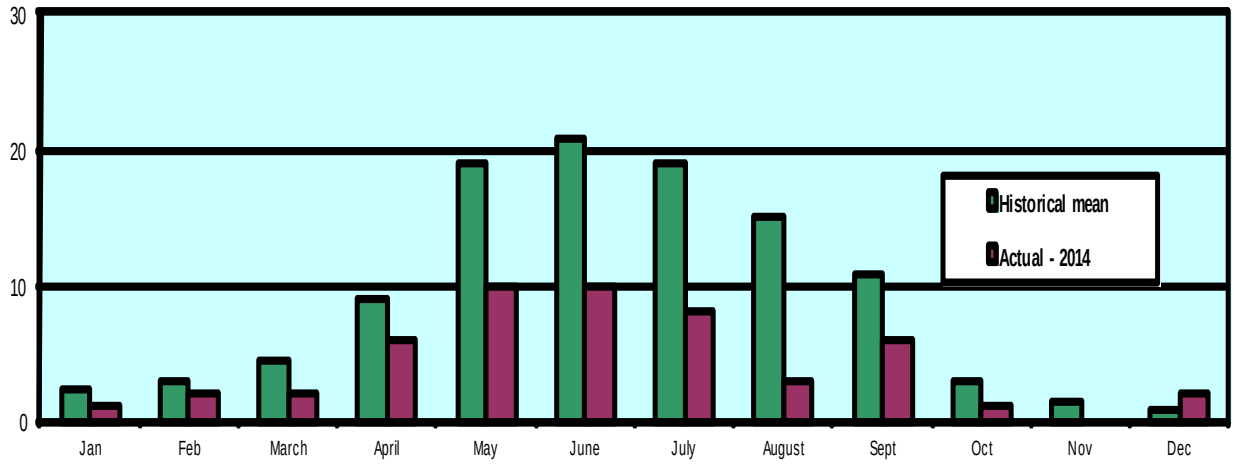


Figure 1. Fish Kill Reports by Month

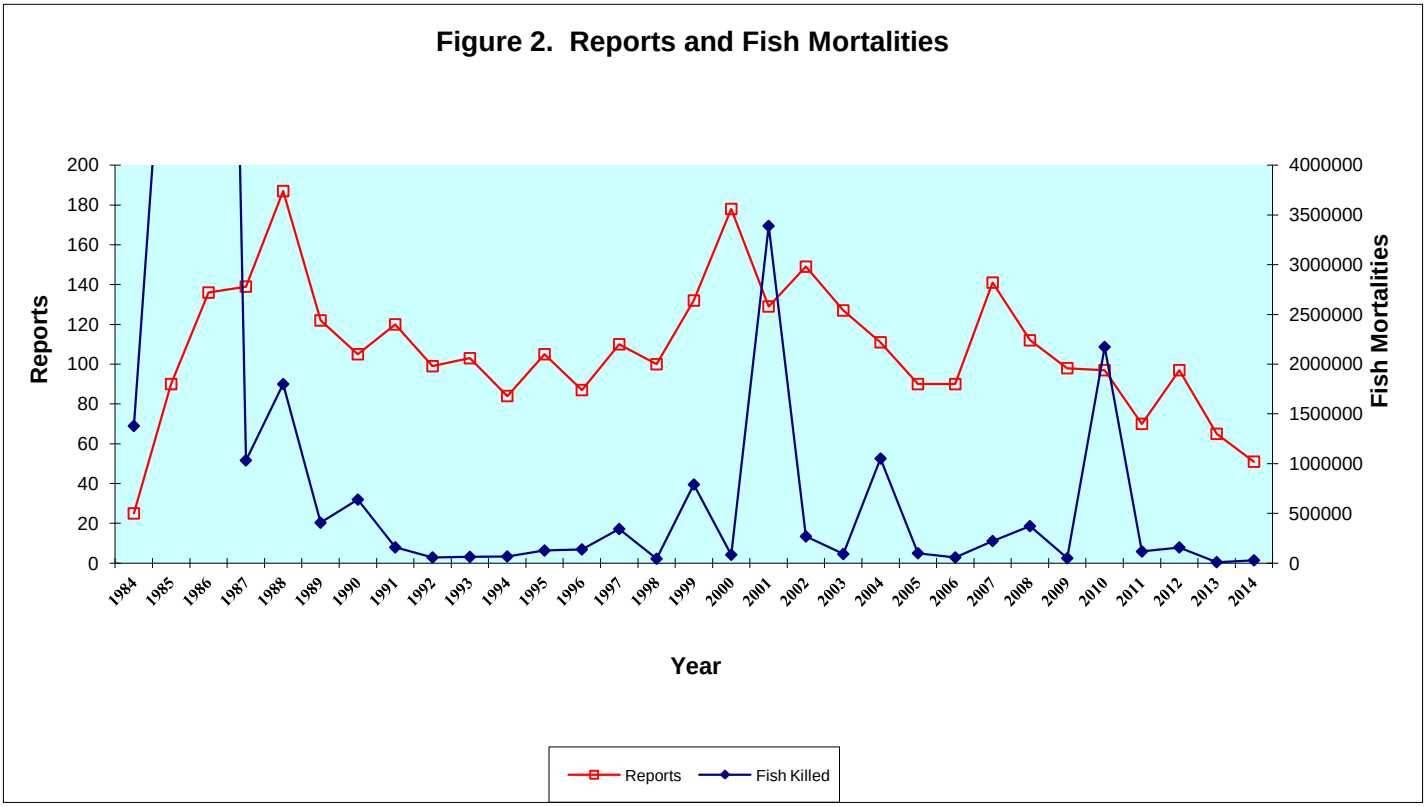
The spring and summer of 2014 was characterized by frequent but moderate rainfall. The absence of prolonged dry, hot spells greatly reduced water quality issues and resulted in a shrunken summer “dead zone” in the Chesapeake Bay and its tributaries (EPA Bay Program). There was also a resultantly low number of fish kills for the year (only 51). Fish kill events typically vary from year-to-year depending upon rainfall, temperature, ice cover, variations in fish populations, and disease outbreaks.

Teams consisting of two or more agencies conducted several of the investigations. MDE Fish Kill Investigation Section personnel investigated 27 fish kill reports. The Maryland DNR-Fisheries Service participated in two. Other MDE groups participated in seven investigations: five by the Water Management Administration and two by the Field Operations Program-Shellfish Compliance Division. The Montgomery Department of Environmental Protection participated in one investigation.

Magnitude of Events

MDE estimates the number of fish and other organisms involved with each reported event. Single events may dominate the total number of fish killed each year. For instance, in the 1980's large schools (in the millions) of young-of-year menhaden were involved in several exceptionally large kills as a result of corralling in shallow, oxygen depleted headwaters. Data from these events strongly skews the long-term average. As schools of young of the year menhaden gradually became less plentiful in the Chesapeake Bay, the number and magnitude of menhaden kills has dropped. The total fish mortalities in Maryland for 2014 (28,443) is only 2.1 percent of the 31-year fish mortality average of 1,334,998. It was the second lowest annual total recorded since 1984.

Figure 2. Reports and Fish Mortalities



Distribution of Fish Kills

All but three counties were affected by fish kills in 2014 (Table 1). The highest number (7) occurred in Anne Arundel County. Prince George's and Cecil Counties had the second highest occurrence with 5. Other counties with notable numbers of events were Baltimore and Harford (4 each), and Baltimore City and Queen Anne's with 3 each. Of these seven jurisdictions, six rank in the top eight for historical reports. Anne Arundel County has had the most reported kills (622) since 1984. Baltimore County ranks second highest with 344. Counties with abundant tidal shoreline and high population densities experience the most fish kill reports. These factors exacerbate anthropogenic impact and also increase the likelihood of reports being received. Additionally, Anne Arundel County historically is at the center of the highest densities of blooms of the toxic dinoflagellate, *Karlodinium veneficum*. Fish kills attributed to Karlotoxin (either alone or in concert with low Dissolved Oxygen) have accounted for 35 fish kills

Table 1: Fish Kill Reports by County.

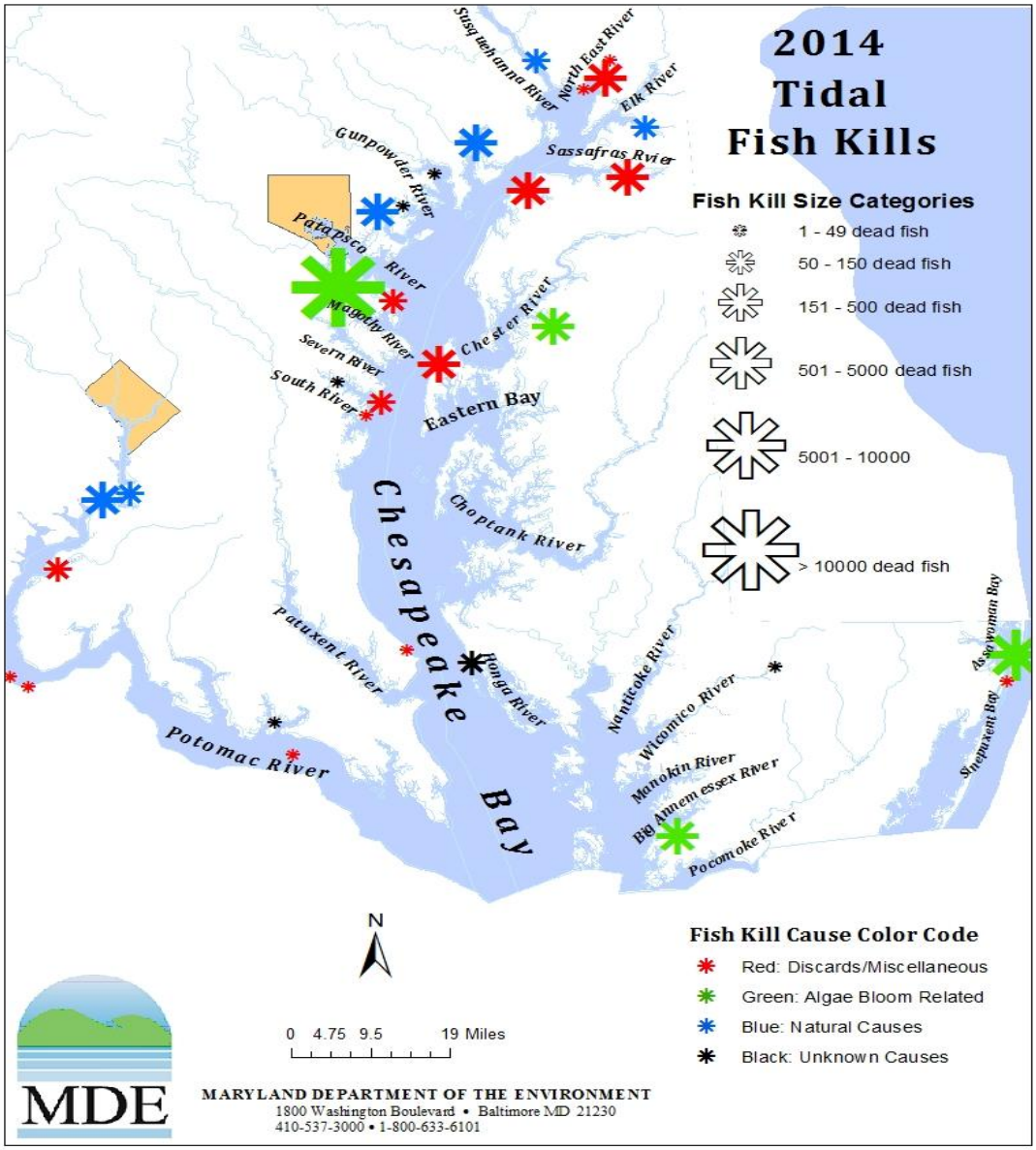
County	# Reports (2014)	# Reports (1984-2014)
Allegany	0	31
Anne Arundel	7	622
Baltimore	4	344
Baltimore City	3	100
Calvert	1	164
Caroline	1	63
Carroll	1	99
Cecil	5	201
Charles	2	116
Dorchester	0	65
Frederick	1	107
Garrett	0	41
Harford	4	163
Howard	2	76
Kent	2	112
Montgomery	1	138
Prince Georges	5	146
Queen Anne's	3	145
Somerset	1	59
St. Mary's	2	174
Talbot	1	90
Washington	1	56
Wicomico	2	102
Worcester	2	87
TOTAL*	51	3301

**Totals do not include kills reported out of state.*

since 2002. Fifteen were in Anne Arundel County. No fish kills attributable to *Karlodinium veneficum* were observed in 2014.

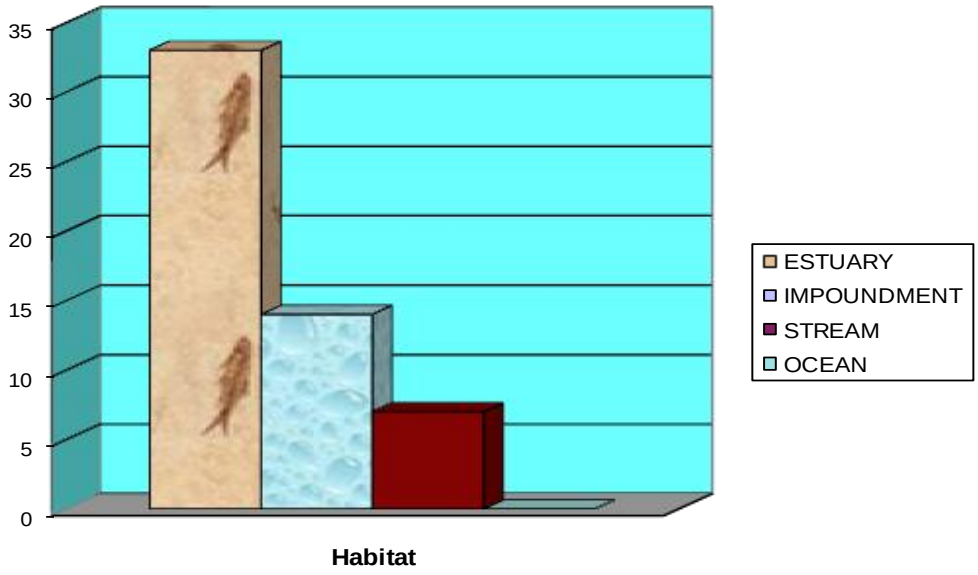
Figure 3 shows the geographical distribution, magnitude and causes of tidal fish kills and the causes attributed to them in 2014.

Figure 3: Distribution of fish kills throughout Maryland tidal waters.



Reported fish kills occurred in various aquatic habitats. There were seventeen reported from impoundments, nine from free flowing streams, and thirty-nine from estuarine waters (Figure 4). The number of reports from all environments was slightly below average. The percentage of kills reported from the various environments was very close to historical percentages.

Figure 4. 2014 Fish Kills by Environment



Causes of Fish Kills

Of the 31 events investigated, 30 were confirmed fish kills. One was determined to be a non-kill or an insignificant event where no dead fish were found.

Probable cause was determined in 25 of the 30 confirmed kills (Table 2). Natural causes were implicated in 12 events, including 5 cases of oxygen depletion, 6 cases of seasonal stress, and one case of disease. The remaining events included 9 caused by

fishing discards, 3 pollution cases, one case of entrapment at a construction site, and 5 cases where the cause was undetermined.

In 2014, for the fifth year in a row, no fish kills in Chesapeake Bay were attributed to toxins from blooms of the toxic dinoflagellate, *Karlodinium veneficum*. This algae is a long term resident of Chesapeake Bay. Although previously thought to be non-toxic, aka. *Gyrodinium estuariale*, it was associated with fish kills for many years. Around 2002, researchers at the University of Maryland corrected the misidentification and isolated potent ichthyotoxins (i.e. Karlotoxins) released by *K. veneficum*. Bioassay experiments performed at UM demonstrated the specific dose response associated with Karlotoxin. Since then, this office has worked to combine pertinent data from fish kill investigations (phytoplankton identification and enumeration, water quality, UM Karlotoxin analysis and dose response data) to diagnose kills caused by Karlotoxin. Since then, 35 Karlotoxin associated kills have involved 440,686 fish mortalities. No known human health effects are associated with these phenomena.

Algal blooms generally cause poor water quality by depleting the water column of oxygen. This condition occurs if excess nutrients induce large enough blooms to overwhelm biological oxygen demand (particularly in bottom water) during decomposition.

Table 2: Probable causes of investigated incidents, 2014.

Probable cause	# of incidents (2014)	Percent of Annual Total	# of incidents (1984-2014)	Percent of Historic Total
Natural	**12**	**38.7%**	**910**	**44.61%**
Low dissolved O_2	5		558	
Low D.O/Karlotoxin synergism	0		14	
Disease	1		123	
Toxic algae	0		19	
Seasonal/spawn stress/stranding	6		146	
Other natural causes	0		50	
Pollution	**3**	**9.7%**	**250**	**12.25%**
Industrial discharge	**1**		61	
Municipal sewage	**0**		38	
Municipal discharge	**2**		21	
Unknown toxin	**0**		42	
Other	**0**		88	
Miscellaneous	**10**	**32.3%**	**391**	**19.17%**
Discards	9		261	
Entrapment	1		86	
Pond mismanagement	0		32	
Other causes	0		12	
Unknown	**5**	**16.1%**	**360**	**17.65%**
Non-kill	**1**	**3.2%**	**129**	**6.32%**
TOTAL investigations	**31**		**2,040**	

Events by Number of Fish Involved

Approximately 28,443 fish mortalities were confirmed in 2014. An additional 20,100 invertebrates and other aquatic animals were involved in incidents totaling 48,543 aquatic animals killed in 2014.

In an average year approximately 5-10 fish kills in excess of 10,000 fish are noted. One kill involved more than 10,000 fish in 2014.

The largest kill (#214044) occurred September 9th in Eli Cove, a tributary of Stony Creek and the Patapsco River in Glen Burnie (Anne Arundel County). Approximately 10,000 Atlantic Menhaden and several Gizzard shad died due to low dissolved oxygen. Low D.O. fish kills in tidal headwaters were common events in the past decades; however they are less common in the past three years.

The second largest event (#214011) occurred April 28th in the Patapsco River from the mouth of Rock Creek to Masonville Cove and Canton. Approximately 7,000 Atlantic Menhaden died throughout the day as a school of moribund fish moved to the west. Fish were observed struggling and dying throughout the event, which lasted several hours. Water quality in the area was acceptable. It is believed that these fish suffered some stress that triggered the event. Investigation and several follow-ups were not able to rule out a temporary stranding, entrapment, or discharge of scalding water or toxin as the trigger.

The third largest kill (#214040) occurred August 20th in a tributary to Marshyhope Creek, immediately downstream of the spillway at Smithville Lake in Smithville (Caroline County). Approximately 3,000 Gizzard Shad and several Largemouth Bass, Carp, and unidentified sunfish died due to low dissolved oxygen. The spillway of the pond was passing very low flows and skimming a surface scum of the bluegreen algae, *Anabaena compacta* into the stream. Decomposition of the concentrated algae in the shaded stream resulted in elevated Biological Oxygen Demand and anoxia.

The fourth largest kill (#214042) occurred August 21st in Tiffany Run and Herring Run, a tributary of the Back River in Baltimore City. A citizen complaint of dead fish and a chlorine odor made to Bluewater Baltimore, an environmental advocacy group, resulted in a unilateral assessment of the kill by the group and an email to this office the following day

(Friday afternoon). Baltimore City was also notified, and was not able to determine a cause. When MDE became aware of the kill, four days later, staff form the Water Management Compliance division, and from the Fish Kill Section were not able to properly assess the damage or find evidence of the suspected chlorine discharge. In the past, fish kills have occurred in the same location due to accidental discharge of chlorine from the Montebello water treatment plant. Photographs and the email report that more than 1,000 unidentified minnows and white sucker died in this event.

The fifth largest kill (#214036) occurred July 10th in a dead end canal in Ocean City (Worcester County). Approximately 1000 fish, comprising five species died due to low dissolved oxygen. Poor water quality in dead end canals is a seasonal problem in the Coastal Bays region.

Pollution Caused Events

Intense local pollution or other direct anthropogenic causes were implicated in four Maryland events, killing approximately 2,013 fish. Approximately eight pollution caused kills occur in a typical year. Several other pollution discharges were investigated in 2014 where no kill occurred due to timely containment of the spills by MDE Emergency Response Division and others. All of the confirmed or suspected pollution-caused kills were referred to the appropriate enforcement agencies for follow-up procedures. These kills are presented below, ranked from highest to lowest magnitude of fish mortalities:

- (#214042) occurred August 21st in Tiffany Run and Herring Run, tributaries of the Back River in Baltimore City. Approximately 1,200 fish, mostly unidentified died due to a suspected chlorine discharge.

- (#214019) occurred May 26th in the Northeast Branch of the Anacostia River in Hyattsville, Prince George's County. Investigation revealed that 693 fish (3 species) died after they became entrapped and exhausted their available oxygen. The event occurred at the site of a railroad bridge construction site, where the installation of cofferdams and modification to bars in the stream bed created a depression. As stream flow and level decreased seasonally, the depression became isolated from the flowing portion of the stream and the fish were trapped in and around the coffer dam.
- (#214005) occurred March 20th in a storm water retaining pond at Baltimore Washington International Airport in Glen Burnie, Anne Arundel County. Investigation revealed that 100 Goldfish died after an unidentified substance with high BOD was discharged into the pond. The resulting anoxia triggered the kill and an eruption of sulfur bacteria resulting in hydrogen sulfide odors. Tests were unable to show what the substance was although glycol (antifreeze/deicer) and sewage appeared to be ruled out.
- (#214014) occurred May 9th in Beaver Creek, immediately upstream of and beside the Albert Powell Trout Hatchery in Hagerstown, Washington County. Investigation revealed that the discharge of hypoxic bottom water and sediments from a nearby quarry killed 20 fish (6 species). A timely response by hatchery staff and MDE prevented a more serious fish kill from occurring.

Causes of Non-investigated Fish Kills

Of the 20 non-investigated reports, 17 are classified as probable, non-confirmed fish kill events. Three reports are classified as non-kills. This classification is based on initial alerts, interviews with complainants, knowledge of fisheries, and/or scientific activity and historical data from the vicinity of the report (Table 3). Natural events are suspected in six of these kills. Anthropogenic causes are suspected in six. The causes of 5 reports are unknown.

Table 3: Suspected causes of non-investigated incidents.

Probable cause	# incidents (2014)	# of incidents (1984-2014)
Natural	**6**	**469**
Low dissolved O_2	3	250
Disease	0	111
Low D.O/Karlotoxin synergism	0	4
Seasonal/spawning stress	3	72
Other causes	0	32
Miscellaneous	**6**	**303**
Discards	6	218
Entrapment	0	56
Pond mismanagement	0	25
Other causes	0	4
Pollution	**0**	**22**
Unknown	**5**	**415**
Non-kill	**3**	**102**
TOTAL	**20**	**1,311**

Species Involved

Fish kills in 2014 affected at least 26 species of fish, representing 14 families and 10 orders (Table 4). Non-piscine species affected were: diamondback terrapins (100), and snails (20,000). Approximately 682 fish were unidentified.

Table 4: Species and Numbers of Individuals Affected by Fish Kills in 2014.

Mollusca	
Gastropoda	
Viviparidae	
***Campeloma* sp.-snail**	**20,000**
Reptilia	
Emydidae	
***Malaclemmys terrapin*- diamondback terrapin**	**100**
Chondrichthyes	
Myliobatiformes	
Rhinopteridae	
***Rhinoptera bonasus*-cownose ray**	**22**
Osteichthyes	
Unidentified bony fish	**682**
Anguilaformes	
Anguilidae	
***Anguilla rostrata*-American eel**	**30**
Atheriniformes	
Cyprinodontidae	
***Fundulus* sp.-killifish species**	**100**
Clupeiformes	
Clupeidae	
***Alosa* sp.-unidentified herring**	**30**
***Brevoortia tyrannus*-Atlantic menhaden**	**17,515**
***Dorosoma cepedianum*-gizzard shad**	**6,260**
Mugiliformes	
Mugilidae	
***Mugil cephalus*-striped mullet**	**100**
Salmoniformes	
Salmonidae	
***Oncorhynchus mykiss*-rainbow trout**	**2**
***Salmo trutta*-brown trout**	**1**

Cypriniformes	
Cyprinidae	
Unidentified minnows	**1,000**
***Carassius auratus*-golldfish**	**100**
***Cyprinus carpio*-common carp**	**205**
***Rhinichthys atratulus*-blacknose dace**	**9**
Catostomidae	
***Catostomus commersoni*-white sucker**	**205**
Siluriformes	
Ictaluridae	
Unidentified catfish	**48**
***Ameiurus nebulosus*-brown bullhead**	**505**
***Ictalurus furcatus*-blue catfish**	**20**
***Ictalurus punctatus*-channel catfish**	**40**
Perciformes	
Centrarchidae	
***Amploplites rupestris*–rock bass**	**1**
***Lepomis auritus*-redbreast sunfish**	**1**
***Lepomis macrochirus*-bluegill**	**350**
***Lepomis sp*.-unidentified sunfish**	**261**
***Micropterus salmoides*-largemouth bass**	**37**
***Pomoxis nigromaculatus*-black crappie**	**26**
Percidae	
***Etheosoma flabellare*-fantail darter**	**2**
Stromateidae	
Peprilus triacanthus-butterfish	**24**
Percopsiformes	
Moronidae	
***Morone americana*-white perch**	**740**
***Morone saxatilis*-striped bass**	**27**
Sciaenidae	
***Leiostomus xanthurus*-spot**	**100**