2017 Fish Kill Summary

Maryland Department of the Environment
Water and Science Administration
Bioregulatory Monitoring and Response Division
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 Bioregulatory Monitoring and Response 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. Information obtained by interviewing the complainant, knowledge of fisheries, and or scientific activity and historical data from the vicinity occasionally eliminates the need to investigate reports.

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.

2017 After Hours fish kill duty roster: Nick Kaltenbach, Chris Luckett, and Charles Poukish.

Others who participated in 2017 investigations:
Kate Ansalvish (MDE-WAS-CP), Kathleen Basset (MDE-FOP), Paul Benevento (PA-Fish & Boat), Mark Ecker (MDE-WAS-CP), Tiffany Granberg (CBF), Isabel Hardesty (Chester River Assoc), Deborah Hinkle (MDE-WWP), John Holt (MDE-FOP), Roman Jessian (MD-CBP), Oladapo John (MDE-WAS-CP), Dave Jordahl (MO-DEP), Megan Kennedy (MDE-WAS-CP), Mark Matsche (DNR-FWHP), Mike McAdams (PA-DEQ), Beth McGee (CBF), Rusty McKay (MDE-FOP), John Mullican (DNR-FS), Kevin O'Neill (MDE-WAS-CP), Alan Place (UM-IMET), Mark Rockman (MO-DEP), Bob Swann (MDE-ERD), Alex Torrela (MO-DEP)

Cooperating agencies in 2017:

- MDE- Emergency Response Division (ERD)
  - Office of Communications and Digital Strategy
  - Water and Science Admin.- Compliance Program (MDE-WAS-CP)
  - Water and Science Admin.- Field Operations Program (FOP)
  - Water and Science Admin.- Wetlands & Waterways Program (MDE-WWP)
- DNR- Fisheries Service (DNR-FS)
  - Natural Resources Police (DNR-NRP)
  - Oxford Cooperative Lab, Fish & Wildlife Health Program (DNR-FWHP)
  - Tidewater Ecosystem Assessment Division
  - MANTA-Annapolis Field Office
  - Coastal Bays Program (MD-CBP)
- MDA- Pesticide Regulation Division
- University of Maryland
  - Institute for Marine and Environmental Technology (IMET)
  - Veterinary Services
- USGS-Fish Health Branch
- Virginia Department of Environmental Quality (VA-DEQ)
- Virginia Department of Health, Division of Shellfish Sanitation (VDH-DSS)
- Montgomery County Department of Environmental Protection (MO-DEP)

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.

Summary

This report contains a summary of fish kills reported to Maryland Department of the Environment in calendar year 2017. After the completion of investigations and/or communications with witnesses or knowledgeable officials, a probable cause is usually determined for fish kills. The data presented were gathered from field investigations and discussions with reporting persons and officials.

Teams consisting of two or more agencies conducted several of the investigations. MDE Fish Kill Investigation Section personnel conducted 44 investigations. Other MDE groups participated in seven: three each by the Water and Science Administration (Inspection and Compliance) and the Field Operations Program-Shellfish Compliance Division and one each by the Wetlands and Waterways Program and the Emergency Response Division. The Maryland DNR-Fisheries Service, Fish and Wildlife Health Program, and Maryland Natural Resources Police participated in one each. The Maryland Coastal Bays Program participated in two investigations. The University of Maryland's Institute of Marine and Environmental Technology participated in one. The Montgomery County Department of Environmental Protection participated in one. Two events originating in Pennsylvania were investigated by the Pennsylvania Department of Environmental Quality and the Pennsylvania Fish and Boat Commission. The Chesapeake Bay Foundation and the Chester River Association each participated in one investigation.

Number of Events

Fish kill events typically vary from year-to-year depending upon rainfall, water quality, temperature, ice cover, variations in fish populations, and disease outbreaks. A total of 75 fish kills were reported in 2017, and 53 were considered significant enough to warrant on-site investigation. This represents the fifth lowest number of reports received for a year since 1985, and was 70% of the historic average of 107 reports per year. Most fish kills occur in tidal waters during warmer months when waters become warm and stratified, and hypoxia becomes more common. Seventy-eight percent of reported kills occurred during the six month period between April 1 and September 30 (Figure 1). Fifty-seven percent occurred during the four month period of June 1 through September 30.

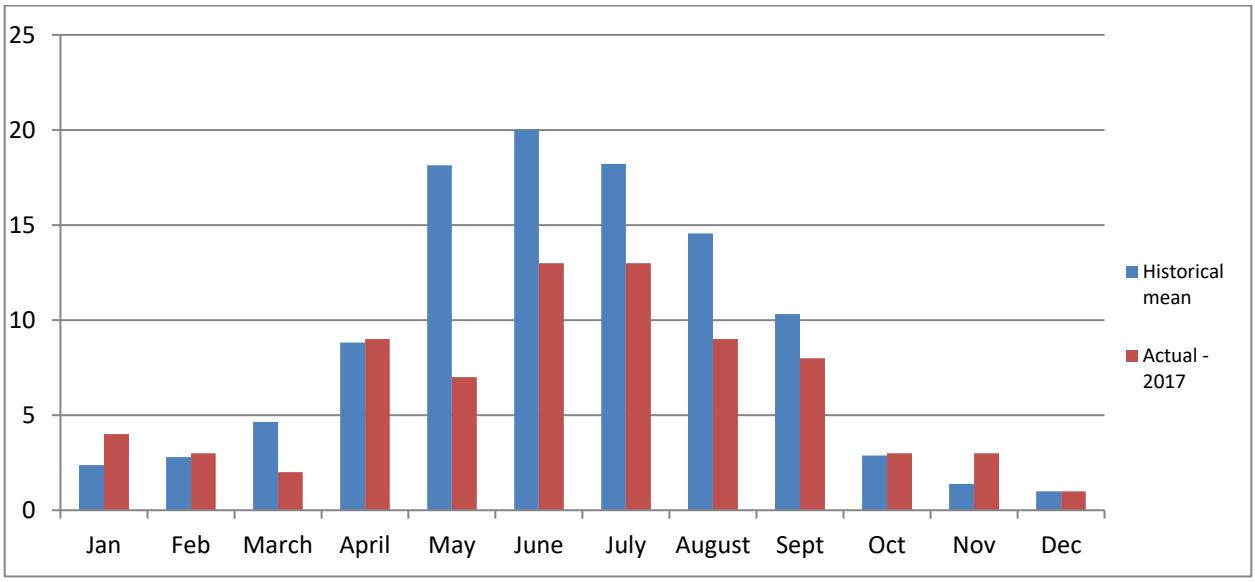


Figure 1. Fish kill reports received by month.

The early months of 2017 were characterized by relatively mild weather. Winter Salinities were above average throughout the Chesapeake Bay. This trend continued until June. Freshwater input was below normal until April, when rainfall and freshwater

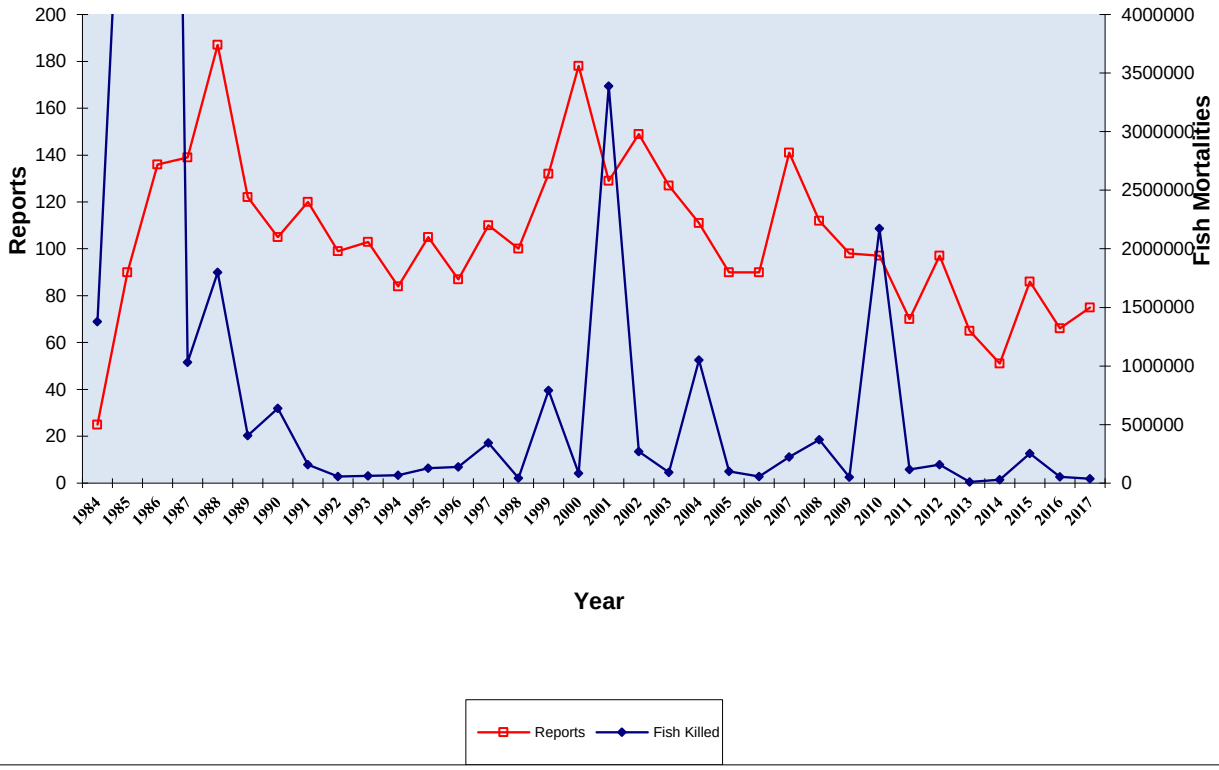
input returned to normal. Rainfall in spring and summer was frequent but moderate. Chlorophyll levels were below normal to normal throughout most of the bay and its tributaries (MD-DNR monitoring data). The absence of prolonged dry, hot spells reduced water quality issues and resulted in a shrunken summer “dead zone” in the Chesapeake Bay and its tributaries (EPA Bay Program). This pattern resulted in fewer fish kills during the warmest months. Water temperatures remained warm into December. The onset of very cold weather and freezing-over came with the New Year and resulted in several winter kills (to be included in the 2018 Annual Report).

Magnitude of Events

MDE estimates the number of fish and other animals involved in each reported event. Single events may dominate the total number of fish killed in a year (Figure 2). For instance, in the 1980’s large schools (in the millions) of young-of-year menhaden were involved in several very large kills as a result of corralling in shallow, oxygen depleted headwaters. These events strongly skew the long-term average. As schools of menhaden became smaller and less plentiful in the Chesapeake Bay, the number and magnitude of menhaden kills has dropped.

The total fish mortalities in Maryland for 2017 (36,240) is only 3 percent of the 34-year average of 1,227,359. It was the third lowest annual total recorded since 1984. Since 2013, the five-year average annual fish mortality (76,772) is 6.3 percent of the historic mean, testimony to both improved water quality and reduced stocks of young of year Atlantic Menhaden in the Chesapeake Bay.

Figure 2. Reports and Fish Mortalities



Distribution of Fish Kills

Every county except Carroll, Somerset, and Wicomico was affected by fish kills in 2017 (Table 1). The highest number (14) occurred in Anne Arundel County. Baltimore County had the second highest occurrence with 10. Harford had the third highest with 8. Calvert, Cecil, and Worcester Counties were tied for fourth with 4. Of these six jurisdictions, all but Worcester rank in the top five for historical reports. Anne Arundel County has had the most reported kills (656) since 1984. Baltimore County ranks second highest with 371. Counties with abundant tidal shoreline and high population densities experience the most fish kill reports. These factors increase the likelihood of reports

being made and typically exemplify localized anthropogenic impact. Additionally, Anne Arundel County historically is at the center of the highest densities of toxic dinoflagellates (e.g. *Karlodinium veneficum*), with fifteen historical incidents. Fish kills attributed to Karlotoxin (either alone or in concert with low Dissolved Oxygen, or high salinity) have accounted for 38 fish kills since 2002. No fish kills attributable to *Karlodinium veneficum* were observed in 2017.

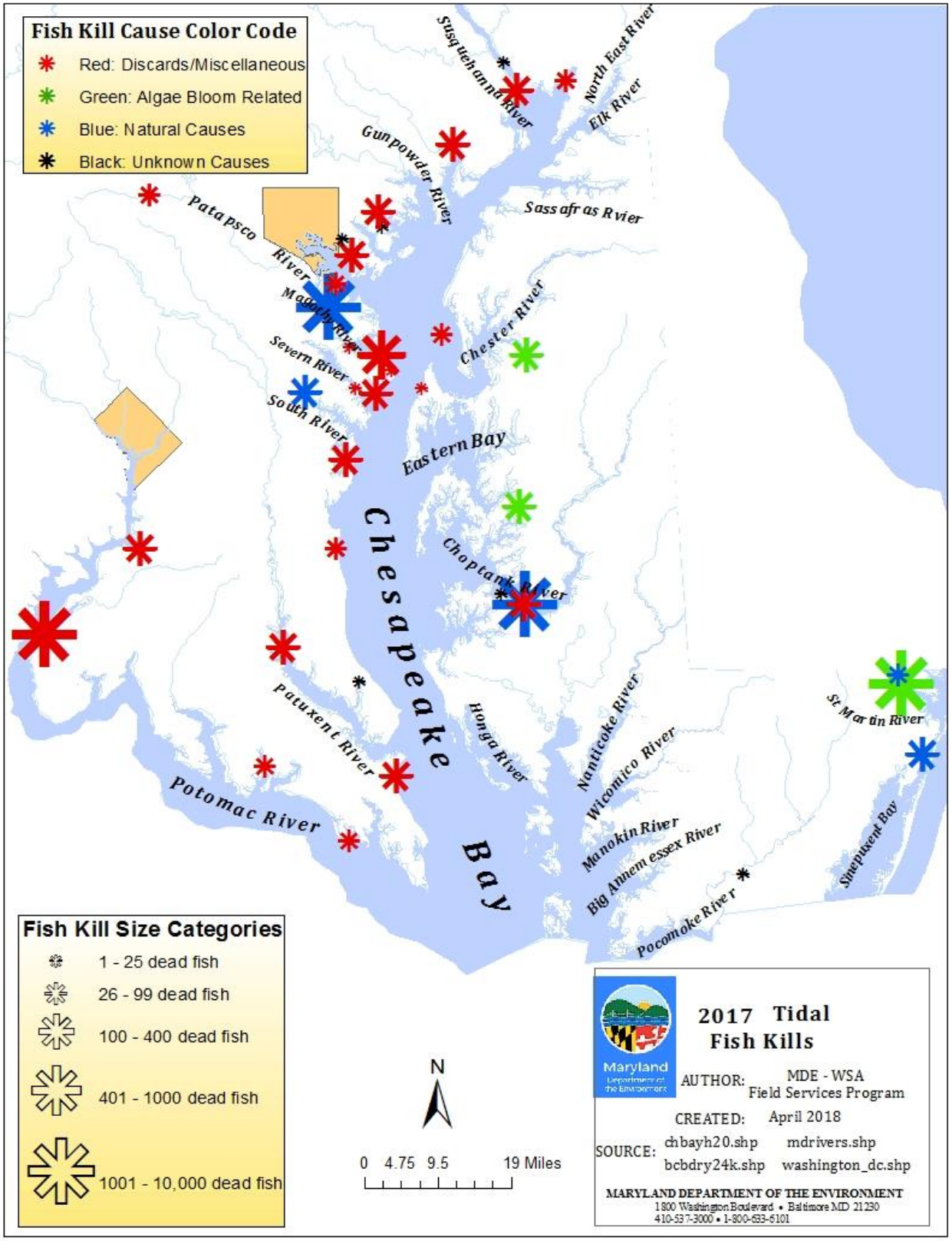
Figure 3 shows the geographical distribution, and magnitude of tidal fish kills, including the causes attributed to them in 2017.

Table 1: Fish Kill Reports by County.

County	# Reports (2017)	# Reports (1984-2017)
Allegany	1	35
Anne Arundel	14	656
Baltimore	10	371
Baltimore City	2	107
Calvert	4	175
Caroline	1	68
Carroll	0	101
Cecil	4	209
Charles	1	130
Dorchester	3	68
Frederick	2	111
Garrett	1	45
Harford	8	175
Howard	2	80
Kent	2	118
Montgomery	3	152
Prince Georges	2	157
Queen Anne's	2	155
Somerset	0	61
St. Mary's	3	187
Talbot	3	95
Washington	1	61
Wicomico	0	104
Worcester	4	101
TOTAL*	73*	3522

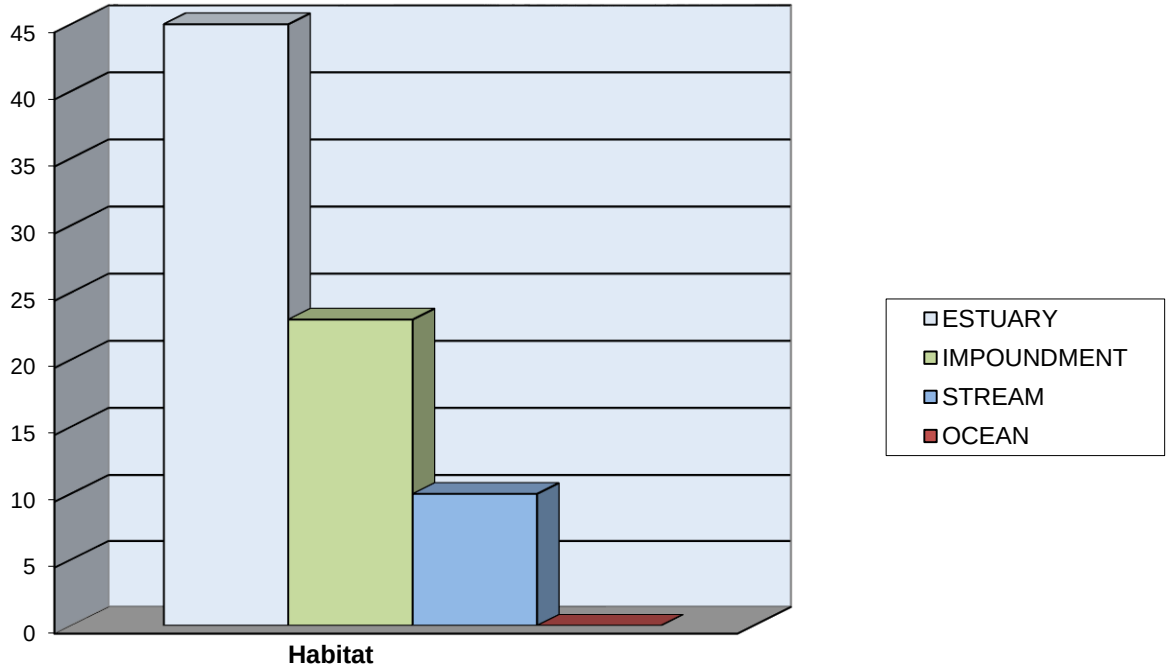
**Totals do not include kills reported out of state or statewide events.*

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



Reported fish kills occurred in various aquatic habitats. There were twenty-two reported from impoundments, nine from free flowing streams, and forty-four from estuarine waters (Figure 4). The number of reports from all environments was below average.

Figure 4. 2017 Fish Kills by Environment



Causes of Fish Kills

Of the 75 events reported, 63 were classified as fish kills. Twelve were determined to be a non-kill or insignificant events where no dead fish were found.

Probable cause was determined in 52 of the 63 fish kills (Table 2). Natural causes were implicated in 21 events, including 10 cases of oxygen depletion, 6 cases of winter/seasonal/spawning stress, 2 cases of stranding, and one each of saline shock,

disease, and lightning strike. The remaining events included 20 caused by fishing discards, 5 cases of entrapment in man-made structures, 5 pollution cases, and one case of stocking stress. There were 11 cases where the cause was undetermined.

Table 2: Probable causes of fish kill reports, 2017.

Probable cause	**2017 Only**	***Percent of Annual Total***	**# of Reports 1984-2017**	***Percent of Historic Total***
Natural	21	28.00%	1453	40.63%
Disease	1		236	
Low dissolved O_2	10		844	
Seasonal / Spawning stress	5		229	
Stranding	2		67	
Salinity shock	1		4	
Thermal shock	1		29	
Toxic algae bloom	0		22	
Toxic algae/water quality synergism	0		16	
Storm surge	0		1	
Lightning Strike	1		1	
Predation	0		4	
Pollution	5	6.67%	288	8.05%
Agriculture	0		32	
Municipal sewage	0		46	
Industrial discharge	3		55	
Swimming pool discharge	0		19	
Fuel/Oil spills	0		30	
Unidentified source	0		54	
Construction	1		12	
Municipal discharge	0		25	
Pond Management chemicals	1		15	
Miscellaneous	26	34.67%	759	21.22%
Discards	20		535	
Entrapment	5		151	
Stocking stress, pond Mgmt.	1		65	
Scientific discards, exotic species control	0		8	
Unknown	11	14.67%	816	22.82%
Non-kill	12	16.00%	260	7.27%
TOTAL	**75**		**3576**	

In 2017, no fish kills were attributed to toxins produced by the 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, 38 Karlotoxin associated kills have involved 479,028 fish mortalities. No known human health effects are associated with these phenomena.

Other nuisance algae species (e.g. *Prorocentrum minimum, Gyrodinium uncatenum, G. instriatum*) are not known to be toxic in Maryland, but may occasionally bloom to high enough levels to cause fish kills resulting from high Bio-chemical Oxygen Demand (B.O.D).

Events by Number of Fish Involved

Approximately 36,240 fish mortalities were confirmed in 2017. An additional 130 invertebrates and other aquatic animals also died totaling 36,370 organisms for the year.

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 2017.

The largest kill (#217035) began June 20th in Pink's Pond in Cambridge (Dorchester County). Approximately 11,110 fish (eight species) died of low dissolved oxygen immediately after a thunderstorm, evidently causing an inversion in the water column.

The second largest event (#217069) occurred October 1st in a community pond in Olney (Montgomery County). Approximately 5,932 fish (bluegill and bass) died of low dissolved oxygen and population stress. Only five of the bluegills were larger than four inches and there were only five adult bass in the pond. There was no sign of bass reproduction.

The third largest kill (#217034) occurred June 19th in Sloop Cove off Stoney Creek in Glenburnie (Anne Arundel County). Approximately 5,000 Atlantic menhaden died immediately after a thunder storm. Water quality was acceptable at the site and it is believed that the kill was initiated by a lightning strike.

The fourth largest kill (#217065) occurred September 18th in Bishopville Prong, a tributary of the Saint Martin's River (Worcester County). Approximately 3,000 Atlantic menhaden died of low dissolved oxygen during a strong bloom of the non toxic dinoflagellate, *Gyrodinium instriatum*.

The fifth largest kill (#217063) occurred September 14th in the headwaters of Chicamuxen Creek, a tributary of the Potomac River (Charles County). Approximately 2,500 fish, mostly blue and channel catfish but also four other species, died after being confined in a haul seine overnight. The commercial fisherman had intended to keep the large number of fish alive to be transported another day but were to densely concentrated and expired.

Pollution Caused Events

Intense local pollution or other direct anthropogenic causes were implicated in five Maryland events, killing approximately 2,632 fish. Approximately eight pollution caused kills occur in a typical year. Both pollution-caused kills were referred to the appropriate enforcement agencies for follow-up procedures.

- (#217057) occurred August 13th in Northeast Creek in Rising Sun (Cecil County). Approximately 2,200 fish (12 species) died of low dissolved oxygen after a high BOD substance was released into an unnamed tributary in Pennsylvania. An additional 2,300 fish died in Pennsylvania. The findings were quickly referred to Pennsylvania authorities and coordinated with the MDE Inspection and Compliance Program. PA DEQ and Boat and Fish commission investigators suspected the substance was potato waste water from a potato chip plant in Nottingham. It was not until a smaller incident (#217060) occurred that the responsible party's actions were proven and corrective measures taken.
- (#217001) occurred January 10th in Beaver Dam Creek in Union Bridge (Frederick County). A cement truck overturned at the bridge over the creek and lost much of its load. Investigation revealed that at least 332 fish (11 species), 15 salamanders, 3 crayfish, a frog and a tadpole died in the high pH plume that resulted.
- (#217030) occurred June 13th in a cemetery pond on Taylor Avenue in Baltimore City. Investigation revealed that 200 fish (4 species) died in the pond as a result of severe hypoxia two days after treating the pond with

algicide. The decomposition of the algae resulted in a high BOD and oxygen suppression.

- (#217018) occurred April 29th in an unnamed tributary of Herring Run in Towson (Baltimore County). Investigation revealed that 50 blacknose dace died in the small stream after oil spilled from construction equipment entered the steam.
- (#217060) occurred August 25th in an unnamed Pennsylvania tributary of Northeast Creek, which flows into Cecil County. Approximately 50 unidentified fish died in Pennsylvania but no fish kill resulted in Maryland waters. Investigation by PA authorities revealed that the cause was a discharge of high BOD potato waste water from a plant in Nottingham. This incident and investigation provided the information needed to hold the responsible party for the previous fish kill in the same area (#217057).

Species Involved

Fish kills in 2017 affected at least 36 species of fish, representing 12 families and 10 orders (Table 3). Non-piscine species affected were: unidentified frog (1), unidentified tadpole (1), unidentified salamander (15), blue crab (110), and unidentified crayfish (3). Approximately 409 fish were unidentified.

Table 3: Species and Numbers of Individuals Affected by Fish Kills in 2017.

Arthropoda	
Portunidae	
***Callinectes sapidus*-blue crab**	**110**
Cambaridae	
Unidentified crayfish	**3**
Chordata	
Amphibia-	
Unidentified frog	**1**
Unidentified tadpole	**1**
Unidentified salamander	**15**
Osteichthyes	
Unidentified bony fish	**409**
Anguillaformes	
Anguillidae	
***Anguilla rostrata*-American eel**	**1**
Atheriniformes	
Cyprinodontidae	
***Fundulus* sp. unidentified killifish**	**1**
Clupeiformes	
Clupeidae	
***Brevoortia tyrannus*-Atlantic menhaden**	**8,524**
***Dorosoma cepedianum*-gizzard shad**	**6,394**
Salmoniformes	
Salmonidae	
***Oncorhynchus mykiss*-rainbow trout**	**10**
Cichliformes	
Cichlidae	
***Oreochromis sp.*-tilapia**	**40**
Scorpaeniformes	
Cottidae	
***Cottus girardi*-potomac sculpin**	**15**
Siluriformes	
Ictaluridae	
Unidentified catfish	**22**
***Ameiurus natalus*-yellow bullhead**	**5**
***Ameiurus nebulosus*-brown bullhead**	**80**
***Ictalurus furcatus*-blue catfish**	**2,054**
***Ictalurus punctatus*-channel catfish**	**531**
***Noturus insignis*-margined madtom**	**35**
Percopsiformes	

Moronidae	
***Morone americana*-white perch**	**4,154**
***Morone saxatilis*-striped bass**	**1,087**
Cypriniformes	
Cyprinidae	
Unidentified minnows	**213**
***Campostoma anomalum*-central stoneroller**	**16**
***Carassius auratus*-goldfish**	**13**
***Cyprinus carpio*-common carp/koi**	**612**
***Exoglossum maxilingua*-cutlips minnow**	**225**
***Luxilus cornutus*-common shiner**	**87**
***Notropis hudsonis*-spottail shiner**	**433**
***Pimephales notatus*-bluntnose minnow**	**36**
***Rhinichthys atratulus*-blacknose dace**	**248**
***Rhinichthys cataractae*-longnose dace**	**47**
***Semotilus atromaculatus*–creek chub**	**402**
Catostomidae	
***Catostomus commersoni*-white sucker**	**526**
***Hypentelium nigricans*-northern hogsucker**	**35**
***Moxostoma erythrurum*-golden redhorse**	**20**
Perciformes	
Centrarchidae	
***Lepomis auritus*-redbreast sunfish**	**572**
***Lepomis gibbosus*-pumpkinseed**	**1,015**
***Lepomis macrochirus*-bluegill**	**7,943**
***Lepomis sp*.-unidentified sunfish**	**5**
***Micropterus salmoides*-largemouth bass**	**112**
***Pomoxis nigromaculatus*-black crappie**	**52**
Percidae	
***Etheostoma blennioides*-greenside darter**	**3**
***Etheostoma flabellare*-fantail darter**	**73**
***Etheostoma olmstedi*-tessellated darter**	**139**
***Perca flavescens*-yellow perch**	**51**