2024 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. If appropriate, findings should be acted upon to require the reparation of any damage done and the restoration of the affected water resources, to the 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 fish kill reports 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, 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 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.

2024 After Hours fish kill duty roster: Nick Kaltenbach, Chris Luckett, and Barbara Sikorski.

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Cooperating agencies in 2024:

MDE- Emergency Response Division (ERD)
Water and Science Admin-Compliance Program (MDE-WSA-CP)
Water and Science Admin-Field Invest & Env Resp. Program (FIERP)

DNR- Fishing and Boating Services (DNR-FBS)
Natural Resources Police (DNR-NRP)
Tidewater Ecosystems Assessment (DNR-TEA)
Oxford Cooperative Lab, Fish & Wildlife Health Program (DNR-FWHP)

Anne Arundel Community College (AACC)
Maryland Coastal Bays Program (MD-CBP)
MEMA-Maryland Emergency Management Administration
MES- Maryland Environmental Service
MDA- Maryland Dept. of Agriculture, Pesticide Regulation Division
University of Maryland- Institute for Marine and Environmental Technology (IMET)
Virginia Department of Environmental Quality (VA-DEQ)
Virginia Department of Health, Division of Shellfish Sanitation (VDH-DSS)
Baltimore Co. Dept. of Environmental Protection & Sustainability (BA-EPS)
Montgomery County Department of Environmental Protection (MO-DEP)
Montgomery County Parks (MO-Parks)

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

Summary

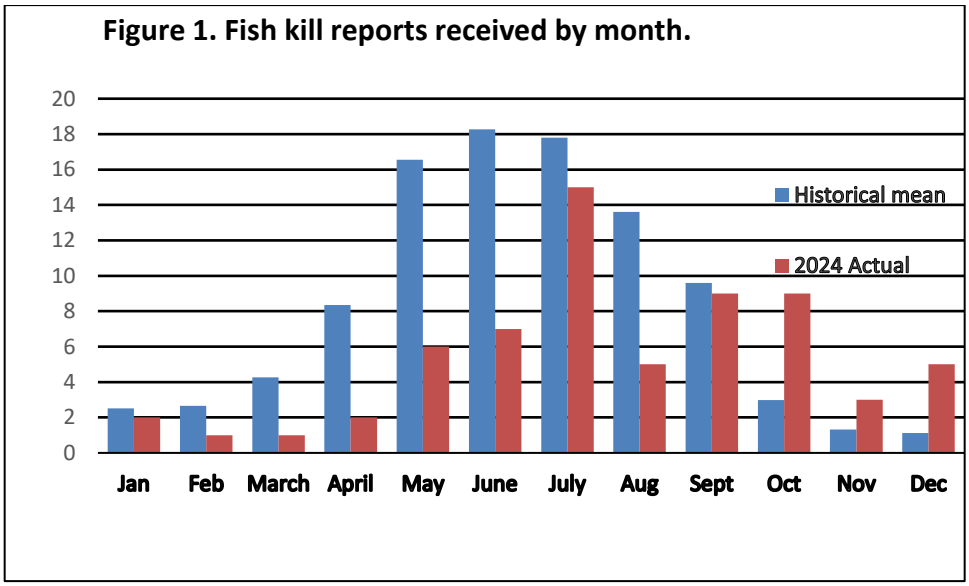
This report contains a summary of fish kills reported to MDE in the calendar year 2024. After the completion of investigations and/or communications with witnesses or knowledgeable officials, a probable cause is usually determined for fish kills. The data presented was gathered from field investigations 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 31 investigations, and all investigations were coordinated through this office. Other MDE groups participated in 12 investigations: three by the Water and Science Administration's Compliance Program and nine by the Field Investigation and Environmental Response Program. Maryland DNR groups participated in six investigations: two by the Fishing and Boating Service, three by the Tidewater Ecosystem Assessment Service, and one by the Natural Resources Police. The Montgomery County Department of Environmental Protection, The Washington Suburban Sanitary Commission (WSSC) and Anne Arundel Community College participated in one each.

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 65 fish kills were reported in 2024, and 43 were considered significant enough to warrant on-site investigations. This represents the fifth-lowest number of reports received for a year since 1985 and was 62% of the historic average of 104.9 reports per year. Most fish kills occur in tidal waters during warmer months when waters become warm and stratified, and hypoxia becomes more common. In 2024, 65% of reported kills occurred during the five-month period between May 1 and September 30 (Figure 1). Seventy-eight percent occurred during the six-month period of May 1 through October 31. Fish kill reports from March through June fell well below historic averages, while combined reports in September and October were above average. While most fish kill reports still occur in the warmest months, the total number of events have been well below average for the past ten years.

Figure 1. Fish kill reports received by month.



Chesapeake Bay (Tidal) Water Quality

In most years, periods of intense heat, cold, drought, or heavy precipitation (resulting in nutrient inputs) create conditions that help explain adverse effects on aquatic life, including fish kills. MD DNR's extensive tidal monitoring network provides an excellent dataset of water quality conditions throughout much of the State. The data is publicly available on their "Eyes on the Bay" page.

In 2024, there were no historic heatwaves, cold spells, and rain events. However, the year was unusually dry, except for the months of January through March. The year began with below-average salinities in most tidal waters. As spring aproached, salinities gradually increased to about normal, where they remained through August. Very dry weather, began in May and lasted through the remainder of the year. By September or October in most tidal tributaries and the Chesapeake Bay, salinities were above average; they remained above average through December. Water temperatures were above average in most tidal waters from January through April. They were about average until October. From October through December, most tidal waters remained above average in temperature.

Dissolved oxygen in the Chesapeake Bay and its tidal tributaries began slightly below average in the early months but were about average throughout most of the late spring and summer. Several locations experienced below average dissolved oxygen in the fall.

By the end of 2024, the annual summary of the Chesapeake Bay hypoxia performed by DNR (with Old Dominion University) concluded that the volumes of hypoxia varied through the warm months at near or below average (MD DNR, Eyes on the Bay

2024). The average monthly ranking for size of the dead zone was fifteenth over the past 39 years.

The percentage of fish kills reported in estuarine waters (58%) was about the historic average (57%). The percentage of kills attributed to low dissolved oxygen (22%) was at the historic average in 2024.

Magnitude of Events

MDE estimates the number of fish and other animals involved in each event. Single events may dominate the total number of mortalities 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 menhaden schools became smaller and less plentiful in the Chesapeake Bay, the number and magnitude of these kills fell, until a sharp increase again in 2024. Similarly, the sudden icing over of shallow wetlands in the winter of 2017-18 resulted in large mortalities of shoreline fish species that dominated the yearly totals for this period.

After several years of below average total mortalities, the total fish mortalities in Maryland for 2024 (5,011,045) are more than four times the 41-year average of 1,210,352; it is also thirty-one times greater than the median of 158,680. It was the third highest annual total recorded since 1984.

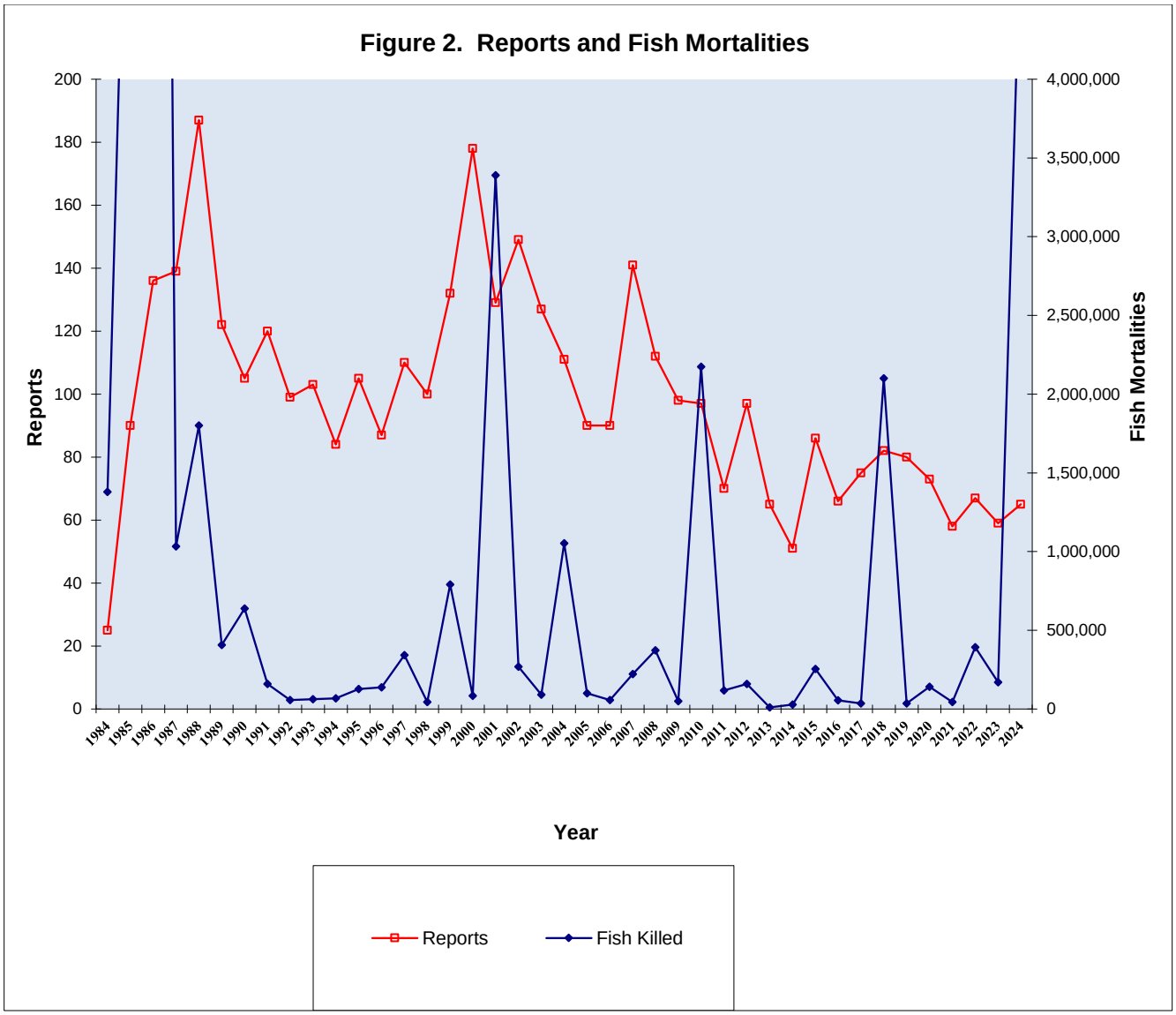


Figure 2. Reports and Fish Mortalities
Reports
Fish Mortalities
Year
Reports
Fish Killed

Distribution of Fish Kills

Every county, except Allegany, Charles, Harford, Kent, and Washington was affected by fish kills in 2024 (Table 1). The highest number (ten) occurred in Anne Arundel County. Somerset County had the second highest occurrence with seven. Saint Mary's had the third highest with six. Queen Anne's County had Baltimore City tied for the fourth highest occurrence with five reports. Of these five jurisdictions, three rank in the top seven in number of historical reports. The outlier, *Somerset County*, with seven reports typically ranks 21st for all counties. Anne Arundel County has had the most reported kills (739) since 1984. Baltimore County ranks second highest with 413. 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 has been at the center of the highest densities of toxic dinoflagellates (e.g., *Karlodinium veneficum*) with 15 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 2024.

Table 1: Fish Kill Reports by County.

County	# Reports (2024)	# Reports (1984-2024)
Allegany	0	40
Anne Arundel	10	739
Baltimore	3	413
Baltimore City	5	126
Calvert	1	201
Caroline	2	83
Carroll	3	108
Cecil	3	223
Charles	0	141
Dorchester	2	79
Frederick	2	128
Garrett	2	50
Harford	0	189
Howard	1	86
Kent	3	138
Montgomery	2	179
Prince Georges	1	171
Queen Anne's	5	184
Somerset	7	72
St. Mary's	6	228
Talbot	2	111
Washington	0	66
Wicomico	2	115
Worcester	2	125
TOTAL*	64*	3995*

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

Figure 3 shows the geographical distribution, magnitude, and causes of tidal water fish kills that occurred in 2024.

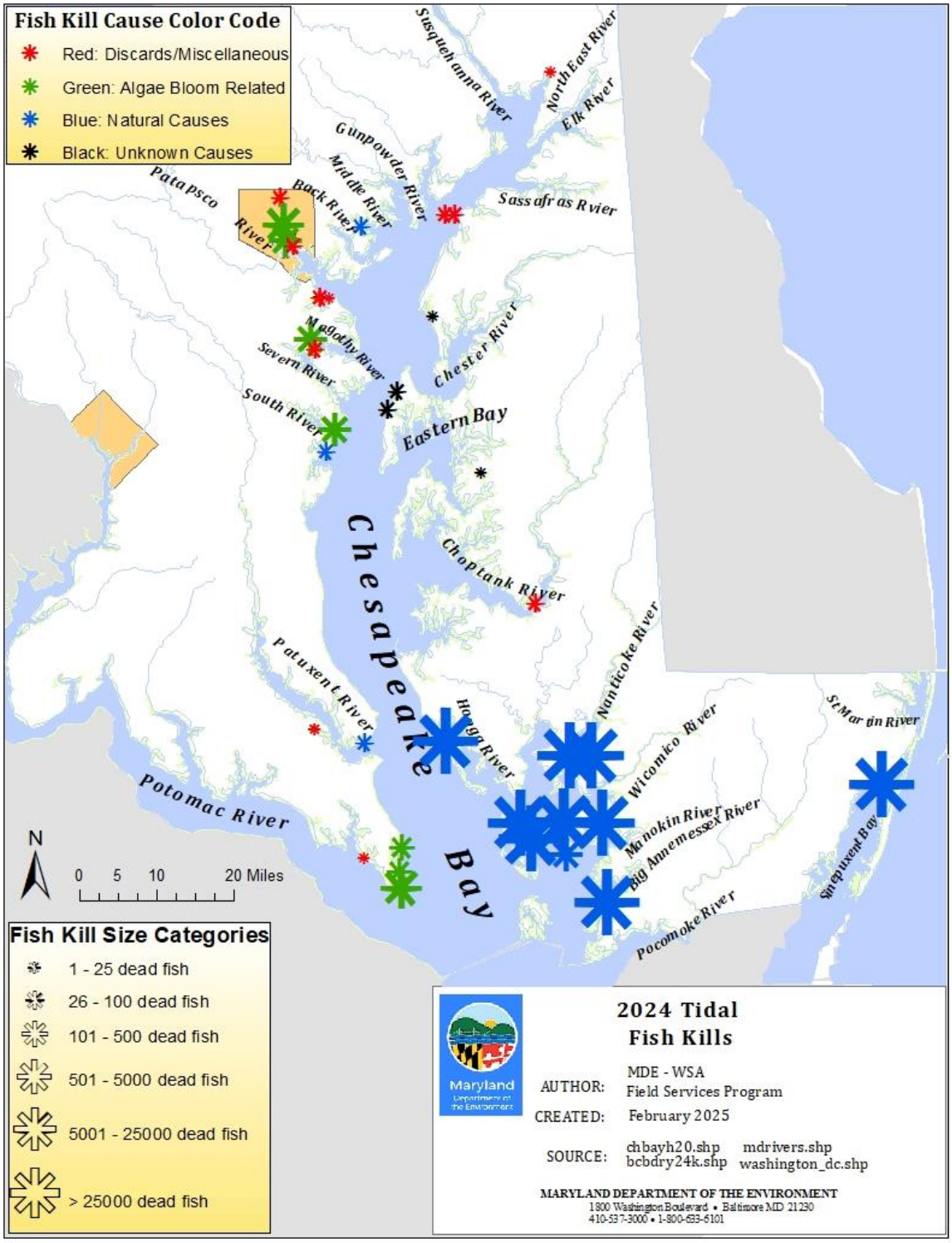
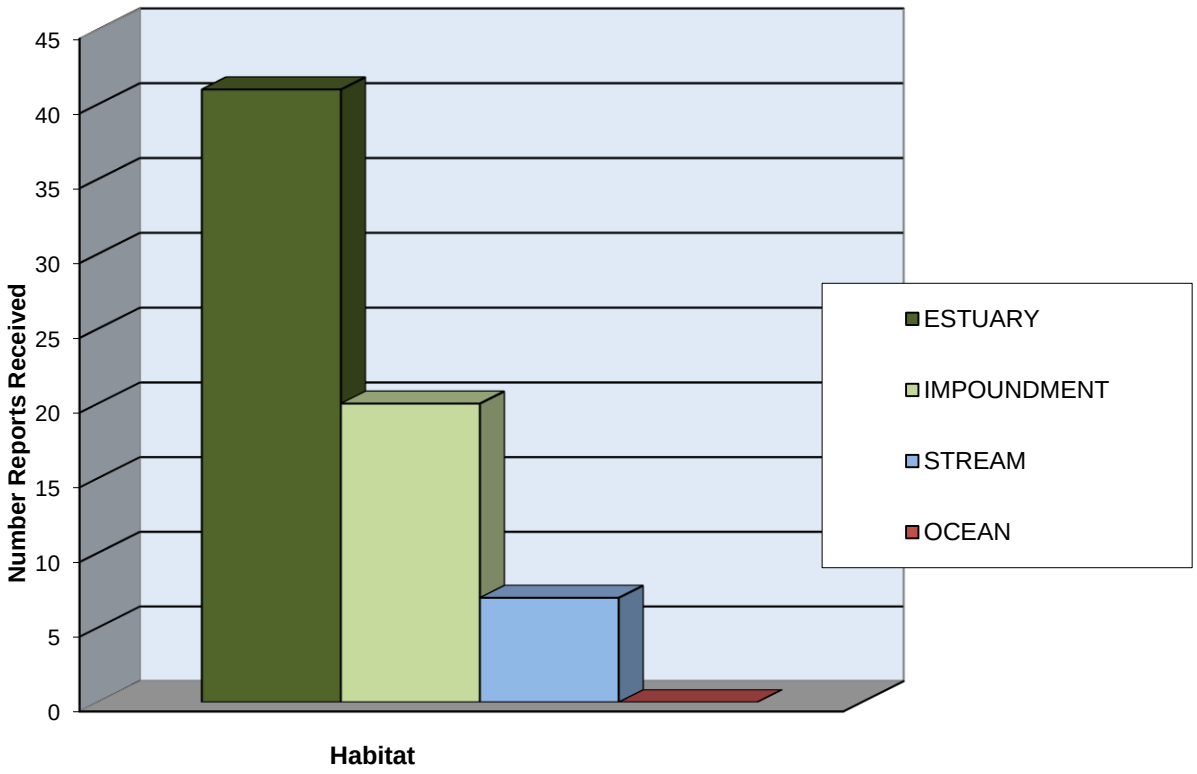


Figure 3: Distribution of fish kills throughout Maryland tidal waters.

Reported fish kills occurred in various aquatic habitats. There were 19 reported from impoundments, six from free-flowing streams, and 40 from estuarine waters (Figure 4). The number of reports from estuarine waters was 17 below the historic average. The number of reports from impoundments was nine below average. The number of reports from streams was eight below average. The ten-year average number of reports from all three ecologies is well below the historic average. However, the *percentages* of fish kill reports from streams, estuarine and impounded waters tend to be about at the historic average.

Figure 4. 2024 Fish Kill Reports by Environment



Causes of Fish Kills

Of the 65 events reported, 57 were classified as fish kills, and eight were determined to be non-kills or insignificant events where no dead fish were found.

Probable cause was determined in 45 of the 57 fish kills (Table 2). Natural causes were implicated in 33 events, including 18 cases of oxygen depletion, three cases of seasonal or spawning stress, and *twelve* cases of stranding. The remaining events included 11 caused by fishing discards, one case of entrapment in man-made structures, and four pollution cases. There were eight cases where the cause was undetermined.

Table 2: Probable causes of fish kill reports, 2024.

Probable cause	**2024 Only**	***Percent of Annual Total***	**# of Reports 1984-2024**	***Percent of Historic Total***
Natural	33	50.77%	1650	40.64%
Disease	0		242	
Low dissolved O_2	18		963	
Seasonal / Spawning stress	3		257	
Stranding	12		93	
Salinity/Osmotic shock	0		9	
Thermal shock/Freezing	0		41	
Toxic algae bloom	0		22	
Toxic algae/water quality synergism	0		16	
Storm surge	0		1	
Lightning Strike	0		1	
Predation	0		5	
Pollution	4	6.15%	323	7.96%
Agriculture	0		34	
Municipal sewage	2		48	
Industrial discharge	0		63	
Swimming pool discharge	0		22	
Fuel/Oil spills	0		32	
Unidentified source	1		60	
Construction	0		15	
Municipal discharge	1		34	
Pond Management chemicals	0		15	
Miscellaneous	12	18.46%	880	21.67%
Discards	11		636	
Entrapment	1		168	

Stocking stress, pond Mgmt.	0		67	
Scientific discards, exotic species control	0		9	
Unknown	8	12.31%	903	22.24%
Non-kill	8	12.31%	304	7.49%
TOTAL	**65**		**4060**	

In 2024, 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, a.k.a. *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 (e.g., 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, and 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, Levanderina fissa (*formerly *Gyrodinium uncatenum and G. instriatum*)) are not known to be toxic in Maryland but occasionally bloom to high enough levels resulting in fish kills caused by high biochemical oxygen demand (B.O.D.). In 2024, three fish kills were attributed to low dissolved oxygen caused directly by an algal bloom, even though most low dissolved oxygen cases are indirectly due to excess nutrients and algae.

Events by Number of Fish Involved

Approximately 5,011,045 fish mortalities were confirmed in 2024. An additional 3,436 invertebrates, amphibians, and other aquatic animals also died, totaling 5,014,481 organisms for the year.

In an average year, approximately five fish kills of more than 10,000 fish are noted. In 2024, there were ***eleven*** events of this magnitude.

The largest kill (#2024051) occurred October 3rd in Scotts Cove (west side) and Haines Pond, a tributary of Tangier Sound in Chance (Somerset Co). Approximately 2,000,000 Atlantic menhaden died after being stranded overnight in the shallow headwaters of the creek. This scenario played out on the lower eastern shore from late August until mid-October.

The second largest kill (#2024055) occurred October 10th in Scotts Cove (east side) in Chance (Somerset Co.). Approximately 103,010 fish, almost exclusively Atlantic Menhaden, died after being stranded overnight in the shallow headwaters of the creek.

The third largest kill (#2024040) occurred September 1st in a canal off Jones Creek, a tributary of the Annemessex River near Crisfield (Somerset Co.). Approximately 750,000 Atlantic menhaden died after becoming stranded overnight in the dead-end canal.

The fourth largest kill (#2024042) occurred August 31st in a canal off Gibbs Pond, a tributary of Newport Bay near Berlin (Worcester Co.). Approximately 650,000 Atlantic menhaden died after becoming stranded overnight in the dead-end canal.

The fifth largest kill (#2024048) occurred September 26th in Bivalve Harbor off the Nanticoke River in Bivalve (Wicomico Co.). Approximately 151,689 Atlantic menhaden died after becoming stranded overnight in the Marina.

The sixth largest kill (#2024052) occurred September 27th in Scotts Cove in Chance (Somerset Co.). Approximately 150,000 Atlantic menhaden died after becoming stranded overnight in the dead-end canal. This was one of three similar events in the same general area.

The seventh largest kill (#2024054) occurred September 25th at Wenona Harbor, near the mouth of the Manokin River (Somerset Co.). Approximately 100,000 Atlantic menhaden died after becoming stranded overnight in the Marina.

The eighth largest kill (#2024050) occurred October 3rd in Bivalve Harbor off the Nanticoke River in Bivalve (Wicomico Co.). Approximately 50,000 Atlantic menhaden died after becoming stranded overnight in the Marina.

The ninth largest kill (#2024021) occurred July 5th in Northwest Creek on Kent Island (Queen Anne's Co.). Northwest Creek is a tidal pond with a poor connection to the bay. It is prone to algal blooms. Approximately 46,929 Atlantic menhaden and gizzard shad died after a bloom of the raphidophyte, Heterosigma akashiwo, died off.

The tenth largest kill (#2024049) occurred September 1st in Back Creek of the Honga River (Dorchester Co.). Approximately 30,000 Atlantic menhaden died after being stranded overnight in the headwaters of the creek

The eleventh largest kill (#2024044) occurred September 3rd in the Inner Harbor (Baltimore City). Approximately 24,000 fish and several crabs died after an anoxic inversion brought oxygen depleted water to the surface of the harbor.

Pollution Caused Events

Intense local pollution or other direct anthropogenic causes were implicated in four Maryland events that totaled approximately 3,907 fish, 930 salamanders, 5 tadpoles, and 2,462 oligochaete worms. Approximately an average of eight pollution caused fish kills occur each year. All pollution related events are referred to the appropriate enforcement agencies for follow-up procedures.

- (#2024003) occurred February 3rd in the Eastern Branch of Herbert Run in Arbutus (Baltimore Co). Approximately 3,347 fish (nine species), 748 salamanders, 462 oligochaete worms, and 2 tadpoles died as a result of a discharge of an unknown toxin. The source of the discharge was determined to be within a one block area; however, the exact source was not determined in the densely urban area.
- (#2024001) occurred January 14th in the Manor Run tributary of Rock Creek in Rockville (Montgomery Co). Approximately 317 fish (eight species), 2,000 oligochaete worms, 182 salamanders, and 3 tadpoles died as a result of a discharge of chlorinated water. The local utility dewatered a large water main with inadequate dichlorination.
- (#2024024) occurred July 15th in the upper pond of Tanyard Branch in Easton (Talbot Co). Approximately 213 fish (three species) died as a result of a sewage discharge.
- (#2024035) occurred August 11th in Cypress Creek in Severna Park (Anne Arundel Co). Approximately 30 fish died after a sewage spill entered the creek.

Fish Kills of Special interest

One common summer fish kill scenario is stranding. In this scenario, fish, often in schools, become confined in shallow headwaters or dead-end canals. In some cases, fish will be corralled into this habitat by predatory fish. Then, coincident with a low tide or sunset, the fish become concentrated in a smaller volume of water and respire the available oxygen until they die en masse.

In the 1990's and before, large stranding events, sometimes involving well over one million young of the year Atlantic Menhaden, were not uncommon. Then the large events stopped occurring. Since then, through 2023, strandings rarely involved more than 100,000 fish.

Atlantic menhaden spawn offshore. Their young enter estuaries in the spring. They swim in schools and feed throughout the summer as they grow. They are the most important forage fish for striped bass and other larger predatory fish in Chesapeake Bay. Since the 90's, the annual recruitment of this species has been very low, triggering hypotheses that the small numbers contributed to the decline in the striped bass population. The cause of the decline in menhaden recruitment has been debated but not uncovered.

In 2024 there were nine large stranding events. Over 4.9 million menhaden died in these events. Maryland DNR's annual Young-of-the-Year Survey is often described as intended to follow reproduction of striped bass; however, biologists conducting the survey identify and count all species they encounter. Results published in the 2024 survey show that recruitment of menhaden in 2023 and 2024 has suddenly rebounded to numbers not previously seen since 1990. Although the stranding events are of concern to those who

witness them, they are natural events. Perhaps the large recruitment will continue, and predatory fish populations will increase.

Species Involved in Fish Kills

Fish kills in 2024 affected at least 34 species of fish, representing 14 families and 10 orders (Table 3). Non-piscine species affected included blue crabs, shore shrimp, salamanders, oligochaete worms, diamondback terrapins, tadpoles, and a common watersnake. Approximately 708 fish were unidentified.

Table 3: Species and Numbers of Individuals Affected by Fish Kills in 2024.

Anellida	
Lumbricidae – oligochaete worm	**2,487**
Arthropoda	
Decapoda	
Portunidae	
***Callinectes sapidus* - blue crab**	**2**
Palaemonidae	
***Palaemonetes* sp. – shore shrimp**	**4**
Chordata – Amphibia	
Plethodontidae	
Unidentified salamanders	**748**
***Eurycea bislineata* - Northern two-lined salamander**	**181**
***Pseudotriton r*uber – Northern red salamander**	**1**
Ranidae	
unidentified tadpoles	**5**
Chordata – Reptilia	
Order Testudines	
F. Emydidae	**7**
***Malaclemys terapin* - diamondback terrapin**	
Order Squamata	
F. Colubridae	**1**
***Nerodia sipodon* - common water snake**	
Chordata – Chondrichthyes	
Myliobatiformes	
Rhinopteridae	
***Rhinoptera bonasis* – cownose ray**	**15**
Chordata – Osteichthyes	
unidentified bony fish	**708**

Anguilliformes	
Anguillidae	
***Anguilla rostrata* - American eel**	**3**
Atheriniformes	
Atherinopsidae	
***Menidia menidia* – Atlantic silverside**	**200**
Cyprinodontiformes	
Fundulidae	
***Fundulus diaphanus* – banded killifish**	**500**
***Fundulus heteroclitis* – mummichog**	**100**
Cyprinodontidae	
***Cyprinodon variegatus* – sheepshead minnow**	**400**
Clupeiformes	
Alosidae	
***Brevoortia tyrannus* - Atlantic menhaden**	**4,990,419**
Dorosomatidae	
***Dorosoma cepedianum* - gizzard shad**	**6,593**
Siluriformes	
Ictaluridae	
unidentified catfish	**51**
***Amieurus natalus* – yellow bullhead**	**8**
***Amieurus nebulosus* – brown bullhead**	**50**
Scorpaeniformes	
Cottidae	
***Cottus caeruleomentum* – blue ridge sculpin**	**3**
***Cottus girardi* – Potomac sculpin**	**155**
Cypriniformes	
Cyprinidae	
***Campostoma anomalum* – central stoneroller**	**131**
***Cyprinella analostana* – satinfin shiner**	**12**
***Cyprinus carpio* - common carp/koi**	**147**
***Notemigonas chrysoleucas* – golden shiner**	**1000**
***Notropis procne* – swallowtail shiner**	**167**
***Pimephales notatus* – bluntnose minnow**	**95**
***Rhinichthys atratulus* - blacknose dace**	**2,653**
***Rhinichthys cataractae* - longnose dace**	**39**
***Semotilus atromaculatus* – creek chub**	**9**
Catostomidae	
***Catostomus commersoni* - white sucker**	**67**
***Hypentelium nigricans* – northern hogsucker**	**24**
Acanthuriformes	
Scianidae	
***Cynoscion nebulosus* – spotted seatrout**	**1**
***Leiostomus xanthurus* – spot**	**500**
Perciformes	
Centrarchidae	
***Lepomis auritus* – redbreast sunfish**	**112**

***Lepomis gibbosus* - pumpkinseed**	**300**
***Lepomis macrochirus* – bluegill**	**4,397**
***Lepomis microlophus* – redear sunfish**	**500**
***Lepomis sp*.- unidentified sunfish**	**2**
***Micropterus salmoides* - largemouth bass**	**905**
***Pomoxis nigromaculatus* - black crappie**	**51**
Moronidae	
***Morone americana* - white perch**	**129**
***Morone saxatilis* - striped bass**	**301**
Percidae	
***Etheostoma olmstedi* – tessellated darter**	**298**

References

MD DNR, Eyes on the Bay web site, 2024.

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https://news.maryland.gov/dnr/2024/10/17/results-of-chesapeake-bay-2024-young-of-year-striped-bass-survey-show-little-change/