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Harmful algae blooms (HAB) occur when toxin-producing algae grows excessively in the amount of water. Algae are microscopic organisms that live in the aquatic environment and use photosynthesis to generate energy from sunlight, just like plants. Excessive algae growth, or algae bloom, becomes visible to the naked eye and can be green, blue-green, red or brown, depending on the type of algae. Algae is always present in natural waters such as oceans, lakes and rivers, but only a few species can produce toxins. For these algae, toxin production can be stimulated by environmental factors such as light, temperature, and nutrient levels. Algae toxins released into the surrounding water or into the air can seriously harm humans, animals, fish and other parts of the ecosystem. Why do HAB perform? Scientists know that environmental conditions trigger HAB's, such as warmer water temperatures in summer and excess nutrients from fertilizers or wastewater brought into the drain, but there is still more to know as to why HABs occur. As climate change gradually warms the earth's climate, scientists expect HAB to become more frequent, widespread and serious. How do people come into contact? During HAB, people can be exposed to toxins in the fish they catch and eat, from swimming or drinking water, and from the air they breathe. In recent years, there have been numerous habs in the lakes that provide drinking water, such as Lake Erie. Importantly, eating contaminated seafood or boiling contaminated water does not destroy toxins. People rarely get sick with hab-related toxins in commercial seafood because national regulators closely monitor and close the catches of habs during flowering. People can avoid contact with HAB by following local health advice on the safety of recreationally caught seafood and drinking water sources. What are the health effects of flowering algae harmful to health? Depending on the type of algae, HAB can cause serious health effects and even death. For example, eating seafood contaminated with toxins from algae called aconum can lead to paralytic shellfish poisoning, which can lead to paralysis and even death. Algae Pseudo-nitzschia produces a toxin called domoic acid, which can cause vomiting, diarrhea, confusion, seizures, permanent short-term memory loss, or death when consumed at a high level. Habs, which occur in freshwater, such as the Great Lakes and other drinking water sources, are dominated by cyanobacteria microcystis. This body produces a liver toxin that can cause gastrointestinal disease, as well as liver damage. As with many environmental exposure, children and the elderly may be particularly sensitive to HAB toxins. Populations that rely heavily on seafood are also at risk of long-term health effects from potentially frequent, low exposure to HAB toxins. The table below summarizes the common HAB and their health effects. Other effects of habs in addition to health problems, HAB may also in the environment, depleting oxygen in water, which can cause fish death, or simply blocking sunlight from reaching the organisms deeper into the water. Habde's economic impact on fisheries and recreation areas can also be extensive. Closed fisheries can lose millions of dollars in revenue each week. The environmental sample processor may leave it in the water to test the habs continuously. It was developed by NIEHS in support of the Woods Hole Center for Oceans and Human Health. (Illustration: E. Paul Oberlander, Woods Hole Oceanographic Institution) Since the immediate effects of harmful algae blooms are well known, niehs-funded scientists are currently studying the potential long-term effects of HAB. For example, researchers are investigating whether consuming trace amounts of neurotoxic domoic acid over time impairs brain function, especially in children or the elderly. In animals, researchers have observed that chronic, low exposure to domoic acid altered the expression of genes controlling the nervous system and reduced cell function. The rapid detection of HABs may help national regulatory authorities to protect public health with minimal economic impact on fisheries and recreation areas. The Woods Hole Center for Oceans and Human Health (WHCOHH) in Massachusetts designed a robotics system called an environmental sample processor that can be anchored to a body of water remotely to test seawater samples of HAB when they begin to bloom, and send results to scientists. Other scientists supported by NIEHS are developing tools that can detect habs by counting algae cells in water samples or using satellite images to track hab from afar. Scientists are also studying the ability of water treatment plants to detect hab and are developing new methods to help detect them. With the frequency and seriousness of the Habs around the world, a better prediction will allow government officials to be a step ahead of the flowering. NIEHS-funded scientists at the Woods Hole Center for Oceans and Human Health found that in deep waters, algae Alexandrium fundyense can flourish based on an internal annual clock, while in shallow water, conditions such as temperatures can trigger blooms. These researchers have also shown that the number of dormant cysts formed after the summer alexandrium fundyense bloom can predict the extent of next year's bloom. Harmful algae blooms (HAB) are the rapid growth of algae that can harm animals, humans or local ecology. HAB can look like foam, sedi or mats on the surface of the water and can have different colors. HAB can produce toxins that have caused a wide range of diseases in humans and animals. HAB can occur in warm fresh, sea or brackish waters with rich nutrients and become more common due to climate change. You may have read about the algae taking over giant swaths of coastline, closing beaches and turning the sea into a frothy brownish red phenomenon known as the red tide. But harmful algae blooms are not just in our oceans. They also form freshwater collections, making lakes, ponds or your favorite swimming hole smelly and slimy. The flowering of algae is disgusting, but more importantly, they can also be dangerous, public health and aquatic ecosystems, and costly, affecting the local economy. Although they are not a new phenomenon (Spanish explorers recorded blooms along the Florida coast in the 1500s), reports of freshwater harmful algae blooms have increased significantly in the last 40 years, and they are now an environmental problem in all 50 states. It is predicted that climate change will only exacerbate the problem. Here's what you need to know about algae blooms, including their causes and consequences. Duck wades through algae bloom in Florida. What is algae bloom? Algae that are critical to water food networks are photosynthetic organisms, in other words, they receive energy for the growth of the sun. Algae blooms are overgrowth of microscopic algae or algae-like bacteria in fresh, salted or brackish water. Depending on the type of algae or bacteria that cause it, algae blooms can produce bad-smelling site, foam, foam or a colorful slick. Algae blooms can have many colors, including blue-green, yellow, brown, pink and red. Not all algae blooms are toxic, but studies show that more and more are. Harmful algae blooms, or HAB, are a flower that produces toxins that are dangerous to humans and potentially to other organisms. The most common freshwater harmful algae All types of algae can reiferize the hab under the right conditions. Most freshwater HABs in the United States are produced by cyanobacteria. Cyanobacteria (blue-green algae) Cyanobacteria flowering is most common in HAB lakes, ponds and other freshwater systems in this country, although they can also occur in rhyme and seawater environments. Cyanobacteria are, as the name suggests, bacteria-but they do photosynthesis, as algae do, and are often called blue-green algae. Some, though not all, types of cyanobacteria can produce dangerous cyanotoxins. The most commonly reported types of blooms forming cyanobacteria are Microcystis.Golden algaeThricationsTheest are found mainly in the oceans, golden algae (Prymnesium parvum) are emerging as a problem in freshwater rivers, reservoirs, and lakes, especially those with higher salinity (due to higher mineral content) such as those found in Texas and New Mexico. While bloom golden algae can cause massive fish kills, it has not been shown to pose a threat to humans. Surface water drains lead to the cord water to fill the lake in Wisconsin. Wisconsin Department of Natural Resources via Flickr What Causes Freshwater Algae Blooms? HAB is present both naturally in the environment and as a result of human activity, but the latter significantly increase the frequency, prevalence and toxicity of HABs. The following are some of the main causes of freshwater algae flowering: nutrient pollution Nutrients such as nitrogen and is a natural part of underwater ecosystems. But when they run away from urban and ground and flow into a river, lake, pond, or reservoir over-phenomenon known as nutrient pollution—they behave like fertilizer and promote the growth of algae and bacteria. Most excess nutrients enter waterways through agricultural run-off (especially from live water and chemical fertilisers washed by rain from farms), leaked waste from animal feed, stormwater run-off from urban and suburban areas, and discharges from wastewater treatment facilities. According to the U.S. Environmental Protection Agency's latest research on the state's water quality, nutrient pollution in the United States is a problem in more than one-third of lakes and about half of all rivers and streams. Warm waterSoe water gives cyanobacteria a competitive advantage. These bacteria grow faster than benign algae at higher temperatures, and when bloom forms, feedback loops can be triggered: As blooms grow thicker, the dark surfaces of algae mats absorb more sunlight, leading to warmer water and more algae growth. More water With slow or stagnant water can also become thermally stratified, which means that the layer of warm water, which favors algae blooms, floats on top of cooler water. Factors contributing to the reduction or water flow are drought, extraction of water for irrigation or drinking, and the modification of natural waterways through dams, canals and other anthropogenic infrastructure. Linton Marina in Linton, Utah, after harmful algae bloom overloaded lake Rick Egan/Salt Lake Tribune through the AP Climate Change Climate Change is both increasing the frequency and duration of drought in many parts of the country and intensifying extreme storms. Drought periods, mixed with heavy rainfall, increase the run-off from agricultural land, grass and other sources, leading to higher levels of nitrogen in rivers and thus to the flowering of harmful algae. Burning, deforestation and land development increase the amount of carbon dioxide in the atmosphere. It fuels harmful algae blooms because cyanobacteria can feed on carbon dioxide not only on the surface of the body of water, but also dissolved in water. And when the algae die and sink to the bottom of the freshwater body, they degrade and release the carbon that was once extracted, providing more fuel for the growth of cyanobacteria. Climate change and more severe droughts are also changing the flow regime of freshwater bodies and can increase competition for increasingly scarce freshwater resources. Reduced water flows on waterways mean that the rest of the water is warmer and more stagnant, creating ripe conditions for algae blooms. If we continue to search natural waterways as our main source of water and do not apply efficiency, protection and re-use to reduce excessive water diversions, freshwater bodies will become more vulnerable than they already are. the impact of climate change. A dog swims in a blooming algae-covered pond in Swepsonville, North Carolina. Dogs are susceptible to disease or even death after exposure to HAB toxins. What are the effects of freshwater harmful algae blooms? Health risksPeople may be exposed to HAB toxins by swallowing or swimming in damaged waters, eating poisoned fish or shellfish (even if the food is cooked, algae toxins remain) or when inhaled in the air drops of damaged water. Depending on the level of exposure and the type of algae toxin, health consequences can range from mild to severe to extreme deaths. Pets are also vulnerable to HAB – especially dogs , as they are most likely to swim in the water or drink water. A recent paper published in the journal Toxins found 63 dog deaths linked to HABs in 13 countries. Cyanotoxins are in three classes and each type has different effects: neurotoxins, which can cause neurological damage;peptide hepatotoxins, which can cause serious hepatic damage; dermatotoxins, which can cause skin irritation and breathing problems. The most commonly reported cyanoxins in freshwater ecosystems are liver-damaging toxins, microcysins and cyalindrospermopsin. A sample of water pulled from Lake Erie near Toledo, Ohio, after a 2014 toxic algae bloom in the congested lake of Haraz N. Ghanbari/AP Photo Imperiled drinking water supplies Estimated at about 30 million to 48 million Americans receiving their drinking water from lakes and reservoirs that could be periodically contaminated with algae toxins. And boiling HAB-contaminated water not only destroys toxins, but can actually increase their concentration. Fortunately, drinking water treatment processes can usually remove algae toxins, such as those obtained from cyanobacteria-but if the processing facilities are not well maintained and up-to-date, bacteria can remain in the water. Inadequate treatment can endanger water quality and endanger public health and disrupt or even shut down treatment plants. In 2014, for example, in the large LAKE HAB Erie, the state of Toledo, Ohio, prompted the city of Toledo to give away a drink for tap water, which affected nearly 500,000 people for three days and threw up more than 100 people. If cyanotoxin levels exceed EPA health advisory levels for tap water, people are at risk of various adverse health effects, gastrointestinal issues with the liver and kidney damage. The economic costs of HABs lead to the ugly and at times dangerous development of lakes, reservoirs and rivers, to reduce tourism, leisure, commercial fishing and real estate values, and to increase water quality monitoring, management and medical costs. While the economic toll of HABs in the United States is not yet fully estimated, estimates suggest freshwater blooms can cost the nation \$4.6 billion a year. Even isolated blooms can be destructive to local economies. As one 2015 EPA report found, a steady algae bloom in an Ohio lake from 2009 to 2010 caused as much as \$47 local tourism revenue. Left: Dead fish washed ashore during a 2008 golden algae toxic bloom in Texas. Right: A river otter swims in an algae-infested Capitol Lake in Olympia, Washington. From left: Mike Hooper / USGS; Jon D. Anderson via Flickr Sickened animals Toxins released by HAB can cause large-scale fish kills (usually seen as a result of golden algae blooms) and work its way up the food web, affecting mammals, birds and other wildlife that feed grasses, shellfish or fish dented toxins. Texas recently experienced a big fish kill that devastated Lake Texoma, a reservoir on the Oklahoma-Texas border. Some 157,000 fish died in just three days due to the flowering of golden algae. It wasn't the first time a lake had been hit by this type of bloom. From 2004 onwards, the Commission will be member of the European Commission. Statewide, from 2001 to 2010, gold algae blooms caused more than 130 large fish kills and led to the loss of more than 34 million fish, costing the Texas economy more than \$14 million in revenue. Dead zonesEven non-toxic HAB can have adverse effects on aquatic ecosystems in the form of dead zones, in areas of a body of water with so little oxygen that water life cannot survive. Also known as hypoxic zones, dead zones are usually caused by eutrophication, which is what happens when the waterway becomes too contaminated with nutrients. When algae and bacteria die in the bloom of algae and bacteria, the degradation process exploits most of the surrounding oxygen, causing other organisms in the affected body of water to suffocate and die or relocate in order to survive. According to the EPA, more than 166 dead zones have been reported nationwide. The largest, in the Northern Gulf of Mexico, shows how nutrient pollution from the Mississippi River basin, a freshwater river, can affect coasts and seawater. This dead zone has reappeared and varies in size every year in recent decades. Experts predict 2019 will rival 2017 as the largest yet, where a dead zone at the mouth of the Mississippi River is expected to occupy more than 8,500 square miles, an area the size of Massachusetts.Increased cloudy A blooms on the water's surface will create a cloudy (cloudy) underwater environment that prevents much of the sun's light from reaching the bottom of living organisms, including plants. Underwater plants are often a critical source of food and shelter for other organisms, and healthy water food networks and ecosystems can be affected without them. In the 1970s, for example, the European Commission was a member of the European This loss of critical habitat contributed to the decimated populations of blue crab, which fell in the early 1990s and early 2007. Blue crab caught in Chesapeake Bay north of Deal Island, Maryland Will Parson/Chesapeake Bay Program prevention Harmful algae blooms In recent decades, HABs have increased frequency and distribution, and the climate crisis we have created is exacerbated by conditions that favor HABs. Curbing climate change and adopting better rules to reduce nutrient contamination will help reduce beards and mitigate their impact on human health, ecosystems and the local economy. Better farming practices On farms, restoring soil health can help collect the rain where it falls, rather than allowing nutrient-packed run-offs to be washed into water bodies. These practices include planting cover crops, diversification of crops grown, reducing tillage, proper application of compost and manure, and compliance with best practices in fertiliser. The NRDC is working to expand the adoption of these good practices by working with states and others to financially reward farmers who make cover crops in an effort to improve federal initiatives, such as the federal plant insurance program, to give farmers the opportunity to adopt restorative farming practices, and to work to stimulate smart cultivation practices under the Agricultural Policy Act. Green infrastructure As mentioned above, it is not just farms that produce tainted runoff. Every year, an estimated 10 trillion gallons of untreated stormwater washes through storm drain systems and waterways. This run-off may contain high levels of nutrients, which can trigger HAB. The solution the NRDC is working on is to use more green infrastructure in cities. Adding green roofs, planting trees, and building gardens to rain-absorbing plants all capture rainwater before it flows into waterways. It is also vital to protect smart water policy and nature conservation Wetlands, which act as natural filters to improve water quality, take up drainage and increase biodiversity. A law that protects our nation's wetlands, the Clean Water Act, is under threat by the Trump administration. The administration wants to leave more than half of the country's wetlands under protection. The NRDC is fighting these reversals. In many parts of the country, the directing of water bodies and surrounding habitats from rivers to cities, agriculture and other uses has significantly changed and put the health of our rivers, lakes and vital ecosystems at risk. Directing more than 80 percent of the river's natural groin is not uncommon in parts of the western United States, where large river systems like Colorado, The Rio Grande and San Joaquin run dry in huge stretches due to upstream deviations. Excessive diversion creates warm and stagnant conditions in which habs thrive. Harmful algae blooms have been re-emanated in communities around the Sacramento-San Joaquin River Delta, the west coast's largest estuary, as river flows have dwindled. The NRDC works with government agencies, local communities and businesses to develop practical to reduce excessive diversions from rivers and lakes, while at the same time providing sustainable water supplies for a growing population and economy. A water quality scientist is taking samples of toxic blue-green algae bloom at copco reservoir in California. Improved monitoring and evaluation ofhab studies is also essential for monitoring, mitigation and cooperation. There is no nationwide system for collecting and responding to data on HABs, and the type of information available on hab varies greatly in individual countries. Better communication methods for the general public, between organisations and countries can speed up the response to emergencies to THE HAB, reducing the damage to the environment, wildlife and humans. Congress is funding studies on how best to prevent and mitigate HAB by supporting groups including the National Oceanic and Atmospheric Administration (NOAA) and the EPA. Congress also provides funding for the U.S. Geological Survey (USGS) to research algae toxins. The EPA, NASA, NOAA and the USGS formed the Cyanobacterial Assessment Network (CyAN) to collect, analyze and distribute real-time satellite data to help authorities detect cyanobacteria outbreaks in U.S. lakes and reservoirs more quickly. The network has also made satellite images of HAB more accessible to the public. While the federal government is investing in research and prevention programs, there is a lack of concerted national effort to detect, respond and prevent hab outbreaks, and this threatens public health. Countries are currently at the forefront of the hab crisis and must do more to protect their populations from exposure to toxic blooms. Fortunately, some countries have improved their monitoring and reporting activities. In 2017, for example, the European Commission will be very friendly and The state responded by creating a guide to dealing with habs, launching a public awareness campaign and posting signs in lakes, ponds, rivers, campsites and fishing sites that appeal to the public for help in finding HABs. Unfortunately, too many countries are not even able to monitor the habs and inform the public about their risks, not to mention important steps to reduce outbreaks. Knowing where the HAB is and whether the government responds is an important first step in ensuring the safety of our waterways, families and ecosystems. Safe.

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