

Holly Abeels, Florida Sea Grant

FS# 7106SG

Fish Kills in Florida's Marine Waters: How Do They Occur

Fish kills often occur in Florida because of our warm, and often hot, weather, and because of changes in the biological and chemical environment of the water and fish. Fish kills occur for a variety of reasons, and are often connected to either a decline in dissolved oxygen in the water, the presence of algae or a bloom of algae, or some pathogen that may be affecting the fish. In March 2016, a large fish kill was reported in the Indian River Lagoon. This was the first large fish kill to occur since 2010, when a prolonged cold snap caused a fish kill of many tropical and subtropical species of fish.

In the March 2016 fish kill, there were many reports of fish gulping for air at the surface, indicating low dissolved oxygen in the water. Warm water fish generally need dissolved oxygen levels of at least 5 parts per million, also expressed as 5 milligrams per liter or 5 mg/L. When dissolved oxygen levels drop between 4 mg/L and 2 mg/L, most fish become stressed and try to leave the area. If dissolved oxygen levels drop below 2 mg/L fish begin to die. If the low levels of dissolved oxygen cover a vast area, fish may not be able to escape before they succumb. Fish kills caused by low dissolved oxygen affect fish of all different sizes and species. Some fish species are more sensitive to low oxygen levels than others. Also, large fish tend to be affected first, and more severely, than smaller fish. In the March 2016 fish kill, species reported included pufferfish, mullet, sheepshead, flounder, catfish, spotted sea trout, croaker, red drum, stingray, ladyfish, and pinfish.



Fish washed up on shore during a fish kill. Photo credit: Cris Wagner

What causes dissolved oxygen to drop?

Basically, when consumption of oxygen exceeds production of oxygen in the water, then dissolved oxygen becomes depleted. An increase in consumption can occur because of too many plants or algae in the water (e.g., the brown and green algae blooms in the Indian River Lagoon). This is because plants and algae are photosynthesizing during the day and releasing oxygen into the water, but at night they are respiring and taking up oxygen from the water. In addition, fish are respiring and consuming oxygen during both the day and night. If the amount of algae or plants in the water is too great (i.e., algae bloom), then they will consume more oxygen through respiring than they create through photosynthesis. Low oxygen can also occur because of decomposition of organic matter, such as when plants, algae, or animals die. When animals or plants die, the bacteria that feed on the decomposing matter uses up oxygen in the process. With more food available (because of more plants or animals dying), the bacteria increase in number and



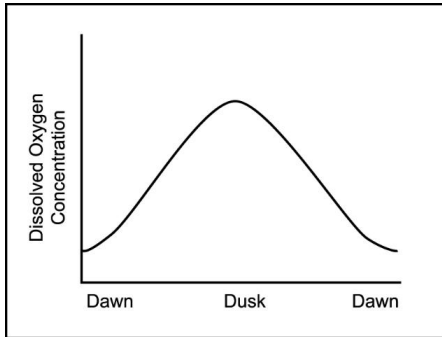
Dead fish floating at the surface. Photo Credit: Greg Hendricks

Fish Kills in Florida

continue to use oxygen in the water. Less oxygen means more fish will die, the oxygen will continue to be consumed by the bacteria, and the cycle continues. In March 2016, the Brevard County government organized cleanup and removal of the dead fish found along the shoreline, which is an important step in stopping the cycle.

What are the agencies involved when a fish kill occurs?

The Florida Fish and Wildlife Conservation Commission (FWC) is the first agency informed when large fish kills occur. They have a Fish Kill Hotline and online reporting system where anyone can report a fish kill. You can report a fish kill in your area by calling FWC's Fish Kill Hotline at 800-636-0511 or by submitting a report online at: <http://myfwc.com/fishkill>. This website also has the Fish Kill Database Directory where you can look at where fish kills are occurring in your area and the species that is affected. Scientists with FWC and the Fish and



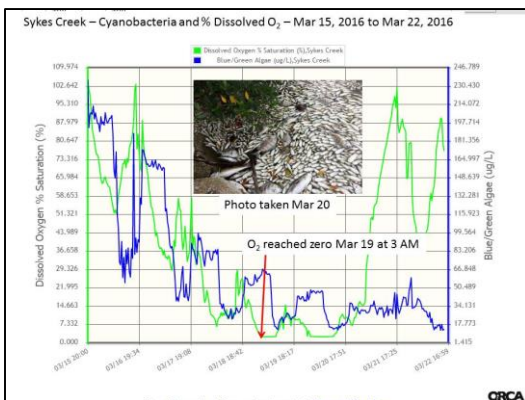
Wildlife Research Institute (FWRI) will often come out to a large fish kill, like the one that occurred in March 2016, to take samples of the fish and water in order to determine the cause of the fish kill.

Dissolved oxygen concentration fluctuates on a 24-hour basis. This fluctuation is called the diurnal oxygen cycle. Dissolved oxygen increases during daylight hours when photosynthesis is occurring and decreases at night when respiration continues but photosynthesis does not. Source: <https://edis.ifas.ufl.edu/fa002>

Low dissolved oxygen will be one of the first things that scientists will measure and look for when determining the cause of a fish kill. Dissolved oxygen in the water can change over time so the levels in the water say at 10:00am on Tuesday won't be the same as at 3:00pm on Wednesday. In general, oxygen levels are greatest later in the day because the plants and algae have been photosynthesizing all day and adding oxygen to the water. In contrast, oxygen levels are lowest before sunrise because the plants and algae have been respiring and taking up oxygen during the night. This is called the diurnal oxygen cycle.

Local governments are also involved when a fish kill occurs, especially if there's any type of cleanup that might occur because of the fish kill. Generally, during a fish kill, the fish are left in the water to decompose naturally. But often times local governments will try to remove the fish from the water, especially if the fish kill covers a large area.

Local governments are also involved when a fish kill occurs, especially if there's any type of cleanup that might occur because of the fish kill. Generally, during a fish kill, the fish are left in the water to decompose naturally. But often times local governments will try to remove the fish from the water, especially if the fish kill covers a large area.



ORCA Kilroy data from Sykes Creek, Merritt Island, showing levels of the blue/green algae bloom (blue line) and dissolved oxygen % saturation levels (green line) before and after the fish kill. Source: ORCA

Was the fish kill in March 2016 caused by low dissolved oxygen?

There are several remote water quality monitoring stations in the Indian River Lagoon. One of these is ORCA Kilroy (<http://www.teamorca.org/cfiles/kilroy.cfm>), which monitors and measures physical, chemical, and biological indicators in the waters. There is a Kilroy located in Sykes Creek, Merritt Island. Historical data shows that dissolved oxygen levels fell below 2 mg/L starting late in the day on March 17th and continued to be below this level until the morning of March 21st. You

Fish Kills in Florida

can look at this historical data and current water quality data yourself at their public Kilroy data website: <http://api.kilroydata.org/public>. This evidence suggests that low dissolved oxygen for an extended period of time was the most likely cause of the fish kill. Additional data collected by FWC and other agencies will need to be looked at in order to say this is the definite cause.

References and Additional Reading

1. Here is a great article that further explains fish kills:
<http://flseagrant.ifas.ufl.edu/newsletter/2012/08/summertime-fish-kills>
2. Fish Kills in Florida: <http://myfwc.com/research/saltwater/health/reported-fish-kills-abnormalities/common-causes>
3. Fish kills in Florida freshwater systems, the concepts are the same for marine systems:
http://lakewatch.ifas.ufl.edu/circpdffolder/fish_kill_LR.pdf
4. Dissolved Oxygen for Fish Production: <https://edis.ifas.ufl.edu/pdffiles/FA/FA00200.pdf>
5. Information on dissolved oxygen in marine environments:
http://oceanservice.noaa.gov/education/kits/estuaries/media/supp_estuar10d_disolvedox.html and
http://web.vims.edu/bio/shallowwater/physical_characteristics/dissolved_oxygen.html
6. ORCA Kilroy <http://www.teamorca.org/cfiles/kilroy.cfm> and public historical data website
<http://api.kilroydata.org/public/>