PHOTO BY MARY LUNDEBURG

A Kemp's ridley sea turtle succumbs to red tide bloom at Stump Pass in August 2018.

PHOTO BY DIANNA WHITMAN/

Horseshoe crab kill, Live Oak Park Point, Port Charlotte, 11 days after Tropical Storm Debby. Dark water suggests high organic loading and low-oxygen risk.

Anatomy of a Fish Kill

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Fish kills have become alarmingly common in Charlotte Harbor.

The harbor is particularly vulnerable to these tragic events because of high river input, shallow water, urbanization, extensive canal systems, restricted ocean exchange, and coastal isolation.

Fish kills in Charlotte Harbor generally fall into three major categories, with chemical spills and other acute pollution events sometimes triggering localized die-offs.

1. Low-oxygen kills are the most common, especially in summer following heavy rainstorms.
2. Kills caused by toxic, harmful algal blooms—especially red tide and blue-green algae—can result in widespread mortality of fish, mammals, and invertebrates.
3. During winter, sudden or prolonged cold-water events can also cause fish to die, particularly species adapted to tropical conditions, including juvenile tarpon, goliath grouper, and snook of all ages.

Less common but often dramatic and disastrous are toxic spills into the watershed from wastewater releases, agricultural runoff, industrial sources, or misuse. Frequently, it is not a single stressor but a combination of events that collectively weakens fish, making them more vulnerable to these conditions.

LACK OF OXYGEN (HYPOXIA/ANOXIA)

This is one of the most common causes of fish kills in Charlotte Harbor. The typical scenario involves heavy summer rains followed by calm weather, cloudy skies, or warm water. These conditions promote stratification, increased organic matter, and ultimately an oxygen crash.

Summer storms wash debris from yards, agricultural lands, streets, wastewater systems, wetlands, and uplands into rivers and canals, which then deliver this material to the harbor as freshwater. Because freshwater is lighter than saltwater, it forms a surface layer above denser, saltier bottom water.

When winds are light and temperatures are high, vertical mixing is inhibited. In addition, reduced water transparency limits its photosynthesis and oxygen production. The bottom layer becomes increasingly depleted of oxygen and can eventually turn anoxic.

If fish can escape, they do. If they cannot, they suffocate.

Canals are particularly harsh environments for fish. They are warm (and therefore hold less oxygen), nutrient-rich, and poorly flushed. Canal bottoms often consist of lawn clippings, eroded soil, leaf litter, and urban debris (i.e., 'muck')—an ideal recipe for oxygen depletion. When fishes are seen gasping at the surface water, especially in the early morning, it is often a sign of oxygen stress. Other warning signs include sluggish fish, the smell of rotten eggs, or darkened water.

NUTRIENT LOADING

Here, the culprit is excess nutrients, primarily nitrogen and phosphorus. While nutrients are the underlying driver, fish usually die from oxygen depletion.

Stormwater, fertilizers, wastewater, and runoff after a good rain deliver nutrients to the harbor. These nutrients fuel algal blooms, which eventually collapse and decompose, consuming oxygen in the process.

These events are often associated with major storm-driven organic loading, such as after Tropical Storm Debby.

TEMPERATURE STRESS

Fish are cold-blooded organisms and, unlike humans, cannot regulate their internal body temperature. When water temperatures change rapidly, fish have limited physiological ability to adapt. Once a fish's core temperature crosses a critical threshold, its capacity to seek warmer or cooler water, or to tolerate the change, becomes severely limited.

If oxygen levels are already low, thermal stress from a cold snap or heat wave is amplified.

PHOTO BY DR. ALLEN STEWART

Fishes starving for oxygen gulp topwater, Pirates Harbor.

Charlotte Harbor is particularly vulnerable because it is shallow and subject to large temperature fluctuations.

HARMFUL ALGAL BLOOMS

There are many types of harmful algal blooms, but the most dangerous to aquatic life are blue-green algae and red tides. Blue-greens (cyanobacteria) can produce several toxins (including liver toxins and some neurotoxins), depending on the bloom.

Red tide-caused by the algae Karenia brevis-is especially toxic.

Neurotoxins paralyze fish muscles and gills, leading to suffocation. Red tide events primarily occur when coastal blooms enter and become trapped within the harbor, although blooms might develop locally under favorable conditions.

Dead fish typically accumulate along leeward shorelines or downcurrent, creating not only an ecological tragedy but also a public health concern. In some cases, red tide will weakens fish, making them more susceptible to oxygen stress and other environmental pressures.

CHEMICAL SPILLS

Spills from industrial waste, sewage releases, herbicides, pesticides, and petroleum products can kill fish directly or contribute to large die-offs. The list of harmful substances is long and includes gasoline, lubricants, chlorine, ammonia, heavy metals, acids, surfactants, herbicides, hydrogen sulfide, and organic wastes.

Some chemicals kill fish rapidly (e.g., chlorine, ammonia, petrochemicals), while others act more slowly or indirectly (e.g., organic loading from stormwater, acidification, or excessive yard waste).

PHOTO BY MARY LUNDEBERG

Fish kill at Boca Grande due to a massive K. brevis/ red tide event in June 2018.

WHAT CAN WE DO?

■ • Report fish kills and spills immediately. The sooner Florida FWC or FDEP are notified, the faster they can respond.

■ Be mindful of what leaves your home, business, and streets during storms.

■ Avoid fertilizing during the rainy season, and sweep excess fertilizer from curbs, streets, driveways, and seawalls.

■ Keep grass clippings and yard waste out of canals and storm drains.

■ Don't overwater lawns — conserve freshwater.

■ Maintain (or eliminate) failing septic systems.

■ Think of the watershed as a whole, not just your yard or favorite fishing spot.

A fish kill is a diagnosis, not the disease itself. The anatomy of a fish kill is ultimately the anatomy of the watershed—and how we manage it. If we want fewer fish kills, each of us must do a better job of caring for the water that flows into Charlotte Harbor.

The harbor is telling us what is wrong. The question is whether we are willing to listen.