When Lake Erie warms in the spring, it begins to form two distinct layers. The warmer upper layer or epilimnion floats above the colder lower layer or hypolimnion. These two layers are separated by a very thin area of rapid temperature change called the thermocline, which normally forms at a depth of about 50 feet during May/June. As the thermocline develops in the early summer, there is plenty of dissolved oxygen in the hypolimnion. But as organic matter decomposes and uses oxygen on the lake’s bottom, the amount of oxygen available for fish and other aquatic life decreases. The epilimnion will not mix with hypolimnion and replenish its oxygen until fall. This can eventually result in the hypolimnion becoming anoxic (no oxygen).

Lake Erie is divided into three basins. While the Western Basin is too shallow to have a thermocline except on rare occasions, the Eastern Basin has more water and, therefore, more oxygen in its hypolimnion. The intermediate depth of the Central Basin allows a very thin hypolimnion to form. This area is the home of Lake Erie’s dead zones.

What Causes the Zones?

Although anoxic areas have existed since the 1930s, the Lake has survived. However, anoxic areas are not good for any water body. Understanding what causes dead zones will help us find ways to eliminate them. Some possibilities are:

Excessive Runoff of Nutrients (Phosphorus)

As anoxic areas became more common in the late 1940s, researchers found that phosphorus was the culprit (limiting nutrient). Research indicated that by reducing the amount of phosphorus entering the lake, the amount of algae could consequently be reduced. When algae sink to the lake’s bottom and are decomposed by bacteria, the bacteria use too much oxygen and cause the hypolimnion to become anoxic. The amount of phosphorus entering the lake from municipal, industrial, and farm run-off decreased by the early 1980s and dead zones decreased significantly in size. Even with phosphorus restrictions, phosphorus levels have begun to increase again.

Zebra and Quagga Mussels

Early research results indicate that as mussel process organic matter, they excrete phosphorus into the water where it is repeatedly used instead of going into the sediments. Therefore, more zebra mussels may mean more phosphorus and ultimately less oxygen. In addition, massive quantities of zebra and quagga mussels die annually, contributing to oxygen loss as the dead mussels are decomposed by bacteria.

Organic Matter

Organic matter which sinks and decomposes will use oxygen. More decomposition leads to increased oxygen consumption and a larger dead zone or a dead zone that lasts longer.

Low Water Levels

As Lake Erie’s water level drops, the volume of the hypolimnion is reduced, and the amount of available oxygen decreases. If water levels continue to decline, the anoxic area may cover less of the lake’s bottom, but arrive earlier, and last longer each year.

Inaccurate Reporting of Phosphorus Levels

As the lake improved in the 1980s, various governmental groups reduced monitoring efforts. Therefore, it is possible that current estimates of the amount of phosphorus entering the lake are inaccurate.