



Mosquitoes and Herring River Restoration

Outer Cape Cod, biting mosquitoes have and will always be a nuisance to a lesser or greater degree depending upon rainfall and tidal events. This is because the mosquitoes that most commonly annoy people are brackish-water breeding species that deposit their eggs in wetlands with salinity ranging from freshwater to that of seawater. There are thousands of acres of coastal wetlands and floodwater mosquito breeding habitats in Wellfleet alone.

Nevertheless, under natural conditions mosquito breeding is severely limited in Wellfleet's tidal marshes: twice-a-day low tides flush mosquito larvae from marshes into surface waters where they are eaten by fish; and every high tide brings small predatory fish (e.g. killifish and sticklebacks) onto marsh surfaces and into marsh pools to voraciously consume mosquito larvae and pupae.

Without tidal flushing in the Herring River, mosquito larvae are no longer flushed from the wetland surface at low tide. Without high tides predatory killifish have no access to mosquito breeding sites. Further, the Herring River's creeks and drainage ditches have become very acidic because naturally occurring sulfur in salt marsh peat has been exposed to oxygen, creating sulfuric acid and making the water toxic to fish and other aquatic animals...but not mosquito larvae, which are adapted to tolerate extremely acidic water. Fish kills have occurred and fish are absent from low-flow drainage ditches. Acidified surface water and high mosquito production are not unique to Herring River, but have occurred throughout the world wherever salt marshes have been diked and drained.

Despite the damage, peer-reviewed scientific research has shown that restoration of tides and daily tidal flushing with seawater will reduce acidity to levels normally found in salt marshes and allow fish to access habitat and eat mosquito larvae in Herring River's extensive marshlands. This together with restored conditions at low-tide will assist in reducing the habitat of brackish-water breeding mosquitoes including *Ochlerotatus cantator*, the predominant nuisance biter in the north Wellfleet area, and *Culex salinarius*, a competent vector for both West Nile virus and Eastern Equine Encephalitis.

Friends of Herring River

Note that medical entomologists and public health officials believe that the potential for mosquitoes to transmit serious viral diseases on outer Cape Cod is low. This is because there is limited habitat for the freshwater-breeding mosquitoes (e.g. *Culiseta melanura*) that feed on birds, the normal hosts for viruses like Eastern Equine Encephalitis. With limited freshwater swamp habitat (such as red maple and white cedar swamps) on outer Cape Cod, there are few *C. melanura* and apparently a low incidence in birds carrying the viruses that might otherwise be transmitted to humans by mosquito species that feed on both birds and mammals. Although the risk for transmission of insect-borne viruses in this area is generally low, in 2019 one sample of mosquitoes collected in Truro tested positive for West Nile virus. Further, two samples of mosquitoes collected in Truro and two samples of mosquitoes collected in Wellfleet tested positive for Eastern Equine Encephalitis. Another unfortunate consequence of the 1909 diking of Herring River has been to increase freshwater swamp habitat suitable for the mosquito species more likely to increase the prevalence of these viruses in wild animals. The freshening of the flood plain has allowed red maple swamps to replace salt marshes in the upper Herring River; swamp habitat is also in the process of displacing black cherry woodlands over many acres between High Toss and Bound Brook Island Roads. The restoration of tides and salty water will return much of this habitat, currently conducive to virus-carrying freshwater mosquitoes, with healthy salt marshes throughout much of the Herring River estuary.