# The Effect of Nitrogen on Oysters

The purpose of the experiment was to prove that nitrogen would increase the growth of oysters. By collecting length and volume measurements and comparing that to the levels of nitrogen found at the three sites, it was determined that the areas of concern for eutrophication showed greater growth, confirming the hypothesis. This correlation of high nitrogen to faster growth is important because it shows that towns should be using oysters in the areas of eutrophication and encouraging oyster farmers to grow their oysters in the areas of high nitrogen and algae. It is hypothesized that the increased levels of nitrogen in the areas in critical concern of eutrophication will lead to greater oyster growth.

Due to septic runoff, many marine ecosystems are experiencing excess amounts of nitrogen in the form of nitrate, nitrite, and ammonium. The nitrogen added to the water is causing the growth of algae, which leads to a decrease in the oxygen levels found in the water, blocks sunlight, and smothers life on the seafloor such as eelgrass beds, which are a habitat for a large number of species. Therefore, the ecosystem is hurt and the plants and organisms suffer due to the disruption of

their environment. This situation creates a eutrophic zone where much of the ecosystem dies. There have been attempts to stop this eutrophication, including the renovation of the septic systems to fix the problem of the nitrogen-rich runoff, but there is still a problem. Recently, oysters have become a way to combat the eutrophication. Oysters filter-feed on the harmful algae and remove the nitrogen from the water by storing nitrogen in their shells and tissues, and also through their feces which gets broken down by microbes in a process known as denitrification. In places such as the Chesapeake Bay region, oysters are being used to correct the harm that has been done to the marine environments (NOAA, retrieved 3/2/16 from http://chesapeakebay.noaa.gov/habitats-hot-topics/oyster-denitrification-research-overview). The oysters are way of removing nitrogen that is less costly than treatment systems and also results in more food for the ecosystem and humans (Zweig, 2015).

The objective of this experiment was to determine the effect of nitrogen levels in the waters of Cape Cod on the

growth of oysters. This project was motivated by work in the Chesapeake Bay region to remove some of the nitrogen from the waters of the ecosystem that harmed the balance of life. Due to the Chesapeake Bay program's efforts to remove the nitrogen through oyster growth, I became interested in the effects that the nitrogen would have on oysters. If the project could prove that the nitrogen could grow oysters faster, efforts could be made to incorporate oyster farms in areas of risk of eutrophication, which would benefit the ecosystem and the oyster farmers. To test this effect, three sites were selected with different levels of nitrogen, with two bags of oysters at each site on an above-ground cage. Six thousand oysters were initially distributed equally into six bags, and every other week measurements of total volume and random sample of the population of each bag were measured for length. These were compared with the levels of nitrogen found for each sample site as well and the correlation observed.

The oyster spat were grown in an upweller in Phinney's Harbor. They were all initially generally the same size, and when they were large enough transferred into larger mesh

bags. Two bags of oysters at each site were attached with cable ties to an above-ground cage. Six thousand oysters were initially distributed equally into six bags, and every other week measurements of total volume and random sample of the population of each bag were measured for length.

Cages were constructed out of PVC to suspend oyster bags off the bottom (minimizing predation by benthic organisms and allowing for water flow around bags). Legs of cages were filled with stone dust to weigh them to the bottom. Two bags were placed on a cage at each of the three sites located in Back River, Pocasset River, and Tobey Island.

About every other week, water samples were collected to test for nutrients in the water (ammonium, nitrate, silicate, and phosphate). Water was collected using an uncontaminated syringe to suck up water that was next to the cage. Each water sample was pushed through a filter to remove particles in the water. Water samples were taken to Paul Henderson of the Department of Marine Chemistry and Geochemistry at Woods Hole Oceanographic Institution for processing.

The total volume of all of the live oysters at each site was recorded about every 14 days. Volumes were measured by displacement of water to ensure accuracy when measuring the shells. Oyster lengths were obtained through a random subsampling of 25 individual oysters from each bag at each site. Oysters were sorted during each sampling time to keep in small bags or to move into larger mesh bags. Multiple bags and greater mesh size allowed for more water flow to the oysters.

The nitrate levels measured at the Pocasset River and Back River were higher, while Tobey Island samples had undetectable amounts of nitrates. These differences in nitrate levels were expected, due to classification of the two rivers as areas of critical environmental concern because of risk of eutrophication. Tobey Island was expected to have low nitrate levels due to its proximity to Buzzards Bay and a resident's claim of very clean water with little seaweed (Ken Legg, pers. comm.). Oysters in Back River showed the most growth, Pocasset River was similar, and the least amount of total growth was at Tobey Island. A logarithmic line was used in the growth charts as it most accurately described the growth rates as they would have a greater initial increase and then the rate

would decline slowly. The Back River oysters showed a greater growth, Pocasset River oysters were in the middle, and Tobey Island oysters had the least growth.

The hypothesis that areas in concern of eutrophication would show greater growth is supported by my data, with the two sites of high concern having larger growth than the control area.

References:


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