Mashpee River Monarchs

An ecological restoration and nutrient overload mitigation experiment with economic benefit potential.

Friends of the Mashpee River

Provides an organization through which forward thinking citizens can work for common goals shared by those who are concerned with the environment of the watershed.

If the current damage to our watersheds remains uncorrected, future generations will never know the natural beauty and tranquility of this historic ecological pearl.

We must not deprive them of the comfort and tranquility provided by a restful and relaxing visit to this serene locale.

We must protect this resource for future generations and ourselves to enjoy. Please support our mutual efforts to protect this living resource of diverse habitats. Membership is open to everyone.

Consider joining your friends at The Mashpee Environmental Coalition. Annual dues are as low $10.00 for a family membership.

Please make checks payable to" Mashpee Environmental Coalition" or" MEC".

Our address is: Mashpee Environmental Coalition
P.O. 274
Mashpee, MA 02649

Web Address www.mashpeemec.us

Membership Options

Family membership (single address)	$10.00
Silver membership (individual)	$15.00
Gold Membership (individual)	$25.00
Sponsor	$50.00

Cover: September 22, 2004 sample temporarily removed from growing tray for photo. Note the 90 days old 2-¾ inch long center oyster.

Mashpee Environmental Coalition, Inc. is a 501 c. 3 non-profit organization.

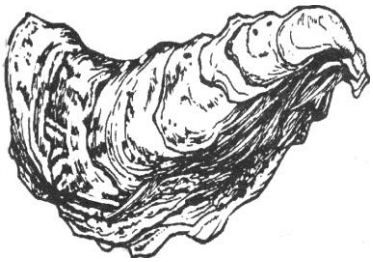
PREFACE

This booklet is an attempt to chronicle the implementation and progress of an ambitious program to restore an oyster fishery to the waters of Mashpee's Popponesset Bay.

The program has the potential for multiple benefits, including local earnings from oyster harvesting/marketing, no-cost waterways nutrient pollution reduction and aquatic habitat improvement.

The growing tendency of America's population to migrate to coastal areas has created significant pressures for housing and the infrastructure required to maintain an adequate living standard for the area's residents. The increased impacts on the ecological well being of our surface waters are not being balanced by measures to mitigate the damage introduced by that demand. A restored oyster fishery is one of many small steps that will contribute to the problem solution. The Mashpee River Friends Sub-committee of the Mashpee Environmental Coalition believes a population informed about local ecological assets would support reasonable efforts to protect them from harm.

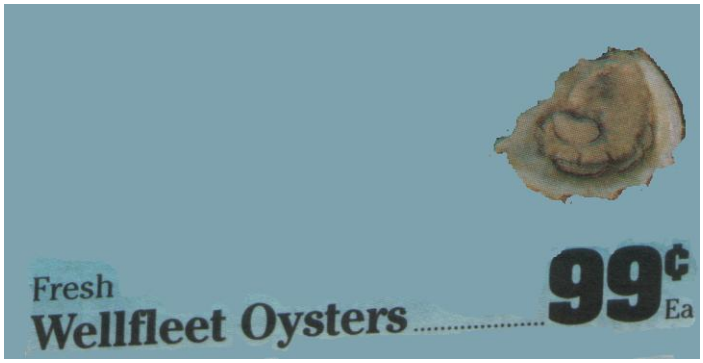
Consistent with this belief, the Mashpee River Friends have established an organization to familiarize the public with the Mashpee River Corridor, its watershed, status and needs. The organization will support measures that enhance and protect the river area and the public enjoyment of this unique place.



Beneficial results from a redeveloped oyster fishery will cover the spectrum from total system nutrient contamination reduction and aquatic habitat improvement to recreational and commercial harvests.

The Mashpee River algae mat pictured on the left results from excess inputs of nitrogen compounds that come from human (anthropogenic) activities. Algal blooms are a major cause of eelgrass losses due to blockage of needed sunlight. The algae, at the end of its life cycle, dies producing the unsightly river clogging mats as it decays giving off putrid odors and adds to the bottom sediments.

Algae are food for filter-feeding oysters and an adult oyster can filter up to 60 gallons of water daily. Demonstration projects consisting of an aquarium containing a few oysters show rapid clearing of water made cloudy by the addition of algae.



(Modeled after a local Supermarket Flyer)

The economic value of this "love it or hate it" menu item relates more to individual taste buds than to its reputed aphrodisiac potential.

In the water it provides free algae removal thereby lessening the need for more costly nutrient removal facilities while growing to a marketable size.

The oyster's market price increases with each step along the economic path to the final consumer. From waterman to processor followed by retailer and sometimes restaurant menus, the consumer is the final stage of a valued industry. Even the recreational shell-fisher enticed by the prospect of an individual harvest supports the community through license fees.

In addition to eelgrass beds and a bottom composition conducive to shellfish and other bottom dwellers, a valuable aquatic habitat should include a substrate that provides attachment capabilities for fauna such as mussels, barnacles and oysters.

It should also provide an uneven surface with its nooks and crannies that provide the safe harbors for the early life stages of diverse "next generations".

This bag of Hatchery clamshell after about two weeks in the river is shown as an aid to visualize the nooks and crannies.

An oyster reef provides a surface area that is orders of magnitude greater than a smooth flat bottom. (See picture of remote set bag above)

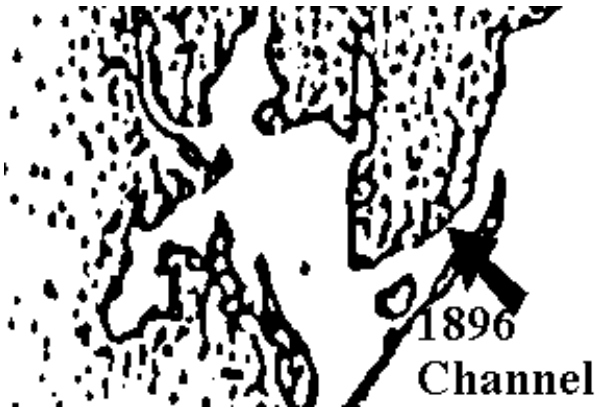
Many juvenile animals including elvers, grass shrimp, the different species of infant crabs, etc make these nooks and crannies their home. The predators ranging from adult crabs and various species of fish are naturally attracted to the potential of a relatively easy meal as they, themselves, become part of the food chain that in many cases ends with man.

The Genesis

Knowledge of Barnstable County's "Remote Set " Program for Oysters, the economic value of oysters and their algae filtering capacity coupled with a familiarity of the Mashpee River's severe nutrient contamination problem led the Mashpee Shellfish Department to invest a major effort in this experiment.

Oysters, at one time, were a major source of local income and supported a profit producing industry in Popponesset Bay circa 1880 as shown in the Mashpee Archive Photo below.

Since the 1880s, the oyster shack of Horatio Amos stood on the present open space on the south shore of Daniels Island. It withstood the 1938 hurricane, but was destroyed by the storm of 1944.



This 1896 sketch shows the old channel at the time when Popponesset Spit was significantly longer.

Eddie Handy scattered 500 bushels of scallop shells along the channel in Popponesset Bay and the drifting oyster caught onto the shells, 60 -70 per shell. Growing up thus as an attachment until big enough to crowd each other off. In 3 seasons the oysters are ready for market. From the 500 bushels of shells, he harvested more than 500 bushels of oysters per year.
James Morse 1899

Years of Mashpee River Water Quality monitoring as a part of a Town-wide program had identified excessive algae impacted the river's water quality. Knowing from experience and education that oysters are a tremendous filtering device that once thrived in Mashpee's waters, the Shellfish Constable (Richard York) evaluated the existing conditions for a restoration program.

At this point several favorable conditions became apparent. The food source was present and plentiful. Its reduction via oyster ingestion was a benefit, oyster embryos set on shell strata was available from a no-charge-to-the-town Barnstable County program and lower salinity Mashpee River waters reduced aquatic predator/disease threats.

In addition to the favorable conditions for the reintroduction of oysters, public and governmental concerns about the degraded quality of our estuarine were rapidly moving to the forefront of so-called "Quality of Life" issues.

Publication of Algae mat photographs in local newspapers combined with stories recounting the harmful effects helped spread the bad news. Resident's petitions to local government, environmental organization's publicity, the Clean Water act of 1972 and the state's compliance activities have led to a general belief that conversion from individual septic systems to some sort of advanced treatment of wastewater will provide a solution to the estuarine problem.

The development of a wastewater treatment infrastructure has been "ball-parked" at numbers that could entail the equivalent of $40,000 for each man, woman and child residing in Mashpee. Operation and maintenance costs have not been defined but they would be significant.

Based upon the foregoing, it becomes obvious that any other item that can reduce the size of the nutrient contamination problem deserves a careful examination of its costs and potential benefits. An examination of the potential benefits, by scientists associated with the much larger and similarly impacted Chesapeake Bay, has concluded that significant benefits, both ecological and economic, will accrue from the restoration of oysters to the Bay.

A successful reintroduction of a thriving oyster population in Popponesset Bay would be a win/win partial solution to the nutrient pollution problem. A 10% reduction in the need for wastewater treatment using the assumptions used here would be equivalent to saving $4,000 for every Mashpee resident.

Oysters at all life stages are susceptible to some diseases and predation by other forms of marine life.

MSX (Haplosporidium nelsoni) and Dermo (another microscopic parasite, Perkensus Marinus) are short names for diseases that potentially affect oysters in this area.

Oyster Drills are a snail named for the feeding mechanism of drilling through an oyster shell to eat the oyster inside.

The Oyster Drill and the example of a Drill's deadly work on the oyster shell to the right is a snail that grows to a maximum length of about 1 ¾ inch.

It is a major predator of oysters. Most environmentally related agencies suggest their removal from waters where they are found.

Based upon the potential gains and salinities that, although not prohibitive to the known parasites, offered a degree of protection and were low enough to exclude oyster drills, the Shellfish Constable decided to proceed with remote set experiment.

The financial loss risk involved was limited to the Constable's and his volunteer's work effort. The bags of embryo deposited shell were free from a County program. Other needed equipment was available from existing shellfish nursery programs.

The major threats are the diseases mentioned above and winter ice damage.

Reductions in algae can be measured by oyster growth as they change algae to meat and exuded pellets and by measuring and comparing algal parameters upstream and downstream of a colonized site.

The first hands-on activity was a 2004 visit to a Dennis Aquaculture facility to pick up 200 mesh bags of oyster embryos set on empty clam shell (cultch).

The mesh bags of clam shells were in a tank resembling a small above ground swimming pool with aeration much larger but similar to a bottom fed home aquarium air pump. A very close inspection by an individual with good eyesight would reveal tiny white specks distributed on the empty shells.

The tank was on the second floor of a small annex. A relay system consisting of a man in the tank picking up bags from the water and handing them to a three-person relay team for transfer to the truck loader (catcher) was set up.

The photo above shows the relay team set-up by the preceding Barnstable pick-up group. The man on the bottom left is standing in a boat on a trailer. He catches each dropped bag and stacks it in the boat.

Mashpee's 200 bags were loaded in a similar manner into the Shellfish Dept. pick-up.

The truck, as it is shown here, is loaded with all the bags and covered with a white tarpaulin to retain moisture and retard heating from solar radiation.

The bags were then driven to the New Seabury Marina Boat Ramp where they were transferred to a Shellfish Dept. Boat (Carolina Skiff) for final transport to the relay site in the Mashpee River.

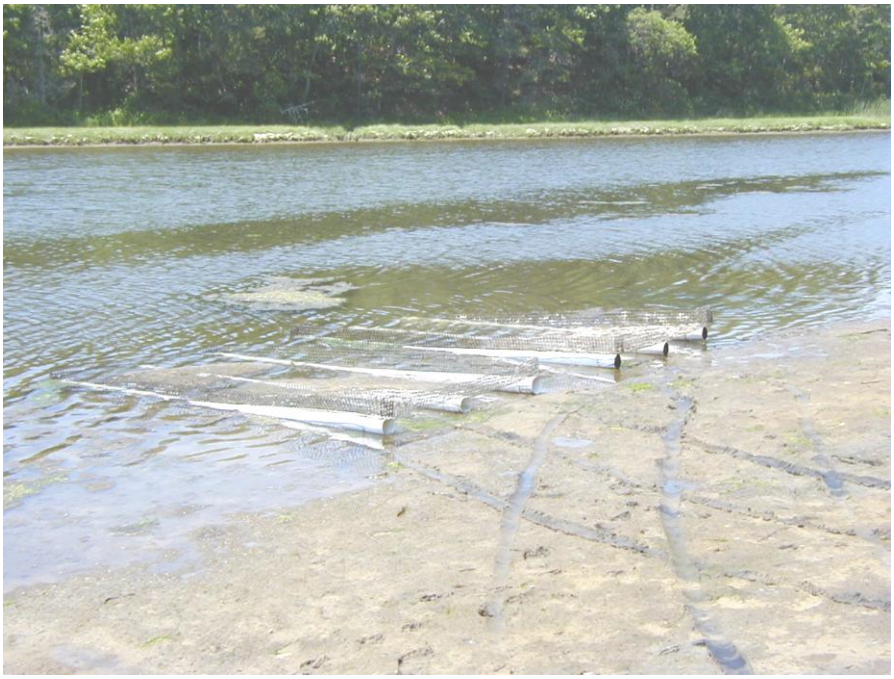
The temporary growing site shown in the USGS map section above contained about 20 growing racks in the river to contain the mesh bags in a single layer until it was necessary to remove the oysters from the bags and spread them out to allow room for them to grow. Keeping the oyster set in the bags, initially, was aimed to reduce natural predation by crabs, etc at this critical stage.

The growing racks are open trays of 1-inch grid, plastic coated wire mesh. They measure 5 feet by 10 feet with 6-inch sides.

PVC drainage pipe is attached the full length on each edge and center to hold the trays off the bottom allowing some underflow and reducing sedimentation problems.

PVC pipe being attached to trays on-site

A pair of trays assembled and ready for transport to the growing site upstream.



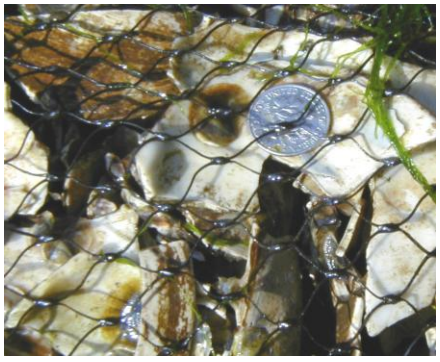
Orsini Beach in Pirates Cove

An inspection of a sample group of bags 18 days later gave the first indication of the rapid growth these oysters would achieve. The river water, continually darkened with algae blooms, was providing more food than the oysters could handle and they were taking full advantage.

7/11/04 *oysters on shell substrate with dime*

Day 27's inspection verified the growth rate was continuing and a projection of some legal size (3 inch length) oysters by years end seemed reasonable.

The 2 photographs on the left side were taken on 7/20/04.



Although still less than a dime in size, the growth achieved in a nine-day period is obvious. The oysters are still very thin and only the top portion if the shell is visible

Friday, the 13th of August was 51 days at the relay site and a day for both the pessimistic and the optimistic.

The optimistic had visions of a future oyster crop and algae reduction factory.

Many of the oysters that were tiny specks on June 24th now were much greater in size than a dime.

The pessimistic had visions of the effort entailed in opening and breaking apart the mesh bags that looked more like old logs festooned with oysters sticking out like mushrooms after a wet spell.

It was time to start removing the oysters from the mesh bags and to spread them thinly in trays so they had room to grow.

At several hours for 2 people working per 10-bag tray, the 200 bags of oysters appeared more of a challenge than an experiment. The task at hand involved removing the bags from an underwater tray, lining the tray bottom with a ½ inch mesh screen, cutting the bags open, breaking what was now a cohesive mass apart and returning it in a thin layer to the lined tray.

One notable learning experience was discovering how sharp the new growth on an oyster shell could be. Leather gloves are the order of the day for this work and you should have spare replacements at hand.

The sides of the tray closest to shore are just coming through the water surface at low tide while the mesh bags are being removed for conversion to the non-bag spread out configuration. Portions of the bags in the next tray out from shore are faintly visible through the waters surface on a clearer than usual water transparency day.

The algae clouded water prevents a clearer view of the next tray in line but, fortunately provides the food for oyster growth.

Clumps of enteromorpha intestinalis (Gutweed) are visible on the tray area perimeter-marking pole and caught on the exposed tray edge.

A few of the trays with the thin layer of oysters attached to old shell are pictured above. Once the oysters were spread on the trays that took well into October to complete, the remaining tasks were to check the well being of the prospective harvest, experiment with methods to determine nutrient removal rates and to worry about what the winter and the river ice would do.

Pictured above are Americorps volunteers developing the raw data to establish a juvenile oyster length, total weight and shell to meat weight ratio for future nutrient reduction evaluations and method evaluation.

March 17, 2005 Trays @ Ebb Tide

Spring brought good news with the oyster survival very high and every tray in the exact position where it was left in the fall of 2004. In fact, the oysters on several trays that were purposely constructed without sides as an experiment had not been dislodged.

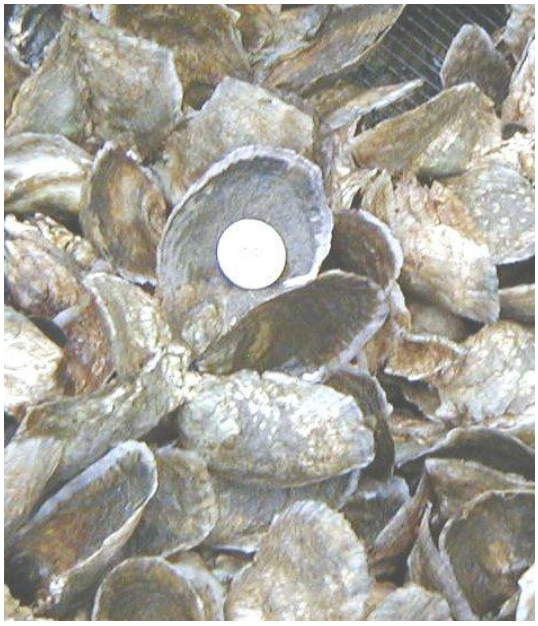
Based upon the memories of local individuals and anecdotal observations of the number and extent of dock piling movement due to tide and ice cover, it was concluded that the potential for ice damage over the winter was lower than other years.

May of 2005 brought warmer water temperatures and an influx of gut weed attaching to the trays. It also brought darker colored waters indicating the start of the suspended algae bloom activity.

Although the preceding period from complete ice-out in March to mid-May appeared to be a period of suspended activity, some new growth is evident along the edges of the shell.

The growing season with its greater algal food supply and increased metabolism as estuarine water temperatures rise in June restarts the visible growth and shows promise of harvests to come.

A new supply of remotely set oyster spat became available in late-July of 2005 as part of the continuing Barnstable County program. A grouping of these new entries was placed in the river downstream and close to the opposite shore from the original 2004 placement. A second remote set grouping became available and was relayed to Hamblin Pond.



2004 seed relay on 10/14/05

2005 seed relay on 10/14/05

The 25-cent piece in the picture on the left measures a shade less than 1 inch in diameter and demonstrates a significant amount of oysters above the 3-inch legal minimum. The 2005 vintage sample substrate is 6 inches long.

New Year's Day of 2006 was a pleasant day in Mashpee weather-wise and a more than rewarding day for the harvesters of legal (3 inch) sized oysters on the first day of the first oyster season in many years.

While the reader can decide if the smiles are based upon enjoyment of a connection with Mother Nature in a gathering endeavor, the thoughts of an epicurean feast or the reputed aftereffects of oyster consumption, the knowledge of progress towards the overall goal excites many participants.

Visions of a lessened nutrient impact on the Mashpee River and Popponesset Bay, improved aquatic habitat and oyster harvest benefits from both a financial and gastronomical yield appear realistic.

The harvester heading towards his vehicle with his "catch" in hand undoubtedly has thoughts of the taste delights to come. He may or may not realize the contribution he is making to the watershed as he carries away from the estuary nutrients sequestered in the oysters.

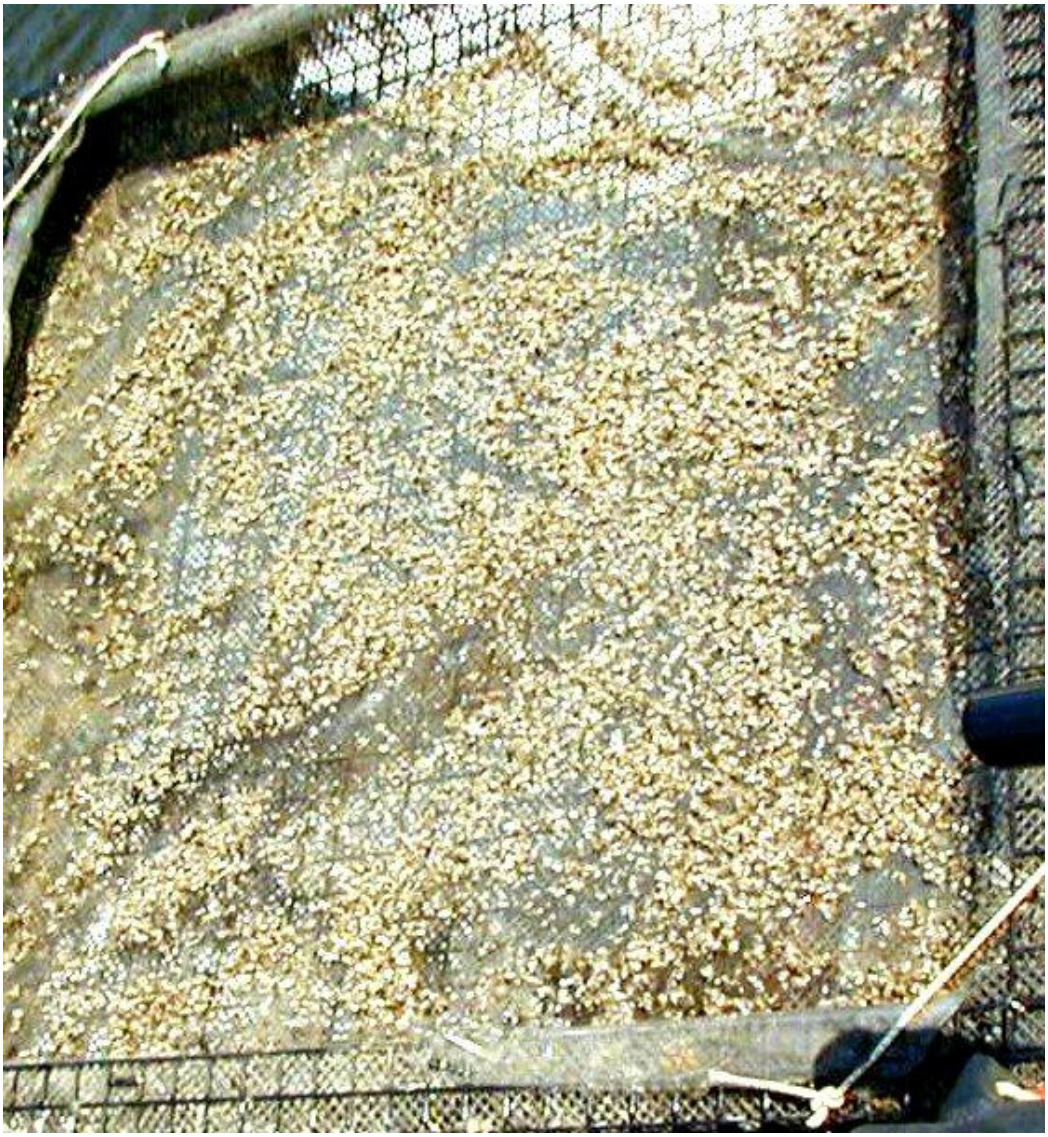
The photograph above was taken on January 25, 2006. It is a six (6) inch long harvested oyster that was one of the bigger specimens from the 2004 planting.

The 2005 and 2006 "Remote Set" plantings are similar to the 2004 activities with an increase to 400 mesh bags from the past 200 in 2006.

An additional step in 2006 was the introduction of approximately one million seed oysters adjacent to the remote set growing area in late June. These seed were not attached to old shells but were separate individuals approximately 1/32nd of an inch in length when placed in the river. The picture above (with a dime for reference) is a random sample of the seed taken on October 15, 2006 and contains a large proportion of approximately 2-inch oysters. The specimens are proportionally thinner than a mature oyster but the growth observed is phenomenal. Mashpee River algae are the equivalent of a growth hormone for oysters.

The gains achieved are not without effort. Trays must be lined with small mesh screening in the early stages of growth to contain them physically while allowing flow to bring algae laden water for food.

Flow blocking algal growths must be removed from trays that also need covers maintained to exclude predators and feet to hold them off the bottom sediments. The biggest "catch22" is the maintenance of a thin single layer of juveniles to allow maximum access to food when in early life they can double in size in a few days. Maximizing growth equates to maximizing the frequency of adding trays to thin the layers and the resulting maintenance effort



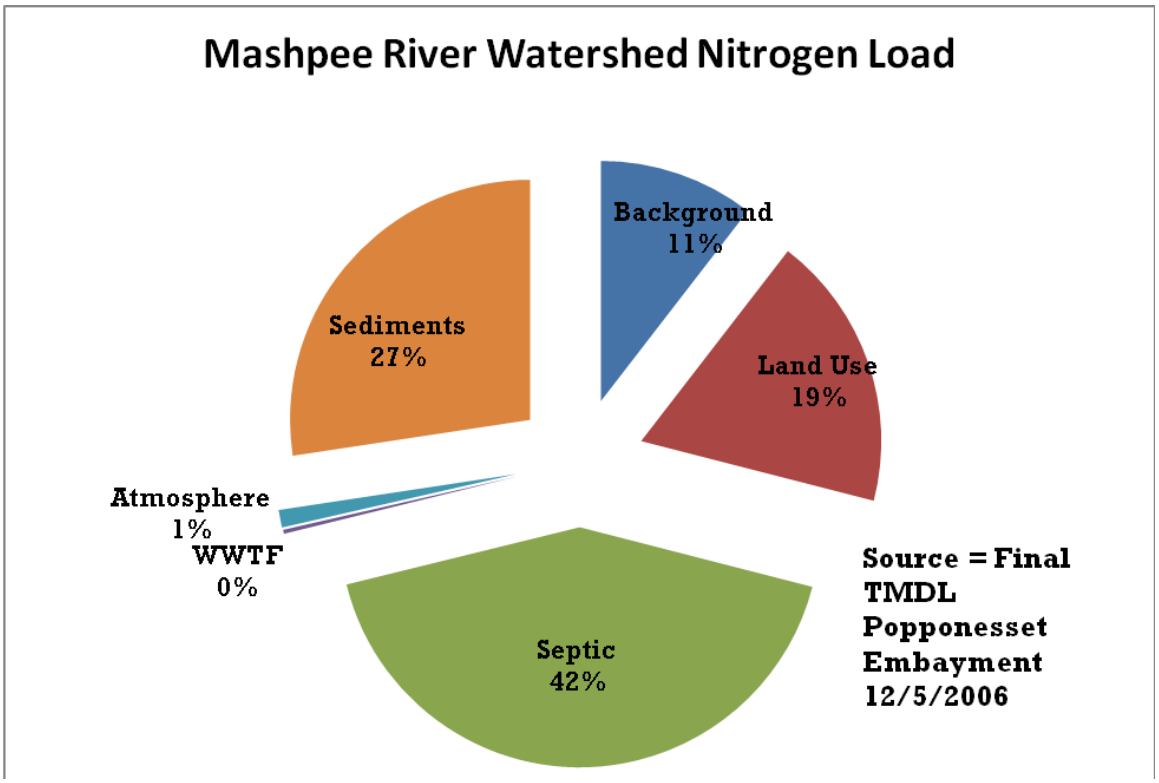
Compare this photo taken on July 1,2006 of a tray with the cover removed, containing a lining 1 mesh size larger than the starting lining, that was utilized two weeks earlier, to the October 15th photo on the previous page. The large mesh on the tray proper contains 1-inch squares. The bungee cord showing on the trays lower right corner is on all 4 corners and holds the cover (not shown) in place.

The Downside

The oyster lives in a complex that starts in the river, flows to the bay and through the sound to the Atlantic Ocean. The good news is a harvested oyster is a nitrogen removal from the complex. The bad news is the improvement may be a further impaired river with the benefit occurring somewhere beyond the estuary. There is no scientific data publicly available to support a supportable conclusion.

The oyster filtered algae, when filtered from the Mashpee River water, travels through the oyster's internal system where some nitrogen is stored while unused nutrient containing by-products become sediment. Without oyster filtration, nitrogen containing algae suspended in the water column would flush away from the river.

Scientific studies of the total embayment before the introduction of oysters indicated 27% of the nutrient contamination in the Mashpee River came from sediment regeneration. In effect you multiply the nutrient damage impairment created by the original pollution infiltration by reintroducing the nutrients via sediment regeneration producing more damage.



A possible solution would be a marsh restoration program that would, via improvements to the river's flow, maintain more algae suspended in the water column to be carried away, plus wastewater treatment.