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# Can Eelgrass and Aquaculture Coexist?

Tessa S. Getchis
tessa.getchis@uconn.edu

# Can Eelgrass and Shellfish Aquaculture Coexist?

## *Balancing the Needs of Connecticut's Environment and Economy*

*by Tessa S. Getchis*

*"Thinking back to my childhood, I can remember heading out of the Mystic River and hearing my father cursing the eelgrass. He'd slow the boat down, throw the motor in reverse, grumble, and we'd be off again. A couple of hundred yards later, as we headed towards the Monastery on Mason's Island, I heard that familiar strain of the "prop" and the engine would again grind to a halt as eelgrass jammed the whirling propeller blades. The eelgrass was everywhere, and it seemed to grow taller and thicker as the fishing season progressed."*

My father, as frustrated as he was getting entangled in it, knew the importance of eelgrass even then. At the time, he was moonlighting as a commercial fisherman, and he understood the interconnections among the various species in the food web. Before heading out to the fishing grounds, he slowly and patiently trolled through the eelgrass, where he found the large schools of bunker (also called Atlantic menhaden, *Brevoortia tyrannus*), and the crabs he used as bait. He was grateful for the life that the eelgrass supported. As kids, we wished the eelgrass would just all go away. And then it *did*–almost all of it.

### What is Eelgrass?

Eelgrass (*Zostera marina* L.) is a seagrass that forms extensive emerald green meadows in shallow subtidal areas of Long Island Sound (LIS). Eelgrass is a true marine plant, which means that like terrestrial plants, it has roots, flowers, leaves and seeds, but this plant spends its life submerged beneath coastal waters. The plant consists of 3-7 thin, ribbon-shaped leaves, less than 3/8" wide bundled together into a sheath. The sheath is supported by a thick root system called a rhizome from which leaves grow to more than three feet in height (see drawing, next page).

Eelgrass is a perennial plant (one that regrows season after season) which reproduces by flowering and sending out seeds, or vegetatively by sending out offshoots from the rhizome. As the seeds germinate and develop, they transport nutrients from their roots to their leaves in order to grow. The plants depend on sunlight for photosynthesis, and so eelgrass growth is limited to clear and shallow coastal waters.

Kaitlyn Shaw

**Eelgrass (*Zostera marina*) meadow in eastern Long Island Sound**

### Why is Eelgrass Important?

Eelgrass provides habitat to a myriad of juvenile fishes, birds, and invertebrates. A number of these species, for example winter flounder and bay scallops, are recreationally and/or commercially important. Without submerged aquatic vegetation these species would have little refuge from predators. Submerged aquatic vegetation also provides benefits to water and sediment quality.

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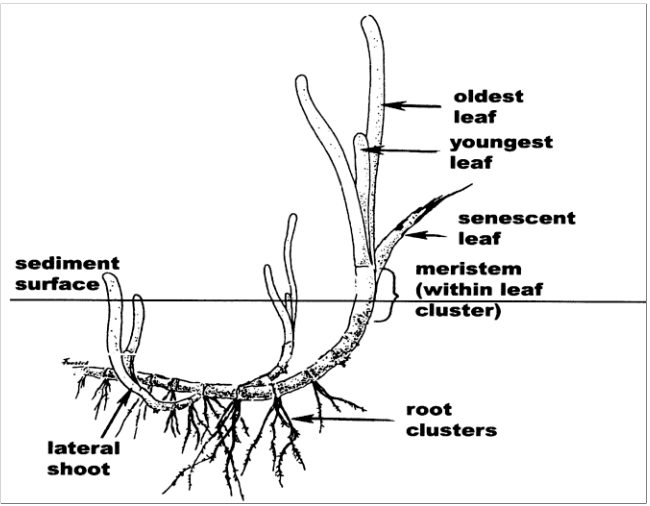


Morphology of eelgrass (*Zostera marina*).
Courtesy of Mark Fonesco.

Peter Auster

A young spider crab (*Libinia emarginata*) in eelgrass.

"Large eelgrass beds can reduce current velocity, allowing suspended sediments to settle out of the water column, thus stabilizing the sediment," says Dr. Jamie Vaudrey, an estuarine ecosystems ecologist with the University of Connecticut. Eelgrass can also remove nutrients, such as nitrogen, from the water column, and convert them into a form that is available to animals. "Ecologists use eelgrass as an indicator of ecosystem status, and the condition of eelgrass populations can help us to understand how humans impact coastal systems," explains Vaudrey.

**What Happened to all of the Eelgrass in LIS?**

Although populations have fluctuated throughout time, eelgrass was virtually wiped out in the 1930s by a wasting disease caused by a pathogenic slime mold, *Labyrinthula zosterae*. Eventually many of the beds in central and eastern Long Island Sound recovered, but for various reasons, those in the western Long Island Sound did not. Nutrient inputs to the Sound from point-sources such as sewage treatment plants, and non-point sources from more diffused origins such as runoff from land, leaking septic systems, and atmospheric deposition, increased over several decades. High levels of nutrients gradually decreased both water quality and clarity in the Sound. This further limited the areas where eelgrass could thrive, thus reducing the environmental benefits it could provide.

Resource managers became so concerned about the loss of eelgrass that they began mapping populations Sound-wide. In 2001, the Connecticut State Legislature passed Public Act 01-115, which required the Department of Environmental Protection (DEP), in consultation with the Department of Agriculture (DOAg), to investigate the effects of commercial and recreational fishing on eelgrass. In addition to investigating the impacts of fisheries activity on eelgrass, the DEP identified other factors affecting the abundance and distribution of the species.

"A number of factors such as dredging, filling of coastal waters, construction of bulkheads, boat moorings and various fishing activities may have contributed to substantial loss of eelgrass in the past," says Mark Johnson, a marine biologist with the Connecticut DEP's Marine Fisheries Division, "but this does not explain the long-term disappearance of eelgrass in the western and central Sound, and more recent declines in certain areas in the eastern Sound. In addition, a regulatory process to minimize additional impacts from these factors has been in place for some time."

In the following year (2002), the Legislature passed a subsequent act stating, "The Commissioner of Environmental Protection shall adopt regulations…to protect and restore eelgrass, including the protection of existing beds from degradation, and the development of a restoration plan to restore eelgrass…" State resource managers were then charged with minimizing or preventing any impacts to the remaining eelgrass.

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Alan Banister

Brian Odo, Noank Aquaculture Cooperative, and Tessa Getchis, Connecticut Sea Grant, deploy oyster depuration cages.

Tessa Getchis

Juvenile lobster (*Homarus americanus*) in oyster cage. These gear attract a wide variety of marine organisms.

**How Does Eelgrass Management Affect Aquaculture?**

Concerns quickly began to arise over the potential direct and indirect effects of shellfish aquaculture gear on eelgrass. Although most shellfish aquaculture in Long Island Sound is still conducted on the bottom, resource managers were concerned with the growing trend of utilizing structures, such as bags, racks and cages, used for cultivation and depuration of shellfish. Minimizing or preventing impacts quickly translated into making a choice between eelgrass and many other uses of the shallow coastal environment that included aquaculture. Managers cited studies that were conducted on intensive aquaculture operations on the West Coast of the United States which demonstrated that cultivation gear could, in fact, have negative effects on eelgrass, such as uprooting of rhizomes and cutting or scarring of leaves. They settled on taking a precautionary approach to shellfish aquaculture and eelgrass management. For an activity that had traditionally been thought of as a "benign" use of the marine environment, this was truly a concern for shellfish aquaculture producers.

In the wild, habitat-forming shellfish such as oysters and mussels provide their own set of "ecosystem services". Like eelgrass, shellfish provide refuge and foraging habitat for numerous fishes and invertebrates. Shellfish cultivation gear has also been shown to provide equal or greater habitat value than eelgrass, and scientists have observed that these gear attract a diverse and abundant assemblage of marine organisms. Molluscan shellfish are also filter-feeders. Particles of food are filtered out from large amounts of water that passes in and out of their bodies. In dense populations, they can reduce excess nutrients and particulate organic matter from the water column, resulting in improved water clarity and quality-good attributes for plant growth! Some scientists have even suggested using mollusk aquaculture as a means to control eutrophication, a condition characterized by an overabundance of nutrients in a water body. Even so, managers were responsible for taking immediate measures to protect any remaining eelgrass in Long Island Sound.

Alan Banister

Dr. Jamie Vaudrey, UConn Marine Sciences, prepares light meters for field deployment.

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In response to concerns of both resource managers and shellfish producers, the Connecticut Sea Grant Extension Program, the University of Connecticut's Department of Marine Sciences, and local resource managers collaborated to evaluate the impacts of oyster cultivation gear on eelgrass. Research and Extension specialists examined the direct effects of shellfish cages on eelgrass, comparing spatial coverage and density of eelgrass at both control and farm sites. The indirect effects of shellfish aquaculture on water and sediment quality were also assessed.

"There may be positive and/or negative impacts of this type of aquaculture, but at the current level of activity in Long Island Sound, we have been unable to measure any impact to the eelgrass resource, or to water or sediment quality," Vaudrey says. This may be explained by the fact that beneficial and detrimental impacts resulting from aquaculture are dependent on a number of factors which include the physical and ecological footprint of the gear, density of the gear, gear soak time (how long it stays in the water), biomass, and oceanographic factors such as current velocity and direction which influence the environment's capacity to assimilate inputs.

These vary from operation to operation, and also among water bodies. In intensive aquaculture operations, such as many of those that exist on the West Coast, large expanses of estuarine waters are occupied by densely-packed gear, which can soak in the water column for months at a time. In Long Island Sound, most shellfish producers only use bottom gear for a short period of time, several weeks rather than months, and these gear are spread over large geographic areas.

**Can Shellfish Aquaculture and Eelgrass Coexist?**

The answer is complicated. The DEP and DOAg examined the available information and have concluded that the use of fishing and aquaculture gear was not responsible for the disappearance of eelgrass in western and central Long Island Sound, and is not having a significant impact on the remaining eelgrass in the eastern portion of the Sound. Johnson says it is possible that these gears cause damage in localized areas, but "in the big picture, the amount of damage is probably small and we have the management tools for addressing those problems when we become aware of them."

You may be asking yourself, "if there is so little eelgrass left, then why don't aquaculturists just move their operations to another area?" Good question. Currently,

Alan Banister

**Tessa Getchis, Connecticut Sea Grant (L), and Kaitlyn Shaw, UConn Marine Sciences (R), collect eelgrass, sediment, and water samples.**

there is little overlap with shellfish aquaculture and eelgrass, and only a handful of growers in eastern LIS have been impacted. The difficulty is that projects are currently reviewed on a case-by-case basis, and the potential for cumulative impacts from individual operations over time, or the expansion in the number of businesses in a particular water body is unclear and difficult to predict. One thing *is* clear: shellfish producers are equally concerned about the condition of eelgrass and water quality –their livelihoods depend upon it.

Resource managers are now focusing their efforts on determining the extent to which nitrogen and these other factors may be affecting eelgrass. As restoration efforts progress and eelgrass coverage expands, use conflicts with aquaculture and other recreational and commercial uses of the shallow marine environment are inevitable. Aquaculture is likely to expand to fulfill consumer demand for seafood. Ultimately, resource managers, scientists and producers will need to put shellfish aquaculture into perspective with other natural and anthropogenic disturbances to eelgrass, and in doing so, will find a way to balance ecological and socio-economic needs of Long Island Sound.

About the Author:

Tessa Getchis is Connecticut Sea Grant's Extension Educator specializing in Aquaculture. She is also a faculty member of the UConn Department of Extension and a frequent author for **WL.**