

SEA URCHINS

Integrating New Crops into Seafarms in Maine



Maine Seaweed Exchange

Maine Seaweed Exchange (MSE) is a 501(c)(3) non-profit corporation with a mission to support the development of an organic, sustainable, and restorative seaweed aquaculture industry. We work to support the seaweed aquaculture industry through seaweed farming education and training, innovative research and outreach, and building stronger networks for the industry. For more information, visit www.maine-seaweed-exchange.com.

USDA SARE

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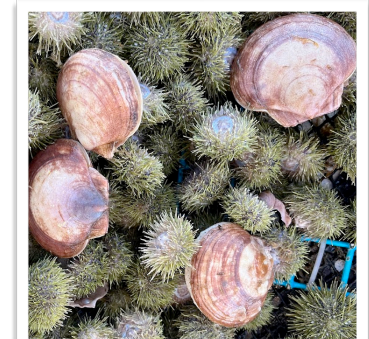


A New Opportunity for the Aquaculture Industry

Seaweed and shellfish aquaculture is a fast growing industry in Maine, but most farms rely on only one crop and lack diversification options. Green sea urchins (*Strongylocentrotus droebachiensis*) represent an opportunity for multi-cropping on aquaculture farms, especially if seaweed can be cultivated on the farm for feed.

Sea urchins are easily integrated into cold water seaweed or shellfish farms, and can provide additional biofouling control for shellfish and the inside of culture cages. Sea urchins feed on seaweeds added to cages, as well as wild set algae and juvenile mussels throughout the year. Current work on uni development and seasonality indicates that Maine seaweed-fed farmed urchins produce excellent quality uni from September through February, with maximum yields recorded at 42%. Urchin growth rates are around 10mm/yr, requiring an estimated 3-5 years to reach harvestable size (>52mm).

The MSE facilitated a research project that tested sugar kelp and sea urchin culture integration strategies on two farms in Maine



Environmental Conditions

The green sea urchin is a cold water echinoderm species distributed globally in Northern seas, and the only sea urchin species found in the Gulf of Maine. As the dominant herbivore in the Northwest Atlantic, sea urchins are an important component of nearshore coastal ecosystems, both as consumers and as food for other species.

Sea urchins are benthic omnivore grazers, grazing on a wide range of foods including native seaweeds, diatoms, algae, small invertebrates, and detritus, and are commonly associated with the Laminarian kelps.

Urchins can be found from the intertidal zone down to 1200m, in a temperature range of -1°C to 18°C for larvae and 20°C for benthic urchins. Juvenile urchins grow best at 9-13°C, and should be kept below 16°C. Maximum lethal temperatures are 19°C for larvae and 22°C for benthic stages.

While green sea urchins can tolerate changes in salinity, variability and low salinity environments can be stressful. Farm sites with full strength seawater (30-35ppt) are recommended.



in 2020-2021—an oyster farm in the mid-coast and a seaweed farm Downeast. The variable nature of the southern oyster site, with high temperatures up to 25°C, and salinity fluctuations, resulted in 100% urchin mortality, and kelp deterioration after May, while the more northerly, deeper water of the Downeast site was successful in cultivating urchins year round with 100% survival, and kelp remained healthy through July. Sea urchins are sensitive to high temperatures and salinity fluctuations, so will probably not be a viable crop on typical oyster farms that are sited in warmer, shallow areas near estuarine environments.



Nursery Seed

Seed urchin “seed” are juvenile sea urchins produced in a hatchery. Sea urchins are spawned and hatched when they are reproductive in early spring, cultivated through their free-floating larval stages, and settled as microscopic benthic urchins. It takes about 6-8 months for a seed urchin to reach 5-10mm in the hatchery, when they can be placed on farms at sea for cultivation.

Farm Cultivation

Sea urchins can be cultivated in cages suspended from horizontal long lines, in cages on the seafloor, or by open ocean ranching.

Contained cage culture protects the urchins from predators, allows for regular feeding, and reduces the risk of loss.

Open culture, or ranching, places juvenile urchins on ocean bottom that is supportive of growth, allowing urchins to freely roam in their natural habitat. Open culture eliminates the use of gear, but has an increased risk of loss from predators, harvesters, or urchins moving off site, and requires diving for site access.

Urchin aquaculture techniques could also be utilized to reseed natural ecosystems, providing opportunities for ecosystem restoration and fisheries enhancement.

