# EXTRAORDINARY Eelgrass

*In New Hampshire's estuaries, a humble marine plant functions as food source, water filter, habitat stabilizer, fish nursery and more.*

BY ETHAN NEDEAU

The marine habitats that we are most familiar with are the ones that we can walk through. We can stroll around salt marshes and see fiddler crabs scurry into their burrows, mummichogs dart down tidal creeks and periwinkles slide up stalks of cordgrass. We can trek across rocky intertidal areas and see orange seastars under clumps of brown seaweed, barnacles on the surface of stones and herring gulls hunting for green crabs. But since we do not have gills and cannot see well underwater (without special equipment), we rarely get to see and appreciate one of New Hampshire's most ecologically valuable estuarine and coastal habitats — eelgrass beds.

Eelgrass is both a species and a habitat, a home for some animals and food for others, a water purifier and a habitat stabilizer. Scientists estimate that on the Atlantic coast, 50-75 percent of economically important fishes use estuaries at some point in their lives. In these estuaries, eelgrass provides the best habitat, supports the greatest diversity and abundance of marine animals and has far-reaching effects on estuarine and marine food webs.

## Eelgrass: A multi-tasking marvel

Swimming in an eelgrass bed is like driving into the fabric curtain at a carwash—the leaves slide across your face and body, obscure your vision and make it difficult to swim. If you have ever played hide-and-seek in a cornfield or looked for cottontails in dense underbrush, you can begin to understand one value of eelgrass: it provides hiding places. Healthy eelgrass beds are underwater jungles, providing safe refuge for a variety of marine creatures. Predators hunting in eelgrass have a hard time spotting and capturing prey. Eelgrass beds improve water quality and water clarity by slowing down waves and currents and by trapping nutrients and sediment.

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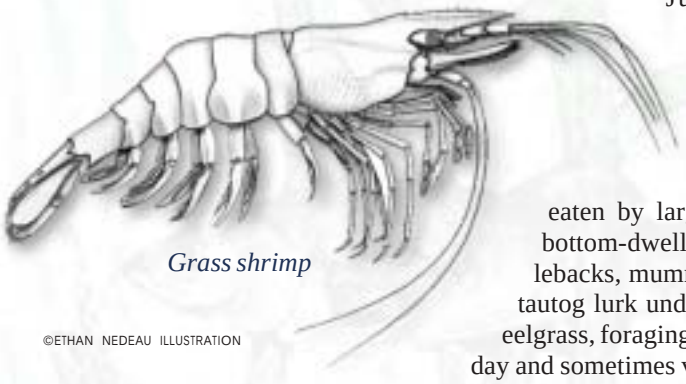
Rhizomes — underground eelgrass stems or rootstalks that grow to form a dense mat — impede large predators and allow smaller animals time to escape. Eelgrass roots and rhizomes also protect small invertebrates that burrow in the sediment, such as marine worms and clams. The sediment within eelgrass beds is stable because roots and rhizomes anchor it. This keeps burrowing animals from being dislodged and exposed to predators or transported to unfavorable habitats. Stable sediments are also more secure places for depositing eggs and for juvenile animals that settle in from the water column. Some kinds of burrowing animals are far more abundant in eelgrass beds than in nearby areas without eelgrass.

*Some estuaries, such as Waquoit Bay on Cape Cod or Chesapeake Bay, have lost 90-100 percent of their eelgrass.*

*Tiny grass shrimp and other invertebrates, an integral part of the estuarine food chain, live among the eelgrass.*



*Grass shrimp*

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Jungles of eelgrass leaves provide hiding places for juvenile and small-bodied fish and invertebrates that are vulnerable to being eaten by large predators. Small, bottom-dwelling fish such as sticklebacks, mummichogs, grubby and tautog lurk under dense canopies of eelgrass, foraging among the fronds by day and sometimes venturing into nearby sand flats when night falls. Juveniles of larger fish—such as winter flounder, striped bass and Atlantic cod—use eelgrass beds as nurseries until they are large enough to escape some predation risk in open waters. The same is true for American lobsters, which are vital to the economy of New Hampshire's coastal communities. Smaller crustaceans—such as sand shrimp, green crabs, rock crabs and amphipods—are extremely abundant in eelgrass beds and comprise an important food source for many types of fish and birds.

Eelgrass leaves provide a surface onto which many sedentary animals attach. Juvenile blue mussels and bay scallops attach to eelgrass leaves with their byssal threads and benefit by being elevated above the sea floor and exposed to better feeding conditions. If you look closely at eelgrass, you will likely see a variety of tiny jellies, anemones and sponges, plus bryozoans and entoprocts (two types of moss-like aquatic animals) attached to the surface of the leaves. These creatures—along with fine sediments, bits of organic material, bacteria, algae and single-celled animals—create a brownish "slime layer" on eelgrass leaves. This slime layer is very nutritious and is eaten by grazing animals such as snails and seastars when the plants are still alive, and by a variety of detritivores (animals that eat

## EELGRASS

*(Zostera marina)*

Eelgrass *(Zostera marina)* is a grass-like flowering plant that lives entirely underwater. Unlike most plants that are pollinated by insects or by wind, eelgrass relies on water for pollination. Eelgrass plants have underground stems called rhizomes and ribbon-shaped leaves that are usually one to six feet long; air spaces in the leaf tissue make them buoyant. Eelgrass beds usually grow in sandy or muddy habitats in subtidal areas, in depths that receive enough sunlight. This varies with water clarity, but usually eelgrass is not found much deeper than 20-30 feet. Eelgrass begins a period of rapid growth in May and reaches peak abundance in August; the plant's leaves drop and decompose through the autumn. In New Hampshire, most of the eelgrass is found in Great Bay, with lesser amounts in Little Bay, Portsmouth and Little Harbors and the Piscataqua, Lamprey and Swampscott Rivers.

*Eelgrass (*Zostera marina *L.) in healthy condition growing in clean ocean water. However, as water quality deteriorates, over time so will the eelgrass beds as shown in the sequence to the right.*

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decaying organic matter) when the eelgrass drops its leaves in fall. Eelgrass is a staple food item for ducks and geese that forage in New Hampshire's estuaries.

## Challenges for Atlantic eelgrass

Eelgrass has been declining along the Atlantic seaboard in recent decades, especially south of the Gulf of Maine. Some estuaries—such as Waquoit Bay on Cape Cod or Chesapeake Bay—have lost 90-100 percent of their eelgrass. A primary cause of eelgrass decline is nutrient enrichment of estuaries, caused by human population growth, pollution and land uses in the watershed. Air pollution, wastewater treatment plants, industries, agricultural runoff, urban and suburban runoff and leaky septic systems all contribute excess nutrients to rivers and estuaries.

Scientists at the University of New Hampshire's Jackson Estuarine Laboratory have been monitoring eelgrass for many years to look for indicators of ecosystem stress. Eelgrass in New Hampshire has not declined in recent years. Nevertheless, there are signs that estuarine health—and possibly eelgrass—might decline in coming years. These signs include increases in environmental nitrogen concentrations, declines in shellfish and low-oxygen periods in some parts of the estuary.

Population growth and urbanization in New Hampshire's coastal watersheds is occurring at a rapid rate, and nutrient enrichment of estuaries is expected to worsen. Nutrient enrichment—particularly nitrogen—allows phytoplankton,

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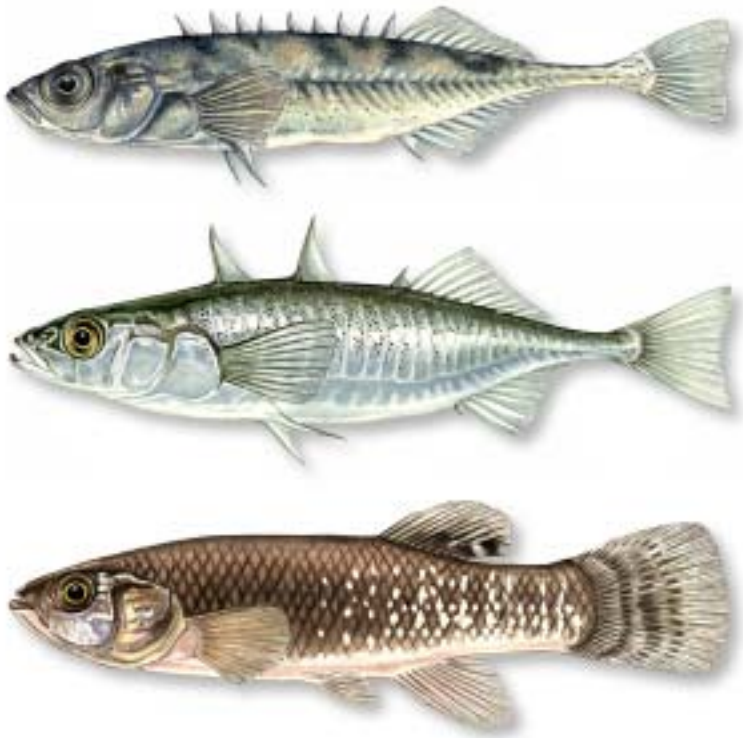


*Eelgrass beds serve as fish "nurseries," providing shelter and food for small bottom-dwellers such as (top to bottom) ninespine stickleback, threespine stickleback and mummichog.*

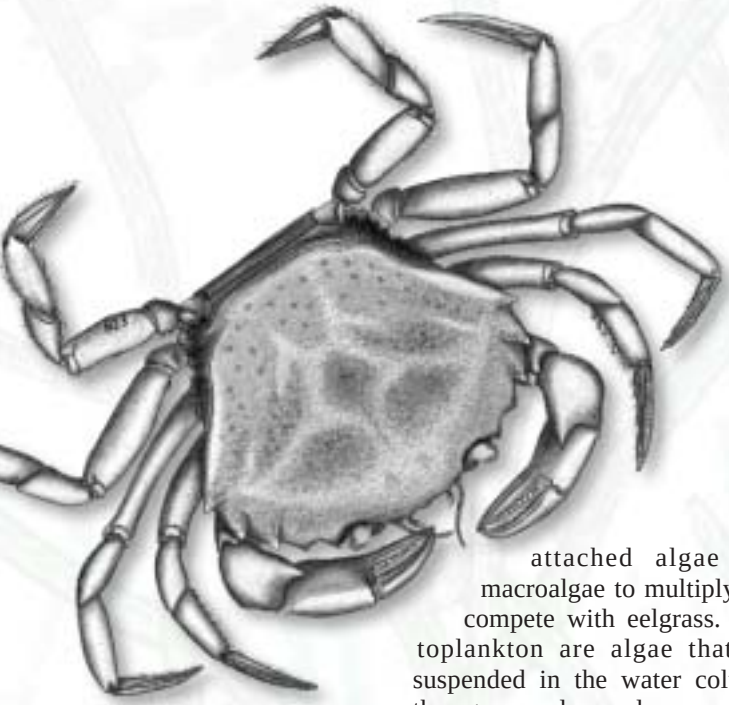


*1.) Eelgrass with epiphytes growing on the leaves as a result of moderate nitrogen loading. Eelgrass can thrive even with some epiphyte cover.*

*2.) The eelgrass is overgrown by nuisance green seaweed resulting from high levels of nitrogen loading.*

*3.) As the levels of nitrogen loading increase, a red seaweed,* Gracilaria *sp., takes over the area.*

*4.) Eventually the eelgrass is smothered by green algal growth and the area gradually becomes barren.*



Top to bottom:
*Green crabs, mud snails and sea stars are only three of hundreds of marine creatures that rely on eelgrass habitat for food and shelter.*

*Pollutants such as heavy metals, hydrocarbons, pesticides and wastewater effluents may degrade water quality or habitat quality to the point where eelgrass...will be threatened.*

attached algae and macroalgae to multiply and compete with eelgrass. Phytoplankton are algae that are suspended in the water column; they grow and reproduce very rapidly when provided extra nutrients. This may cause an "algal bloom," during which the water takes on a greenish hue, becomes murky and blocks sunlight from penetrating into the water. Since eelgrass is rooted on the bottom and needs sunlight for photosynthesis, eelgrass in deep water will stop growing and eventually die if sunlight does not reach the plants.

Macroalgae form thick, unattached mats near the bottom, especially in shallow water. Macroalgal growth is usually limited by a shortage of nutrients, and in healthy estuaries macroalgae are scarce or form very thin mats. Macroalgal mats increase in size and thickness in response to nutrient enrichment and warmer temperatures, overgrowing eelgrass shoots and competing with them for light. In a Cape Cod estuary, scientists found that eelgrass declined drastically when the macroalgal mat grew 3-4 inches thick. When the scientists manually removed thick macroalgal mats, eelgrass increased its productivity by 500 percent. Similarly, algae that attach to eelgrass leaves (called epiphytes) will overgrow and smother eelgrass as nutrients become more abundant.

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## What does the future hold for eelgrass?

Nutrient enrichment and algal growth are only two of the potential hazards for New Hampshire's eelgrass. Eelgrass "wasting disease" is caused by a slime mold that can quickly spread among eelgrass habitats and kill most of the plants. The most recent outbreak in New Hampshire was in the late 1980s, when most of Great Bay's eelgrass was lost (though it did subsequently recover). Climate change may cause a resurgence of wasting disease in this region because the disease prefers warmer, more saline environments. Sea-level rise and warmer air and water temperatures might create favorable conditions for wasting disease in areas where eelgrass is now abundant.

Erosion of shorelines because of encroaching sea levels, as well as land conversion and construction in the watershed, may increase turbidity of estuarine waters and limit eelgrass growth in deep waters. Construction of docks and piers, dredging for maintenance of shipping lanes, and other types of bottom disturbance (trawls, anchor lines, outboard motors and fishing gear) may damage or destroy eelgrass beds. Finally, pollutants such as heavy metals, hydrocarbons, pesticides and wastewater effluents may degrade water quality or habitat quality to the point where eelgrass—and the rich assemblage of animals that rely on it—will be threatened.

New Hampshire's citizens know how important its estuaries are to the state's economic prosperity, quality of life and natural heritage. We want estuaries where mussels and scallops are abundant and harvestable; where winter flounder spawn in great numbers and juvenile fish flourish; and where waterfowl return by the tens of thousands to spend the winter or regain strength on their journey south. We cannot have these things without eelgrass: eelgrass is the cornerstone of a healthy Great Bay ecosystem. WJ

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