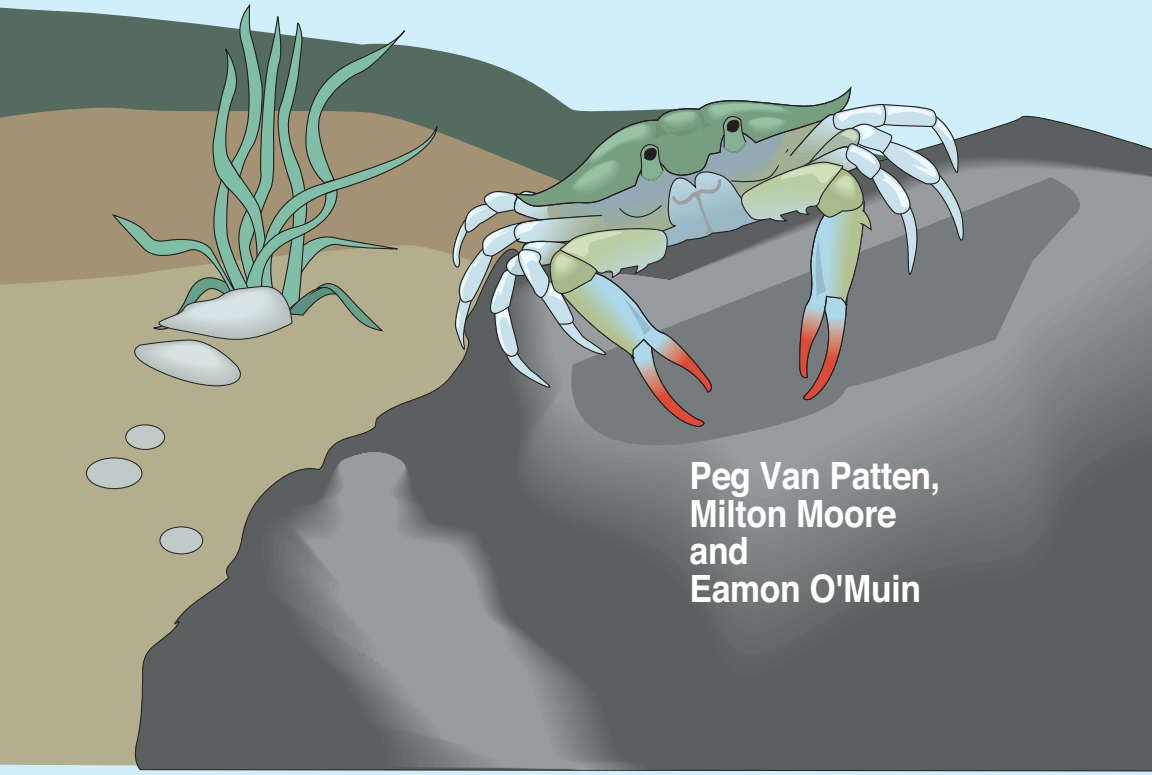
Sound facts

fun facts about Long Island Sound

Second Edition



Peg Van Patten,
Milton Moore
and
Eamon O'Muin

Sound Facts originally appeared as a weekly feature in The Day newspaper (New London, Connecticut). They were produced as a collaboration between The Day and the authors named below. Later, in 1997, the facts were compiled into "Sound Facts: fun facts about Long Island Sound," published by Connecticut Sea Grant and funded by Connecticut Sea Grant and the EPA Long Island Sound Study. The booklet sold out and was out of print for many years. This new, larger edition incorporates several brand-new Sound Facts, and the information in many of the older Facts has been updated.

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Sea Grant Connecticut

The Day

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A Partnership to Restore and Protect the Sound

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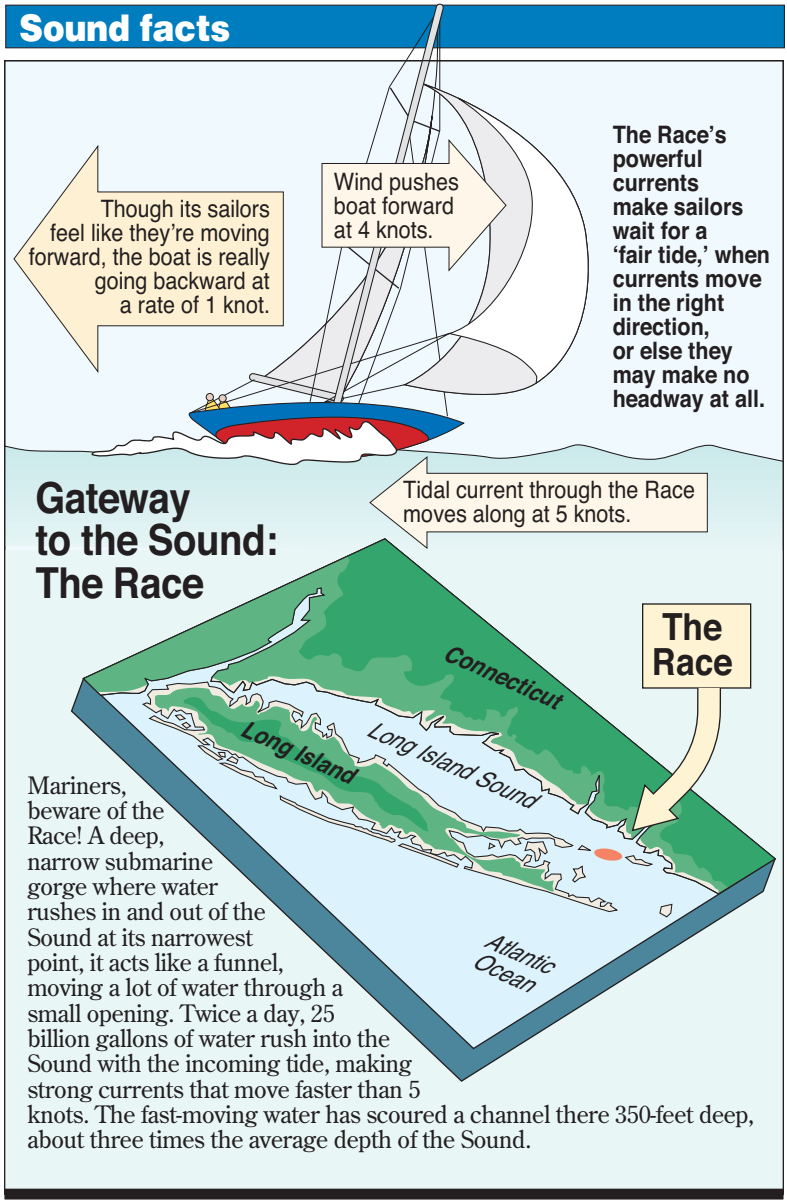
Contents

This booklet is meant to give the reader an appreciation for the Long Island Sound. It's a place of beauty, mystery, and *life*. It's also a fragile place, threatened by the competition for its valuable resources and the stresses of increased coastal population.

Meet the Sound



Source: Peg Van Patten & Eamon O'Muin, /Connecticut Sea Grant Milton Moore/The Day

Long Island Sound's east-west orientation makes it unusual among estuaries. Most large estuaries in the North Atlantic are north-south.

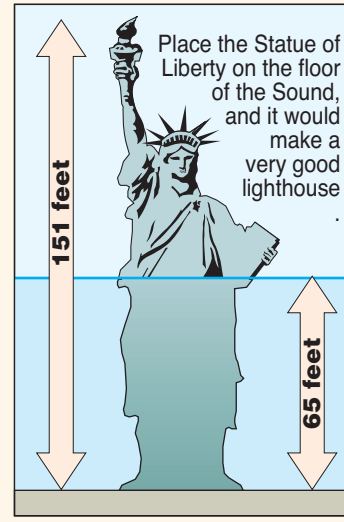
Sound facts

It's long, narrow and shallow

Long Island Sound is an estuary, a place where fresh and salt water mix. It gets salt water from the Atlantic Ocean and 90% of its freshwater from three major rivers: the Thames, the Housatonic and the Connecticut.

The Sound is 21 miles wide at its widest point and 110 miles long if you draw a straight line down its center, but it has about 600 miles of coastline because of all the bays and inlets on its shore.

The Sound covers 1,300 square miles, and its surface temperature ranges from 32F in winter to 73F in summer. There are two high and two low tides a day, with the highest tides at the western end.



The average depth of the center of the Sound is a shallow 65 feet. If dropped into the Sound, the Statue of Liberty would still have 86 feet exposed above the water — and that's without its 150-foot granite base.

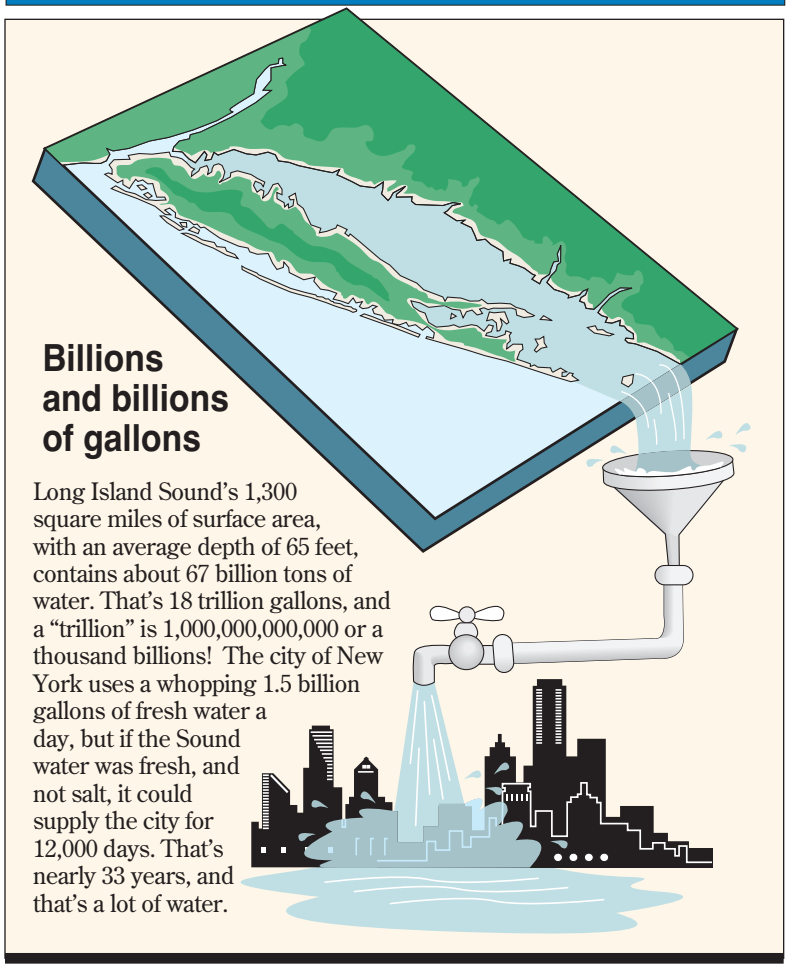
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Water, water...

Just how much water is in Long Island Sound? It's open to the Hudson River at the western end, and the Atlantic Ocean at the eastern end. In between, fresh water enters from three major rivers: the Housatonic, the Thames, and the mighty Connecticut.

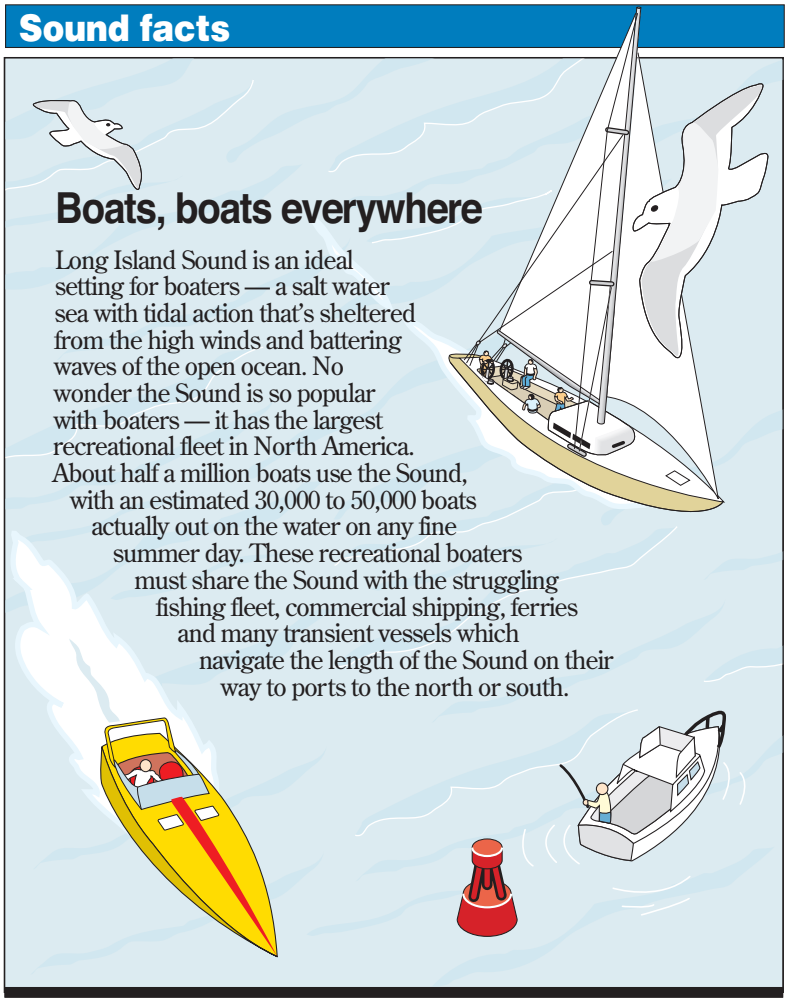
Sound facts



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts



Source: Peg Van Patten, CTDEP & NYDEC/Conn. Sea Grant

Milton Moore/The Day

Sound facts

We are the watershed

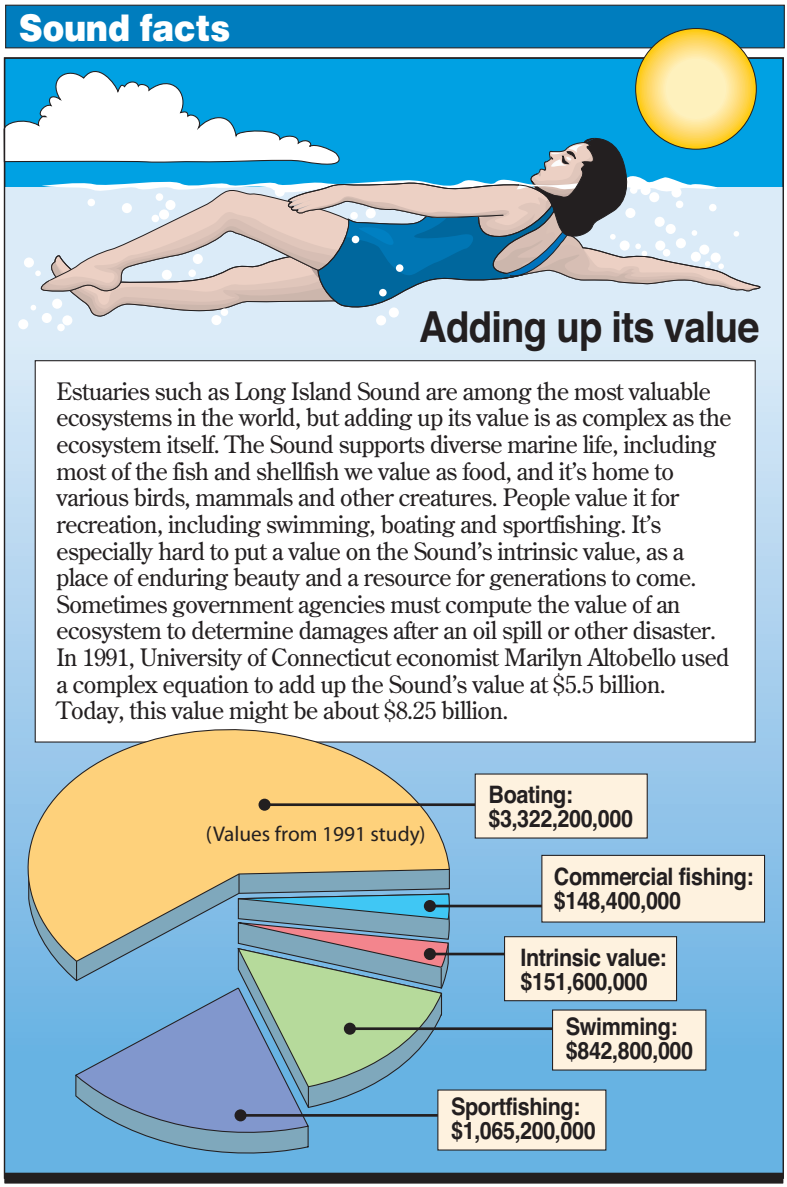
Do you live in the watershed of Long Island Sound? You do if you live anywhere in Connecticut, southwestern Rhode Island, or any other area shaded on the map. A watershed is land that collects rain water, sediments and dissolved materials that flow to rivers, their tributaries and estuaries. The three rivers shown are ① the Connecticut, ② the Housatonic and ③ the Thames. The Sound's watershed includes 6 states and extends into Canada, covering an area of 16,820 square miles. More than 8 million people live in the watershed, which has 410 sub-watersheds. A whopping 20 million people live within 50 miles of its shores, nearly 7% of the U.S. population! Any pollutants entering the water in this vast area can ultimately harm the Sound, so be careful about what goes in.

Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

What's it Worth?

We can't really put a dollar value on the pleasure you get from sticking your toes in the sand, or watching a heron eat breakfast.

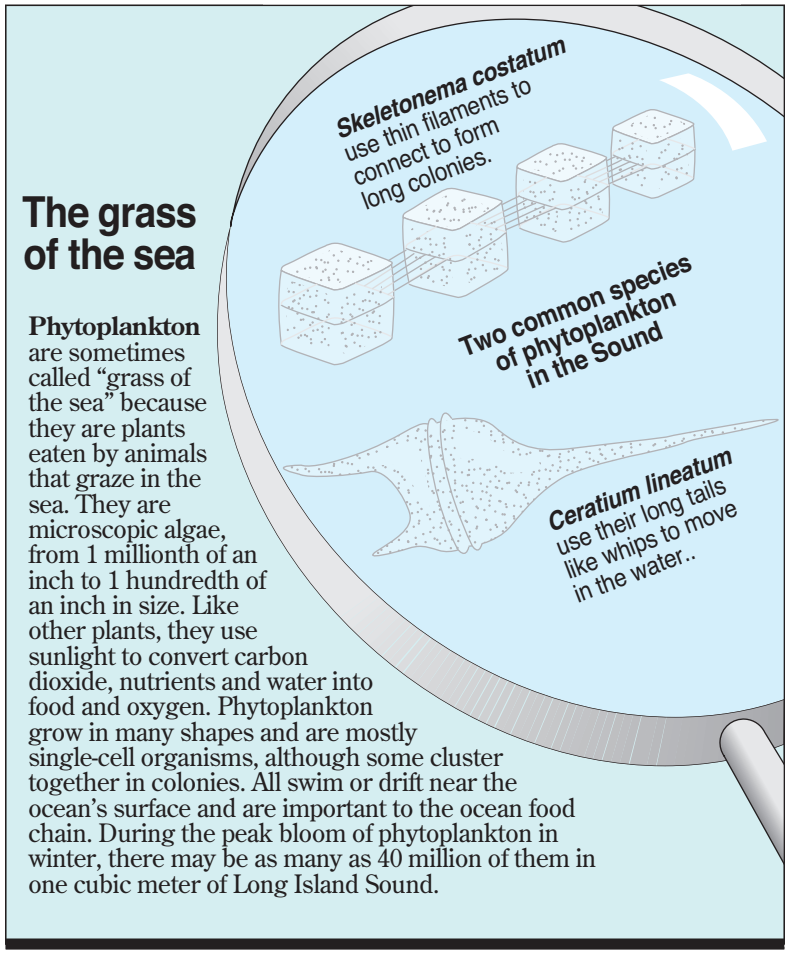


Source: Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

It's alive !

Long Island Sound is home to all sorts of fascinating life. Both phytoplankton and zooplankton are tiny but very important organisms in estuaries like the Sound, as well as in the ocean. These microscopic organisms form the base of the food web, on which all other life depends. Some have elaborate silica shells - "glass" houses!

Sound facts



Source: Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

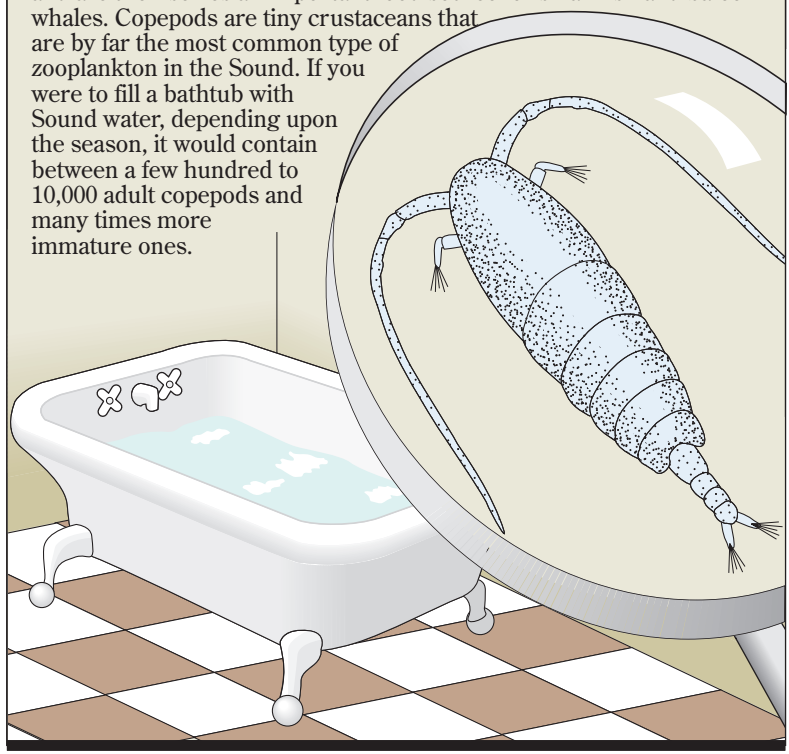
Mini-animals

Because zooplankton eat phytoplankton, they are most abundant when light is adequate and temperatures are not too harsh. Some are permanently members of the zooplankton, while others belong only in their juvenile, or larval, stages. Zooplankters migrate up and down in the water daily. There are about ten species in the Sound.

Sound facts

Literally teeming with life

Zooplankton are microscopic animals that live suspended in the waters of Long Island Sound and other salt water bodies. They graze on algae and are themselves an important food source for small fish and baleen whales. Copepods are tiny crustaceans that are by far the most common type of zooplankton in the Sound. If you were to fill a bathtub with Sound water, depending upon the season, it would contain between a few hundred to 10,000 adult copepods and many times more immature ones.

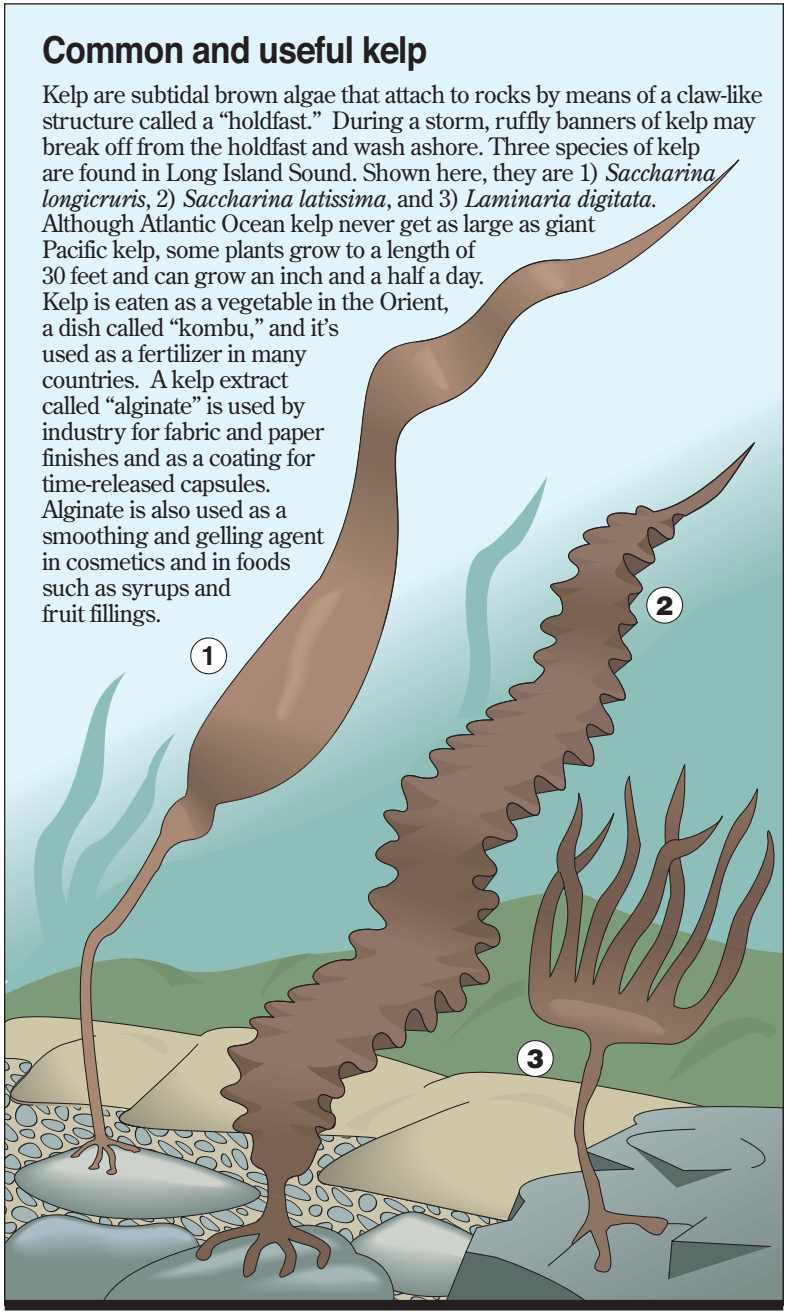


Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant Milton Moore/The Day

Sound facts

Common and useful kelp

Kelp are subtidal brown algae that attach to rocks by means of a claw-like structure called a "holdfast." During a storm, ruffly banners of kelp may break off from the holdfast and wash ashore. Three species of kelp are found in Long Island Sound. Shown here, they are 1) *Saccharina longicruris*, 2) *Saccharina latissima*, and 3) *Laminaria digitata.* Although Atlantic Ocean kelp never get as large as giant Pacific kelp, some plants grow to a length of 30 feet and can grow an inch and a half a day. Kelp is eaten as a vegetable in the Orient, a dish called "kombu," and it's used as a fertilizer in many countries. A kelp extract called "alginate" is used by industry for fabric and paper finishes and as a coating for time-released capsules. Alginate is also used as a smoothing and gelling agent in cosmetics and in foods such as syrups and fruit fillings.



Source: Peg Van Patten/Connecticut Sea Grant

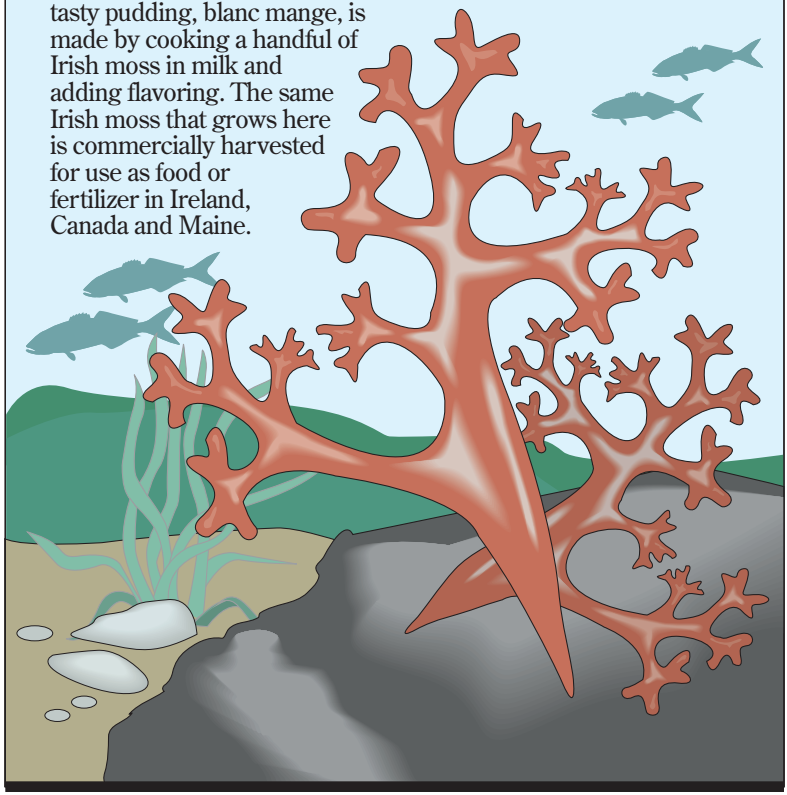
Milton Moore/The Day

Seaweeds are Not Weeds!

Sound facts

My wild Irish moss

Irish moss, or *Chondrus crispus,* is a bushy red seaweed that commonly grows in colonies on subtidal rocks and often washes up onto the beaches of Long Island Sound. It may sometimes be more dark purple than red, and it may fade to white in the sunlight on a beach. This seaweed is a source of carragheenan, a thickener used in ice cream, pudding, toothpaste, pastry fillings and many other food products and cosmetics. A tasty pudding, blanc mange, is made by cooking a handful of Irish moss in milk and adding flavoring. The same Irish moss that grows here is commercially harvested for use as food or fertilizer in Ireland, Canada and Maine.



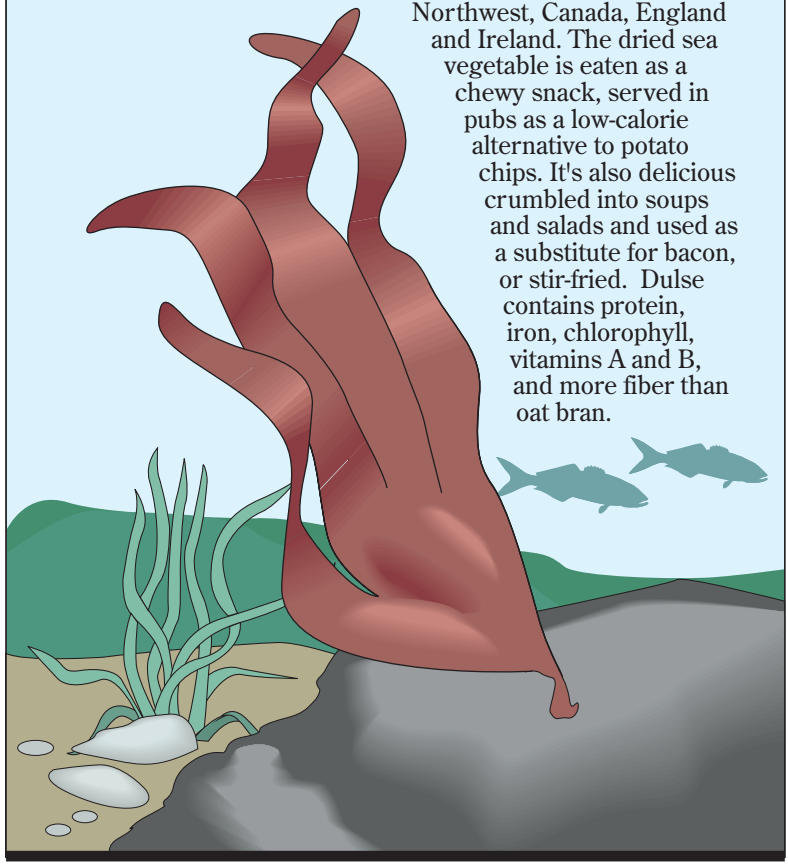
Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant Milton Moore/The Day

Seaweeds, or macroalgae, are classified by their dominant photosynthetic pigments into green, brown, and red.

Sound facts

A sea vegetable

Dulse, known to scientists as *Palmaria palmata*, is a purplish-red algae found on sub-tidal rocks in open waters of Long Island Sound. It has a leathery blade, with several divisions that resemble a pudgy hand. Dulse is harvested and dried in the sun, in parts of New England, the Pacific Northwest, Canada, England and Ireland. The dried sea vegetable is eaten as a chewy snack, served in pubs as a low-calorie alternative to potato chips. It's also delicious crumbled into soups and salads and used as a substitute for bacon, or stir-fried. Dulse contains protein, iron, chlorophyll, vitamins A and B, and more fiber than oat bran.



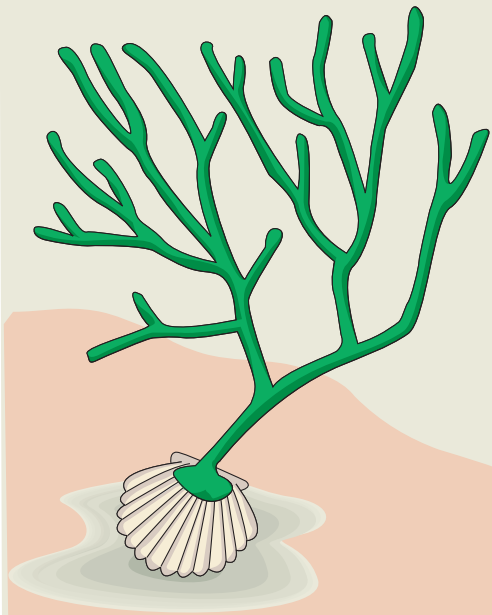
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Another red alga, nori, or *Porphyra*, (not shown) is dried and pressed into sheets for use in delicacies such as sushi and nori rolls. As it dries, the nori loses its red pigment and becomes dark green . Rice, vegetables, and pieces of fish can be wrapped in the nori sheets.

Sound facts

The oyster thief



There's an alien in Long Island Sound. Dark green and spongy, with forked rope-like fingers, the invader attaches itself to its victim as it grows.

No, it's not a Hollywood creation, but a species of seaweed called "deadman's fingers" that came here from Asia on ship bottoms and in oyster shipments.

It's known to scientists as *Codium fragile*, but fishermen call it "the oyster thief". It attaches to any hard surface, even an oyster or scallop. It gets buoyant as it grows, finally lifting the shellfish out of its bed.

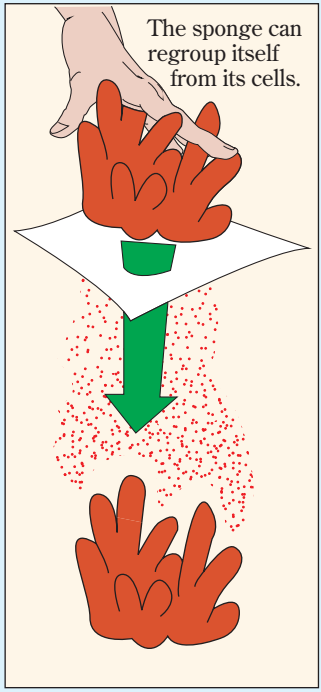
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Other "alien invaders" in Long Island Sound include mute swans, common periwinkles, and a recent newcomer—Asian crabs. Invading species occupy habitats formerly used by native species, and they thrive if there are few or no natural predators. Such invaders often travel in ballast water on ships.

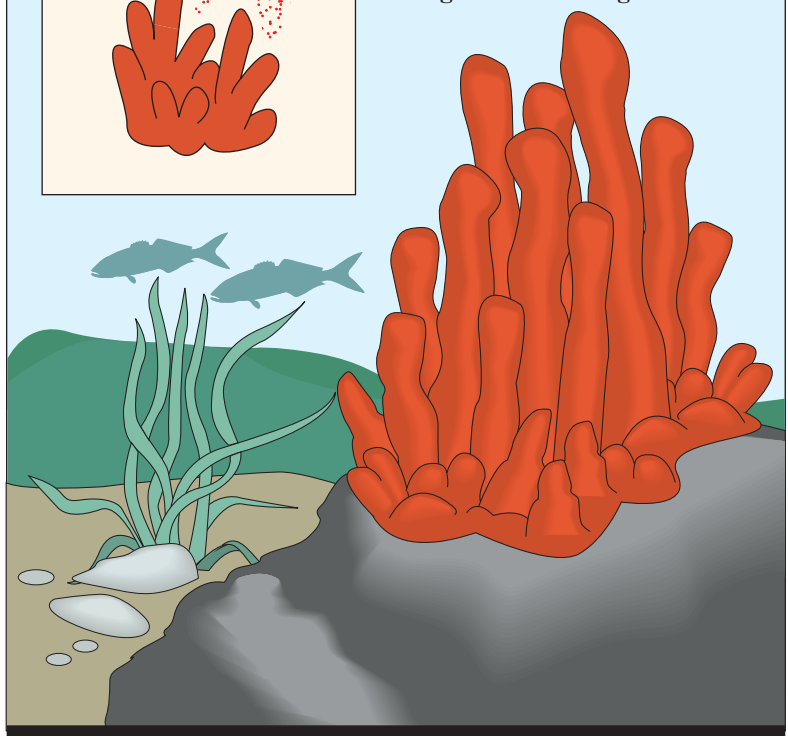
Plant or animal? Sometimes it's hard to tell in the water. A sponge is an animal.

Sound facts



Getting itself back together

The **red beard sponge**, *Microciona prolifera*, begins life as a thin, crusty layer on rocks, pilings, and even oysters. It grows until its "arms" are about eight inches long. Like other sponges that live in estuaries, it can adjust its internal chemistry to withstand changing salinity in the water. Amazingly, if strained through a cheesecloth and broken down into its individual cells, it has the ability to reform itself into a mass of cells that then reorganize into its original form.



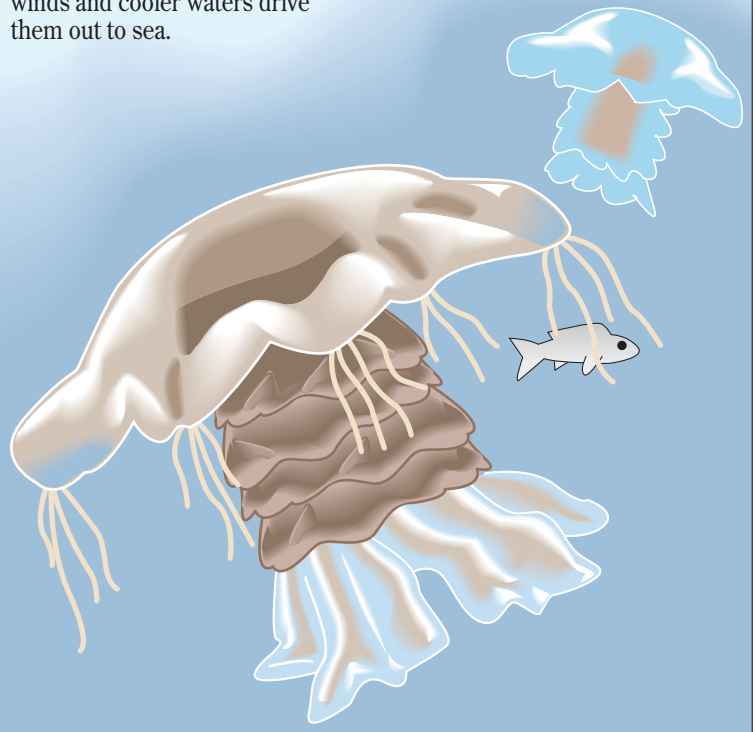
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Stinging jellyfish

Warm summer waters attract an unwelcome visitor to Long Island Sound, the **lion's mane jellyfish**. This jellyfish, easily identifiable by its eight-lobed umbrella and reddish color, is a plague to swimmers. Its eight clusters of tentacles cause burning and itching when touched. In the Sound, they range from 4 inches to a foot in size, but in Arctic waters, they grow to a diameter of 8 feet. Many small fish swim with the jellyfish, seeking shelter from predators under its umbrella. The red jellyfish will leave shortly as northerly winds and cooler waters drive them out to sea.



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Pale moon rising

The moon jelly is the most abundant jelly in the Sound. They have four pale yellow horseshoe-shaped structures in the center of its bell-shaped "umbrella" , and four relatively short tentacles underneath. The sting can prickle a bit but doesn't pack the wallop of its relative, the lion's mane. They propel themselves through the water column in pulses, stinging and catching food with the tentacles. Jellies have been on earth for about 650 million years. Jelly bodies are about 95% water.

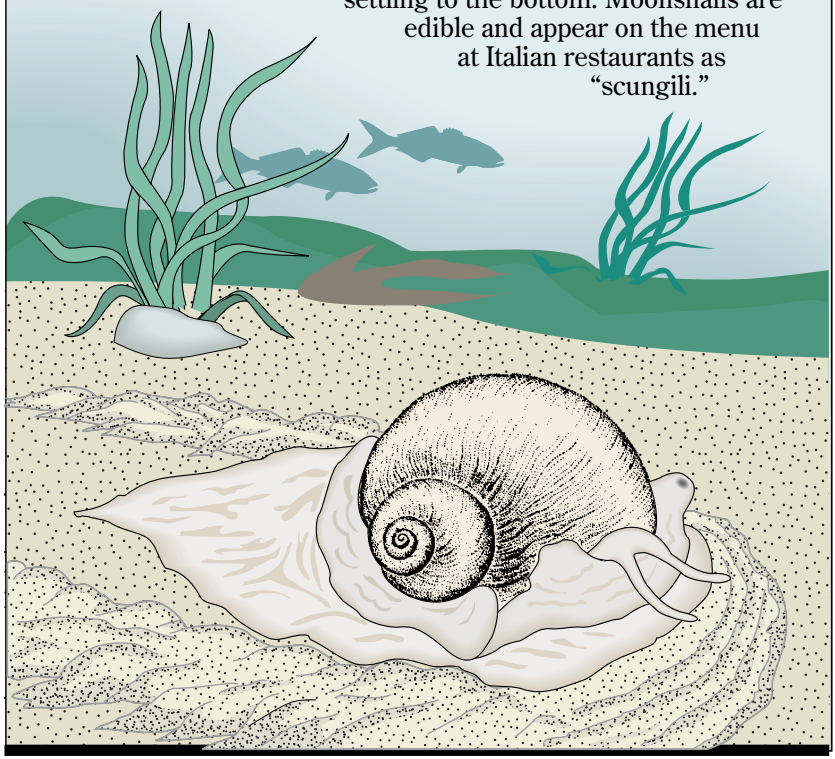
Source: Peg Van Patten/Connecticut Sea Grant

Those marvelous mollusks in Long Island Sound include gastropods (i.e., snails), bivalves (clams, oysters, and scallops) and cephalopods (squid). We can't show you all of them in this small booklet so we chose a few. See how many more you can find! But please leave them in the Sound - that's their home.

Sound facts

There's a moon out tonight

Moon snails are predatory mollusks that live in the intertidal zone or in deeper water. They are sometimes seen plowing along wet sand on Long Island Sound's beaches, using their very large, muscular foot . Other mollusks may become lunch for the moon snails, which can drill holes through the shells of bivalves such as clams. Moon snails construct "sand collars," conical rings of sand, by secreting mucus to embed their eggs the spiral sheet of sand grains. The young emerge from the collars as free-swimming larvae before settling to the bottom. Moonsnails are edible and appear on the menu at Italian restaurants as "scungili."



Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant

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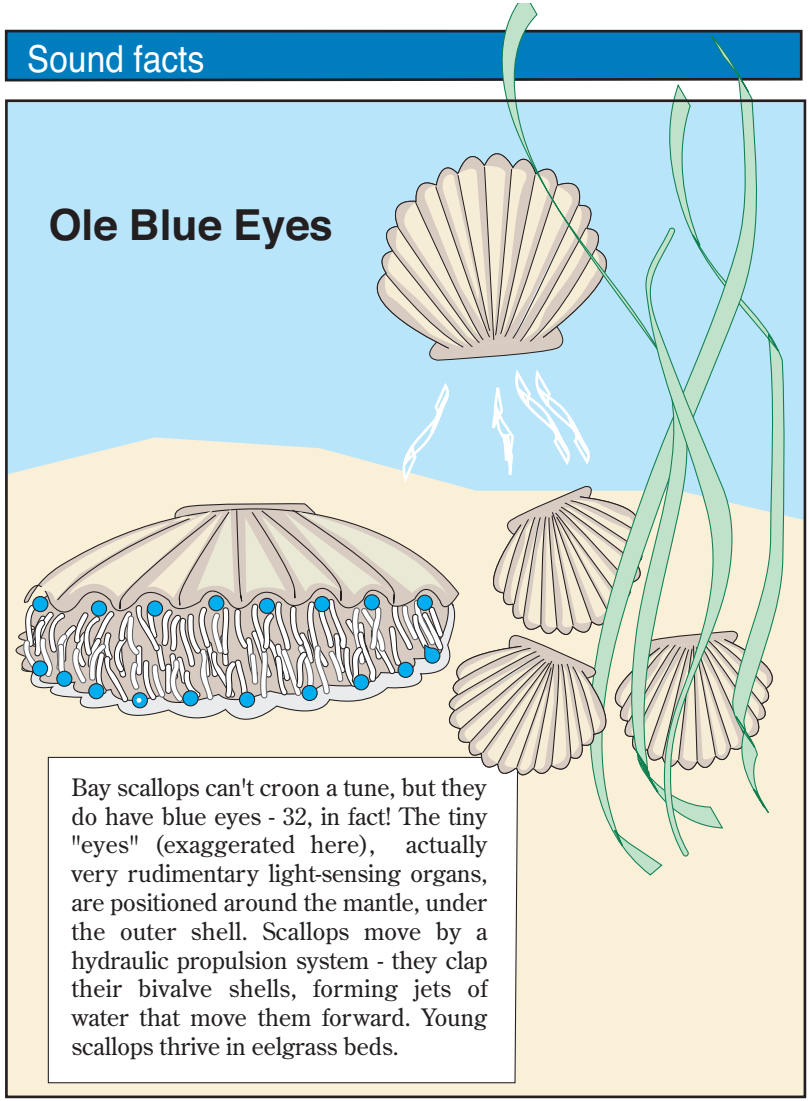
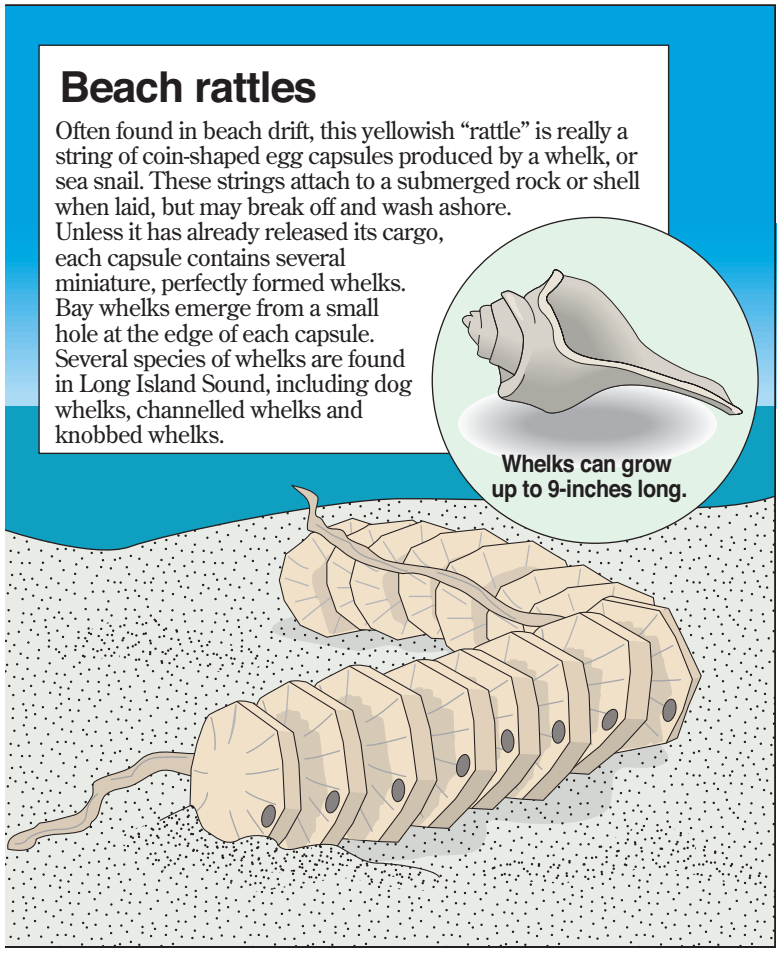
Atlantic Bay Scallops - lookin' at you, kid



Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

Shake, rattle & roll in the Sound

Sound facts



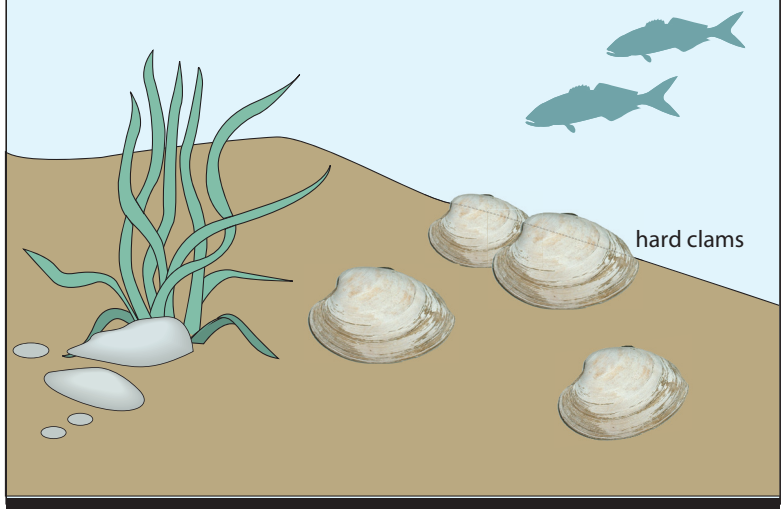
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Clams – do you dig 'em?

Three types of clams are commonly found in Long Island Sound: soft clams or "steamers" (*Mya arenaria*), hard shell clams or quahogs (*Mercenaria mercenaria*), and long, narrow razor clams (*Ensis directus*). These clams, the basis of the ever-popular New England clam chowder and clambake, are bivalve molluscs. That means they have two shells that open and close, connected by a hinge on one side. Inside the hard shells, their bodies are soft. Their strong pink and white adductor muscles close the shell tightly. The hard shells are composed of calcium carbonate, like blackboard chalk, and have lines that indicate a year's growth. These animals burrow in the sand, extending a tube called the siphon for bringing in food and water and expelling what's left after filtering out the food. Native Americans valued shellfish so much that they used pieces of quahog shells as money, called "wampum". Digging clams is still a popular and tasty pastime today. The commercial clamming harvest in the Sound amounts to thousands of bushels each year.



Source: Tessa Getchis and Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

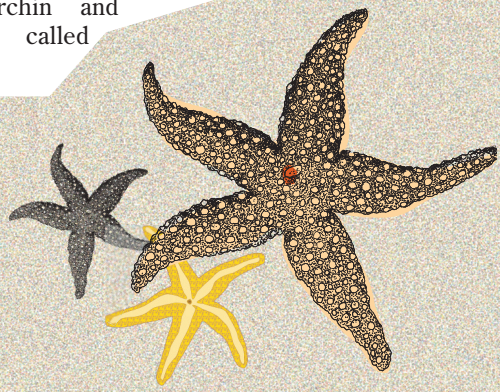
Sound facts

Seeing Stars - it's totally tubular!

Sea stars, or starfish, are common in Long Island Sound and easy to recognize. They usually have five tapered legs, or "rays", all connected to a center. Some have ten or more rays. On the underside of the legs are many tiny "tube feet", which work like suction cups for moving slowly or attaching to a hard surface. The top surface is tough and has one circular "bump" near the center. This bump, called the madreporite, directs the star's movement. Sea star size may vary from one inch to a foot. Most stars in Long Island Sound are yellowish-orange to tan colored, though brightly colored stars are found too. Stars like to eat mollusks such as clams by wrapping around them and using the grip of the tube feet to pry them open. Then the sea star pushes its stomach into the clam to digest the contents.

Sea stars and their spiny-skinned relatives such as the sea urchin and sand dollar are called **echinoderms.**

Imagine your feet were tubes!

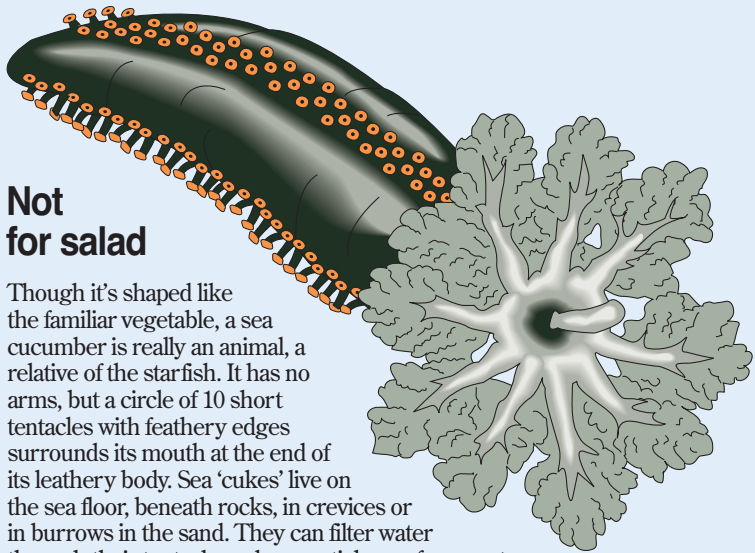


Peg Van Patten/Connecticut Sea Grant

Sea Cucumber

Echinoderms have bodies that form in five parts, or multiples of five. The fancy name for that is “pentameric symmetry.” How many of these do you know already? Other echinoderms besides sea cucumbers and sea stars include sand dollars and their spiny cousins the sea urchins. If you counted the spines on an urchin, they would be a multiple of five. But it could be a sharp experience -ouch!

Sound facts



Not for salad

Though it’s shaped like the familiar vegetable, a sea cucumber is really an animal, a relative of the starfish. It has no arms, but a circle of 10 short tentacles with feathery edges surrounds its mouth at the end of its leathery body. Sea ‘cukes’ live on the sea floor, beneath rocks, in crevices or in burrows in the sand. They can filter water through their tentacles, where a sticky surface can trap food. They then curl up their tentacle and pop the food in their mouths. They are slow and sluggish, but they can escape a hungry crab by shooting sticky strings from their body, tangling the crab to give them time to crawl away. Sea cucumbers have a good waste disposal system: when they get too much sand and sediment in their body, they expel their waste-laden stomach and digestive tracts and grow new ones. There are several species of sea cucumbers in Long Island Sound, growing up to 8 inches long and ranging in color from olive green to black. Shown is the orange-footed cucumber, dotted with tiny orange feet.

Source: Peg Van Patten/Connecticut Sea Grant

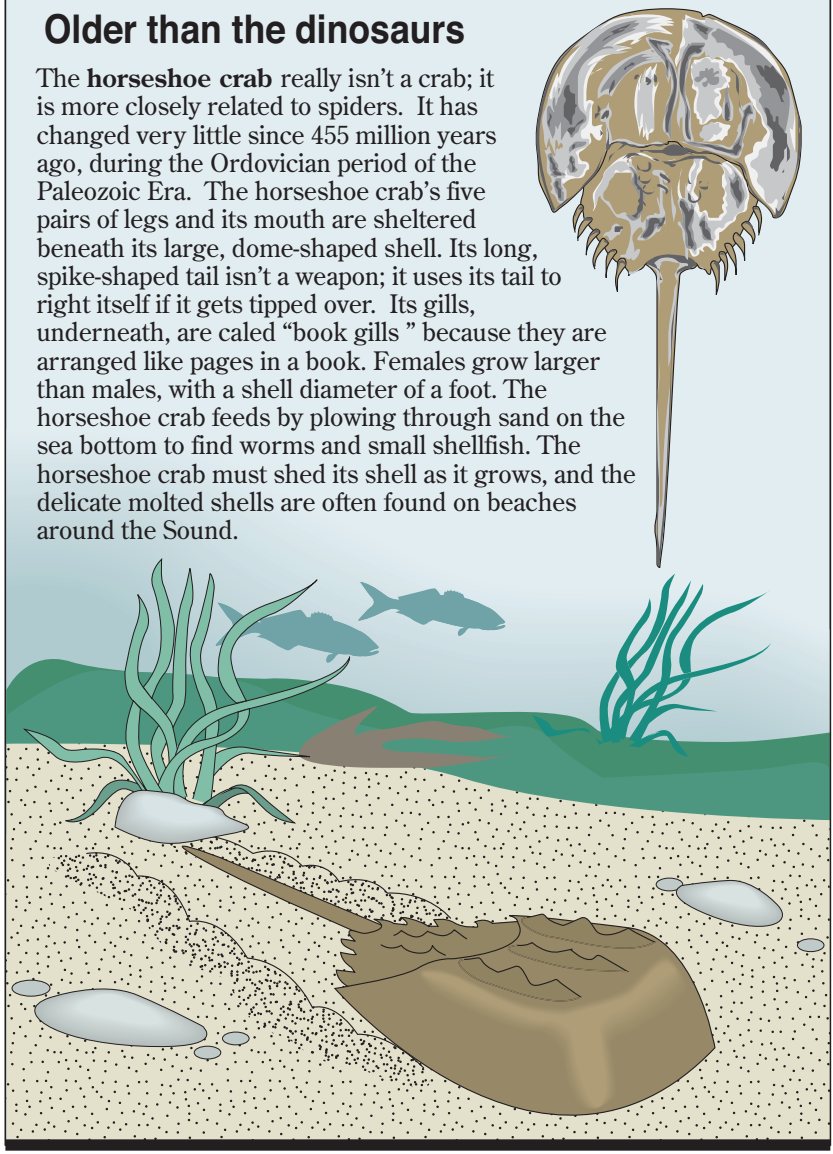
Milton Moore/The Day

An ancient arthropod:

Sound facts

Older than the dinosaurs

The **horseshoe crab** really isn't a crab; it is more closely related to spiders. It has changed very little since 455 million years ago, during the Ordovician period of the Paleozoic Era. The horseshoe crab's five pairs of legs and its mouth are sheltered beneath its large, dome-shaped shell. Its long, spike-shaped tail isn't a weapon; it uses its tail to right itself if it gets tipped over. Its gills, underneath, are caled "book gills " because they are arranged like pages in a book. Females grow larger than males, with a shell diameter of a foot. The horseshoe crab feeds by plowing through sand on the sea bottom to find worms and small shellfish. The horseshoe crab must shed its shell as it grows, and the delicate molted shells are often found on beaches around the Sound.



Peg Van Patten & Jen Mattei/Connecticut Sea Grant

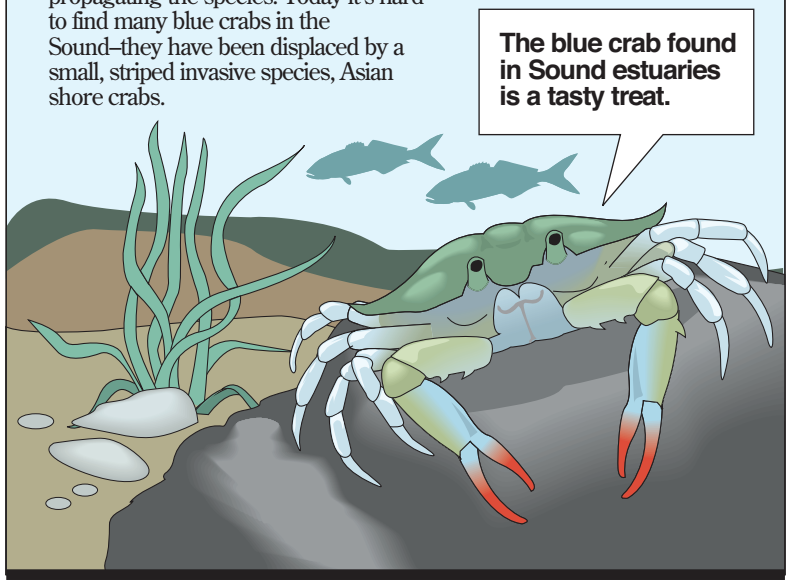
Milton Moore/The Day

Crabs, lobsters, and shrimp are all familiar crustaceans, animals with jointed bodies, eyestalks, and a hard outer shell, or exoskeleton. Many smaller animals including much of the zooplankton, are also crustaceans.

Sound facts

Claws make the crab

When fishermen harvest crabs, they look for the large males. Sometimes they remove the big claws and leave the rest of the animal behind, knowing that it can regenerate new claws. But according to University of Connecticut professor Hans Laufer, this isn't a good strategy because it can thwart the species' reproduction. Males use the claws to grasp the female during mating, and research shows that female crabs prefer males with large claws. Males without claws or with puny claws are useless for propagating the species. Today it's hard to find many blue crabs in the Sound–they have been displaced by a small, striped invasive species, Asian shore crabs.



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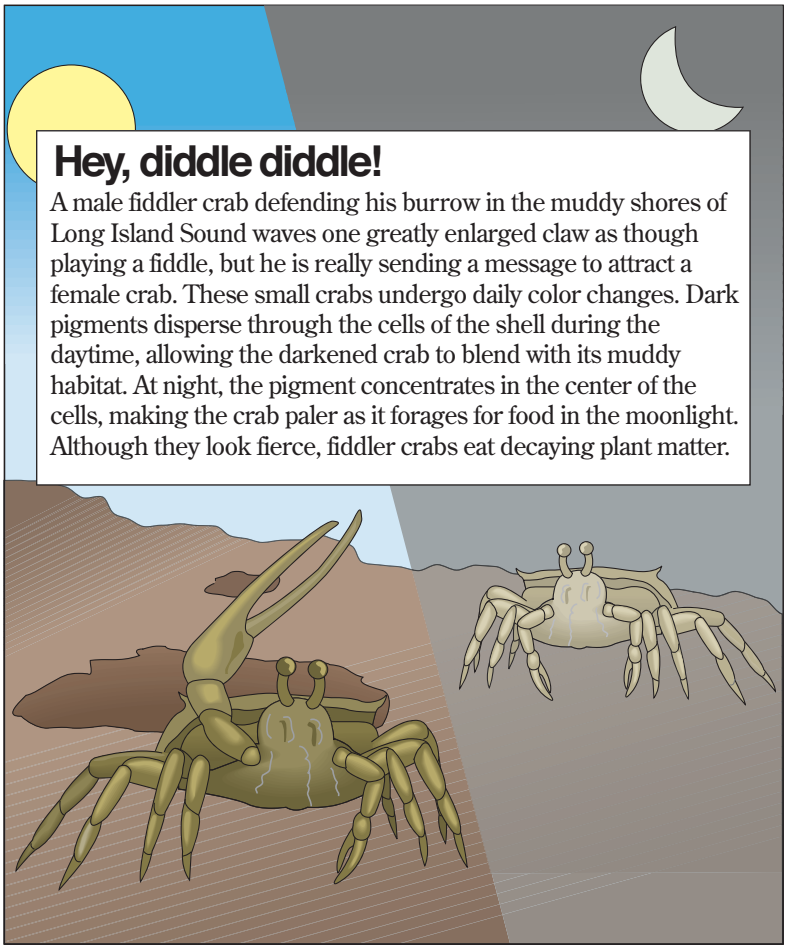


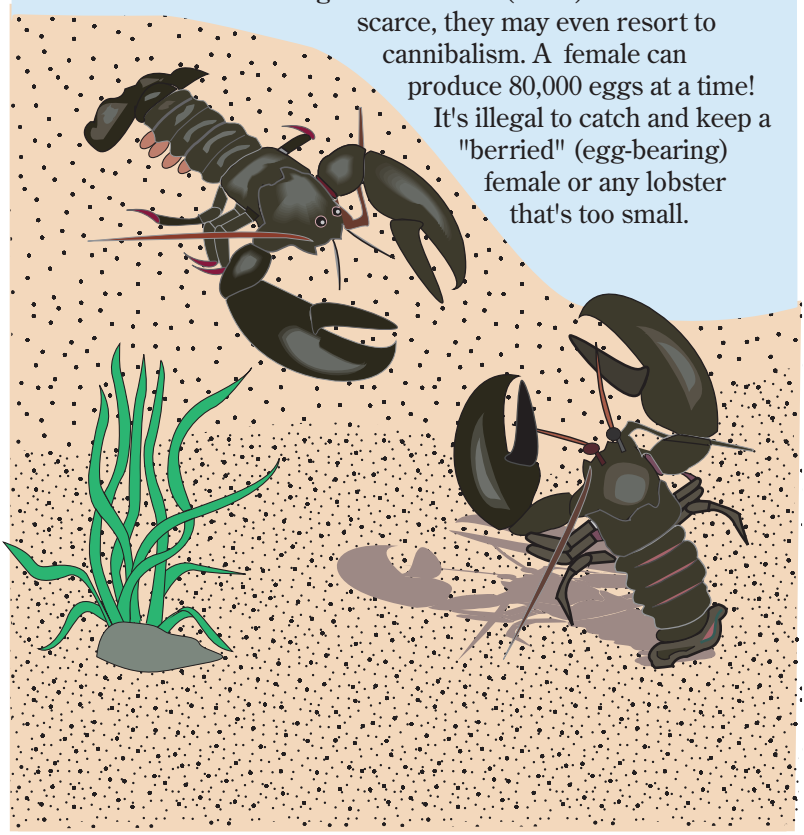
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

A crusty crustacean

Put up yer dukes and fight! American lobsters, *Homarus americanus,* are aggressive decapod (ten-legged) crustaceans. They assume a fighting posture and wave their large, meaty claws when threatened. Lobsters like to live alone, in burrows or rock crevices. They shed their outer shell, called a carapace, many times during their youth—just like you outgrow your shoes. Their diet includes many other sea creatures including their relatives (crabs) and if food is scarce, they may even resort to cannibalism. A female can produce 80,000 eggs at a time! It's illegal to catch and keep a "berried" (egg-bearing) female or any lobster that's too small.

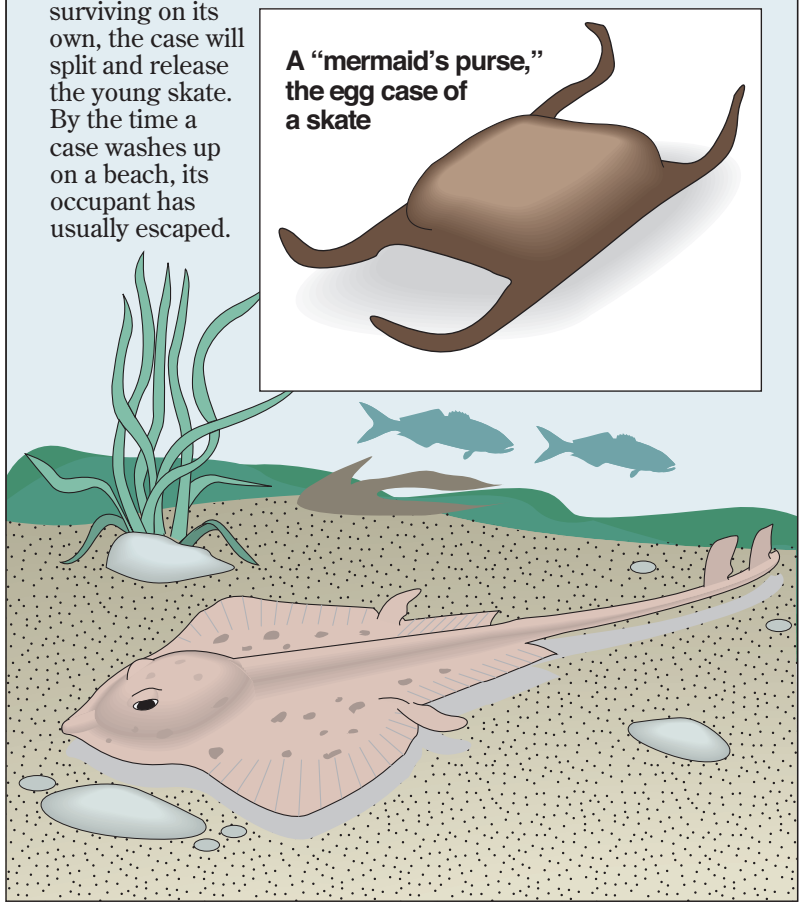


Peg Van Patten/Connecticut Sea Grant

Sound facts

What is that thing?

That curious brown rectangular object with hooked projections at the corners is called a "mermaid's purse." Often found by beachcombers, it is really the tough protective egg case of the skate, a bottom fish related to sharks and rays. Inside the leathery container, a single embyro develops, nourished by a yolk. When the embryo is well developed and capable of surviving on its own, the case will split and release the young skate. By the time a case washes up on a beach, its occupant has usually escaped.



Source: Peg Van Patten/Connecticut Sea Grant

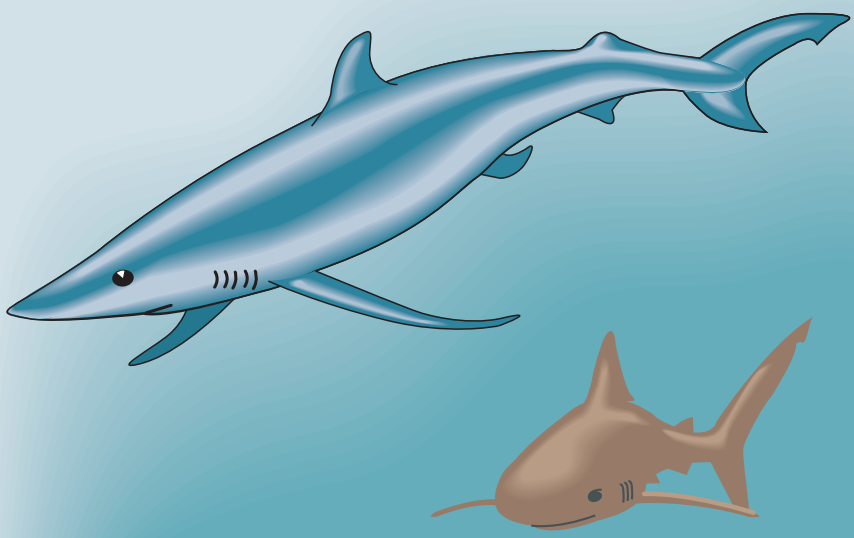
Milton Moore/The Day

Sharks have a bad reputation because of their occasional attacks on humans. But in fact it's usually the other way around. Many sharks are now threatened or endangered species.

Sound facts

Sharks in the Sound

The 10-foot-long blue shark is usually found in deeper waters off Long Island, but it often comes into the Race and the eastern Sound chasing bluefish. Blue and other sharks have highly specialized kidneys that enable them to tolerate the salinity changes from open ocean to estuary. Sometimes anglers in the Sound have caught brown sharks usually found in the open Atlantic. The brown sharks were caught off the Connecticut River, perhaps attracted by the warm waters and the same bass and bluefish that the anglers sought.



Source: Peg Van Patten/Connecticut Sea Grant

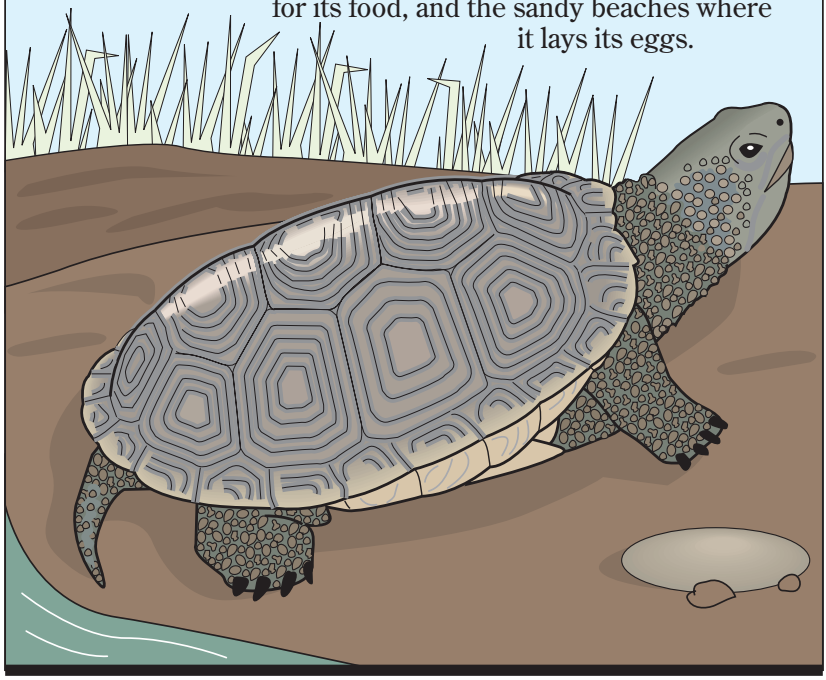
Milton Moore/The Day

On this page we show you a marsh turtle. There are also some true sea turtles that visit Long Island Sound: the green turtle, Kemp's Ridley, leatherback, and loggerhead. Their legs are modified into swimming flippers. Some make amazingly long journeys to breed and lay eggs in the sand. All, like the diamondback, are endangered or threatened species. So, watch where you step!

Sound facts

Are diamonds forever?

The diamond-back terrapin lives in coastal marshes along the Sound's shores. Once common, it became rare after 1900, when turtle meat was prized as a gourmet food. Continued survival of this reptile depends on two Sound habitats — the salt marshes that supply the mollusks, crustaceans, plants and fish remains for its food, and the sandy beaches where it lays its eggs.



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

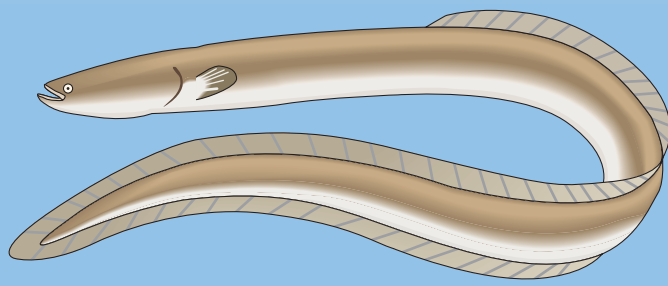
Something's Fishy Here!

Long Island Sound has so many species of finfish that it was hard to pick a few main characters to include here. Like us, fish are vertebrates - creatures with backbones.

Sound facts

Marathon swimmers

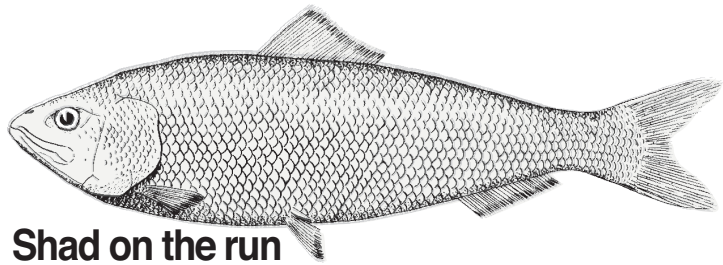
American eels, *Anguilla rostrata*, may look like snakes, but they're really fish. They swim with paired fins and breathe with gills, growing up to 5 feet in length. Their life cycle is the opposite of salmon and shad: they live in freshwater and migrate to the sea to spawn. After spending their adult lives in rivers and lakes, adults migrate to the mysterious Sargasso Sea to reproduce. Motherhood is not an on-going role for eels — they lay 10 to 20 million eggs, then die. The leaf-shaped larvae grow into tiny eels, called elvers, while swimming the incredible distance of 1,000 miles in open ocean to North America. They swim through Long Island Sound on their way to the rivers and streams that feed it.



Source: Peg Van Patten /Connecticut Sea Grant

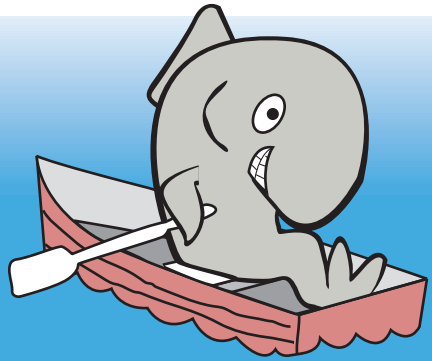
Milton Moore/The Day

Sound facts



Shad on the run

The spring migration of shad, *Alosa sapidissima*, happens between April and June, about the same time that the shadbush shrub is in bloom. Shad are anadromous fish, which means that they live in the ocean, but swim up rivers to reproduce in fresh water. Shad swim through Long Island Sound to get to their "home" rivers, the rivers where they were spawned. In 1995, a record 1.6 million shad returned to Connecticut waters, and about 156,000 in 2006. Shad return to their home rivers for as many as 8 springs. Members of the herring family, shad are silvery-green toothless fish that eat plankton and grow to about 18 inches in length and more than 3 pounds in weight. A female may lay 30,000 or more heavy, pinkish eggs to be fertilized by the male. Fresh shad is on the menu at this time of year, and it's an important sportfish as well as a commercial catch. Shad is now Connecticut's state fish!



Can shad row?

Of course a fish can't row! But masses of eggs taken from females caught by anglers are called 'shad roe.' Roe is cooked as a popular spring delicacy.

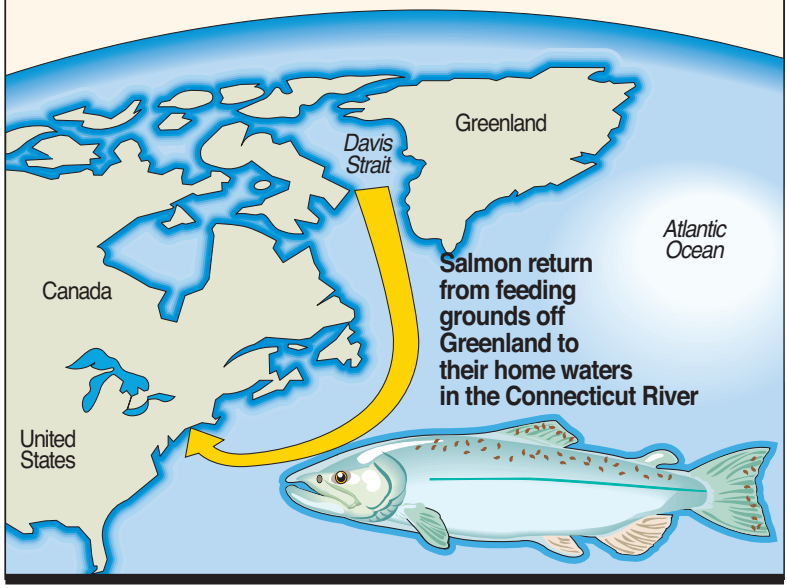
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Return of a native

Atlantic salmon are successfully returning from life at sea, navigating Long Island Sound and making their way up the Connecticut River in their struggle to spawn. This fish's scientific name, *Salmo salar*, means "the leaper" — a good description of its drive to leap waterfalls to return to the precise place where it hatched. Salmon find their way home by using olfactory clues, having been imprinted with the smell of their river of origin as young fry. When they return each spring as adults, a male will fertilize the 5,000 or so eggs laid by the female, a process that once occured naturally in gravel beds but now is done in state holding facilities as part of an ongoing restoration effort. Stair-step waterways called "fish ladders" have been built to help salmon get past dams that block their way. An abundant fish in early times, salmon were eliminated from state waterways by 1800 as a result of dams, overfishing and pollution.



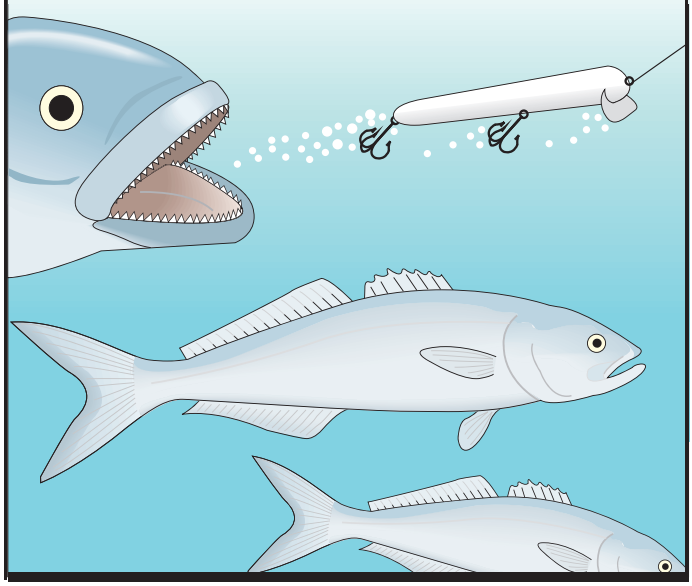
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Late summer/early fall is the best time to fish for one of Long Island Sound's biggest and most voracious gamefish, **the bluefish**. Bluefish are a warm-water species and are chowing down on everything in sight in preparation for their annual migration south to the Carolinas. Typical blues are 1 1/2to 2 feet in length and weigh from 3 to 10 pounds, though they may grow much larger.
They travel in schools and sometimes engage in mass feeding frenzies, making the water boil with the motion of the hunters and their frantic prey. Sometimes called "choppers," they can shred everything in sight with their teeth. They have even been known to slash at swimmers.

The blue will thrash mightily on the line, giving anglers an excellent fight. The second word of their species name — *Pomatomus saltatrix* — means "dancing girl." Many cooks say the tastiest part is the cheeks.



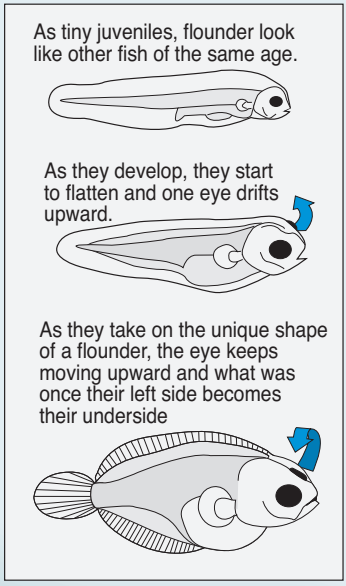
Source: Peg Van Patten/Connecticut Sea Grant

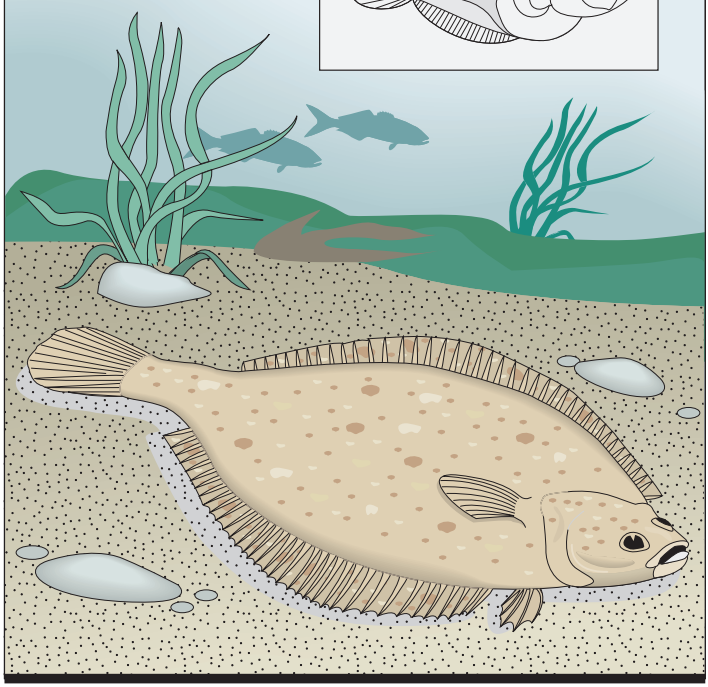
Milton Moore/The Day

Sound facts

Nowhere to go but up

The winter flounder, like other flatfish, starts life with an eye on both sides of its head, just like any other fish. But shortly after hatching, one eye begins to migrate to the other side. The young flounder will then settle permanently on the sea floor. These flatfish have camouflage coloring – their skin can change color to match the bottom. They are a dark brown on a muddy bottom and a dappled tan on the sand. With a little bit of burrowing, so little but their eyes poke out of the sand, they are all but invisible to predators. Winter flounder are tasty and are popular with both recreational and commercial fishermen.



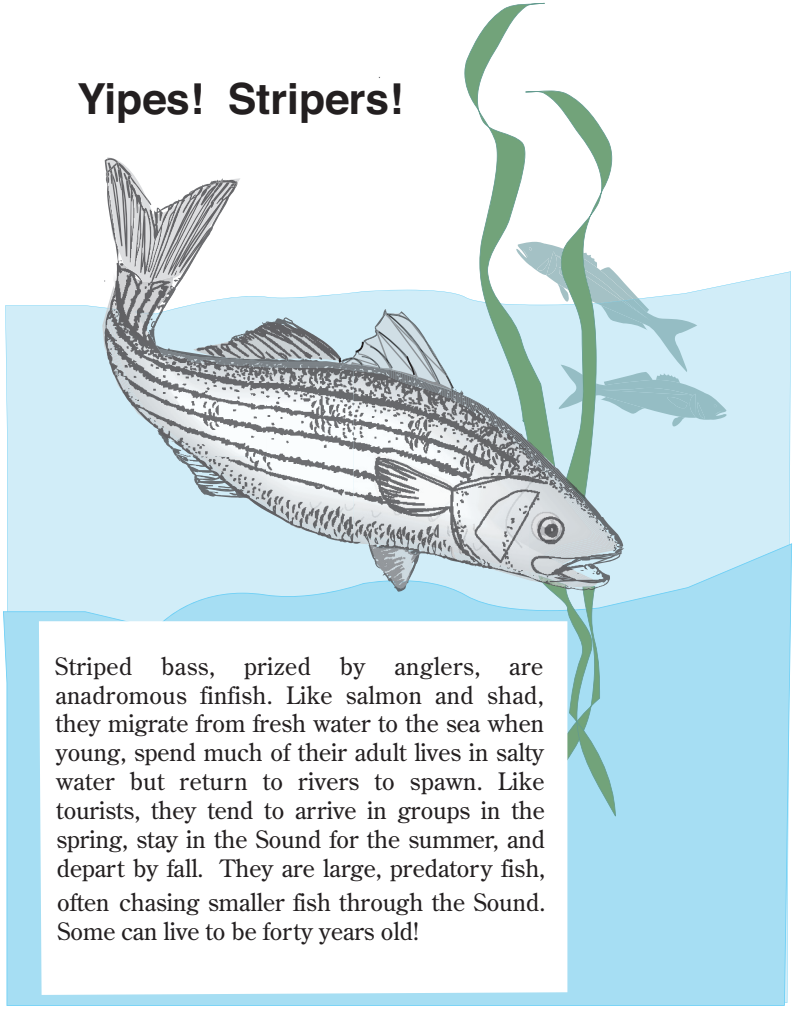


Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Yipes! Stripers!



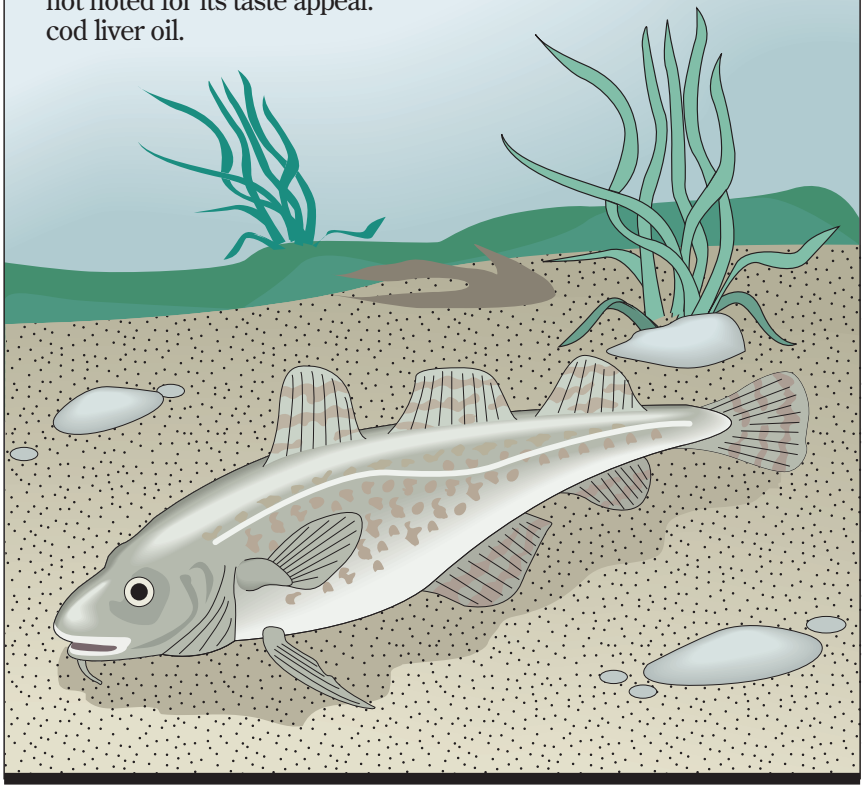
Striped bass, prized by anglers, are anadromous finfish. Like salmon and shad, they migrate from fresh water to the sea when young, spend much of their adult lives in salty water but return to rivers to spawn. Like tourists, they tend to arrive in groups in the spring, stay in the Sound for the summer, and depart by fall. They are large, predatory fish, often chasing smaller fish through the Sound. Some can live to be forty years old!

Peg Van Patten/Connecticut Sea Grant Judy White

Sound facts

A cool character

Tomcod, small relatives of the Atlantic codfish, are now enjoying the cool waters of Long Island Sound. Because they love cold water, tomcod can be found in abundance in fall and winter, when many other species have left for warmer waters. Only about a foot long, tomcod can be recognized by a small appendage called a 'barbel' under the chin, a pale lateral line, three dorsal and two anal fins and a rounded tail. Although they rarely weigh more than a pound, they are a tasty treat for anglers.
Like their larger cousins, they provide a product rich in Vitamin D, but not noted for its taste appeal: cod liver oil.



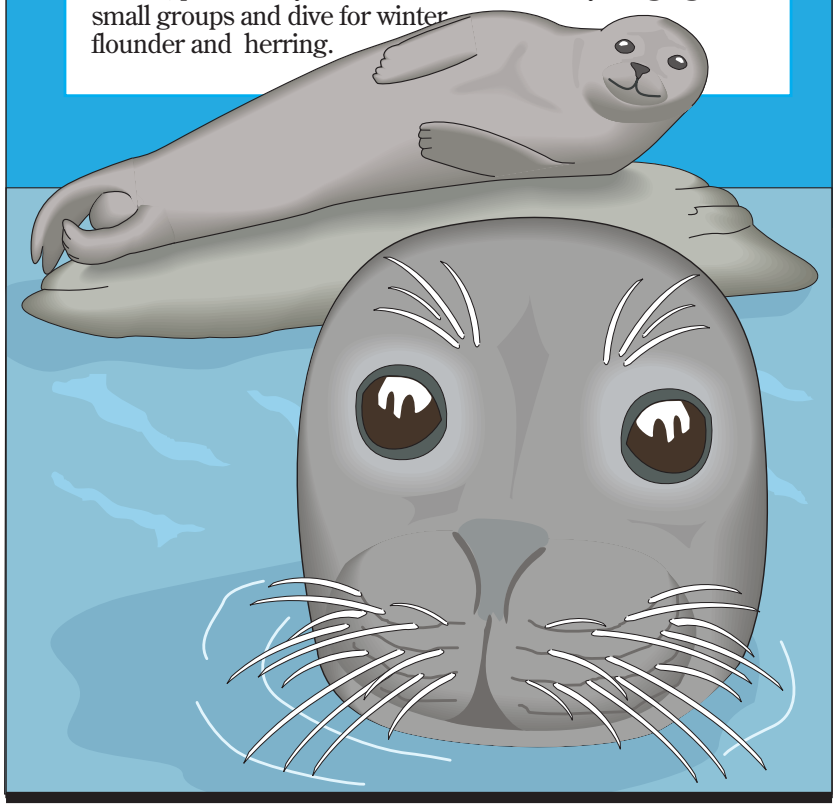
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Winter visitors

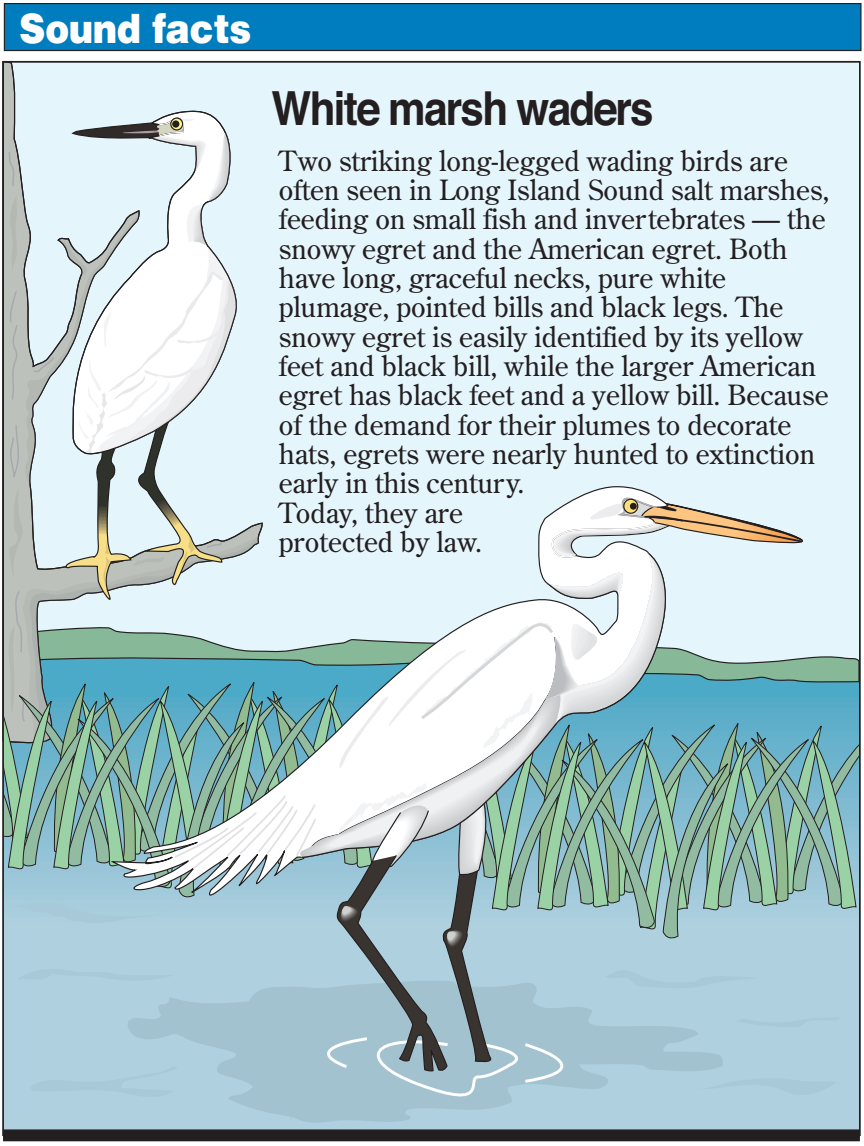
Harbor seals are coming to Long Island Sound for their annual visit. Along with a few grey seals, they are the only marine mammals that regularly enter the Sound, though a dolphin or whale may visit on rare occasions. The earless seals, which grow up to six feet in length and weigh up to 250 pounds, arrive here in the fall and leave in the spring for parts unknown, though many biologists believe they summer in the Gulf of Maine. Their numbers in the Sound are increasing (317 have been observed in one afternoon), and they can often be seen sunning on rocky outcrops and islands, particularly near Fisher's Island. They congregate in small groups and dive for winter flounder and herring.



Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

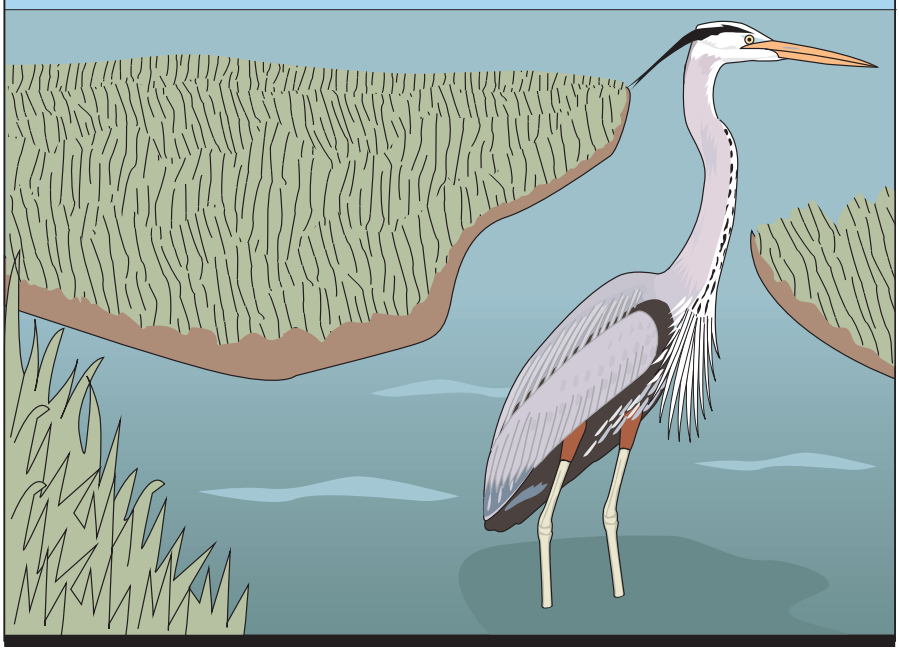
Yes, we have a few egrets.



Sound facts

Breeding grounds for the Sound

Tidal wetlands, or salt marshes, are fascinating grasslands between land and sea that form an important link to adjacent estuaries. Once thought to be worthless, tidal wetlands are now known to be among the most productive ecosystems in the world. Decaying marsh grass fragments that wash into Long Island Sound are an important part of the food web, supporting many species of fish, invertebrates and birds. Forty different species of birds, and most finfish, are nutured by marshes on the Sound. Besides providing food, shelter and breeding or nursery grounds for many species of wildlife, salt marshes also protect the land from flooding and erosion in stormy weather, and they filter pollutants from the water. Long Island Sound once had 50,000 acres of salt marsh; less than half remains today.



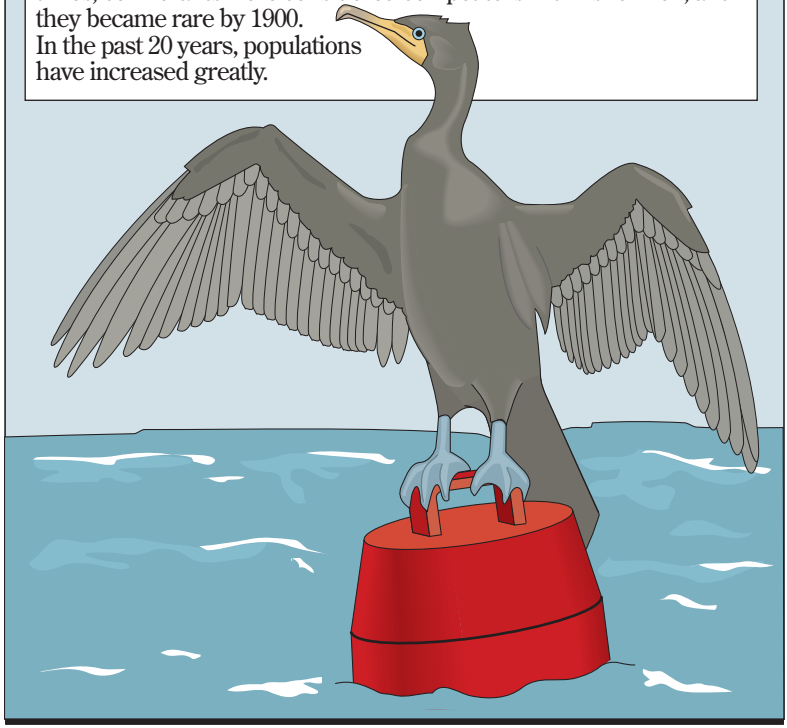
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Spreading their water wings

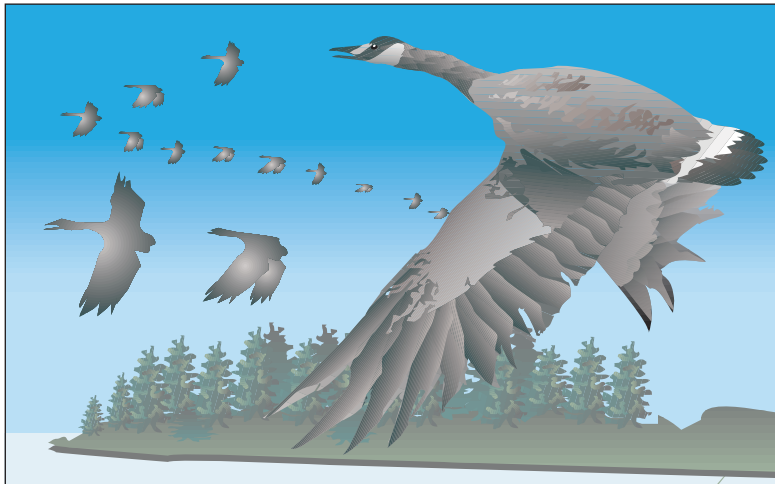
Double-crested cormorants, *Phalacrocorax auritus*, are a common sight around coastal waters, spreading their glossy black wings to dry in the sun. Because the oil glands in their wings are less efficient than in other seabirds, their feathers can become waterlogged during swimming and need to dry out for flight. These seabirds have large wingspans, long necks and webbed feet, nature's streamlined body plan that makes cormorants master divers, swimmers and fish-catchers. Cormorants have two ways of swimming — bobbing on the surface like a cork or "flying" submerged with only the head showing. They often plunge to depths of 20 to 30 feet in their quest for eels and other favorite foods. Abundant in Connecticut in Colonial times, cormorants were considered competitors with fishermen, and they became rare by 1900.
In the past 20 years, populations have increased greatly.



Source: Peg Van Patten /Connecticut Sea Grant

Milton Moore/The Day

Sound facts



Honk if you're headed south

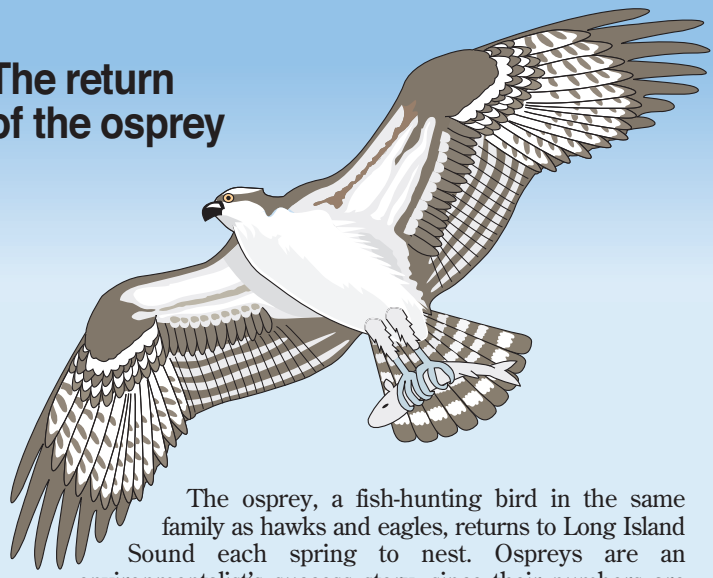
Hear that hoarse honking outside? The noisy V- or W-shaped formation flying overhead is a flock of Canada geese heading south for the winter at a rate of nine miles or more a day. Not all of these birds take the trip, however. Some stay year-round. The large long-necked geese are grey-brown with black heads and white cheeks. Those that inhabit the shores of Long Island Sound graze on marsh grass and reeds, algae, and eelgrass, but their aquatic diet may include worms, mollusks, crustaceans and small fish when vegetation is less abundant. Canada geese are believed to mate for life.

Source: Peg Van Patten/Connecticut Sea Grant Knight-Ridder & Milton Moore/The Day

It's for the Birds!

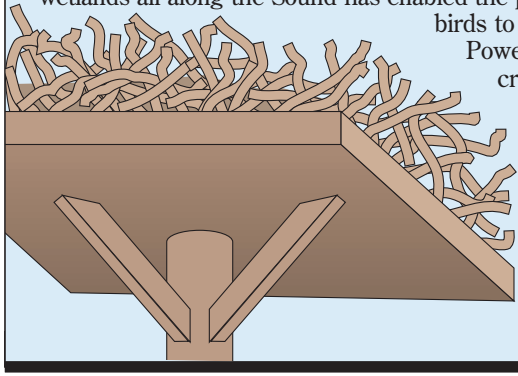
Sound facts

The return of the osprey



The osprey, a fish-hunting bird in the same family as hawks and eagles, returns to Long Island Sound each spring to nest. Ospreys are an environmentalist's success story, since their numbers are increasing after a population crash from the effects of the pesticide DDT and a loss of marsh habitat where they nest. The banning of DDT and the construction of the manmade nesting platforms that pop up from wetlands all along the Sound has enabled the population of these large birds to recover in recent years.

Powerful predators, osprey cruise over the water looking for fish, diving from heights of 50 to 150 feet to grab their prey near the water's surface.



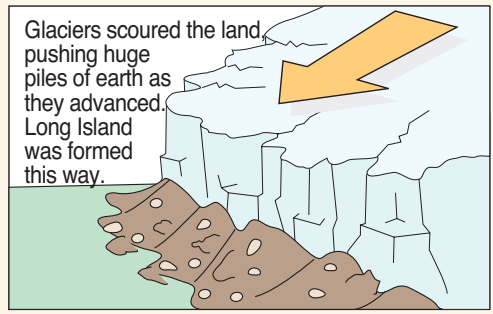
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

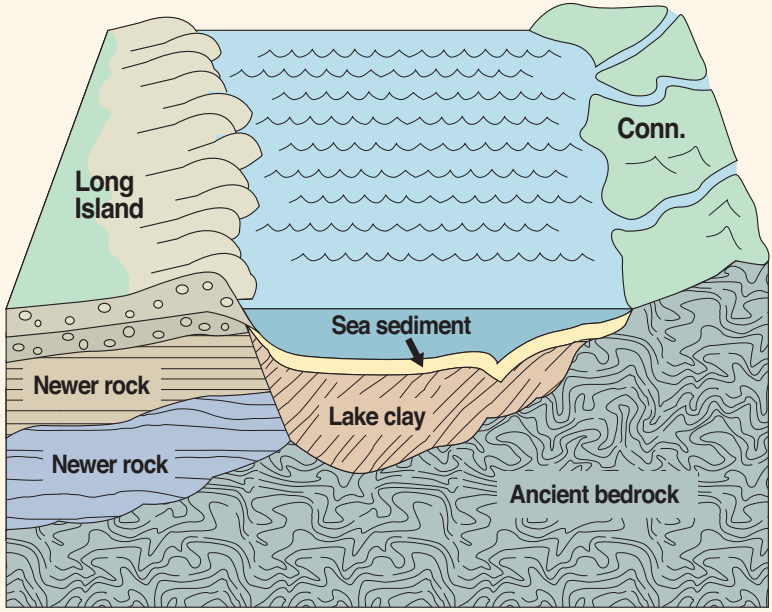
Rock Around the Sound

Sound facts

Beneath the Sound



Beneath the waters of Long Island Sound are clues to its past. Layers of sediment and rock tell us it was once a freshwater lake. When the last ice age ended 19,000 years ago, the great ice sheet left a pile of rocks and dirt at its southern end as it melted. This pile, called a morain, became what is now Long Island. The morain acted as a dam and trapped the melting glacier water to form a large lake. Lake deposits formed on its bottom over thousands of years, filling much of the basin in the bedrock with clay sediment. About 14,000 years ago, the sea level had risen enough for the sea to overflow in to the lake. Scientists can tell the difference between the thick clay sediment from the fresh water lake and thinner ocean sediments on top, and those sediments show the history of the Sound.



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

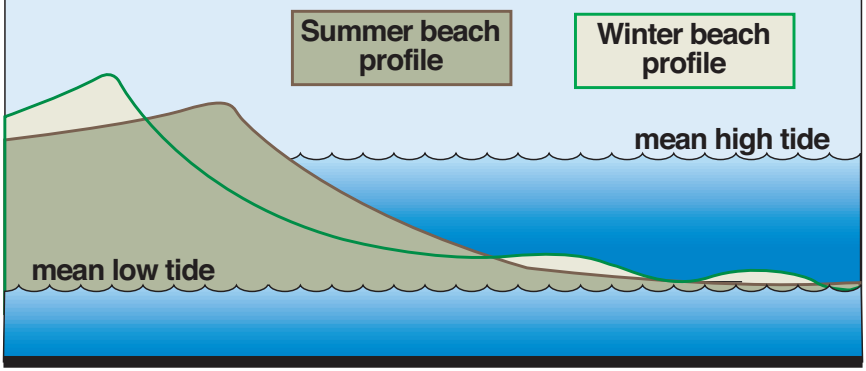
Beaches are on the move!

Beaches and sand spits are among the most dynamic habitats nature offers - a real challenge for the organisms that live there. A summer beach can be much different than a winter one, and a beach can change very dramatically after a storm.

Sound facts

Shifting sands

Like New England's weather, beaches also go through seasonal changes, so the one where you sunbathed last summer may look very different in winter. Winter storms with strong winds and waves and exaggerated tides rearrange the profile of a beach by gouging out tons of sand and transporting to sandbars off the beach. This seasonal transformation is more severe for beaches exposed to the open ocean, but beaches on the Sound are also affected. Some upper sandy beaches disappear altogether, exposing the underlying beach to further erosion. But as with most seasonal changes, there is rebirth in the spring, when smaller waves move sand back onto the beach in time for bathing suit weather.



Source: Peg Van Patten & Ken Sherwood/Conn. Sea Grant

Milton Moore/The Day

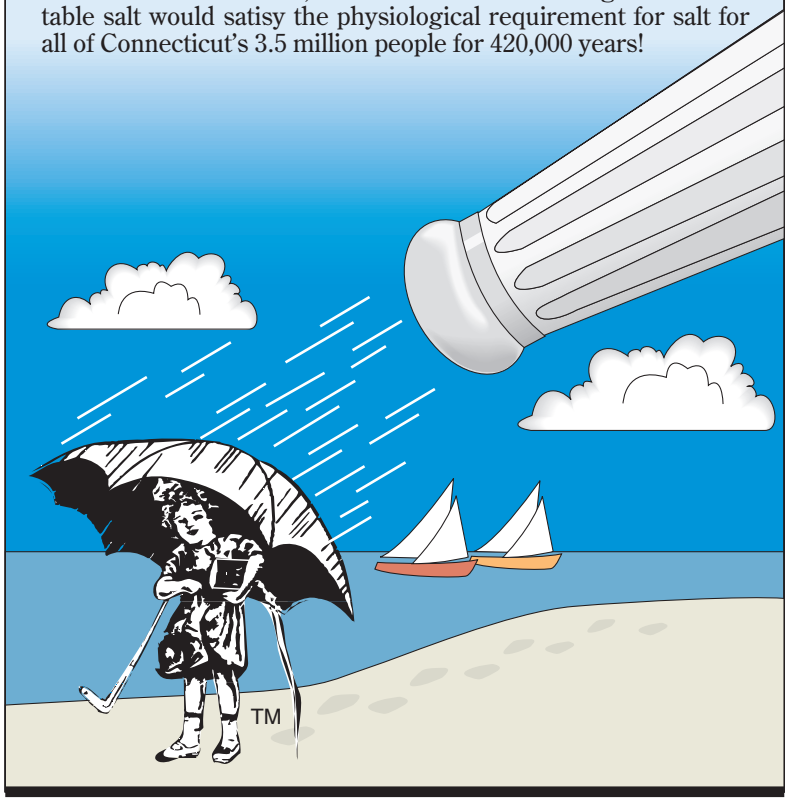
Let's Get Physical!

Physical oceanographers study currents, tides, waves, and physical properties such as temperature, light, and salinity. These physical characteristics determine how things move in the water, and which organisms can live there.

Sound facts

Salt to taste

Dissolved in the 67 billion tons of water in Long Island Sound are almost 2 billion tons of sea salt, which gives the waters of the Sound a saltiness — or salinity — of 28 parts per thousand on average. Included among the components of this sea salt are 1.5 billion tons of table salt, sodium chloride. This huge amount of table salt would satisy the physiological requirement for salt for all of Connecticut's 3.5 million people for 420,000 years!

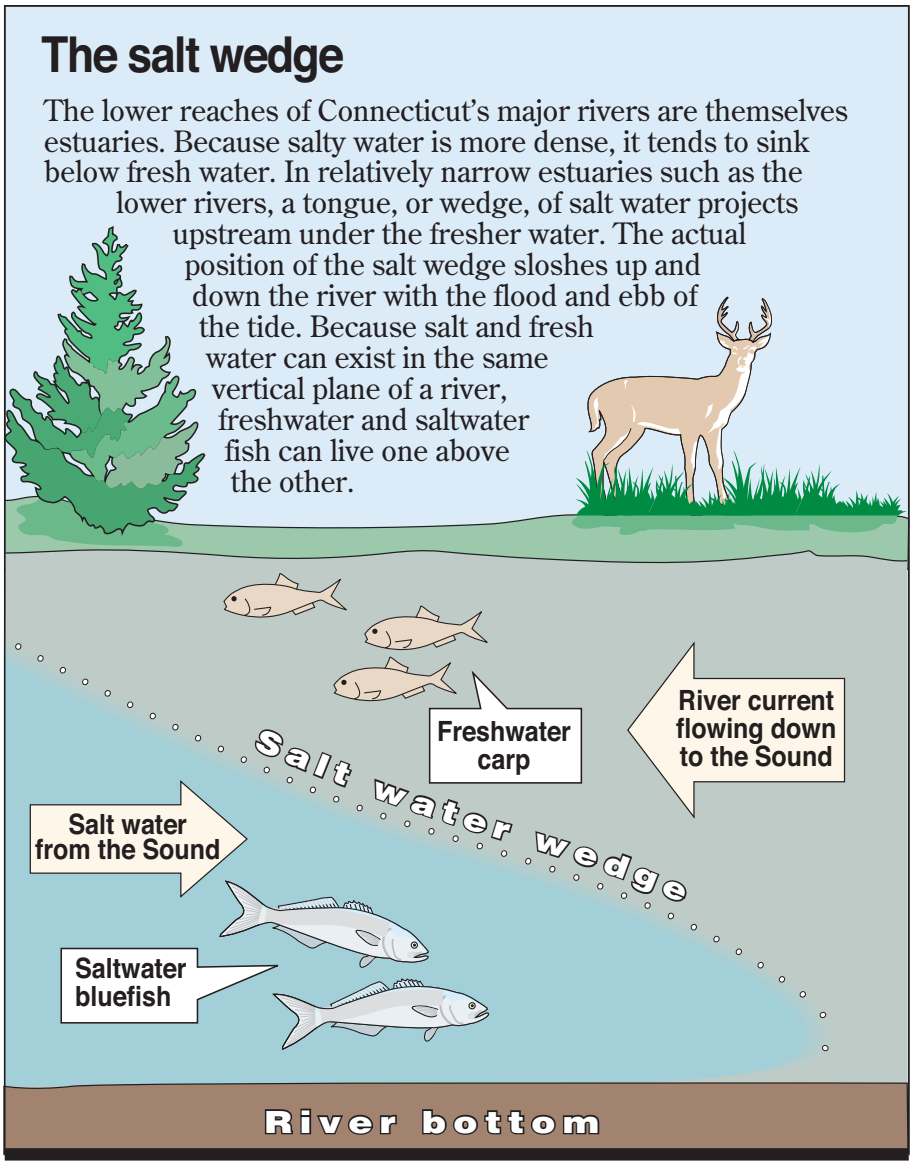


Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Sound facts

The salt wedge

The lower reaches of Connecticut's major rivers are themselves estuaries. Because salty water is more dense, it tends to sink below fresh water. In relatively narrow estuaries such as the lower rivers, a tongue, or wedge, of salt water projects upstream under the fresher water. The actual position of the salt wedge sloshes up and down the river with the flood and ebb of the tide. Because salt and fresh water can exist in the same vertical plane of a river, freshwater and saltwater fish can live one above the other.

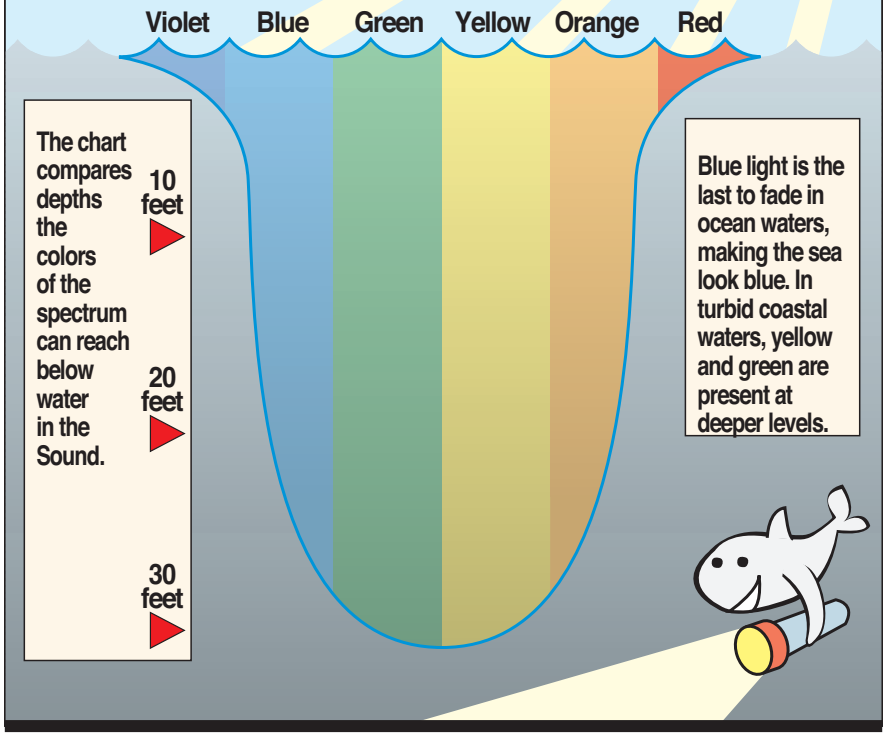


Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Sound facts

Let the sun shine in

The region of the ocean in which aquatic plants and phytoplankton have sufficient light to live is called "the euphotic zone." The bottom of this zone, the lowest level where plants and plankton can live, gets just 1 percent of the light that strikes the ocean's surface. Because of the teeming life and great variety of dissolved materials in Long Island Sound, the bottom of the euphotic zone here is often less than 30 feet below the surface, compared to more than 200 feet in the Sargasso Sea and other crystal-clear parts of the ocean.

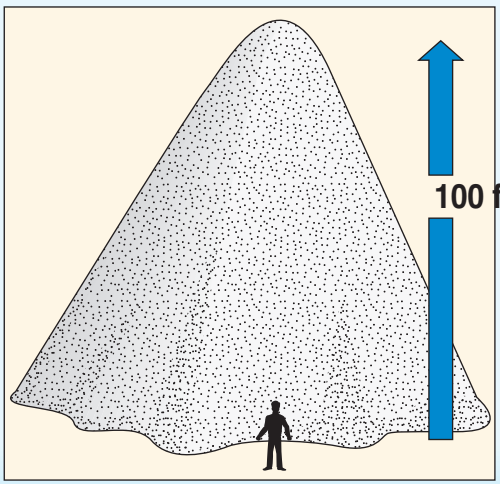


Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Sound facts

That salt air …

Rolling whitecaps are a familiar sight to boaters on Long Island Sound. When the wind blows and causes waves to break, bursting bubbles shoot tiny "jet drops" of water into the air. The moisture of the atmosphere is increased in this way.



The drops contain salt, organic debris and any pollutants that may be on the water surface. These salty droplets give the invigorating tang to the sea air, but they als speed up the rusting of cars an machinery near the shore.

The amount of salt that is shot into the air each year fron Long Island Sound is about 33,000 tons. This much salt would form a pyramid nearly 100 feet tall.

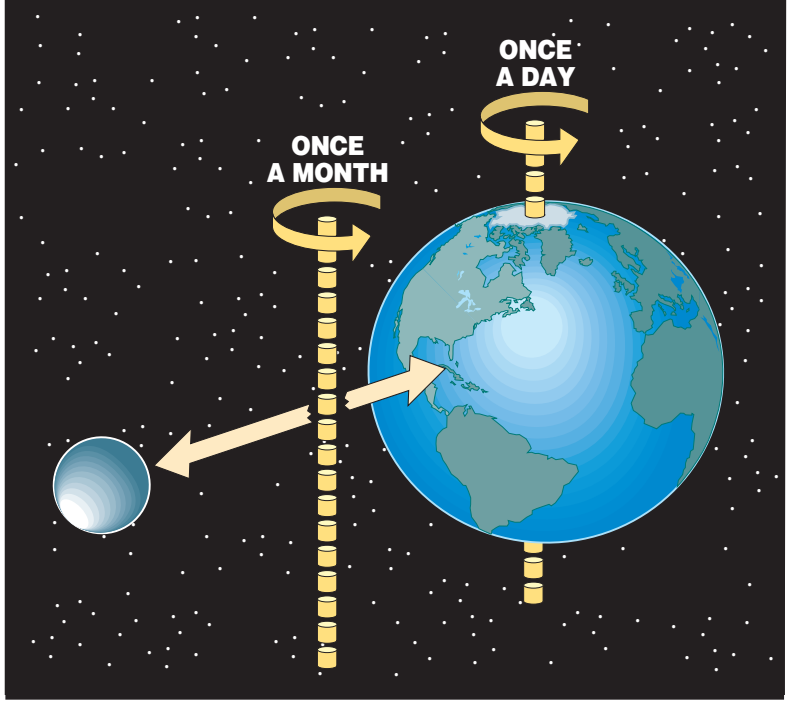
Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Not exactly twice a day

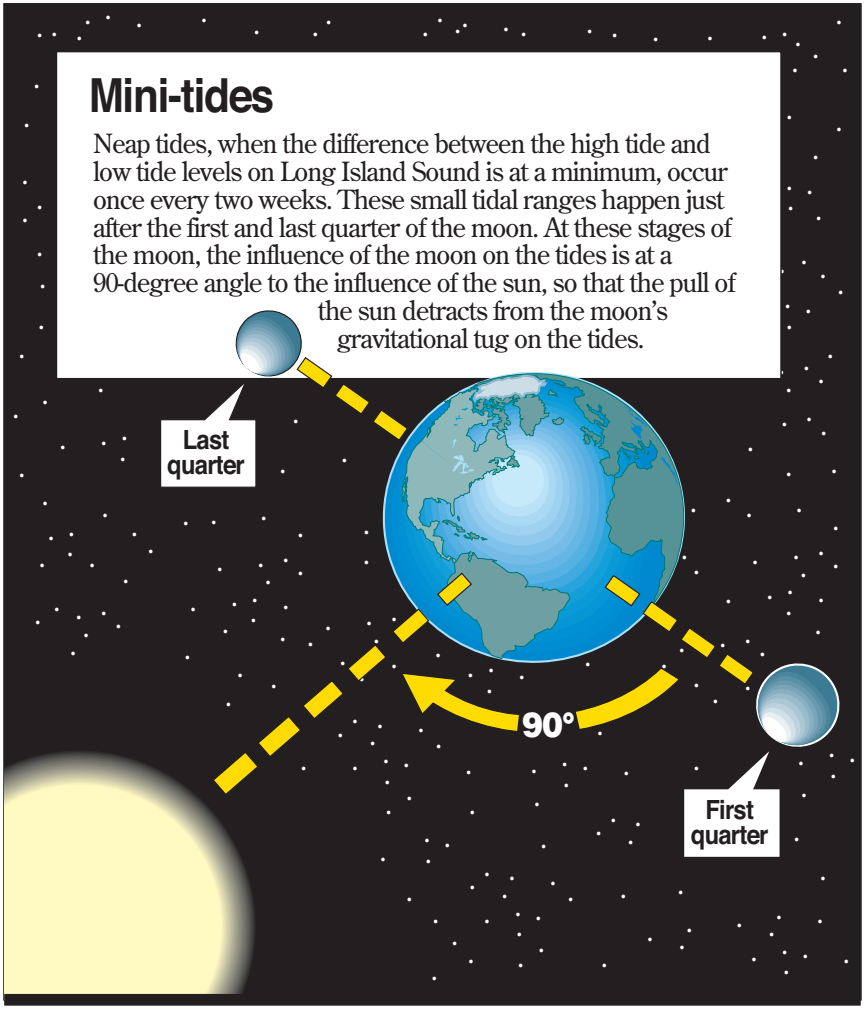
Along the coasts of New England, we have one high tide following another about every 12 hours and 25 minutes. The waters of Long Island Sound oscillate through two complete cycles of high and low tides every 24 hours and 50 minutes. Tides are caused by the gravitational influence of the moon, Earth, and sun on the seas. We get two high tides a day instead of one because the moon does not actually revolve once a month around the Earth, but rather the moon and Earth rotate monthly around their common center of mass, or balance point. Because the moon is smaller than the Earth, it has a much longer path to travel around this point. The reason it takes almost 25 hours for two full tidal cycles instead of just one day is that by the time the Earth revolves once around its axis (24 hours), the moon has traveled some distance in the same direction, moving the tidal bulge on Earth forward.



Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant

Milton Moore/The Day

Sound facts



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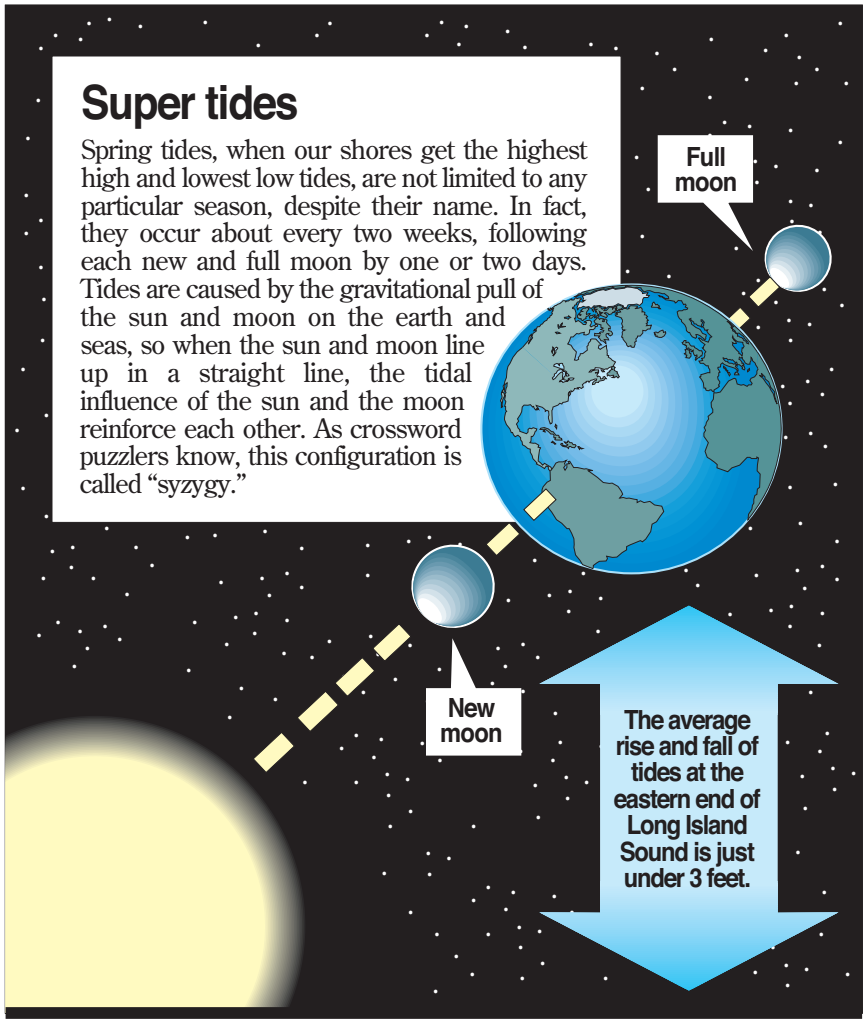
Milton Moore/The Day

Sound facts



Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Rolling home

A person living at the eastern end of Long Island Sound, where the shore is exposed to the Atlantic Ocean, might be listening to a radio description of a storm well out to sea — and at the same time, hear the boom of long, rolling waves breaking against the shore. These long waves, known as "swell," fan out rapidly and give advance warning of the storm that spawned them. Although the warning should be heeded, the impending blow may or may not ever make it to shore.

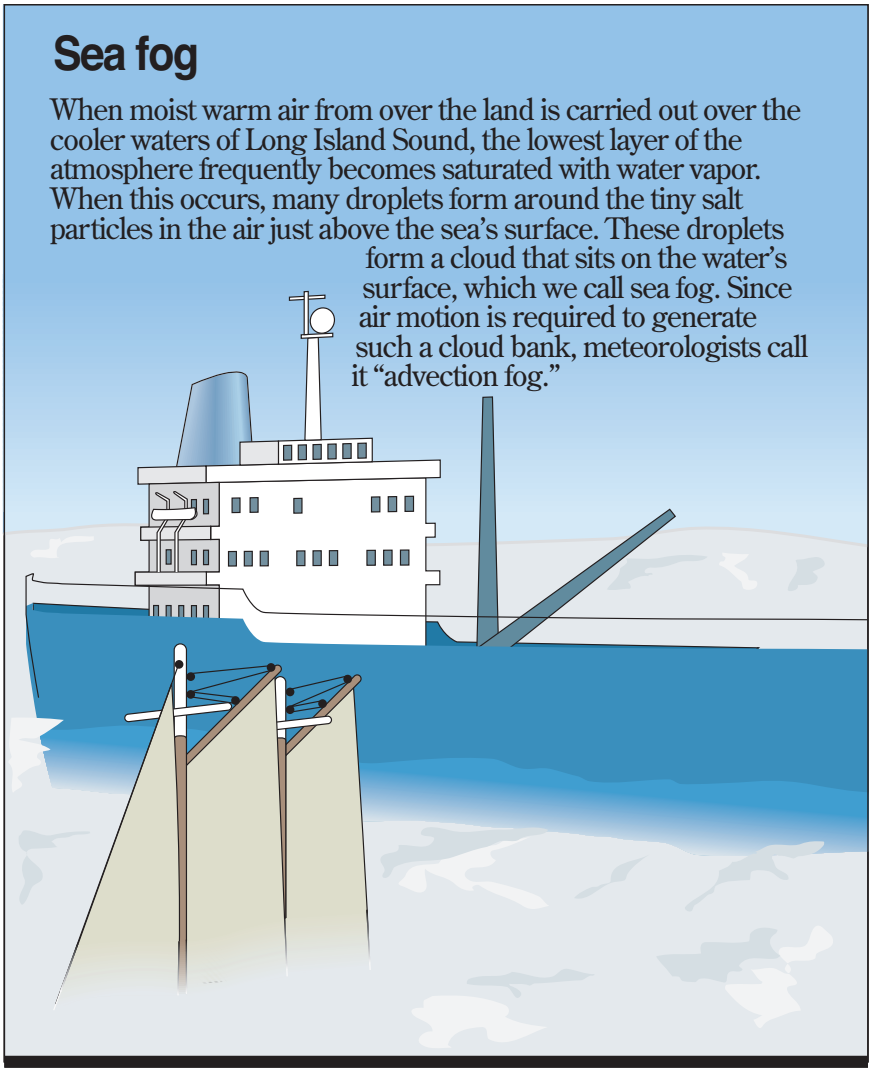
Source: E. O'Muin and P. Van Patten, Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Sea fog

When moist warm air from over the land is carried out over the cooler waters of Long Island Sound, the lowest layer of the atmosphere frequently becomes saturated with water vapor. When this occurs, many droplets form around the tiny salt particles in the air just above the sea's surface. These droplets form a cloud that sits on the water's surface, which we call sea fog. Since air motion is required to generate such a cloud bank, meteorologists call it "advection fog."

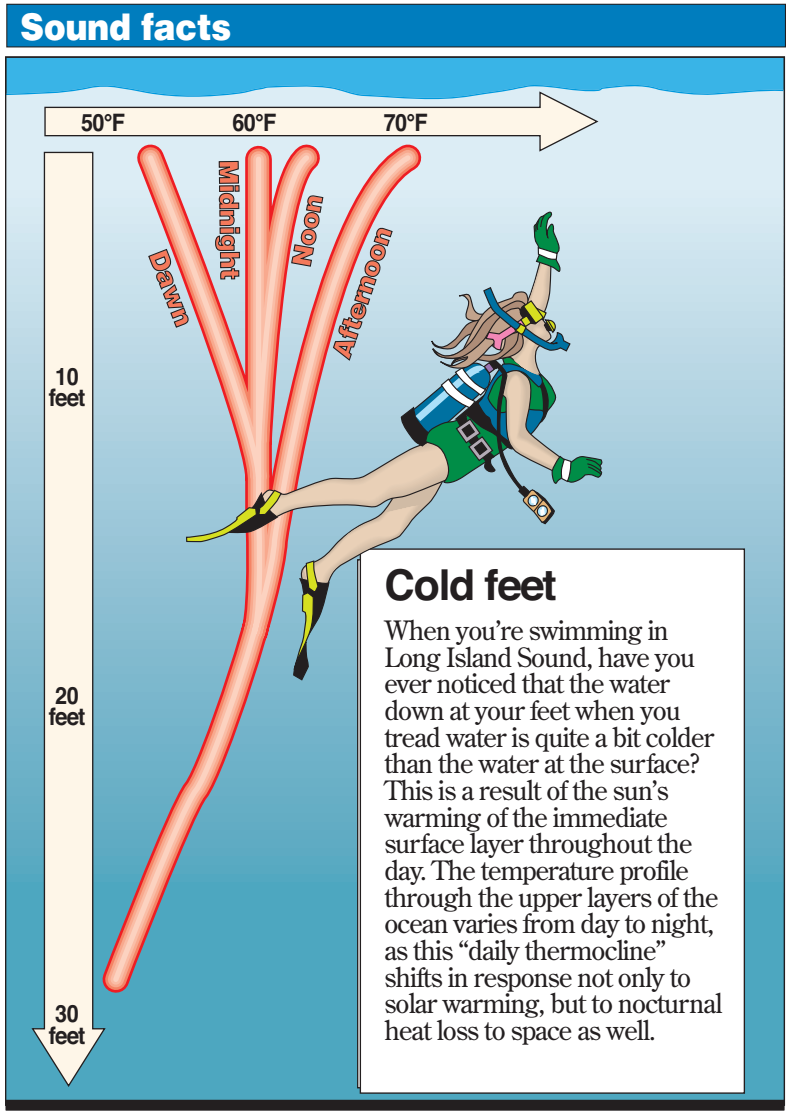


Source: Eamon O'Muin and Peg Van Patten/Conn. Sea Grant

Milton Moore/The Day

Sound facts

Source: Eamon O'Muin and Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

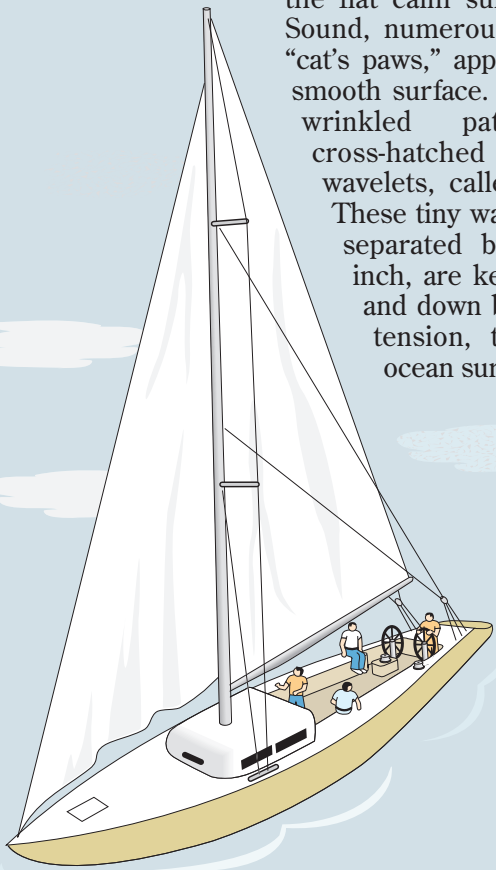


Source: Peg Van Patten & Eamon O'Muin/Conn. Sea Grant Milton Moore/The Day

Sound facts

Cat's paws

When a gust of wind first blows over the flat calm surface of Long Island Sound, numerous ruffled patches, or "cat's paws," appear on the otherwise smooth surface. A close look at these wrinkled patches reveals a cross-hatched pattern of short wavelets, called "capillary waves." These tiny waves, with crests often separated by less than half an inch, are kept from wriggling up and down by the water's surface tension, the elasticity of the ocean surface.



Source: Eamon O'Muin & Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

Sound facts

Source: Eamon O'Muin & Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

React to the Sound

Chemical oceanographers study the components of seawater and the chemical reactions that occur in the ocean and its sediments.

There's a lot more than salt in the briny "soup" of the Sound! Seawater contains many elements, though most are present in very small amounts. The proportion of the elements of seawater in relation to the others remains constant, so you can figure how much is in the water if you know its volume and salinity. See page 68.

Sound facts

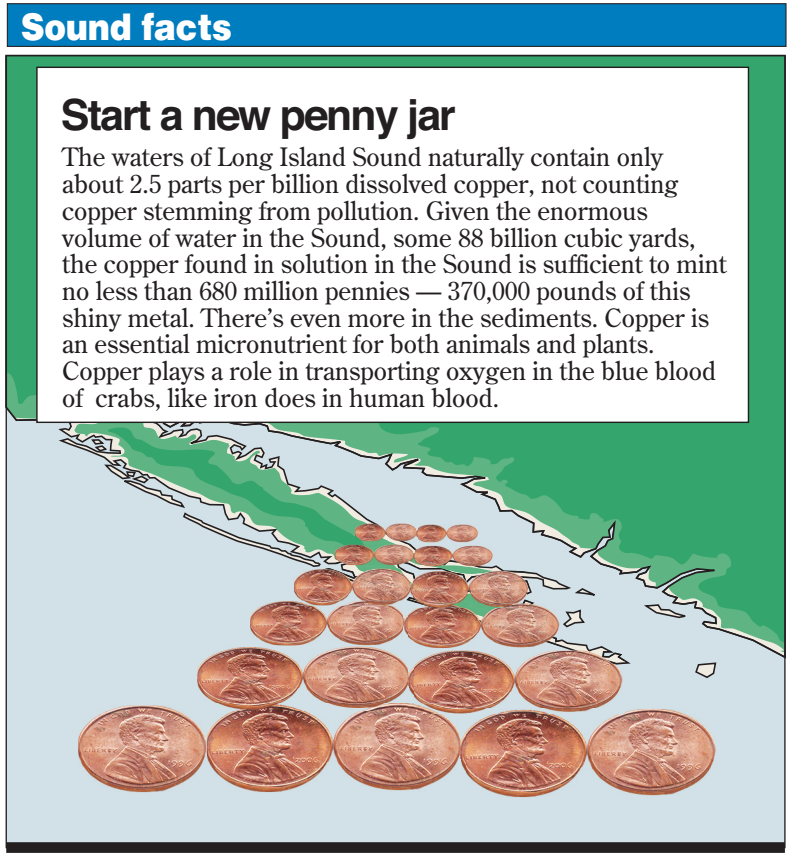
There's gold in them thar waves

In addition to salt, the sea water in Long Island Sound contains small amounts of many trace elements, including metals such as gold. While the gold in sea water accounts for only 3 parts per trillion by weight, the volume of the Sound is quite large. If all of the gold could be extracted it would add up to more than 440 pounds, worth well over $2 million dollars. A warning to prospective prospectors – the gold is so widely dispersed in such small quantities, you'd probably go broke collecting it.

Source: Peg Van Patten, Eamon O'Muin /Connecticut Sea Grant Milton Moore/The Day

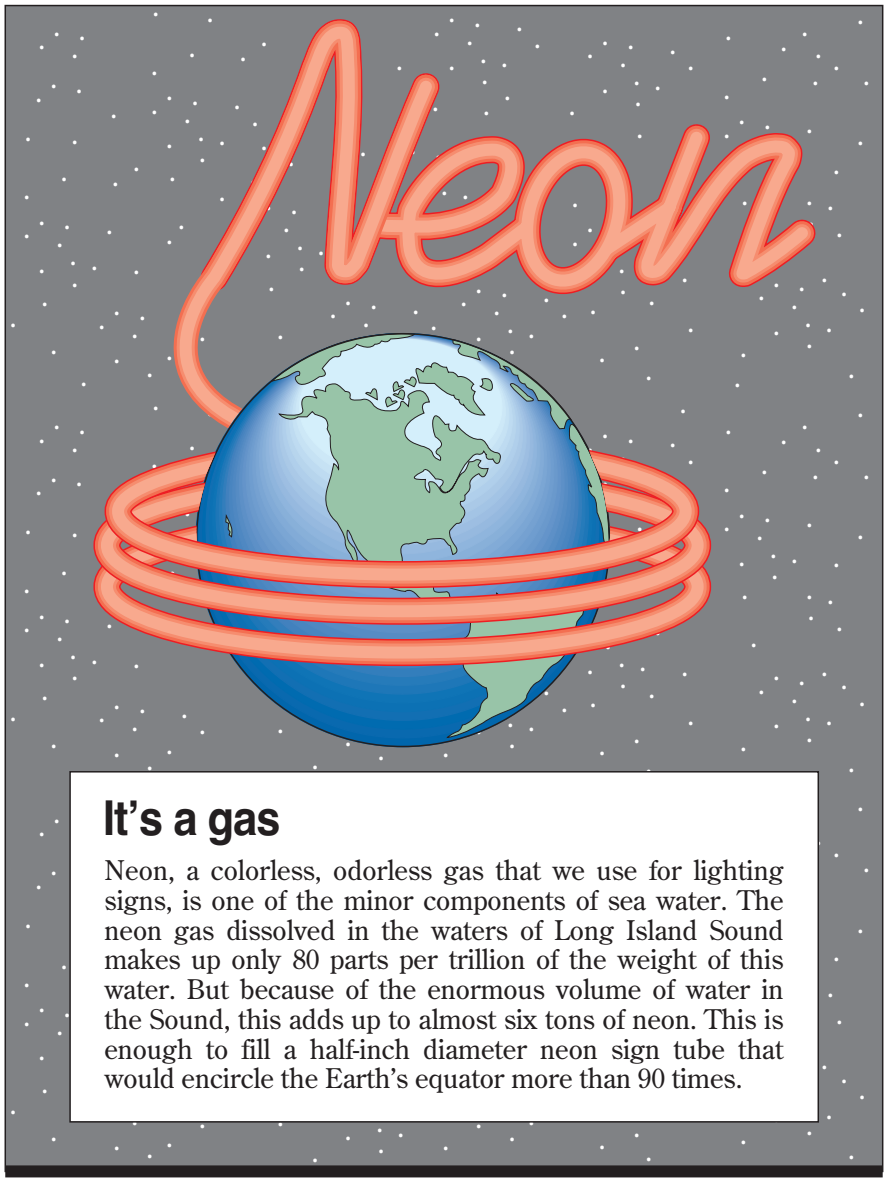
A penny for your thoughts?

Copper is one of many trace elements found in the Sound's water, sediments, and bodies of living plants and animals.



Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Sound facts

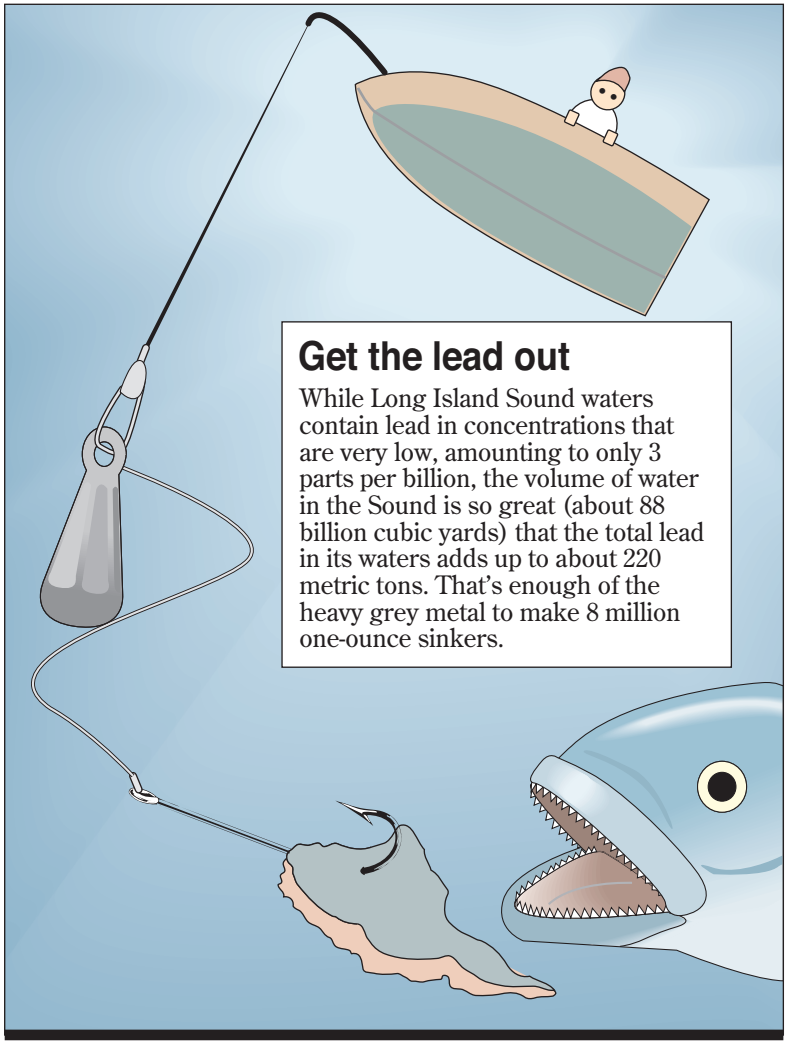


It's a gas

Neon, a colorless, odorless gas that we use for lighting signs, is one of the minor components of sea water. The neon gas dissolved in the waters of Long Island Sound makes up only 80 parts per trillion of the weight of this water. But because of the enormous volume of water in the Sound, this adds up to almost six tons of neon. This is enough to fill a half-inch diameter neon sign tube that would encircle the Earth's equator more than 90 times.

Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

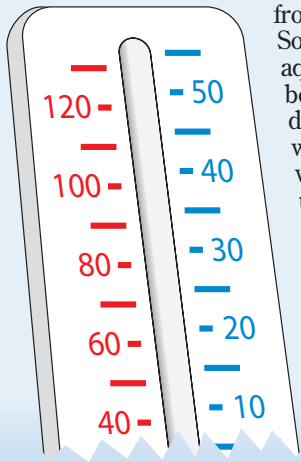
Sound facts



Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

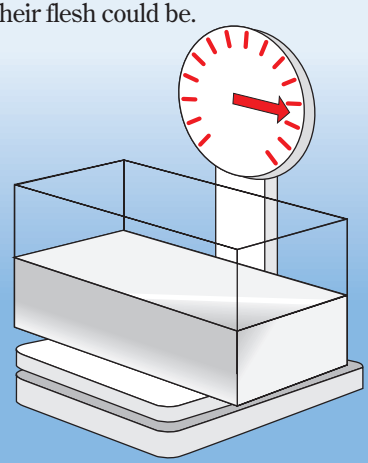
Sound facts

Quicksilver



The amount of mercury, or "quicksilver," in the waters of Long Island Sound adds up to only one or two parts per trillion. If all of this silvery liquid metal could be extracted from the 67 billion tons of water in the Sound, it would barely half-fill a five-gallon aquarium. This aquarium would need to be very sturdy, because mercury is so dense that the 1.4-2.7 gallons of the metal would weigh 150-300 pounds. It's just as well there is such a small amount of this useful metal in the Sound, as it is very dangerous to marine life as well as humans. Swallowing Sound water is not particularly dangerous to humans, but eating a steady diet of large fish that concentrate one form of mercury in their flesh could be.

Today, people are more likely to see mercury in daily use in thermostats, electronic devices, smoke detectors, or scientific instruments than in a thermometer, unless it's a very old one.



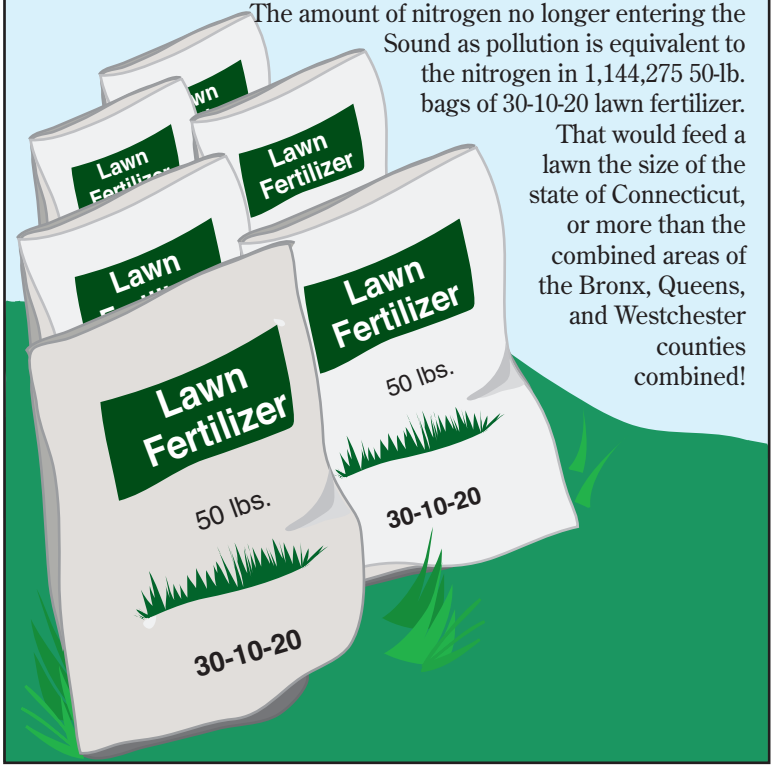
Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Ecology and Environmental Concerns

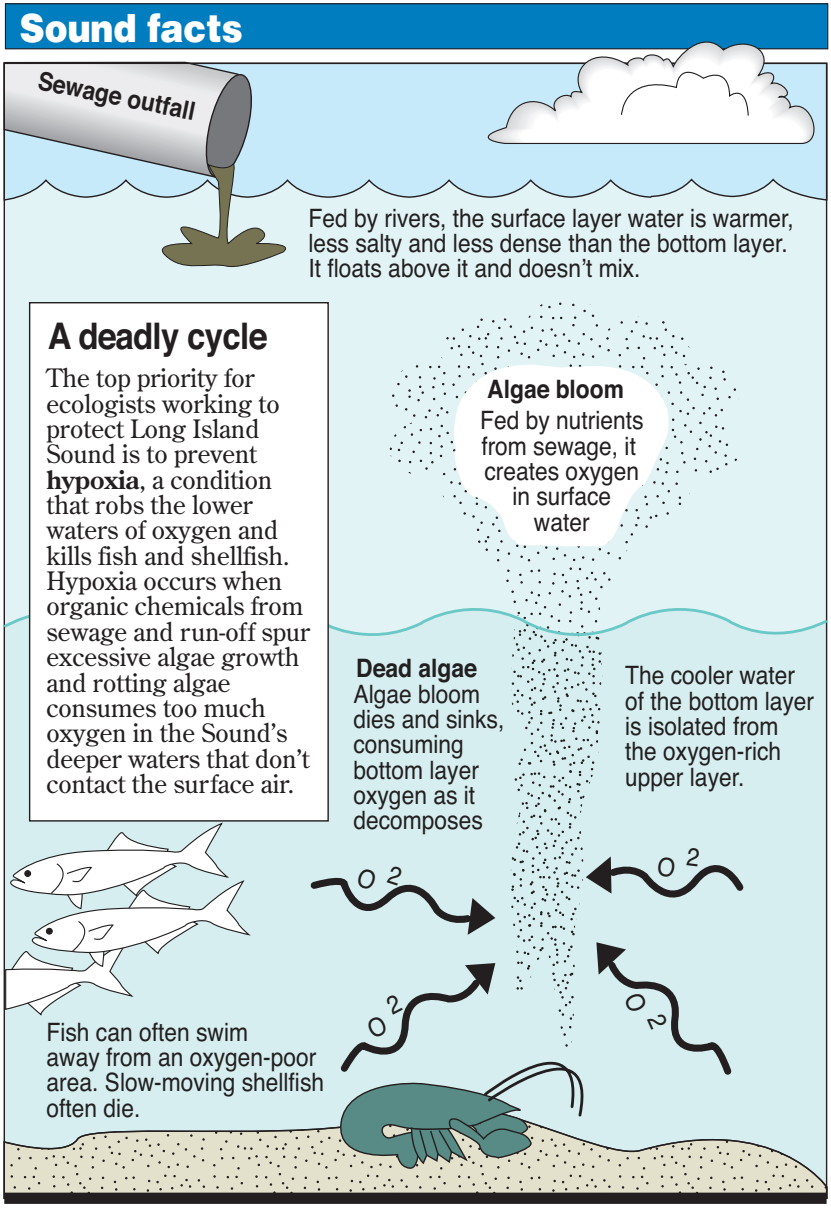
Sound Facts

"Hey! Where's the Nitrogen?"

Since 1990, Connecticut and New York have reduced the amounts of nitrogen discharged into Long Island Sound by a whopping 47,000 pounds per day. That's 17,155,000 pounds per year, or 8,578 tons. We can't see nitrogen, an invisible gas, but we can visualize it as a component of the visible compounds and solutions it forms when it combines with other elements. The amount of nitrogen no longer entering the Sound as pollution is equivalent to the nitrogen in 1,144,275 50-lb. bags of 30-10-20 lawn fertilizer. That would feed a lawn the size of the state of Connecticut, or more than the combined areas of the Bronx, Queens, and Westchester counties combined!



Source: Mark Parker/DEP and Peg Van Patten/Connecticut Sea Grant Judy White



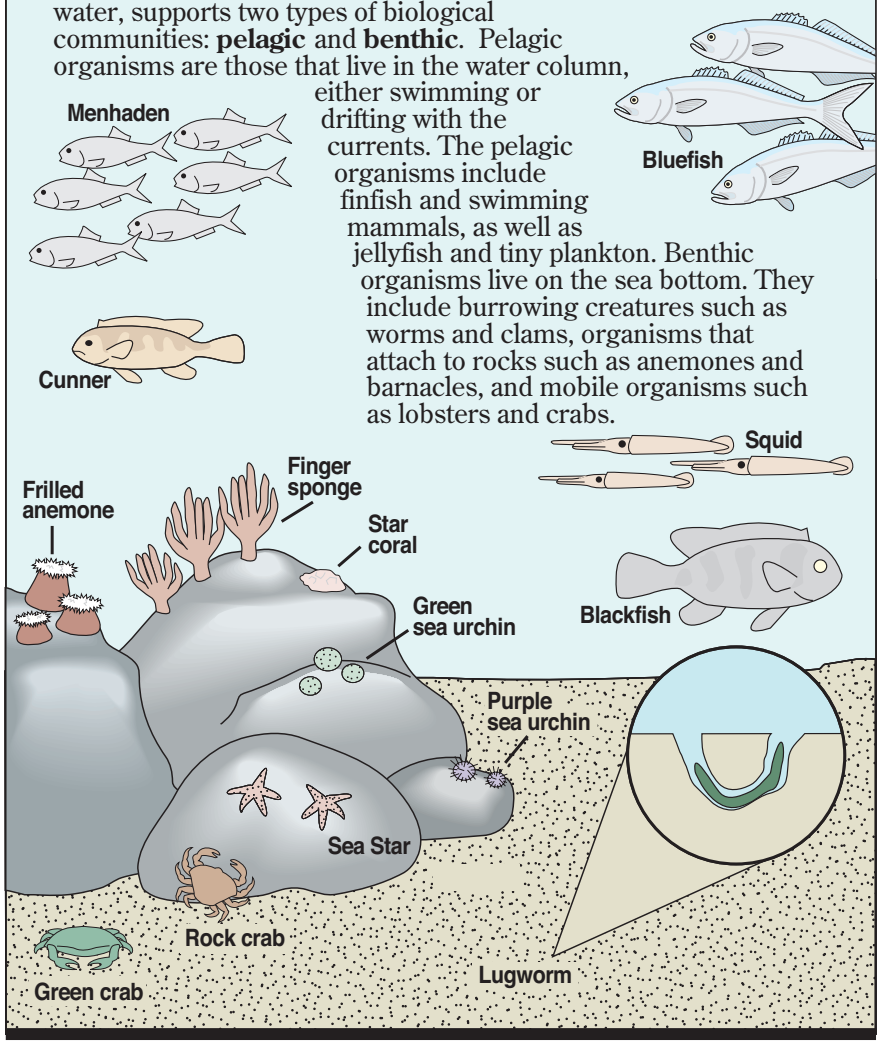
Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts

Upstairs, downstairs

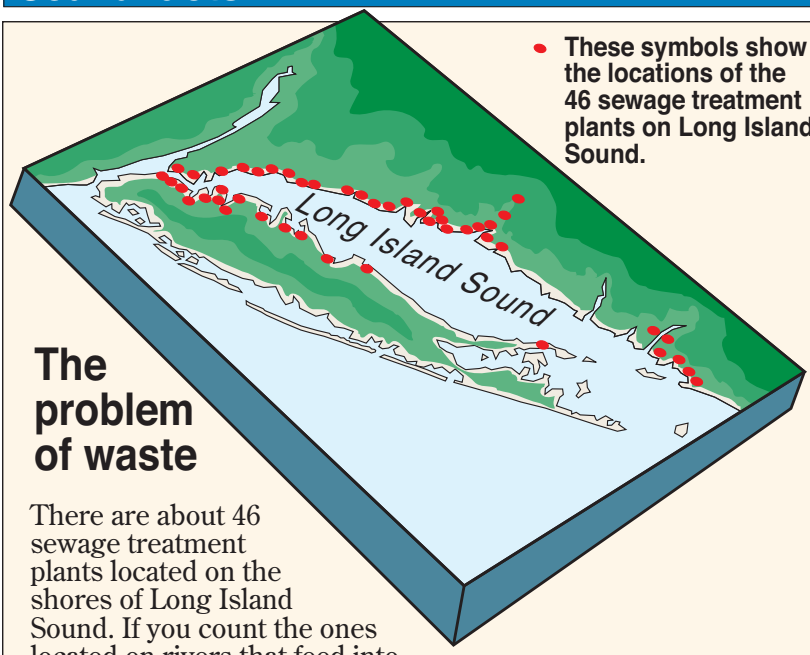
The area of the Sound below the intertidal zone, where marine life is always submerged under water, supports two types of biological communities: **pelagic** and **benthic**. Pelagic organisms are those that live in the water column, either swimming or drifting with the currents. The pelagic organisms include finfish and swimming mammals, as well as jellyfish and tiny plankton. Benthic organisms live on the sea bottom. They include burrowing creatures such as worms and clams, organisms that attach to rocks such as anemones and barnacles, and mobile organisms such as lobsters and crabs.



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

Sound facts



The problem of waste

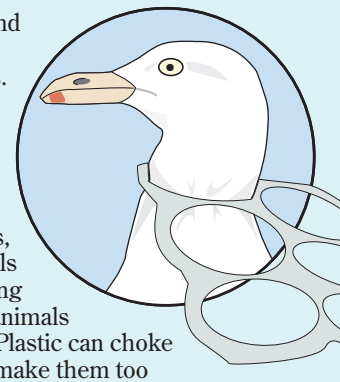
There are about 46 sewage treatment plants located on the shores of Long Island Sound. If you count the ones located on rivers that feed into the Sound, there are 104. About 43% of these now have advanced treatment to remove nutrients. (How many is that?) The combined wastewater that enters the Sound every day from these facilities adds up to more than a billion gallons. To hold a billion gallons, you would need a container as long and wide as a football field and twice as tall as the Empire State Building. Wastewater is full of nutrients that upset the balance of life in the Sound. If everyone cut down on water use around the home, they would help solve this problem.

Source: Peg van Patten/Sea Grant

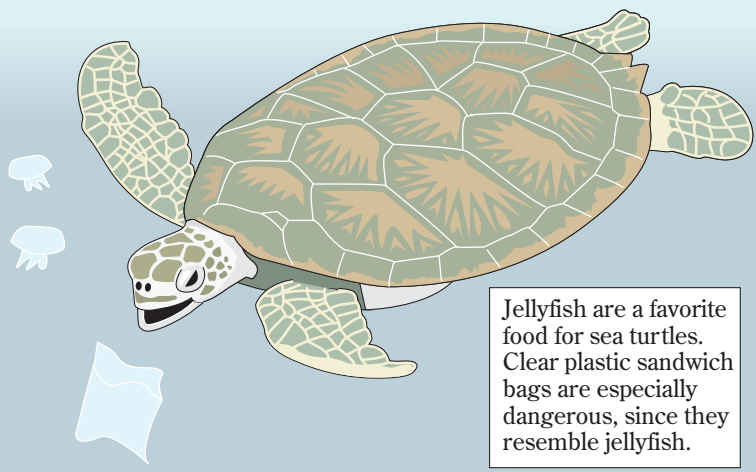
Milton Moore/The Day

Sound facts

Plastics are forever



On the Connecticut shore of Long Island Sound in 2008, 7.5 tons of debris were picked up by beach cleanup volunteers. Plastic is especially dangerous to sea animals, and it can last 400 years before it breaks down. Six-pack holders cause the death of an estimated 6 million seabirds and 100,000 marine mammals such as seals, dolphins and whales *every year*. Animals get tangled in pieces of discarded fishing line or nets and choke or drown. Sea animals often eat plastic, mistaking it for food. Plastic can choke them, clog their digestive systems, or make them too buoyant so they can no longer dive for food and slowly starve.



Jellyfish are a favorite food for sea turtles. Clear plastic sandwich bags are especially dangerous, since they resemble jellyfish.

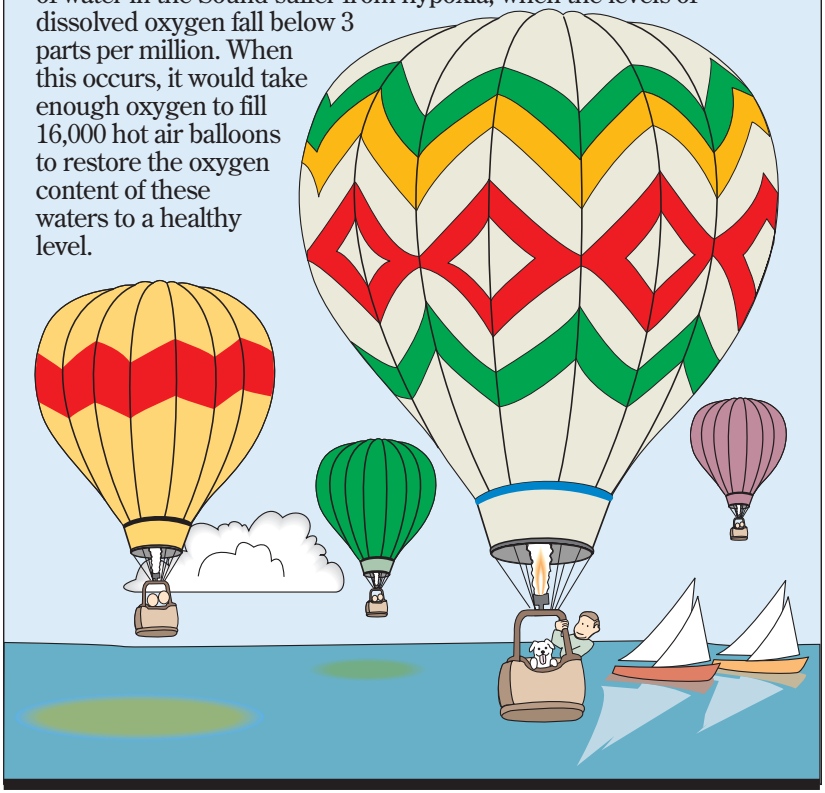
Source: Peg Van Patten, Conn. Sea Grant

Milton Moore/The Day

Sound facts

Hypoxia

Late each summer, much of the water in Long Island Sound is trapped beneath a 'pycnocline,' the layer that divides lighter surface waters from the denser deep waters. Because it doesn't mix with surface waters, this bottom water may have insufficient oxygen for fish, lobsters and other animals to live. In some years, 8 billion tons of water in the Sound suffer from hypoxia, when the levels of dissolved oxygen fall below 3 parts per million. When this occurs, it would take enough oxygen to fill 16,000 hot air balloons to restore the oxygen content of these waters to a healthy level.

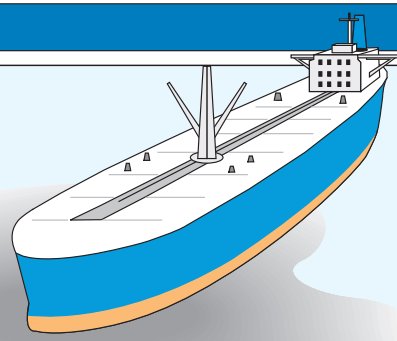


Source: P.eg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

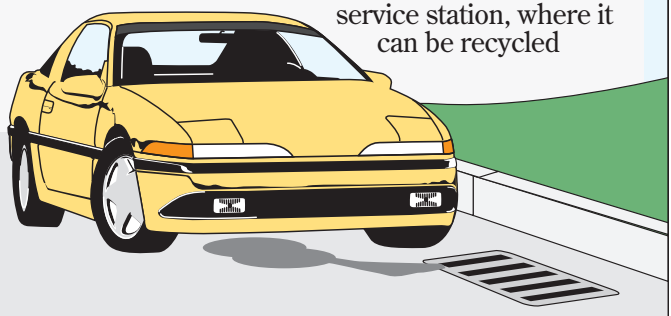
A can of motor oil might not seem very important, or very threatening–but it is! It all adds up.

Sound facts

Oil and water — and cars



Oil spills from tankers and barges get the headlines, but more oil pollutes Long Island Sound each year from street run-off. Oil leaking from cars that runs into storm drains is the main cause. Just a quarter teaspoon of oil will make a film over 2,000 square feet of water surface. One quart of motor oil can contaminate 250,000 gallons of water — more water than 30 people will drink in their lifetimes. The oil from one car engine, about 4 to 6 quarts, can produce an 8-acre slick. Be sure to take used motor oil to a service station, where it can be recycled



Source: Peg Van Patten/Connecticut Sea Grant

Milton Moore/The Day

A "carbon footprint" is a name for the impact an individual, activity, or facility leaves on the environment. Many natural processes, as well as industrial ones, emit carbon dioxide. The ocean helps us out!

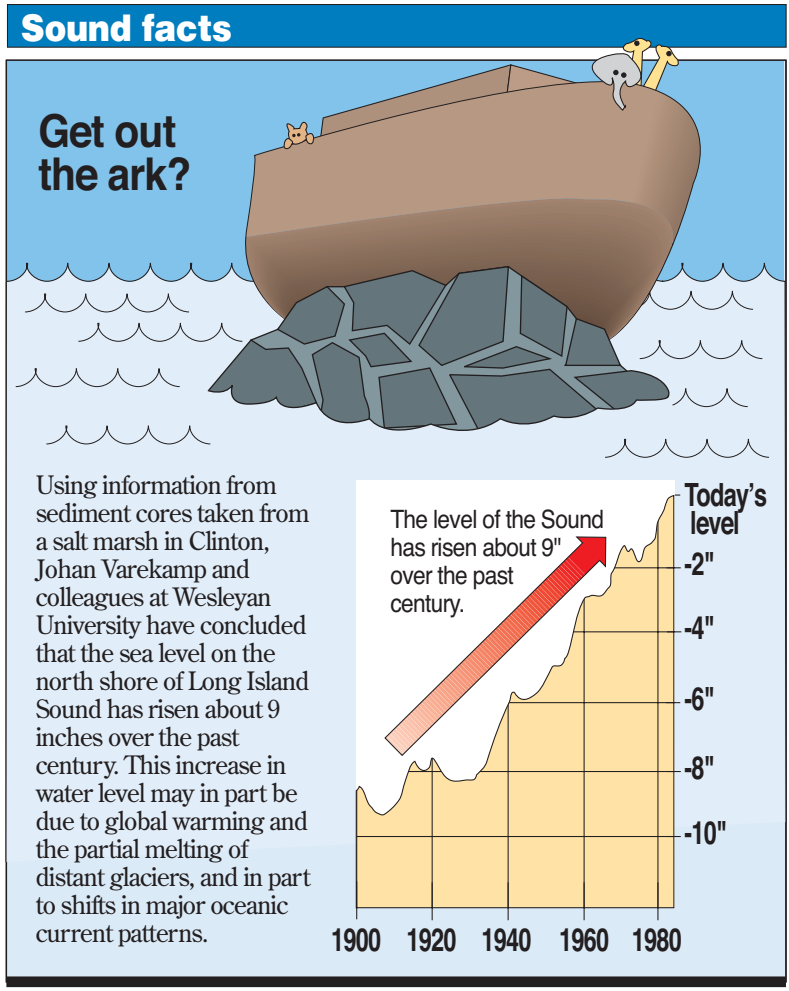
Sound facts

The carbon dioxide 'sponge'

Long Island Sound, along with the rest of the world's oceans and seas, plays an important role in slowing the global warming expected to occur as the amount of carbon dioxide in the atmosphere increases. Without major water bodies to act like sponges to soak up carbon dioxide, the annual carbon dioxide build-up in the atmosphere from burning fossil fuels would increase by 50 percent. Each time a wave breaks, the temporary whitecap and its plume of spray act as a vent, allowing the transfer of carbon dioxide from the air to the waters of the Sound that absorb it.

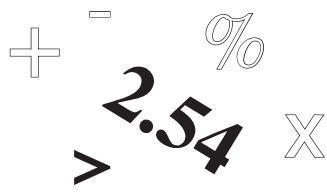
Source: Eamon O'Muin & Peg Van Patten/Connecticut Sea Grant Milton Moore/The Day

How High's the Water?



Source: Peg Van Patten & Eamon O'Muin/Connecticut Sea Grant Milton Moore/The Day

Go Figure: The Arithmetic Behind the Numbers



by Eamon O'Muin

Where did we come up with the figure that there are "more than 440 pounds" (i.e., 200 kilograms) of gold in the waters of Long Island Sound, a statement that appears in the "There's Gold in Them Thar Waves" Sound fact?

Well, first we needed an estimate of the volume occupied by the Sound's waters. We came up with this required estimate by doing a "back-of-the -envelope" calculation. We started with the assumption that the Sound could be approximated by a thin rectangular box, some 100 miles long by 13 miles (on average) wide by 60 feet tall (or deep!). It's easy to calculate the volume of a rectangular solid, as all you need do is multiply the length times the width times the height. When we converted each of these dimensions to their metric equivalent and carried out the multiplications, we found that the approximate volume of Long Island Sound was 67 billion cubic meters (6.7×10^{10} m^3). (Some folks will have recourse to tables or fancy calculators to give them the number of meters in a mile and the numbers of meters in a foot, but we simply remember that there are 2.54 cm (0.0254 m) in an inch, 12 inches in a foot, and 5,280 feet in a mile, and get on with our calculations.)

Now, from our oceanographic reference books, we determined that in standard sea water of salinity 35 ‰ (parts per thousand), gold is present in a concentration of roughly four-millionths of a milligram per kilogram of sea water, i.e. 4×10^{-6} mg/kg or 4×10^{-12} kg/kg. But the waters of Long Island Sound have been diluted by fresh water from the Connecticut River and run-off from the land in general and has as a result a lower salinity than is typical for open ocean sea water, and we had to take this into account. We took 28 ‰ as our estimate of the salinity for our Sound waters, and thus concluded that the gold concentration in the Sound's waters would only be about 80% (28 ‰ / 35 ‰ = 0.8) of its concentration in the open ocean, i.e. about 3×10^{-12} kg/kg.

Thus, we had reached the stage where we could estimate the total gold in Long Island Sound, if we knew the mass ("weight") of its water. What remaining information did we need to know, in order to calculate the mass of Sound water that occupied a volume of $6.7 \times 10^{10} m^3$? We needed to know the density of coastal sea water of salinity approximately 28 ‰ and a temperature of 10ºC or 20ºC, and this density turns out to be 1.025×10^3 kg/m^3 (i.e., 1.025 grams per cubic centimeter). It's useful to remember that the mass of freshwater occupying a volume of one cubic centimeter is, by definition, one gram, and that the mass of freshwater that occupies one cubic meter is a "metric ton", i.e., 1,000 kg. The mass of water in the Sound is simply its density (1.025×10^3 kg/m^3) times its volume ($6.7 \times 10^{10} m^3$), which comes out to be about 6.9×10^{13} kg.

Given that the concentration of gold in the waters of the Sound was about 3×10^{-12} kg/kg of water, we had only to multiply this number by the mass of Sound water (6.9×10^{13} kg) to arrive, finally, at the figure of 2.1×10^2 kg for the total "weight" of the gold in these waters. This is more than 200 kg, and since there are 2.2 pounds in one kg, our final conclusion was phrased "more than 440 pounds".

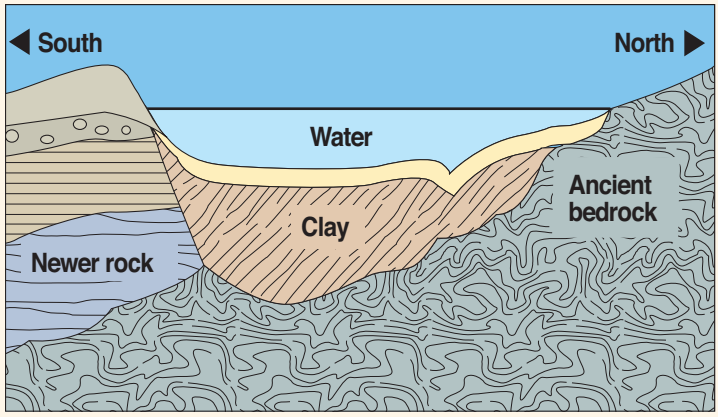
We further concluded that if all that gold could all be extracted from the Sound, it would be enough to cast some 6,300 "double eagles," the old U.S. $20 gold pieces, which would surely have filled a treasure chest to overflowing! How did we arrive at this conclusion? First, we phoned a numismatist (coin dealer) in Hartford, Connecticut, who looked up the weight of a "double eagle" and found it to be 33.5 grams (0.0335 kilograms). Then we divided this number into 210 kg, and, assuming that these coins were pure 24 K gold, arrived at a figure of 6,269 coins. Since it would be inappropriate to express our results with more than two significant figures, considering all the approximations used, we come up with about 6,300 coins.

Try it yourself! We also figured the amount of neon, copper, lead, and mercury in the Sound. Try to calculate these just as we did the gold, and see if you agree. Or try something we didn't do, such as silver.

Putting it in Perspective

Drawing the Sound on paper is one way of putting our region's most valuable estuary into perspective. Another way is to think about our relationship to the Sound, remembering that people are very much a part of it. To find out how our everyday actions can impact the Sound, and how you can help out, contact one of the organizations listed on the back inside cover of this booklet.

Sound facts



A matter of perspective

As public interest in issues concerning Long Island Sound grows, publications often use depictions of vertical sections, or slices, through the Sound. Based on data prepared by state geologist Ralph Lewis, this idealized north-south section gives a sense of how shallow the Sound is, compared to its width. But this illustration, as in all such drawings, has expanded its vertical scale – by a factor of 100-to-one in this case. If this were redrawn with no exaggeration, the entire depth of the water in the Sound would lie within the thickness of the black line used to depict its surface. It should be clear why two masses of water trying to get past each other in the Sound usually pass side-by-side, instead of over and above each other.

Source: P. Van Patten & E. O'Muin/Connecticut Sea Grant — Milton Moore/The Day

See for Yourself

We couldn't show you all the wonders of Long Island Sound in this small booklet, but we suspect that your interest in this exciting estuary is awakened. The next step is to get out on the Sound's shores, by foot or by boat, and sample it for yourself.

How about an old-fashioned scavenger hunt? Try to find as many creatures shown in *Sound facts* as you can, and list the others that we missed. But remember, it's their home. So don't disturb them, and collect only on paper or camera film. A good environmental rule for the shore is "leave only footprints," and if you go underwater, "leave only bubbles."

There are other ways to discover more about the Sound, too—even on a rainy day. Long Island Sound has a fascinating maritime history, and some very interesting lighthouses. Visit aquaria, museums, historical exhibits, nature centers, seaports, and your library to learn more. Keep a journal to record your discoveries.

The Long Island Sound Study

The Long Island Sound Study (LISS) is a partnership involving federal, state, interstate, and local agencies, universities, environmental groups, industry, and the public in a program to protect and restore the health of Long Island Sound. The LISS began in 1985 under the sponsorship of the U.S. Environmental Protection Agency (EPA) and the states of New York and Connecticut. At the request of the states of Connecticut and New York, EPA designated Long Island Sound an estuary of National Significance in 1988 and convened a management conference. In 1994, the LISS Management Conference issued a Comprehensive Conservation and Management Plan (CCMP) to improve the health of Long Island Sound, while ensuring compatible human uses. Subsequently, the Governors of New York and Connecticut and the EPA signed a Long Island Sound Agreement, reaffirming their commitment to the restoration effort. *Visit http://www.longislandsoundstudy.net.*

Acknowledgments

This booklet benefits greatly from the artwork by Milton Moore, who was the arts editor at *The Day* newspaper in New London, Connecticut, when the original *Sound Facts* were done. The project has been a joint collaboration between the newspaper and the Connecticut Sea Grant College Program. *Sound Facts* are reproduced here as a public outreach project of the Environmental Protection Agency's Long Island Sound Study, funded by the Study and Connecticut Sea Grant.

The authors offer thanks to the many people and agencies that contributed information and enthusiasm to Sound Facts, including the teachers who prodded us to compile the Sound facts into a booklet. We are grateful to Ralph Lewis and the Long Island Sound Resource Center for contributions on the geology of Long Island Sound, the Connecticut Department of Environmental Protection and New York Department of Environmental Management for their input, and Lance Johnson, former managing editor of *The Day*, for his enthusiastic support. Watershed facts and others were provided by the Long Island Sound Study

Any opinions, findings, mistakes, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the sponsoring agencies.

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We hope you've enjoyed *Sound Facts!*