

# A Lobster's Life

## The early years



**Newly Hatched Larva**

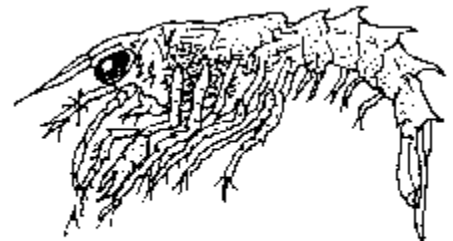
When first hatched, a lobster doesn't look at all like an adult lobster (which may be why lobstermen call it a "bug").



**Stage I**  
8 mm



**Stage II**  
9 mm

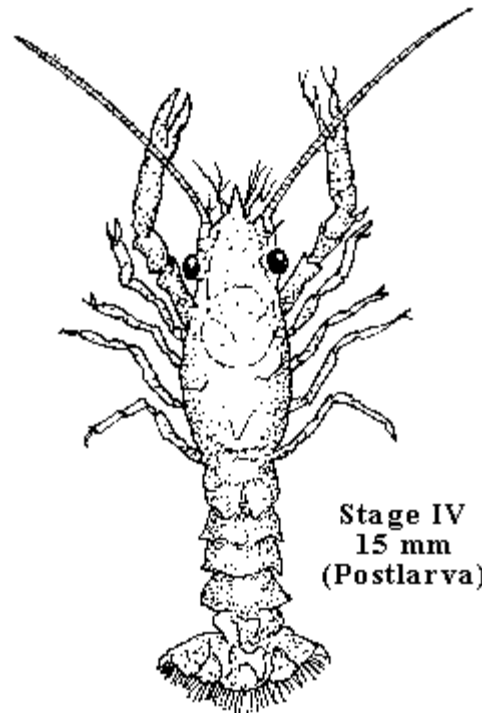


**Stage III**  
11 mm

Feathery hairs on its legs help it swim in the water for the first month or so after hatching. Here it is prey for seabirds and for any larger animals in the sea, which is most of them. Most lobster larva are found within the top meter of the sea's surface. Here the lobster will molt, or shed its shell, three times before it begins to look like a miniature adult.

By that time, as a "fourth-stage" lobster, it is between 15 days and a month old. At this stage, the lobster is a very good swimmer, although it appears to be helplessly bobbing up and down in the water column. Actually, it is beginning to purposefully look for a place on the bottom of the ocean on which to settle. This stage may last for many weeks, as the post larva move up and down the water column. The lobster may settle in a variety of habitats, such as salt marsh peat on Cape Cod, but the preference seems to be for a hard bottom with lots of hiding places, such as cobble. This is where the most dense settlements are found. Of 10,000 eggs that a female may release, only 1/10 of 1%--maybe 10--will survive beyond the first four weeks of life.

After the lobster settles to the bottom, it molts to the fifth stage. At this point, a small lobster still has many enemies. It spends the first year or so in a small tunnel which it can excavate, or in a natural crevice beneath cobble or other hard bottom material. Cod, sculpin, eelpout, sea robins, skates, and other lobsters will attack it if it leaves its shelter. During the first year, the lobster captures small prey which are carried in water which the lobster pumps through its living space using its abdominal pleopods (small appendages called swimmerets under the flexible abdomen, which



**Stage IV**  
15 mm  
(Postlarva)

is commonly called the "tail.") The tiny lobster spends the next few years, until almost age four, hiding under seaweed and small rocks, catching food that drifts down to it. At this size it may also stalk and eat little shrimp-like creatures, amphipods and isopods, called "sand fleas," even though they may be twice its size.

A small lobster rarely ventures out of hiding. If it does it is attacked by a fish within minutes. One experiment in which baby lobsters were tethered with fine thread to the ocean floor and monitored by video suggested that new settlers could expect to be attacked within minutes if they did not find shelter. However, they outgrow that vulnerability with small increments in body size. Even as an adult, the lobster will avoid predators by remaining primarily nocturnal.

## Home is where the hiding place is

Research has found that lobsters have definite opinions as to the type of ocean bottom they prefer. Given the option of settling down on mud, sand, gravel, or cobble (small stones), they all gravitated to the cobble bottom where they could hide from predators in the spaces between the rocks and still catch falling food. "Adolescent" lobsters (a few years old to market size) prefer areas with larger boulders. Adult lobsters don't seem to care--they'll go anywhere and sometimes migrate long distances. They also have fewer predators.

## Molting

The lobster molts, or sheds its shell, up to 25 times in its first 5 years of life. As an adult, it molts about once a year, until it becomes quite large, at which point it may go several years between molts. Molting is hard work. In advance of molting, the flesh inside the claws shrivels to about a quarter of normal size, as water and blood leave the appendages. The lobster's shell weakens, as the flesh reabsorbs some of the calcium that will help harden the new shell. Some of that calcium is stored in a structure called a gastrolith (stomach stone) deposited on the outside of the foregut. The old shell cracks along the joint that separates the carapace (the back shell) and the tail and along a line down the middle of its back. The lobster lies on its side and flexes its body several times to pull itself from the cracked shell. Even though the claw muscles have shrunk, they sometimes get stuck in the narrow knuckle of the claw during molting, and the lobster must throw the claw and abandon both the shell and flesh. The remaining old shell is a perfect double of the lobster, down to the claws, legs, mouth parts, and even the covering of the eyeballs. The lobster eats its old shell to help harden the new one more quickly. While the new shell is still soft, the lobster absorbs sea water to gain about 15% in size and 40-50% in weight. A just-molted lobster feels like a rubber toy. If it is lifted from the support of the water, its heavy front claws may drop right off. It stays in hiding for a week or two until the new shell is fortified against predators.

Much of the weight of a "shedder," or newly-molted lobster, is water, as disappointed diners who crack open a soft-shell lobster quickly learn. That allows the new shell to accommodate the growing lobster for a year or more. Most of us can remember our parents using a similar concept when they bought us clothes several sizes too big to give us some "growing room."

Many factors control when a lobster will molt: water temperature, food supply, salinity (the amount of salt in the seawater varies from place to place and from season to season), availability of shelter, the type of bottom, and the depth of water. Lobsters living in warm water grow faster than those in cold water. Experiments have shown that lobsters raised in hatcheries with water at 70 degrees Fahrenheit can grow to one pound in less than two years, while in the frigid waters of the north Atlantic, it takes a lobster 5 to 7 years to reach this market size, known as a "chicken lobster." Males grow faster than females, and females may go two years between molts when they are breeding. Female tails (abdomen) grow relatively larger than males' tails, but male claws grow larger than females'. In the largest lobsters, claws make up as much as 45% of the total body weight.

## Diet

While the lobster has been called a scavenger, it actually prefers fresh food, though a whiff of lobster bait might belie that fact. Its diet typically consists of crabs, clams, mussels, worms, and an occasional sea urchin or slow-witted flounder. A lobster may eat up to 100 different kinds of animals, and occasionally eats some plants as well. One large lobster in an aquarium was seen gnawing on the tail of a skate while the fish tried vainly to flutter away. A lobster has been observed catching a crab, dragging it back to its home, and burying it like a dog buries a bone. For the next few nights the lobster snacks on the crab instead of going hunting.

An opportunist, a lobster will also eat another lobster if given the chance. Captive lobsters become especially can-

nibalistic, which is why they must be banded in a lobster pound or separated in individual compartments in a lobster hatchery. However, cannibalism has not been observed in the wild. Because lobsters eat their molts, it is dangerous to make this inference based on gut content analysis!

## **Predators**

Many animals, especially humans, eat lobsters. After humans, cod are probably the lobster's principal enemy, followed by other bottom dwelling fishes, such as flounder, sculpins, wolffish, eels, rock gunnels, crabs, and seals. Even raccoons have been known to raid coastal lobster pounds at low tide.

## **A Lobster's Neighbors**

After their first month or so of life, lobsters settle down on the ocean floor and become bottom dwellers. They co-exist with other bottom-dwelling life in the Gulf of Maine such as algae, sea urchins, crabs, mussels, and sculpin. Crevices in rocks, cobble bottoms, and kelp provide good hiding places for lobsters which like to hunker down during the day.

Not long ago, hordes of sea urchins had created vast open stretches of ocean floor-urchin barrens-where they had devoured kelp beds. As a result of being harvested for their roe, as uni for the Japanese market, sea urchin populations have decreased, and fields of kelp have once again flourished. Some scientists believe the resulting proliferation of hiding places for young lobsters has helped the lobster population grow. Others think the decline in cod and flounder due to over harvesting has also helped the lobster population increase.

## **Lobsters don't make good neighbors**

Aside from the fact that a lobster will eat almost any of its neighbors given the opportunity, an American lobster is not by nature a convivial beast. It is aggressive, territorial, and secretive. It hides in a burrow by day and prowls the ocean floor by night. It may cover a mile or more each night foraging for up to 100 different kinds of animals (and some plants). It may sneak into its neighbor's burrow when it's not around, and sometimes even if it is!

Lobsters living together, whether in tanks or in territories on the ocean bottom, soon establish a hierarchy of dominance. They usually fight once, sometimes with great ferocity, to determine who will become the boss. The winner, not surprisingly, is usually the larger and more aggressive one, but occasionally a smaller but tougher opponent wins. After that, whenever the two lobsters meet, the winner whips his antennae across the other lobster's claws. The loser grovels in the sand until the dominant one passes by. In captivity, subordinate lobsters often suffer slower growth and less frequent molting. It could be the result of stress or less food. The dominant lobster gets first choice of shelter, food, and mates. In captivity, the female lobsters actually stagger their molts in order to wait their turn to mate with the dominant male!

Dr. Robert Steneck of the University of Maine has videotaped lobster behavior in many bays in Maine. "It's amazing how much more you can learn when a lobster doesn't know it's being watched," he says. "They're very sensitive to human presence." He has even used Remotely-Operated Vessels (ROVs), unmanned minisubs, to follow deep-dwelling lobsters.

In one experiment, Dr. Steneck used PVC pipes for lobster shelters. He grouped them close together in a tight formation he called "lobster condos." He left a camera running to see how the lobsters would deal with living in close proximity. Several lobsters took up residence in individual "condos." Before long, Dr. Steneck observed a large male evicting smaller lobsters from their tubes. He would back into the tube, raise his claws, and more often than not, abandon the shelter after establishing his superiority.

Lobsters are known as cannibals, but they don't usually eat each other unless they are in crowded conditions like a lobster pound, or if they find a particularly vulnerable lobster just after molting that is unable to get to a shelter before its new shell hardens.

## **Courtship and mating**

For more than twenty years, Dr. Jelle Atema of the Marine Biological Laboratory has been studying lobster mating behavior. He claims lobsters make tender lovers. A female lobster can mate only just after she sheds her shell. Lobster society has evolved a complex, touching

courtship ritual that protects the female when she is most vulnerable. When she is ready to molt, the female lobster approaches a male's den and wafts a sex "perfume" called a pheromone in his direction. Unlike a female moth, whose sex pheromone may attract dozens of random suitors, the female lobster does the choosing. She usually seeks out the largest male in the neighborhood and stands outside his den, releasing her scent in a stream of urine from openings just below her antennae. He responds by fanning the water with his swimmerets, permeating his apartment with her perfume. He emerges from his den with his claws raised aggressively. She responds with a brief boxing match or by turning away. Either attitude seems to work to curb the male's aggression. The female raises her claws and places them on his head to let him know she is ready to mate. They enter the den, and some time after, from a few hours to several days later, the female molts. At this point the male could mate with her or eat her, but he invariably does the noble thing. He gently turns her limp body over onto her back with his walking legs and his mouth parts, being careful not to tear her soft flesh. They mate "with a poignant gentleness that is almost human," observes Dr. Atema. The male, who remains hard-shelled, inserts his first pair of swimmerets, which are rigid and grooved, and passes his sperm into a receptacle in the female's body. She stays in the safety of his den for about a week until her new shell hardens. By then the attraction has passed, and the couple part with hardly a backward glance.

## Pregnancy

A lobster's pregnancy is long: from mating to hatching takes perhaps twenty months. After mating, the female stores the sperm for many months. When she is ready to lay her eggs, she turns onto her back and cups her tail. As many as 10,000 to 20,000 eggs are pushed out of her ovaries. They are fertilized as they pass through the sperm receptacle, marked by a small triangular shield at the base of her walking legs. A sticky substance glues the eggs to the bottom of the female's tail.

She will carry the eggs for 9 to 11 months, fanning them with her swimmerets to bring them oxygen and to clean off any debris that might stick to the developing eggs. Finally, when it's time for the eggs to hatch, the female lifts her tail into the current and sets them adrift in the sea. It may take up to two weeks for all of the eggs to be released.

## Lobster Boats-Icons of the Maine Coast

Before the advent of the gasoline engine, lobsterboats were powered by oar or sail. These workboats owed their graceful lines, stability, and speed to generations of other Maine fishing vessels that plied the formidable Gulf of Maine before them.

Cheap to build or buy because of its simple lines, the Dory, a high-sided, flat-bottomed, sharp-bowed rowboat, was used in many New England fisheries by late 18th century.



# How to Eat Lobster and Other Items to Discuss over Lobster

## What is the best lobster to eat?

Lobster is one of the few meal choices that invites you to choose your own victim. While there are some restaurants in the Midwest where you can pick out your own steak, it's not like seeing the whole cow. With lobsters, you do see the whole thing. This leaves the diner with several tough decisions:

- Should you have a soft-shell or a hard-shell lobster?
- Will a large lobster be as tender as a small lobster?
- Should you choose a male or a female?
- Should you choose a green lobster or a red one?

According to David Dow, former Director of the Lobster Institute in Orono, Maine, and a lobsterman himself, "Most people in the industry prefer the new shell: the 'shedders.' Their meat is sweet, and the shells are easy to break apart." However, others claim hard-shelled lobsters are better because the meat is firmer and there is more of it than in a newly-molted lobster.

Of course, you have to expect that the shell will not be crammed full of lobster meat in a 'shedder.' Lobster dealers sometimes refer to soft-shell lobsters as "low quality". It's not that they don't taste as good, but rather that in their weakened post-molt condition, these lobsters don't transport well. So if you plan to take a Maine lobster across state lines, a hard-shell lobster travels best.

Dow also claims that large lobsters taste as good as small ones "until you get to 5 to 7 pounds. Then the meat gets kind of stringy." Advocates of tail meat recommend getting a female whose tail is broader than a male's of equal size since she uses the space to carry her eggs. The best time to buy lobsters is in the fall, after Labor Day, when all the tourists have gone home and the lobster landings are at their highest.

Because lobster meat can go bad quickly, it's generally necessary to cook a lobster while it's still alive. That means you pick a green lobster, but don't eat it until its shell turns red! Never eat a cooked lobster with its tail uncurled, as it died before it was cooked.

## What is the best way to cook a lobster?

How to cook a lobster in the most humane manner has been a concern of guilt-ridden chefs for generations. In order to put the matter to a rest scientifically, one researcher instructed his graduate students to boil lobsters after having subjected them to various relaxation techniques. The students determined which method of dispatching them was the kindest by counting the number of tails flicks heard in the kettle before each lobster succumbed to the boiling water. They tried hypnotizing the subjects (rubbing their backs until they stood on their heads), soaking them in fresh water, heating them slowly from room temperature to boiling, and other accepted strategies. They found that putting them in the fridge before cooking to numb them up, (as happens naturally in winter), resulted in the lowest number of tail twitches. So, according to modern science, a few minutes in the freezer means less agony in the kettle.

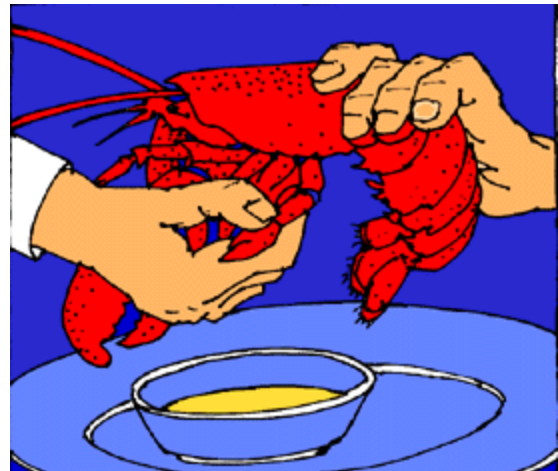
The most common way to cook lobster is to steam it in sea water (or salted water) for 10-15 minutes.

## How to eat lobster?

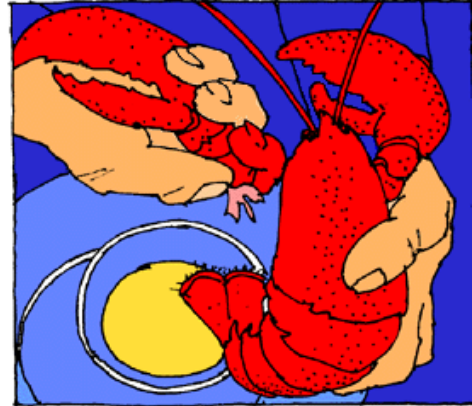
What better place to discuss lobster anatomy than at the dinner table? The first thing to do when your cooked lobster arrives is turn it over and announce whether it is a male or a female..

Most people start by breaking off the legs. Holding the lobster by the back, gently pull off the legs with a twisting motion.

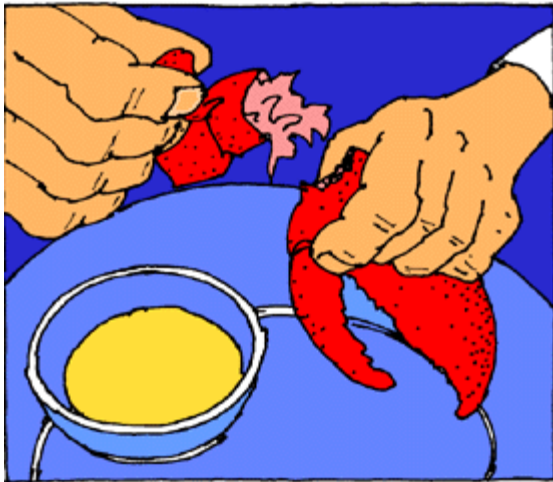
Don't throw these away: there are plenty of delicious morsels inside!



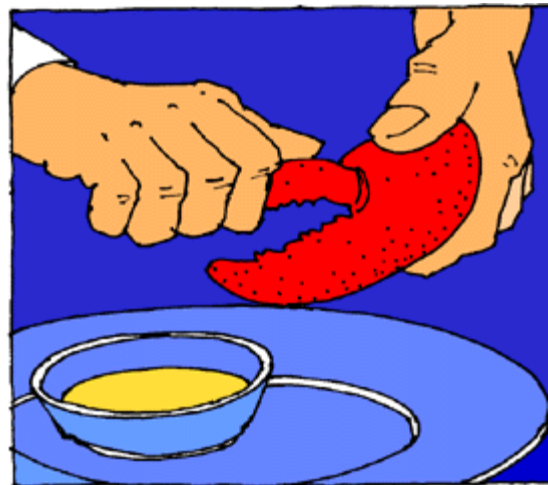
Next, take off the claws, which are also called chelipeds.



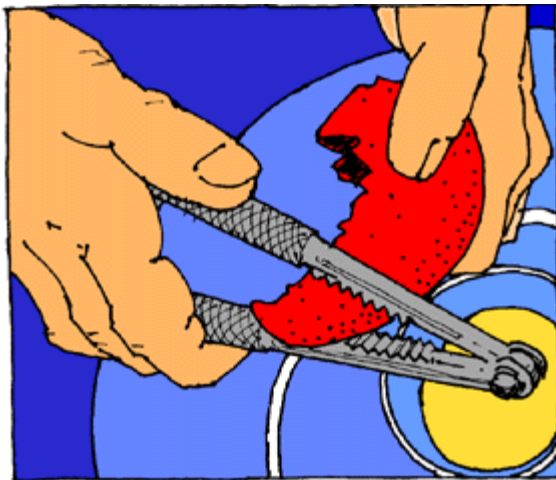
Tear them off at the first joint, again with a gentle twisting motion, and note that the crusher claw usually is bigger than the tearing claw.



Gently remove the loose part of the claw. Again, check for especially tasty morsels in small parts!

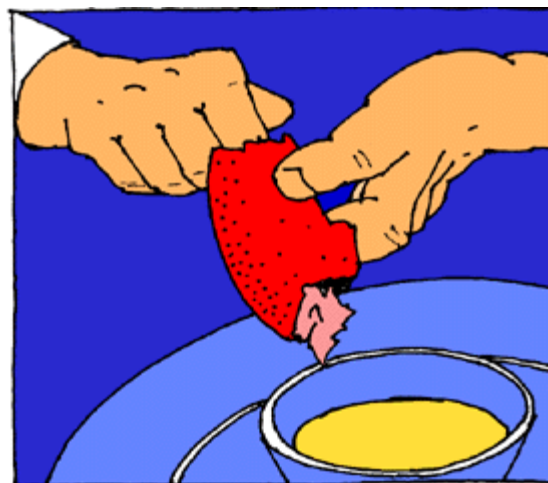


Using a nutcracker, break off the tip of the large section of claw, revealing the meat.



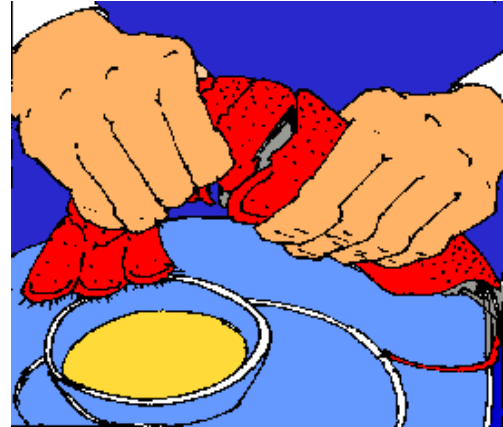
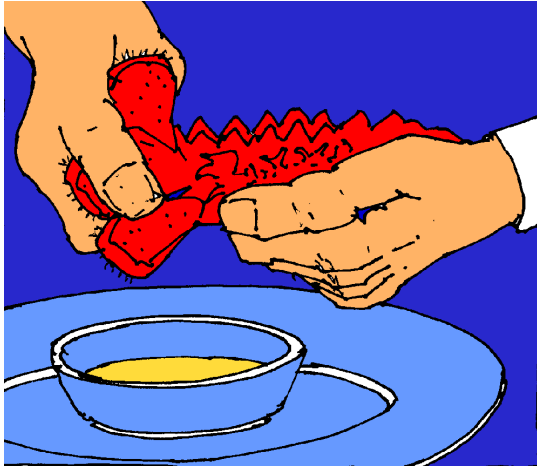
With your forefinger, push the meat from the tip of the claw out the larger open end.

Notice the mouth parts, antennae, antennules, and rostrum or beak, all of which are inedible.



Grasp the tail portion with one hand, and the back with the other hand.

Twist to separate the two sections.

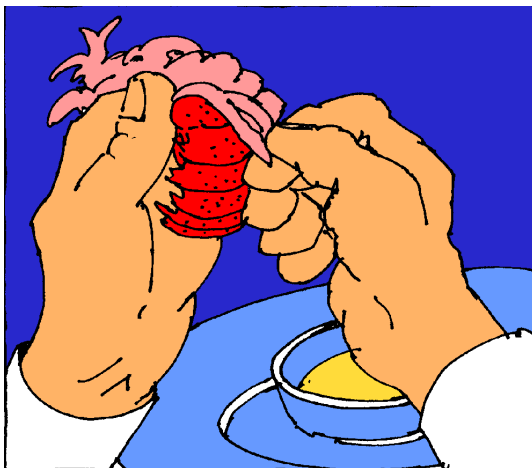
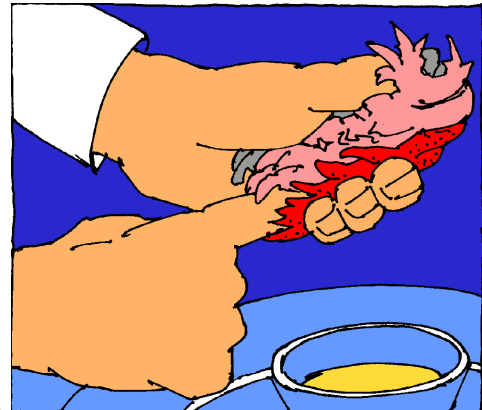


After that, turn to end of the tail which has small flippers, or telsons, at the base.

These provide tasty if miniscule chunks of meat to those who don't mind a little extra work.

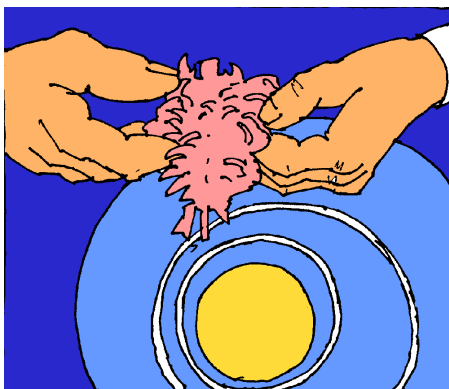
Arguably, the best part of the lobster (the debate rages between tail lovers and claw lovers) is the tail meat.

Then insert your fingers into the telson end to push the tail meat out intact through the larger opening.

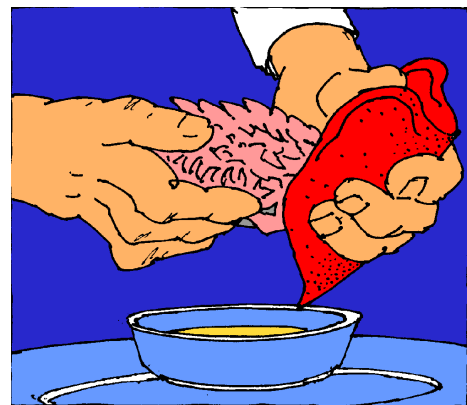


Peel off the top of the tail to reveal the digestive tract, which should be removed before eating the rest of the tail meat.

Intrepid diners who explore further find small chunks of meat inside the carapace, the hard shell or body of the lobster.



They may also encounter the gills, the circulation system, and green "tomalley" (the digestive gland) and in a female lobster, red "coral" or "roe" (the unfertilized eggs). Hard-core lobster lovers eat the latter two.



## **How can you tell a male from a female?**

The swimmerets, the small feathery appendages on the underside of the tail, will provide the answer. The first pair of swimmerets closest to the body are hard and bony on a male, and soft and feathery like the rest of the swimmerets, on a female. Only the female has a small rectangular shield between her second pair of walking legs. This is the sperm receptacle where she stores the sperm after mating until she lays her eggs.

A female also has a wider tail than a comparably-sized male. She needs the breadth for carrying all those eggs.

## **How big is a lobster's brain?**

Dave Dow, former Director of the Lobster Institute, claims a lobster has a brain the size of a grasshopper's. The lobster brain is primarily just a collection of ganglia, or nerve endings.

It's evident from the lobster brain's lack of complexity that a lobster does not do much deep thinking, adding support to lobstermen's claims that lobsters probably do not feel pain, certainly not in the way humans do.

Diagrams furnished courtesy Maine/New Hampshire Sea Grant Program. Used with permission.

## **How do you hypnotize a lobster?**

To hypnotize a lobster, stand it on its head with its claws laid out in front of it and its tail curled inward. Rub your hand up and down the carapace making sure to rub between the eyes. Eventually it may stand by itself. (Whoever thought of this must have been really starved for excitement.)

## **Why are lobsters banded?**

Crowded into tight quarters, lobsters become especially cannibalistic, which is why they must be banded in a lobster pound or store displays.

Lobster bands are small and strong. Lobster harvesters use a special tool that resembles a pair of pliers to open the rubber band to slip it over the lobster's claw

## **Why don't lobstermen use wooden pegs anymore?**

Years ago, lobstermen used wooden or plastic pegs inserted into the base of the claws to prevent lobsters from opening them. When they did so, they broke the protective skin or integument of the lobster. Disease-causing bacteria could attack the lobster through this lesion.

## **Why do lobstermen release a *berried* female?**

Because berries are eggs and females with eggs are released so the eggs can hatch. The eggs spend at least ten months on the female. The colder the water, the longer the eggs take to hatch. A berried female is also marked with a V-notch in her tail so if she is caught again the lobsterman knows she was an egg-bearing female and releases her.

## **What are some of the more unusual types of bait tried?**

After WW II, the Lob Lure Corporation tried to find a fool-proof type of artificial bait. Some of their unusual concoctions ranged from a bait bag that blinked like an electric light to less-promising kerosene-soaked bricks or white coffee mugs.

## **Why aren't more lobsters raised through aquaculture?**

Many sea creatures, including salmon, oysters, and mussels, are raised successfully through sea farming or aquaculture. Since lobsters command such a high price at the market, you would think there would be massive aquaculture operations to raise them. Lobsters are not easy to raise in captivity, and as yet no one has made a profit from it. Experiments have been conducted for years trying to find an economic way to raise them without much success.

Two problems repeatedly crop up:

1. Lobsters in close quarters will eat each other. When lobsters are raised in captivity, they are kept in large vats as larvae. Whirlpool currents keep the baby lobsters spinning beyond each other's reach. When they settle to the bottom, they must be kept in individual pens and moved to ever larger enclosures as they grow.
2. Lobsters grow very slowly, taking an average of 5-7 years to reach market size. That's a long time to feed and maintain them. They can grow faster in warmer water, but it still takes several years to reach market size. Factor in food costs (lobsters can be picky eaters in captivity), heating the water to make them grow faster, and treating disease, and it's easy to see why raising a lobster to adulthood is expensive.

Another approach to lobster aquaculture has been to keep them captive only from egg to hatching to the fourth or fifth stages when they start to settle to the bottom. Hatchery operators then free the baby lobsters into the ocean and hope that they survive long enough to join the lobster fishery as market-size catch. A portion of the income from the sale of lobster licenses in Maine goes to fund a "seed lobster program" to support research in aquaculture or "sea farming." Perhaps 100,000 larval lobsters are released into coastal waters each year.

For lots more lobster history and trivia, we recommend [The Illustrated Dictionary of Lobstering](#) by Kendall Merriam. (The Cumberland Press, Freeport, Maine, 1978)

## **What's the green stuff?**

It's the lobster's liver or more accurately, its digestive system. Although many people like to eat the "tomalley" it probably isn't a good idea because this is where pollution in the lobster's own meal choices would become concentrated in the lobster's body.

## **What's the red stuff?**

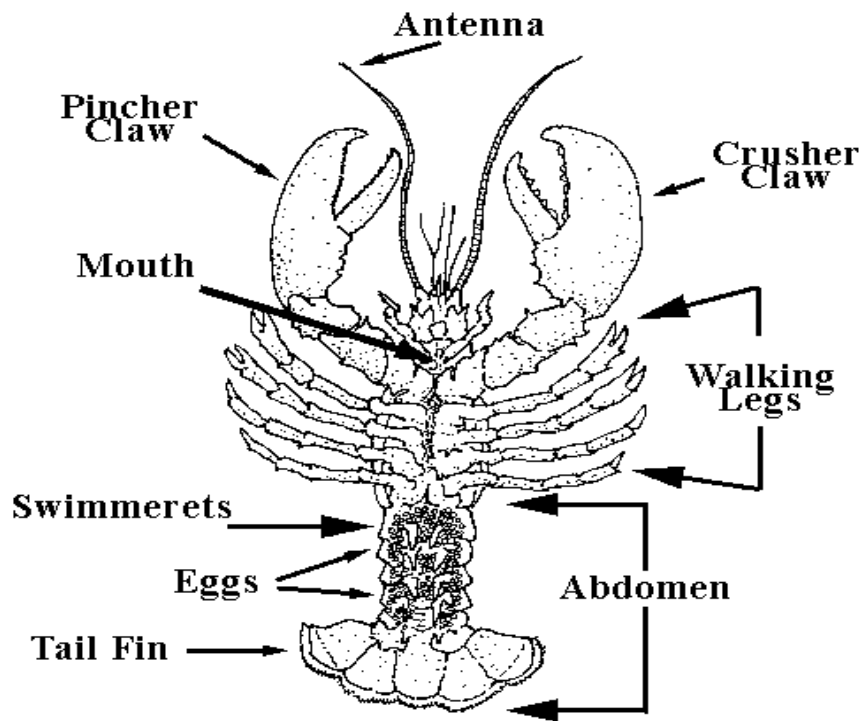
It's the roe, the unfertilized eggs of the female. Lobster eggs were once considered a delicacy, like caviar. The roe is also called "coral" because of its bright red color.

## **What is the nutritional value of lobster?**

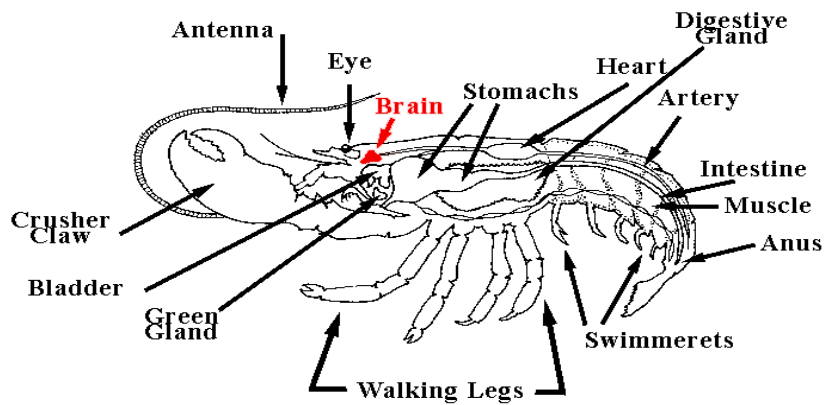
Nutrition studies show that 3 1/2 ounces of lobster meat (without the butter) contains only 90 calories, compared to 163 calories for the same amount of chicken and 280 calories for sirloin steak. Lobster also contains omega-3 fatty acids, the "good" cholesterol that seems to reduce hardening of the arteries and decrease the risk of heart attacks.

## **Can you eat lobster when there is a shellfish ban?**

Yes. Lobsters, unlike mussels, oysters, and clams, are not "filter feeders." Filter feeders pump sea water, and any plankton or pollution it carries, through their bodies. Any toxins in the water will be concentrated in their flesh. Meat eaters like lobsters, crabs, and fish do not filter plankton from sea water, so they are safe to eat during an outbreak of red tide.



**Lobster: Bottom View**



**Lobster: Side View**

## Lobster Links

Gulf of Maine Aquarium

<http://octopus.gma.org/lobsters/lobsteractivities/lobactindex.html>

From the New York Times:

Down East, the Lobster Hauls are up Big

[http://octopus.gma.org/lobsters/NYTimes\\_article.html](http://octopus.gma.org/lobsters/NYTimes_article.html)

The Department of Marine Resources has several areas of interest to anyone wanting to learn more about lobstering and the industry. Start at their Home Page <http://www.state.me.us/dmr/index.htm> to find laws and regulations about lobster zone management and other lobster landings statistics.

Try Resource Management—Lobsters <http://www.state.me.us/dmr/rm/lobster/lobster.html>

to find a wealth of resources and information on lobsters, including how to order a wide variety of information leaflets...or for downloadable copies of regulations, go directly to: State of Maine Rule Chapters for the Department of Marine Resources. (This is an ftp site where you may download the Rule Chapters in Word 2.0 or WordPerfect 5.1 format. The regulations are no longer posted for online viewing.)

The Darling Marine Center <http://server.dmc.maine.edu/default.htm> is the marine laboratory of the University of Maine. It functions year round as a research and educational facility serving the marine interests of faculty, staff, students and visiting investigators from around the world.

The Lobster Institute <http://www.lobster.um.maine.edu/>

Bigelow Laboratory for Ocean Sciences <http://www.bigelow.org/>

The Lobster Conservancy <http://www.lobsters.org/> is a non-profit research organization dedicated to preserving the American lobster and the traditional trap fishery through scientific research and education.

The Lobsterman's Page <http://www.lobstermanspage.net/>

Maine/New Hampshire Sea Grant College Program <http://www.seagrant.unh.edu/>

Sea Grant at Woods Hole Oceanographic Institution <http://www.whoi.edu/seagrant/>

Lobster catchers are as interesting as lobsters, and like lobsters, they tend to be a distinctive breed. Their lives are depicted in various ways in *Going Lobstering* by Jerry Pallotta, *Finest Kind O' Day: Lobstering in Maine* by Bruce McMillan, *Lobsterman* by Dahlov Ipcar, and in *Lobsters: Gangsters of the Sea* by Mary Cerullo.

### Books for adults

- Acheson, James, 1988. *Lobster Gangs of Maine*. Hanover, NH: University Press of New England
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#### **Curriculum resources**

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West Boothbay Harbor, ME 04575

(207) 633-9500

Joel Rubin, Teacher Resource Center

New England Aquarium

Central Wharf

Boston, MA 02110

Tel. (617) 973-5200

The New England Aquarium has many educational materials, guidebooks, & kits on popular topics, as do Sea World and Baltimore Aquarium

Elaine Jones, Education Director

Maine Department of Marine Resources

State House Station #21

Augusta, ME 04333

Free marine curriculum materials, teachers' newsletter

Susan White, Education Coordinator

University of Maine/University of New Hampshire Sea Grant College Program

Coburn Hall

University of Maine

Orono, ME 04469

(207) 581-1440

Materials on lobsters and other marine topics, videos

Teacher Resource Center

University of New Hampshire Marine Program

University of New Hampshire

Durham, NH 03824

(603)749-1565

Library of marine curriculum materials, volunteers who visit schools