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LIFE HISTORY OF THE AMERICAN OR EASTERN OYSTER
CRASSOSTREA VIRGINICA

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Classification

The American or Eastern oyster is of the phylum Mollusca, class Bivalvia, more specifically, the genus *Crassostrea* and the species *virginica*. Oysters are further classified into two distinct categories of nonincubatory or oviparus species. Reproduction in the species *Crassostrea* occurs with the dispersion of eggs into the water and the fertilization entirely outside of the organism. The second is the incubatory or larviparus species *ostrea*, which refers to those oysters in which the eggs are fertilized in the gill cavity. The eggs of this species are incubated and discharged when they have reached an advanced stage of development.

Range

Oysters can be found in almost every tidal marsh and estuarine zone from Texas to Maine. In southern reaches of its domain, oysters form “rocks or bars” that grow in these tidal areas. In New England, oysters thrive in the southern extremities of rivers where they are protected from salt-water predators. In northern fisheries, such populations on river bottom are called “oyster beds” or just “natural beds.”

Environment

The American oyster (hereafter referred to as oyster) has the ability to survive in water where the salinity and temperature tend to vary greatly. The optimal salinity range is 10 to 28 parts per thousand salt in water or 1 to 2.8 percent saline.

Temperature plays an important role in determining when or how long an oyster may live in a certain salinity range. Generally, the lower the temperature, the longer an oyster can survive in a low salinity environment

The adaptability of the oyster to live in areas of extreme temperatures is even further indicated when you consider that oysters living between tidal levels in the winter, may be frozen solid, and if left undisturbed, will thaw out in warm water and continue to live.

Biology

The American oyster is primarily a filter feeder and consumes flagellates and unicellular algae. The oyster is supported by the base of the marine food chain, and because energy is lost at each step of the food chain, oysters are excellent protein producers. Oysters filter seawater in search of food particles and absorb calcium carbonate for building a shell, which is their means of protection from predators. Oysters also need a substrate on which they can affix themselves and have a beak or hinge area at this point of attachment. A very large muscle, that is called the abductor, opens and closes the two shell halves for feeding. This allows the mantle area to secrete calcium carbonate for shell growth and also directs water to the gill where oxygen exchange takes place for respiration. Food particles are passed along ciliated gills to the mouth and passed to the stomach for digestion. Feces are expelled from the intestine through the anus. When actively feeding, an average three-inch oyster will consume 10 to 20 thousand cells of phytoplankton daily. In order to fulfill its food requirement, oysters will siphon 10 to 100 gallons of seawater daily. In fact, some oysters will siphon 10 gallons an hour for short periods. Oysters select algae cells of specific size; however, the type is not important, and it will feed upon many diverse strains. In temperate areas, oysters begin feeding in early spring and cease in the fall when the water temperature falls below 50 degrees Fahrenheit.

Reproduction

Incubatory (Ostrea)

Incubatory oysters are generally bisexual, or hermaphroditic. Eggs and sperm are produced simultaneously in the gonad of these oysters.

Nonincubatory (Crassostrea)

Nonincubatory oysters are very rarely hermaphroditic. Once a year, however, a certain percentage of these oysters will change their sex; this reversal is not unusual. Often, this change occurs after spawning when the gonad is in an indifferentiated state.

The American or Eastern Oyster (*Crassostrea virginica*) is nonincubatory and releases its eggs and sperm directly into the water. Adult oysters of this genus will reach a length of 14 inches however; a more commercially valuable size is slightly over 4 inches and of a more rounded shape.

The gonads are the reproductive organs of the oyster. When ripe, they constitute a sizeable portion of the oyster body.

In the cold season (November-April), the gonads of the oysters in Long Island Sound are relatively small and contain sex cells in the early stages of development. Oysters will spawn when the water has reached a favorable temperature, usually about 70 degrees Fahrenheit. Spawning season occurs in New England from late May to early September. It is important that water temperature manipulated under controlled conditions induce oysters to spawn. This technique originated at the U.S. Bureau of Commercial Fisheries Laboratory in Milford, Connecticut. The "Milford Method" is now the basis of several successful shellfish hatcheries. Temperature requirements for spawning are lower in the northern oyster population than in the southern population.

The success of a spawn is dependent upon several factors, however, the most important is the ability to produce eggs and sperm. When the temperature reaches 67 degrees Fahrenheit, some oysters will begin releasing eggs and sperm. Oysters will sense the eggs and sperm, and a general spawning process begins as the water temperature rises. A sudden cold snap or heavy rain may delay this process, resulting in a partial release of eggs and sperm. If the spawning procedure is interrupted, often a poor set or spawn is achieved. When the water temperature fails to reach the high sixties, chances of a good spawn are greatly diminished.

Immediately after release, eggs and sperm mingle in the water column and are fertilized.

Approximately six hours later, a few large cilia (hairs) become visible on the outside of the larva. The beating of the cilia is not coordinated at this point, and the movements of the larva are irregular and spasmodic. A few minutes after the first cilia appear, more powerful cilia are formed, and the larva is able to swim to the surface for about fifteen minutes. This swimming action will last 24 to 48 hours. Approximately five days after fertilization, the larva will develop an important organ called the "foot" which determines where the oyster will "set." The oyster "sets" or attaches itself to a suitable substrate where it will develop. Prior to setting, the oyster swims in search of a good location. During this period, the foot serves to guide the larva, giving it some sense of direction. Finally, after two to three weeks, the larva drops to the bottom, and the newly developed foot moves it along hard surfaces, looking for a suitable place to live, preferably an old oyster shell. When the oyster sets, the foot is no longer needed and disappears. During this setting period, the oyster secretes a cement that dries in a few minutes and anchors the oyster to the surface permanently. Recently anchored oysters are called set. Before setting, oysters are frequently called "spat".

which prefer certain types of surfaces over others when choosing a permanent place to live. Old, clean and soft oyster shells which are called "clutch," are the best collectors of spat

Much research has centered around finding the ideal spat collector. Oyster shell remains the favored clutch for many commercial operations in the United States and provides the basis for the "natural growth" oyster fisheries.

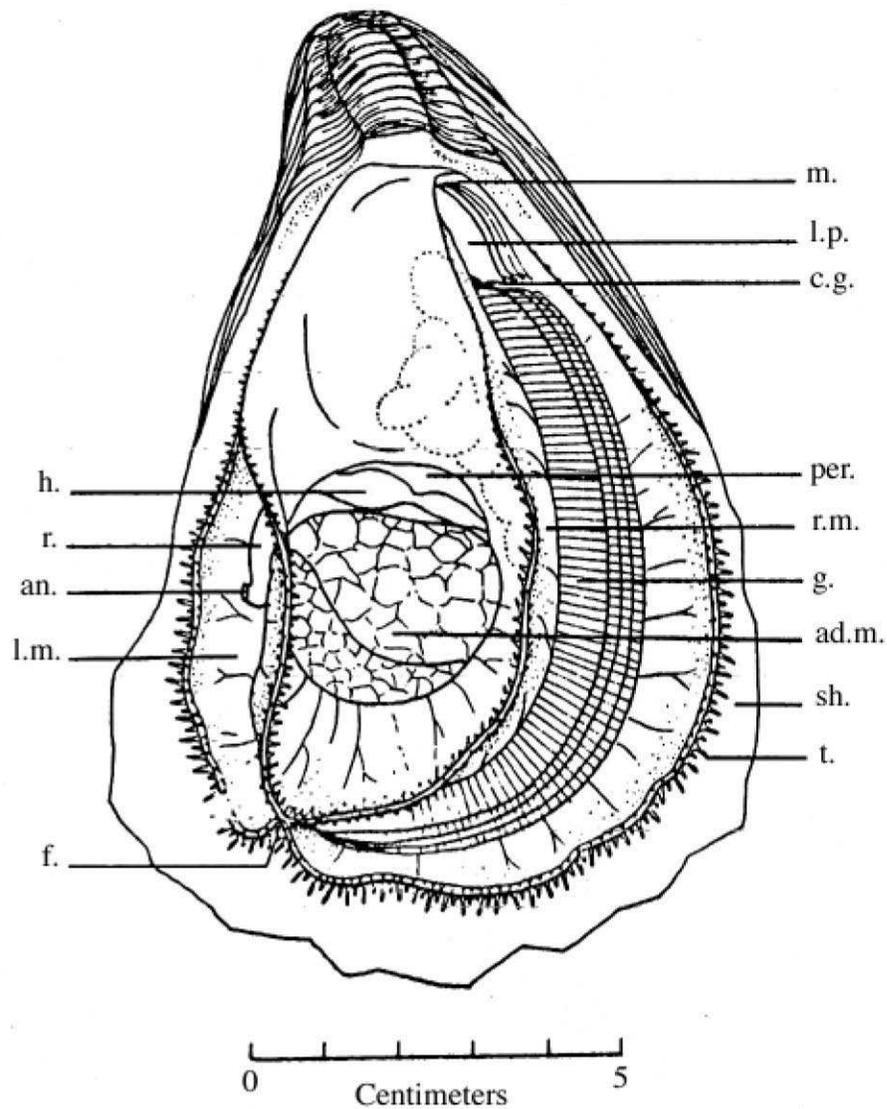


Figure 3. Anatomy of the American Oyster *Crassostrea virginica* (from Galtsoff 1964).

h = heart, r = rectum, an = anus, lm = left mantle, f = fusion of mantle lobes and gills, m = mouth, lp = labial palps, cg = cerebral ganglion, per = pericardium, rm = right mantle, g = gills, ad.m = adductor muscle, sh = shell, t = tentacles

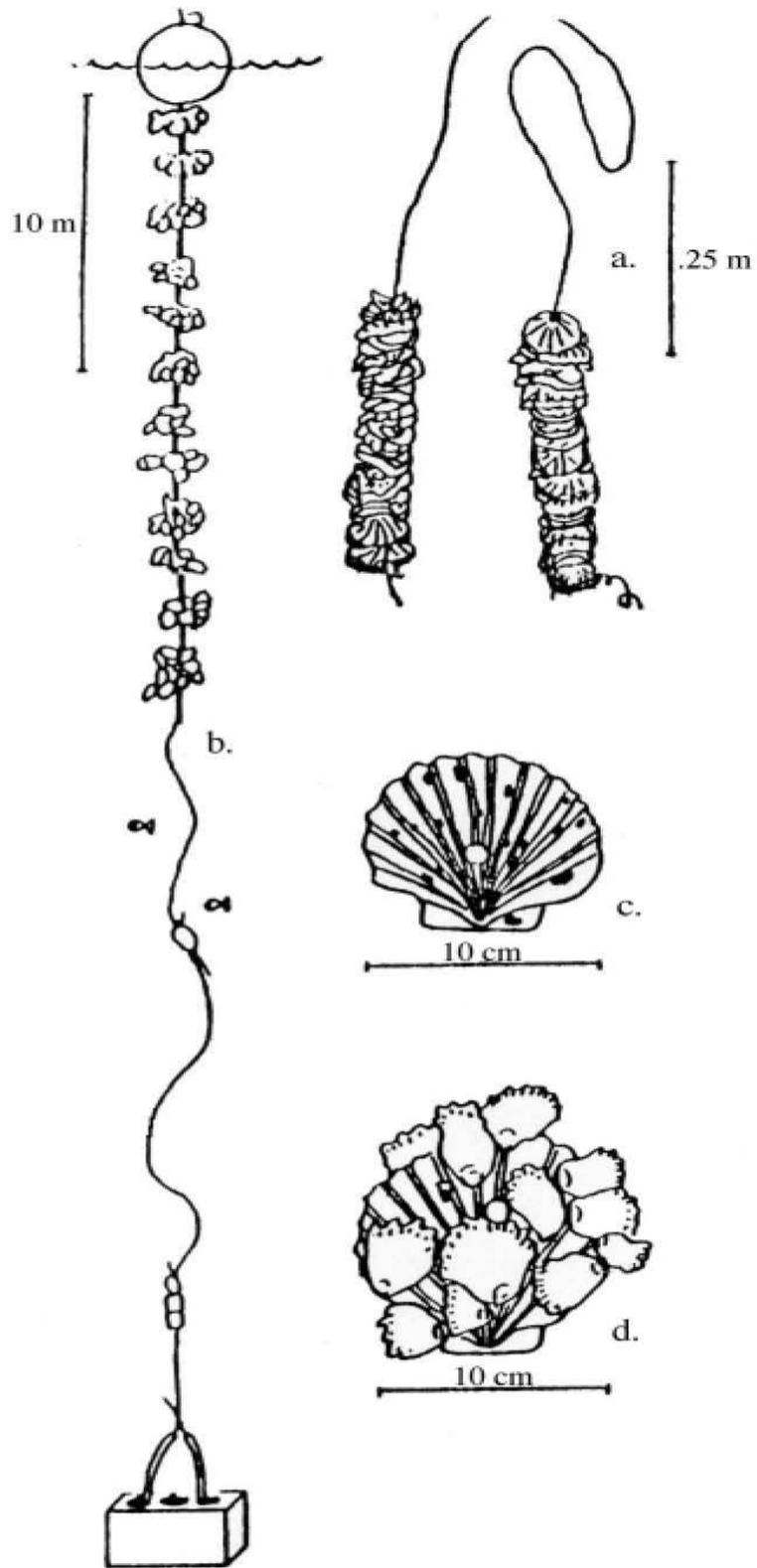


Figure 4. Various scallop shell spat collectors, “D” shows newly set oysters on surface of scallop shell.