

STUDENT MASTER

Save the Oyster Reef

The Problem

Something is wrong on the island of Wando Fooka. The normally successful local oyster harvesters have seen a reduction in their annual oyster harvest. Now the number of tourists who come to the island to eat the wonderful oysters has started falling off. What's even worse is that this year, for the first time ever, local residents had to order oysters from hundreds of miles away to use in their traditional oyster roasts. Can you help the good folks of Wando Fooka discover what is causing the decline in their local oyster reef population?

The Task

You are a noted marine biologist. Your assignment on Wando Fooka is to uncover what is causing the decline in the oyster population and propose a solution to the problem. To do this, it will be necessary for you to better understand oysters, how oyster reefs develop, what the economic and biological importance is of an oyster reef, and how oyster reef populations are threatened.

The Process

Read the article, *Ode to the Oyster*, to find out more about the life of the eastern oyster. Then you'll want to read about some of the things that threaten the oyster and lead to shrinking oyster reefs and decreased oyster populations. Read about the problems facing oysters along the South Carolina coast. Finally, read about the oyster reef restoration efforts of the SCORE (South Carolina Oyster Restoration and Enhancement) project.

Your Research

As you do your research, record your answers to the following questions. The information may come in handy as you develop your Plan of Action later.

Q1. In what environment do oyster reefs develop?

Q2. Name three conditions that support oyster reef establishment.

Q3. Why is the oyster called a filter feeder?

Q4. What is the main diet of the oyster?

Q5. Name two factors that influence spawning activities of oysters.

Q6. Why are oysters considered “broadcast” spawners?

Q7. Describe the development of oyster larvae.

Q8. Explain how oyster reefs are formed.

Q9. Describe the commercial and recreational importance of the American oyster.

Q10. Describe the ecological importance of the oyster.

A Plan of Action

You’ve done the research. Now it is time for you to tell the residents of Wando Fooka your recommendation to restore Wando Fooka’s oyster harvest and save the island’s economy. Write down a Plan of Action to save the local oyster reefs. Propose at least two new regulations that the island officials or public service groups can institute to slow or stop the decline in reef oyster populations.

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Ode to the Oyster

Description

Oysters, like other bivalves, have two shells that are hinged at one end. The shape of the shell and its weight vary according to where the oyster lives. For instance, oysters that live in subtidal areas do not form clusters and tend to have regular, heavy shells. Cluster-forming, intertidal oysters have shells that are typically thin, elongated, and irregularly shaped. All oysters are attached to a base material or to one another by their left valve. This valve tends to be thicker and more deeply curved than the right one.

Inside an oyster's shell, the internal organs are covered by a thick fold of tissue called the mantle, whose primary job is to produce a hard, protective shell. Unattached parts of the mantle enclose a space known as the mantle cavity which, in a living oyster, is always full of seawater. This keeps the oyster's organs constantly bathed in water even when it is exposed to air at low tide.



Eastern oyster (*Crassostrea virginica*)

How do oysters eat?

The oyster feeds by filtering food particles from the surrounding water. Opening and closing of the valves are controlled by an adductor muscle attached to each shell. Food and other particles, suspended in the water, are drawn into the oyster by the motion of small, hair-like whips called cilia located on the gills. A large, healthy oyster may pump almost four gallons of water per hour. Food particles captured by the gills are moved by the cilia to the mouth and then to the stomach of the oyster. Matter brought into the shell, but not passed through the mouth, is trapped by sticky mucus on the gills and then discarded. This ability to separate food from other material apparently allows oysters to survive in waters of high turbidity which occurs in many estuaries. The filtering action of oysters can play an important role in removing not only suspended sediments from the water column, but can cleanse the water of various pollutants.

When do oysters reproduce?

Spawning begins in the spring when water temperature exceeds 70 degrees F. In South Carolina for example, most spawning occurs from April to October and is intensive during the summer months. The sperm and eggs are released directly into the water column where fertilization and the early stages of development occur. Tiny young oyster larvae develop in approximately 24 hours and can swim freely in the water. Oysters' have a limited ability to move around by the controlled motion of the cilia. However, tides and currents produce the greater movement. After three to four weeks these larvae settle on the bottom where they must locate a hard, clean surface for permanent attachment. If a place for attachment cannot be found, the larvae sink to the bottom and die.

Do oysters move around after they attach to the substrate?

If a suitable surface for attachment is found, the larva secretes a fluid that cements the left shell permanently to the object. Unless removed by some external force, the oyster will never move again. Almost any hard, clean surface is acceptable for attachment. However, other oyster shells appear to be the most-favored surface.

After attachment occurs, these small oysters are called spat. In southern waters there is a nearly continuous setting of spat during warm weather.

Where do oysters live and are they safe from attack?

Intertidal oysters occur in all of South Carolina's estuaries. Typically in South Carolina, sounds, bays and river mouths are connected by a system of creeks and rivers separated by extensive saltwater marshes. Oysters are found along most of these creeks and riverbanks and on exposed mud flats.

Oyster predators suffer more from exposure to the elements than do oysters. Therefore, intertidal oysters safer from predators than oysters which grow subtidally. The blue crab, as well as other crab species, oyster drills, starfish and boring sponges can all kill oysters, especially when the oysters are young.

The numbers of oysters in South Carolina has remained relatively stable in recent years, although populations are lower now than they were in 1900. Declines, in part, have been related to increased sediment resulting from alterations in stream flow, overharvesting, and physical disturbances to the shell bed. Diseases have also periodically killed oysters.

What are oyster reefs?

Intertidal oysters are also found in groups known as oyster reefs. Oyster reefs are formed by oysters growing on a firm foundation of dead shells. The intricate structure of oyster reefs provides extensive habitat for numerous marine species. Mud crabs, shrimps, juvenile fishes and other organisms have been observed to seek shelter in reefs from predators as the tide rises. Loose oyster shell on creek bottoms serves as hard clam habitat as well as substrate for sponges, sea fans, and whip corals which, in turn, supply habitat for small crustaceans and fishes.

Stone crabs typically reside near or in oyster reefs and feed on oysters. Many larger fish hunt for prey hiding among the oysters. Oyster reefs are important in stabilizing exposed marsh edges, which prevents erosion and loss of marsh grasses. The energy of natural and man-made waves is dissipated as the waves reach the complex structure of the reef.

Why are oysters important?

The American oyster, also called the eastern oyster, is the only commercially important oyster species on the East Coast of the United States. In South Carolina, it is among the most popular local seafoods. Harvesting is done by handpicking clusters of oysters at low tide in authorized areas. In addition to providing commercial and recreational benefits, oysters also fulfill several important ecological functions. For instance, their filtering action serves to remove suspended sediments from the water as well as certain pollutants. Oyster reefs provide valuable shelter and habitat for many other species, such as stone crabs, and prevent erosion by stabilizing marsh edges. Several marine species--some of commercial importance--seek habitats where the bottom is covered with loose oyster shell.

Oysters in the food web

Oysters and other bivalves are filter feeders, and as result, they play a very important role in filtering (thereby cleaning) the waters of the estuary. While filtering, the oysters take in water and ingested the small particles of algae, detritus and other foods out of the water. Who else eats oysters? The spat or larvae are very vulnerable and are eaten by a wide variety of fish and invertebrates. Larger oysters may be eaten by crabs, fish (oyster toadfish, rays, skates, drum), starfish, worms, or birds (oystercatchers). Humans also like to eat oysters.