Keystone Species of the Estuary

Bivalve Basics

Oysters, clams and mussels are classified as mollusks and are relatives of other spineless animals such as snails and octopuses. They are further classified as bivalves because they have two-part shells held together by a ligament hinge, and are also referred to as filter feeders because they feed by drawing water through their gills and filtering out tiny plants and animals called plankton.

The many species of bivalves reproduce and mature differently, undergoing rather elaborate body changes at different life stages, some even switching genders. After bivalves spawn they live as larvae in the water for a few weeks, metamorphose into juveniles, and then settle onto surfaces where they mature. Oysters and mussels attach to shells, rocks and other suitably hard surfaces while clams attach to bottom sands until they are large enough to burrow below the surface. Shellfish that settle in intertidal areas are exposed to the elements and deal with low-tide conditions by tightly clamping their shells together to retain water for hours or even days at a time.

Some of the more common bivalve species in Washington include Pacific oysters, blue mussels and numerous varieties of clams, including littleneck, Manila, butter, geoduck, cockle, horse, softshell and razor clams.

Photo courtesy Taylor Shellfish Farms

Bottom-culture oyster beds in Totten Inlet, Thurston County

Ecosystem Influences

Shellfish are integral components of the coastal ecosystem, so much so that some ecologists view oyster beds and oyster reefs as the outstanding communities of the estuary. The interactions between shellfish beds and other organisms and elements of the coastal ecosystem are numerous and complex. Environmental factors such as water temperature, salinity, food availability, substrate and predators determine the distribution, abundance and condition of different shellfish species. In similar but reverse fashion, shellfish exert a dramatic influence on the character and condition of the estuarine environment, providing three-dimensional structure and habitat for plant and animal life of all kinds and playing particularly important roles in the uptake and recycling of energy and nutrients.

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Clean water has been called the lifeblood of the shellfish industry. Perhaps less well known is the critical role that shellfish play in keeping clean the very waters in which they live. Shellfish perform functions in the coastal ecosystem similar to the role that kidneys play helping to filter and regulate the flow of blood in the human body. In the ecosystem, bivalve shellfish filter seawater at rates ranging between 6 and 26 gallons a day, depending on size, species and other factors. Mature oysters can filter as much as 55 gallons of water a day. Healthy populations of shellfish can filter a substantial fraction of an estuary's water on a daily basis, and in the process help regulate vital flows of nutrients and energy in the overall coastal system.

Oysters, mussels and most clams are suspension feeders, meaning they capture and eat plankton and other particles that are free floating in the water. The shellfish assimilate some of what they take in and pass on the rest as digested and undigested material that settles to the bottom sediments. This uptake and recycling of organic matter helps control phytoplankton levels, improve water clarity, supply nutrients to bottom sediments and allow greater light penetration for the growth of seagrasses and

other bottom vegetation. These filtering and recycling processes are critical in regulating the health of coastal ecosystems. The processes take on even greater importance as human activities and related pollution discharges increase in shoreline areas. The processes help counteract the potentially damaging effects of excessive nutrient enrichment of coastal waters, a process known as *eutrophication*.

Ecologists use the word *mutualism* to describe mutually beneficial interactions between species. Such is the effect of different types of natural and farmed shellfish habitats. Shellfish operations provide three-dimensional structure and create conditions that are often attractive to other animals and conducive to new plant growth, commonly leading to the emergence of new and rich biological communities. For example, farmed beds with rows of oyster-laden posts and lines (a method known as "longline" aquaculture) can facilitate the growth of eelgrass between the rows, provide sanctuary for forage fish, and attract Dungeness crab and other prized species to the modified tideland habitat.

Fascinating Facts

- The Olympia oyster is the only native West Coast oyster.
- Typical bivalve filtering rates range between 6 and 26 gallons of seawater a day depending on size, species and other factors. Mature oysters can filter as much as 55 gallons of seawater a day.
- Geoduck are the world's largest burrowing clam (up to 14 pounds) and are found on the West Coast of North America from California to Alaska. They constitute the greatest biomass of any animal species in Puget Sound.
- Shellfish play critical roles in the uptake and recycling of nutrients and energy in coastal ecosystems.
- Shellfish assimilate nutrients in their tissues as they grow, removing nearly 17 grams of nitrogen from estuaries for every kilogram of shellfish meat harvested.

Shellfish Aquaculture

For both small-scale gardening and large-scale farming, shellfish aquaculture involves the direct use and management of the shoreline environment. The production and harvest of different shellfish species involve a wide range of practices that cause a variety of effects. These include an array of beneficial environmental effects as well as potential negative impacts. To avoid and mitigate these impacts, the Pacific Coast Shellfish Growers Association has instituted an environmental management system that spells out recommended practices for all facets of the shellfish farming industry.

Photo courtesy Taylor Shellfish Farms
Oyster and eelgrass interactions in Samish Bay, Skagit County

In similar fashion, recreational diggers, shoreline property owners and others who get involved in growing and harvesting shellfish need to follow a number of basic rules to minimize and avoid impacts to the shoreline environment. The challenge to everyone is to use and manage these unique and highly productive environments in such a way that their natural functions and values are not compromised, and wherever possible are rehabilitated or even enhanced through the use of good conservation principles and techniques. The accompanying resource page provides more information.

Sources

D. Quale, 1969, *Pacific Oyster Culture in British Columbia*. Washington Sea Grant Program, 2002, *Small-Scale Oyster Farming for Pleasure and Profit in Washington*. R. Smith, 1980, *Ecology and Field Biology*. R. Newell, undated, *Environmental Change in the Coastal Environment: The Influence of Bivalve Suspension-Feeders on Phytoplankton and Inorganic Nutrient Cycling*. M. Rice, 2001, *Environmental Impacts of Shellfish Aquaculture: Filter Feeding to Control Eutrophication*. Pacific Coast Shellfish Growers Association, 2002, *Environmental Codes of Practice*.

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