

Ecosystem services provided by oyster reefs

Oysters are shellfish having two valves (bivalve) often referred to as the engineers of ecosystem for they have the ability to attach themselves to hard surfaces such as rocks and other oyster shells. This leads to formation of oyster reefs consisting of thousands of oysters attached to each other. These reefs play various roles, such as; habitat for small and large species, breeding ground for commercial fish, maintaining coastal and estuarine environment. (1) oysters having complex three dimensional structure are able to alter water flow and trap sediments from the water. By providing habitat for the various species Oyster reefs support complex ecosystems and food webs. (2)

These three dimensional reefs predominantly formed by Angasi or flat oysters were common in mid-late 1800s and early 1900s, in Australia's southern coastal waters. Oyster reefs were destroyed because of destructive fishing practices and changes in estuarine conditions. Even though these practices have been ceased but the natural structures of oyster reefs do not seem to be recovering. (3) Oyster reefs are combination of living and dead oysters. These together provide structured habitat, provide food and shelter for various types of crustaceans and invertebrates, protect the shorelines from tidal action and filter out excess nutrients from the water. The crustaceans which depends on these reefs include sheepshead *Archosargus probatocephalus*, brown shrimp *Farfantepenaeus aztecus* and blue crab *Callinectes sapidus*. Whereas, they also provide temporary shelter and foraging grounds to species such as southern flounder *Paralichthys lethostigma*.(4)

Apart from providing shelter to marine species oyster reefs act biological filters that remove the materials from water. They also transform and release some substances back into water. Oyster reefs receive signals in various forms in different forms such as energy, information or matter. The energy signals are received because of different reason and are in different forms. Biochemical energy is due to feeding processes taking place in the water, mechanical energy is received as a result of water currents and thermal energy comes from thermal changes taking place within water. Signals in the form of materials processed by oyster reefs are the changes in concentration of various nutrients and substances present in water. Oyster reefs receive information signals in the form of larvae and gametes having genes which carry biological information. These reefs act as black boxes of the estuarine ecosystems as they receive and send signals. (5)



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Oyster reefs form the breeding grounds for many commercially important fish species, thus aiding in the economic growth. They provide refuge to the prey and hunting grounds for the predators. This leads to balance in the ecosystem.(6) Excess of Nitrogen in the seawater leads to water pollution caused by Eutrophication.



Oyster Reefs in Georgia - UGA Marine Extension and Georgia Sea Grant [Internet]. [cited 2022 Jan 7]. Available from: <https://gacoast.uga.edu/outreach/programs/oyster-reefs-georgia/>



Significant Progress for Chesapeake Bay Oyster Reef Restoration—Yes, Even in 2020 | NOAA Fisheries [Internet]. [cited 2022 Jan 7]. Available from: <https://www.fisheries.noaa.gov/feature-story/significant-progress-chesapeake-bay-oyster-reef-restoration-yes-even-2020>

High amounts of nitrogen in water causes algal blooms, loss of habitat and formation of dead zones. This excessive level of nitrogen can be reduced by sediment denitrification, a step wise reduction pathway of nitrate to dinitrogen gas. Oysters and clams act as top down controllers of phytoplankton, as they can filter out excessive amount of nitrogen from water by sediment cycling, through benthic-pelagic coupling. Oysters feed on phytoplankton which contain particulate nitrogen, thus they reduce both nitrogen and biomass. The nitrogen is assimilated, a part of which is excreted in the form of dissolved nitrogen back into the water, and the remaining amount of nitrogen is excreted in the form of bio deposit which eventually becomes part of the sediments. The sediments are utilized by the microbes thus further enhancing the denitrifying process. Additionally the formation of sediments regulates the process of DNRA which is more suitable in conditions where carbon is high and nitrates are in low concentrations. Oysters also provide habitat for the denitrifying bacteria thus aiding in regulation of nitrogen. (7)

Oysters promote the transfer of energy in many trophic levels by capturing the suspended particles before they become fuel for the microbial loops. They promote the movement of energy from the primary level to the higher levels of the food chain such as tarpon, bottle-nose dolphins and red drums. Filtration by oysters is beneficial for the aquatic vegetation, which is the main source of habitat of fish species living in the sea. By filtering nitrogen and consuming phytoplankton the oyster reefs enhance the light penetration in the water. The harmful or excessive nutrients are transformed into the bio deposits.

Oysters have been widely recognized as fishery commodity but it is much more than that. Oyster reefs provides habitat to tiny crustaceans which are food for many fishes. It directly or indirectly increases the production of the economically important fish species. (8)

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