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A Review on Marine Ecosystems

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Abstract

Seafood, habitats, energy sources, nutrient cycling and primary production, weather and climate regulation, coastal protection, water detoxification, sediment trapping, and cultural and economic services are just a few of the goods and services that large marine ecosystems located around the margins of the continents provide. Ten Large Marine Ecosystems (LMEs) the California Current, Gulf of California, Gulf of Mexico, Pacific Central American Coastal, Caribbean Sea, Humboldt Current, Patagonian Shelf, South Brazil Shelf, East Brazil Shelf, and North Brazil Shelf are found along the coastlines of Latin America. Each one has distinctive qualities that make it distinctive and important to local populations. The goal of ecosystem-based management is to take the health and significance of ecosystems into account in all processes that contribute to the recovery and sustainability of LME goods and services. This chapter explains the concept of ecosystem-based management, describes certain products and services offered by large marine ecosystems, and paints a basic picture of the large marine ecosystem approach to sustainable development of coastal ocean resources in Latin America.

Keywords: Seafood; Coastal; Ecosystem; Populations; Marine

Introduction

Over 90% of all organisms on our planet are found in the oceans, which make up around three-quarters of the surface of the world. We have only lately started to pay attention to the ocean's importance, which sustains the great majority of species on Earth, billions of people worldwide, more than 90% of global trade, renewable energy like wind, wave, and tidal power, and a reserve for fossil fuels like oil. Even Nevertheless, the ocean is not impervious to human impact, which is substantial. Threats to the sustainability of coastal ocean ecosystems include overfishing, toxic pollution, invasive species, nutrient over-enrichment, habitat deterioration and destruction, biodiversity loss, dependency on its commodities and services by an increasing global population, and coastal development. A developing threat that may be more significant than global warming, pollution, and overfishing is ocean acidification [1].

Large Marine Ecosystems

The term "Large Marine Ecosystem" (LME) refers to expanses of ocean space that include coastal areas, including river basins, estuaries, the seaward edges of continental shelves, and the outer margins of the major current systems in the world. They are trophically dependent populations in rather wide regions with different hydrography, productivity, and bathymetry. Actually, there isn't one clear definition of ecosystem-based management that applies to all situations (also known as Ecosystem Approach or Holistic Management Approach). Scientists who are in charge of managing fisheries have used the idea of EBM, which they view as "a new direction for fishery management, basically reversing the order of management priorities to start with the ecosystem rather than the target species to sustain healthy marine ecosystems and the fisheries," according to Ecosystem Based Fisheries Management (EBFM) [2].

The advantages individuals receive from ecosystems are known as ecosystem services. These consist of provisioning services, like the supply of food and water, regulating services, like the prevention of floods and the control of diseases, cultural services, like the provision of spiritual, recreational, and cultural benefits, and supporting services, like the cycling of nutrients, which preserve the conditions necessary for life on Earth [3].

Revolution

The free-drifting creatures at the base of open ocean foodwebs are known as plankton. Coccolithophores and planktonic foraminifera are two significant clades of contemporary plankton that contain calcium carbonate shells, or "tests." The clade Haptophyta's principal producers, coccolithophores, make up the majority of the planktonic calcifying algae in today's oceans. Foraminifera, a clade in the superfamily Rhizaria, are mixotrophic to heterotrophic eukaryotes, and planktonic foraminifera are one of these groups. Despite being minuscule on their own, coccolithophores and planktonic foraminifera combined account for around half of the creation and burial of calcium carbonate in the world's oceans today, with reefs making up the majority of the remaining calcium carbonate. In these clades, planktonic calcification first appeared around 200 million years ago in the early Mesozoic, but it didn't become ecologically significant until the mid-Cretaceous, between 150 and 200 million years ago. Surprisingly late in the history of marine biomineralization, both of these developments took place [4].

In the Early Cambrian (around 520-540 million years ago), biomineralization spreads widely, and a variety of species independently acquired biomineralized skeletons, shells, or tests during this time. In contrast, marine plankton calcification just started to play a substantial role in ecosystem engineering some 350 million years ago. Pelagic calcification increased quickly during the Cretaceous and provided a second open ocean sink for calcium carbonate, stabilizing the carbonate cycle. This process is indicated by the species richness of planktonic foraminifera and calcareous nannoplankton (the group containing coccolithophores). Dinoflagellates, diatoms, and coccolithophores

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are examples of eukaryotic algae that have undergone evolutionary changes, which can be traced by the species richness of each group, respectively. These changes may have altered the size structure of open ocean foodwebs to include larger body sizes and increased energy transfer to higher trophic levels [5].

Evolution

One of three significant algae groups that gained ecological importance starting in the middle of the Mesozoic was the coccolithophores. These Mesozoic algal innovators, along with dinoflagellates and diatoms, are the main eukaryotic primary producers in a large portion of the current ocean. The two flagella that dinoflagellates possess one transverse and one longitudinal unify this varied group of marine eukaryotes, but they are otherwise surprisingly diversified and complicated. Numerous dinoflagellates are mixotrophic, which means they both photosynthesis and devour organic substances. The pelagic foodwebs underwent a Mesozoic revolution as a result of the Mesozoic development of these three key clades. Due to their faster growth rates and lower nutritional needs, tiny algae should typically outcompete giant algae given comparable losses (death and predation) [6].

Contextually speaking, however, dinoflagellates, diatoms, and coccolithophores all altered the game by increasing nutrient uptake in oligotrophic conditions through mixotrophy (dinoflagellates), having unusually high maximum growth rates for their size (diatoms, possibly because of the siliceous frustule), and minimizing losses to predation (diatoms and coccolithophores, via biomineralized shells). Large-bodied predators may have had significantly more energy available to them in the late Mesozoic due to changes in foodweb structure and independent evidence of increased nutrient delivery to Cretaceous oceans. The environmental and biological changes that occurred in the second part of the Cenozoic, or the last 34 million years, including the beginning of the polar glacial and the spread of productive pelagic ecosystems, are thought to have accelerated this trend. The growth of diatom-based food chains and numerous, large-bodied filter feeders, such as sharks and whales, which are so characteristic of our present oceans, were brought about by these late Cenozoic alterations [7].

Marine Revolution

The Mesozoic Marine Transformation, the defining revolution of the Mesozoic, took place (MMR). Famously, Geerat Vermeij noted the evidence for the evolution of shell-crushing feeders in a variety of groups, including crabs, stomatopods, lobsters, rays, and bony fishes. He also noted the marked diversification of anti-predatory defences in marine mollusks during the Mesozoic, including habitat and movement ecology. As a result, Vermeij characterized the MMR as an evolutionary arms race between predators and prey, in which diversification and innovation at one trophic level trigger retaliatory innovations at a lower level and vice versa. The foundational assumptions of this concept have been widely supported by evidence throughout the decades since Vermeij's seminal observations. Groups like crinoids also exhibit a move from largely sessile to mostly mobile life histories, a tendency seen across shelly marine invertebrates, in addition to the proliferation of anti-predatory defences in mollusks. The frequency of predation attempts in Mesozoic and younger fossils (drill holes/chips and repair scars), the proportion of marine predators across time, and the average energetics of marine animals have all been shown to rise as a result of subsequent research [8, 9].

Conclusion

Throughout the Mesozoic, a number of ecological and evolutionary revolutions remodelled marine environments into what we see today. The development of pelagic calcifiers altered the marine carbon cycle and made the ocean much more resistant to changes in the carbon cycle, such as acidification. A possible evolutionary arms race between marine predator and prey species may have been sparked by the advent of three key algal clades (coccolithophores, dinoflagellates, and diatoms). Whatever the reason, these directional changes in marine ecosystems over the past 300 million years have altered the sensitivity of marine chemistry to CO_2 swings, increased energy availability to the top of the foodweb, and tightened up the marine ecosystems' dynamics [10].

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Conflict of Interest

None

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