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ROLE OF MARINE PROTECTED AREAS IN MARINE BIORESOURCE CONSERVATION

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ABSTRACT

This paper deals with relationships between bioeconomics and marine protected areas. It outlines the importance of marine protected area, Indian marine protected areas, role of marine protected areas in protecting marine habitats and biodiversity and marine biodiversity consumers. This paper makes a special note on benefits of marine protected areas and research areas in marine protected areas. This paper concluded with some interesting findings along, with policy measures towards development of marine protected areas.

KEY WORDS: Bioeconomics, Marine protected area, Marine bio resource, Marine biodiversity

INTRODUCTION

Marine protected areas, are regions in which human activity has been placed under some restrictions in the interest of protecting the natural environment, its surrounding waters and the occupant ecosystems, and any cultural or historical resources that may require preservation or management. Marine protected area is an umbrella term for protected areas that includes some area of marine landscape and biodiversity. Each specific area still falls under the methods of categorization applied to protected areas which is a way of allotting the management tasks for regions which require will conservation of different scope and detail. The IUCN (2008) defines a marine protected area as; any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.

BIOECONOMICS AND MARINE PROTECTED AREA

Bio-economics is the study of biological and economic relationships. In the context of marine protected areas, it is a modelling

discipline that offers insights to: the costs to commercial fishermen in terms of closing off areas from harvesting; the economic value of subsequent increases in catch rates in areas adjacent to the protected areas the 'spillover' effect; the behaviour of fishermen following a marine closure and the effect of this spatial redistribution of fishing effort on economic benefits; and the beneficial effect of marine reserves to commercial fisheries as a buffer or hedge against uncertain environmental shocks.

Bioeconomics may be simply described as economics applied to human activities dealing with biological processes, such as forestry, farming, or fishing. Accordingly, a bioeconomic model is a simplified and formalized representation of interacting biological and economic processes. It is usually made up of three components: a biological component, describing the bioecological processes at work, a technical component, describing the way human activities interact with this processes, and an economic component, describing the results of these activities in terms of (market or non-market) costs and benefits, and the consequences of these results on human behaviors.

The increasing sophistication of bioeconomic modeling, marine economists are beginning to change their views on the value of marine protected areas as a fisheries management tool. Theoretical modeling has shown that due to the 'buffering effect' provided by marine reserves against environmental shocks and other forms of uncertainty, marine reserves can increase the cumulative harvest and generate positive economic payoffs.

IMPORTANCE OF MARINE PROTECTED AREA

Marine protected area is also defined geographical space, recognized, dedicated, and managed through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values". Marine protected environments are strong tools ensuring the environment and marine biodiversity.

Natural or historic marine bio resources are protected by local, state, territorial, native, regional, or national authorities and may differ substantially from nation to nation. This variation includes different limitations on development, fishing practices, fishing seasons and catch limits, moorings, bans on removing or disrupting marine life of any kind. As of 2014, the world hosted more than 6,500 marine protected areas, encompassing 2.09% of the world's oceans. The September 2014 expansion of the Pacific Remote Islands Marine National Monument in the territorial waters of the United States increased the world MPA coverage to over 2%, with only 0.83% in strongly protected no-take marine reserves. The study of marine resources comes under the bio economics.

Marine bioreserves help protect and preserve areas of our oceans that are rich in biodiversity, ecologically significant and vulnerable to destruction. These areas are closed to all extractive uses, such as fishing, mining, oil exploration, waste dumping etc. There is growing scientific evidence suggesting that large-scale networks of marine reserves are urgently needed to protect marine species and their habitats.

Marine bioreserves are not just about preserving fish stocks. They are an essential global tool to protect entire ecosystems. Marine reserves can help increase the planet's ability to adapt to the effects of climate change and carbon pollution. Coastal seas can also be protected with the help of marine reserves. Here, marine reserves can have 'core' zones, where no human activities are allowed. These

can be areas of scientific reference or areas having particularly sensitive habitats or species. Other areas may remain open to small-scale, sustainable, non-destructive fisheries. Marine biologists firmly believes that marine reserves must be declared only with the consent and participation of communities that stand to be affected by the reserve in question

MARINE PROTECTED AREAS IN INDIA

Table-1, List of Marine Protected Areas in peninsular India

S.no.	Name of MPA	State	Category	Area	Year of establishment
1.	Coringa	Andhra Pradesh	Sanctuary	235.7	1978
2.	Krishna	Andhra Pradesh	Sanctuary	194.81	1989
3.	Pulicat Lake	Andhra Pradesh	Sanctuary	500	1980
4.	Dadra & Nagar Haveli	Dadra & Nagar Haveli	Sanctuary	92.16	2000
5.	Fudam	Daman & Diu	Sanctuary	2.18	1991
6	Chorao Island	Goa	Sanctuary	1.78	1988
7.	Marine (Gulf of Kachchh)	Gujarat	National Park	162.89	1995
8.	Khijadia	Gujarat	Sanctuary	6.05	1981
9.	Marine (Gulf of Kachchh)	Gujarat	Sanctuary	295.03	1980
10.	Kadalundi Vallikkunnu Com R	Kerala	Community Reserve	1.50	2007
11.	Malvan Marine	Maharashtra	Sanctuary	29.12	1987
12.	Bhitarkanika	Odisha	National Park	145	1998
13.	Bhitarkanika	Odisha	Sanctuary	672	1975
14.	Chilka (Nalaban)	Odisha	Sanctuary	15.53	1987
15.	Gahirmatha	Odisha	Sanctuary	1435	1997
16.	Balukhand Konark	Odisha	Sanctuary	71.72	1984
17.	Gulf of Mannar Marine	Tamil Nadu	National Park	6.23	1980
18.	Point Calimere	Tamil Nadu	Sanctuary	172.6	1967
19.	Pulicat Lake	Tamil Nadu	Sanctuary	153.67	1980
20.	Sundarbans	West Bengal	National Park	1330.1	1984
21.	West Sundarbans	West Bengal	Sanctuary	556.45	2013
22.	Haliday Island	West Bengal	Sanctuary	5.95	1976
23.	Sajnakhali	West Bengal	Sanctuary	2091.12	1976
24.	Lothian Island	West Bengal	Sanctuary	38	1976

Source: ENVIS Centre on Wildlife & Protected Area, Government of India.

India has around 8,000 kms of coastline with two island systems, viz, the Andaman & Nicobar and Lakshadweep, and 2,305,143 Sq. Kms of Exclusive Economic Zone (EEZ). The marine and coastal environment of India harbours a host of resident and migratory wildlife. The important species found in the Indian waters include, Dugongs, Whales, Dolphins, Olive Ridley Turtles, a variety of fishes including the Whale Sharks & other sharks, Giant Gropers,, Sea cucumbers, horseshoe crabs, sea shells, soft & hard corals, etc. India has at present 5 designated Marine Protected Areas as follows: Gulf of Mannar National park, Tamil Nadu, Gulf of Kutch Marine National Park, Gujarat, Gulf of Kutch Marine Sanctuary, Gujarat, Mahatma Gandhi Marine National park, Andaman & Nicobar Islands and Gahirmatha Sanctuary, Orissa.

India has only five marine protected Areas. Comparing to the marine diversity, is it too less and there is a greater need to have more marine protected areas in the country with well-developed management plans, Since, most of the marine species are migratory and not confined to one area only, management plans have to be based on large areas, rather than confining them to a protected area.

The role of Marine protected areas in protecting marine habitats and biodiversity:-

Properly designed and managed marine protected areas play important roles in: conserving representative samples of biological diversity and associated ecosystems; protecting critical sites for reproduction and growth of species; protecting sites with minimal direct human impact to help them recover from other stresses such as increased ocean temperature; protecting settlement and growth areas for marine species so as to provide spill-over addition in adjacent areas; providing focal points for education about marine ecosystems and human interactions with them; providing sites for nature-based recreation and tourism; and providing undisturbed control or reference sites serving as a baseline for scientific research and for design and evaluation of management of other areas.

Marine Biodiversity Conservation;-

Some change to coastal and marine ecosystems happens on a time-scale that makes it hard to realize its nature, extent or magnitude. All too often the significance of biological diversity and ecosystem processes is only appreciated after they have been lost or damaged. Without measures such as marine protected areas and 'no-take' reserves, marine biodiversity is likely to be lost before we of know of its existence or importance for humanity, or how it should be managed for long-term sustainability. The most immediate benefits of marine protected areas are that they provide natural areas with lower human impacts. Most species and biological communities have evolved some capacity to survive or recover after periodic stresses such as high or low salinities, temperatures or severe storms.

Research into high temperature-induced coral bleaching suggests that corals from areas with low stress from human activities have a higher capacity to recover and are less likely to suffer or be killed by extreme coral bleaching. Maintaining representative samples of marine ecosystems in intact condition, aiming for them to be self-sustaining and able to adapt to incremental changes in ocean climate, is a prudent investment for the future. Maintaining a comprehensive gene pool of marine species, covering their natural ranges of populations and their functions, will help ensure the broadest possible variety of biodiversity options for the future.

Sinks and sources:-

The young life forms of coastal marine organisms have the potential to disperse from less than a metre up to hundreds, and in some species, thousands of kilometres, but their effective dispersal may be much less than this maximum potential distance. This is because it takes more than a single new recruit to recolonise an area and form a viable population. The effective dispersal distance of a marine species depends on where they are, the prevailing water currents, the time of year when spawning occurs, their ability to live without feeding, and their behavior in the water column some sink to the bottom where currents are weak, while others swim to the surface where currents may be stronger

Simulation models using observed and estimated dispersal distances suggest that, for the coasts of continents or large islands, reserves should be about 4–6 kilometres in size and located about 20 kilometres apart. Such reserves, it is suggested, would provide adequate insurance for populations of many common benthic marine species, although would not be adequate for larger mobile fish which may range across wider areas and need reserves of a different design. Reserves that provide insurance for fish stocks may require a larger

area than those strictly for conservation purposes alone, because of the need for higher levels of recruitment of the harvested species needed into other areas to support the fishery.

Repairing damage:-

Reserves with undisturbed marine biodiversity and ecosystems are particularly important in the search for effective methods to mitigate damage and restore damaged ecosystems. It is preferable and most cost-effective to prevent or minimise damage as far as possible, a range of restoration and rehabilitation techniques are being developed.The focus of restoration and rehabilitation needs to be on removing threats and accelerating natural recovery processes.

Marine Protected Areas Benefits:-

Marine protected areas with core 'no-take' reserves can play an important role in arresting and possibly reversing the global and local decline in fish populations and productivity. The global fish catch is reported to be in decline since the late 1980s. Indications of this decline include: fishing for smaller and lower-value species; having to fish further from home bases; and the destruction or degradation of fish habitats in coastal areas.

The effects of a declining fish catch fall disproportionately on poor coastal communities, as an estimated 94% of all fishers are subsistence fishers, producing nearly half of the world's fish for human consumption. In the face of increasing world population, reversing the decline and maintaining the high quality protein supply from the sea will require considerable improvement in the management of wild capture fisheries, aquaculture and the health of the ecosystems upon which they depend.

Throughout the world, marine protected areas have had remarkably similar effects. Protection from fishing simply allows exploited species to live longer, grow bigger and become more numerous. Industrial fishing usually reduces populations to only a handful of age classes, never allowing them to reach full maturity. This has happened to the northeast Atlantic cod stocks, for example. MPAs especially allow slow-maturing, long-lived species to develop natural age structures, thus increasing the number of large fertile animals that can yield more offspring. Such a population has a higher resilience when facing environmental disturbances.

It could be noted that without protected areas, fish stocks can collapse completely during periods when conditions are unfavorable for offspring survival - which makes it more difficult for them to recover when better times return.

There is a substantial weight of evidence in favour of the beneficial role of marine protected areas in a range of different types of fisheries, in different global localities, and within different fisheries management regimes. Marine protected areas on their own are not sufficient as a single management tool, except possibly in small-scale subsistence fisheries where other management systems may not be very effective. For fisheries, marine protected areas generally can be considered to provide four basic benefits: support for stock management, including: protection of specific life stages such as nursery grounds; protection of critical functions feeding grounds, spawning grounds; provision of spillover of an exploited species; and provision of dispersion centres for supply of larvae to a fishery improved socio-economic outcomes for local communities; support for fishery stability; and ecological offsets trade-off for ecosystem impacts; and better understanding of impacts and options.

Support for stock management:-

Traditionally marine protected areas and reserves including specific fisheries management measures such as closures and catch restrictions have benefited fisheries through stock enhancement and management. Protection of habitat is important to key life cycle stages including spawning, juvenile settlement, nursery grounds and major feeding grounds. Strategically located protected areas provide sites for settlement and early growth of juveniles which when mature, spill over into adjacent fished areas.

Support for fishery stability:-

Studies of marine protected areas with core 'no-take' reserves established in coastal and inland areas which have been overfished show a significantly improved fish catch and has led to sustained catch levels. While the benefits of marine protected areas for fisheries are generally understood, the value of marine ecosystem services, including waste assimilation, coastal protection, flood management and provision of critical environmental requirements for fished species, is often unrecognized. Marine protected areas can help to ensure continuity and future options for those benefits by protecting the health of marine ecosystems.

For example, the ecosystem services of coral reefs include shoreline protection, sediment production, and sediment retention. Figures for limestone production per square metre of healthy coral reef range from 0.8 to 8.9 kilograms per year. Fragments of calcium carbonate skeleton accumulate as sediments on the sheltered, low energy side of reefs. There they may foster the growth of mangrove forests and seagrass beds, which in turn also assist shoreline protection and produce ecosystem goods in the form of seafood products.

It may be possible to identify and value the current range of goods and services provided by a particular marine or coastal ecosystem, but little is known of what the ocean might provide in the future in the way of new products, new resources and new opportunities to create wealth. Keeping samples of the ocean ecosystems in their natural form is a prudent investment in the future.

The interactions in coastal and marine ecology are becoming clearer. It is now understood that the physical structure of coastal and marine habitats can play a crucial role as the spawning and nursery grounds supporting many fisheries. Similarly increasing understanding of the defence mechanisms of marine plants and animals is revealing an array of marine biochemical compounds, some of which have been identified as having value as sunscreens, anti-viral, anti-inflammatory or related medicinal applications. More recently the oceans have been found to support an entire set of ecosystems that are independent of carbon produced from the sun's energy the sulphur-based geothermal vent fauna where rare-earth minerals are also concentrated. Coastal and marine ecosystems contribute to beach and shoreline stability, assimilate and process wastes and contribute to the quality of life of coastal people. A wide range of goods and services can be provided by these ecosystems, many representing options for possible future uses and benefits.

Research in Marine Protected Areas:-

Research baselines or reference sites marine protected areas protecting representative samples of biodiversity provide broad benefits as sites for reference in long-term research. This may involve the understanding of marine ecosystems and ecosystem services, developing and evaluating techniques for sustainable management and

exploring options for new forms of use. The slow and incremental changes caused by human activities and natural events can be difficult to measure. Without reference sites the value of comparisons is limited. 'No-take' reserves provide a crucial means for establishing points of reference to assess human and other impacts on adjacent marine environments.

Research and Monitoring Tools:-

Sustainable use of marine resources requires detailed knowledge of the oceans' biodiversity. There has been a recent emphasis on developing more sophisticated tools for observing and measuring the physical, chemical and biological characteristics of the oceans. New initiatives in the past decade include high-resolution and multi-spectral satellites designed to measure ocean wave heights, currents and phytoplankton productivity; acoustic techniques for mapping of water column and seabed habitats; and video techniques for improved census of fish populations in continental shelf waters.

The development of much new ocean technology depends, to some extent, on the availability of areas where trials can be conducted free of interference from other users and impacts and where there are normal ocean biological conditions. This is especially true of the video and acoustic technologies, which require natural systems complete with typical levels of primary and secondary production, such as the natural levels of zooplankton and phytoplankton, in order to determine the effectiveness of the equipment across a range of biological conditions. Other technology that requires testing in natural conditions includes antifouling designs and treatments, fish-finding equipment, benthic ecosystems mapping, in water calibration for satellite-based ocean and marine weather observing systems. Near-pristine ecosystems allow the developers of new technology to assess the performance of such systems within ecosystems that are behaving 'normally'.

One of the major constraints on managing marine ecosystems is the lack of empirical observations and data on larger and mobile marine organisms in waters beyond comfortable scuba diving depths deeper than 10 metres. This is due to the increasing safety issues with scientific diving, the sheer extent of the area of marine habitats and the high cost of maintaining active teams of scientific divers. The recent development of remotely deployed video technology is likely to provide a major boost to the capture of knowledge in marine ecosystems. Deployment of remote video may be able to provide data across large areas and in deep water that are inaccessible to divers. However, the effectiveness of video as a sampling tool has to be tested, and this can only be effectively calibrated within highly protected areas where near-pristine conditions can be expected to prevail.

CONCLUSION

It could be seen clearly from the above discussion that the role of marine protected areas is very essential to protect the coastal bio resources. The sustainability of coastal bio resource depends on development protected area net work. The development of marine protected areas reduces over exploitation of endemic marine bio resources in general and protection of coastal coral reef diversity in particular. The government should concentrate on development of marine protected areas net work on the basis of number of threatened species and endangered species. The coastal zone regulations should be based on protection of discrimination utilization of marine bio resources. The essential development of marine protected areas depends on the following factors.

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