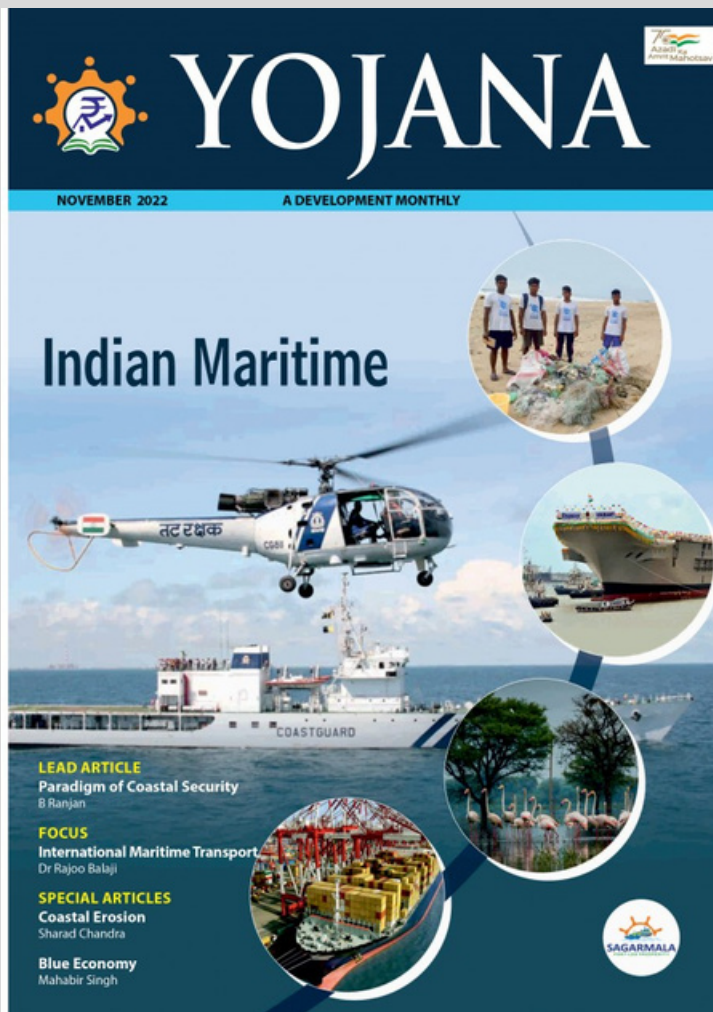


# YOJANA



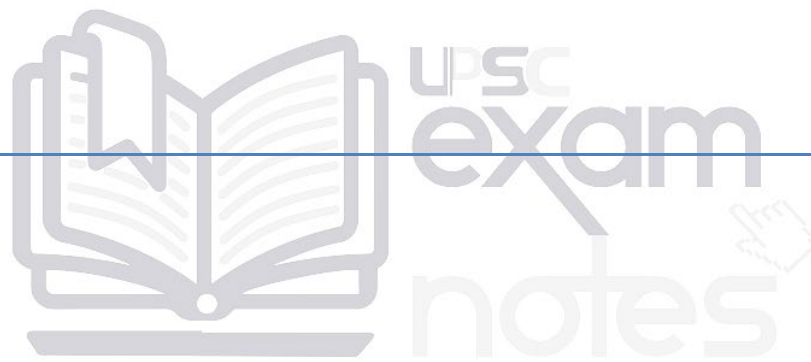
## NOVEMBER 2022

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## Table of Contents

Introduction .....	1
Land Based Sources.....	1
Ocean Based Sources .....	1
Micro Plastic Survey of India.....	1
Tamilnadu Coast .....	2
Biodiversity-Gulf of Mannar Biosphere .....	2
Abandoned, Lost or Discarded Fishing Gear (ALDFG).....	2
Micro plastics .....	2
Swachh Sagar, Surakshit Sagar.....	3
Discussion.....	3
History of coastal erosion in India.....	5
Causes of coastal erosion.....	5
Natural causes .....	6
Man induced erosion.....	6
Coastal Protection measures .....	7
Non-structural measures .....	7
Structural measures.....	8
Combination of Structural and Nonstructural measures .....	8
Maritime Governance and Blue Economy .....	9
Concept of Blue Economy .....	9
Importance of Blue Economy.....	10
India's Blue Economy .....	10
Ocean resources .....	10
Coastal Economy.....	11
Blue Revolution: Integrated development and Management of Fisheries .....	11
Maritime Security Strategy .....	12
Indian Coast Guard (ICG).....	13
Duties of ICG .....	13
Strait of Hormuz and the Strait of Malacca .....	14
Indian Coast .....	15

Threats Of climate Change.....	15
Steps Taken .....	19
Suggestions .....	20





# Marine Plastic Pollution

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## Introduction

Marine plastic pollution is a global menace. There is a need for regular and standardized monitoring of marine litter to understand long-term changes changes in marine litter pollution and for the successful development and implementation of mitigation strategies.

## Land Based Sources

Based on a fixed percentage of the mismanaged plastic waste entering the oceans (15% for the low-range estimates and 40% for the high-range estimates), they estimated that between 4.8 and 12.7x 10<sup>6</sup> t of plastic entered the global oceans.

## Ocean Based Sources

Plastic water can also enter the ocean directly from ocean-based sources such as the fishing industry, commercial and recreational shipping, and offshore platforms.

## Micro Plastic Survey of India

Under the Coastal Ocean Monitoring and prediction system (COMAPS) programme by ICMAM-PD now the nation center for Ocean Research of the Ministry of Earth Sciences, accumulation of marine debris was reported along the coast Great Nicobar Island, Andaman. This is the first Indian scientific publication and it is reported that 8% of the total solid waste produced in plastic waste and the top three cities that contribute most of pollution are Delhi, Kolkata and Ahmedabad. Plastic pollution in India increased by 39.7% and now stands at 9.46 million tonnes of plastic waste per year when five years ago it was 5.7 million tonnes per year. However 15% of the plastic waste produced is recycled in India and the rest is sent to landfills, incinerators or dumped into the oceans and rivers. Rivers contribute to about 67% of the total marine plastic debris in the World.

## **Tamilnadu Coast**

Tamilnadu coast has a long coast line but stands second in the plastic production in India and the plastic waste reaching through rivers and land run-off and ghost gear dumped cause serious problems to the flora and fauna as well as the livelihood of the fishing communities along the coast. The Government of Tamilnadu banned the usage of Thin plastic (Polymer of thickness below 40 microns). Thermocol (30.82%), Plastic bags (28.30%), Bottles and Caps (13.84%), straws (12.83%), and food wrappers (8.97%) comprises the majority of micro plastic debris.

## **Biodiversity-Gulf of Mannar Biosphere**

The Gulf of Mannar is an important biodiversity hotspot as it supports numerous marine ecosystems and provides a sense of economic security for Tamilnadu due to its fisheries resources. Anthropogenic influences on the environment leading to pollution and climate change are the major causes of biodiversity degradation worldwide.

## **Abandoned, Lost or Discarded Fishing Gear (ALDFG)**

Abandoned, Lost or Discarded Fishing Gear (ALDFG) is a serious problem worldwide as there is a lack of data. Most of these wastes are due to the shipping or fishing accidents, bad weather etc. and while most of the lost gears are retrieved by the fishers, the little that remains causes serious problems to the marine ecosystem. About 20% of all the plastic debris in the oceans is from ALDFG according to UNEP.

## **Micro plastics**

Plastics are made from non-renewable sources such as crude oil and hence they are hard to decompose as the polymers are bonded through covalent bonds, a strong bonding force. Micro plastics are about 5mm of diameter and are always disposed into the environment through anthropogenic sources. The majority of the plastic debris (~94%) in the Oceans disintegrates into micro plastic while the remaining 6% remains as micro plastic.

Micro plastics show a high affinity to other toxicants, making them more dangerous to the organisms ingesting them. Calculating the amount of micro plastic entering the ocean can be challenging as they are small and the rate at

which plastics degrade is unknown. Large discharge causes harm to the natural ecosystems and inevitably affects humans too.

Under the Marine plastics survey programme of NCCR, the distribution of micro plastics was studied in Coastal locations in the Bay of Bengal and Arabian Sea in particular along the international waters. The most dominant type of micro plastics found in the water column is microfiber/lines. The major types of polymers identified in the study are Polypropylene (PP), High-Density Polythene (HDPE), Low Density Polythene (LDPE) and Polyamide-6 (Nylon).

One of the main plastics, polyethylene terephthalate (PET) is found in clothes and when these clothes are washed small plastics known as Micro plastics are released.

### **Swachh Sagar, Surakshit Sagar**

Commemorating the 75<sup>th</sup> year of India's Independence, a coastal cleanup drive was carried out at 75 beaches across the country for 75 days over 7500 km long coastline. This unique first-ever national campaign culminated on "International Coastal Cleanup Day" on 17 September 2022. This drive was aimed to remove 1500 tonnes of garbage from the sea coast which will be a huge relief to marine life and the people staying in coastal areas.

### **Discussion**

The biodiversity of India is unique, and steps must be taken to ensure its safety. Plastic pollution is a concerning issue as consumption and discharge have increased but no steps have been taken by India to study, monitor and reduce plastic usage. While the petrochemical sector is the backbone of plastic production, it is also considered a yard stick for measuring global growth; where in plastic processing and production are of vital importance.

## **Coastal erosion**

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Coastal erosion is a wearing away and redistributing solid elements of the shoreline as well as sediment, normally such normal forces as waves, tidal and littoral currents, and deflation

The developmental activities have put tremendous pressure on coastal line and 20% of Indian population lives on that coastal lines

Industrial cities as well as thickly populated cities are coastal cities in India like Mumbai, Chennai, Vishakapattanam, Kolkata, and Kochi

The usual problems along Indian coast which needs to be intervened by engineering activities are

1. Silting up of entrance channels
2. Closing river mouth
3. Flooding during a storm surge
4. Sand bar formation near mouth, inlets, rivers, and estuaries, and erosion of the coast

A coastline is a complex series of interlinked physical systems in which offshore and onshore are involved

Erosion occurs when material being, for depositing somewhere else exceeds rate of supply finally resulting in the landward shifting of the shoreline

The coastal sediments, together with those arising from inland erosion and transported seaward by rivers are redistributed along the coast providing material for dunes, beaches, marshes, and reefs

Sand can be moved to another beach, to the deeper ocean bottom into an ocean trench, or onto the landslide of the dune

The removal of the sand from the sand sharing system can cause permanent changes in beach shape and structure

Waves are the main reason for coastal erosion, they form in the middle of the ocean and will reach the coast

Waves bring an enormous energy to the coast that is dissipated through the wavebreaking, generation of currents, water level changes and movement of sediments, turbulence and heat

Wave energy is the result of the three factors

1. The speed of the wind blowing over the surface of the sea



2. The length of the fetch (distance of the sea over which wind blowing)

3. The length of the time the wind has been blowing for

Incident waves vary spatially and temporally, with their properties changing with movement over the bottom

Waves are the major factor in determining the geometry and composition of the beaches. The action of waves dictates the process of removal and addition of material/ sediment on the coast

Accretion: Coastal sediments returns to the visible part of the coast by the process called accretion

The two processes of accretion and erosion play a major role in defining coastal geography

The shoreline changes induced by coastal erosion and accretion are natural processes that take place over period of time scale

### **History of coastal erosion in India**

Kerala is the state which is worst affected by coastal erosion in India, in the original assessment in 1960s, about 57% of the coastline was identified as vulnerable

Erosion of the coastal land in the state has been experienced for the long time, records shows first anti erosion works was done in the 19<sup>th</sup> century

According to the assessment made in 1980s, an 85% of the Kerala coastline was in the grip of erosion

Karnataka, Maharashtra also get affected badly by the coastal erosion

### **Causes of coastal erosion**

The shoreline or coastline, the boundary between land and sea, keeps on changing its shape and position continuously due to dynamic environmental activities

Developmental projects are made in coastal areas, placing great pressure on them, and leading to diverse coastal hazards like soil erosion, seawater intrusion, coral bleaching, shoreline change etc.

The causes of erosion is either natural or man-made, sometimes it is combination of both, natural and manmade factors. While combination of both is a relentless process that is often impossible to resist and the latter is often due to ill planned activities and certainly be contained or reversed

Coastal areas are given vital importance because people settlements have increased along coastal lines as well as development activities

### **Natural causes**

The natural factors influencing coastline erosion are winds, waves, tides, near-shore currents, storms, sea level rise etc.

The combined action of different processes on the coastline like waves and tides maintain the stability of the shoreline

Sediment supply to a section of beach is reduced to littoral drift/ sea level rise or constant impact of waves it can cause severe erosion

Increased gradient in transport rate in the direction of the net transport

Natural variation in the supply of sediments to the coastline from the river can affect the erosion of coastline

An increasing sea level will promote shoreline setbacks; this setback is higher in the littoral coasts consisting of finer sediments as compared to coasts consisting of coarser sediments

Subsidence is a regional phenomenon that lowers the surface area in the specific region

Catastrophic events like severe storms, tidal surges, and cyclones cause the sea level rise to abnormal heights and cause severe erosion

### **Man induced erosion**

Building houses through land reclamation or within sand dune areas has a long term impact on coastal processes and sediment stability

Harbours meant to provide safe mooring and navigation for the calling vessels, have shore perpendicular/inclined solid quays and breakwaters, which obstruct the long-shore transport of sand cause accretion on the up-drift side, and erosion down drift

Sand removal above replenishable quantities from the coast upsets the long shore sand transport budget and can result in erosion down drift

Groynes and jetties and other structures on the coast/ shoreline interfere with long-shore and sand transport and can result in erosion when these are ill designed , Groynes protect a part of the shoreline by blocking littoral transport through the accumulation of the littoral sediments on the upstream side of the groynes, This causes a deficit in the littoral drift budget and this has negative consequences on the downstream as the erosion problem shifts to the downstream areas

Structures like seawalls, bulkheads, breakwaters etc. have side effects in terms of erosion of adjacent areas

The mining of sand/ gravel along beaches and in the surf zone will cause erosion by depleting the shore of its sediment resources

The maintenance of dredging of harbours, navigational channels, and tidal inlets causes loss of sand from the littoral zone and the sand is dumped into the deep sea

Coral mining and other means of spoiling the protective coral reefs will also cause coastal erosion and beach degradation

Vegetation is important for maintaining/ improving the sediment slope stability and consolidating the sediments by trapping the sediments

### **Coastal Protection measures**

Coastal protection measures moderate the long-term average erosion rate of shoreline change from natural or manmade causes

Reduced erosion reciprocates the buffer (longer) zone between land and sea

Protection works to prevent erosion should be on a long term basis and must be planned to suit the particular site conditions on the basis of thorough field investigation and available data which require observations over an extended period of time

### **Non-structural measures**

Some measures are be called as a Soft solutions, some of these are

1. Artificial nourishment of beaches

2. Coastal vegetation such as mangrove and palm plantation
3. Sand bypassing at tidal inlets
4. Dune construction/rehabilitation

### **Structural measures**

The structural measures used for coastal erosion prevention include seawalls, revetment, off-shore, breakwaters and artificial headland

### **Combination of Structural and Nonstructural measures**

1. Combining beach nourishment with artificial headlands/groynes
2. Revegetation with temporary offshore breakwaters / artificial reefs is commonly used

## **Blue Economy**

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The ocean is one of Earth's most valuable natural resources. Mankind exploits the ocean to meet his energy, food, recreational, military and other needs.

Oceans are used for transportation-both travel and shipping. Today around 80 per cent of world trade is seaborne.

Among the world's oceanic divisions, the Indian Ocean is the third largest, covering an area of more than 70 million sq km that includes extensive Exclusive Economic Zones (EEZ) of different countries and large High seas.

The economic and sustainable development issues in the Indian Ocean rim are particularly challenging since a majority of littorals are developing countries.

These countries are home to one-third of the world's population that rely extensively on marine resources for livelihood and food security.

The sheer size of this population subjects the Indian Ocean's resources to pressures from pollution, habitat degradation and over-exploitation.

As the population of the region is projected to increase significantly in the coming decades its impact on food security and the economy from marine resources would become more substantial.

## Maritime Governance and Blue Economy

With its geographic and geostrategic position in and critical dependence on the Indian Ocean, India has been leading the Blue Economy discourse at the highest level of the Government, with a greater focus on the Indian Ocean region.

The essence of this approach was spelt out by Government for seeking **“Security and Growth for All in the Region” (SAGAR)**.

The Indian Ocean is vital to the economies, security, and livelihoods of its littoral states.

India is focusing on overall maritime governance including economies based on marine resources assured, advancing the blue economy through sustainable management and utilization of the ocean’s resources, food security and livelihoods for achieving Sustainable Development Goals.

The Current Governance Framework of Marine resource management in the Indian Ocean explores the challenges in Blue economy development to ensure sustainable development in the region.

Maritime security is essential to ensure a holistic approach toward the governance, use and maintenance of Oceans.

## Concept of Blue Economy

The Blue Economy encompasses a wide range of economic activities about the sustainable development of resources and assets in the oceans, related rivers, water bodies, and coastal regions in a manner that ensures equity, inclusion, innovation and modern technology.

Subtly distinguishable from the **“Ocean Economy”** in terms of nuance and emphasis, the blue economy is a newer and more contemporary term, popular with Small Island Developing States (SIDS) as well as international organisations, media, experts and governments in a growing number of countries.

The Blue Economy is viewed as an integral element of Sustainable Development Goals.

## **Importance of Blue Economy**

It would as Indian Ocean Rim Association (IORA) points out, “Contribute to food security, poverty alleviation, the mitigation of and resilience to the impacts of climate change, enhanced trade and investment, enhanced maritime connectivity, enhanced diversification, job creation and socio-economic growth”.

From the Business perspective, Blue Economy requires innovative and dynamic business models, forming business connections between India and other relevant countries, especially those located in the Indian Ocean region.

## **India's Blue Economy**

India's Blue Economy concept is multi-faceted and plays an important role in the country's economic growth because of its enormous maritime interests. It accounts for roughly 4 per cent of the GDP.

The sector has stood strong despite the challenges caused by the Covid-19 Pandemic and has recorded exports worth US\$ 7.2 billion between April 2021-February 2022.

## **Ocean resources**

Ocean resources, Physical infrastructure for maritime economic development, marine amenities and coastal management services are all part of the plan to ensure economic growth and sustainability, as well as national security.

Fisheries and minerals are the two most viable components of the blue economy in India.

The two mineral deposits of commercial significance to developers in the Indian Ocean are Polymetallic nodules, which are golf-to-tennis-ball-sized nodules containing nickel, cobalt, iron and manganese that grow over millions of years on the seafloor, are often discovered at 4-5 Kms in water depth.

In 1987, India was granted exclusive rights to explore polymetallic nodules in the Central Indian Ocean Basin.

It has explored four million square miles and established two mine locations since then.

## **Coastal Economy**

The Coastal Economy sustains over 4 million fishermen and coastal towns. India is the second largest fish-producing nation in the world and has a fleet of 2, 50, 000 fishing boats.

India comprises 200 ports of which 12 are major ports that handled 541.76 million tonnes in FY 2021, the highest being Mormugao Port located in Goa, which handled 62.6 per cent of the total traffic.

Shipping and shipbuilding are also important aspects of the blue economy in India.

The modal share of coastal shipping has the potential to increase to 33 per cent by 2035.

Most of the country's oil and gas are supplied by sea, leading to making the Indian Ocean region critical to India's economic growth. This reliance is expected to increase dramatically by 2025.

India has significant diplomatic interests in the Indo-Pacific and international commitments in the region under the UNCLOS, such as Search and Rescue, seabed mining and counter-piracy.

## **Blue Revolution: Integrated development and Management of Fisheries**

**Centrally Sponsored Scheme (CSS)** was established in 2015-16 with a five-year budget of Rs. 3, 000 crores.

**The Fisheries and Aquaculture Infrastructure Development Fund (FIDF)** was established in 2018-19 with a fund size of Rs. 7, 522. 48 crores to provide concessional credit to state / UT governments, their entities and the private sector to fill significant gaps in the fisheries infrastructure.

**Pradhan Mantri Matsya Sampada Yojana (PMMSY)** was launched in May 2020, with the highest investment of Rs. 20, 050 crores to bring about a Blue

Revolution through sustainable and responsible development of the country's fisheries sector.

## **Maritime Security Strategy**

India's maritime security strategy focuses on all aspects of the challenges including the ocean economy that are affecting the health and the future of oceans and countries.

As it combines the traditional and non-traditional security paradigms of maritime security, it provides a cohesive definition that is apt to address prevalent challenges such as environmental degradation, ocean trade security, migration, climate change, energy security, drug trafficking and privacy among other non-traditional challenges.

Climate change, environmental degradation, access to resources, expanding sea lanes, and the evolving international ocean regime highlight the need to focus on maritime security.

With nations committed to fulfilling the Sustainable Development Goals towards Blue Economy, the role of oceans in this is significant.

Addressing the strategic, environmental and ocean ecosystem challenges is one of the greatest challenges for India and the world.

Maritime security is an enabler of the Blue Economy, for example through safeguarding navigation routes, providing important oceanographic data to marine industries and protecting rights over valuable marine resources and activities within claimed zones of maritime jurisdiction.

The non-traditional security threats affect the military and strategy, policy, operations, training, capacity building and environmental protection.

The Security issues have also seen a transition as maritime security moved from military and traditional issues to non-traditional security threats.

Today, minerals are significant drivers of economic development. India and China are the most active nations in the Indian Ocean Region. China is already exploring minerals at the South-West Indian Border.

There are huge opportunities but uncertainty still looms over mineral exploration with the possibility of large-scale pollution.



There is a need to conduct further research to understand the impacts of deep-sea mining on the ocean ecosystem and ecology.

Unregulated and illegal fishing is another aspect that endangers the ocean ecology and while checks and balances have been established to address illegal, unreported and unregulated fishing (IUU), the current international law regime still lacks rigid barriers and stringent mechanisms to address the rising problem.

## **Indian Coast Guard (ICG)**

Indian coast Guard plays a far bigger role in averting major pollution incidents, anti-poaching and Search and Rescue, its importance as an essential actor in non-traditional security is well established.

The role of Indian Maritime Forces and the definitions of maritime security have changed especially in the Indian context, highlighting the myriad challenges and opportunities of the current maritime global order that would be faced by India in the coming decades while pursuing a Blue Economy.

### **Duties of ICG**

As India is all set to achieve the goals of the Blue Economy, the role of ICG becomes very crucial. The duties of ICG as enshrined align with the Blue economy vision of the Government.

Indian Coast Guard is one of the major maritime law enforcement agencies in the Indian Ocean Region.

India focuses on the development of sectors viz. fisheries, shipping, port and maritime logistics, marine coastal tourism and leisure, conventional minerals exploration and production and marine construction activities.

Other emerging sectors are renewable ocean offshore extraction of oil and gas in deep-sea and other extreme locations, seabed mining for metals and minerals, marine aquaculture, marine biotechnology, ocean monitoring, control and surveillance and education and research which can be harnessed to our advantage.

Indian Coast Guard is the Nation's premier maritime agency. They provide a broad array of services to protect people and the maritime environment.

The Indian Coast Guard has been carrying out duties such as oil spill response, helping mariners in distress at sea, warning vessels during bad weather offering

assistance during scientific experiments and augmenting the national defence resources.

## **Strait of Hormuz and the Strait of Malacca**

India has a 7517 km coastline, 1197 islands and an Exclusive Economic Zone (EEZ) spanning 2.01 million sq km, which is expected to go up to almost 3 million sq km after the delimitation of the continental shelf.

India is strategically located between two important choke points namely the Strait of Hormuz and the Strait of Malacca, through which most of the trade in commercial shipping moves in the Indian Ocean.

These straits and rime of the Indian Ocean are laced with a large number of countries from four continents-Asia, Africa, Australia and Antarctica.

It is a large mass of water that has deep-lying resources and dense traffic. The traffic of hazardous and noxious substances for industrial and energy purposes is constantly increasing.

Many of the nations in the rim have political problems and regional stability is therefore only transitory.

Privacy and other transnational crimes support militant activism and homemade insurgencies.



## Conclusion

In pursuit of the SDGs of Blue Economy, revolutions in maritime transportation and information systems, growth of ports and shipping, mineral research and exploitation, emerging threats to the marine environment and changing national security concerns will shape the course of the Nation.

With mindful responsibilities the ICG has charted its course and embarked on an ambitious plan to renew assets and increase capabilities, by matching its high-performing people with modern equipment and technologies, the Indian Coast Guard will remain always ready to meet the challenges ahead.

# INDIAN COASTAL COMMUNITY AND CLIMATE CHANGE

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## Indian Coast

The country has a total of 1382 offshore islands, comprising 514 islands along the mainland coast and 868 islands in the island territories (Andaman & Nicobar and Lakshadweep). Among the 1382 islands, 346 are inhabited.

- It is endowed with a wide range of abiotic and biotic resources which provide many demanding products.
- Important economic generation activities include fishing, salt production, agriculture, aquaculture, animal husbandry, energy, tourism small scale and major industries.

**Climate change** –it refers to long term shift in temperatures and weather patterns. National Environment Policy (2006), has indicated that in future sea level rise due to climate change may have major adverse impacts on the coastal environment.

## Threats Of climate Change

Climate change parameters such as sea level rise, increase in sea surface temperature, shoreline change and hazards such floods, cyclones, tsunamis,

storm surges, erosion and droughts are influencing livelihood of coastal communities.

**1. Sea Level Rise**-it is a major impact on coastal regions that cause a combination of risks of risks in retreat, submersion, erosion, and increased vulnerability to extreme marine events. Coastal communities and other stakeholders are impacted by loss of land, erosion, flooding, and saltwater intrusion in coastal aquifers. This leads to the squeezing of settlements, reduction of common property lands, inland movement of coastal habitats, and submergence of construction, roads, buildings, and other infrastructures in the coastal areas.

SLR is a predicted consequence of climate change however; regional variations due to local subsidence, tectonic upliftment and ocean currents similar to the El Nino shall differentiate the rate of local level SLR.

SLR Affects -

The consequences of SLR cause changes in livelihood dependency, ecosystem degradation, reduction in potable water, an increase in hazards, and health ailments, a rise in homelessness and poverty, involuntary migrations, loss of employment, and an increase in debt. It also increases conflicts, criminal cases, delinquencies, and inequality and pave way for human right violations among the coastal communities.

**2. Increased Sea Surface Temperature (SST)** -Sea surface temperature (SST) is the water temperature close to the ocean's surface. As greenhouse gases trap energy from the sun, the oceans absorb heat, resulting in an increase in SST. Changes in ocean temperatures and currents increase SST and lead to alterations in climate patterns around the world.

SST Affects - SST affects fish migrations, fish physiology, fish breeding, fish recruitment, and habitat loss. An increase in SST enhances ocean acidification, salinity, and longshore current patterns that influence the primary production and fish stock in the sea. Due to changes in the SST, several species have disappeared or migrated to other regions.

Change of SST not only affects fish stock and biomass but also influences cyclogenesis (development or strengthening of cyclonic circulation in the atmosphere), as the warm waters could transform tropical disturbances into cyclones. Tropical disturbances normally become cyclones if the SST is more

than 26°C. As the SST increases, the saturation vapor pressure increases. The water vapor associated with the latent heat of water increases the frequency and intensifies cyclones in coastal areas that affect coastal communities' lives and livelihoods in India.

**3. Shoreline Change (SLC)** - The wave energy closer to the shore leads to an increase in shoreline changes in soft rocks and beaches. Based on the results of trend analysis, the coastal stretches of India have been classified as stable, accreting, low erosion, medium erosion, and high erosion coasts. Accordingly, the high erosion (HER) site is where the erosion is higher than -5m/yr, and medium erosion (MER) is between -2m/yr. and -5m/yr and low erosion (LER) coast if it ranges from -0.5m/yr to -2m/yr. Stable coast (ST) is where the erosion or accretion rate is within the range of -0.5m/yr to + 0.5m/yr.

Shoreline Affects-

Shoreline changes cause social and economical effects on livelihoods, property, recreation and tourism, ecosystem services, resilience, and vulnerability.

**4. Saltwater Intrusion**- Seawater intrusion problem takes place in the dug wells and bore wells of households and enterprises which are close to the shore, during the summer months. The primary data of the coastal villages in coastal districts indicate that there are saltwater intrusions in near-shore freshwater sources during the summer season as most people use bore wells and municipal water for drinking and other domestic purposes.

In addition, overharvesting of water from coastal aquifers, SLR by variations in atmospheric pressures, expansion of summer, and melting of ice sheets and glaciers impose additional saline water intrusion

Saltwater Intrusion Affect –

Saltwater intrusion affects the productivity of horticulture and livestock. Reduction in income and expenditure for potable water reduces the savings of indigenous communities and increases their debt.

## **5. Drought**

Climate change parameters also increase drought conditions in coastal areas.

Drought Affects-

Drought affects the coastal village through prolonged shortages in the water supply on the surface and groundwater. An increase in water demand for drinking, domestic purposes, and agricultural and industrial usage are the major consequences of drought. Horticulture crops including coastal plantations and livestock of coastal communities face major problems during drought. During the drought season, coastal communities experience skin allergies and heat-related diseases.

## **6. Reduction in capture fishery**

Climate change impacts the productivity of marine fisheries due to the increase of SST, changing current patterns, and upwelling affecting fish biology, especially reproductive biology, alteration of habitat, and migratory routes

It is difficult to detect the impacts of climate change on the distribution and diversity of fish populations though there are some indications such as the shift in Indian oil sardine shoals. Due to the colder temperature and timely intense up-welling leading to nutrient enrichment in the surface waters in the west coast of India. However, long-term data on capture fisheries inferred that the reduction in fish catches is not by overfishing alone but by a combination of fishing and climate change parameters

Affects –

Fishery is the source of income, source of protein, vitamins, and micronutrients for the coastal community. A decrease in capture fishery influences in per capita income, revenues, wealth, and socio-economic status of the fishing community

Additional catch/ effort to increase the fish catch shall reduce income and create competition between fishermen and neighbouring fishing villages. However, conflicts in fish catch, an increase in poverty, migration of fishermen, shifting of occupation, and an increase in inequality are the consequences on fishing communities.

## **7. Frequency of cyclones and floods**

During the 21st century, there has been an increase in the occurrence and severity of flood hazards in India. The trend of intense and extreme precipitation events is serious for potential future flood extent

Affects -

Cyclones and floods cause casualties, and injuries besides the devastation of coastal infrastructures, road networks, schools, cyclone centres, health centres, houses, and, other common properties which are livelihood capitals and assets of coastal communities. In addition, health hazards due to injuries and epidemics enumerate as common problems due to floods, storms, and cyclones

### Steps Taken

1. The Coastal Regulation Zone Notification (2019) under Environment Protection Act 1986 implemented by MOEF&CC directs to clear the developmental projects in the coastal areas after considering the disaster risks including climate change risks such as SLR and other natural disasters. It is one of the primary factors to drive the historical shoreline changes and wave climate changes that engulf land masses with the economically potential physical infrastructures significant to the coastal communities, environmental features, and potential land masses.

2. To protect the life and livelihoods of coastal communities, MoEF&CC through the Survey of India and the National Centre for Sustainable Coastal Management (NCSCM) has prepared the Hazard Line (HL) map. The HL is demarcated taking into consideration of possible tides, waves (water level fluctuation), sea level rise, and coastline modifications in the coastal areas of India.

The HL is a 100 yrs return interval of dangers by natural events such as cyclones, floods, storms, waves and shoreline changes, and sea level rise due to global climate change. The hazard line has been suggested as a tool for the disaster management plan for the coastal environment, including planning of adaptive and mitigation measures to reduce the vulnerability of the coastal communities and ensuring sustainable livelihood (CRZ 2019).

3. National Disaster Management Authority (NDMA) and the India Meteorological Department (IMD) Government of India have prepared a Hazard Profile Map (HPM) of India (Cyclone), where the cyclone, storm, and flood-prone districts have been classified as Not Affected (NA), Moderate Affected (MA), High Affected (HA) and Very High Affected (VHA). This HPM helps to determine the vulnerability status of a particular area.

## Suggestions

1. Artificial Coasts-Construction of seawalls, groynes, training walls, breakwaters, and other protection structures on the shores to reduce the impacts of SLR, wave action, and erosion are classified as artificial coasts (AC). This will help to reduce impact.
2. Raising the groundwater table in the fishing village using suitable methods may be one way of mitigating intrusion of saltwater in coastal stretches.
3. Using RS and GIS data, susceptible agriculture and horticulture plantations affected by the drought can be identified.
4. To tackle climate change risks; prioritization of problems due to climate change based on the risk and vulnerability using the Livelihood Vulnerability Index shall support identifying the location-specific problems to mitigate climate change risks.
5. Coastal habitats shall be demarcated and suitable locations for shelter during the flood which are the high elevated areas along the coasts shall be identified. In the potential saltwater intrusion areas and drought-prone areas, sites for water tanks in the coastal habitats to mitigate the water scarcity problems due to climate change shall be constructed
6. Research and Development on coastal climate change should be conducted with regular finance.
7. To maintain the fish stock in the coastal zone, fish stock trends and assessments shall be conducted to develop policies and schemes to replenish the economically important fishery resources with the involvement of local stakeholders. To reduce captured fishery demand from the natural coastal environment, near shore cage culture, aquaculture, and mariculture activities shall be encouraged with the participation of local communities under Public Private Partnership (PPP) mode.
8. The codes for the construction of buildings and infrastructure in cyclone-prone areas for disaster preparedness to mitigate climate change impacts should be incorporated into the building plans
9. Creating awareness and mock drills on natural disaster through the district disaster management plan, Panchayat plans, and Hazard line map by the district disaster management authority would keep the coastal community prepared.



**For Mains:**

- 1. Discuss the significant steps taken by India to promote Blue Economy (250 Words)**
- 2. What is Blue Economy and suggest what needs to be done to harness the available potential (250 words)**
- 3. National Environment Policy (2006), has indicated that in future sea level rise due to climate change may have major adverse impacts on the coastal environment (250 words)**
- 4. Kerala is the state which is worst affected by coastal erosion in India. Discuss the causes of Coastal erosion (250 words)**
- 5. Marine plastic pollution is a global menace. Comment (250 words)**

**For Prelims:**

1. Which of the following is/are the union territories shares coastal boundary in the country?

1. Daman & Diu
2. Pondicherry
3. Andaman and Nicobar Islands
4. Lakshadweep Islands

A. 1, 2 and 3      B. 2, 3 and 4      C. 1, 3 and 4      D. 1, 2, 3 and 4

2. Arrange the following states in the descending order based on their share on coastal line length?

1. Tamil Nadu
2. Gujarat
3. Andhra Pradesh
4. Kerala

A. 2, 3, 1 and 4      B. 2, 1, 3 and 4      C. 2, 3, 4 and 1      D. 2, 3, 1 and 4

3. Consider the following statements

1. At present there are 12 major and 238 non-major ports are functioning in India
2. There are nine states, four UT and 1295 islands spread along the coast of India.

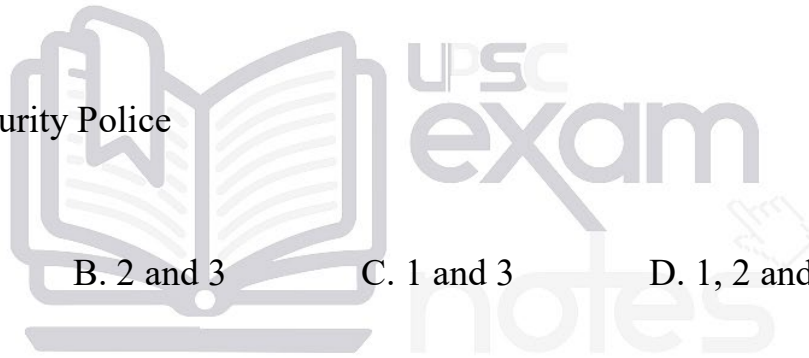
Which of the above mentioned statement/s is/are true?

- A. 1 only      B. 2 only      C. Both 1 and 2      D. neither 1 nor 2

4. Which of the following is/are the stakeholders in ocean governance?

1. Fisheries
2. Coastal Security Police
3. Customs

- A. 1 and 2      B. 2 and 3      C. 1 and 3      D. 1, 2 and 3



5. Consider the following statements

1. Coastal Security Exercise “Sagar Kavach” is conducted annually for each coastal state.
2. More than 200 coastal police stations along with patrol boats have been established in the coastal states.

Which of the above mentioned statements is/are false?

- A. 1 only      B. 2 only      C. Both 1 and 2      D. neither 1 nor 2

### **Prrelims Question key**

1. Answer: D

Daman & Diu

Pondicherry

Andaman and Nicobar Islands

Lakshadweep Islands

2. Answer: A

Gujarat, Andhra Pradesh, Tamil Nadu and Kerala

3. Answer: B

At present there are 12 major and 239 non-major ports are functioning in India.

4. Answer: B

Several agencies include Indian Coast Guard, Indian Navy, Coast Security Police, Customs, Fisheries, Port Authorities, Intelligence Agencies and other Central and state departments are the stakeholders in ocean governance.

5. Answer: A

Coastal Security Exercise “Sagar Kavach” is conducted bi-annually for each coastal state.



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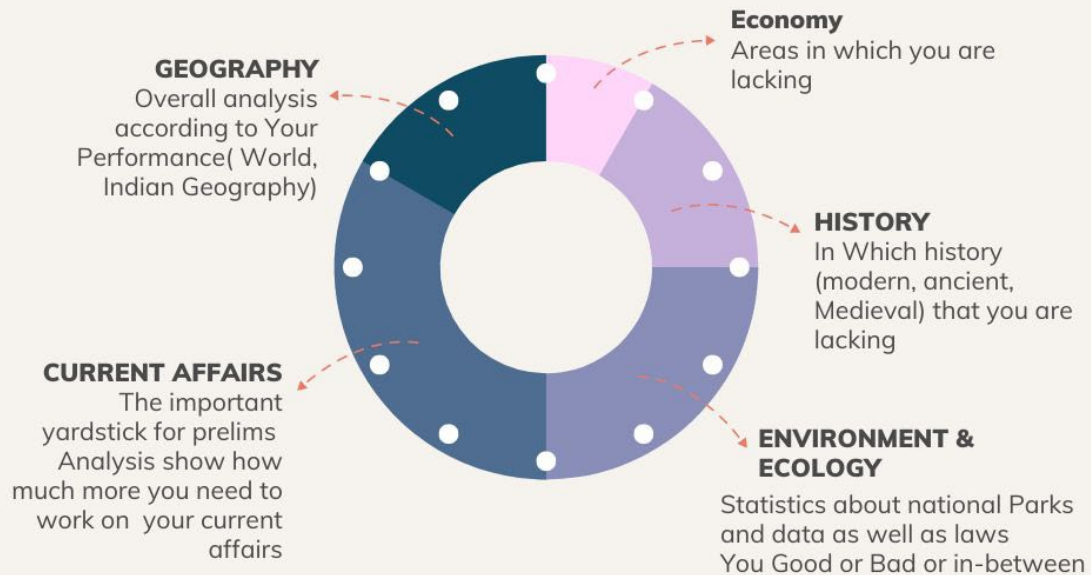
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