Yojana Summary

INDIAN MARITIME

NOVEMBER 2022

PARADIGM OF COASTAL SECURITY

Need for Coastal Security

- In 1993 Mumbai blasts, it was established that the explosives used were smuggled through the sea route. It was then that the need for a Coastal Security mechanism emerged.

- The impetus for an institutionalised framework was accorded by the **Group of Ministers Recommendations after the Kargil War**.

- However, the coastal security construct, framework and mechanism took a paradigm shift after the 26/11 Mumbai terror attacks.

- In the Indian context, three out of four metro cities are located on the coast. About 14.2% of the population in India lives in coastal districts. Around 95% of India's trade by volume and 68% by value is conducted through these waters, with priority being accorded to port-led development plans in recent years.

- The offshore development areas are critical for securing India's energy needs, and we have one of the largest fishing fleets globally.

- There are nine Coastal States, four UTs and 1295 islands spread along the coast of India which host major commercial cities, and significant strategic and vital installations of Defence, Atomic Energy, Petroleum, and private ventures besides 12 major ports and more than 239 non-major ports, thus increasing the coastline's vulnerability.

- The **geostrategic location of the Indian** peninsula poses typical oceanic challenges owing to:
  - ✓ proximity to major international shipping lanes,
  - ✓ inimical neighbourhood-sponsored cross-border terrorism,
  - ✓ transnational maritime crimes like narcotics and weapon trafficking, human trafficking etc.
- With the focus on **promoting the blue economy**, oceanic traffic is expected to increase further.

Agencies involved in providing coastal security

- Several agencies, which include Indian Coast Guard, Indian Navy, Coastal Security Police, Customs, Fisheries, Port Authorities, Intelligence Agencies, and other Central and State Departments, are the stakeholders in ocean governance.

- **Indian Coast Guard** is additionally responsible for coastal security in territorial waters, including areas to be patrolled by Coastal Police.

- Te Director General Indian Coast Guard is designated as Commander Coastal Command with responsibility for overall coordination between various agencies.

Steps taken to improve the security along coastal areas

- Standard Operating Procedures (SOPs) for Coastal Security were promulgated to ensure a high degree of preparedness.

- **Coastal Security Exercise 'Sagar Kavach'** is conducted bi-annually for each coastal state. Focus has been given on the infrastructure and asset creation.
  - ✓ More than 200 Coastal Police Stations along with patrol boats have been established.
- Further, measures such as coastal mapping, strengthening of security at non-major ports, setting up of **State Maritime Boards** by coastal States, and biometric identity cards for fishermen have also been implemented.

- The integration of technology with surveillance methodology has been achieved by establishing **Coastal Surveillance Network** (CSN) for seaward electronic surveillance up to 25 NM from the coast.

- **Joint Coastal Patrol** (JCP) by Indian Coast Guard and Coastal Police has been instituted.

- The apex level monitoring and review of the implementation of measures for enhancing the effectiveness of the Coastal Security Framework are done by the **National Committee on Strengthening of Maritime and Coastal Security against threats from the sea (NCSMCS), Multi-Agency Maritime Security Group (MAMSG) under NSA**.

Security beyond territorial water

- On average, 45-50 Indian Coast Guard ships and 10-12 aircraft are deployed daily for surveillance of EEZ of India. The Indian Coast Guard ships and aircraft provide the essential deterrence and ensure the security of maritime zones of India.

- The critical issues as challenges for coastal security and, in turn, safety for vessels ranging from small country craft to Ultra Large Crude carriers are primarily embedded in the legal regime of **United Nations Conventions for Laws of the Seas** (UNCLOS) and its adoption under various other applicable national acts and the rules thereof.

Conclusion

- Coastal security is the maintenance of "Law and Order" close to the coast, and a subset of ocean governance for maintaining good order at sea.

- Over the past four decades, the service has evolved as a multi-mission formidable force performing diverse and concurrent operations to protect the maritime interests of our Nation.

INTERNATIONAL MARITIME TRANSPORT

- Today, transportation is ubiquitous globally, but water transport, especially through the oceans and seas has been a major contributor to the planet's progress.

- As industrialisation and international trade expanded, countries increasingly invested in seaports, airports, produced storage, and large ocean-going ships.

Status and Challenges

- A major disruption in the sector was caused by the **pandemic pause**. Prior to and during these periods**, decarbonisation had been the major challenge**. Shipping costs, fuel costs, freight and logistics costs had increased.

- Economies in transition have been the most affected. But if cargo loaded during this phase is considered, developing countries especially in Asia continue to be on top.

- One of the trends for analysis is the size of vessels. The preference to large container carrying capacity may be attributed to the companies sighting economies of scale.

- However, given the experience of the ship, *'Ever Given'*, which grounded and caused the blockage of the Suez Canal in March 2021, this trend might slow down.
  - ✓ About 10% of the world's shipping transits through this waterway. The gravity of such risks entailing high salvage/insurance costs has caused a relook at this of big builds.
  - ✓ While large petroleum tankers can be tied to buoy moorings well away from the ports (eliminating the need for large berthing facilities inside the port), large container ships require deeper ports and larger berths.

- Crew care will be a crucial area on the human resources front. Timely wages vaccinations, free and preferential passage (seafarer as an essential worker) etc., will be in the fleet managers' perspectives.

- A challenge in perpetuity that maritime transport faces is the regulatory maze due to multiple regulations. The greatest challenge will <u>however be the efforts towards decarbonisation</u>.

Post-Pandemic Trade Climate

- In the post-pandemic periods, the effect of <u>uncertainties centring around Covid-19, transport costs, supply chain globalisation patterns disruption, and port congestion</u> persist.

- Of these, though the Covid-19 infections have shown diminishing trends, there are other threats (monkeypox), which may slow down the progress.

- **Geopolitical factors** of the <u>Russia- Ukraine conflict and the China-Taiwan tensions</u> also add up to the diminishing growth.

Opportunities for Improvement

- Globalisation is now well embedded in India's growth plans. The Chabahar port (Iran), the management of petroleum requirements under changing geopolitical scenarios, trade equations with China along with persisting border tensions, the opening up of inland waterways etc., all stand as evidence. However, following are some challenges:

- **Structure favourable tax regimes and incentivising shipping**: India is placed 35th amongst 46 countries in the PRIME (Protectionism in Maritime Economies) index, implying a high level of protectionism.

- **Low tonnage and dependence foreign vessels for overseas on trade**: This is largely attributed to the poor vessel turnaround and ageing Indian fleet.

  - ✓ This causes a bleed of foreign exchange also. Another factor affecting this is the **port calling costs in India**, which had generally been higher by 3 to 5 times the costs in neighbouring ports, and high logistics costs.
  - ✓ <u>Improved hinterland connectivity, easing port congestion and investment in infrastructure etc., can help with in fighting these challenges.</u>

- **Lack of focussed attention on core and areas of concern**: India has about 32 yards with the capacity to build ships but the major share of shipbuilding is held by the public sector yards.

  - ✓ **On the ship repair front**, India is yet to exploit its proximity advantage (geographic location on the international trade routes). The southern Vizhinjam port initiative faces local resistance, financing issues, etc.
  - ✓ **On the recycling front**, while the global market is between USD10-12 billion, India's share is around USD100 million only.

- **Development delays in Ports Sector** (Inland waterways, Sagarmala projects etc.)

- **Manpower:** India has 12 major ports, 200 minor ports spotting 7157 km of coastline. Though India stays in the top seafarer supplying nations, lesser attraction to sea career amongst youth has dented the and the quality of the workforce. This is a matter of concern.

Maritime India Vision 2030 (MIV 2030)

- Significant initiatives have been envisaged under MOV 2030. This includes:

  - ✓ **Ports** (> 55 initiatives) – Improve infrastructure; Smart Port Concepts; Reduce logistics costs; Institutional, Regulatory & Legislative Reforms.
  - ✓ **Shipping** (>70 initiatives) – Ship building, Ship repair, Ship Recycling (Atmanirbhar); Reform Shipping Policy; Cruise Hubs (Ocean, Coastal, Islands)

- ✓ **Waterways** (>20 initiatives) – Promote Cargo movement (Improve regional connectivity, multi-modality & coastal integration); River Cruise tourism; Urban Water Transport

- In addition, <u>National Logistics Portal and non-core asset monetisation</u> also are among the initiatives.

- **The Indian Ports Bill**, is one developmental initiative. This is expected to redefine the Centre-State model for better transparency and to foster growth.

- The latest announcement of the **National Logistics Policy** to be implemented through a comprehensive plan is expected to bring the logistics costs down among many other intended benefits.

COASTAL EROSION

Coastal Erosion is wearing away and redistributing solid elements of the shoreline as well as sediment, normally by such natural forces as waves, tidal and littoral currents, and deflation. The causes of erosion are either natural or man-made. Sometimes, it is a combination of both.

History of Coastal Erosion in India

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

- An assessment made in the late 1980s indicated that almost 85% length of Kerala's coastline was in the grip of erosion. Later, it was found that Karnataka and Maharashtra were also affected badly by sea erosion.

Causes of Coastal Erosion

- The causes of erosion are either natural or man- made. Sometimes, it is a combination of both natural and man-made factors.

- While the former is a relentless process is often impossible to resist, the latter is often due to ill-planned activities and can certainly be contained, or even reversed.

- The effects of climate change, sea-level rise and other long-term causes of erosion are still unaccounted for.

- **Natural Causes**

  - ✓ Natural factors influencing coastal erosion are <u>waves, winds, tides, near-shore currents, storms, sea level rise</u>, etc. The combined action of different processes on the coastline like waves and tides maintains the stability of the shoreline.

  - ✓ Another major factor promoting **coastal erosion is the sea level rise**. 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.

  - ✓ Another factor is the **phenomenon of subsidence**. Subsidence is a regional phenomenon that lowers the surface area in a specific region. It impacts the coastline in a way similar to sea level rise, however, the rate may vary as per the factor causing this subsidence.

  - ✓ Also, **catastrophic events** like severe storms, tidal surges, and cyclones cause the sea level to rise to abnormal heights and cause severe erosion.

- **Man-induced erosion**

  - ✓ Human activity may be enumerated as Coastal defence structures, river regulation works, dredging aggregate extraction/ sand mining, oil/gas exploration and ports/harbours that impact sediment transport.

  - ✓ Other activities responsible for beach erosion are:
    - o **Building houses** via land reclamation or within sand dune areas

- o **Sand removal above replenishable quantities** from the coast upsets the longshore sand transport budget and can result in erosion down drift.

- o **Structure**s like seawalls, bulkheads, etc. have side effects in terms of erosion of adjacent areas.

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

- o The **removal of dune vegetation and mangroves** due to man interventions causes exposure of the low-energy shorelines to the increased energy and reduced sediment stability.

Climate Change and Coastal Erosion

- The phenomenon of Climate Change has recently emerged as an important determinant in the coastal environment. Coasts are sensitive to sea level rise, changes in the frequency and intensity of storms, increases in precipitation, and warmer ocean temperatures.

- In addition, rising atmospheric concentrations of carbon dioxide (CO2) are causing the oceans to absorb more of the gas and become more acidic.

- This rising acidity can have significant impacts on coastal and marine ecosystems. The low-lying areas along the coast are likely to be prone to salinisation due to seawater intrusion (surface and ground).

Coastal Protection Measures

- Protection of the coastline from erosion is provided by nature in the form of a stable beach, capable of dissipating incident wave energy. Nature's coastal protection is also demonstrated at the headlands, reefs, shores dunes, etc.

- The measures to control erosion include non-structural and structural or their combination.

- **Non-structural Measures**

  - ✓ The Non-structural measures aim at the dissipation of the wave energy by mirroring the natural forces and maintaining the natural topography of the coast. These measures are also **called soft solutions**. Some of these are:
    - o Artificial nourishment of beaches

    - o Coastal vegetation such as mangrove and palm plantation

    - o Sand bypassing at tidal inlets

    - o Dune reconstruction/rehabilitation

  - ✓ **These measures have limitations**. While artificial nourishment of beaches is complicated and costly - mangrove plantation is possible only in marshy land and in semi-tropical or tropical conditions.

- **Structural Measures**

  - ✓ The structural measures, also known as the hard structural/engineering measures use physical structures constructed near the coast to prevent or restrict water from reaching the potential damage areas.

- **Combination of the Structural and Measures**

  - ✓ The hard solutions offer a wide variety of disadvantages like causing erosion and unnecessary accretion at various points, being expensive, and also, at times, spoiling the economic value of the site by making it look less beautiful.

  - ✓ In terms of the soft solutions, it may be noted that these are not quick-fix solutions and they take time to be effective and these are effective only in a medium to long-term perspective.

  - ✓ Hence, many combinations of soft and hard solutions can be selected.

Shoreline Change Atlas of Indian Coast

- Coastal Protection and Development Advisory Committee (CPDAC) recommended the need for preparation of a **Coastal Atlas** showing information related to coastal erosion derived from satellite data and protection measures undertaken by all maritime states of India.

- Accordingly, a project entitled, "**Shoreline Change Atlas of the Indian Coast**", was initiated by Space Applications Centre (ISRO), Ahmedabad, in collaboration with Central Water Commission.

MARINE PLASTIC POLLUTION

- Every year, humans produce 300 million tonnes of plastic waste including 11 million tonnes of plastic waste that eventually wind up in the ocean. In fact, **by 2050, there could be more plastics than fish in the ocean**.

- Most plastics never disappear instead, it becomes smaller, with particles being swallowed by fish and eventually consumed by Humans in their food and tap water.

Sources of Marine Plastic Pollution

- **Land-based sources** - plastic waste entered the ocean from coastal populations living within 50 km of the coastline.

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

Marine Plastics Survey in India

- Under the **Coastal Ocean Monitoring and Prediction System** (COMAPS) programme by the National Centre for Ocean Research of the Ministry of Earth Sciences, accumulation of marine debris was reported along the coast of Great Nicobar Island, Andaman.

- It is reported that 8% of the total solid waste produced is plastic waste and the top three cities that contribute most to pollution are Delhi, Kolkata, and Ahmedabad.

- Plastic production 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.

> **Gulf of Mannar Biosphere**
>
> - It is situated in Tamil Nadu and extends from Rameswaram to Kanyakumari.
> - **Horst- Graben structure**, the prevalence of monsoon, two courses of drift in water currents, **Cenozoic sedimentary functions** and riverine processes make the Gulf of Mannar biosphere ideal for a lot of marine biota and stable marine ecosystems.

- However only 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.

- 0.6 million tonnes of plastic waste end up in oceans from India alone via rivers, surface run-off etc. The Ganges discharges about 105000 tonnes of plastic waste into the Bay of Bengal every year.

Challenges

- Abandoned, Lost, or Discarded Fishing Gear (ALDFG) is a serious problem worldwide. Most of these wastes are due to shipping or fishing accidents, bad weather, etc.

- While most of the lost gears are retrieved by the fishers, the little that remains causes serious problems to the marine ecosystems. A lot of species are killed by these wastes, and since they do not decompose easily, they keep killing various organisms throughout their lifetime.

- About 20% of all the plastic debris in the oceans is from ALDFG according to UNEP.

- **Microplastics**

  ✓ Microplastic is about 5mm in diameter and is always disposed into the environment through anthropogenic sources.

  ✓ They are particularly hard to locate, track and study as they are smaller. Another major issue with microplastics is that they <u>show a high affinity to other toxicants, making them more dangerous to the ingesting them</u>.

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

Swachh Sagar, Surakshit Sagar

- Commemorating the 75th 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 Clean-up Day" on 17 September 2022.

Conclusion

- Many industries employ plastic in various products due to its nature and ease of production. They have certainly helped us enhance the efficiency of products.

- The major challenge, however, is the segregation and re-aggregation of plastic waste stream such as packaging waste, including laminated plastic.

BLUE ECONOMY

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% of world trade is seaborne.

Concept of Blue Economy

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

Why Focus on 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.

- It may be underlined that the theatre of the development of the Blue Economy, from India's prism, will be the waters surrounding it, i.e., the Indian Ocean.

- Hence the countries situated in our immediate and extended neighbourhood would receive our focal attention.

- The Blue Economy may offer a **partial path toward food security and millions of jobs** to the unemployed.

Maritime Governance and Blue Economy

- 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 spelled out by Government for seeking "**Security And Growth for All in the Region**" (SAGAR).

Overview of India's Blue Economy

- It accounts for roughly **4% of the GDP** and is estimated to increase once the mechanism is improved.

- 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.

- **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 and polymetallic huge sulphides*.

    ✓ 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.

- The coastal economy sustains over 4 million fishermen and coastal towns. India is the **second largest fish-producing nation in the world**.

- India comprises 200 ports of which **12 are major ports** that handled 541.76 million tones in FY 2021, the highest being Mormugao Port, located in Goa.

- **Shipbuilding and shipping** are also important aspects of the blue economy in India.

- 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.

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

The Blue Revolution: Integrated Development and Management of Fisheries

- A 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.

- The Government of India launched the **Pradhan Mantri Matsya Sampada Yojana** (PMMSY), in May 2020, to bring about a Blue Revolution through sustainable and responsible development of the country's fisheries sector.

Maritime Security Strategy

- Maritime security is an enabler of the Blue Economy for example through safeguarding navigation routes, providing important oceanographic data to marine industries etc.

- Today, minerals are the 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 Ocean border.

- Therefore, there are huge opportunities but uncertainty still looms over mineral exploration with the **possibility of large-scale pollution**.

- **Unregulated and illegal fishing** is another aspect that endangers the ocean ecology.

Indian Coast Guard (ICG): A Maritime Blue Economy Enabler

- As India is all set to achieve the goals of the Blue Economy, the role of ICG becomes very crucial. <u>Indian Coast Guard is one of the major maritime law enforcement agencies in the Indian Ocean Region</u>.

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

- The **traffic of hazardous and noxious substances** for industrial and energy purposes is constantly increasing.

- **Piracy and other transnational crimes** are rampant and ongoing almost daily. Such crimes support militant activism and homemade insurgencies.

- Also, considering the **future of the exploitation of ocean resources** in the IOR, the Indian Coast Guard will have a major role to play.

INS VIKRANT: INDIA'S FIRST INDIGENOUS AIRCRAFT CARRIER

- India commissioned its **first-ever Indigenous Aircraft Carrier** (IAC) Vikrant.

- Designed by the Indian Navy's in-house Warship Design Bureau (WDB) and built by Cochin Shipyard Limited, Vikrant has been built with state-of-the-art automation features and is the largest ship ever built in the maritime history of India.

- India now joins a select <u>group of countries like the US, Russia, China, France, and the UK</u> that can indigenously design, build and integrate an aircraft carrier.

- The Indigenous Aircraft Carrier is named after her illustrious predecessor, India's first Aircraft Carrier which had played a vital role in the 1971 war.

- With the commissioning of Vikrant, <u>India will have two operational Aircraft Carriers</u>, which will bolster the maritime security of the nation.

SAILING THROUGH THE HISTORY

Aircraft carriers are extremely and have powerful weapons. An aircraft carrier offers a wide range of strategic benefits. Surveillance, air defence, airborne early warning, protection of Sea Lines of Communication (SLOC), and anti-submarine warfare are some of its principal functions.

History of Aircraft Carriers in India

- **INS Vikrant (R11)- India's First Aircraft Carrier**

  ✓ The INS Vikrant was launched in September 1945 as Hercules. In March 1961 it was commissioned as Vikrant in its first avatar.
  ✓ <u>INS Vikrant was the first ever carrier for an Asian country</u> and remained so for a long time.
  ✓ Soon after its commissioning, the INS Vikrant saw action during the Goa Liberation Operation in 1961. It played a crucial role in the 1971 war

✓ The INS Vikrant helped in preventing reinforcement of Pakistani forces from the sea, leading to the birth of Bangladesh. It was decommissioned from active service in January 1997.

- **INS Viraat- Over 30 Years of Service to the Nation**

  ✓ INS Viraat was originally commissioned by the British Royal Navy as HMS Hermes in November 1959. The Indian Navy acquired the HMS Hermes in April 1986.

  ✓ INS Viraat's first major operation was 'Operation Jupiter' in July 1989 as part of Peace Keeping Operations in Sri Lanka.

  ✓ It also played a pivotal role in Operation Parakram, which was carried out in the wake of the 2001 terrorist attack on the Indian Parliament.

  ✓ By establishing a blockade against Pakistan during the 1999 Kargil War, the INS Viraat also played a crucial part in Operation Vijay.

  ✓ The ship has additionally taken part in a number of foreign joint exercises, including **Malabar** (with the US Navy), **Varuna** (with the French Navy), and **Naseem-Al-Bahr** (with the Oman Navy).

  ✓ It was decommissioned from service in March 2017.

- **INS Vikramaditya- Indian Navy's Biggest Ship**

  ✓ Russia's refurbished Admiral Gorshkov was commissioned into the Indian Navy as INS Vikramaditya in November 2013.

- **INS Vikrant (IAC-1): The Self-Reliant Rebirth**

  ✓ The 262-metre-long carrier has a full displacement of close to 45,000 tonnes which is much larger and advanced than her predecessor. It has an overall indigenous content of 76%.

PORT-LED DEVELOPMENT

- **Sagarmala** is the flagship programme of the Ministry of Shipping to promote port-led development in the country through harnessing India's 7,500 km long coastline, 14,500 km of potentially navigable waterways.

- The main vision of the Sagarmala Programme is to **reduce logistics cost** for international and domestic trade with minimal infrastructure investment.

- It aims to develop access to new development regions with intermodal solutions and promotion of the optimum modal split, enhanced connectivity with main economic centres and beyond through expansion of rail, inland water, coastal and road services.

- The Sagarmala Project intends to achieve the broad objectives of **enhancing the capacity of major and non-major ports and modernising them to make them efficient.**

- It also aims at **simplifying procedures** used at ports for cargo movement and **promotes usage of electronic channels** for information exchange leading to quick, efficient, hassle-free, and movement.

Coastal Community Development

- Under Sagarmala Programme, an integrated approach is being adopted for improvement in quality of life with a focus on skill building and training.

- The main features of the **Coastal Community Development plan** include Skill development, Coastal tourism, Development of fishing harbours, and R&D in the Port and Maritime Sector.

- To ensure technology-based skill development, the Ministry of Shipping has set up Centre of Excellence in Maritime & Shipbuilding (CEMS) with two campuses at Vizag and Mumbai.

- As part of the coastal community development component of the Sagarmala Programme, Ministry is part-funding fishing harbour projects in convergence with Department of Animal Husbandry and Dairying (DADF).

- For promoting tourism in maritime states under Sagarmala, projects have been identified in convergence with the Ministry of Tourism. Key coastal tourism projects include:

  ✓ Development of Coastal Circuits under Swadesh Darshan Scheme of Ministry of Tourism
  ✓ Development of infrastructure for promoting Cruise
  ✓ Tourism Development of lighthouses
  ✓ National Maritime Heritage Museum Complex at Lothal
  ✓ Underwater viewing gallery and restaurant at Beyt Dwarka

INDIAN COASTAL COMMUNITY AND CLIMATE CHANGE

Vulnerability of Indian Coast

- Most of India's coastal regions are low-lying and densely populated, with nearly 250 million people living within 50 km of the coast.

- As per the Census data of 2011, there are 486 census towns along the coast of India, accounting for a population of 41.7 million constituting 20.7% of the total coastal population.

- India's coast is vulnerable to exponential developmental activities coupled with climate change impacts. The **National Environment Policy** (2006) has indicated that in the future, sea level rise due to climate change may have major adverse impacts on the coastal environment.

- The **Coastal Zone Management Guidelines of India** emphasise strengthening the coping capacity of coastal communities to face the challenge of sea-level rise caused by climate change, as well as the more frequent occurrence of tsunamis and cyclones to protect the life and livelihoods.

Various Factors Affecting Indian Coast

- **Sea Level Rise (SLR)**

  ✓ Globally, the rate of sea-level rise is about 4.5 mm per year. SLR is a major impact on coastal regions that cause a combination of risks in retreat, submersion, erosion, and increased vulnerability to extreme marine events.
  ✓ SLR is a predicted consequence of climate change however, regional variations due to local subsidence, tectonic upliftment and ocean currents similar to the El Niño shall differentiate the rate of local level SLR.
  ✓ 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 hazard line has been suggested as a tool for the disaster management plan for the coastal environment to reduce the vulnerability of the coastal communities and ensuring sustainable livelihood.

- **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 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.

- 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.

- **Shoreline Change (SLC)**

  - The wave energy closer to the shore leads to an increase in shoreline changes in soft rocks and beaches.
  - Shoreline changes cause social and economical effects on livelihoods, property, recreation and tourism, ecosystem services, resilience, and vulnerability.

- **Frequency of cyclones and floods**

  - Besides cyclones, tidal range, storm period, high tide water level, shoaling waves, river discharge, and rainfall-driven runoff also contribute to flooding in coastal areas.
  - During the 21st century, there has been an increase in the occurrence and severity of flood hazards in India.
  - National Disaster Management Authority (NDMA) and the India Meteorological Department (IMD) have prepared a Hazard Profile Map (HPM) of India (Cyclone), helps to determine the vulnerability status of a particular area.

- **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.
  - Similar to drought, 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.

- **Drought**

  - Climate change parameters also increase drought conditions in coastal areas. However, drought affects the coastal village through prolonged shortages in the water supply on the surface and groundwater.

- **Reduction in capture fishery**

  - Climate change impacts the productivity of marine fisheries due to the increase of SST, changing current patterns, and upwelling.
  - 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.

Recommendations and Conclusion

- Prioritisation of problems due to climate change based on the risk and vulnerability using the **Livelihood Vulnerability Index** will support identifying the location-specific problems to mitigate climate change risks.

- **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 shall be constructed.

- The identified suitable evacuation location during cyclone and flood shall be informed to coastal communities through **awareness creation activities**.

- 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.

- 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.

- **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.