THE COASTLINE

The seashore is the place where the land meets the sea.

A "coastal ecosystem" includes estuaries and coastal waters and lands located at the lower end of drainage basins, where stream and river systems meet the sea and are mixed by tides. The coastal ecosystem includes saline, brackish (mixed saline and fresh) and fresh waters, as well as coastlines and the adjacent lands. It can consist of rocky cliffs, sandy beaches or mudflats beside a river or estuary.

The world's coastline is 312,000 km (193,000 miles) long and India's coastline is 7,500 km.

The coastal domain

- Extends from 200 m above to 200m below sea level
- Occupies 18% of the surface of the globe
- Is where around a quarter of global primary productivity occurs
- Supplies approximately 90% of world fish catch

The coastal zone is rich in resources including shells, shellfish, fish, seaweeds, corals, salt and minerals.

THE INDIAN COASTLINE

Peninsular India is bounded by water on 3 sides: the Arabian Sea in the west, the Bay of Bengal in the East and the Indian Ocean in the South. The Indian coastline runs over a distance of 7500 km (5700 kms on mainland) distributed along nine coastal states, two groups of islands and four union territories. The coastal belt comprises of a wide range of ecosystems extending from sandy beaches and mangroves to coral reefs and rocky shores.

Factfile

- Seventh longest in the world
- 1/5 of the population live along the coast
- Gujarat has the longest coastline
- 3 of our metropolitan cities are on the coast.

India has a variety of natural coastal ecosystems. The Indian coastline can be divided into the Gujarat region, the west coast, the east coast and the Islands.

- The Western coastline has a wide continental shelf and is marked by backwaters and mud flats.
- The east coast is low-lying with lagoons, marshes, beaches and deltas rich in mangrove forests.
- Coral reefs are predominant on small islands in the Gulf of Kutch in Gujarat, Gulf of Mannar in Tamil Nadu and on Lakshadweeep and Andaman and Nicobar groups of islands.

Coral reefs, mangroves, estuaries and deltas are delicate and fragile ecosystems rich in biodiversity.

LIVING ON THE COAST

Around the world, nearly 1 billion people live along the coast. Of the 25 cities with population above 9 million, 15 are on the coast: Hong Kong, Calcutta, New York are some. Can you name the others?

The narrow coastal stretches are under immense pressure today as a very large segment of the population want to live there. Living on the coast is highly attractive because of

- scenic beauty
- moderate weather
- plentiful and cheap seafood
- innumerable opportunities for employment in the fishing, shipping and leisure activities
- entertainment by way of sea sports like swimming, surfing, boating, etc.

Besides

- The most fertile agricultural lands are found beside the coast.
- Industries prefer to be located close to the coast for easy discharge of their effluents.
- Thermal and nuclear power plants are also located on the coast for easy access to plentiful water for cooling.
- Ports and harbours on the coast are an important source of employment and overseas trade.
- Tourism flourishes on the coast owing to all the water related sports and activities.

THE LIVING SEAS

The seashore is an area of continual change. As the waves roll in at high tide, much of the shore becomes part of the ocean. At low tide, the sea rolls back and the same area again becomes part of the land. This ever-changing environment, supports a great variety of living things, many of which live nowhere except along the ocean's edge. Many seashore animals feed on tiny organisms or plankton which roll in on the waves. Sea birds feed on plankton eating species.

Seashores are classified into three main types, depending on their surface:

- rocky shores, including coral reefs
- muddy shores
- sandy shores

Characteristic groups of organisms live on each type of shore.

The marine biodiversity of India is outstanding in the entire south Asian region. Species ranging from the tiny sea horse to the massive whale sharks have been documented by scientists in our coastal waters.

Factfile

- 26 species of fresh water turtles and tortoises and 5 species of marine turtles, which inhabit and feed in coastal waters and lay their eggs on suitable beaches are found in India. Over 200,000 Olive Ridley turtles come to Orissa to nest in the space of three or four nights. All the five species of sea turtles along with marine mammals are severely threatened and endangered.
- Highest tiger population is found in the Sunderbans along the east coast adjoining the Bay of Bengal.
- Dugongs occur in relatively large numbers in the Gulf of Mannar and Palk Bay. Today they are the most vulnerable in the region.
- Some species of whales like false killer whale, Balenoptera and humpbacked whales have been also reported.
- Of the 21730 species of fish found in the world, 2546 are found in India (11.7% in the World).

MANGROVES: SENTINELS OF THE COAST

Mangroves are generally found along the coastlines of tropical and subtropical regions, between 25oN and 25oS latitude, throughout the world. Mangroves are located all along estuarine areas, deltas, tidal creeks, mud flats and salt marshes.

India has some of the best mangroves in the world. About 380 km or 6% of the coastline of mainland India is covered by mangroves, while 40% of coasts (260 km) of Andaman and Nicobar are lined with mangroves. They are located in the alluvial deltas of rivers. The Sundarbans of West Bengal represent the largest stretch of mangroves in the country.

The mangrove is a specially adapted salt-tolerant tree. They are characterized by dark green foliage and a network of many stilt like roots that support them above water.

The mangrove swamps are highly productive and are an important nursery ground for fish, crabs and prawn. They are an essential habitat for spawning and nursery bed of marine fishes, endangered migratory birds, estuarine crocodiles, dugongs, dolphins, Royal Bengal Tiger, Olive Ridley turtles and sea otters. The east coast and Andaman & Nicobar Islands are richer in biodiversity than the west coast.

The wood, leaves and bark of mangroves are used mainly as fuelwood, thatch and for tanning leather respectively.

Role of mangrove ecosystem

- Act as a cost-free, self-repairing and static border security force, for protecting the coast from erosion by storms, cyclones and floods
- The thousands of stiltlike roots catch silt (mud deposits) at the mouths of streams, slow down the current and help the silt to settle
- Support a vast range of biodiversity
- Act as a natural sewage treatment plant
- Absorb pollution, including heavy metals

The principal reasons for degradation

- Dependence of coastal population on mangroves for domestic fuel needs
- Decreased freshwater discharge and increased salinity
- Unchecked expansion of salt pans and aquaculture along the coast

CORALS : AN UNDERWATER JUNGLE

Coral reefs have existed for close to 500 million years, making them one of the earth's oldest, largest and most diverse ecosystems. The number of species, representing nearly every group of organism, found on them rivals that of the tropical forests.

Coral reefs are a fairy tale world of beautiful colours and changing patterns. They are also a very fragile ecosystem gravely endangered by our carelessness and ignorance.

Coral reefs are often compared with tropical rainforests in terms of their importance as a habitat and the biological diversity they harbour. Some 4,000 species of fish and 800 species of reef-building coral have been described to date, but the total number of species associated with reefs is probably more than 1 million. Coral reefs are a colony of tiny animals called coral polyps. When the animals die, they leave limestone "skeletons" that form the foundations of coral reefs. The creation of a reef can take centuries. Coral islands or atolls develop from reefs that grow up around volcanic islands.

The living coral-forming animals colour the formation in beautiful shades of orange, yellow, purple and green. Reefs grow in warm seas in temperatures between 20ºC and 30ºC, in clear, shallow, saline waters where a lot of sunlight filters through.

In India, corals are found in

- Gulf of Kutch, off the western mainland coast
- Mandapam group of islands in Gulf of Mannar near Rameswaram
- Andaman and Nicobar islands
- Lakshadweep Islands

India has 18,000 sq. km of corals while the global presence of coral reefs is estimated at 1.5 lakh sq. km. The largest coral reef is the Great Barrier Reef off the east coast of Australia.

Globally, 58 percent of the world's reefs are at risk from human activities, with about 27 percent of reefs at high or very high risk. The reefs of Southeast Asia, which are the most species-diverse in the world, are also the most threatened, with more than 80 percent at risk, including 55 percent at high or very high risk.

Uses of coral reefs

- Remove and recycle CO 2 a greenhouse gas
- Protect the shore from erosion by storms and floods
- Are home to over 4,000 species of fish, 800 species of coral and thousands of other forms of plant and animal life, all of which will not survive without the reefs
- Account for 12% of the marine fish catch
- Could provide important medicines including anti-cancer drugs and a compound that blocks ultraviolet rays
- Coral skeletons are being used as bone substitutes in reconstructive bone surgery

Coral reefs are threatened by

- Destructive fishing practices, such as dynamite or cyanide fishing and trawling in deeper waters, cause direct physical damage to corals.
- Widespread over fishing leads to very low levels of herbivorous fish, which check coral killing algae.
- Nutrient-laden sewage released near the shore causes algal blooms which block sunlight, stunting coral growth and interfering with reproduction.
- Shoreline construction disturbs sediments, which smother corals.
- Tourism and tourists cause physical damage to reefs by construction activities, trampling, boat abrasion and the removal of corals "souvenirs".

LIFE ON THE REEF

The most colourful and diverse groups of fishes are found on the reef. They are of bright colours with bold and distinctive patterns, which serve a purpose.

Red colors appear black under water, helping a fish to go unseen; stripes help a fish to merge with the coral; spotted patterns confuse its predator. They are also of unusual shapes and characteristics. Eels, angel fish, sea snakes, pufferfishes that swell up like a balloon, fierce looking lion fish with a poisonous sting, sharks and sea horses abound in the reef. The vast variety of species include

- Sponges
- Echinoderms like starfish, urchins, feather stars and sea cucumbers
- Sea worms
- Crustaceans like crabs
- Mollusks like snails, clams, oysters, octopus and sea slugs
- Shells
- Sharks and rays
- Reptiles like sea turtles and snakes.
- Marine mammals like dugongs or sea cows, dolphins and whales, seals and sea lions

COASTAL RESOURCES

Development of ports and harbours

India seems to be the first country of the Indian Ocean to possess a real navy, carrying on a flourishing trade with the Arab world. After the 16th Century, the Portuguese and the East India Trading Companies, became very active in trading with India. Today, India has many established ports along its coastline, that facilitate trade and tourism. Cargo ships dock in their harbours bringing valuable and necessary goods like oil, grains, coal, iron ore, etc. There are many natural harbours along the coast of Peninsular India, while Chennai has a manmade harbour. Ports are also useful in training and deploying our naval fleet.

Fishing industry

Fishing is an important livelihood of the people in India. Besides, seafood is a cheap and nutritional component of their diet. The total commercial marine catch for India has stabilized over the last ten years at between 1.4 and 1.6 million tonnes, with fish from the clupeoid group (e.g. sardines, Indian shad and whitebait) accounting for approximately 30% of all landings.

Coastal tourism

Our country has a long coastline along the mainland and numerous islands. It has achieved commendable success in Goa and Kovalam regarding beach tourism. Beach tourism involves water based activities like, bathing, diving, swimming, snorkeling, surfing, wind-surfing, sailing, sun bathing and beach football, etc.

Indian coastal areas are richly endowed with cultural heritage. They have sweeping golden beaches and roaring waves with temples, palaces, gardens, hills, wildlife sanctuaries and a variety of fairs and festivals.

Tidal energy

In most of the shores, tides slowly rise and fall a few feet twice a day, and causes difference in water levels. The rise in water level is high tide and the fall in water level is low tide. The energy produced by the periodic rise and fall of ocean water, due to the gravitational force of the moon, sun and earth can be harnessed to produce electricity. Tidal energy could become an important source of energy in future, because it is a renewable resource. Tidal energy like solar energy and wind power is a relatively "Clean" source that does little damage to the environment.

Minerals from the sea

Coal, oil and natural gas can be obtained from under the seabed. Many minerals are also present in sea water. The most common one is salt. Seawater is evaporated to get salt.

India has large reserves of beach sand minerals, such as ilmenite, rutile, zircon, monazite, sillimanite and garnet. These deposits are mostly located in the coastal stretches of peninsular India. Ilmenite is the largest constituent of the Indian beach sand deposits, followed by sillimanite and garnet. India is one of the leading producers of garnet in the world.

Desalinization

It is the process of removing dissolved salts from ocean water. The average salinity of sea is about 3.5%. In 1869, the first patent for desalinization was given in England.

There exist two main ways to desalinize ocean water: distillation and reverse osmosis. The former is the simpler and less costly method - heat is used up to evaporate fresh water from salt water, leaving the salts behind. In reverse osmosis, sea water is forced under high pressure through a filter. The salts are left behind.

COASTAL POLLUTION

Pollution changes coastal habitats and destroys fish and other species. Most of the trash and pollutants produced by human activities end up in the world's oceans and remain in water near the coastal areas. They are directly drained or dumped into the ocean either on purpose or by accident (oil spills). Sewage and sedimentation from land-clearing and construction are the two most serious causes of coastal pollution. Rivers dump a lot of pollution into the sea, like sewage, industrial effluents, fertilizers and pesticides from farms and sediments.

There are six major types of pollution that affect the world's oceans and coasts: sewage, litter, petroleum, synthetic chemicals, toxic metals and radioactive materials.

Factfile

- Sediments are the major pollutant of the coastal waters of India amounting to as much as 1600 million tonnes.
- Nearly 8000 industries are releasing their effluents into the Indian coastal waters either directly or indirectly.
- It is estimated that about 390 million tonnes of industrial effluents are released annually into Indian coastal waters.
- Among the coastal states, industrial pollution is high in West Bengal, Tamil Nadu, Gujarat, Maharashtra and Andhra Pradesh.
- The Indian coastline is vulnerable to erosion along the coasts of the western states of Kerala and Karnataka.
- The Chilka lake in Orissa, the largest brackish water lake in Asia, was shrinking due to siltation.
- Reckless construction in major tourism centres like Goa, Mahabalipuram and Kovalam have accelerated coastal erosion.

MARINE PROTECTED AREAS

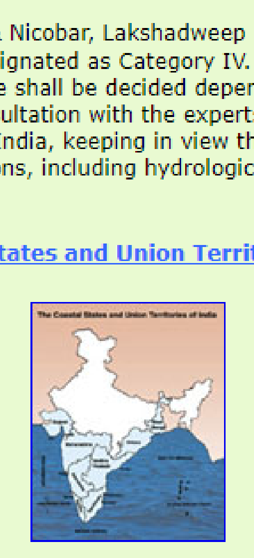
Indian coasts have a large variety of sensitive eco-systems. Sand dunes, coral reefs, mangroves, seagrass beds and wetlands deserve special mention. They are the spawning grounds and nursery of a number of commercially important fish, gastropods and crustaceans.

Marine Protected Areas (MPAs) in India comprise national parks and wildlife sanctuaries declared in coastal wetlands, especially mangroves, coral reefs and lagoons, under Wildlife (Protection) Act, 1972. There are a total of 26 Marine Protected Areas distributed in Gujarat, Maharashtra, Tamilnadu, Orissa, West Bengal, Lakshadweep and Andaman and Nicobar Islands. The total area of the MPAs in India is 5,318.9 sq. km, which is very small (3.4%) compared to total extent of the Protected Areas (586 PAs covering 15.64 million ha. area) in the country.

CRZ NOTIFICATION

In order to protect the coastal environment, the Govt. of India has issued a Coastal Regulation Zone (CRZ) Notification in 1991 under the Environment Protection Act, 1986. According to the Notification, all the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL are defined as Coastal Regulation Zone. Many restrictions are imposed on the setting up and expansion of industries, hotels, resorts, residential buildings and other kinds of developmental activities.

Coastal areas are classified into four categories depending on the importance of the area.

- Category I covers areas that are ecologically sensitive and important, such as national parks marine parks, sanctuaries, reserve forests, wildlife habitats, mangroves, corals/coral reefs, etc. No new construction is permitted within 500 metres of the HTL in this area.
- Category II deals with areas that have already been developed upto or close to the shore-line. No building is permitted on the seaward side of the existing road.
- Areas that are relatively undisturbed and those that do not belong to either Category-I or II are classified as Category III. The areas upto 200 metres from the High Tide Line are earmarked as 'No Development Zone'. No construction is permitted within this zone except for repairs of existing authorised structures.
- Coastal stretches in the Andaman & Nicobar, Lakshadweep and small islands except those designated as CRZ-I, CRZ-II or CRZ-III are designated as Category IV. For permitting constructions of buildings, the distance from the High Tide Line shall be decided depending on the size of the islands. This will be laid down for each island in consultation with the experts and with the approval of the Ministry of Environment and Forests, Govt. of India, keeping in view the land use requirements for specific purposes vis-à-vis the local conditions, including hydrological aspects, erosion and ecological sensitivity.

The Coastal States and Union Territories of India