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Truth of the Ocean

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Introduction

It is not too much to say that water is life. Our planet is the only one in our entire solar system which has been blessed with water and ocean. You may recall that our earth is often called 'a watery planet' as 71% of the earth's surface is covered by the oceans with all the adventures and challenges they provide both to man and science. Today, parts of the world ocean are intensively exploited for recreation, military purposes, commercial shipping, fishing, extraction of gases, oil and other mineral resources.

Physical Features

The oceans form the biggest store house of world's water resources. In fact, the oceans constitute about 97% of the world's water resources and the remaining 3% is in the form of ice in the polar regions of the earth. The average

depth of ocean is about 3,800 meters. But when compared with the earth's diameter of 13,250 kilometers, the ocean is actually a very thin film of water covering the earth's crust. All the oceans are inter connected by straits and they are saline (salty water) in nature. The pressure within the ocean varies from 1 atmosphere at the sea surface to about 1000 atmosphere at the greatest depth. There are five oceans on the earth. These are: Pacific ocean, Atlantic ocean, Indian ocean, Arctic ocean, and Antarctic ocean. The pacific ocean is the biggest and deepest ocean of all. Actually, the pacific ocean is so vast that it can accommodate all the five continents of the earth. The maximum depth of pacific ocean is 11,033 meters, at Marina Trench, halfway between the islands of Guam and Yap in the pacific ocean. In fact, this depth exceeds the height of Mount Everest which is 8,848 meters.

Some comparative features of the major ocean basins

Ocean	Area 10 ⁶ km ²	Volume 10 ⁶ km ³	Average Depth (m)	Maximum Depth (m)
Pacific	165.2	707.6	4,282	11,033
Atlantic	82.4	323.6	3,926	9,200
Indian	73.4	291.0	3,963	7,460
Arctic	14.1	17.0	1,205	4,300
Caribbean	4.3	9.6	2,216	7,200
Mediterranean	3.0	4.2	1,429	4,600

Mountains beneath the ocean

Oceanic depths extend to over 11,000 meters, but most of the depth lies between 3,000 meters and 6,000 meters. What lies at the bottom of oceans is the hills, valleys, plains and plateaus just as they occur on land. A mountain range is present in the bottom of the Atlantic ocean, called 'Mid Atlantic Ridge'. This mid Atlantic ridge is about 3 kilometers high and about 65000 kilometers long and it encircles the earth like a belt.

Origin and composition of seawater

The sea water contains many inorganic salts and organic matter. It has accumulated them during the course of billions of years by soil erosion, decomposition of organic matter and the condensation of water vapour from the atmosphere. Ocean is also a resource for many important minerals such as sodium, potassium calcium, nickel, cobalt, magnesium etc., "Nodules" which are present in certain areas of sea bottom are rich in nickel, cobalt and manganese metals. It also contains metallic salts of phosphate, silicate, nitrite and nitrate. Dissolved gases and organic compounds derived from living organisms are also present in the sea water. Organic compounds of seawater include fats, oils, carbohydrates, vitamins, amino acids, proteins etc. Scientists think that these compounds are an important source of nutrients for marine bacteria and plankton. There exists an organic cycle right from plankton to biggest animal like whale in the ocean to stabilize its ecosystem.

Upwelling

Upwelling phenomenon occurs when the wind direction drives the surface water away from the coast and it is replaced by water from deeper regions which are colder and nutrient rich. "Upwelling" areas are found along the coast of certain areas. The upwelling of deeper waters provides nutrients for the growth of tiny organisms, which fish and other sea animals eat. Upwelling areas have great fish resources and

in fact, it yields half of the world's fish catch. Important upwelling regions include the coasts of Peru and north western Africa. In India, several upwelling areas are identified along the west and east coasts. But, most of them are found within the EEZ. The west coasts of India has been noted to have well-known upwelling areas, generated during southwest monsoon. Most of the areas of upwelled water is found on the sea surface, which enhances the primary productivity which is again utilized directly by the herbivorous fishes such as sardines and anchovies or it is consumed by the zooplankton which, in turn are eaten by fishes like mackerel.

What is Guano?

'Guano' are the accumulated droppings of numerous sea birds like "Guanary Cormorant" and others. These accumulated droppings usually float in the seawater. The farmers of countries like Ecuador, Chile and Peru collect these Guanos and use them as organic fertilizer for their farms and get very good harvest. Years of great upwelling resulted in the production of huge quantities of Guano.

El Nino effects

Each summer during Christmas, a warm oceanic current from the north (El Nino means the child Jesus) flows to south, bringing rain and warm temperatures. When this phenomenon occurs warm water flows further south than usual, and eventually reaches Chile coast preventing cold nutrient-enriched water from upwelling. This effect is particularly severe along the Peruvian coast. This results in dramatic reduction in planktonic growth, reducing the fish population and leading to the death of millions of sea birds. The real reason for the occurrence of El Nino at random intervals remains unexplained and hence dates/periods of further occurrences can not be forecast. El Nino happened six times during this twentieth century and it is associated with anomalous behaviour of the atmosphere and oceans in other parts of the world.

Correlations have been made between El Nino and sea surface temperature anomalies in the western Pacific Ocean, drought in Sahelian zone of north Africa, cold winters in the USA and failure of monsoon rains in the Indian sub-continent.

Continental shelf

The continental shelf is the submerged land at the edge of the continents. It begins at the shorelines and gently slopes under water to an average depth of about 130 meters. The width of the continental shelf averages 75 kilometers. In Arctic it measures only 1.6 kilometers or less. In total, continental shelves account for about 8% of the ocean's surface area. The shelf collects sediments (sand and mud) which is carried by rivers and deposited into the ocean. Continental shelves harbour the maximum variety and quantity of marine organisms. The main reason being its fertility due to the addition of various nutrients from adjacent terrestrial runoff.

Continental drift: Tectonic plates of the continents

The positions and shapes of the land masses of the earth, the size and shape of the intervening oceans were not the same some 200 million years ago. They have been changing continuously over the years. In 1912, a German astronomer and meteorologist, Alfred Wegener, developed and propounded a theory that about 200 million years ago all land masses of the earth were nestled together in one single super-continent called Pangaea (from Greek, meaning "all land"). The evidences given by him for his theory, were ambiguous and most scientists during his time were unconvinced. But in 1968, the reports of the ship, the *Glomar Challenger* based on her ocean floor exploration beyond 7,000 meters depth on both sides of the Mid-Atlantic Ridge firmly supported the concept of seafloor spreading and continental drift. As such, the African continent is drifting northward on a collision course with Europe slowly closing the Mediterranean sea.

The Atlantic Ocean is becoming wider at the expense of the Pacific Ocean. The south Atlantic is widening about 3 cm each year, whereas the Pacific Ocean is shrinking somewhat faster. India and Australia continue to creep northward, slowly changing the shapes of the ocean basins they border. The present day occasional violent earthquakes are resulted by the collision of continental plates with one another due to continental drift.

Deep sea hot springs

Deep-sea hot springs were recently discovered along the axes of ridge near Ecuador. It supports unique communities of deep-sea animals. Dissolved hydrogen sulphide emerging from seafloor cracks is used as an energy source by chemosynthetic bacteria. The bacteria in turn source of nutrition for dense animal populations clustered around these springs. Water temperature sometimes exceeds 100 degree Celsius at hot spring sites in sharp contrast to the near uniform temperature of 2 degree Celsius abyssal water just a few meters away.

Exclusive Economic Zone (EEZ)

To utilize meaningfully the ocean resources for supplementing the fast dwindling resources of the land, the issue of extending the jurisdiction over the ocean areas remained a subject of discussion for several years. After years of deliberations, a new regime was established by the United Nations Convention on the Law of the Sea (UNCLOS) in 1982, which has been signed by many countries, including India. Finally the Law of the Sea Convention came into force with effect from November 1995. With this, the way is cleared for exploitation of sea resources, both of deep sea as well as the near shore areas. The UNCLOS has declared an Exclusive Economic Zone upto 200 nautical miles with respect to the shorelines. India has nearly 2.02 million sq.km of the sea area along the west and east coasts and the Andaman sea, as the EEZ for her oceanic exploitation.

Icebergs: Titanic disaster

Ice bergs are a great hazard to shipping which was highlighted by the Titanic disaster on 14 April 1912 in the north Atlantic Ocean. Icebergs can be as much 70m high (above the sea level) and 1,000m long. The volume of an iceberg is 90% while the depth underwater and height above varies with type and shape of the iceberg. Antarctic icebergs present a significant threat to regular shipping routes only near the tip of South America. Establishment of an ice reconnaissance and warning service, now known as International Ice Patrol, was one outcome of the lessons of the Titanic disaster. The patrol observes sea ice and icebergs, particularly in the shipping lanes, and keeps the ships informed of the ice conditions twice daily by radio.

Tides

The periodic rise and fall of the sea constitutes tides. Tides are caused primarily by the gravitational pull of the sun and the moon. The cycle of tides is every 24 hours and 50 minutes which is the interval between the consecutive meridian passages of the moon, that is, each day tides occur 50 minutes later than on the previous day. There are areas with a 24 hour (or daily) i.e., one high water and one low water a day, a 12 hour period called a semi diurnal (or half day) tide with two high and two low waters a day, also a 6 hour period with four high and four low waters a day. Semi diurnal tide is most common and this form of tide occurs obtains along the coasts of the Indian sub continent.

Feats of some marine organisms

Myriads of biological wealth originated from the sea and support the human beings in many ways. Single celled plant and animal members like diatoms, protozoans to mammals

like blue whales are inhabiting the sea as their niche. A blue whale calf initially weighing 3 tons at birth increases in body weight of 23 tons after seven month at an average weight gain of almost 100 kg a day.

This kind of astonishing growth rate is possible only with the abundant supply of high fat milk. Cetacean milk has the fat content of 25 to 50% (Cow's milk contains 3 to 5% fat). The daily milk yield of a baleen whale is estimated to nearly 600 liters. Marine mammals have long gestation period ranging from several months to a year. Cestaceans and Pinnipeds (eg. Walrus) occupy the colder waters and produce more milk with high fat content. Whales and Pinnipeds like Walrus mate only once in every two or three years.

The periodic seasonal movements exhibited by some animals is called migration. Some of the marine organisms too exhibit migration for an astonishing distances. Thus gray whales spend the summer in the Berring sea and the adjacent areas of the Arctic region. As the formation of sea ice starts in the Arctic waters in autumn, the gray whales migrate as far as 18,000 km to the warm protected coastal lagoons of Baja California by late January. In the protected waters, the whales mate and the pregnant females give birth to their calves. By early spring, they again migrate northwardly to Berring sea. Similar long distance migration are noted in marine turtles, eels, tuna and salmon also.

Conclusion

Similar wonders and concepts are abundant like the extent of the ocean itself. As human investigation progresses, new knowledge and wonders of the ocean may reveal astonishing facts about the ocean to future generations. Hence explore the ocean continuously.