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Aquatic Resources, Biodiversity And Over-Exploitation With Special Reference To Human Impacts On Biodiversity Of Aquatic Ecosystem

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Abstract

Aquatic ecosystems contribute to a large proportion of the planet's biotic productivity as about 30% of the world's primary productivity comes from plants living in the, ocean. These ecosystems also include wetlands located at lakeshores, riverbanks, the ocean shoreline, and any habitat where the soil or vegetation is submerged for some duration. When compared to terrestrial communities, aquatic communities are limited abiotically in several different ways

Organisms in aquatic systems survive partial to total submergence. Water submergence has an effect on the availability of atmospheric oxygen, which is required for respiration, and solar radiation, which is needed in photosynthesis. Some organisms in aquatic systems have to deal with dissolved salts in their immediate environment. This condition has caused these forms of life to develop physiological adaptations to deal with this problem. Aquatic ecosystems are nutritionally limited by phosphorus and iron, rather than nitrogen and These are generally cooler than terrestrial systems, which limit metabolic activity.The fish resources are no longer considered to be infinite. But at the same time, the current thinking is that fish is renewable sources. Regulations of proper inputs can make the fishery as a sustainable process, if it is tuned with the ecosystem of which it is an end product. Fish technology is very diverse, embracing aspects as varied as biology and bionomics, fish detection and location of fish stock, fish behavior. We know fairly little about the biodiversity of the world's marine and freshwater systems. The world's marine and freshwater systems provide important ecological and economic services, resulted into overexploitation.

Keywords: *Aquatic resources, biodiversity, overexploitation*

**Fisheries Resource Management, CFSC, GBPUAT, Pantnagar*

Introduction

Aquatic ecosystems contribute to a large proportion of the planet's biotic productivity as about 30% of the world's primary productivity comes from plants living in the, ocean. These ecosystems also include wetlands located at lakeshores, riverbanks, the ocean shoreline, and any habitat where the soil or vegetation is submerged for some duration. When compared to terrestrial communities, aquatic communities are limited abiotically in several different ways

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Global Scenario

The earth, two-thirds of which is covered by water, looks like a blue planet-the planet of water-from space (Clarke, 1994). The world's lakes and rivers are probably the planet's most important freshwater resources. But the amount of fresh water constitutes only 2.53% of the earth's water. On the earth's surface, fresh water is the habitat of a large number of species. These aquatic organisms and the ecosystem in which they live represent a substantial sector of the earth's biological diversity. The association of man and aquatic ecosystem is ancient. It is not surprising that the first sign of civilization is traced to wetland areas. The flood plains of the Indus, the Nile delta, and the Fertile Crescent of the Tigris and Euphrates rivers provided man with all his basic necessities. Water may be required for various purposes like drinking and personal hygiene, fisheries, agriculture, navigation, industrial production, hydropower generation, and recreational activities. The wide variety of wetlands, like marshes, swamps, bogs, peat land, open water bodies like lakes and rivers, mangroves, tidal marshes, and so forth, can be profitably used by humans for various needs and for environmental amelioration. Ever-increasing population and the consequent urbanization and industrialization have mounted serious environmental pressures on these ecosystems and have affected them to such an extent that their benefits have declined significantly.

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It is interesting to know that there are nearly 14 x 108 cubic km of water on the planet, of which more than 97.5% is in the oceans, which covers 71% of the earth's surface. Wetlands are estimated to occupy nearly 6.4% of the earth's surface. Of those wetlands, nearly 30% is made up of bogs, 26% fens, 20% swamps, and 15% flood plains. Of the earth's fresh water, 69.6% is locked up in the continental ice, 30.1% in underground aquifers, and 0.26% in rivers and lakes. In particular, lakes are found to occupy less than 0.007% of world's fresh water (Clarke, 1994). This amount of water is found in lakes, rivers, reservoirs, and those underground sources that are shallow enough to be tapped at an affordable cost. Only this amount is regularly renewed by rain and snowfall, and is therefore available on a sustainable basis.

Indian Scenario

India by virtue of its geography, varied terrain, and climate is blessed with numerous rivers and streams that support a rich diversity of inland and coastal wetland habitats. Major river systems in the north are Ganga, Yamuna , and Brahmaputra (perennial rivers from the Himalayas) and in the south, Krishna, Godavari, and Cauvery (not perennial, as they are mainly rain-fed). The central part of India has the Narmada and the Tapti. The Indo-Gangetic floodplain is the largest wetland regime of India. Most of the natural wetlands of India are connected with the river systems. The lofty Himalayan mountain ranges in northern India accommodate several well-known lakes, especially the palaearctic lakes of Ladakh and the Vale of Kashmir, which are sources of major rivers. In the northeastern and eastern parts of the country are located the massive floodplains of Ganga and Brahmaputra along with the productive system of swamps, marshes, and oxbow lakes. Apart from this, there exists a number of man-made wetlands for various multipurpose projects. Examples are Harike Barrage at the confluence of the Beas and the Sutlej in Punjab, Bhakra Nangal Dam in Punjab and Himachal Pradesh, and the Cosi Barrage in Bihar-Nepal Border. India's climate ranges from the cold, arid Ladakh to the warm, arid Rajasthan, and India has over 7,500 km of coastline, major river systems, and mountains. Terrestrial ecosystems range from wet evergreen to deciduous forests in the Western ghats and north-east, scrub/plains in deccan plateau and gangetic plains amidst the mountain ranges.

There are 67,429 wetlands in India, covering about 4.1 million hectares. Out of these, 2,175 wetlands are natural, covering about 1.5 million hectares, and 65,254 wetlands are man-made, occupying about 2.6 million hectares.

According to Forest Survey of India, mangroves cover an additional 6,740 sq km. Their major concentrations are Sunderbans, and Andaman and Nicobar Islands, which hold 80% of the country's mangroves. The rest are in Orissa, Andhra Pradesh, Tamilnadu, Kamataka, Maharashtra, Gujarat, and Goa.

Wetlands have been drained and transformed due to anthropogenic activities, like unplanned urban and agricultural development, industries, road construction, impoundments, resource extraction, and dredge disposal, causing substantial economic and ecological losses in the long term. They occupy about 58.2 million hectares, of which 40.9 million hectares are under paddy cultivation. About 3.6 million hectares are suitable for fish culture. Approximately 2.9 million hectares are under capture fisheries (brackish and freshwater). Mangroves, estuaries, and backwaters occupy 0.4, 3.9, and 3.5 million hectares respectively. Man-made impoundments constitute 3 million hectares. Nearly 28,000 km are under rivers, including main tributaries and canals. Canal and irrigation channels constitute another 113,000 km (Rajinikanth, R. and Ramachandra, T.V., 2000).

Though accurate results on wetland loss in India are not available, the Wildlife Institute of India's survey reveals that 70-80% of individual fresh water marshes and lakes in the Gangetic flood plains have been lost in the last five decades. Indian mangrove areas have decreased by half from 700,000 ha in 1987 to 453,000 ha in 1995.

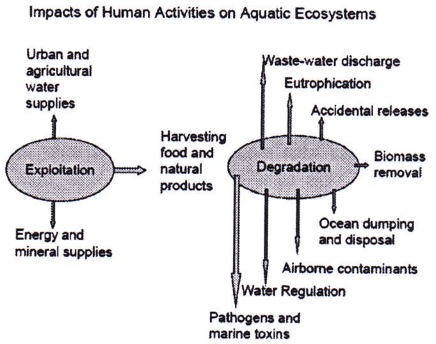
Aquatic Biodiversity

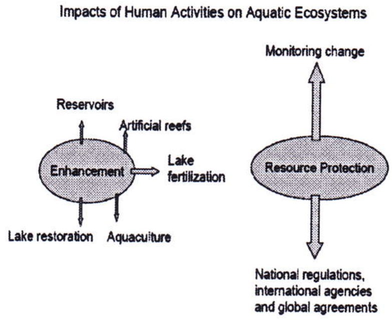
- Fairly little is known about the biodiversity of the world's marine and freshwater systems.
- The greatest marine biodiversity occurs in coral reefs, estuaries and the deep ocean floor.
- Biodiversity is higher near the coast and surface because of habitat and food source variety.
- The world's marine and freshwater systems provide important ecological and economic services.

Human Impacts On Aquatic Biodiversity

The fish resources are no longer considered to be infinite. But at the same time, the current thinking is that fish is renewable sources. Regulations of proper inputs can make the fishery as a sustainable process, if it is tuned with the ecosystem of which it is an end product. Fish technology is very diverse, embracing aspects as varied as biology and bionomics, fish detection and location of fish stock, fish behavior.

During 1950's and 1960's witnessed the explosion of fishing technologies. Use of radars and sonar helped in detection and location of fish schools, boosting up the exploitation of the high seas and oceans. Improvement





in fishing vessels, enable to reach close to the fishing grounds and improvement in gears for industrial fishing to deal with capture the bulk amount of catches further added for the exploitation, there by the over fishing eventually becomes a common practice in industrial fishing. Globally about 70% of conventionally preferred food species are subjected to overfishing.

Last few decades the world wide fish catches declined, that were at peak in the Atlantic, Pacific and Mediterranean oceans where as Indian ocean was the last to be subjected to over fishing. The impact of the over fishing was felt in many ways. More over fishing to meet the supplies made the situation worse. Subsidies coming from respective Governments rise to meet out the deficits in the fishing industry and to keep employment. Resort to fishing of species situated lower in the food web and having lesser food value boomeranged in loss of food to large wild fish, causing further declining in their population. The commercial important alternative resources to wild fish [fish culture, shrimp culture or the other aquaculture practices] did not bring much improvement in the situation in the face of ever increasing fish demand resulting from ever increasing growth of human population.

Human activities have destroyed, disrupted or degraded a large proportion of the world's coastal, marine and freshwater ecosystems. Approximately 20% of the world's coral reefs have been destroyed. During the past 100 years, sea levels have risen 10-25 centimeters. We have destroyed more than 1/3 of the world's mangrove forests for shipping lanes.

Why is it Difficult to Protect Aquatic Biodiversity?

· Almost half of the world's people live on or near a coastal zone and 80% of ocean water pollution comes from land-based human activities.

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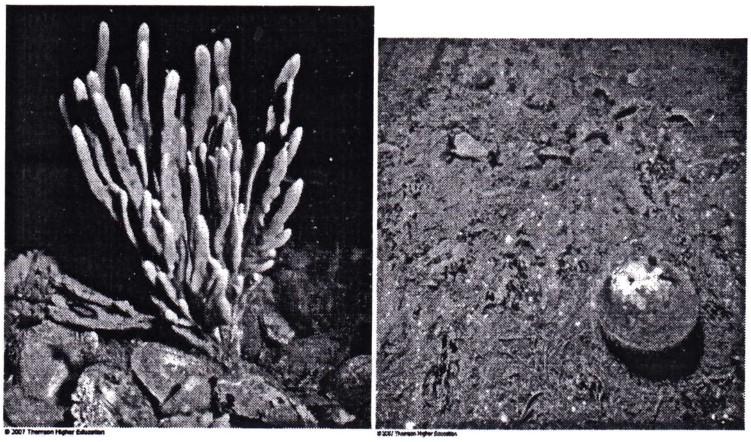


Fig Area of ocean before and after a trawler net, acting like a giant plow, scraped it

· Increasing human population has also posed a great threat.

· Each year plastic items dumped from ships and left as litter on beaches threaten marine life.

· Rapid increasing human impacts, the invisibility of problems, citizen unawareness, and lack of legal jurisdiction hinder protection of aquatic biodiversity.

· Human ecological footprint is expanding.

· Much of the damage to oceans is not visible to most people.

· Many people incorrectly view the oceans as an inexhaustible resource.

Overfishing and Extinction:

Over fishing is the greatest threat to populations of fish that live in surface waters. About 75% of the world's commercially valuable marine fish species are over fished or fished near their sustainable limits.

About three-fourths of the world's commercially valuable marine fish species are over fished or fished near their limits.

Today fish are hunted throughout the world's oceans by a global fleet of millions of fishing boats. Some of them longer than a football field.

These fleets, most supported by government subsidies, use sonar, satellite global positioning systems, and aircraft to find fish.

In 2003, fishery scientists Ransom Myers and Boris Worm looked at fishing data for 13 commercial fisheries since 1952. Their data indicate that during the last 45 years the abundance of large open-ocean fish such as swordfish, marlins, tunas, and sharks and bottom-dwelling ground fish such as cod plummeted by 90%

One result of the increasingly efficient global hunt for fish is that big fish in many populations of commercially valuable species are becoming scarce.

Big fish are becoming scarce, smaller fish are next.

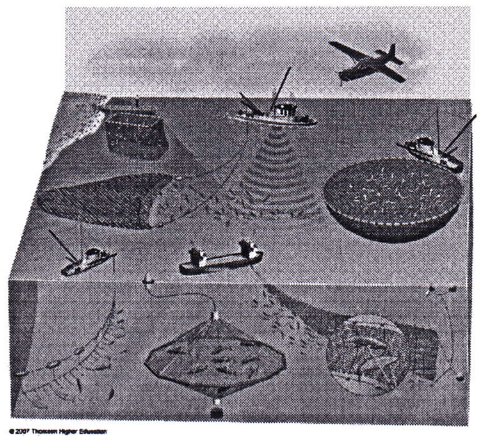
We throw away 30% of the fish we catch; almost one-third of the world's annual fish catch consists of such species that are thrown overboard dead or dying.

Many depleted species, like the bottom-dwelling North Atlantic cod, may never recover because too much of their habitat has been destroyed or degraded or there are too few survivors to find mates.

We needlessly kill sea mammals and birds.

The fishing industries are beginning to work their way down to the smaller, faster growing fish. If this happens, it will disrupt the marine ecosystems, and hinder the recovery of fish feeding.

In addition to wasting potential sources of food, this can deplete the populations of the species that play important ecological roles in oceanic food webs.



Effect of dams and barrages on fisheries

River systems in the country have been developed by constructing dams and barrages across the rivers for purpose of irrigation, flood control, navigation, power generation, water storage for public supplies, recreation, development of fisheries and sport fishing. Dams usually comprise a massive concrete wall built across a stream or river leading to the formation of vast reservoir upstream of the bunds. It often stretches to hundreds of miles. Dams, weirs, barrages and anicuts raise the water level for facilitating diversion of the flow. Weirs cannot discharge water over its crest or through wide openings. The barrage is weirs provided with sluice openings. Anicuts is a low barrage built for irrigation purposes. Dams holds water for public supply and allow excess of water to pass out over a spill way. Dams, which are more complicated, have built in spill ways through which the volume of the discharge can be regulated by a system of gates to meet the down-stream needs of water. The effects of dams and barrages on fish population can be categorized into *obstruction* and *ecological changes.*

Obstructions:

Dams and other structures act as physical barriers to migration, tending to prevent access of the fish to their usual breeding, rearing and feeding grounds. The denial of migration may result in permanent and irrevocable reduction of fish stocks. The new environment so created may be occupied by undesirable species.

Ecological changes:

Ecological changes adversely affect both the migratory and non-migratory species of fishes. Due to the dam construction and reservoir formation, substantial morphological changes the dams, torrential water converts into a water body or reservoir of slow discharge characteristics and radical changes take place in organisms. Some species shift to new spawning grounds, anadromous fish tend to settle down, intra- specific biological differentiation of fish occur, egg laying substrate change take place and torrential fish gradually disappear. Other changes like inundation of spawning grounds, fluctuations in water levels, alterations in the physico-chemical conditions of spawning grounds, disappearance of marsh lands, complete change in turbid and silting patterns occur which may result in the failure of spawning of many important fishes. Reduction of flow in the residual rivers tailing below the dam, alters the ecology of the spawning grounds, which even dry up. Reduction of water level results in the formation of shallow areas which obstruct the fish movements. The reduction of water discharge due to the construction of dam in estuarine areas results in the changes in temperature and salinity in brackish waters. The construction of dam across a river results in the creation of a reservoir. These constructions restrict the migration of the fishes and affect the population. Even in certain cases there is a chance of disappearance of the fish races in nature.

Based on the migatory habits, fish can be classified in to three types: They are

· Resident species which prefers to remain confined to the local territories

· Local migrants which tend to perform seasonal migration within the short distances for breeding, feeding and

· Long distance migrants which prefers regular annual migrations for feeding or breeding.

Indian shad, *Hilsa hilisa* migration is restricted to the portion of the rivers below the anicuts and barraiges and the fisheries bearing on these stocks

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declined considerably. In these streatches of the rivers above the anicuts hilsa fishery has been rendered practically non-existent. Another bad effect has been found in the case of *Pangasius pangasius* in Ganga, Brahmputra, Mahanadi and Godavari rivers. Dams located on the lower and middle reaches of these rivers obstruct the migration of this fish and adversly affect its population. Torrential fishes like *Glyptothorax, Leptognathus* cannot survive in reservoirs and there is a chance of disappearance of their races in nature. Hence fish ways and fish lifts are provided at dam sites to help the migratory fish to negotiate the dam height. Fish ways are expensive to build and operative.

Physical Effects of Dams

· Alterations of flow

- Prevents movement of sediment, nutrients downstream

- Slower flows upstream

Ø leads to settling of sediment Ø reservoirs can fill by as much as 80% in 12 years

- More unpredictable flows downstream

- Disturbs normal flood-pulse in spring

· Interchange of nutrients between river and floodplains

Biological Effects of Dams

· Interrupts fish migration (e.g., salmon)

- Fish ladders can help

- Still can have 10-20% fish loss during outmigration

· Loss of important spawning/foraging habitat in floodplain

- Net economic loss -river fisheries more productive than reservoir fisheries

- Changes in plant communities, reduced species richness below dams

Human Health Effects of Dams

· Parasite passes from humans to snails to humans

· Irrigation from lake provided more habitat for snails

Protecting And Sustaining Aquatic Biodiversity

Since 1989 the U.S. government has required offshore shrimp trawlers to use turtle exclusion devices.

Sea turtle tourism brings in almost three times as much money as the sale of turtle products.

Dams can provide many human benefits but can also disrupt some of the ecological services that rivers provide.119 dams on Columbia River have sharply reduced (94% drop) populations of wild salmon. U.S. government has spent $3 billion in unsuccessful efforts to save the salmon. Removing hydroelectric dams will restore native spawning grounds.

Laws, international treaties, and education can help reduce the premature extinction of marine species.

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