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An echo in India of declining world seafish populations?

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More than a billion people in the world rely on fish as a primary source of protein and 200 million depend on fishing for livelihood. In the developing countries, 4.2 million people work directly in the sector and 2.8 million depend on fish products for 20% of animal protein. Therefore exhaustion of world's fisheries would be a real threat for food security in future.

It is estimated more than three fourths of the world's fisheries are fished to their biological limits or beyond with many marine ecosystems having been disrupted by the devastation of major species such as cod, tuna, sharks and swordfish. The volume of fishing increased proportionally to feed the quickly growing populations world over, resulting in breakdowns of ecosystems, declining of fish populations and even extinction of species. Current fishing practices leading to over fishing caused serious economic repercussions, disruptions and food shortages in seafood dependent developing nations. From the economic and ecological point of view, it is expedient to arrest by all means, the declining sea fish Populations world-wide.

The present account based on several reports and reviews highlights the trends in world sea fish production and sea fish production in India in recent years, the over fishing scenario, the state of the oceans, effects of climate change and conservation and management of sea fisheries resources.

Sea fish production in the world

As per the FAO statistics, marine capture fish accounted for 86.8 (2000), 84.2 (2001), 84.5 (2002), 81.5 (2003), 85.8 (2004) and 84.2 (2005) million tones. Global catch was found to have decreased by 13% between 1994 and 2003. According to FAO estimates, over 70%of the world's fish species are either fully exploited or depleted. Reports indicate populations of fish and other marine creatures suffered drastic reductions because of over fishing and environmental degradation. Fishing has greatly reduced the diversity of fish in the world's open ocean as well as in coastal areas. In 2003, 29%of currently fished species were considered collapsed. A major scientific study, though highly debated and flowed, indicated, if current trends of fishing countries, there could be global collapse of all the species currently harvested by commercial fishermen by the year 2048. A new global study, spread over 10 years found, compared to 1950 levels, when industrial fishing commenced, 10% of large ocean fish stocks at the top of the food chain (tuna, cod, swordfish, martin and sharks) are left in the seas. The data going back to 47 years covering nine oceanic and four continental shelf systems revealed staggering drop in population of big fishes off the coasts of Newfoundland, Canada and gulf of Thailand. These conclusions, were however, questioned in many quarters. Though changes due to decline of these large species are hard to predict and difficult to understand, they are predicted to occur on a global scale and a reason for concern.

The Namibian fishery, which crashed as a result of over fishing, was a good example of that, beyond a certain point, the collapse is likely to be permanent. Stocks of fishes were found to have collapsed in nearly one-third of the sea fisheries with the rate of decline accelerating. The collapse has been generally related to loss of marine biodiversity. Bigger vessels, better nets and new technology

have not been found useful to increase the catches. Coastal zones in North America, Europe and Australia have indicated declining trends of fish productions along with loss of species diversity. Besides over fishing, global sea fish population reductions are attributed to pollution, other environmental factors including those induced by climate change with simultaneous degradation of ecosystems. Countries like Iceland, New Zealand and parts of United States of America are implementing quota systems to preserve collapsing sea fish populations. Reversing the decline was estimated to require cutting back fishing by as much as 60%. It was pointed out, restrictions on fishing like keeping certain areas of the ocean out of grounds for fishing, restored fish populations remarkably well.

Sea fish production in India

The CMFRI estimates for sea fish production in the country were: 2.70 (2000), 2.32 (2001), 2.64 (2002), 2.62 (2003), 2.59 (2004), 2.29 (2005), 2.71 (2006) and 2.88 (2007) million tones (CMFRI Annual Reports).

From the above it can be seen, in the last two years, there was a significant increase in production which can be attributed to increase fishing coverage reaching further offshore and oceanic regions and efforts at multiday fishing operations. Thus another 1.05 m t of fish is expected to be available from the rest of the unexploited areas of the EEZ, 3.93 mt being the total potential yield.

Out of about 14 major groups of marine fishes harvested from the Indian Seas (CMFRI marine fisheries profiles), during the period 1961-2005 the catches of the most of the groups have been found to fluctuate, with the oil sardine, mackerel, Bombay duck, elasmobranches and penaeid prawns exhibiting high fluctuations. Though fluctuating, the catches of Bombay duck, tunas, pomfrets and carangids show increasing trends in recent years. The groups that have indicated declining trends include elasmobranches, mackerel, penaeid prawns, perches, croakers, ribbon fishes, cat fishes, seer fishes and cephalopods.

State-wise, in the year 2005 (CMFRI marine fisheries profiles), increasing trend in total catches was observed in West Bengal, Orissa and Karnataka. The catches tended to declining Andhra Pradesh, Pondicherry, Tamil Nadu, Kerala, Goa, Maharashtra and Gujarat. Generally, in all the states more groups have shown decrease than increase in the total catches. Prominent among the few groups showing increase were catfish, ribbon fish, elasmobranches, croakers, carangids, seer fish, tunas and cephalopods.

Since marine fish production even today is predominantly from the coastal region and the fishing intensity gradually increase over the years and beyond the maximum sustainable yield, most of the stocks reached MSY level and the some of them beyond. Therefore, further increases are not expected from the presently exploited areas. The recent trends in wider coverage of the EEZ exploiting partly the offshore and oceanic resources by modifying the existing indigenous crafts and gears are a healthy sigh to reduce the fishing stress on coastal stocks and habitat. There is no doubt certain coastal stocks are suffering declines but what is happening elsewhere globally, especially in the industrial fishing nations is not applicable at the moment in India. The 'fish famines', now and then reported in some steps in the country are attributable to the inherent fluctuation in abundance of several species and groups compounded by human interferences, environmental interferences and increasing demand for fish. The focus therefore should shift to increase harvesting of far sea fisheries resources.

Over fishing

Over fishing, leading to depletion of fisheries poses a major threat to the food supplies of millions

of people round the world. The combined effects of over fishing and increasing human population have reduced the amount of fish available for consumption. Studies have indicated excess fishing greatly reduced the diversity of fish in the world's open ocean. Mass disappearance of fish and seafood species has been found to be accelerating. Industrial fishing was stated to have decimated the world's biggest and economically important species of fish to the extent of 90%. Fishing has become so efficient that some populations disappeared within just a few years. As per reports, in the year 2005, out of about 85 m t of fish landed from global oceans, 100 m sharks and related fishes were slaughtered for their fins, 250000 turtles were entangled in fishing nets, 300000 sea birds including 100000 albatrosses trapped. Due to uncontrolled fishing, using non-selective fishing gear, larger and larger living species are fished out first, creating imbalances in the whole food chain and upsetting prey-predation relationship. It was found, depletion of large predators allows multiplication of lowly and uneconomic species which devastate bottom dwelling groups of mollusks and permits easy explosions of swarms of jelly fish making recovery of wiped out fishes difficult. Besides overexploitation of target species, shrimp trawling adversely affected juveniles of several species of fishes, other bottom biota and sea turtles across the globe, thus wrecking the ecosystem. Several non targeted species are caught by shrimp trawls and discarded. It is estimated, about 27 m t of by catch is discarded annually by the World's marine fishing fleets and in India 1,30,000 t of by catch was estimated to have been discarded annually along the east coast alone.

Trawl fisheries of the world are required to use By catch reduction devices (BRDs) to help exclude non targeted species in fishing. In India, use of Turtle Excluded Devices (TEDs) is mandatory but not the BRDs. Enforcement of use of both the devices will go a long way in conservation of marine resources.

In the world's oceans sharks are heavily fished, sum of them coming under the category of endangered species. Hundred million sharks are estimated to be caught in commercial and sport fishing every year. Several species are reported to have declined by more than 80% in the past decade, leaving 70% of world's ocean free of sharks.

They are more vulnerable to over fishing than thought earlier. Although about 8 species, including the whale shark are considered endangered in India and several hundreds of specialized fishermen are depended on these fishes for their livelihoods, it is rather difficult to identify them quickly from others at sea for enforcing the regulations. As in the case of whales, dolphins and porpoises, molecular identification of species to match morphological characters would help to a great extent. In the 1960s the author observed the large sharks, sawfish and hammerheads measuring up to 25 feet long in drift gill nets from the Gulf of Mannar, India but in later years such large fishes were scarcely seen in such abundance.

Longlines and gill nets used to catch the sharks are known to snare whales, dolphins, tentles and albatrosses. Excess shark fishing is also known to have cascading effects on the entire food chain by allowing multiplication of animals down the link. Rapid decline in great shark in the world oceans is stated by the disrupting the marine ecosystems. There has been a sudden uprising of species they prey upon. Records of data from 1970s to 2005 revealed dramatic drop in great shark populations. Cownose rays upon which the great sharks prey jumped of a year to an estimated population of 40 million along the US Atlantic coast which lead to a complete collapse of scallops. It is estimated 73 million sharks are killed each year around the globe but it is important to maintain the populations of the oceans predators to ensure equilibrium in nature. The whale shark in India is a protected species but illegal fishing has caused steady decline in their number.

There is lack of awareness about the importance of such large species of shark. There are conflicting views between fishermen who depend on fishing for their livelihood on scientist who realize that if future fish population are to be sustainable, there is need for regulation to avoid over fishing, reduced intensity of fishing or even close some fisheries. The quota system implemented by Içeland combats declining fish populations and may as well serve as a model for other fishing nations. To help FAO which compiles world fisheries statistics based on the data provided by individual countries, reporting of accurate and true data is very essential to assessing over fishing and its effects on world sea fish population. Reservation of fisheries should be the chief aim.

The state of the ocean

It is known, more than 90% of world's living organisms are found in the ocean and 60% of marine world and its rich biodiversity is found beyond the limit of national jurisdiction, vulnerable and at increasing risk, more research is needed for investigating 90% of the ocean's that remain unexplored. Once limited to open ocean fishing and shipping, commercial activities at sea are expanding rapidly. Hitherto, oceans had the reputation of a refuge and resource of near infinite proportions but this is believed in the present day. It is estimated nearly every corner of the ocean has been damaged by human activity with 41 % of the waters heavily affected by extensive fishing and absorption of carbon emissions from atmosphere. Scientist who mapped the extent of damage by human activity found greatest intensity of damage along densely populated areas. The oceans have all along been treated as sinks to receive acid- rain, dumping of garbage, toxic wastes, oil, chemical spills and assaulted but shipping lines and extensive fishing. Vulnerable marine animals like corals and shelled animals cannot resist the rising pH which inhibits shell growths and caused bleaching combined with warming of water and altering chemical composition, over fishing causes imbalance in marine species. Solution for preventing further worming and acidification lie in reducing carbon dioxide absorption in ocean, develop renewable energy sources and forests, carbon capture and storage. Other method like fertilization of ocean waters with iron, adding chemicals to offset acidification and dumping of lime stone are suggested but such means are considered to the unsustainable and prohibitively costly.

Out of about 17 kinds of human ocean impacts, the most prominent are depleted resources, degraded ecosystems, organic pollution, agricultural run off, sewage and garbage dumping, destructive fishing methods including bottom trawling, intensive traditional fishing along reef areas and extensive shipping across the oceans. As a result of this water quality greatly deteriorated and marine dead zones spread across the world's tropical ocean effecting fish and other life. Oxygen minimum zones expanded and intensified during the past 50years in the eastern tropical Atlantic and equatorial pacific which is linked to rise in sea water temperature. These areas and Indian Ocean are known to be naturally low in oxygen. Entering on agro-chemicals into the ocean, reported to be highest in the Gulf of Mexico, cause severe disturbances in the oceans. Pollution of oceans from various sources, including discarded plastics killed sea birds and other animals. In the vast oceans, organisms are interconnected perhaps more so than on land with implication that changes at one level affect all other levels below. Many predators have such varied diets that cascade effects through ecosystems. Large scale removal of large predators' fish from the ocean resulted in huge surges of other fish and animal population below, often endangering the bottom fauna and generating of noxious invertebrates like jelly fish which compete for plank tonic food with fish and also feed on the latter. It is said reversing this trend is sometimes difficult.

In view of the damage being caused to the ocean and its inhabitants, all the ocean species have to be managed together as working ecosystems, allowing species to regenerate and maintained the health of the ocean. The key implication is that more of the oceans should be protected. The ocean is full of

surprises but the growing impact of human beings of various resources of the ocean can not be ignored for long. Unanticipated trouble spots, similar to terrestrial biodiversity hot spot, are also known to occur in the ocean.

Climate change

About half the production generated by world's living organisms is done by phytoplankton in the 100-200 m depth zone of the ocean where light levels are high enough for photosynthesis. Thus, phytoplankton in the sea is a major source of sustenance of animal life. It inhabits three-fourths of the earth surface capturing and absorbing sun's radiation, thus warming the planet. The radiation results in global climate warmer by 0.1-0.6^{0}C. thus the magnitude of phytoplankton concentrations will dictate the strength of warming influence. Fertilizing ocean with iron is thought of reducing global warming through production of phytoplankton for absorbing carbon dioxide from atmosphere. These are however, conflicting views about the role of phytoplankton. It was found phytoplankton responds to warming by scaling down productivity by 30% or more which could affect the whole of food chain dependent on it.

The FAO has caution on the repercussions of climate change on fisheries and aquaculture. Impact of higher temperature is expected to have a greater impact in certain geographical areas and more intense in surface waters, though warming oceans can go deeper than 700m. more than 90% of earth's heat can be stored in the ocean. Changes in ocean's salinity and acidity affects fisheries and aquaculture. It was found marine organisms are responding faster to global warming.

Algal-blooms in the northern hemisphere oceans raise alarm signals for the survival of fish. Species composition in the region would change with warmer water species replacing coldwater species and even freshwater species taking place of marine species causing uncertainties in the availability and access to food. The IPCC forth report predicts a warming of about 0.2^{0}C per decade for the next 2 decade. Asia, the major contributor to aquaculture will be the most vulnerable region. If global temperature keeps rising there could be dramatic consequences for marine life and communities that depend on the sea for living.

Satellite data indicate global warming creating on ocean famine in some tropical and sub tropical seas. In these areas as warming continues, fish stocks may drop significantly due to less production at the bottom of the food chain. The erratic, unpredictable monsoon rains causing excess precipitation for lack of it could adversely affect the reproductive cycles and spawning of fishes, thereby altering fish production rates. Expansion of low oxygen under water deserts in the tropical oceans could be potential threats to marine ecosystem. Warming of sea surface would hamper mixing of the ocean waters resulting in dropping of oxygen levels affecting the functioning of ecosystems. Warmer surface temperature brings in changes inflow of currents that deliver nutrient rich water from depth to the surface. In suboxic waters, nitrogen can not react with oxygen to form biologically available nitrate resulting in phytoplankton deprived of nutrients to survive.

Jelly fish, swamps were reported from coasts of Spain, France, Great Barrier Reef of Australia, Waikiki and Virginia Beach in USA. Explosion of jelly fishes reflect a combination of severe over fishing of natural predators like tuna, shark, sword fish and rising sea temperature caused in past by global warming and pollution that depleted oxygen levels in coastal areas. They thrive in such degraded and damaged environments. They seem to have filled a vacuum created by removal of predatory fish by man. Their presence is more sharply felt in the Mediterranean where there explosive numbers devastated native marine species. Two centuries data indicated their populations naturally swell every

12 years, remain stable for four or six years and subside. Reports indicate, for the eight year in succession, in 2008, medusae will be present in massive numbers. Over exploitation of ocean resources helped create a near perfect environment for them multiply unchecked. Off the coast of Nambia in the Atlantic one of the most intensely fished oceans in the world, huge surges of jelly fish were reported. Climate change with warmer waters seemed to have prolonged their reproductive cycles.

Conservation and management

Oceans need a respite of at least several years of reduced catches to restore depleted fisheries. Collapsed fisheries in several parts of the world have revived through fishing regulations. Therefore the present state of oceans and their resources call for an overhaul in global management.

Trawling especially the colossal quantities of by catches, often discarded at sea, has caused extensive damage to the marine ecosystems, calling for stricter regulation of mesh sizes of the cod ends of nets and mandatory installing of BROs and TEDs. Similarly, the by catches in long line operations, which are extensively operated in several parts of the globe in industrial fishing needs attention and regulation.

Countries like Australia plan to ban fishing and shipping in nearly a third of the Great Barrier Reefs. The crisscrossing of the world's oceans by shipping lines has been identified as one of the major human impacts on machine life. The extensive damage caused by shipping, mainly through oil spillages, shipwrecks and discharge of several other waste production in the sea causes untold misery to living organisms. Most heavily affected waters include the North Sea, south, east china seas, Caribbean Sea, east coast of North America, Medeterrinean, Red Sea, Parsian Golf, Bering Sea and several regions in the western pacific. Just 3.7% of the oceans (near the poles) is considered very low impact area. Shifting shipping lines away from sensitive continental shelfs and coral reefs and fragile Iceland ecosystems would significantly reduce the impact on ocean life. The Sethusamundram project along the South East coast of India (Palk Bay and Gulf of Mannar region) which would operating the close proximity of coral reefs and sensitive Iceland ecosystem can cause extensive damage to the reefs and other marine resources of the region by shipping routes, other related disturbances and consequent pollution.

Marine resources go a long way for recovery of depleted stocks of marine fish and other animals. Recovery plans need to focus also on the coastlines, coastal wetlands and river mouths areas which form critical spawning ground for depleting ocean species. Such areas are degraded because of poorly planned coastal development. Information available from marine resources in different parts of the world indicated diversity of species recovered dramatically and with it the ecosystem productivity and salinity. Greater use of protected areas could safe guard the existing stalks. If damaged ecosystems are brought under control in time through regulation they can recover with remarkable speed. The upsetting of prey-predator relationships and other unforeseen and devastating impacts on fish population, other marine animals and ecosystems underscore the need to take a more holistic ecosystem- based approach to fisheries based management. The damage to fisheries or ecosystems may not be solely attributed to individual activities like over fishing, pollution and habitat loss but to cumulative destruction. Good management of marine parks, marine protected areas and biospheres is required for recovering depleted resources and damaged ecosystems. It is on record marine reserves and no catch zones bring an average 23% improvement in biodiversity and increase in fish stocks around the protected area. In all such efforts participation of all stakeholders is linked to success, since marine resources are traditionally exploited by fishing communities along coast lines for centuries. They should be allowed to continue their activities but with necessary limitations. Conservation of resource does not

mean complete denial of access to resources but better control and scientific management. The endangered and protected stocks have to be periodically reevaluated for recovery and recoupment. If necessary certain species and animals have to be translocated for better habitat and food availability for improved survival and replenishment.

Countries need to manage oceans along ecological boundaries rather than political boarders. Many Governments in the world implemented fisheries management policies for curbing environmental impact of fishing, control human activities affecting fish stocks for the aquatic environment. The lows include quotas for fishing, limiting number of vessels and imposition of seasonal restrictions on fishing, fishing areas and species. Satellites and internet are used to monitor fishing activities at sea.

Enforcement of lows regarding conservation and management of marine resources, coastal regulation zones, coastal management plans, and development of industrial corridors in coastal areas required participation of coastal communities, especially fishermen who depend on marine resources for their livelihood. For fruitful implementation of various programmes, plastic awareness has to be created, self imposed regulations amongst communities have often proved to be successful than regulation brought in by force. Short sighted environmental policies could act negatively to rebuild fish population. Scientific findings and research advice shoud be translated into policies for fishermen to catch fish without damaging the ecosystems.

Summary

Based on global scientific studies a wake-up call has been sounded on the declining world sea fish populations as well as the drastic decimation of large predatory fish, largely attributed to over fishing, pollution of the seas and other environmental factors. Though the conclusions are debated, scientific advice calls for regulation, fisheries, maintenance of the health of the oceans, rational exploitation of the resources with responsibility and concern for the continued functioning of the marine ecosystems.

The impending climatic changes and their effects on ocean productivity, food chains dynamics of sea fish populations have to be met by suitable measures. Protection to endangered marine animals, establishments of sanctuaries, marine resources and parks and creation of public awareness have to be accorded high priority in the context of continuously deteriorating marine habitats and divested marine fish populations and other animals. Proliferation of obscure marine creatures should be recognized as indication of poor health of the seas.

Since Indian marine fisheries are predominantly coastal, the alarm signals sounded on the diminishing world sea population, vastly applicable to industrialist fishing nations, are immediately of not much concern. However, such caution have to be needed as far as the presently exploited coastal fisheries, especially since many stocks are exploited to the maximum sustainable level and therefore require management. Over capitalization and over capacity of the coastal fisheries should be scaled down to optimum levels and surplus diverted to developed oceanic fisheries giving the needed respect to coastal fisheries resources to recuperate.