in high quality protein (6-28%), vitamins such as A, B12, C, D, E thiamin riboflavin, nicotinic acid, pantothenic acid, pyridoxine, biotin and folic acid and minerals (0.4-1.5%) such as potassium, calcium, phosphorus, sulphur, sodium, magnesium, chloride, iron, manganese, Zinc, fluoride, arsenic, copper and iodine.The essential aminoacids determined in certain low value fishes are Leucine, phenylalanine,valine, methionine, tryptophan, threonine, arginine, lysine and histidine.

The above low value fishes could therefore be converted into health powder for addition in cruels and other food stuff especially for the nutritionally deficient children of developed and underdeveloped countries. The shell wastes of shrimps and crabs which are hitherto wasted in processing industries could be converted into chitin and chitosan. As a polymer chitosan reduces in cholesterol level and weight loss; decreases urea and creatine level; increases haemoglobin level; improves appetite and sleep; protects liver; prevents tumour and ulcer formation; regulates blood pressure and promotes immune response and growth of bacteria in intestine to improve digestion, cleanse colon and prevent diarrhoea and constipation. It is estimated that about 40,000 tonnes of chitosan could be obtained from the above crustacean shell wastes. The inner shell (bone) of cuttle fish is rich in calcium carbonate (80-85%) and is a good source of dietary calcium. It is also known to be a traditional medicine for tropical sprue and dysentery. The black coloured ink of cuttle fish is nowadays traditionally included by the people of southeast Asian countries in rice and pasta Intensive research is needed to identify its pharmaceutical properties. The above calls for creating awareness among seafood processors and pharmaceutical industries to put up new industries in tamilnadu coast so as to generate alternative employment avenues for fishermen. Details relating to number of such industries, finance requirements and training programmes to be offered for fishermen have been worked out and discussed.

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## Management of endangered mangrove coasts and human health: a proposed comparison of cholera dynamics in the Sundarban and Amazonian regions

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In many developing countries, particularly in their coastal region, cholera is still an important cause of mortality and morbidity. In 1991 a cholera epidemic started in Peru and spread throughout South America reaching the Amazonian coast. espite modern advancements, cholera was reported from over 90 countries during 1994, the largest scale ever recorded in human history (WHO, 1998). As early as 1884, Robert Koch suggested that the Sundarban mangrove forest was the main source of cholera. He stated that the combination of a brackish wetland environment, rich in organic matter and with a high density of human population depending on wetland resources, represented the ideal conditions for the proliferation of *Vibrio cholerae*, the etiological agent of cholera. Although the high demographic density surely plays a role, probably amplifying the transmission mechanisms of cholera, it is not necessarily its primary cause. *V. cholerae* is part of the autochthonous flora of brackish and estuarine environments, and cholera epidemics can be linked to plankton blooms, rise in temperature, El Niño Southern Oscillation, and persistence of brackish to saline water conditions (Colwell, 1996). Cholera generally breaks out more devastatingly after floods by cyclones or other natural disasters.

In Bangladesh, from the southern Bay of Bengal, increased frequency and intensity of storms produces salinization of inland water bodies, facilitating the spreading of the salt-loving *Vibrio* organisms and affecting drink water availability. From the land side, transboundary dam construction has severely reduced riverine discharge into Bangladesh, what has further

facilitated salt intrusion into its estuaries. The vulnerability of this setting has recently increased due to the massive damage inflicted to the Sunderbans by the cyclone Sidr in 2007, which affected about 30% of its extension and killed ~10.000 people. Particularly affected was the marine front of the mangrove and the villages therein, which respectively most mitigated and suffered the strongest cyclone impact (Ocha, 2007). This situation has led to a controversy regarding the strategy to reduce the vulnerability of the Sundarban socio-ecological system (SES). While sectors of the Forestry Department originally planned a rapid reforestation of the affected sectors, environmentalists proposed to leave the system regenerate by itself. Although both had reasons supporting their positions, some intermediate solutions were not considered, such as the selection of pilot areas for comparative studies on the adequacy of each approach for increasing the robustness of the coastal belt in a time scale compatible with the increased cyclone frequency. This could have included the monitoring of vegetation development, participatory management for fallen wood use and tree replanting, and the study of *V. cholerae* dynamics in natural and replanted wetlands, water bodies and human population. Particularly interesting tools for such purpose would have been the approaches of the "Social Forestry" and "Coastal Greenbelt" Projects, initiated in Bangladesh in 1980's and '90s and the UNESCO Ecohydrology Program, which deals with new ways of increasing the bio-physical stability of coastal zones, using the system's own properties for the creation or restoration of wetlands (Zalewski, 2000).

In Brazil, the mangroves in the Amazonian coastal region show presently significant changes, being the loss of vegetation coverage the dominating process along the coastline in the last 25 years. At the same time mangrove has actively invaded herbaceous mud flats in the topographically higher locations. The topography-dependent dynamics of this process strongly suggest an increase in inundation frequency and changes in soil salinity, and the current dynamics of vegetation change matches predicted rates of sea-level rise (Cohen and Lara, 2003). Other parallel studies show an increase of the socio-economical vulnerability of the coastal region (Szlafsztein and Lara, 2003). Although this region has been affected by cholera in the past, the disease never established as around the Bay of Bengal. The first city in Brazil struck by Asian cholera en 1855 was Belém, in the Amazonian coastal zone. From there it followed the Amazon river upstream into the interior of Pará and westward into the province of Amazonas. In 1991, the epidemic initiated in Perú expanded roughly eastward and soon hit the Amazonian coast, but there it extinguished after seven months.

At a global level, a comparison between the two largest brackish wetlands worldwide as *Vibrio* habitats, the Sunderbans and the Amazonian mangroves, could provide a deeper insight into the mutual interactions between the impact of cholera on human coastal population, wetland dynamics and *Vibrio* diversity. The environmental setting of both regions is similar: large mangrove extensions, high riverine input and sediment load. Despite several epidemics in Amazonia and throughout South America, cholera did not develop regular annual outbreaks with a seasonal pattern as in South Asia. Thus, a major question regarding the dynamics of the SES in each region is: Why is cholera endemic in Bangladesh/India and not in tropical South America? Is this mainly a biodiversity, biogeochemical or social/demographic issue? Although human population density in Amazonia is much lower compared to South Asia, the seasonality of cholera epidemics in the latter is strongly related to natural aquatic cycles. Thus, the reasons for endemicity, whose consequences permeate the whole SES are not obvious and deserve an integrated, comparative research approach in order to further improve mangrove management criteria and disaster mitigation policies.

## Coral reef degradation and management implications at Samui Island, Surat Thani Province, Thailand

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Main causes of coral reef degradation around Samui Island, the Gulf of Thailand are high sedimentation exposure during low tides and mass coral bleaching. The process of degradation involves a failure to recover from disturbances. The present study concentrates on settlement and recruitment of corals which is critical to the recovery of coral reefs after disturbance and hence an important aspect of reef resilience. The settlement, plate experiments showed that coral