charged from land based aquaculture systems or other sources.

Another important ecological role that bivalves play in the coastal ecosystem is the addition of larvae into zooplankton. One female oyster has the capacity to produce 50 million eggs in a single season. Due to a relatively long larval period of up to three weeks in the zooplankton, larvae become an important part of the food chain.

The long larval period also enables a wide dispersal range of bivalve larvae. Larvae of oysters are capable of dispersion over a distance as great as 1300 km. This dispersal capability contributes to colonisation of new areas, enhancement of bivalve populations, enrichment of the coastal ecosystem and maintenance of genetic variability.

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Major Changes in Environmental Conditions during a Decadal Time Scale of a Tropical Lagoon along East Coast of India

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Chilka lake (19° 28′–19°54′N; 85°05′–85°38′E) situated along the eastern seaboard of India is one of the largest water bodies in the tropics of Asia. The physical setting and hydrographical regime of the lake composing of brackish characteristics contribute to a highly productive ecosystem. During winter, it attracts more than one million migratory waterfowl from Siberia. Due to its rich biodiversity, it has been identified by the Government of India as a Ramsar site, under the convention of wetlands of international importance, since 1981. More than 100,000 fishermen depend on the lake resources directly or indirectly for their sustenance. Thus, the lake has a considerable impact on the socio-economic conditions of the people living in its vicinity and therefore needs regular monitoring and management from an ecological point of view.

The lake is formed by accumulation of coastal sediment in the beaches of the barrier berm spit over a period of time. The water-spread area of the lake varies between 1165 to 906 km^2 during the monsoon and summer seasons, respectively. A narrow intricate channel, 35 km long and 150 m wide, connects the main body to the Bay of Bengal. The lagoon receives drainage from the branches of a major Indian River system from the north and is surrounded by hills in the south. During the monsoon months, heavy precipitation results in the increase of water levels to over a meter. The tidal fluctuation inside the lagoon is small (around 0.2 m). Though tides of about 0.9–2.4 m occur along this coast, it is not strong enough to override the long channel and initiate an active circulation inside the lake. A huge amount of coastal sediment moves along this coast during the monsoon season (April to September), which results in blockage of the channel mouth or if carried through the channel, leads to siltation. All these factors lead to spatial stratification of the lake, and the lake is broadly classified into four/five major ecological sectors on the basis of its hydrographic distribution. The lake has undergone rapid changes in the last two decades and is facing major transformations such as shrinkage in total lake area, siltation/sedimentation, eutrophication and depletion of fishery resources, etc. As a part of a restoration program and to enhance the productivity of the lake, several developmental projects are on its way. A new mouth was cut across along the outer channel to the Bay of Bengal on the 23rd of September 2000 in order to improve the water quality and circulation pattern in the lake.

This paper highlights some of the major changes in the environmental conditions of the lake during a decadal time-scale based on our long-term field survey and Indian Remote Sensing (IRS) satellite data. A comprehensive assessment of the integrative physical, chemical and biological factors crucial to the functioning of the lake's ecosystem is reviewed and discussed. Some of the fundamental questions related to the pollution and fisheries of the lake are examined.

Limnological, meteorological and biological parameters monitored during the last 10 years at different seasons were found to be dependent on the physiographic conditions of the lake. The southern and central zones of the lake are deeper (~2 m) whereas the northern portion of the lake is very shallow (0.5~1 m) due to heavy sedimentation. Relatively warmer water is observed in the southern portion of the lake, largely attributed to the weak water exchange. The average salinity of the lake ranges from 0.55 to 16 psu. High saline water occupies in the central sector and the distribution pattern shows a

tongue-like intrusion towards north. The salinity distribution can be attributed to the combined effects of bathymetry, a larger fetch area, greater wind stress, inequality in evaporation and the tidal influx of high saline water. The surface-bottom differences are more pronounced in the shallow areas. The lagoon is well oxygenated, however, extreme values are observed in the northern sector where thick vegetation and poor mixing takes place. pH values varied from 7.6 to 10.2 for the entire lake and the northern sector values varied from 8.32 to 10.2. Nutrients such as nitrate, phosphate and silicate values are found to be highest in the northern sector whereas the lowest values are recorded in the southern sector. Chlorophyll-a values varied from 0.17 to 18.88 mg/m^3 in the lagoon during the entire period of observation. It is observed that saline conditions primarily regulate the fisheries of the lake. Fish landing data reveals that there was a sharp decline in the fish production in the lake from 1988 to 2000. However, fish, shrimp and crab production suddenly jumped to the order of 2.5, 6 and 10 times respectively in the 2000–2001 period after the dredging of a new mouth resulted in considerable increase in salinity (32 psu). The catch of the major prawn *Penaeus indicus* has increased dramatically. The rivers bring huge sediments (turbidity). IRS data sets for different time periods reveal that the vegetation spread occurs at the rate of 25 km^2/year. A Chloro-alkali factory that uses mercury is in production a little further away from the lake. Besides that, the lake is surrounded by paddy fields that are major sources for different fertilizers that enter the lake environment. However, the pollution components of the lake are still not properly studied.

Past events in the lake are the best examples of interaction between natural process, human impact, socio-economic conditions of traditional fishing folk and government policies in coastal habitats. A recent observation indicates that the lake is over exploited and lacking proper regulation in relation to resources management. Hence, it is suggested that the involvement and education of the local community and the state Government can play a key role in shaping the future of this pristine environment.

Ngaremeduu Conservation Area GIS Project Palau

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GOAL: To utilize the GIS application to enhance understandings of impacts of the development and other activities on water quality in the Ngaremeduu Conservation Area, and to better equip managers to make wise decisions.

The Ngaremeduu Conservation Area encompasses approximately 29,400 acres of land, mangroves, estuary and reef areas. In order to understand the environmental impacts of the various developments and activities in or near the Conservation Area, water quality monitoring is carried out in rivers, streams, mouths of estuaries, and water bodies in or near the Ngaremeduu Conservation Area.

Currently, with the development of the 53 miles Compact Road around Babeldaob, there is the potential for environmental impacts that may be caused by increased development once the Compact Road is completed. The purpose of the project is to provide managers with adequate decision-making tools that will assist them to manage their resources sustainably. Water quality samples will enable the managers to see the impacts occurring during times of increased sedimentation or nutrient runoffs caused by developments around the Ngaremeduu Conservation Area.

The project will provide managers, landowners and decision makers with adequate decision making tools using the GIS application. The agencies or organizations involved in the water quality monitoring include EQPB, Ministry of Resources and Development and the state governments.

Mangroves of Samoa and Science Education

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Traditionally, mangroves have been a part of the country's environment and providing goods and services to the Samoans. The goods include firewood, timbers, fishing poles, dyes, and medicines. With services, the mangroves have been playing a role in protecting the islands against strong wave and wind actions. The trees also trap a significant proportion of sediments from flowing towards the sea and thus sparing the marine environment from unavoidable damages. As far as the nutrients cycles are concerned, mangroves have been involved in carbon sequestration, contributing to the islands' fertile soils. In addition the role of the mangrove ecosystem in providing niches for various organisms have been instrumen-