Chilika Lake is rich in natural and cultural beauty, and important to local livelihoods

Chilika Lake’s unique ecosystem provides a food source for the livelihood of local communities. It is a home to a variety of fish species, making it an important source of income for the local communities. The lake also supports cultural activities, such as the annual Chilika Fish Festival, which attracts tourists from all over the world.

Pressures affecting the Chilika Lake ecosystem

Chilika Lake is under threat from various pressures, both natural processes and human activities. The main pressures highlighted here are sedimentation, pollution, tourism, and aquaculture. These pressures can result in a degradation of the lake’s ecosystem, which is crucial for the livelihoods of the local communities. To address these pressures, it is necessary to implement effective management strategies to protect and preserve the lake’s ecosystem.

Sedimentation

During monsoon season, an excess of sediment is washed into the lake, primarily from the Mahanadi River. This sediment influx affects the health of the lake, leading to reduced water clarity and the loss of vital fish species. To mitigate this problem, measures such as the construction of sediment traps and the implementation of effective land-use practices are necessary.

Pollution

The lake is also under threat from pollution, which is caused by various activities, including the discharge of untreated sewage and industrial waste into the lake. This pollution can lead to the growth of algae blooms, which can deplete oxygen levels and harm aquatic life. To address this issue, it is essential to implement effective waste management practices and enforce strict regulations on industrial discharges.

Tourism

While tourism is providing a welcome source of income for the local communities, it can also have negative impacts on the lake’s ecosystem. Activities such as boat tours and fishing can disturb the delicate balance of the lake’s ecosystem. To mitigate these effects, it is necessary to implement sustainable tourism practices and to educate visitors about the importance of preserving the lake’s natural beauty.

Fisheries and Aquaculture

The lake’s fish population is essential for the livelihoods of the local communities. Overfishing and the use of illegal fishing nets can lead to the depletion of fish stocks, affecting the ability of the lake to sustain the local fishing industry. To address this issue, it is necessary to implement effective fishing regulations and to enforce strict penalties on illegal fishing activities.

Aquaculture

The growth of fish farms has also put pressure on the lake’s ecosystem. The introduction of non-native species and the discharge of fish farm effluents can harm the natural fish population and disturb the lake’s delicate balance. To mitigate these effects, it is necessary to implement effective regulation and monitoring of fish farm activities.
How the report card was prepared

This is the third of a proposed series of annual Ecosystem Health Report Cards for Chilika Lake. The report card was developed in order to enhance understanding and management of the Chilika Lake ecosystem through a collaboration involving the Natural Resources Institute (NRI), Laboratory of Freshwater Ecosystems (LFE) and the Department of Environment Protection (DEP) through the NRI’s Ecosystem Health Program. The Chilika Lake core team is led by Dr. Arunava Roychoudhury. The core team is supported by a range of different partners, including the Indian Ministry of Environment and Forests, the Odisha State Pollution Control Board, and the Center for Coastal Science and Engineering at the University of Rhode Island. The report card series is funded by the European Union through the Horizon 2020 programme.

Measures of ecosystem health

Measuring the ecosystem health of Chilika Lake is conducted using 15 indicators organized into three main categories: Water Quality, Fishes, and Biodiversity. Together, these indicators provide a holistic view of the lake’s health. These coarse indicators are derived from a number of different sources of information: direct observations, scientific literature, and expert knowledge. Each indicator is evaluated on a scale of 0 to 100, with 100 representing the best possible condition for that indicator. The overall health of the ecosystem is then calculated as an average of all 15 indicators, with a maximum score of 100.

**Water Quality**

- **Water clarity** indicates how much light penetrates the water column, which affects the growth of phytoplankton. Clear water allows phytoplankton to thrive.
- **Dissolved oxygen** is crucial for lake ecosystems. Low levels can lead to oxygen depletion, which affects aquatic life.

**Fishes**

- **Total catch** indicates the total amount of fish caught in a given year. A healthy ecosystem supports a diverse and abundant fish population.
- **Commercial species diversity** measures the diversity of commercially important fish species.

**Biodiversity**

- **Benthos richness** measures the diversity of benthic organisms at the bottom of the lake.
- **Dolphin abundance** is a key indicator of the health of the dolphin population.

**Selected conditions guide ecosystem change**

Desired conditions are based on available guidelines, current scientific knowledge, and local historical data and trends. For each indicator, the desired condition is identified based on the level of sustainability for the lake ecosystem. This information is used to assess the current condition of the lake and guide future management decisions. The desired conditions provide a framework for evaluating the lake's health and for setting goals for improvement.
Calculating the ecosystem grade for Chilika Lake

Chilika Lake was divided into four reporting zones, each of which received a report card grade. The grades were calculated from the average of water quality, fish health, and biodiversity indices, comprised of data collected over the 2011-2013 period. On-going monitoring will allow grades to be updated on a periodic basis, providing a means to track change over time.

What do the grades mean? *

A) 90-100%. All water quality and biological health indicators meet expected levels. Quality of water in these locations tends to be very good, most often leading to very good habitat condition for fish and shellfish.

B) 70-89%. Most water quality and biological health indicators meet expected levels. Quality of water in these locations tends to be good, often leading to good habitat conditions for fish and shellfish.

C) 60-69%. There is a mix of good and poor levels of water quality and biological health indicators. Quality of water in these locations tends to be fair, leading to fair habitat conditions for fish and shellfish.

D) 30-59%. Some or few water quality and biological health indicators meet expected levels. Quality of water in these locations tends to be poor, often leading to poor habitat conditions for fish and shellfish.

E) 0-29%. Very few or no water quality and biological health indicators meet expected levels. Quality of water in these locations tends to be poor, often leading to very poor habitat conditions for fish and shellfish.

* Grades depicted with a + indicate zones that are within 0.5% of a water quality or biodiversity. For example, a grade 85% indicates 75%.
Chilika Lake 2012 Report Card

Overall, Chilika Lake scored 85% for ecosystem health based on performance of water quality, fisheries, and biodiversity indices. The Lake as a whole displayed excellent dissolved oxygen concentrations, water clarity, total fish yield and size, and benthic influe na-diversity. The Lake failed, however, for total of phytoplankton concentrations. Based on these conditions, the ten indicators were assessed within water quality, fisheries, and biodiversity. Each zone was assessed individually, with the Central Zone followed by the Southern Zone, then the Outer Channel Zone, and finally the Northern Zone. A breakdown of these indicators by zone is provided below:

Northern Zone
- Good water quality with the exception of total phytoplankton, and average biodiversity largely due to an absence of dolphin sightings.

Central Zone
- Good water quality with the exception of total phytoplankton, and excellent biodiversity.

Southern Zone
- Good water quality with the exception of total phytoplankton, and excellent biodiversity.

Outer Channel Zone
- Good water quality with the exception of total phytoplankton, and excellent biodiversity.

There’s more to this story: Salinity

The four zones used in the Chilika Lake Report Card are based mostly on salinity variations that occur within the Lake. Salinity in the Lake is driven by freshwater river flow from the north and east, and tidal seawater from the east and south. This results in a variation of salinity in the Lake. Results from freshwater in the north, saline waters in the central and south, and tidal seawater in the east around the islands and outer channel. The boundaries between these zones shift throughout the year, driven by monsoonal rains and seasonal winds.

During the 1990s, extensive salinity in the Lake was limiting access to the sea, reducing fish breeding and decreasing salinity to such an extent that biodiversity declined and invasive aquatic species proliferated. This had a highly negative impact on the Lake’s habitat for wildlife and fisheries resources. In 1992, the area included in the Monsoon Reserve by Ramnar in 1991 due to the ecological changes. In 1996, COICOP opened a new mouth for the outer channel. This new opening increased salinity throughout the entire basin. The new mouth increased the rate of water exchange with the sea, improving water quality and biodiversity.
Where do we go from here?

This report is a significant step forward in our understanding of how human activities (Pressures) affect the environmental condition of Chilika Lake within the Pressure-State-Response (PSR) framework for environmental management.

The Chilika Lake Development Authority has a Response plan which envisages conservation and sustainable resource development and livelihood support through institutional development, communication, education and public policy, and institutional development as the key management response components.

The addition of this report card that awareness and monitors the State of Chilika Lake completes the PSR loop, and strengthens the framework that ultimately aims to decrease uncertainty in resource management decision-making for the sustainability of Chilika Lake and how that depends on it.

Key management Response strategies to be adopted include the following:

- Ensuring hydrological connectivity of Chilika with freshwater and coastal processes at the basin level.
- Establishing hierarchical and realistic inventory of biological, socio-economic, socioeconomic, and institutional features and ecosystem services to support management planning and decision-making.
- Promoting sustainable cultivation management practices to manage influx of all and nutrients into the wetland system.
- Adopting environmental flows as a basis for water allocation for conservation and development activities.
- Promoting biodiversity conservation through habitat improvement and ecological and indigenous species.
- Supporting ecosystem development for enhancing awareness, income generation, and livelihood diversification.
- Promoting sustainable livelihoods for maintaining agricultural security, well-managed ecosystems biodiversity and imperative sharing of benefits.
- Reducing poverty through sustainable resource management and utilization and livelihood diversification.
- Protecting institutional arrangements ensuring integration of ecosystem management planning and that beak and coastal zone management.
- Strengthening CDA, with adequate legal and administrative powers to regulate detrimental activities.
- Building capacity at all levels for technical and managerial skills for implementation of integrated management planning.

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For copies of this report card and additional information, please visit http://www.chilika.org and http://news.sciencemag.org.

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