'LAKES OF ODISHA' SERIES-3

NIRMAN
An Initiative for Sustainable Development

RAPID STATUS APPRAISAL: CHILIKA LAKE

Bikash Rath

20 April 2025

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A Note from NIRMAN

This is the 3rd publication in our series on the lakes of Odisha. NIRMAN has been interested in wetlands conservation, and has initiated studies on lakes, mangroves, and salt marshes of Odisha. The present series is an outcome of our studies on the lakes of the state, and we hope to publish more in this series in future.

Our observations are constructive as we understand the complex nature of the larger socio-ecological systems and hence believe that no single stakeholder can be made accountable/responsible for the overall situation of the larger concern.

Our consultant Mr.Bikash Rath has his own ways of conducting credible socio-ecological studies, and this series shall chiefly contain reports based on his rapid assessments as in-depth appraisals require a lot of resources & time which we can't afford at present because of our limitations and want of sponsorship for this work. While accepting the limitations of this paper, we are however sure that Mr.Rath has sincerely attempted to produce an authentic document for all stakeholders; more particularly because unlike the previous two publications under this series, this one on Chilika is based on his studies for more than 5 years and includes some of his personal or other professional experiences too. In fact, he visited different parts of the Chilika lagoon on different dates during the period 2020-25; and even I was a part of his field visit on 2nd December 2020. He conducted field visits despite the COVID outbreak, and has tried to be as comprehensive & holistic in his perspective as feasible within our limitations which would of course make this report a very distinguished one.

Unless otherwise quoted or cited or acknowledged, all the images provided in this report have been taken by the author. We hope this adds a lot of value to the report, and look forward to the constructive feedback and collaborations for some more concrete achievements in wetland conservation in the state.

Prasant Mohanty

Executive Director

STATUS APPRAISAL: CHILIKA LAKE

1. INTRODUCTION TO THE LAKE:

Spreading between $19^0$28' and $19^0$54' N and $85^0$05' and $85^0$28' E, within three districts of the Odisha state in India the intriguing Chilika waterbody is popularly recognized as a lake although scientifically it happens to be a lagoon actually. This covers a vast area in diverse geographies, and is accordingly divided into four sectors: the Outer Channel connecting it to the Bay of Bengal, the relatively shallower Northern sector which is a major confluence area of rivers, the more saline & relatively deeper[1] Southern sector having another connectivity with the Bay of Bengal, and the Central sector having characteristics intermediate between those of Northern and Southern sectors in terms of water depth and salinity[2]. Tourism is prominent in the Outer Channel and Central sector, and religious tourism particularly occurs in the latter where goddess Kalijai is worshipped on an island since long.

The major traditional stakeholders of the lake are the fisher communities, but the governmental stakeholders are the Forest Department, the Revenue Department, the Fishery Department, and so on.

The lake is accessible from various sides, but by rail it is best approached from Balugan on the Chennai-Howrah rail route whereas by air Bhubaneswar is the nearest airport.

Eco-degradation of Chilika primarily due to increasing load of sediments was formally recognized during the 19th century, as we find in the Odia book on geography 'Odishara Bhugola' published in 1892[3]. While the lagoon was undergoing a phase of rapid degradation during 1950-2000, it was designated as a RAMSAR site in 1981 followed by its inclusion in the Montreux Record of Ramsar Convention for prioritized conservation attention. In the meantime, the Odisha government created a special administrative body named as Chilika Development Authority (CDA) in 1991[4]. The eco-restoration initiatives launched by CDA succeeded in removing the lagoon's name from the Montreux Record in 2002. At present, CDA is the competent authority for managing the lagoon although other agencies/departments exercise their authority independently in many respects.

The present author visited different parts of Chilika for more than 5 years since now, and most of these visits were sponsored by NIRMAN, if not all. Some were his personal/private visits too. However, the experience gained in all these visits were useful in drafting this report. The 1st NIRMAN-sponsored

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[1] Hence locally known as 'gabhira Chilika' implying to the deeper areas of the lagoon where shallow water fishing methods will not help much. However, as the local people experience even these areas are loosing their depth and are becoming shallower.

[2] Balachandran S., Pattnaik A.K., Gangaiamaran P., and Katti Tuhina (2020). **Avifauna of Chilika, Odisha: Assessment of Spatial and Temporal Changes.** *In* Finlayson C. M., Rastogi G., Mishra Deepak R., and Pattnaik A.K. (2020), **Ecology, Conservation, and Restoration of Chilika. Lagoon, India**, p.337; https://www.researchgate.net/profile/Gangaiamaran-Pichaimuthu/publication/338957655_Avifauna_of_Chilika_Odisha_Assessment_of_Spatial_and_Temporal_Changes/links/61a5cc914553ea1b7ab53c71/Avifauna-of-Chilika-Odisha-Assessment-of-Spatial-and-Temporal-Changes.pdf#page=217

[3] Anonymous (1892). **Odishara Bhugola** (Odia), p.19; accessible at https://odiabibhaba.in/bahi/ .

[4] Kumar, R. and Pattnaik, A.K. 2012. **Chilika - An Integrated Management Planning Framework for Conservation and Wise Use**, p.1. Wetlands International - South Asia, New Delhi, India and Chilika Development Authority, Bhubaneswar, India.

visit for a participatory understanding of the lagoon was conducted on 2nd December 2020 despite the COVID situation. The last such visit was on 2nd January 2025.

Reports & publications on Chilika have often remained one-sided; i.e. either from the fishers' perspective or from the administrators'/scientific perspective, which reduces their credibility. Participatory socio-ecological status appraisal can bridge the gap between these two, which has been attempted in this report.

The view at Balugan

2. APPRAISAL METHODOLOGY:

This series is based on a rapid appraisal of the lakes following the methodologies mentioned below:

- Study of literature (like management plan, if any; media reports; other relevant documents, etc.)
- On spot-appraisal including interaction with various stakeholders and where feasible/possible a boating for understanding some of the marked realities of the lake.

3. CONSERVATION CONCERN:

3.1 Hydrological concerns:

As a coastal lagoon Chilika's major hydrological concerns are two-fold: shrinking lake area, and reducing trend of its depth.

The 'lake' receives fresh water from its northern & western sides through as many as 52 rivers & rivulets/steams. Daya & Bhargavi, the two major riverine representatives in the South Mahanadi Delta[5] touching the lagoon, dominate in this catchment:

> "The catchment area of the lagoon is 4,406 km^2, in which 68% is constituted by western catchment and 32% by the Mahanadi delta. xxx The three distributaries of Mahanadi River, namely, Daya, Bhargavi, and Nuna, account for 55% of the total inflow whereas the streams/rivulets from the western catchment contribute the rest 45% xxx[6].

Sea water enters through the inlet(s) primarily on the eastern side. The waterspread area varies between 1,165 and 906 square kilometres during the monsoon and summer respectively, making the lagoon semi-ephemeral also in nature. The average water depth, which is not consistent spatially, also varies between from 0.9 to 2.6 ft (0.3-0.8 m) in the dry season to 5.9-13.8 ft (1.8 - 4.2 m) in the rainy season[7].

Originally a part of the Bay of Bengal, the foundation of its hydrological limitations was laid by nature when a barrier beach(sand bar) (now called 'Rajahansa' and developed as a tourist spot) was formed:

> "Chilika Lake is bordered between the sea and mountains. Formation of a barrier spit near Palur due to littoral drift and creation of a sand bar along the eastern shore have transformed the Lake gradually into a shallow lagoon. xxx[8]"

> "Shorefront of Chilika lagoon covers 65 km and includes barrier spit and the inlet region (three spits: south, middle, and north). Dynamics of the inlets during pre (1973–1999) and post (2000–2020) hydrological intervention period were studied xxxx. Results indicate depositional environment on the barrier spit and south spit while erosional environment on the middle and north spit. After the hydrological intervention period (2000–2020), the south spit enhanced by 5.37 km, resulting in northward migration of the Sipakuda inlet, while the morphological changes of the middle and the north spit were observed considerable both in spatiotemporal scale. xxx Significant variability in inlet position and morphology along with vulnerability of the middle and north spit are matters of concern for the lagoon environment. Therefore, the study suggests that limiting the northward growth of south spit and adopting measures to control erosion at middle and north spit as two management interventions to restore the stability along the shorefront of Chilika lagoon.[9]"

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[5] Mishra, Siba & Dwibedy, Soumyak. (2015). **Geo-hydrology of South Mahanadi Delta and Chilika Lake, Odisha**. *International Journal of Advanced Research*. 3. https://www.researchgate.net/publication/324820193_Geo-hydrology_of_South_Mahanadi_Delta_and_Chilika_Lake_Odisha/citation/download

[6] Sarkar, Santosh & Satpathy, K.K. & Chatterjee, M & Bhattacharya, Bhaskar Deb & Mohanty, Ajit & Panigrahi, Satya. (2012). **Chilika Lake it past and present status.**. *in* **Encyclopaedia of Lakes & Reservoirs**,2012, a Springer publication;
https://www.researchgate.net/publication/236852846_Chilika_Lake_it_past_and_present_status/citation/download

[7] Wikipedia(2025). **Chilika Lake**; https://en.wikipedia.org/wiki/Chilika_Lake

[8] Saha A., Biswas B., and Das D.(2022). **Socio-Economic Impact Assesment of Chilika Lake on Its Surrounding Zone: A Review Based On Geospatial Appraisal.** *Journal of Research in Humanities and Social Scie*nce Volume 10 ~ Issue 5 (2022) pp: 01-20. https://www.questjournals.org/jrhss/papers/vol10-issue5/Ser-4/A10050120.pdf

[9] Pradhan, Subhasis & Mohanty, Pratap & Samal, Dr. Rabindro & Kar, Prabin & Sahoo, Rabindra Kumar & Pradhan, Umakanta & Baral, Rakesh. (2022). **Spit and inlet dynamics, beach morphology, and sediment characteristics along shore front of Chilika lagoon, East coast of India** (abstract). Geo-Marine Letters. 42. 10.1007/s00367-022-00741-y.

> "In spite of the relative linearity of the spit, it has curvatures of different magnitudes. Landward of the spit, but adjacent to it, are a number of other sand ridges, some of which are parallel to the coast. xxx The processes of deposition of the spit and the ridges were initiated sometime during the last sea-level rise, before 3,750 ± 200 years B.P. Subsequently, the emergence of land occurred due to minor tectonic uplift and this helped these features to be more permanently above sea level. The constructive wave action and the northward drift were the main processes in the building of the spit from the southern part where there is an abrupt curvature in the solid coastline. The changes in the orientation of the spit are due, in particular, to the differences in the shelf gradients off the coast, the absence or presence of strong river and tidal currents, and the pattern of wave refraction. In part, the constructive wave action, and in part, the tidal currents, storm waves, and wind have built the other ridges[10]."

The original contributory nature of Chilika's catchment dynamics seems to be following a reducing trend, that too creating other complications for the lagoon. While heavy deforestation and high agricultural activities in this region have intensified the deposition of a huge load(about 1.6 million ton/year[11]) of silts each year in this lagoon thereby reducing its area and water depth, diversion of river/stream water for agricultural activities have also reduced the discharge rate[12] of the concerned freshwater sources[13]. Not only that, this freshwater flow is also contaminated with various pollutants that create a favourable nutrient-rich environment of the growth of invasive weeds, particularly the Common Water Hyacinth(*Pontederia crassipes*) which in turn chokes the flow channels. The free ingress of the monsoon run off into Chilika was badly restricted as uncontrolled establishment of prawn culture farms altered the natural topography[14] by creating bunds or elevated structures.

https://www.researchgate.net/publication/364987108_Spit_and_inlet_dynamics_beach_morphology_and_sediment_characteristics_along_shore_front_of_Chilika_lagoon_East_coast_of_India

[10] K. Venkatarathnam, **Formation of the Barrier Spit and other sand ridges near Chilka Lake on the east coast of India**, *Marine Geology*, Volume 9, Issue 2, 1970, Pages 101-116, ISSN 0025-3227, https://doi.org/10.1016/0025-3227(70)90063-0
(https://www.sciencedirect.com/science/article/pii/0025322770900630)

[11] Saha, A. ***et al***(2022); *op.cit*. However, a media report suggests it to be around 1 million tons/year (**Chilika pain satarka ghanti: Barshaku jama heuchi dasha laksha ton patu** (Odia), *The Sambad*, 28 November 2024).

[12]CIFRI(Central Inland Capture Fisheries Research Institute), 1998. **Chilika Lake: Present & Past**, p.7; Bulletin No.80; http://www.cifri.res.in/Bulletins/Bulletin%20No.80.pdf

[13] Climate change is also affecting the riverine discharge. As media reports said in January 2025, both Bhargavi & Daya rivers get gradually dried up in summer.

[14] *Ibid*, p.8

A choked rivulet at Dochian

On the other hand, the tidal influx, which plays a vital role in the lagoon's hydrology, gets much affected adversely by depositional barriers of different kinds created on its shoreline with the Bay of Bengal on the eastern side. The lake bed is mostly above the mean sea level by 1-2.5 metres[15] which naturally limits the scope of tidal ingress. Heavy siltation has significantly increased the lake's bed elevation, accordingly reducing the depth also which in turn reduced the water holding capacity[16]. The floods pushing the silt eastward and the longshore drift choking the inlets at the sea further worsen the situation.

A study of Chilika's water depth for the period of 1985-86 to 1995-96 indicated that during that 10-year period the maximum water depth in the Southern Sector was reduced from 2.7 m to 1.4 m and from 3.30 m to 1.95 m during the pre-monsoon & post-monsoon periods respectively whereas for the Central sector this range varied from 2.9 m to 1.44 m and 2.8 m to 3.47 m respectively for the same period. For the Northern sector, a minor reduction in maximum depth was observed pre-monsoon with a minor increase post-monsoon[17]. This suggests an overall reducing trend despite temporal or spatial contradictions (which can be attributed to the uneven lake bed and inconsistent distribution of siltation). In fact, between 1965-1995/96, the average depth(pre-monsoon/summer data) in the Southern Sector was reduced from 2.69 m to 1.05 m, from 1.61 m to 1.21 m in the Central Sector, and from 0.94 m to 0.89 m in the Northern Sector[18].

Similarly, the lake area has undergone significant shrinkage as a result of which its water-spread area (pre-monsoon/summer) reduced from 906 sq.km. in 1965 to 620 sq.km. in 1995-96. The rate of peripheral reduction was found to be 14.17 sq.km./year as per the 1988 satellite data[19].

[15] *Ibid*, p.9. Interestingly, Panda, R.C.(1928). *Op.cit.,* mentions Chilika's bed to be below the MSL.
[16] *Ibid*, p.39
[17] *Ibid*, p.11

[18] *Ibid*, p.39
[19] *Ibid*, p.39

Salinity, which is the key determining factor of the lagoon's hydro-chemical nature influencing the ecology & biodiversity, has recorded significance changes over the years. Like, in 1957, the average salinity at Rambha was as high as 19.27 ppt which decreased to as low as 2.69 ppt in 1995. Similarly, at Aarakhakuda it got reduced from 25.54 ppt (1957) to 1.52 ppt (1995)[20].

The Palur canal on the southern side of this lagoon also has a strategic importance, not only from the hydrological point of view (it served both as an inlet and outlet), but also from navigational-, fishery-, and biodiversity aspects (etc). It is said that the big Kandakhai channel that existed between Malud & Bajrakot, was used for navigational purposes by ships, and the mouth that was later closed naturally is known as *Pota Muhana*(meaning 'closed mouth')[21]. On the north-eastern side of the lagoon, Manikapatana was another flourishing port till 19th century. However, as hydrological dynamics in Chilika became unfavourable for navigation of larger ships, the maritime activities suffered a setback:

> "The 10th century AD text, the *Brahmanda Purana*, describes that the Chilika lake itself was an important centre of trade and commerce. Ships having a number of masts and sails were often sheltered in the lake. Some of the ships had curvilinear towers with three to five stories and used to go to Java, Malaya and Ceylon from Chilika. The lake was very deep and through a wide-opening mouth was connected with the sea, which provided easy berthing for boats and ships bound for Southeast Asian countries in ancient times.
>
> Xxx
>
> The reasons for the decline of maritime heritage in the Chilika lake is twofold: (i) sediment transported by the distributaries of Mahanadi in the northern end of the lake reduced the depth and area of the lake and (ii) deposition of sediment in the inlet mouth by littoral current. Due to these reasons Chilika was gradually transformed into a shallow lagoon. These two factors also prevented the movement of large ships in the lake, which caused a decline in the maritime heritage. In later periods, to retain their tradition mariners of the region constructed flat-bottom small boats known as 'nauka', suitable for movement in shallow waters inside the lake for trade and commerce, and these are still in use. Coastal surveys and offshore explorations at other port sites in Orissa and the east coast of India may shed new light on the factors responsible for their decline and their present status.[22]"

The lagoon gradually losing its brackish nature and turning into a freshwater lake has been a matter of great concern because of the multi-dimensional adverse impacts of the same, and this has led to man-made hydrological interventions dating back even to a time before the British started intervening. The common-most of this intervention was manually digging the closed inlet mouths so that sea water can enter the lagoon, and it is known to have been attempted in 1780, 1825, and 1927[23]. However, intensive mechanised interventions are of the recent period and include "the

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[20] *Ibid*, Table 14. All figures of salinity are for the month of November only. It is interesting to correlate this data with the historical information that many traditional salt harvesting areas have been closed over time. Like, Parikuda & Gurubai used to be the major salt harvesting sites in Chilika, as per Dr.Radhacharan Panda[vide Panda, R.C.(1928). **Parikuda** (Odia), p.31; Utkal Sahitya Press, Cuttack; e-copy available at https://odiabibhaba.in/bahi/]

[21] Panda, R.C.(1928). *Op.cit.,* introduction

[22] Tripati, S. & Vohra, K.H.(2005). **Maritime heritage in and around Chilika Lake, Orissa: Geological evidences for its decline**; *CURRENT SCIENCE*, Vol. 88, No. 7, 10 APRIL 2005; https://drs.nio.res.in/drs/bitstream/handle/2264/28/Curr_Sci_88_1175.pdf?sequence=1

[23] Mishra, Siba & Nanda, Rabindra & Mishra, Saswat & Sethi, Kumar. (2021). **Anthropocene Physiography and Morphology of Chilika; India.** *Annual Research & Review in Biology*. 36. 71-95. 10.9734/ARRB/2021/v36i230344.; Panda, R.C.(1928). *Op.cit.,* p.117

opening of a new artificial lake mouth nearer to the main water body of the lake (11 km from Magarmukh), desiltation of 14 km long Palur canal restoring the connectivity with the sea through the mouth of Rusikulya River, dredging of a 27 km long new channel connecting Magarmukh and the river confluence point in the northern sector, and desiltation of the lead channel between Magarmukh and the lake mouth xxx. The hydrological intervention in 2000 increased the tidal influx by 44% and salinity level in the lake by 35% as compared to the pre-restoration period xxx[24]." More desilting interventions like dredging from Tinimuhana to Magaramukha and from Jahnikuda to Satapada, alongwith digging of a channel from Balipatapur are also said to be proposed[25].

3.2 Geo-morphological concerns:

The lagoonal ecosystem of Chilika (which also has the estuarine characteristics to some extent) is critically dependent on the inlet mouth linked with the Bay of Bengal. The number, location, and size of such inlet mouths have been changing since centuries because of a phenomenon called 'littoral drift':

> "The estuary is very sensitive to the sediment dynamics. The closure of estuary mouth or shifting of Chilika Lake mouths tremendously changes salinity and ecology of the lake system. The east coast of India along this coast is having a net alongshore drift of about 0.7×10^6 m³ annually toward north direction. The inlets of Chilika Lake are under the influence of alongshore sediment transport from the coast. Apart from this, the rivers bring sediments during peak southwest monsoon season. Because of this the inlets are migrating, depending on the season."[26]

The existence & working of tidal mouths of the lagoon, that serve as inlets for the tidal water, are subjected not only to the influence of littoral drift but also to the force & sedimentation of/through high flood in the rivers draining into the lagoon and to the impact of cyclonic storms:

> "xxx The old shallow inlet at Village Motto, 34km from the lake mouth Magarmunha was closed in natural processes by Nov 2003 and Sipakuda inlet shifted north by 400m xxx. Another mouth opened on 1st August, 2008, 2.3km north of Sipakuda, at Gabakunda. xxxx Sipakuda mouth was shifted by 550m north east during the same period. In Feb 2010 another tidal inlet at Mirzapur opened 1.0km SW of Gabakunda Mouth during solar eclipse day. By then the Sipakuda mouth had shifted by 830m and the Gabakunda mouth, by 200m to NE from the place of origin. By 2012 the Sipakuda mouth shifted by 1.5km, Gabakunda mouth by 500m and Mirzapur mouth by 300m from place of origin in north east direction. Meanwhile during December 2012 a mouth also opened at Sanapatna, 4.511km from the origin of the dredged mouth close to a full solar eclipse day. In 2013, Phailin, a very severe cyclonic storm (VSCS) visited the area. xxxxx, the artificial mouth at Sipakuda shifted by 1.857 km reducing the water channel. The Gabakunda mouth and Mirzapur mouth

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[24] Mohanty, Surya & Mishra, Subhrendu & Khan, Muntaz & Mohanty, Rajeeb & Mohapatra, Anil & Pattanaik, A.. (2015). **Ichthyofaunal diversity of Chilika Lake, Odisha, India: An inventory, assessment of biodiversity status and comprehensive systematic checklist (1916–2014).** Check List. 11. 10.15560/11.6.1817. https://www.researchgate.net/publication/287277817_Ichthyofaunal_diversity_of_Chilika_Lake_Odisha_India_An_inventory_assessment_of_biodiversity_status_and_comprehensive_systematic_checklist_1916-2014/citation/download

[25] **Chilika pain satarka ghanti: Barshaku jama heuchi dasha laksha ton patu** (Odia), *The Sambad*, 28 November 2024

[26] Sundaravadivelu, R. & Shanmugam, Palanisamy & Patnaik, A. & Suresh, P.. (2019). **Migration of Chilika Lake Mouth**: Volume 2(abstract). 10.1007/978-981-13-3134-3_28. https://www.researchgate.net/publication/330024081_Migration_of_Chilika_Lake_Mouth_Volume_2/citation/download

merged with each other and moved in NE direction. The inlet at Sanpatna was widened by 521m.xxxx"[27]

In 2019, the impact of cyclone Fani opened four new mouths two of which were closed naturally in April 2022. The cyclonic impact is said to have reduced the fish catch by 30-40%[28].

Being a highly dynamic ecosystem, the lagoon experiences changing rates of erosion versus accretion, sometimes to its advantage and sometimes to its disadvantage, as an international study found for the period 2000 to 2020:

"After 2000, the erosion was greater than the accretion. The shoreline observed net erosion in around five-year intervals from 2000 to 2020, and net deposition from 1990 to 1995 and 1995 to 2000. The erosion rate which intensified from 2005 to 2011, was predominantly caused by two cyclones Bijli and Aila in 2009. xxx

Lack of sediment supply by Mahanadi river, which is the source of fresh water, may have resulted in recent erosion along the Chilika shoreline. The river has been experiencing a progressive decline in sediment load due to construction of dams in its catchment areas.

While the rising sea level is globally accelerating shoreline erosion, further reduction in sediment supply exacerbates the process, the study found.[29] "

3.3 Water quality:

The water quality of the lake, which is vital for its flora & fauna, has variations both in space & time. Like, during a study for the period 1998-2001, the northern sector of the lagoon showed a high pH likely because of the photosynthesis of the larger amount of weeds present there. It is also in the same sector that low salinity values and higher amounts of nutrients have been observed as this area received a lot of fresh water from the rivers & rivulets and this fresh water is loaded with nutrients from the local agricultural lands (where fertilizer is used). As artificial opening of the new mouth led to an increased level of salinity in the lagoon waters of this area, the Dissolved Oxygen level got decreased accordingly leading to the depletion of the weed cover[30].

The weed spread area of the lagoon was estimated to be about 20 sq.km. during 1973, which increased to as high as 523 sq.km. by the year 2000[31]. A key factor behind this unwanted extension of weed

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[27] Mishra, S.P. & Jena, Joygopal(2014). **Migration of Tidal Inlets of Chilika Lagoon, Odisha, India -A Critical Study**. *International Journal of Engineering and Technology* (IJET),Vol 6 No 5 Oct-Nov 2014; https://www.researchgate.net/publication/287348406_Migration_of_Tidal_Inlets_of_Chilika_Lagoon_Odisha_India_-A_Critical_Study

[28] Sangomla, A.(2019). **Cyclone Fani opens four new mouths in Chilika lake, increases salinity, wipes out fish**; *Down to Earth*, 13 January 2019. https://www.downtoearth.org.in/natural-disasters/cyclone-fani-opens-four-new-mouths-in-chilika-lake-increases-salinity-wipes-out-fish-65071; Anonymous (2023). **Chilika fishers robbed of livelihood since Cyclone Fani opened new mouths**; February 7, 2023; https://optimizeias.com/chilika-fishers-robbed-of-livelihood-since-cyclone-fani-opened-new-mouths/

[29] Rout, H.K.(2021). **Changing erosion, accretion pattern of Odisha's Chilika lake a threat to its biodiversity: Study**. *The New Indian Express*, 21 Oct 2021; https://www.newindianexpress.com/states/odisha/2021/Oct/21/changing-erosion-accretion-pattern-of-odishas-chilika-lake-a-threat-to-its-biodiversity-study-2373888.html

[30] Nayak, B & Acharya, B & Panda, U & Nayak, Binod & Acharya, S. (2004). **Variation of water quality in Chilika lake, Orissa.** *Indian Journal of Marine Sciences*. 33. https://www.researchgate.net/publication/237636728_Variation_of_water_quality_in_Chilika_lake_Orissa

[31] Mishra, S.P. *et al* (2021). **Anthropocene Physiography and Morphology of Chilika; India**; Table-1

cover is the water quality of the lagoon. Common Water Hyacinth (*bilati dala or raja dala*) in the drainage channels of the northern sector and Pondweed(*chari dala*) are among the major weeds of concern for this lagoon; and apart from direct interventions such as manual or mechanical deweeding, indirect interventions changing the water quality have also proved to be effective in their cases:

> "It is seen clearly that, after the opening of the new mouth, weeds have reduced by an area of 172km^2, the area of turbidity has increased by 118.67 km2, particularly in the northeast part of the lagoon, and clear water has increased by an area of 53.79km. xxx
>
> It is observed that changes in tidal and wind conditions influence the spatial distribution of various xxxx weed classes[32] xxx. The change in weed cover between 1 and 5 December 2003 is from 306.73 to 365.50 km^2 and has been validated during ground-truth observations. During December (post-monsoon), salinity in the lagoon decreases abruptly, especially in the northern sector. The growth of the freshwater weeds is tremendous during this period, as confirmed by ground-truth observations carried out by the CDA and the Regional Research Laboratory at Bhubaneswar. It was observed that during high tide and mid tide, the changes are at a maximum; the total weed area has reduced by 88.58km^2, clear water has increased by 41.71km^2, and the turbid area has increased by 46.53km^2 (26 November 2003 compared with 5 December 2003). xxx[33]"

Average salinity of the lagoon has followed a decreasing trend and other water quality parameters have also kept fluctuating more or less owing to the complex hydrological dynamics of the lagoon. However, a study analysing data for the period 1999 to 2015 claimed that "the physicochemical parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrite nitrogen (NO2), nitrate nitrogen (NO3), and phosphate phosphorous (PO4) were within the threshold range suitable for the propagation of wildlife and fishery. The primary source of PO_4 and NO_2 were mostly from *in situ* mineralisation processes whereas, NO_3 and silicate (SiO_2) from the riverine influx[34]."

The water quality of Chilika has been influenced by both natural & anthropogenic factors. Like, the impact of COVID-19 lockdown, which reduced the anthropogenic interference, helped reduce the "metal influx in the water column and improved the water quality of the Chilika lagoon[35]". Extreme weather phenomena, particularly cyclonic storms, have also been changing the water quality of the lagoon chiefly through heavy precipitation & related impacts; as observed in case the very severe cyclonic storm Phailin(2013) decreased the pH level from 8.48 to 7.98 and there was an immediate increase in the Dissolved Oxygen. There was a sudden fall in the salinity which decreased by 28.7% in

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[32] Like, 'dense', moderately dense', 'submerged', etc.

[33] Razawat A.S., Gupta M., Acharya B.C,, & Nayak S.(2007). **Impact of new mouth opening on morphology and water quality of the Chilika Lagoon – a study based on Resourcesat-1 LISS-III and AWiFS and IRS-1D LISS-III data.** International Journal of Remote Sensing, March 200728(5):905-923; https://www.researchgate.net/publication/232874301_Impact_of_new_mouth_opening_on_morphology_and_water_quality_of_the_Chilika_Lagoon_-_a_study_based_on_Resourcesat-1_LISS-III_and_AWiFS_and_IRS-1D_LISS-III_data

[34] Muduli, P.R. & Pattanaik(2020), A. **Spatio-Temporal Variation in Physicochemical Parameters of Water in the Chilika Lagoon**. *In* Finlayson C. M., Rastogi G., Mishra Deepak R., and Pattnaik A.K. (2020), **Ecology, Conservation, and Restoration of Chilika. Lagoon, India** ; https://www.researchgate.net/profile/Gangaiamaran-Pichaimuthu/publication/338957655_Avifauna_of_Chilika_Odisha_Assessment_of_Spatial_and_Temporal_Changes/links/61a5cc914553ea1b7ab53c71/Avifauna-of-Chilika-Odisha-Assessment-of-Spatial-and-Temporal-Changes.pdf#page=217

[35] Mishra, A. K., Mishra, A., Mohakud, S. K., Acharya, P., Muduli, P. R., & Farooq, S. H. (2024). **COVID-19 induced lockdown reduced metal concentration in the surface water and bottom sediment of Asia's largest lagoon**; *Marine Pollution Bulletin*, 209, 117127. https://www.preprints.org/manuscript/202106.0378

the Southern Sector, by 29.8% in the Central Sector, and by 19.1% in the outer channel although that in the Northern Sector remained more or less constant (equitably). The average salinity of the lagoon reached as low as 1.72 in October 2013[36] when the cyclone was active.

Man-made pollution has been affecting the lake, but the sewage discharge from the state capital Bhubaneswar through the Gangua drain which in turn exhausts itself in the Daya river ultimately draining out in Chilika has raised various health- and other concerns:

> "In recent years, the lake has become especially vulnerable to pollution, notably from MPs[37]. This susceptibility arises from its vast monsoon water spread area of 1020 km^2 and its linkage to over 50 rivers and streams from both the Mahanadi basin and the Western Catchment. xxx The Orissa State Pollution Control Board (OSPCB) notes that Bhubaneswar (Odisha's capital) releases over 550 million liters of sewage daily. This untreated sewage, potentially laden with MPs, is channeled directly into the Daya river, passing through the Khurda and Puri districts before merging into Chilika lake xxx. Consequently, the lake has endured substantial ecological degradation, evidenced by significant drops in fish, prawn, and crab populations and a reduction in biodiversity. Erroneous disposal of plastic waste from households, industries, tourism endeavors, run-offs, and riverine inlets have exacerbated the prevalence of non-degradable contaminants like MPs in Chilika lake[38]."

Promoted aquaculture in the form of prawn farming has been another source of contaminants in the Chilika water:

> "Usually, most of the farmers remove effluents from the pond bottoms after each harvest and they typically dump them on the bank of the pond or in the nearby land. During rainy season when Chilika expands and submerges landmass, the effluents discharged from shrimp ponds mix with lake water. The effluents discharged from shrimp ponds on the higher side of the lake also flow into the lake. These pollutants stagnate due to typical tidal activity in the lagoon. The increasing influx of rich organic silt and sedimentation to the lake over the years from the shrimp culture ponds around the lake has become an issue, especially since the mid 1980s. However, this is overlooked by the people who are engaged in the shrimp culture and they are least bothered about the effluents discharged from the shrimp ponds[39]."

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[36]Saroja K. Barik, Pradipta R. Muduli, Bita Mohanty, Alaya T. Behera, Suprava Mallick, Abhijit Das, R.N. Samal, Gurdeep Rastogi, Ajit K. Pattnaik, **Spatio-temporal variability and the impact of Phailin on water quality of Chilika lagoon**, *Continental Shelf Research*, Volume 136, 2017,
Pages 39-56; https://www.sciencedirect.com/science/article/abs/pii/S0278434316300383

[37] Micro-plastic

[38] Panda *et al*., 1995 and Sethi & Patra, 2021 quoted in Mohit Kumar, Dinesh Kumar Naik, Dusmant Maharana, Moumita Das, Ekta Jaiswal, Amiya Shankar Naik, Neha Kumari (2024),
Sediment-associated microplastics in Chilika lake, India: Highlighting their prevalence, polymer types, possible sources, and ecological risks, *Science of The Total Environment*, Volume 914, 2024, 169707; https://www.sciencedirect.com/science/article/abs/pii/S0048969723083377#:~:text=Recognizing%20its%20unique%20aquatic%20biodiversity,to%20pollution%2C%20notably%20from%20MPs.

[39] Mishra, Lopamudra. (2016). **Economic and Environmental Analysis of Shrimp Farming in Chilika Lake, India. Management of Sustainable Development. 7. 5-16. 10.1515/msd-2015-0024.**
https://www.researchgate.net/publication/294257890_Economic_and_Environmental_Analysis_of_Shrimp_Farming_in_Chilika_Lake_India

A 'gheri' or enclosure for prawn culture near Biluamari (southern sector) in 2021

Nutrients released in Chilika water from the prawn culture sites[40] and catchment areas support extensive weed growth resulting in eutrophication that in turn has adverse consequences on the local ecology. In the recent years, although repeated demolition of illegal prawn farms have helped reduced their environmental impact, the issue of pollution through the catchment areas still continues. In January 2025, following a diarrhoea outbreak in the Kanas Block in the northern periphery of Chilika which allegedly took atleast 4 lives the district health authority of Puri advised the people not to drink the highly polluted Daya water[41].

3.4 Threatened fauna:

Expedition of the Zoological Survey of India(ZSI) during 1985-87 led to the "enumeration of 61 species of protozoa; 6 species of porifera; 7 species of coelentrata; 29 species of platyhelminthes; 36 species of nematoda; 31 species of annelid; 62 species of crustacea; 136 species of mollusca; 5 species of echinodermata; 216 species of pisces; 7 species of amphibian; 30 species of reptilia; 168 species of birds; and, 19 species of mammals" among which the freshwater species dominated (this relative dominance of freshwater fauna is said to be one of the factors leading to the hydrological intervention of 1999-2000)[42].

During the said ZSI survey, 8 reptilian species recorded during 1915-24 were not observed in the lagoon[43]. On the other hand, the rare and endemic limbless lizard (*Barkudia insularis*) reported in 2015 was again recorded in the year 2003 in Barakuda island by CDA[44].

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[40] Kadekodi, G.K. & Gulati,S.C.(1999). **ROOT CAUSES OF BIODIVERSITY LOSSES IN CHILIKA LAKE**. CMDR Monograph Series No. – 26. https://cmdr.ac.in/admin_panel/file_upload/prj_comp/Root%20causes%20of%20biodiversity%20losses%20in%20chilika%20lake%20in%20india.pdf

[41] Nayak, S.(2025). **Health department says water of Daya River is polluted, advices people not to use as four people die after diarrhoea outbreak in Puri district.** https://kalingatv.com/odisha/health-department-says-water-of-daya-river-is-polluted-advices-people-not-to-use-as-four-people-die-after-diarrhoea-outbreak-in-puri-district/

[42] ZSI report quoted in Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.45

[43] Mishra S.S. & Mohapatra A.(2016). **Faunal diversity of Chilika lagoon.** https://www.researchgate.net/publication/309764162_Faunal_diversity_of_Chilika_lagoon. *In* Kailash Chandra, Raghunathan C., Tamal Mandal, and Dash S.(2016). **Current Status of Marine Faunal Diversity in India**, 1-525, Zoological Survey of India,

[44] Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.45

The important mammalian species of the lagoon include *Dugong dugon*(so-called sea cow), Irrawaddy dolphin (*Orcaella brevirostris*) alongwith the terrestrial species on the islands such as blackbuck (*Antilopa cervicapra*[45]), chital deer(*Axis axis*), hyena (*Hyena hyena*), and the golden jackel (*Canis aureus*). Among these, the Sea-cow reportedly(2002) reached the extinction phase[46] while the population of the lagoon's flagship species Irrawaddy dolphin has been showing more or less a promising trend in the recent years. The added excitement is the presence of two other dolphin species. As per the 2025 census the lagoon has 159 Irrawaddy dolphins alongwith 15 Humpback dolphins[47]. The dolphin population varies from year to year, and that of Bottlenose dolphins in the lagoon was recorded as 19 in 2024[48].

There is a place called 'Kaincha gahira'(implying to a deep waterbody having turtles[49]) near Mahisha island village where turtles are said to have been found in large numbers sometime in the past although at present they are no more seen there. Similarly, it is said that salt water crocodile and gharial were also seen somewhere in the lagoon in the past[50].

The lagoon is said to have the credit of world's first fishing cat census which revealed the presence of around 176 fishing cats in 2021-22[51].

Molluscs, which form a very important part of the food chain of Chilika's fishes and shellfishes (and also the birds), were found dominating among the Benthic fauna. The Benthic fauna are also known as sedimentary fauna because of their close association with the sediments. On the other hand, among the Phytal fauna (i.e., fauna associated with or living in aquatic plants, particularly the *Patamogeton* species, *Halophila* species, and *Glacilaria* species in Chilika context) as many as 77 invertebrate species were found (which included gastropods and few bivalves).[52]

The lagoon is also rich in zooplankton, the faunal counterpart of phytoplankton. Atleast 37 species of zooplankton have been identified in the lagoon, and this stock is an important component in the food chain of larvae of crustaceans, molluscs, and fishes[53].

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[45] The presence of this species in present Chilika is dubious.

[46] Mishra S.S. & Mohapatra A.(2016).*op.cit.*

[47] *The New Indian Express*, **Census puts dolphin number in Odisha at 710, Rajnagar tops list**, 13 March 2025, https://www.newindianexpress.com/states/odisha/2025/Mar/13/census-puts-dolphin-number-in-odisha-at-710-rajnagar-tops-list

[48] *Odia Diary*, **Dolphin Census Begins at Chilika Lake: A Three-Day Survey Using Advanced Techniques**, 20 January 2025, https://orissadiary.com/dolphin-census-begins-at-chilika-lake-a-three-day-survey-using-advanced-techniques/

[49] In Odia the term 'kaincha' may refer to a turtle or a tortoise.

[50] Jali Nilamani(2002), **Chilikara Pranisampada**(Odia). *In* **Chilika Paribesha**(Odia), p.32. Pallishri, Bhubaneswar. Accessible on https://odiabibhaba.in/bahi/.

[51] *The New Indian Express*, **Chilika home to 176 fishing cats, finds world's 1st survey**, 6th June 2025, https://www.newindianexpress.com/states/odisha/2022/Jun/06/chilika-home-to-176-fishing-cats-finds-worlds-1st-survey-2462302.html

[52] *Ibid*

[53] Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.45

Irrawaddy dolphin in Chilika (Photo courtesy: Chilika Wildlife Division, Odisha Forest Department)

Chilika is said to be the single largest habitat (lagoon) of Irrawaddy dolphin in the world, and what is simultaneously concerning as well as encouraging is the fact that this population more or less withstands the disturbance and risks created by the continuous movement of motorized boats in the Satapada area (outer channel) where tourists commonly come to see them. In 1991 their number was 60-70 which got reduced to 20 in 1992[54], but subsequent interventions by the Forest Department with support of the local communities did help improve the situation. While the hydrological intervention is said to have contributed to this effort significantly, the Department engages local volunteers as 'Dolphin Mitras'(friends of dolphins) so as to facilitate and mobilize necessary community support. This has succeeded in minimizing the injuries & casualties of dolphins although the risks of occasional trapping in the nets (particularly in the prawn enclosures) or accidental injury/death by colliding with the boat propellers are still there. Further, the plastic waste dumped in the lagoon water by the tourists poses another threat when the dolphins consume the same[55].

The famous Chilika buffalo is another important mammal of the lagoon although being domesticated it has not received the kind of attention the CDA pays to Chilika's wildlife.

[54] *Ibid*, p.62

[55] *The Samaj*, **Chilikare Parjyatakanku Akrusta Karuchi Iraawadi Dolphin** (Odia) 28 February 2025

Chilika water buffalo

Chilika Water Buffalo: An Important Livestock Breed Least Protected

The famous Chilika Buffalo is a distinct indigenous breed(registered) of the Chilika lagoon which yields a very rich & nutritious milk at almost no maintenance cost. It is relatively smaller than the mainstreamed commercial buffalo, and the milk yield ranges from 2 to 3 litres on an average. These buffaloes have the unique habit of swimming across the lagoon in search of their preferred fodder species which primarily consist of the *chheda* grass and some macrophytes. They freely roam in the shallow lagoon water, go to the small & uninhabited grassy eminences found here & there in the lagoon, graze throughout the day & may be in the night also, return to their owners in the morning for milking and then go back to Chilika once again. Their owners may not accompany them unless they want them return as per the man-made schedule. These buffaloes are quite resilient, are less prone to diseases, and are efficient enough in converting the natural fodder biomass in Chilika to a cream-rich dense milk.

The milk of Chilika buffalo is used for making various dairy products, but most famous is its curd which is traditionally made in a bamboo basket having an inner lining of *maida*(refined wheat flour) paste. Unlike a formal container this basket helps release the excess water of the curd through the holes made in the *maida* lining, which in turn helps to prepare a dense & cream-rich curd. The famous legend of Lord Jagannath relishing on the curd at Manikapatana(a village in Chilika) most likely refers to this special curd.

The vulnerability of this breed is related to the following factors:

* *Impact of cyclones:* Although these buffaloes are said to go to Chilika irrespective of the weather conditions, many of them were supposedly lost or killed in the last cyclonic storms of severe kind. Habituated to remain out of shed for most of the hours, they become vulnerable to cyclonic impacts.

* *Dilution of genetic identity:* As some of the herdsmen (particularly those staying in the advantaged areas on the Brahmagiri-Satapada road side) see a better business prospect in keeping the mainstreamed commercial breeds(which yield about 10 litres milk on an average) despite their higher

purchase- & maintenance costs, their bringing of these commercial breeds is posing a high risk of genetic contamination for the indigenous Chilika buffalo.

* *Reduced grazing access:* Many parts of the Chilika shoreline have been converted into aquaculture farms, and this changed land-use has reduced the conventional grazing access of the Chilika buffaloes which has also demotivated the herdsmen to keep them. Further, whereas the Nalabana area has been a favourite grazing ground for these buffaloes kept mainly in the Parikuda- & nearby islands, the Forest Department is not in favour of allowing this grazing access in the sanctuary citing the apprehended risk of damage of the eggs/nests of the migratory birds by the buffalo herds. It is another matter that the Department may not restrict this access always unless until a herdsman is found leading the herd to the sanctuary.

The state government has taken some initiatives to preserve & promote this Chilika buffalo breed and its milk products (like a Chilika Buffalo Product Farmer's Producer Organization[56] has been formed, and buffalo-owners who lost their buffaloes in the cyclone have received compensation), but these have been quite insufficient & inadequate so far. What is more concerning is that the Forest Department, which is the major authority in this lagoon management, doesn't see the Chilika Buffalo at par with the Irrawaddy Dolphin or the migratory birds just because this breed doesn't come under the wildlife category. So it is not surprising that this buffalo breed doesn't get the conservation attention it deserves, which is why its population is decreasing (the number is said to have been reduced to about 6000 as per the 2015 livestock census[57]).

The unique style of curd making using the milk of Chilika buffalo deserves a GI tag.

[56] https://www.facebook.com/argusnews.in/videos/%E0%AC%9A%E0%AC%BF%E0%AC%B2%E0%AC%BF%E0%AC%95%E0%AC%BE-%E0%AC%AE%E0%AC%87%E0%AC%81%E0%AC%B7%E0%AC%BF%E0%AC%B0-%E0%AC%B8%E0%AC%82%E0%AC%B0%E0%AC%95%E0%AD%8D%E0%AC%B7%E0%AC%A3-%E0%AC%AA%E0%AC%BE%E0%AC%87%E0%AC%81-%E0%AC%85%E0%AC%A3%E0%AD%8D%E0%AC%9F%E0%AC%BE-%E0%AC%AD%E0%AC%BF%E0%AC%A1%E0%AC%BC%E0%AC%BF%E0%AC%9B%E0%AC%BF-%E0%AC%9A%E0%AC%BF%E0%AC%B2%E0%AC%BF%E0%AC%95%E0%AC%BE-%E0%AC%AE%E0%AC%87%E0%AC%81%E0%AC%B7%E0%AC%BF-%E0%AC%AA%E0%AC%B6%E0%AD%81%E0%AC%AA%E0%AC%BE%E0%AC%B3%E0%AC%95-%E0%AC%B8%E0%AC%82%E0%AC%98-chilika-buffal/777624224512202/

[57] https://www.facebook.com/News18Odia/videos/%E0%AC%9A%E0%AC%BF%E0%AC%B2%E0%AC%BF%E0%AC%95%E0%AC%BE-%E0%AC%AE%E0%AC%87%E0%AC%81%E0%AC%B7%E0%AC%BF%E0%AC%95%E0%AD%81-%E0%AC%9C%E0%AC%BF-%E0%AC%86%E0%AC%87-%E0%AC%9F%E0%AD%8D%E0%AD%9F%E0%AC%BE%E0%AC%97-%E0%AC%AA%E0%AC%BE%E0%AC%87%E0%AC%81-%E0%AC%A6%E0%AC%BE%E0%AC%AC%E0%AC%BF-%E0%AC%B0%E0%AD%8B%E0%AC%97-%E0%AC%AA%E0%AD%8D%E0%AC%B0%E0%AC%A4%E0%AC%BF%E0%AC%B7%E0%AD%87%E0%AC%A7%E0%AC%95-%E0%AC%B6%E0%AC%95%E0%AD%8D%E0%AC%A4%E0%AC%BF-%E0%AC%AC%E0%AD%87%E0%AC%B6-%E0%AC%85%E0%AC%A7%E0%AC%BF%E0%AC%95-mopuri-odisha-/563665366386184/

The high-fat baunshia dahi (Basket curd) prepared from the milk of Chilika buffalo

3.4.1 Threated fish fauna:

As per the assessment provided in Suresh *et al* (2018) the lagoon's fish fauna include 336 finfish species and 66 shellfish species (29 prawn and shrimp species, 2 lobsters, and 35 brachyuran crab species)[58]. These include atleast 278 food fishes among which 129 commercially important species[59].

Highly unsustainable fishing practices (including capture of brood-fish & juveniles and use of traps that damage juveniles), alongwith natural factors, have caused significant harm to the lagoon's fish fauna. While the conservation status of 53.57% of fishes(like *Muraenesox cinereus*, locally known as Danti) of the lagoon was not known, "35 species in 25 families were recorded as threatened and categorized under Critically Endangered (CR), Endangered (EN), Vulnerable (VU) xxx. Further, 14 more species in nine families are categorized as Near Threatened (NT) that need conservation measures unless they may slip to threatened category very soon[60]." Most of the shellfish species were not evaluated for their conservation status, as we see in Suresh *et al*(2018). However, Sahu(1957) mentioned *Engraulis* species (local name: Phesa), *Stolephorus* species(Patua), *Lates calcalifer* (Bhekti), *Macrones cavasius*(Kantia), *Arius arius*(Singada), *Hemiramphus limbatus*(Saragara)[61], and Ilishi to be under threat due to unsustainable exploitation.

[58] Suresh R.V., Mohanty S.,Manna R.K., Bhatta K. S., Mukherjee M.,Karna S. K., Sharma A. P., Das B. K., Pattnaik A. K., Nanda Susanta, & Lenka S. (2018). **FISH AND SHELLFISH DIVERSITY AND ITS SUSTAINABLE MANAGEMENT IN CHILIKA LAKE**, pp.3, 13, Central Inland Fisheries Research Institute and Chilika Development Authority. http://www.cifri.res.in/books/Chilika%20Fish%20Monograph%202018.pdf

[59] Mishra S.S. & Mohapatra A.(2016).*op.cit.*

[60] Suresh *et al* (2018), *Op.cit*., p.15

[61] Sahu, Viswanath (1957). **Ama Machha Sampada** (Odia), p.173
Pp.178-187. Some of these scientific names have subsequently been revised, like *Hemiramphus limbatus* is now *Hemiramphus far.*

Some fishes of Chilika include *Glyphis gangeticus* (critically endangered' local name 'Munda magara'[62] ?), Chital(*Chitala Chitala*, endangered), Magura(*Clarias magur*, endangered), and Ilishi(*Tenualosa ilisha*, vulnerable) while some like Bami(*Anguilla bengalensis*) [63] belong to the category of 'Near Threatened'. The IUCN assessment however may not always match with the local experience of the fishers. Like, Harimala(Haribolia) khuranta(*Crenidens crenidens*) was said to have become almost extinct in the lagoon(?) by 2020[64] although its IUCN status is that of 'Least Concern' [Suresh *et al*(2018) however do mention its negligible landing[65]]. Similarly, Borada(ବରାଉଡ଼ା) is a Chilika fish mentioned in Praharaj(1936)[66] but not listed in Sahu(1957) or Suresh *et al*(2018).

The migratory dynamics of Chilika's fishery resources have many interesting aspects although these are vulnerable to change due to climatic/natural and anthropogenic factors:

> "More than 70-75% of fishes and 70% of marine prawns and crabs which contribute to the Chilika fishery are migratory. xxx Lake Chilika serves as an ideal habitat for 207 species undertaking river-lake-sea migration and vice-versa"[67].

In fact, it is this dominance of migratory fishes that adds some unique characteristics to Chilika fishery.

The freshwater species are usually found in the river confluence areas, and breeding, spawning, and nursing grounds of other fishes vary according to the salinity changes and other factors. Like, the deltaic area of the northern sector serves as the breeding ground of *Tenualosa ilisha(*local name: Ilishi, a high value fish*)* while the lower stretches of the lead channel area serve as its nursing ground. On the other hand, the lake mouth serves as the breeding ground for *Mugil cephalus(*Chilika khainga*)* whereas the outer channel area serves as its nursing ground. This way, the changing dynamics of the river-lake-sea connection also influences the distribution and availability of various fish fauna in the lagoon, and the indigenous socio-ecological knowledge system also used this knowledge to put appropriate traps or select the species-specific potential fishing areas. In fact, the selection of areas for illegal capture of prawn juveniles also corresponds to this socio-ecological knowledge which is why the Palur mouth has been encroached upon or otherwise interfered with unauthorizedly[68].

Prawn aquaculture, apart from its adverse physical and chemical impacts in the lagoon ecosystem, has also led to the dilution of the original fish diversity of the lagoon which is another matter of concern:

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[62] Venkateswaralu T.(1984) quoted in anonymous (undated). **Common name of *Glyphis gangeticus*** https://www.fishbase.se/ComNames/CommonNameSummary.php?autoctr=103195 . The source of database uses the term 'magur' erroneously as magur implies to *Clarias magur*. 'Magar' is the term used in Odia to imply the shark-category fishes.

[63] Suresh *et al* (2018), *Op.cit*., Tables 1 & 2, also pp.56,60,74

[64] Discussion with Sri(now late) Krushnachandra Jena on 2nd December 2020 at Ramabharatia muhana (Chilika). He also mentioned the non-availability of few other species like Seba khainga(*Chanos chanos*), and blamed the hydrological intervention of 1999-2000 by CDA for that. It seems his concern was chiefly related to the outer channel area where his village exists. By the way, Suresh *et al* 2018 (*op.cit*., p.92) do acknowledge the significant decline in the availability of *Chanos chanos*.

[65] Suresh *et al* (2018), *Op.cit*., p.246

[66] Praharaj Gopalchandra.(1936). **Purnnachandra Ordia Bhashakosha**, Vol.5, p.5941

[67] Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.47

[68] Telephonic discussion with Sri Bhimasen Behera, Rambha on 9th April 2025. See also Suresh *et al*(2018), op.cit., p.29

"Illegal aquaculture development on the lake shore line, particularly culturing of exotic fish species like *Clarias gariepinus*, Tilapia, *Litopenaeus vennamei*, etc. has escaped into the lake during flood incidents, which has been recorded during the cyclone Phailin in October 2013[69]."

The introduction of the exotic Pacific prawn or King prawn (*Litopenaeus vannamei*) for high commercial success in prawn culture is also posing a threat to the native gene pool of shrimps/prawn in this lagoon[70].

Contemporary crab traps are also said to be trapping and damaging the crab juveniles.

Suresh *et al*(2018) identified two finfish species *Eleutheronema tetradactylum* (Chilika Sahala) and *Etroplus suratensis* (Chilika Kundala) as indicator species for the lagoon from ecosystem health assessment perspectives. Of these, the Chilika Kundala (simply called Kundala) is a resident species supposed to be endemic regionally, and is a high value fish under threat. The Chilika Sahala(simply called Sahala) is migratory and is also of high commercial value. [71]

*Mugil cephalus(*Chilika khainga*), Penaeus monodon*(Bagda chingudi*), Scylla tranquebarica*(Chilika Sabuja Kankada), and *Scylla serrata*(Chilika Redha Kankada) are some of the fish fauna of high commercial demand in the lagoon. Besides, the brood of *Mugil cephalus* is also heavily priced for its popular demand in the form of sukhua(dry fish)[72].

Crab traps in the outer channel area(left) and the destructive khanda jala(right)

[69] Suresh *et al* (2018), *Op.cit*., p.25

[70] Kundu, S., Rath, S., Tyagi, K., Chakraborty, R., & Kumar, V. (2018). **Identification of penaeid shrimp from Chilika Lake through DNA barcoding**. Mitochondrial DNA Part B, 3(1), 161–165. https://doi.org/10.1080/23802359.2018.1437794; https://www.tandfonline.com/doi/full/10.1080/23802359.2018.1437794#abstract

[71] Suresh *et al* (2018), *Op.cit*., pp.31, 261,275

[72] If the fish itself costs Rs.350/kg, its dry form fetches almost the double and the dried brood almost 10 times (i.e. Rs.3500-4000 per kg), as understood from Sri Kalindi Mallik, Secretary, Odisha Matsyajibi Mahasangha(OMM) through a telephonic discussion on 19 April 2025.

Scylla tranquebarica(local name: Chilika Sabuja Kankada) is a high-priced shellfish

3.4.1 Threatened avi-fauna:

Chilika has been a bird's paradise, and when the area was under feudal administration permission of the ruler(Zamindar or Raja of Parikuda) was necessary to shooting the birds. Hunters had to pay some fee *in lieu* of this permission[73] unless they were some high status or elite personalities.

In 1987 the Nalabana island(15.52 sq.km) in the central sector, which remains submerged during the monsoon and emerges subsequently to become a favourite habitat for various migratory birds in the winter with its low water level, was declared a sanctuary known as Chilika(Nalabana) Sanctuary. This island was found to shelter about 75% of the winter birds in Chilika[74], thus becoming the largest congregation ground of birds in the lagoon; and hence this protected status was justified. Public access was restricted there without special permission.

[73] Rath Bikash(2002). **Aspects of Garjat Forestry**, Vasundhara, Bhubaneswar (mimeo)

[74] Various sources quoted in Balachandran S., Pattnaik A.K., Gangaiamaran P., and Katti Tuhina (2020). **Avifauna of Chilika, Odisha: Assessment of Spatial and Temporal Changes.** *In* Finlayson C. M., Rastogi G., Mishra Deepak R., and Pattnaik A.K. (2020), **Ecology, Conservation, and Restoration of Chilika. Lagoon, India,** p.339 ; https://www.researchgate.net/profile/Gangaiamaran-Pichaimuthu/publication/338957655_Avifauna_of_Chilika_Odisha_Assessment_of_Spatial_and_Temporal_Changes/links/61a5cc914553ea1b7ab53c71/Avifauna-of-Chilika-Odisha-Assessment-of-Spatial-and-Temporal-Changes.pdf#page=217

Boundary pillars of the Nalabana(Chilika) Bird Sanctuary beyond which entry is prohibited

However, Mangalajodi in the western sector, which happens to be the 2nd largest bird congregation site in Chilika, was not a Protected Area the advantage of which was being taken by the poachers for a long time as this poaching had become a part of their livelihood. Similar cases of poaching occurred elsewhere in the lagoon outside the sanctuary area. It was under these circumstances that a local man Nanda Kishore Bhujabal, who is said to be hurt at heart when he shot an Egret[75], decided to save the birds and hence began mobilizing community support for this purpose which was like going against the flow. He however finally succeeded in turning the poachers into protectors of birds and the organization thus formed, called Mahavir Pakshi Surakshya Samiti, was authorized by the Forest Department to arrange & manage tourist boat rides at Mangalajodi for bird watching. It was in the late 1990s'. Since then, with Departmental action and community sensitization poaching of birds is supposed to be significantly reduced in this lagoon although sporadic cases of poaching have still been reported occasionally[76].

[75] Nath Shivya(2024**), Mangalajodi, Odisha: How an Entire Village Transformed from Poaching Birds to Protecting Them**. https://the-shooting-star.com/mangalajodi-odisha-wildlife-conservation/

[76] See, for instance, *The New Indian Express*(2024). **Poacher held with 29 dead birds near Chilika lagoon**. 17 Dec. 2024. https://www.newindianexpress.com/states/odisha/2024/Dec/17/poacher-held-with-29-dead-birds-near-chilika-lagoon#:~:text=Alok%20Pradhan%20caught%20red%2Dhanded,species%20including%20five%20migratory%20ones.&text=BHUBANESWAR%20%3A%20In%20a%20major%20crackdown,resident%20birds%20near%20Chilika%20lake.

Congregation of birds at Mangalajodi

Climate change and disturbing situations like war along the great flying route are said to be affecting the arrival of migratory birds in Chilika in the recent past. Rising water level demotivates many migratory birds, as said to have happened in the Nalabana sanctuary this year (2025):

> " xxx the xxx Nalabana Wildlife Sanctuary within the Chilika Lake hosted the highest congregation of birds, with 3,43,226 counted this year, slightly fewer than the 3,47,280 recorded last year. Experts attributed the marginal decline of 10,531 birds to increased water levels in the lake caused by untimely rains in December 2024. Xxxx Gadwalls were the most numerous species sighted, with a count of 2,01,926, followed by Northern Pintails (1,93,394) and Eurasian Wigeons (1,54,937), the census revealed. Greater flamingos also saw a significant rise in numbers, with 2,638 recorded this winter compared to 820 last year[77]."

The swampy/marshy habitat of Chilika during winter provides diverse food sources for these birds some of which(like the near threatened River Tern) have ground-nesting habit which makes their nests vulnerable to damage if herds of Chilika buffalo pass by that area or some other undesired anthropogenic intervention occurs. If this marshy nature disappears with significant increase in the water level, then the dependent birds are obviously affected.

Birds of Chilika include both resident and migratory species displaying considerable diversity:

> "Being located on the Indian east coast, significant populations of several waterbird species migrating along the East-Asia Australasian Flyway also winter in Chilika. xxx Chilika also provides a stop-over site especially during the northward journey for the waders wintering

[77] Mohanty H.(2025). **Fewer birds visit Odisha's Chilika Lake this winter, census reveals**. *Down to Earth,* 20 January 2025; https://www.downtoearth.org.in/environment/fewer-birds-visit-odishas-chilika-lake-this-winter-census-reveals#:~:text=On%20the%20other%20hand%2C%20the,3%2C47%2C280%20recorded%20last%20year.&text=Experts%20attributed%20the%20marginal%20decline%20of%2010%2C531%20birds%20to%20increased,compared%20to%20820%20last%20year.

further south of Chilika. The diverse bird habitats, ranging from beaches, mudflats, shallow brackish water zones with submerged vegetation and freshwater zones with floating and emergent vegetation, were observed to support atleast 225 species of birds of 50 families. Of these, 129 were waterbird species, and the rest wetland-dependent xxx. Chilika has also been recognised as a bottleneck site of the Central Asian Flyway[78]."

"xxx intercontinental migrants come from Arctic Russia, West Asia, Europe, North East Siberia and Mongolia. Northern Pintail (*Anas acuta*) and Gadwall (*Anas strepera*) are the most common species amongst the ducks and geese found in the lake. The lake also provides habitat to nine threatened birds species namely Dalmitian pelican (*Pelecanus crispus*), Pallas Fish eagle (*Haliaeetus leucoryphus*), Indian skimmer (*Rynchops albicollis*), Spoonbill sandpiper (*Calidris pygmeus*), Lesser white fronted Goose (*Anser erythropus*) and Great knot (*Calidris tenuirostris*)[79].

The diversity as well as population of birds in Chilika may vary over time depending upon various conditions. Thus, when a subsequent survey found total 124 species of waterbirds and wetland-dependent birds (species which feed elsewhere and use wetlands for roosting, sixty-six of these were identified to be migratory[80]. Not only that, the spatial distribution of the migratory birds may also vary in the same year; like Flamingos are usually found in the Nalabana area but not in Mangalajodi.

Balachandran *et al*(2020) have listed the following threatened bird species of Chilika which include the endangered Pallas's Fish-eagle, Great Knot, and Far Eastern Curlew :

"Fourteen species of birds observed at Chilika have been enlisted under Threatened and Near threatened categories as per the IUCN Red List of Threatened Species. The Near-threatened River Tern was observed to breed in Chilika. One pair of the migratory Pallas's Fish-eagle *Haliaeetus leucoryphus* was recorded on the Nalabana Island during all years of the study. A single Indian Skimmer *Rynchops albicollis* was sighted twice in the Outer Channel Sector in 2005–2006 and again in 2014–2015. As these migratory species have been observed to breed along the Mahanadi River, additional records may be forthcoming in the future[81]. "

3.5 Threatened flora:

Chilika's micro- & macro-flora contribute differently to the local ecological dynamics. Phytoplanktons, algae, and vegetation, particularly those of aquatic or semi-aquatic nature, are linked with the water quality of the lagoon (and hence they may disappear or reappear according to hydrological changes[82]) and some of them serve as natural fish-feed or buffalo(Chilika breed) fodder.

Panda *et al*(2016) have reported [83] 790 plant species belonging to 525 genera and 122 families in the lagoon and its immediate neighbourhood of which, they have mentioned, *Uvaria hamiltonii, Mucuna*

[78] Various sources quoted in Balachandran S., Pattnaik A.K., Gangaiamaran P., and Katti Tuhina (2020). *Op.cit.,* p.336

[79] IUCN Red Data Book quoted in Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.65

[80] Balachandran S., Pattnaik A.K., Gangaiamaran P., and Katti Tuhina (2020). *Op.cit.,,* p.340

[81] Balachandran S., Pattnaik A.K., Gangaiamaran P., and Katti Tuhina (2020). *Op.cit.,* p.352

[82] See, for instance, Kumar, R. and Pattnaik, A.K. 2012. *op.cit.*, p.38

[83] Panda, Pratap & Kar, Subrat & Tripathy, Pramod & Mohanty, Swadhin & Acharya, Pradosh. (2016). **Additions to the flora of Chilika lake and its immediate neighbourhood**. *Journal of Economic and Taxonomic Botany*. 40. 134-150.

monosperma, Cullen corylifolium, Vahlia digyana, Passiflora suberosa, Raulvofia serpentina, Oxystelma esculenta, Stemodia viscosa, Dimorphocalyx glabellus, Halodule uninervis, Aponogetus undulatus are of botanical interest and need conservation action.

Among the above species, *Halodule uninervis* is a sea grass. The lagoon has the credit of being the 2nd largest seagrass meadow (covering approx.. 172 sq.km, as reported in 2022) in India sharing 33% of the country's total seagrass resources, comprising of 7 species[84].

The mangrove heritage of Chilika was lost partly due to anthropogenic activities and partly due to climatic changes, as evident from the palynological studies of core sediments collected from the north-eastern part of the lagoon and reported by Pandey *et al*(2014):

> "xxx mangrove vegetation was well developed between 4165 and 2549 yrs BP[85], indicating warm and humid climatic conditions. However, the climatic conditions became relatively drier in the latter phase, as indicated by diminishing values of mangrove pollen. Around 2549-2246 yrs BP, mangroves again flourished and reached their zenith, probably benefiting from the warm and humid climate and relative stability of the sea-level which was responsible for the re-colonisation of mangrove forests. Nevertheless, mangrove vegetation disappeared since 2246 yrs BP as inferred from the marked increase of midland and aquatic taxa, indicating drier conditions. Probably, anthropogenic activities have accelerated the degradation of mangroves in the area. The present study reveals the existence of mangroves in the area in the recent past[86]."

While that rich mangrove growth was lost, Panda *et al* (2016) however reported of the existence of only one mangrove species *Aegiceras corniculatum* in wild in the lagoon area which is a sign of hope. On the other hand, the success of the mangrove plantation (4 different species including *Aegiceras corniculatum* and *Rhizophora micronata*) near the Arakhakuda area of the outer channel region indeed represents some of the earnest & sincere scientific interventions for reviving the lost ecological glory of Chilika[87]. This mangrove plantation has succeeded in introducing related natural regeneration processes in the periphery as this author found during one of his field visits.

The macrophytes of Chilika hold immense ecological importance. Local socio-ecological knowledge system recognizes them under the general category of '*dala*'(implying to aquatic vegetation) and knows which of them serve as habitat or breeding grounds or shelters for different fish fauna.

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https://www.researchgate.net/publication/321714674_Additions_to_the_flora_of_Chilika_lake_and_its_immediate_neighbourhood

[84] Himanshu(2024), **2022 Flora and Fauna survey in Odisha's Chilika Lake out: Check details**, Kalinga TV, 19 March 2024, https://kalingatv.com/features/latest-flora-and-fauna-survey-in-odishas-chilika-lake-out-check-details/; Acharyya T. *et al* (2023). **Status & Conservation Challenges of the Second-largest Seagrass Bed in India: Chilika Lagoon** (Abstract); https://link.springer.com/article/10.1007/s11356-023-29369-w

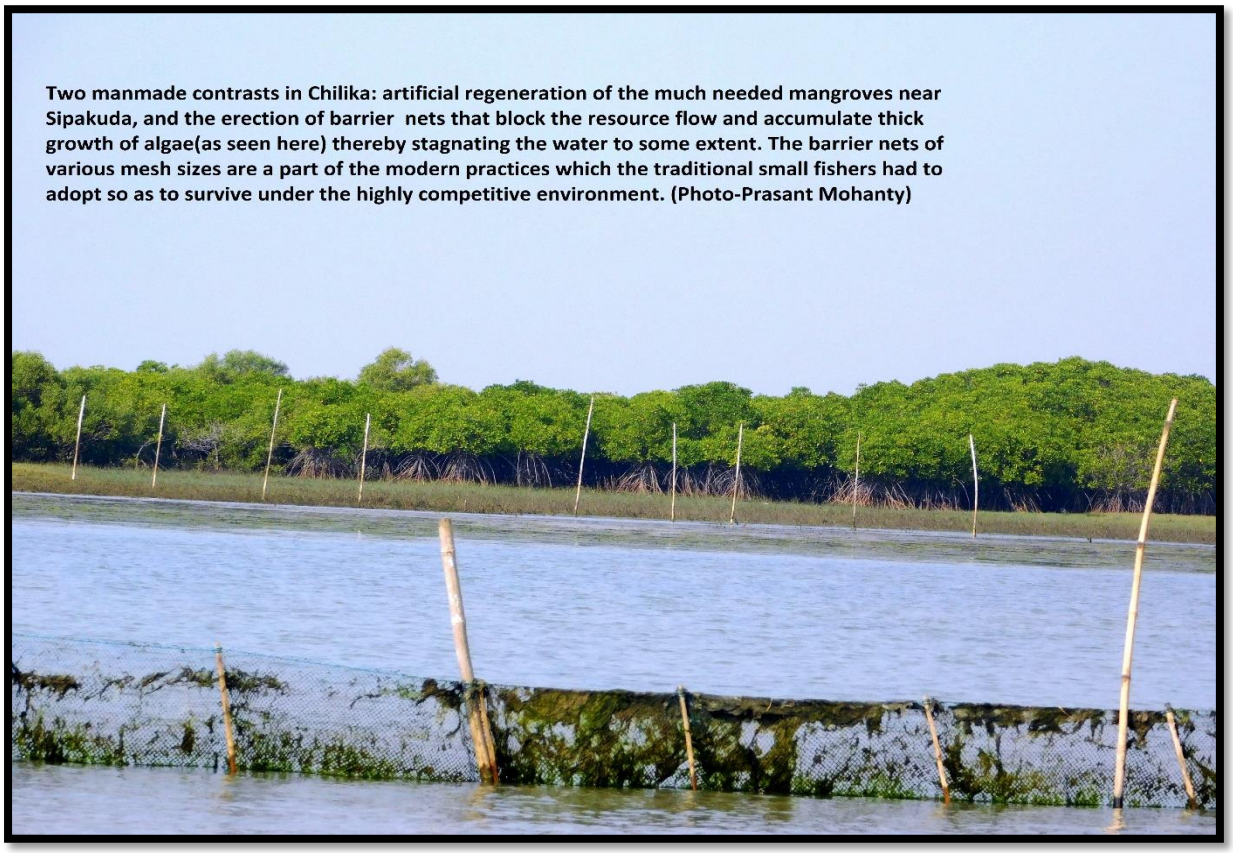
[85] Before present. The mangrove taxa of this period was represented by "*Sonneratia apetala* (3-10%), followed by *Rhizophoraceae* (2.8-9%), *Excoecaria agallocha* (2-8.3%), *Avicennia marina* (3.5-6%), *Acanthus ilicifolius* (2-7%) and *Xylocarpus granatum* (2-6%) are the major core mangrove constituents as indicated by their higher frequencies in this zone. Amongst peripheral mangrove taxa, *Barringtonia racemosa* (3-9.5%)."

[86] Pandey S., Scharf B., and Mohanti M.(2014). Palynological studies on mangrove ecosystem of the Chilka Lagoon, east coast of India during the last 4165 yrs BP; March 2014, Quaternary International 325(10):126–135;
https://www.researchgate.net/publication/260801087_Palynological_studies_on_mangrove_ecosystem_of_the_Chilka_Lagoon_east_coast_of_India_during_the_last_4165_yrs_BP

[87] Panda *et al*(2016). *Op.cit.*

Significant & unnatural disbalance in the distribution of these important macrophytes concerns them for obvious reasons.

Halophila species(red arrow-marked) of sea grass in Chilika



The casuarina plantations along the beach side are vulnerable to both cyclones and man-made damage(cutting).

4. SOCIO-ECOLOGICAL CONCERN:

While the local communities are well aware that Chilika is drastically shrinking both in area and depth because of the high rate of sedimentation, they are chiefly concerned about the significantly reduced fish production and diversity; but these do not normally change their voice as they see this more as a natural dynamics even if unfortunate. However, their voice assumes a different tone particularly that of discontent, objection, disapproval, and sometimes even revolt when it comes to the illegal encroachment of the fishing areas by the non-fishers for prawn farming.

Intensive aquaculture for prawn farming drastically changed the age-old socio-ecological set up in the lagoon. Prawn farmers, usually non-fishers, changed the land-use by encroaching fishing areas, constructing ponds[88] & pathways[89], and boosting the highly destructive fine-mesh(called zero-mesh or mosquito nets) net use for collecting prawn juveniles for rearing purpose. Chilika's permitted fishing areas were traditionally given to different fisher communities and each such granted area of access was known as *sairat*. The corresponding fisher communities employed diverse indigenous techniques for effective fishing there in accordance with the natural ecological set-up; that is to say, instead of compelling the nature for their interest they adopted systems & practices that matched with the local natural dynamics.

Uthapaani (literally meaning lifted water) and *dian* (meaning jumping) are two such indigenous techniques linked with the rain water. During summer, water level recedes in the lagoon and certain parts become dry (such areas are known as *jano*); but after monsoon starts the water enters that area increasing the level upto about 3 ft or so making this shallow water feasible for *bahani* (fishing with net in shallow water, often practiced collectively while standing in the lagoon water). On the other hand, *dian* implies to an earthen structure(like mud walls with nets) made in the drier parts during summer where rain water enters alongwith the fishes but when through an opening this rain water is released slowly the trapped fishes start jumping making it easier to capture them[90].

Similarly, *gada* (literally meaning water flow to a lower level) implies to a trap where water flowing from a higher level to a lower level meets with some obstruction created by bamboo-made traps known as *mugura* or *khainchi* capturing the fishes[91].

Jano/jaana is usually noticeable in the lagoon water by the crescent-shaped or u-shaped array of split bamboo network standing on earthen bunds through which flood water or rushing water enters alongwith fish, but after this water recedes the entrapped fishes try to escape to the lagoon water body through specific openings in the bunds(submerged during the flood but emerged with receding water) where they are captured using indigenous equipments. Ideally, a *jano* was not meant for net fishing[92].

[88] Some of these have earthen embankments and some have an additional enclosure of nets. Gheri/gherry implies to the enclosure.
[89] This obstructed free navigation and free grazing.
[90] Pradhan Gita 2002, **Chilika Matsya Sampadara Vikasha**(Odia). *In* **Chilika Paribesha**(Odia), p.23. Pallishri, Bhubaneswar. Accessible on https://odiabibhaba.in/bahi/.
[91] *Ibid*, p.23
[92] Sahu, Viswanath (1957). **Ama Machha Sampada** (Odia), p.169. Accessible on https://odiabibhaba.in/bahi/.

Some indigenous fishing gears/practices as displayed in the tourist information centre at Satapada

Indigenous species-specific nets & traps like this Bhekti jala (net targeting Lates calcarifer) are now almost the things of past

'Bahani' in shallow water

This is a nylon version of the discontinued 'khadi jala' used earlier for group fishing in shallow water

These techniques indicate a practice of minimum human intervention, often of temporary nature. These alongwith caste-corresponding use of indigenous traps & nets helped in the sustainable exploitation of the resource (if to put aside certain destructive practices like commercial collection of brood-fish, and also natural changes like shifting inlets which affected the fish production despite these sustainable practices) However, while promotion of advanced fishing techniques by the Fishery Department in 1970s caused a gradual shifting to unsustainable practices, the allocation of fishing grounds for prawn culture (and subsequent encroachments) acted like a slow poison for the socio-ecological set up:

> "With the onset of prawn culture in Chilika during early 1990s, the *jano* and *bahani* areas in the shallow zones were occupied by prawn gheries xxx. A total of 33 leased *bahani* grounds operational in the lake during 1960 reduced in area due to ghery operation. Similarly 112 units of *jano* which were operational in the lake during 1965 became non-existent after 1995. A total of 67 units of prawn *khatis*[93] or traps operational in the lake were non-existent and a few were replaced by the ghery and khonda fishing grounds.
>
> The 111 units of *Dian* fishery were occupied by illegal gheries and the *Uttapani* grounds became non-existent. In recent years, approximately 30% of the lake area has been encroached by gheries and khondas xxx.

[93] Refers here to the indigenous prawn capture method

> Trends representing breeding and nursing grounds xxx and change of gears xxxx are indicative of their exploitation for commercial fisheries. The *jano* areas of 1960s coincided with the major nursing areas of *M. cephalus*[94] xxx. Jhingran (1963) ascribed around 60% of mullet catches to these areas. The decline in mullet fisheries coincides with occupation of *jano* areas by gheries for prawn culture"[95].

The intensive prawn culture required large quantities of prawn juveniles for rearing which promoted illegal & highly unsustainable method of juvenile collection using the so-called zero-nets. This method catches diverse fish juveniles but segregates only the prawn (or other desired species) juveniles and throws away the rest leading to the death of some of the thrown-away stock (if not all). This significantly hampers the natural maintenance and growth of fish production & diversity in the lagoon. The CDA took actions against the same (like burning such nets), but still it could not completely stop this illegal activity chiefly because this is but another easy way of income generation even for the adolescents.

Modern net(nylon) systems like the *khonda* jaala have often proven themselves to be fisher-friendly but not lagoon-friendly:

> "The *Khonda* with small meshed net boxes (*Pudas*) are operated intensively throughout the lake where juveniles of *P. monodon*[96] are more concentrated during December-March. *Khonda* sieves out the larvae, post-larvae and juveniles available in ambient water which has led to heavy loss of seeds and juvenile. *Khonda* fishing is mostly concentrated in the recruitment routes such as Outer Channel, Palur canal and dredged channel xxx. These nets are arranged in rows, to capture the mature spawners xxx. More than 98% of the pre-mature spawners of *M.cephalus* are caught by *Khondas* during their breeding migration to sea xxxx[97]."

It is to be noted here that in the highly competitive environment of Chilika the struggling fishers hardly mind to adopt the unsustainable practices for their survival.

Extreme weather phenomena, particularly cyclones, may be occasional but have been quite destructive for the fishers. While the early warning stops them going for fishing or otherwise limits the fishing activity according to the level of warning issued, the cyclones often damage their resources including houses, trees, boats, and nets, etc.. Livestock is also affected. The government has constructed cyclone shelters at different places which help saving the human life, but boats/nets and houses etc. remain vulnerable. Both government and non-government agencies (including NIRMAN) provide relief materials and the government also tries to compensate other losses although that is often alleged to be inadequate/insufficient.

Sector-wise socioecological concerns are briefed in the following:

4.1 Outer channel or Eastern sector:

- The major concern of this sector is the **sea mouth change** in respect of location & size which significantly affects the catch quality & quantity. This change is a natural phenomenon, but since it is this eastern sector where most of the inlets(comprising the outer channel) have

[94] Flathead mullet locally known as Chilika Khainga
[95] Kumar, R. and Pattnaik, A.K. 2012. *op.cit.,* pp. 53,56
[96] *Penaeus monodon*(Giant tiger prawn)
[97] Kumar, R. and Pattnaik, A.K. 2012. *op.cit.,* p.61

existed, hence the impacts of the closure of such inlets (and even new openings) are first felt here.

So, when the Chilika Development Authority opened the new mouth(local name: *Ramabharatia muhana*) near Sipakuda , villagers (more particularly fishers) allegedly experienced drastic consequences which is not officially recognized by CDA. As a local fisher leader Krushnachandra Jena (now late) of Mahisha Brahmapur island shared with us in 2020, the decision of CDA to select a location ignoring the indigenous insight of the local fisherfolk was almost unilateral (although there might be few locals whom CDA used for its purpose, Jena acknowledged) as the socio-ecological knowledge of the experienced local communities preferred a different location. When this new inlet was opened in September 1999, the sea water rushed into the eastern sector at a speed with which the fishers of this sector where not habituated with[98], but also the number of some otherwise dangerous animals like *khanda magara* (a type of shark) & *shankucha* (stingray) got increased in Chilika water followed by some local injuries to the fishers. Jena also cited the increase in the risk of injuries caused by the blade-edged oyster like creature *kastura* whose abundance allegedly increased in Chilika water after the opening of this inlet[99].

As Biswajit Mohanty, a renowned environmental activist of Odisha observed:

> "Before dredging the opening into the sea, the National Institute of Oceanography (NIO), Goa, had started a model study on the dynamics of the proposed new mouth, but before the NIO could initiate the study inside the Chilika lagoon, the new mouth was dredged rather clinically in a haste, which raised many eyebrows among experts.
>
> In the case of such an ephemeral eco-system like Chilika, a mere model study is not enough. Instead, the CDA should have had the patience to wait till NIO finished the study. xxx
>
> While the CDA dredged the opening into the Bay, it was for 100 meters but, the literal[100] drift played its trick and by now the new mouth has increased to over 400 meters, thus creating a situation on which neither the CDA nor anyone else has any control.
>
> During stormy tidal surges, excess water from the sea gushes into the lake and that extra load of salinity has been playing havoc in the lake, seriously affecting the brackish characteristic of Chilika water, which is visible.[101]"

[98] While this local/community version tried to explain how that inlet opening drastically affected fishing, a different but interesting version from conservation perspective says that as the fishers of these outer channel areas used to catch broodfish (*manjia maacha* or *bihania maachha*, i.e. female fish having eggs inside) particularly of the highly valued *khainga* fish(Grey Mullet) (so that they could extract the eggs/ovary and then sell the same dry as *manji sukhua* which fetches significantly higher price than the average dry fish), they faced trouble when the unusually high speed of water rushing from the newly opened mouth did not make it convenient for them to catch the broodfish and hence their discontent although it helped in conservation of broodfish(Pradhan Gita 2002, **Chilika Matsya Sampadara Vikasha**(Odia). *In* **Chilika Paribesha**(Odia), p.28. Pallishri, Bhubaneswar). One mullet brood, if allowed to breed in Chilika, can lead to the production of about 5 tons of mullet (Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.61).

[99] Interaction with late Krushnachandra Jena on 2nd December 2020

[100] Littoral

[101] Singh, D.N.(2024). **Odisha: Chilika, shrinking 'Queen of Nature', wails for attention**. NEWSCLICK, 5 February 2024. https://www.newsclick.in/chilika-shrinking-queen-nature-wails-attention-biswajit-mohanty

- **Dolphin protection & conservation measures** of the Forest Department has sometimes irritated the local fishers & tourist boat operators. Although at present these measures do not appear to be not so oppressive or otherwise troublesome for the boatmen, Banamali Jena, a local fisher leader says the apprehension of a proposed dolphin sanctuary in the area had led to protests years ago although this author has been informed by the Forest Department, against queries under the RTI Act, that no such sanctuary was or is proposed. Banamali says that the local people suspected this after the CDA organized a big awareness programme on dolphin conservation followed by attempts to create a buffer zone around the Ratamati

> ***The traditional bonding between the Chilika fishers and the Irrawaddy Dolphin***
>
> Much before the conservation authorities began sensitizing local communities on the dolphin, the Chilika fishers had been sharing a friendly relationship with this lovely aquatic animal which they call 'khera' in the local language. They know how the dolphins help them get a better catch conveniently as the dolphin-movement facilitates fish movement to the advantage of the fishers. Hence, for them, harming this creature was unethical.

sairat[102] (a specific water area near the villages of Alupatana and Balabhadrapur etc. where the water is deeper and dolphins were/are found) in the year 2004 or so. As the sairats used to be the fishing area of specific villages, this attempt is said to have resulted in bloody conflicts amongst the stakeholder villages as the matter took a political turn. He says that after this attempt was challenged with sufficient legally valid documents alongwith people's protests, it could not be formalized (by erecting poles to delineate the boundary)[103]. He however also says that if somehow a dolphin death occurs despite the precautions taken by the boatmen and fishers, then they are blamed.

- The **proposed coastal highway**, which allegedly included a route from Satapada to Gopalpur via Krushnaprasad, thus involving long bridge construction in the Chilika water, was opposed by environmental activists citing the reason of its massive adverse impact on the Chilika ecosystem[104] although the islanders in Chilika, who have been facing a lot of difficulties because of the want of a land connectivity and have been assured of such connectivity, might have a mixed opinion on the same because there is also a counter voice raised condemning the opposition to the bridge construction in the name of ecosystem conservation[105]. In the meantime, as a media report suggests, the concerned Expert Committee advised to exclude[106] the eco-sensitive Chilika and few other such areas from the coastal highway plan although it could not be confirmed from independent sources. In the meantime, by the time this report was being finalized the Union Road Transport Minister confirmed the approval of the project for construction of road link between Krushnaprasad and Satapada[107].

[102] Implies to a lease area, be on land or in water (for fishery).

[103] Personal communication dated 17 March 2025

[104] Vide, **Chilikare Rajapatha Nirmana Hrada Pain Kshatikaraka**(Odia) , *The Sambad*, 16 December 2024. This needs to be correlated with the observation of Suresh *et al* (2018, p.29) who have mentioned how the construction of bridge near Gokharakuda(southern sector) obstructs the movement of water & biota at low tide.

[105] Vide, **Jor dharila chilikare setu nirmana dabi** (Odia) , *The Samaj*, 14 February 2025

[106] Vide, **Eprilru Upakula Rajapatha Nirmana**(Odia), *The Sambad*, 10 January 2025

[107] *The New Indian Express*(2025). **Odisha's roads will match those in the US soon: Union road minister Gadkari.** https://www.newindianexpress.com/states/odisha/2025/Apr/18/odishas-roads-will-match-those-in-the-us-soon-union-road-minister-gadkari

4.2 Northern sector:

This sector is troubled primarily with its river systems as well as the repeatedly changing inlet dynamics. While the rivers- & rivulets are often clogged chiefly by the common water hyacinth and the government has no effective practice of deweeding the riverine waterways at regular intervals or as & when required, high level of contamination of these water system chiefly because of the urban waste from Bhubaneswar has been causing health issues both for the humans and fishes. As this author was told by the fishers of Gangadharpur,[108] fishery in the local rivers has been significantly reduced whereas inadequate sea water flow from the inlets has been affecting fishery in the lagoon.

Invasion of the Nala ghasa*(Phragmites karka)* is becoming a matter of concern in several areas of this sector, like in Mangalajodi where this reed-grass has clogged the vital waterways and measures to check this problem have not been much effective.

Significant reduction in the availability of sipala*(Schoenoplectus litoralis)* grass has been a major concern for the mat-maker Bengali refugees of this area.

There is an apprehension that Mangalajodi may be declared a Protected Area someday and in that case the fishers' difficulties will increase further.

Invasion of Nala ghasa in Mangalajodi channel

4.3 Central sector:

A major issue of this sector is the restriction related to the Nalabana Wildlife Sanctuary where the fishers expect a good catch, and this has sometimes led to what the Forest Department sees as 'trespassing' into the sanctuary areas resulting in imprisonment or other legal actions on the fishers.

[108] Discussion on 18th December 2024

It is understood from the old fishers of Atharabatia(Chandraput)[109] that decades ago the Nalabana actually contained extensive strands of the tall Nala ghasa that used to provide some support to the fishers at times of cyclone, but now that area hardly contains any patch of this grass, thanks to the initiatives of the Forest Department(?), as they say citing the possible reason that the Department wanted to eliminate the Nala patches in the Nalabana sanctuary so as to make the landscape convenient for the migratory birds. Interestingly, two of the related queries[Query # 7. Year-wise details of the modifications made to the original land-use of Nalabana Island during the last 30 years, with reasons (if any); and query #8.Reasons behind the depletion of Nala grass resources in the Nalabana island, as alleged by local fishers) in the author's RTI application to the PCCF(Wildlife), Odisha have been in a way ignored in the information provided by the Department with the mention of 'nil'.

Sipala grows in the Nalabana sanctuary area and elsewhere in this sector, but whereas its commercial collection from the sanctuary area is restricted, collection from other areas by the mat-making community is opposed or discouraged by the fishers who know the symbiotic relationship of this grass strand with many valuable fish species such as the *kundala machha*. They fear that depletion of the Sipala strands would cause depletion of or otherwise difficult access to those fish fauna.

Sipala strands

[109] Discussion on 2nd January 2025

NALA GHASA: A BOON OR BANE?

As we see in the British-era publication *Purnachandra Bhashakosha*, the Nala ghasa had many uses, both local & outside, about a century ago. The primary use was as a thatch material as well as for making mats and material similar to bamboo screens (used by the poor like a wall), while other uses included making pens from the reed. Interestingly, the Ayurveda recognized its many medicinal properties. However, all these uses were discontinued probably decades ago with various developments and availability of better options.

The local communities say that the Sipala and Nala do not (normally) coexist, and that expansion of Nala 'drives away' Sipala. This may be a reason why Sipala was depleted from many areas in the north-western sector where Nala invasion is a problem. The question is: does the depletion of Nala in the Nalabana area has favoured the growth & expansion of Salicornia weed in the sanctuary ? That is to say, it is to be investigated if the presence & dominance of Nala can be an ecological boon(like inhibiting the expansion of Salicornia, if any) for Nalabana. This is important because long before the sanctuary was declared, Nalabana, with its extensive Nala stands, used to be a bird's paradise. Not only that, secondary fishers of Chilika used specific bamboo-made traps catch fish & crab here, likely in areas where nets couldn't be used.

As of today, Nala ghasa is seen more as a bane for Chilika than a boon because of the ecological threat it poses by increasing its coverage from 76 sq.km. in 2000 to 286 sq.km in 2020, more particularly in the north- and north western sectors:

> "The dense growth of 'Phragmites' is leading to the retention of sediments. The sediments are rapidly replacing the area under this submerged aquatic plant xxx. It is seen that water cannot penetrate into the area densely covered by this species. The aquatic animals face problems in staying on the sediments and soils formed owing to the growth of the species. xxx" (Hemanta Pradhan quoting the Director of the Institute of Life Sciences in **Invasive Species Threaten Chilika Lake**, *The Times of India*, dated 26 March 2020; https://timesofindia.indiatimes.com/city/bhubaneswar/invasive-species-threaten-chilika/articleshow/74817348.cms)

CDA experimented with a chemical control of Nala ghasa by applying herbicides in 2007-08, but despite some apparent success the grass came back after 2 years. Since such chemical control poses may risks to the ecosystem, hence it was preferable .(Pattnaik, Ajit & Panda, Pratap & Rastogi, Gurdeep. (2020). **Survey, Characterization, Ecology, and Management of Macrophytes in Chilika Lagoon**. *In* C. M. Finlayson *et al.* (eds.), **Ecology, Conservation, and Restoration of Chilika Lagoon, India**, Wetlands: Ecology, Conservation and Management 6, https://www.researchgate.net/publication/338957442_Survey_Characterization_Ecology_and_Management_of_Macrophytes_in_Chilika_Lagoon)

In the meantime, research has concluded [vide Ummalyma, Sabeela & Sahoo, Dinabandhu & Puthiyamadam, Anoop & Adarsh, Velayudhanpillai & Sukumaran, Rajeev & Bhaskar, Thallada & Parida, Ajay. (2021). **Sono-Assisted Alkali and Dilute Acid Pretreatment of Phragmites karka (Tall Reed Grass) to Enhance Enzymatic Digestibility for Bioethanol Conversion**. *Frontiers in Energy Research*. 8. 10.3389/fenrg.2020.594452.; https://www.researchgate.net/publication/348958909_Sono-Assisted_Alkali_and_Dilute_Acid_Pretreatment_of_Phragmites_karka_Tall_Reed_Grass_to_Enhance_Enzymatic_Digestibility_for_Bioethanol_Conversion) "that exploiting tall reed grass as a bioenergy raw material can be a viable approach for sustainable utilization of invasive grass/waste biomass for biorefineries, which helps control invasive weeds and management of waste." Other utilities of this grass are also emerging, like the potential of its biochar in the effective phytoremediation of highly polluted textile wastewater [Rozi Sharma, Piyush Malaviya, **Enhanced textile wastewater remediation in Phragmites karka-based vertical flow constructed wetlands using Phragmites-derived biochar**, *Chemosphere*, Volume 366, 2024, 143529, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2024.143529. (https://www.sciencedirect.com/science/article/pii/S0045653524024299)].

4.4 Southern sector:

Improper functioning of the Palur mouth and obstruction/encroachment of many vital channels that linked this sector with the eastern sector and nourished the fish fauna diversity here are the major issues in this part of Chilika. The result has been a drastic reduction in the quality & quantity of the catch.

One of the local fishers of Kholamuhan told us that while the fish availability & diversity was drastically reduced, a surprising trend of increased availability of kau machcha (*Anabas testudineus)* in the local fishing area was observed which was unexpected as this freshwater fish is usually expected in the north-western side where river systems meet the lagoon. Kau is a low-priced fish and its increasing availability in the Chilika water is chiefly because of the escape from prawn aquaculture where this fish is cultured as a supplementary economic species particularly to help withstand the lean periods in prawn farming[110].

5. SOCIO-ECONOMIC CONCERN:

The socio-economic concerns of Chilika are primary and secondary. The secondary concerns correspond to boat making & repairing, business of fishing gears, Sipala mat-making, tourism, and buffalo rearing/dairy business, etc.. The primary concern however essentially corresponds to fishery who is the key economy in the lagoon.

It is now difficult to think that before the year 1900 the socio-economic scenario of Chilika was remarkably different from that discussed or perceived conventionally. Dr.Radhacharan Panda, who was a medical practitioner in the early decades of 20th century in the erstwhile Parikuda estate that had jurisdiction over most parts of Chilika, had the opportunity to interact with people who lived those bygone times of prosperity & difficulties; and had written that before the British enforced their salt monopoly in India (thereby gradually killing the local & traditional salt industry in many areas), the major product of commerce in Chilika used to be salt followed by fish. The Chilika salt was popular because of its quality, and the local people remained engaged in salt extraction for about 8 months in a year (the rest, i.e. the rainy season being focused on fishery and/or agriculture by some). However, this flourishing salt business got almost discontinued in 1900 because of the British restrictions, forcing thereby the local communities to accept fishery as the primary business. Agriculture became a losing hope following repeated rainfall extremities. Then, fish production began to decline owing to unsustainable practices; and whatever production was achieved, commercial supply to Bengal reduced its local availability. Under such distressful conditions, many had to resort to distress migration[111].

Rearing of cow & buffalo was another flourishing occupation with considerable production of milk & ghee. It is further learnt from Dr.Panda that supply of oyster shells (a source of edible lime) was an important secondary product of commerce during those times as deposits of such shells were found at various places of the lagoon. Besides, feathers of Era(Flamingo) bird, used as a sign of military might

[110] Discussion with Sri Lakshmidhar Jaysingh at Kholamuhan on 25 March 2021
[111] Panda, R.C.(1928). *Op.cit.,* pp. 99-101

by the traditional warrior races (Paika) and enthusiasts (like the Nagas of Puri), was another item of commerce here. [112]

5.1 Fishery:

Traditional fishery in the Chilika lagoon was essentially of 'capture' type on which the chief dependents were the Keuta or Kaibartta caste who happened to be the primary fishers. Traditional caste-based livelihood regimes of the lagoon acknowledged them to be the privileged community that was allowed to exercise the primary right of fishing symbolized by the use of nets, whereas secondary fishers[113] (like the Kandara caste) were allowed to use not nets but bamboo-made or reed-made box-traps or conical traps such as the *baja* and *dhaudi*. The author has elsewhere discussed[114] how this traditional caste-based system helped reduce the competition in fishing and eventually the pressure of fishing in the lagoon at any given point of time because the catch from nets is usually of a greater quantity than that from the box-traps. In between these two categories was the *jaana* used by the Tiara(Ghadei) or some other fisher castes, because it is a long array or network of bamboo-made trap capable of a greater yield. Minor fishing implies primarily to the hand-fishing by lower caste women who otherwise do not use any net or traps as they were not acknowledged as fishers.

The socio-economic condition of traditional fishers in Chilika was miserable even during the British era, as we can see in the book 'Parikuda'. This book describes that the 18th century 'king' Harisevak Manasingh, who established his 'kingdom' at Parikuda(island), invited many fisher communities (Keuta, Kandara, and Nolia) from other regions to be settled permanently in his 'kingdom' with an objective of maximizing the revenue from fishery as the existing number of fishermen was but insufficient. However, by the 2nd decade of 20th century unsustainable fishery alongwith shifting and shrinkage of the inlet had already led to significant reduction in the catch from Chilika. It was also the time when the local salt business was suffering drastically and the people were yet to overcome the impacts of the infamous 'Na Anka' famine. Under such conditions distress migration had started[115].

The primary fishing used to be traditionally at night. Fishers left for fishing at night and returned early morning. "*Ratike gale hatie anibu*"("ରାତିକେ ଗଲେ ହାତୀଏ ଆଣିବୁ") is the traditional saying of these fishers which says that going for night fishing ensures a huge quantity of catch[116]. Night time was

[112] *Ibid*, pp.125; Praharaj, G.C.(1931), **Purnnachandra Ordia Bhashakosha**, Vol.1, p.1146 (Electronic version by Srujanika in 2006). In fact, the name 'Shipakuda' directly implies to that as 'shipa' meaning oyster shell and 'kuda' means mound or island.

[113] This is just the author's interpretation and he doesn't claim any legal confirmation of the same.

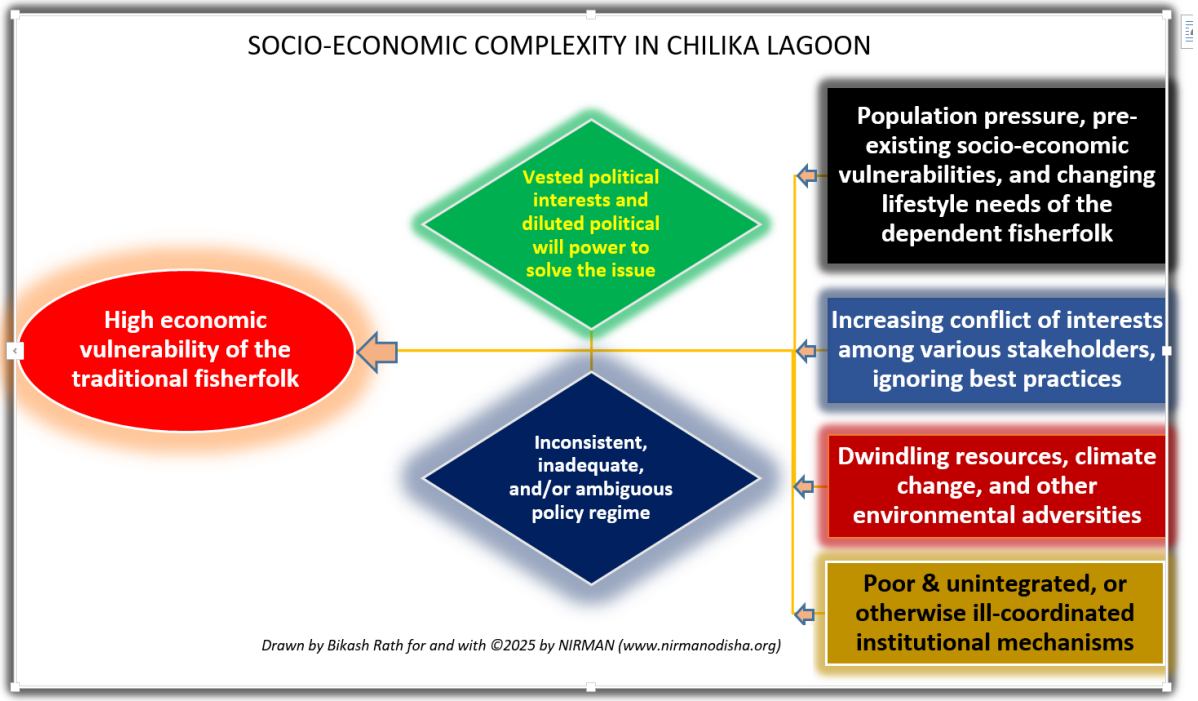
[114] Rath, Bikash(2022). **INDIGENOUS HETEROGENEITY AMONG CHILIKA'S FISHERFOLK: AN INFORMAL BUT EFFECTIVE ARRANGEMENT FOR SUSTAINABLE FISHERY.** Web-publication at https://nirmanodisha.org/wp-content/uploads/2022/02/nirman_indigenous-heterogeneity-among-chilika.pdf

[115] Panda, R.C.(1928). *Op.cit.,* pp. 62,101,129

[116] That however doesn't necessarily mean a heavy income chiefly because of distress sale and market control of the *mahajans*(big traders of fish who also lend money to the fishers in advance and in lieu of that often determine the purchase price according to their own suitability which the fishers used to accept more or less). Sahu(1957, p.191) mentioned how the Chilika fishers did not get the right price for their catch because of the commission agents who in a way restricted the scope of the fishers' direct access to the market as they(agents), working for the mahajans, purchased the catch at the landing sites at exploitative prices. Lower market price was another factor which is why a huge quantity of catch couldn't provide a huge quantity of money. Sri Balia Behera, a veteran fisher of Mangalajodi who now runs a small shop after retiring from his traditional occupation, recalled how during the monsoon season decades ago (when they couldn't go for fishing due to bad weather and many parts were water-logged making farming not much possible), the situation was so miserable that they had to eat even the roots of *tonkei* and seeds of water lily (*koin bento*) after boiling due to the acute food scarcity (discussion at Mangalajodi on 18th December 2024). Against the present author's RTI application the Forest Department identified *tonkei* to be Pistia (*Pistia stratiotes*) whose leaves have been used as a famine food in

preferred because of the significant fish movement during this time. However, during the last few decades, when the traditional occupation was challenged by the culture fishery and growing stake of non-fishers, resulting in huge competition among the fishers for survival, the age-old practice had to be modified significantly with the use bamboo-made box-traps or conical traps becoming rare or extinct in many areas as against the growing use of nylon nets that replace the traditional bio-degradable nets. Fishers are compelled to use motorized boats so as to reach the resource area as quickly as possible early morning and then to come back to the landing site for selling the catch to the fish trader within next few hours. Jaana-type network of nylon nets are fixed to trap the fish overnight, and fishers reach the spot early morning for collecting the trapped fish[117].

The socio-economic complexity of Chilika fishery has been explained in the following diagram:



Already there were pre-existing socio-economic & socio-ecological vulnerabilities as explained before, and population pressure and increasing conflicts of interest complicated the matter. Sahu(1957) mentions the number of Chilika fishermen to be 6531 belonging to but four castes, viz. Keuta(67%), Kandara(22%), Tiara(9%), and Nolia(2%). Total number of fisher villages was 65 at that time and total

India earlier but this identification could not be validated. It may be noted here that many parts of Chilika were almost inaccessible on land decades ago.

[117] As Sri Dasarathi Kara of Jayantipur PFCS explains, seasons and weather conditions influence the time of fishing. Like, when the wind speed is high or the water becomes quite turbulent, large nets put in the Chilika water overnight are likely to get damaged or otherwise useless which is why fishers won't leave them overnight but would rather do the fishing and come back. They may go in the evening and do overnight fishing if the weather is favourable. In case of leaving the array of nets overnight and going early morning to collect the catch from that array, one of the fishers guards the system overnight till others return early morning. On the other hand, as Sri Kalindi Mallik, Secretary, Odisha Matsyajibi Mahasangha explained during a telephonic conversation with this author on 19th April 2025 long distance fishing did not allow same-day return for obvious reasons. Fishing areas in Chilika that were free from leases were for free access for all the fishers, and these 'free areas' known as *bahara Chilika*(outer Chilika) were quite distance from some fisher villages which is why fishers going there used to spend days since daily operation was not possible.

number of boats was 1628[118]. This was essentially referring to capture fishery only. However, as per the management plan of the Chilika sanctuary for the period 2016-17 to 2025-26, there are 424 villages in the Chilika basis within 2 kilometres of the wetland boundary, and 152 among them belong to people(mostly fishers) who depend on the lagoon for their livelihood. In the overall population of 403356 in these 152 villages, the fisher households shared about 36%. Among the fishers, the Keuta caste comprised about 67%, the Kandra about 14%[119]. There is also a small population of the Nolia community who are basically Telegu by linguistic heritage and they mostly practice fishing in the Bay of Bengal, unlike the traditional Odia fishers who confined themselves to the lagoon and/or inland water bodies. Few Muslim fisher villages/hamlets also exist. The highest (41%) concentration of fishers was found to be in the northern sector followed by 28% in the southern sector[120]. The share of the Nolias in the fisher population had increased to 6.8% by then although these Nolias are primarily sea-fishers and hardly assert any stake in Chilika fishery. The decline of the %age of Kandara population and the mention of three other castes, viz. Gokha, Kartia, and Nairi[121] as fishers in the said management plan is noteworthy.[122]

The present author has elsewhere[123] described how the traditional caste-based professional monopoly was useful not only in resource conservation & management but also maintaining consistency in the related skills, apart from safeguarding the linked livelihood, as demonstrated in case of the Lakhara community that used to have a traditional monopoly right to collect & process lac; but after independence when the government, in the name of democracy, overlooked the advantages of these caste-based systems and made the profession open to all, the whole system gradually collapsed as being diluted by the increasing stake of non-traditional players it lost its strength to withstand the market fluctuations and impacts of changing times. More or less the same thing happened in case of Chilika fishery when the government decided to register anybody as a 'fisher', irrespective of caste or religion or gender, if he/she managed to produce the required documentary proof[124]; and thus, the Chilika Fishermen's Central Cooperative Society (apex body of PFCSs) has as many as 45812[125] registered fishers belonging to diverse castes & religions some of which are completely non-traditional[126].

[118] Sahu, Viswanath (1957). **Ama Machha Sampada** (Odia), p.173

[119] DFO, Chilika Wildlife Division(2016). **Management Plan of Chilika Wildlife Sanctuary: 2016-17 to 2025-26**, sub-sections 4.1.1 & 4.1.2

[120] *Ibid*, sub-section 4.1.2

[121] In fact, these Niari and Gokha practice fishing in the open sea, some near the lake mouth.

[122] Their number was very limited. The Bengali refugees who were settled in the Bhusandapur area also tried to assert their stake in fishing in Chilika although that was not easily acceptable for the traditional fishers.

[123] Rath Bikash(2002). **DECLINE OF A PROFESSION: THE LAKHARA LIVELIHOOD**, *in* **Aspects of Garjat Forestry**, Vasundhara, Bhubaneswar (mimeo)

[124] Eligibilities include age between 18 to 70 years, only one member per family, and so on, as learnt from the MD, Central Fishermen's Coop. Society, Balugan on 25th March 2021. In fact, this figure of 45000+ fishers (@1/HH) is the basis of the rough estimation that the number of dependent population in Chilika fishery is between 1.5 lakhs to 2 lakhs (taking the family size between 3-4).

[125] Source: Sri Udayakar Behera, Asst. Registrar of Cooperative Societies –cum- MD, Chilika Central Fishermen's Coop. Society, Balugan, as on 2nd January 2025

[126] Like, some registered fishers are 'Sethi' title holders although the 'Sethi' title essentially implied to the washer-men community as per tradition.

Dwindling fish production in Chilika and the socio-economic distress

An estimate by the Central Inland Fishery Research Institute quoted in Kumar & Pattnaik(2012) suggests that the maximum sustainable yield (MSY) calculated for Chilika is 1,053 MT/month to 1,158 MT/month i.e. 12,636 MT/year to 13,896 MT/year although the potential fish yield would be almost two times of this MSY[127]. Against this, the actual reported yield is said to be 4982.79 tons in 2000-01, 13065.62 tons in 2010-11, 26361.71 tons in 2016-17, 16227 tons in 2019-20, and 12950 tons in 2020-21[128]. Of this quantity the share of shrimp was ±25% whereas that of crab was ±2%. The increase in the yield after 2000-01 is said to be primarily because of the hydrological interventions made by CDA, and Mohanty & Panda(2020) state that " xxx the mean annual fish landing (12,136 tonnes) during post restoration period is hovering close to the mean maximum sustainable yield (MSY) estimate (11,500 tonnes)[129]."

Interestingly, yield data for 1948-1952[130] suggests an approximate average of 80000 *mahan* or maunds (2880 tons[131]) of catch per year from Chilika which suggests also how the old caste-based fishery helped to maintain the yield much below the MSY.

Now, considering 2880 tons of annual catch for 6531 fishers, the per capita catch was but 440 kg/annum approximately. Against this, if we take the present average annual yield as 12000 tons/year against the stake of 45000 fishers, then the per capita catch would be 266 kg/annum approximately. This indicates the growing vulnerability in the capture fishery in Chilika, causing high socio-economic distress.

While there is a consensus among the local fishers that the projected production figures are overestimated (so as to indicate how successful CDA's intervention has been), the official data is likely to include production of shrimp/prawn from aquaculture (culture fishery) and in that case the yield for capture fishery would be further less and so also the per capita catch quantity. In fact, the hard reality is Chilika's capture fishery is both disturbing and frustrating[132].

It is indeed ironical that the governmental policy and approach maintains a double standard so far entertaining equal rights in traditional occupations is concerned. Because, while it treats certain sections of the society as privileged classes providing them reservations and exemptions etc. citing

[127] Kumar, R. and Pattnaik, A.K. 2012. **Chilika - An Integrated Management Planning Framework for Conservation and Wise Use**, p.52. Wetlands International - South Asia, New Delhi, India and Chilika Development Authority, Bhubaneswar, India.

[128] Sethi, Tarulata & Patra, Sudhakar. (2021). **ECONOMICS OF FISH PRODUCTION IN CHILIKA LAKE OF ODISHA**. Table-1. EPRA International Journal of Economic and Business Review. 1-7. 10.36713/epra8829. https://www.researchgate.net/publication/355864827_ECONOMICS_OF_FISH_PRODUCTION_IN_CHILIKA_LAKE_OF_ODISHA. It however seems that the authors misinterpreted 'MT' as million tons and reproduced the fish yield data accordingly which is misleading.

[129] Mohanty, Surya & Panda, Debabrata. (2020). **Fish and Fisheries of Chilika: Post-Restoration Scenario**. Abstract. https://www.researchgate.net/publication/338962943_Fish_and_Fisheries_of_Chilika_Post-Restoration_Scenario#:~:text=Moreover%2C%20the%20mean%20annual%20fish%20landing%20(12%2C136,mean%20maximum%20sustainable%20yield%20(MSY)%20estimate%20(

[130] Sahu, Viswanath (1957). *Op.cit*., p.175

[131] Each *mahan* or maund equals to the local unit of 40 *ser*s, and each *ser* equals about 900 grams.

[132] See, for instance, Ghosh Raskhi (2018), **As catch declines, Chilika fishers are forced to become migrant labourers.** *Scroll.in*, dated 28 April 2018. https://scroll.in/article/876100/as-catch-declines-chilika-fishers-are-forced-to-become-migrant-labourers

grounds such as socio-economic disadvantages, it adopted a completely different stand while honouring the rights of the traditional fisher castes in Chilika and decided to give equal treatment to all castes/communities despite the known disadvantaged situation of the traditional fishers. It is praiseworthy that the management plan for the Chilika sanctuary dared to reflect this dichotomy even if from a different perspective:

> "Fisheries in Chilika were taken up as an occupation by lowest strata of the society xxxx. The fishers established a unique system of governance evolving around caste, with aim of securing livelihoods based on rich understanding of the ecological functions of the wetland system. The community managed fisheries were under pressure from entry of non-fishers, largely lured into the occupation in the interest of short-term monetary gains. Introduction of shrimp culture, however changed the whole picture of Chilika fisheries. A steady increase in global demand of fish provided significant impetus to aquaculture development since the 1970s.Especially the demand of prawn from the affluent societies of North America, Europe, and Japan led to very high international prices. Prawn aquaculture was distinctly picked up as an economic opportunity by the non-caste fishers. The traditional fishers were unable to cash-in this trend primarily because of high capital investment, and dependence of trade chains for value realization. The non-fishers gradually encroached the capture fishing area using multiple means deploying economic and political methods. Introduction of shrimp culture as well as overall decline in fisheries brought about changes in institutions and freedoms of the fisher communities. The traditional caste-occupation relationship broke down with introduction of new fishing gears and increased profitability through prawn farming. The economic return generated by prawn aquaculture gradually led to a massive influx of individuals from farming communities into this fishery and even attracted the interest of investors from outside the basin. Due to low agricultural productivity xxx many individuals from farming communities also took up fishing as a livelihood strategy. This led both to occupational displacement and loss of fishing grounds by the traditional fishing communities, and resentment between traditional fishers and the immigrants xxx. Chilika fisheries gradually converted from a 'community-managed fishery' to 'contested commons' wherein non-fishers gradually exerted pressure for more fishing. In 1990 the non-fishers' petition in the Orissa High Court challenging the traditional rights to fishing grounds held by the fishers led to direction of the court to abolish the traditional system and reallocate fishing ground to fishers and non-fishers in a ratio of 60:40. Following a public interest petition challenging the prawn culture on environmental grounds, the Supreme Court subsequently banned all aquaculture within 1000 metres from the lake. This officially ended aquaculture, but illegal prawn culture still continues along more than 60% of the shoreline especially in the southern sector and on inside[133]."

The growing conflicts of interest among the traditional fishers (locally termed as 'paramparika matsyajibi') and non-fishers(ana-matsyajibi) soon attracted corresponding political interests with the communists supporting the traditional fishers in their struggle against the non-fishers while some other parties(including the contemporary ruling ones) supported the powerful non-fishers so as to ensure a better vote bank. It turned out to be a battle ground between socialism & capitalism, leading to bombing, killing, and other bloody developments often placing the traditional fishers in a more disadavantaged situation because of their poor capacity to withstand this struggle. The communist idealogy might have motivated them to strongly fight for their rights, but it could not improve the

[133] DFO, Chilika Wildlife Division(2016), *op.cit.*, sub-section 4.1.2. It seems this description was in fact reproduced from Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, pp.74-75

status of their socio-economic condition. In 1999, in one such physical conflict between the fishers and non-fishers at Sorana, the police opened fire leading to the death of 3 fishers and injury of several others[134]. However, the overall struggle did compel the government to review its policy and stand, and postpone/cancel certain decisions[135].

The lucrative prawn culture and its violent impacts in Chilika

What makes prawn culture so lucrative? One estimate suggests that considering the price of shrimp @INR 400/kg the overall cost of shrimp farming would be in the range of INR 220–250/kg(operational cost) with a net profit of around INR 150 /kg. Per hectare net profit is expected to be INR 9 lakhs.

Experiences in West Bengal's prawn farming indicate that leasing the land for prawn culture is likely to yield about 8 times the profit of the same land leased for agriculture. If the land-owner himself changes the landuse from agriculture to prawn culture so as to do the prawn farming himself, then the profit would be much higher.

Unlike capture fishery, land is a major factor in culture fishery which is why land prices got significantly increased due to the growth of prawn culture in Chilika. The capital investment includes the costs of land, pond preparation, and equipments used.

Mortality is a major threat in prawn farming. The normal mortality rate due to diseases is 15-20%, but it can be as high as 70% in a bad year[136].

The traditional fishers objected to prawn culture only when it encroached upon their fishing areas and sqeezed the scope in their traditional occupation. Data suggests that non-fishers had asserted their stake in Chilika fishery in one way or the other much before the violent conflict started, and by 1988 as many as 92 fishing grounds in the lagoon had been leased out to the non-fishers as against 203 such ground to the PFCSs. It was also found that some PFCSs had illegally trasferred their fishing rights to non-fishers. This way the non-fishers were able to establish their ground in Chilika fishery even before the intensive prawn aquaculture dominated the scene[137].

As regards prawn farming, it was introduced in Chilika in 1984-85 so as to be developed as a supplementary livelihood activity for the poor in about 120 hectares near the shoreline in the undivided Puri district[138]. The intervention was based on the government's successful experiments in prawn culture the confined water ponds in the periphery of Chilika, and the objective was to ecolomically rehabilitate about 3000 poor families in the coastal rural areas of the state. The target beneficiaries were reported to be agricultural workers by profession engaged in paddy cultivation, and almost landlesswhich is why the government provided them aquaculture ponds on a long-term lease

[134] *Rediff on the Net*(1999). **3 killed, 17 injured as police fire at fishermen**. 31 May 1999. https://m.rediff.com/news/1999/may/31oris.htm#:~:text=Three%20people%20were%20killed%20and%2017%20injured%2C,mostly%20comprising%20fishermen%20armed%20with%20lethal%20weapons%2C

[135] See, for instance, *The Telegraph*(2003). **Chilika bill in troubled waters.** 21 December 2003. https://www.telegraphindia.com/india/chilika-bill-in-troubled-waters/cid/780839

[136] Mahesh Bendre(undated) at https://www.quora.com/How-much-do-you-make-a-year-by-shrimp-farming' ; Saikat Shee(2023) at https://www.news18.com/india/west-bengals-shrimp-farming-yields-high-profits-for-farmers-7599133.html; and Mishra, Lopamudra. (2016). Economic and Environmental Analysis of Shrimp Farming in Chilika Lake, India. Management of Sustainable Development. 7. 5-16. 10.1515/msd-2015-0024; https://www.researchgate.net/publication/294257890_Economic_and_Environmental_Analysis_of_Shrimp_Farming_in_Chilika_Lake_India.

[137] Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, pp.73-74

[138] Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.74

basis[139]. Gradually, as the market potential of shrimp export improved significantly the Odisha government decided to establish a prawn farm in about 300 hectares of area in the lagoon that was subsequently transferred to Chilika Aquatic Farms Limited (CAFL), a joint venture company of the government in which the Tata group had 48% share. This put both the Government of Odisha as well as the Tata group in 'muddy waters', each side trying to defend the decision and involvement against the growing agitation. It appears that the Tatas had not apprehrended how troublesome this project would be for them, and they accepted the state government's invitation for a joint venture with a normal business perspective. In fact, expressing his company's competency the then chairman of Tata group, Mr.Russi Mody said in an interview that the fisherfolk "are not growing it now because most of them cannot afford to grow it. There are some people who are growing it but they are also getting very low yields. They get half a tonne while I will grow six tonnes[140]."

It was during this time (1991) that the Odisha government formally distinguished culture fishery from capture fishery, and allotted about 6000 hectares of Chilika for prawn aquaculture. However, the strong resistance movement known as 'Chilika Banchao Andolan' gradually demotivated the Tata group to continue this venture and they finally left it in 1994[141]; but the site continued to be used by what is termed as the 'prawn mafia[142]'. A rough estimate given by the CMM president indicated that of the total fishing area of about 47000 hectares about 20000 hectares were allocated to the non-fishers for prawn culture who further reduced the fishing area of about 27000 hectares left for the fishers to about 5000 hectares through forceful encroachment[143]. This resulted in a series of violent conflicts between the fishers and non-fishers particularly as the government failed to protet the interest of the fishers effectively.

The conflict also led to a series of litigations in the court with the Odisha High Court ordering to demolish the illegal prawn aquaculture farms (enclosures known as 'gheri') from time to time, resulting in administrative action for a demolition drive; but as the local fishers observed this drive demolished mostly the temporary structures while the landuse changes remained intact and the farm-owners managed to restore the temporary structures after the demolition teams left the place[144]. However, as the hon'ble High Court took a strong stand in this matter and ordered to demolish all

[139] Panikkar, K.K.P.(1990). **A Socio-economic Analysis of Prawn farming in Orissa State**, pp.4-5. *Marine Fisheries Information Service*, Oct-Dec. 1990; Central Marine Fisheries Research Institute. https://azpdf.net/document/qvl870lr-socio-economic-analysis-prawn-farming-orissa-state.html. It is worth noting in context of fisher & non-fisher conflict that whereas this scheme selected agricultural labourers in the Puri district it selected fishers in the Ganjam district.

[140] Shankar Uday(1992). **"I have always been an environmentalist".** *Down to Earth***,** 31 December 1992. https://www.downtoearth.org.in/environment/i-have-always-been-an-environmentalist-30497

[141] Basu S.(2010). **Troubled water of Chilika**. https://fakirchand.wordpress.com/2010/04/12/land-of-no-man/

[142] Uday India(2011). **Chilika's Fishermen Set To Battle Prawn Mafia Themselves**. 21 May 2011. https://www.udayindia.in/news/chilikas-fishermen-set-to-battle-prawn-mafia-themselves

[143] Telephonic conversation with Sri Shyamsundar Behera, President, CMM on 6th April 2025.

[144] As per a report of 2021 quoting the government data, 25,113 ha area in the lake was under illegal prawn gheries of which around 15,163 ha had been freed up since 2018. In 2020 the Covid pandemic affected the major eviction drive, and by the time of the said reporting new prawn gheries had come up over 2,182 ha of the lake, taking the total to 12,131.78 ha under prawn gheerie area which needed to be evicted.(Mohanty H. 2021**. Over 15,000 hectares under illegal prawn enclosures: Chilika Development Authority**. *Down to Earth*, 11 March 2021. https://www.downtoearth.org.in/governance/over-15-000-hectares-under-illegal-prawn-enclosures-chilika-development-authority-75892)

such re-erected gheries[145] gradually the drive succeeded in significantly reducing the area under such gheries and when we interacted with the local fisher communities in 2024-25 they too confirmed this[146].

The government policy on Chilika fishery has thus been quite inconsistent, inadequate, and/or ambiguous since many decades[147]. And the dichotomy mentioned in the above was in fact closely related to the inconsistent approaches and mandates of various government agencies/departments. Promoting culture fishery(aquaculture) was a mandate of the Fisheries Department whereas restricting fishing in the Nalabana sanctuary was the mandate of the Forest Department. Interestingly, although critical decline in valuable species diversity in the Chilika fishery is a well-experienced fact for the traditional fishers, the Fisheries Department, which otherwise would have considered releasing fingerlings of the threatened fish fauna so as to increase their population, is not allowed to do so as the waterbody(Chilika) is managed as per RAMSAR norms which, as we were told by the fishery officers at Balugan, doesn't allow such release/intervention. The mandate is so different that the Fisheries Department has but to recognize the Chilika Development Authority as the competent authority to provide the figures of fish production athough local fishery officers do know how the reality differs from the figures provided by the CDA.

The system of leasing out fishing areas in Chilika by FISHFED(Odisha Fisheries Cooperative Corporation Ltd.) to different PFCSs was discontinued in 2017-18 (allegedly without any notification), and the lagoon became an open-access fishing area since then. The idea of the government was to demarcate fishing areas using GIS(drone-based) so as to allocate the same to the PFCS of the corresponding locality, and this author was told in 2021 that the survey was already in progress. On 2nd January 2025 the same authority updated us that because of the ongoing litigation the expected outcome was yet to materalize[148].

In the meantime, the Chilika Development Authoirity reportedly updated the Odisha High Court in 2024 that a comprehensive policy for Chilika fishery was being drafted and that it was expected by August that year[149]. However, no such policy or regime is known to have been made effective yet. Change of government is supposed to be a possible reason for that, but even that appears to be quite inadequate after so many months of the new government formation.

There is enough ground to believe that although the government declares a stand from time to time to protect the ecology of Chilika lagoon and also to secure the livelihood of traditional fishers, in reality

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[145] *The New Indian Express(2021)*, **Demolish re-erected prawn farms by today, Orissa HC directs Puri Collector.** 17 Nov.2021. https://www.newindianexpress.com/states/odisha/2021/Nov/17/demolish-re-erected-prawn-farms-by-today-hc-directs-puri-collector-2384646.html

[146] *The Samaj* reported on 3rd January 2025 that a large number of such gheries were still existing in Chilika.

[147] A good read in this context is available in the write-up of Ms. Ranjita Mohanty on 'Chilika Banchao Andolan' which is accessible at http://www.mcrg.ac.in/toolkit/inside_pgs/case_study.html . Supplementary reading of Sub-section 8.4, CASE STUDIES ON DEMOCRATIC PEOPLE'S STRUGGLE at https://egyankosh.ac.in/bitstream/123456789/25321/1/Unit-8.pdf is also advised.

[148] Discussion with Sri Udayakar Behera, Asst. Registrar of Cooperative Societies –cum- MD, Chilika Central Fishermen's Coop. Society, Balugan, as on 25 March 2021 and 2nd January 2025

[149] *The New Indian Express*(2024). **Odisha HC updated on Chilika fishing policy progress, draft to be ready by August**. 27 June 2024. https://www.newindianexpress.com/states/odisha/2024/Jun/27/odisha-hc-updated-on-chilika-fishing-policy-progress-draft-to-be-ready-by-august. To be read with **New Chilika fishing policy within 6 months**, *The New Indian Express*, dated 16 May 2023. https://www.newindianexpress.com/states/odisha/2023/May/15/new-chilika-fishing-policy-within-6-months-2575507.html

it hardly dares to displease the powerful non-fishers and all its efforts are thus qulite likely to remain diluted in one way or the other in order to protect the interests of the non-fishers. In fact, the President of Chilika Matsyajibi Mahasangha (CMM), who sees the GPS survey as a good initiative, alleges that despite assurance to the High Court the government has kept the policy pending. He says[150] that in 2023 or so the CMM representatives were invited to a (high level) meeting at the Secretariat so as to discuss the proposed (comprehensive) policy, and that in presence of various departmental representatives as well as scientists the suggestions made by CMM (in the form of a 301-page document) were verbally hailed to be very pertinent to develop the policy framework. However, since then no action seems to have been taken to ensure the release of the desired policy document. It would therefore not be illogical to apprehend that the concerned authorities are deliberately delaying the policy which in turn is affecting other expected outcomes such as the GPS-based demarcation of fishing areas.

The caste-based regime might not have been free from intra-community discontents, but the then prevailing social regime was in a way inviolable[151] for the stakeholders, particularly fishers of different castes. However, after it was severed thanks to the government, intra-community and intra-institutional integrity became much vulnerable. Like, caste-independent regional federations such as Purvanchala Matsyajibi Mahasangha (eastern zone fishers' federation) and caste-based federations such as the Ghadei(Tiara) Mahasangha and Harijana Matsyajibi Mahasangha. Not only that, differential political affiliations affected PFCSs as in the same village traditional fishers ignored unity for individual political preferences. In fact, the PFCSs created by the government were a kind of artificial institutions(despite being legally formal) different from the traditional caste-based social institutions(even if informal) that had a greater acceptance than PFCSs among the fishers. However, realizing the negative consequences of differential institutional set up among the fishers' collectives they are said to have agreed to merge all relevant federations into one body, i.e. the Chilika (Paramparika) Matsyajibi Mahasangha(CMM). which has been effective for more than one year, as we were told by the President of this CMM[152].

The cash value of Chilika fishery is supposed to be quite large, particularly with the contribution of prawn farming:

> "Fisheries of Chilika Lake stand out as the prime renewable natural resource (but not infinite) unless sustainable management through wise use following scientific approaches are ensured with community participation. It contributes more than 96% to the total economic valuation of provisioning services of the ecosystem and support livelihood of 0.2 million local fisher folk. The annual fisheries output generates revenue of more than 1900 million INR. It substantially

[150] Telephonic conversation with Sri Shyamsundar Behera, President, CMM on 6th April 2025.

[151] It was then in fact a dreaded offence in the society to violate the social norms. Usually fishing as an occupation was considered an inferior job by the upper castes who did not prefer even to touch the fishermen. Similarly, there were relative upper castes among the fishermen who would see the lower caste fishermen as inferior. As per the government list almost all the fisherfolk communities belong to Scheduled Castes(SC, the equivalent term in Gandhian philosophy being 'Harijan') . The Tiara(Ghadei) community has expressed discontent because of its exclusion from the SC list(https://www.sakalakhabar.com/chatrapur-1077/) whereas the Proceedings of the Scheduled Caste Welfare Advisory Board, dated 21st July 2007 (item #6 read with item #5) indicates the difference of opinion in the matter of listing/delisting the Keuta(prime fishermen community) as SC (https://stsc.odisha.gov.in/sites/default/files/2020-02/SC_WABMP_21.7.07.pdf). Interestingly, preference to be included in the SC category is chiefly influenced by the governmental benefits it gives that are otherwise not available to the upper caste people.

[152] Telephonic conversation with Sri Shyamsundar Behera, President, CMM on 6th April 2025.

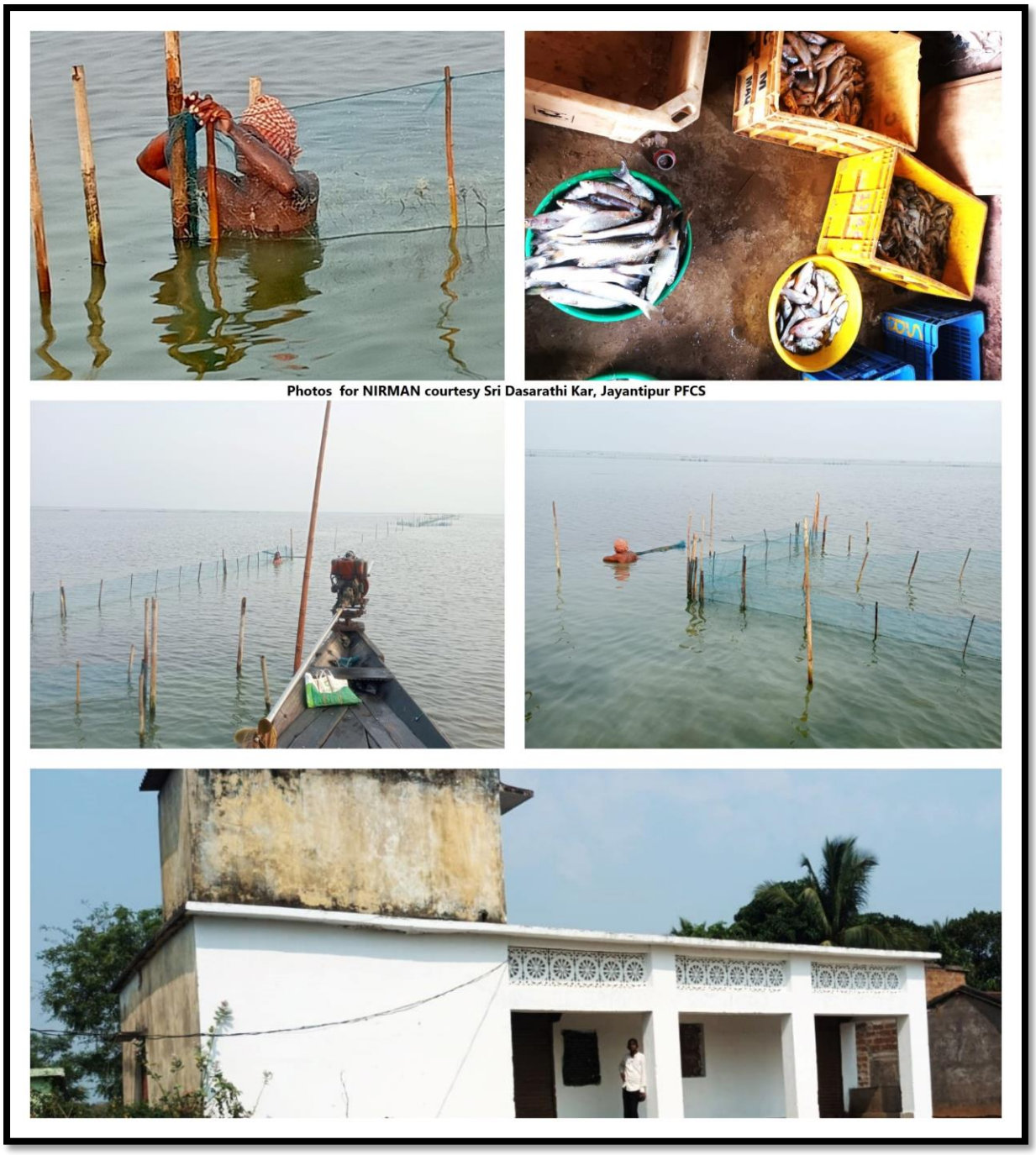
contributes to the state economy and foreign exchange earnings from export of processed shellfish items[153]."

A representative image of the average condition of Chilika fishermen (photo taken in 2020)

However, this turnover doesn't help the fishers much who struggle with an average monthly earning of ±Rs.30000 from capture fishery. In the lean season (Nov.-Feb.) the earning per a family-boat (2-3 members) per day may be around Rs.200 whereas in the favourable seasons (rest 8 months) it can be Rs.1000 to Rs.1500. To ensure that the fishers get the right price from the traders, Primary Fishermen Cooperative Societies(PFCSs) were created by the government with a Central Cooperative as its apex body operating from Balugan. Each such PFCS must have atleast 51 members of which one third should be women. There are 200 PFCSs of which 186 were reportedly working/functional[154]. The government provided some revolving fund (Rs.2 lakhs) to each such society alongwith other kinds of support. However, most of these societies are but poorly or ineffectively functional and although it is blamed that the government support is inadequate to run it effectively it actually seems to be more of a case of lack of institutional integrity among the members. In fact, the Jayantipur PFCS has proven that with the limited support from the government the society can successfully run and sustain itself benefiting its members.

[153] Mohanty Surya K., Bhatta Krupasindhu, & Nanda Susanta (2018). **Bibliography of Publications: Research and Investigations in Chilika Lake (1872 - 2017)**, p.3. Chilika Development Authority. https://www.chilika.com/documents/newsevents_1609466729.pdf

[154] For non-functional PFCSs the members do the marketing themselves individually although this adds to their labour. Commission agents are still active who normally take 10% of the catch value and fishers may work for them like migrant workers if received a substantial amount as advance.



Office of the Jayantipur PFCS and society's members in action in the lagoon

JAYANTIPUR PRIMARY FISHERMEN COOPERATIVE SOCIETY: A ROLE MODEL?

Established in 1996 the Jayantipur PFCS near Kuhudi has about 345 members although the village has about 120 fisher households. This means more than one member of a family can join the society. The Presidential tenure is for 5 years whereas the secretary may continue for more than 5 years.

In the Jayantipur PFCS institutional integrity is the key strength and the members are so united as well as committed to the society values that they won't sell their catch to anybody else other than the society and they would assemble anytime a meeting is convened. There is a good understanding among them which helps in building consensus in decision making.

The society has 4 paid staff members, viz. the Secretary(Rs.8000/month), the Clerk(who looks after the administrative matters and is paid Rs.9000/month), the 'Weightman' (one who is responsible for weighing the fish and is paid @Rs.6000/month), and another assistant responsible for packing with ice, etc. (paid @Rs.5000/month). Other costs in the business are borne by the society.

The membership fee is Rs.10/member.

Understanding that the middlemen shared about 30% of the price the fishers were to get, this society has well-taken steps to make its members free from the middlemen or other exploiters. It keeps track of the market rates, and can bargain with the traders for the best possible rate which is obviously possible because of its active & dedicated functionaries & staff. The society strategy is to revert about 20% of this loss (30% taken by middlemen) to the members and take rest 10% towards its operational cost. So, it offers its collective catch to the trader who gives the highest price. What's more, the CDA[155]/Fishery Department has provided the society 5 units of 100-litres (each) and 1 unit of 600 litres ice boxes to preserve the fish in ice (even each members is also provided with small capacity containers) which it uses to avid distress sale when the price is not optimum, or when a considerable quantity remains unsold. These containers helps preserve the fish for about 3-4 days although it is another matter that because of significant reduction in the catch quantity the question of considerable surplus hardly arises.

For sustainable fishing, its members use nets of mesh size between 55-60 mm.

The society takes its commission @ Rs.5, 10, or 20 per kg depending upon the value of the fish sold; i.e. Rs.20/kg for high value fishes. From this it earns about Rs.50000 profit per month which has helped it repay all the loan amount it received. Not only that, it has also promoted & supported an exclusive women's cooperative society of the village women to help augment their own income through dry fish business. Although a cooperative society is supposed to share its net profit among the members as dividend, the Jayantpur PFCS prefers to spend its earning on community entertainment programmes and village festivals because the members wish to enjoy the net profit that way.

(Based on the interview with Sri Rasik Ranjan Behera, Secretary; Sri Panchanana Behera, ex-Secretary; and Sri Dasarathi Kar, clerk on 2 January 2025 followed by a telephonic conversation with Sri Dasarathi Kar on 21st March 2025)

[155] CDA has supported PFCSs for their rejuvenation and effective functioning.

Anyway, the qualitative & quantitative aspects of the socio-economic status in Chilika's traditional fishery is not uniform/consistent in its geographical coverage. For instance, the miserable condition of Hatabaradiha fish landing centre [156]reflects the situation of how distress migration by fishermen left this infrastructure more or less unused, as reported in the Odia daily 'Samaj' on 2nd March 2025. To be more specific, a survey in 2009 indicated that whereas the maximum average income from fishing was in the southern sector, that from fish trading was found highest in the northern sector[157].

The same survey of 2009 observed a similar inconsistency occupation-wise:

> "The average annual household income was assessed to be Rs. 26,403, or a per capita annual income of Rs.4,632. Farming, fishing and petty business formed the lowest income groups, whereas the middlemen and shrimp farmers fare the highest. Amongst livelihood systems that are related to fisheries, fishing yields the lowest income whereas those which relate to higher value chain, i.e trading and fish-agents have significantly higher average incomes (30% and 124% higher than fishing respectively). Shrimp farming, which is an illegal practice within the lake system, also yields higher incomes (104% higher than fisheries). xxx
>
> The dependence of fisher households on fisheries is not complete, and 23% of the respondent households indicated having an alternate income source. Of this, 8% engaged in agriculture, followed by shrimp farming (5%), and petty trade (4%). Additionally, 5% of the adult population of fisher households migrated seasonally for labour and other alternate income generation purposes. The average annual income generation for fisher households through these activities was estimated as Rs. 8,125. Thus, the total household income of fisher households from all sources was assessed to be Rs. 32,131."[158]

This average household income from fishery was however but poorly standing against the average household indebtedness(annual) of Rs.24232. This indebtedness was chiefly because of high-interest informal loans taken by the fishers for purchasing/repairing fishing implements, and the said survey found that about 74% of the fishers were indebted[159].

Although the 2009 survey data may seem outdated for now, it does indicate the grave economic crisis in traditional fishery, explaining why distress migration is preferred so as to arrange a more viable alternative. If our current information suggests an average monthly income now higher than the amount of the average annual income of 2009, then that doesn't actually indicate that the economic crisis is over because the commodity prices have also increased more or less proportionately and so also the average monthly expenditure particularly because of lifestyle changes.

[156] As on 2nd January 2025 there were 33 FLCs in Chilika while 3 additional FLCs were under construction (source: District Fishery Officer, Balugan)

[157] Kumar, R. and Pattnaik, A.K. 2012. *Op.cit.* , table-15.

[158] Ibid, pp.77,79

[159] Ibid, p.80

Replacement of traditional fishing gears: a turning point in Chilika fishery

Traditional fishing gears in Chilika fishery were either made of biodegradable threads or bamboo and/or wild creepers. Threads produced nets that are flexible whereas bamboo-made or creeper-made gears such as baza, dhaudi, and thata imply to structures or boxes with openings through which fishes/crabs/shrimps can enter but can't escape. Figures provided by Sahu(1957) suggest that there were as many as 26662 numbers of thata and 18530 numbers of baza & dhaudi employed in Chilika of those times apart from 5861 big nets and 16432 other misc. nets[160]. Making the bamboo/creeper traps was a laborious task and some fisherfolk communities had traditional expertize in making the same whereas some Keuta fishermen also learnt & used that skill. However, at present thata & dhaudi are hardly in use or are made whereas baza is rarely seen. The question is: how & why these bamboo/creeper-made structures vanish from the scenario?

Some clue to the answer here is available from Sri Bhaskara Behera, a veteran fisherman (Keuta) of Maleswari Behera Sahi near Maluda. He recalls[161] that around mid-1970s there was an initiative (most likely by the government) to send the traditional fishers for training on improved fishing techniques, and one Maga Behera of Lakshmipur Sahi (Rambha) who came back after receiving such training ('Net & Boat' programme ?) in the neighbouring state of Andhra Pradesh tried to motivate the local fishers to discontinue the labour-intensive old fishing gears and to adopt new types of gears including nets . The training also guided how to adopt new types of boats against the traditional and small canoe-type boats. This initiative proved to be a game changer as local fishers gradually adopted modernized boats & nets for convenience and higher yield, and the old-fashioned boats & gears became things of history in many areas. Needless to say, the improved boats & nets, despite being advantageous in drudgery reduction, accelerated the extraction of fishery resources in the lagoon making sustainability more vulnerable.

Like, for instance, in the traditional regime net fishing was practised in about 29% of the total fishing area and not 100% of the area as is now although the net-users were more than 60% among the total fishers. What's more, the traditional gears were designed according to the fish species and the depth profile of the lagoon[162]. All these, alongwith the caste-based restrictions, helped more or less to keep some(if not all) balance between the increasing need of resource users and the potential of the resource base. This was soon lost after this old regime was in a way 'dismantled' through various governmental interventions.

5.2 Secondary concerns:

In Kumar & Pattnaik(2012) we find the annual market value of Chilika fishery being estimated at Rs. 768.82 million and the ancillary industry(such as the ice factories) based on it with an annual turnover of Rs.215 million. It further estimated the annual value of tourism in Chilika at Rs.2336 million, of inland navigation (for services provided by CDA only) at Rs.0.72 million, and of the diverge aquatic

[160] As of the updated status, we get to know that 8,198 boats and 31,058 fishing nets were damaged due to the cyclone Phailin and subsequent floods in 2014 (Chilika Lake 2014 Ecosystem Health Report Card, p.5; https://odishaforest.in/admin/data/documents/publication_file_2114170134.pdf) which gives some idea about the number of boats and nets in Chilika around 2014.

[161] Telephonic conversation on 5th April 2025

[162] Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.53

vegetation exploited locally[163] to make mats, to use as fuel & thatch materials, and also to use as a packing material for fish & crab at Rs.34.7 million[164].

In the following we present an indicative valuation of the key secondary businesses in Chilika's ecosystem services alongwith the concerns associated with the same, with a disclaimer that these non-statistical(unless otherwise quoted) estimations are only to indicate the potential values and also to create a ground on which validatory research can be taken up.

5.2.1 Tourism:

Chilika has been famous traditionally for a religious tourism because of its Kalijai temple, but in the past decades ecotourism seems to dominate the business.

> "The annual number of tourists visiting Chilika has increased from 1.2 lakhs in 2005–06 (AC Nielsen ORG-Marg, n. d.), to 7.5 lakhs in 2019 (Department of Tourism Government of Odisha [DOT GOO], 2022)[165]."

Of this, the number of dolphin-watchers supposedly appears to have a significant share:

> "The number of tourists visiting the Outer Channel of Chilika Lagoon was 151,752 in 2010 and 156,319 in 2011 (Government of Odisha, 2011)[166]."

D'Lima(2014) estimated the contribution of dolphin watching in Chilika to be worth about $1.4 million annually[167].

Since bird-watching inside Nalabana is restricted and the migratory birds can be seen only in winter, whereas dolphin watching in the outer channel region is free from restriction and dolphins can be seen almost any time in the year, hence Satapada is a major centre for ecotourism. The boost to Satapada comes from its linkage with Puri, the major tourist centre of the district attracting tourists from other states & countries. However, the hot summer and the risky rainy seasons do demotivate the tourists who find the period from October to January preferable for a boat-ride in Chilika.

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[163] "*Schoenplectus litoralis* (Sipala) is used by the fisher communities located near the Bhushundpur village for making mats, *Phragmites karka* (Nala dala) is used as fuel by villages on the northern shores; whereas *Potamogeton pectinatus* and *Naja* sp. (Chari dala) as preservation material for the fishes, crabs and prawns. *Paspaldium* sp. is used as fodder for milch cattle. *Gracelaria*, an agar producing algae is another sp. of economic importance. Three seaweed derivatives viz. agar, alginates and carrageen are currently utilized for economic purposes. Besides they have great ecological value as natural habitat for crabs and other related species. As per assessment of 2007, over 58,000 MT of vegetation is harvested for above mentioned uses."(Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.85)

[164] Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.88

[165] Quoted in Biswanath Dash, Guru Balamurugan, **Sustainable tourism, livelihood and coastal governance: Chilika lake, India, Ocean & Coastal Management,** Volume 253, 2024, 107128, ISSN 0964-5691, https://doi.org/10.1016/j.ocecoaman.2024.107128.
(https://www.sciencedirect.com/science/article/pii/S0964569124001133)
Abstract:

[166] Quoted in D'Lima, Coralie & Welters, Riccardo & Everingham, Yvette & Mustika, Putu & Hamann, Mark & Marsh, Helene. (2013). **Balancing tourism and dolphin conservation at Chilika Lagoon, India**. https://www.researchgate.net/publication/266559373_Balancing_tourism_and_dolphin_conservation_at_Chilika_Lagoon_India

[167] D'Lima, D.F.Coralie(2014). *Striking a balance between fishing, tourism, and dolphin conservation at Chilika lagoon, India; p.102. PhD thesis, James Cook University. https://researchonline.jcu.edu.au/46578/1/46578-dlima-2014-thesis.pdf*

While a direct contact with the boatman may cost approx.. ±Rs.2000/- for a total visiting period about 2 hours, going via tour operators or middlemen may increase this cost by 2 to 3 times or so. Of course there is some advantage of going through professional & registered tour operators as they take some extra care, like ensuring a good boat & boatman, managing fire-fighting, and giving proper guidance, etc.. Even considering the average cost per boat(4 tourists at a time) at Rs.2000/-, 6 lakh visitors to Chilika annually should imply a turnover of Rs.30 crores (300 million INR or 3.4 million USD approx..) for the tourist boats of which the net income to the boat owner is supposed to be more or less about 50% whereas the share of the boatman(if not the owner) may be 20-25%. On the other hand, the revenue generated from three govt-managed nature camps in Chilika was INR 318723 in 2016-17 which increased to INR 2781157 in 2018-19[168].

Interestingly, some of the people engaged in this tourism activities are either former fishers who did not find fishing a reliable source of livelihood anymore, or are part-time fishers.

COVID-19 did impact Chilika tourism, but it was in a way smartly handled both by the authorities as well as the boat operators:

> "the number of tourist visits increased until 2019 but then began to decline due to the effects of COVID-19. In 2020, tourist visits declined by 69.96% compared to 2019 [21–26]. Tourism and local livelihoods were severely impacted. The tourist visit trend can be seen in the cases of Barkul, Satapada, and Rambha xxx). Barkul receives the most visitors among these significant locations, followed by Satapada and Rambha. The trend of tourist visits peaked in these three notable locations in 2019 and began to decline in 2020 owing to the impact of COVID-19 xxxx.
>
> Xxxx despite the impact of COVID-19, the trend of revenue and tourist visits shows an upward trend. The reason is due to the effective management of the pandemic impacts through the implementation of appropriate protocols and strategic advertising. Due to the COVID-19 pandemic, ecotourism destinations were closed between May to August 2021. Later, ecotourism destination sites were opened, and community members were trained by the Institute of Hotel Management (IHM) and the Indian Institute of Tourism and Travel Management (IITTM), Bhubaneswar, to provide excellent service to tourists following Covid protocols. All Nature Camps utilized equipment such as ULV (ultra-low volume) sprayers, sanitizer dispensers, IR (infrared) thermometers, etc., with certified cleansing agents. All community members have been provided with protective supplies for their prevention and safety [49, 50]. In the case of nature camps, it has been interpreted that Rajhans nature camp generates the maximum revenue (52.40%) of the total revenue generated by all nature camps in Chilika, followed by Mangalajodi (33.78%) and Berhanmpura (13.81%). Furthermore, Rajhans Nature Camp has the highest visitor contribution (50.87%) to the total number of visitors, followed by Mangalajodi (35.05%) and Berhampura (14.06%) xxx)[169].

A recent study has concluded the qualitative aspects the socio-economic impact of tourism in Chilika as under:

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[168] Forest & Environment Department, Odisha, **Eco-Tour Odisha: Annual Report 2018-19**, p.42; https://www.ecotourodisha.com/Ecotour%20Annual%20Report.pdf

[169] Samal, Rajashree & Dash, Madhusmita. (2024). **Stakeholder engagement in advancing sustainable ecotourism: an exploratory case study of Chilika Wetland. Discover Sustainability**. 5. 10.1007/s43621-024-00233-2.
https://www.researchgate.net/publication/379504283_Stakeholder_engagement_in_advancing_sustainable_ecotourism_an_exploratory_case_study_of_Chilika_Wetland

"The analysis of the frequency distribution shows that the male population has the maximum participation in tourism sector than the women. To achieve Sustainable development of tourism in Chilika lake, the participation of women should be encouraged. Married people are mostly engaged in tourism related jobs than the unmarried people. The educational qualification of the respondents indicates that the least educated group has highest participation in tourism in Chilika lake. The mean analysis result shows that tourism has both beneficial and adverse effects on the local economy. The beneficial effects are in the form of income and employment generation, diversification of the local economy, increase in the consumption of local products, providing hope to the youth for the future opportunity and prospects etc. while negative impacts are captured by the perceptions such as "tourism increases commodity prices, is responsible for the rise of land price and property tax and tourism gives employment only to a small percentage of population. In order to reduce the adverse effects and to further enhance the benefits, sustainable tourism development should be adopted in the Chilika wetland. It can only be possible through the collaborative effort of the Ministry of tourism, Odisha Tourism Development Corporation (OTDC), Forest department and local community[170]."

The table below provides the recorded number of tourists in the year 2023 at some key tourist locations of Chilika:

Location	Domestic	Foreign
Satapada	341055	505
Barakul	285991	673
Rambha	32703	**0**

(Source: Department of Tourism, Statistical Bulletin 2023, pp.71,76,80

5.2.2 Sipala mat business:

'Sipala pati'(mat) has been a part of the local culture around Chilika since long, but the Bengali refugees who were rehabilitated on the western side of Chilika specialized in the skill of making this mat and it was they who made it a thriving business. However, difficulty in accessing and securing the raw material, as well as loss of the this mat market to the plastic mats have greatly reduced this business as a result of which many Bengali refugee families have completely abandoned this profession, as we found in the Sundarpur Colony. Mat weavers of Jhati Nuagan (Bhushandapur) says that the mat still has its demand in the hospitals where patient's attendants use it for resting temporarily while dead bodies are taken for funeral on this mat. Other uses include making idols (particularly during Durgapuja)[171] where this can substitute paddy straw that is used to make the structure on which mud is applied.

The Nala-Sipala ecological rivalry has led to the loss of Sipala strands in many areas on the western shore of Chilika as locals apprehend that changes in salinity of Chilika water is the main cause of it. Thus, the Sipala mat makers have to collectively reach potential Sipala areas like Kuhudi, Jayantpur, Gangadharpur, and Kalupada, etc.. around the spring season[172] (when the water temperature is comfortable) where they camp in temporary sheds, and cut the Sipala grass leaving it(bundles) in

[170] Khuntia K Sucharita and Khuntia Dr. Nabanita(2023). **The Economic Impact of Tourism on Local Community: A Study of Chilika Lake, Odisha. Journal of Emerging Technologies and Innovative Research (JETIR**), December 2023, Volume 10, Issue 12; https://www.jetir.org/papers/JETIR2312623.pdf

[171] Discussion with Sakhibala Das and Tarani Das, Jhati Nuagan on 18 December 2024

[172] Tarani Das says the cutting season may range from Dussahara time(October) to Raja(June), i.e. the cutters may choose any time during this period as per their convenience.

water for about 5 days for seasoning followed by dragging the bundles to the nearby land for drying for 8-10 days. They work in groups, and if one group is engaged in cutting then another is engaged in drying[173]. Sometimes the mat-weavers go either alone or with a companion early morning to the nearest Sipala area and come back by afternoon (this daily visit may continue for about 15 days and food is taken from home). Then the bundles are transported to the mat-making villages in mini-trucks or tractors where 20 such bundles may be sold at about Rs.1200. These 20 bundles can yield 20-30 mats depending upon the mat size, and each mat may fetch Rs.40-50 based on the size. Thus an average number of 30 mats each costing an average price of Rs.50/- should earn Rs.1500/- against an investment of Rs.1200 plus the cost of thread (nylon threads are now in use are conventional cotton threads are said to be not much available) plus the labour cost. It may take 15-20 days to make 20 mats, but these are not person-days as the working hours are rather informal[174]. The actual potential is said to be 3-4 mats/day/weaver on a full working day. This way it seems that this is either a loss-making or a 'no loss-no profit' business for many if the labour cost is to be considered. However, the profit may be a little considerable for those who bring their own raw material without purchasing the bundles from anybody.

A Sipala mat weaver at Jhati Nuagan with her stock of raw material and product

[173] Discussion with Rasa Behera, Secretary, Jayantpur PFCS on 2nd January 2025; and Sakhibala Das, Jhati Nuagan on 18 December 2024

[174] Discussion with Sakhibala Das, Jhati Nuagan on 18 December 2024

The business has seasonal ups & downs with the rainy season being the off-season usually; and there is no consistency in its income. It is important to note that while some mat-weavers do not have agricultural lands and this Sipala mat business used to be their key livelihood; for some others land is there but either the production(paddy) is nil or negligible or production is not possible because of cattle menace.

Both men and women can weave the mat, but while men take the responsibility of going to the resource areas to bring the raw material, women engage themselves in mat making at home.

It is very difficult to assess the annual turnover of this Sipala mat business as there is no credible data accessible and also the weavers themselves can't provide consistent & proper information. Still, based on whatever information available we can have an idea that earlier(before the COVID lockdown) about 1000 households were engaged in this mat-making and with an average production rate of 40 mats/household/month (480 mats/year) and at average sale price of Rs.20/mat[175], the indicative turnover would be Rs.96,00,000. However, now although the mat price has increased the number of mat-weaver households are supposed to be very few, may be ±20. It is said that the lockdown heavily impacted the business while other issues like plastic competitors and dearth of Sipala were continuing.

5.2.3 Dairy business:

Dr. Radhacharan Panda has mentioned that 'earlier' most of the residents of Chilika area used to keep cattle & buffalos and that there was a good production of dairy products (milk & ghee) which was being exported to Cuttack and Puri, etc.[176]. His book 'Parikuda' suggests that by his time this business had somehow declined.

Eventually, as it appears, the dairy business in Chilika became buffalo-centric in which the famous Chilika buffalo was the sole breed used. This is because this buffalo has almost no maintenance cost, and the lagoon provided extensive grazing areas for it. Gradually however its population declined, and a government report, supposedly of 2007, mentioned their population as under[177]:

Total estimated population: 29000

Females of various age: 18500

Males of various age: 10500

Milking females: 5000

The average milk yield is about 500 litres per annum (lactation period is about 265 days) per she buffalo with the average per day yield at 1.85 litres[178]. This high fat (8.7%) milk of Chilika buffalo should fetch almost double the price of the cow milk, but that doesn't happen partly because the buffalo farmers have an ignorable maintenance cost and partly because of the limitations of the conventional local market which consumes this milk. So, the price of the milk of Chilika buffalo is more or less at par

[175] Telephonic discussion with Tarani Das, Jhati Nuagan and Uttam Sil, Mangalajodi on 19 March 2025

[176] Panda, R.C.(1928). *Op.cit.,* p.100.

[177] Sethi B.P., Dash S.K., and Ray P.C. (undated). **Buffalo Genetic Resources of India: Chilika,** p.18. Odisha Livestock Resources Development Society and Chilika Buffalo Promoters' Society. https://olrds.odisha.gov.in/olrds-live/wp-content/uploads/2021/12/Chilika_book-min.pdf#:~:text=Chilika%20buffalo%2C%20one%20of%20the%20lesser%2Dknown%20cattle,farmers%20in%20particular%20in%20its%20native%20tract.&text=The%20average%20head%20length%20of%20adult%20male,are%2047.21%C2%B10.18%20cm%20and%2047.63%C2%B10.11%20cm%2C%20respectively.

[178] Ibid, p.10

with that of its mainstreamed counterpart (say, Rs.50/litre) although a little higher than the price of cow milk (Rs.40/litre).

Since latest figures of milking Chilika buffalo could not be accessed and the population is supposed to have significantly declined during the last two decades particularly because of cyclonic impacts, hence considering the milking buffalo (Chilika breed) population even at 2500 would imply an annual production of 12,50,000 litres of milk which estimated @Rs.50/litre suggests a value of Rs.6,25,00,000. The actual turnover may be about 25-50% less given the fact that a part of this yield is consumed by the owner's family.

Curd and cheese are the primary value added products of this milk. The curd is prepared on a commercial scale if there is an order for it, otherwise its production is inconsistent. Dung cakes are a major by-product used locally as a traditional fuel.

Male members of the owner family manage the herds outside whereas female members are engaged in milking at home and making value added products.

5.2.4 Boat- & fishing gear business:

As on 5th October 2024, there were 7357 registered (fisher) boats in Chilika of which 5442 (73.97%) were motorized[179].

The boats are usually made of sal (*Shorea robusta*) wood for durability, and fibre coating enhances the durability further by improving the water resistance. Such boats may last 10-15 years depending upon the use, unless lost or damaged in cyclones or otherwise. The average cost of motorized boat is Rs.3,50,000, and considering the estimation of Aruna Kanta Jena[180], an experienced fisher-cum-boat owner of Satapada area, that each year atleast 100 new boats are purchased in the lagoon area, the indicative turnover would be Rs.3,50,00,000.

Similarly, Jena estimates the annual turnover of fishing gear(nylon nets) business in the lagoon to be not less than Rs.10 crores (he says the range may actually be 20 to 30 crores; but with new generations preferring distress migration the requirement has been reduced and hence the turnover). He thinks that each year a fisherman spends Rs.10000 to Rs.40000 (approx..) in net purchasing depending upon his requirement and capacity.

It is worthy to mention here that traditional nets used to be made of cotton woven by the fishers themselves. Either the thread or the whole net was treated with the bark extract of sahaja(*Terminalia tomentosa*) that imparted strength, water resistance, and durability to the net[181].

Investments on boat & fishing gears is a matter of concern with decreasing income from fishery. Of course the Fishery Department has a scheme to provide subsidized financial support to the fishermen for the motorized boat with net (60% subsidy for SC, ST, and women; 40% for others). Component (either the boat, or net, or motor)-wise subsidy @40% is also available[182]. However, they have very limited targets, and the online applications are considered on first-come-first basis so as to avoid the previously alleged practice of benefiting only persons of political-or administrative favour. Unfortunately, many fishermen are yet to be competent enough to do the online process themselves.

[179] Data courtesy: District Fishery Officer, Balugan
[180] Telephonic discussion on 19th March 2025
[181] This indigenous knowledge was courtesy Sri Arun Kanta Jena (telephonic conversation dated 27 March 2025).
[182] Source: District Fishery Officer, Balugan; dated 2 January 2025

5.2.5 Ice business:

The Assistant District Fishery Officer presumes that the average daily consumption of ice in the Chilika lagoon would be around 15-20 tons[183]. Of course the consumption varies according to the quantity of surplus or stored fish. Seasonal variation is also obvious with more demand in summer. Species-wise, the need is said to be more for prawn. Anyway, taking even 15 tons/day, the annual consumption of 5475 tons ice[184] indicates a value of Rs. 8760000 taking the market price of a 50-kg ice slab @Rs.80[185].

The significant reduction in the catch has definitely affected the ice business as the consumption has accordingly dropped.

5.2.6 Inland navigation:

Passengers use both government ferry services as well as private boats (whichever is available earlier or at affordable price) for inland navigation. The major stations of this navigation are Satapada, Krushnaprasad, and Balugan. CDA provides its services at Satapada while the services provided by the Commerce & Transport Department at Balugan for inland water transport(IWT) are also important. Informal information pertaining to the annual revenue from the government's IWT services at Balugan amounted to about Rs.36 lakhs last financial year (2024-25) as against Rs.27 lakhs the previous financial year[186]. Total revenue from all service providers (CDA & private boats, etc.) could not be available while preparing this report.

The floating bridge vessel at Satapada playing a crucial role in navigation

[183] Telephonic discussion with Sri Ashik Indwar, ADFO, Balugan on 21st March 2025

[184] The actual production figure of ice may not coincide with this. Like, the production from 21 local ice factories during 2001-02 was reported to be just 214 MT (Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.56).

[185] Telephonic discussion with Sri Dasarathi Kara, Jayantpur PFCS on 21st March 2025

[186] Telephonic discussion with Sri Ghanashyam Bhola, government launch in-charge, Balugan on 8th April 2025

Advanced facilities for inland water navigation at Balugan; the lower one is a privately operated luxury cruise while the upper one belongs to the inland water transport department .

The gender aspect in Chilika's livelihood ecosystem

In traditional fishing, the roles of & opportunities for women were not uniform. For the *khatia* community, which recognizes itself as the highest social stratum among the Kaibartta caste, women's role was essentially home-based and they were not supposed even to go for retail marketing of the fishes or dry fishes. This was treated more as a custom of dignity than a taboo. In some other sub-castes women were engaged even in retail marketing, and those among the lowest stratum practised hand-fishing in shallow waters. Fishing on boats or using nets was not supposed to be a profession of women of all the traditional fisher castes, and women themselves logically accepted this with the understanding that fishing by boats would be very dangerous for them given the various risks associated. Professional fishing hours(mostly at night) were further unsuitable for them. In such conditions treating the surplus fishes for production of dry fish was commonly a women's job among the fishers. It consisted of different skills such as *luneiba* (salting, or treating the fishes in brine water unless the catch itself was naturally 'salty' enough) and *jhileiba*(drying over the burning hearth during the rainy season when sufficient sun-drying is not possible). The famous *tampada sukhua* (dried big size prawn) basically used to be their product.

However, with the growing uncertainty in the income of their menfolk the fisher community women of modern times obviously yearned to do some more assuring economic activity particularly when the production of dry fish was significantly reduced due to poor or no availability of surplus catch. The government's schemes supporting women self-help groups(SHGs) gave them a scope for untraditional business activities such as producing powdered spice (*masala*). Some SHGs got training & support for improved & hygienic dry fish production & marketing like instead of sun-drying directly on the ground and without cover they were oriented to dry on clean surface and under a net covering so as to minimize the dust & filth in the dry fish. The new generation fisher women are more confident, eager, and optimistic about their economic engagements and some of them reportedly relocated themselves to southern states where they work in textile units or so.

Under such conditions the women of Keutakudi (a village on the Brahmagiri-Satapada route) ventured into crab culture when RCDC, one of the premier NGOs of Odisha, extended them necessary support. They, through their collective, took on lease few failed prawn aquaculture ponds close to their village and started crab culture there. Despite some issues in marketing during the COVID times it helped them gradually. They engaged men on payment basis whenever masculine work was needed. Traders came to them which made marketing easier.

Some women's groups have been supported with solar fish-drying boxes that is supposed to make dry fish production hygienic and quicker although in reality the experience might not be so encouraging thereby discouraging the women to adopt them.

In allied sectors dairy farming traditionally seems to have some good scope for women to be engaged in the production & business of basic dairy products although they too do not assume a leading role in the same externally so far the entrepreneurship is concerned. Sipala mat making also provides a similar scope.

Member of women's self-help group selling dry fish

Nolia woman sun-drying fish (Arakhakuda)

6 SCOPES IN TOURISM:

In winter, the migratory birds arrive at the lake and stay for about three months till the warmer period. They are the major attraction in the central sector(Balugan) and western sector(Mangalajodi). However, there is a differential access facility to see these birds. Tourist boats take the visitors from Balugan to the boundary of the Nalabana sanctuary as their entry is not generally permitted in the sanctuary area. The permission comes from the Bhubaneswar-based headquarters of the wildlife authority against a formal request with reasons only justifiable to the authority (like, research purpose); but almost no tourist (who goes to Balugan with a hope to see the birds in Nalabana) knows this. What is more frustrating is that there is not guarantee that birds would be visible from the outer boundary of Nalabana sanctuary, as this author found in January 2025. It may be mentioned here that the migratory birds prefer the marshy habitat of Nalabana and Mangalajodi, but this landscape becomes submerged during the monsoon. If, for some climatic reasons, the water level rises even during the bird watching season, and the birds have no marshy habitat to use, then they might retreat. Moreover, war or other adverse conditions in their country of origin or *en route* can also affect their migration. The boat operators, who know on a daily basis if the birds can be seen or not, tell the truth from the beginning so that the tourist can decide if to go or not; but not all tourists are that lucky. If however, the Kalijai temple is the destination and the bird watching from the outer boundary of Nalabana is just an added value or attraction, then this frustration can be reduced. In fact, for many Odia tourists the famous Kalijai temple remains the main objective of visit. At Managalajodi, however, the arrangement appears to be rather more reliable, safer, and systematic. The Forest Department has successfully promoted Mangalajodi as an ecotourism centre where manually operated boats take the tourists in the swallow waters to show the birds, and each such boat has a boatman and a guide who explains the birds seen. The slow & smooth boat ride is eco-friendly and tourist friendly also, unlike the boat ride at Balugan or Satapada in motorized boats where(particularly the Balugan region) cases of troublesome boat-ride have been reported many times, sometimes either because the motor fails or the boat capsizes, or otherwise. Visit to Nalabana takes more than an hour, and to Kalijai still longer time. Mangalajodi bird safari is for about 1 to 1.5 hours, and is operated with a legacy of poachers turning protectors in Chilika, because Nanda Kishore Bhujabala, a local environmental enthusiast, had taken a lot of pain to stop bird poaching in this area in 1990's and because of his persuasion the poachers agreed to stop hunting and to protect the birds. The Forest Department trained them to serve as guides in bird watching, provided other support, and handed over the ecotourism services to their committees so that they can secure their own livelihood also from this income. Now their bird watching service is available primarily from November to February although for bird-lovers and researchers they also provide the service during the breeding season (July-October) of resident birds. If contacted before the visit these people tell if the birds have actually come or not, and if the visit would be useful, so that the tourists can decide if it is the right time to come or not. The limitation of Mangalajodi however lies in the fact that some very attractive migratory birds like the Flamingos may not be found here. On the other hand, Flamingos and some other birds may be seen in Nalabana sanctuary only in particular months and not throughout the whole migration season.

For watching the Irrawaddy Dolphins, the access point is Satapada where motorized private boats operate. There is no certainty if the dolphins would be visible, but if the Rajahans island is the final destination then failure to see the dolphins does not frustrate much.

While private tourist boat operators are available at every access point of Chilika, the state government too provides boats and other vessels at select locations. The Directorate of Ports & Inland Water Transport provides some advanced vessels include solar boats/hybrid vessels at its Balugan

office, but unfortunately the private boat operators are so dominating (and the government will power is somehow diluted) that the tourists almost can't know if this facility exists nearby. That is to say, there seems a conspiracy to safeguard the interests of the private boats. At the same time, some of these government vessels may not immediately suit single or 2-3 tourists either because of their larger capacities (the charges vary accordingly) or some technical limitations.

The Forest Department too has its boats which are normally not accessible to or availed by the tourists. However, the Odisha Tourism Development Corporation(OTDC) has its accommodation (Panthanivas) facilities at select places like Rambha and Barakul, and its boats are available at Satapada, Rambha, and Barakul. The private operator Vikash Eco Resorts operates 'GARUDA', a Super Luxury Cruise with six bedrooms, at CDA's Wetlands Research Centre, Barakul. OTDC's Pathanivas at Satapada has been privatized.

The Odisha Forest Development Corporation (OFDC) too provides ecotourism facilities (https://www.ecotourodisha.com/), and organizes nature camps at different locations of Chilika (Mangalajodi, Rajhans, and Berhampura).

By the time this report was being finalized, the Odisha government has announced financial allocations in its budget for in 2025-26 to develop Chilika as a special tourism zone.

Also, the opening of the new Kalijai temple at Mangalajodi seems to have the potential to attract visitors in the coming years if properly popularized.

7. RECOMMENDATIONS:

- Sometimes things are done in good faith, but if that fails or otherwise complicates the situation and turns into a nightmare then that should be discarded. Lessons must be learnt from the mistakes committed for a wiser decision. If promoting prawn aquaculture in Chilika was done in good faith then the government must admit the great harm it has done in the local ecosystem, and must not repeat the same in any manner. It is not simply a question of the fishers' livelihood, it is rather a question of Chilika's eco-survival. Hence, Chilika should be made free from culture fishery with immediate effect.
- In capture fishery, the government must impose a participatory ban on all forms of unsustainable fishing practices taking the help of the Chilika Matsyajibi Mahasangha(CMM) particularly because the local fishers do understand the critical adverse impacts of unsustainable practices and are likely to accept this ban in a phased manner. The Secretary, CMM has told this author that similar to the ban on marine fishing during the spawning season a ban in Chilika must also be imposed during the breeding/spawning season and the government should provide due compensastion & support for the survival of fishers' families during this ban period.
- The proposed policy on Chilika fishery, revised on the above ground, should be submitted to the hon'ble Odisha High Court without further delay, and the action taken based on the Court's ruling must be made public immediately. Full transparency is to be maintained in this matter. Further, if the primary stakeholders of this policy, i.e. the traditional fisher communities of Chilika raise any objections or concerns regarding this policy or the action taken based on the Court's ruling then the matter should be amicably settled at the earliest taking the CMM into confidence and negotiating with it.
- The CDA has emerged more as a technical authority than a holistic administrator, usually dominated by foresters. The gaps of CDA with other stakeholder authorities/departments is clearly visible on the ground whereas this is not desirable at all. CDA should therefore be immediately reconstituted to represent a holistic regime.

- Despite its claims, the mode of action of the CDA or the Forest Department is not much participatory in reality which in turn results in distrust, confusion, and other negative consequences. They may recall the highly embarrassing experience that resulted out of this pseudo-participatory practice when the tourist facility (called *Prakruti Nivas*) developed at Mangalajodi remained locked for months as the villagers protested against the Department's reluctance of not handing over the management responsibility to them as per the understanding of community-based ecotourism[187]. While writing this report we could not find any annual report of CDA on its website after the year 2011-13, which definitely adds to the suspicion of non-transparent operation. CDA must understand that it is accountable to the people of Odisha/India first and its accountability to RAMSAR or any other authority is but secondary. This primary accountability to the people of Odisha must manifest in its approaches, actions, and publications. Further, its headquarters should operate from Chilika and not from the capital city Bhubaneswar.
- The Wetlands Research & Training Centre at Balugan is definitely an institution of pride, but that in no way endorses any kind of arrogance in the behaviour of its scientists and officials in respect of their dealing with the citizens(academic or non-academic) when they visit the centre and interact with them for genuine reasons such as understanding the outcomes of the research there. It is a public institution and the scientists/officials here are paid by public money; even their professional activities such as research is mostly funded from public money. They are thus public servants and their dealings need to be humble accordingly.
- While some of the academic research findings are indeed quite praiseworthy (such as how the water salinity affects the growth of macrophytes in the lagoon), what matters in public interest in general and in the fishers' interest in particular is some effective action research. So far CDA has failed to restrict the expansion of *Phragmites karka* and has also not much succeeded to restoring the species diversity & availability (commercial) particularly in context of the economic species of fishes. That way its research initiatives are hardly a success. CDA must also remember how its pseudo-participatory hydrological intervention in 1999-2000 (opening of the inlet near Sipakuda) ignoring the socio-ecological knowledge systems had drastic results particularly for the communities of the outer channel area. Hence, the govt.-funded research activities on Chilika should be redesigned so as to serve the public interest better & effectively.
- There should be an integrated focus on the conservation of the Chilika buffalo and its dairy products. Present initiatives are inconsistent, unintegrated, and inadequate; so there must be a revised strategy considering this buffalo breed at par with the Irrawaddy dolphin.
- Regular deweeding and desiltation of all water bodies(particularly the rivers & rivulets) linked with Chilika should be done under the joint supervision and planning of CDA and CMM because the present system in this regard is quite inconsistent, unintegrated, inadequate, and irregular resulting in repeated socio-ecological problems in the neighbourhood of the lagoon such as water logging, growing difficulty in navigation, and so on. Dredging & deweeding activities must be regular, consistent , and participatory. The sediments dredged out should not be dumped in the lagoon water as this practice has earlier further reduced the fishing area.
- The womenfolk of the traditional fisher communities need a special attention for their empowerment & economic development. The Women & Child Welfare Department should

[187] The Forest Department was ultimately compelled to reach an agreement with the Mangalajodi villagers when the state government invited NRI Odias to visit the site for bird watching in January 2025.

focus on this and should launch a special mission for all such women not only in Chilika but elsewhere in Odisha.

We also summarize below the recommendations of Sri Nilalohita Purohit as prescribed in the Odia article 'Abakshyamukhi Chilikara Punaruddhara' and published in the Odia daily 'Samaj'(Bhubaneswar edition) on 7th February 2025, with a disclaimer that although these recommendations could not be independently validated, still they do appear to have some relevance:

- The implementation of the government's decision to demolish all existing pond structures within 200 metres of the lagoon's shoreline in 2022 was highly unscientific and also very short-sighted as it was based but a wrong conclusion that this shoreline was a High Tide Line whereas considering the gradual shrinkage of the lake area it was actually more or less corresponding to the Low Tide Line. These structures(we hope Sri Purohit was referring here to the traditional ponds and not the illegal prawn farming ponds[188]) used to accommodate considerable silt when flood water was about to enter Chilika in this buffer area, but after these were demolished the silt deposition in the lagoon became further unchecked. To undo this ecological mistake there should be a fresh survey to determine the HTL and LTL, and thereafter, as the land close to the shoreline is not much suitable for conventional paddy because of the saline water, hence limited (not intensive) aquaculture of indigenous carps should be permitted there as an alternative livelihood. These carps can be fed with the aquatic vegetation collected from the lagoon which in turn can help control the weed growth. Coconut plantations raised on these pond sides can provide both economic and ecological benefits, whereas the ponds can also be used for duckery apart from rearing the Chilika buffalo in the vicinity.
- Islands inside the lagoon should be developed on PPP mode (for accelerated and more effective development).
- A ring road around Chilika (particularly from Rambha to Satapada), taking due care of ecological concerns, can substantially promote tourism and related livelihoods. Coconut plantations should be raised as avenue plantations there.
- Water sports should be promoted at 4 to 5 places in the lagoon.
- Dredging within 200 metres of the lagoon shoreline would help maintain the ecosystem health there removing sediments and the Nala strands which in turn would not only help in navigation but would also increase fish availability near the shoreline.
- Nala grass can be used as a raw material for producing handmade paper that in turn can be used to produce use-and-throw bags as this grass is highly fibrous. The feasibility of running mini thermal plant(s) using the Nala grass as a raw material can also be explored.

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Cover page template courtesy canva.com.

[188] The prawn culture ponds were claimed to have contributed the sedimentation process and also to develop anoxic conditions, vide Kumar, R. and Pattnaik, A.K. 2012., *op.cit.*, p.61.