Discover Sustainability

Case Study

Stakeholder engagement in advancing sustainable ecotourism: an exploratory case study of Chilika Wetland

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Abstract
Ecotourism, over time, has emerged as a preferred strategy for resource utilization within protected areas of developing nations, as it effectively bridges the gap between ecological conservation imperatives and the imperative for local economic development. This study aims to comprehensively analyze the multifaceted impacts of ecotourism on local communities, with due consideration given to its environmental, social, and economic dimensions. Furthermore, the research endeavors to evaluate the degree of stakeholder engagement in fostering sustainable tourism practices within ecotourism initiatives. Thematic content analysis has been used and the data for the analysis has been sourced through field observations, key informant discussions and different secondary sources. This research examines the dynamic interaction between local communities and ecotourism aspects in the Chilika Wetland in India, using the DPSIR (Driver-Pressure-State-Impact-Response) framework. It promotes a comprehensive decision-making method that considers the Triple Bottom Line and Community-oriented Collaborative approach. Findings underscore the potential for Chilika's ecosystem restoration and mitigating adverse tourist impacts with effective ecotourism governance. The need for collaboration among stakeholders becomes crucial for the effective administration of ecotourism, as shown by the instance of Mangalajodi, which exemplifies the successful outcome of community-led ecotourism. Nevertheless, certain prerequisites, such as knowledge dissemination, training, financial support, cultural promotion, eco-friendly infrastructure, and a commitment to conservation, have been recognized as necessary for ensuring long-term community involvement in ecotourism initiatives.

Keywords Biodiversity · Livelihoods · Sustainability · Stakeholders · Ecotourism · Chilika · DPSIR

1 Introduction

The concept of "ecotourism" was initially delineated as the act of traveling to areas that are relatively undisturbed or uncontaminated, with a specific goal of exploration, appreciation, and enjoyment of the natural landscape, its flora and fauna, and any associated cultural expressions present within these regions [1]. In essence, it entails the administration of tourism activities and the preservation of natural resources in a manner that upholds a delicate equilibrium between the demands of tourism and ecological considerations while also addressing the employment, skill development, income generation, and empowerment of local communities. Furthermore, ecotourism serves as a conservation tool aimed at reducing biodiversity decline and enhancing the quality of life within forest, marine, desert, and wetland habitats [2, 3].

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The wetland is known as the "kidney of the earth" because of the vital role it plays as a biodiverse and widespread transition zone between land and water. The aforementioned phenomenon holds significant implications for individual and societal progress, including aspects of human existence, development, and socio-economic advancement [4]. The research topic of wetland ecotourism is relatively recent, although comprehensive research in this area remains incomplete [5]. Currently, the development of wetland ecotourism in India is in its initial stages, and there exist research-related challenges. Wetlands offer a range of ecological services, including water purification, flood control, and climate regulation, which play a significant role in enhancing the long-term viability and adaptability of the tourist sector [6]. Hence, the preservation and effective governance of wetlands are crucial for ensuring the enduring feasibility of sustainable tourism. The integration of ecotourism into the context of sustainable tourism is crucial in wetland habitats due to several noteworthy factors. Ecotourism has the potential to make significant contributions to the conservation and protection of wetland habitats. This is achieved through the dual mechanisms of raising knowledge about the ecological significance of these ecosystems and generating financial resources for their effective management [3]. Additionally, it has the potential to encourage sustainable practices and foster responsible tourism behavior, thus mitigating the adverse effects on wetland ecosystems [7]. Moreover, the practice of ecotourism has the potential to generate economic advantages for indigenous groups, thereby fostering their active participation in wetland preservation [5]. In addition, the practice of ecotourism has the potential to contribute to the advancement of scientific research and monitoring efforts focused on wetland ecosystems. This can result in a greater understanding of the ecological processes within these ecosystems as well as the formulation of more efficient conservation plans [8]. Nevertheless, the augmented influx of visitors and the engagement in recreational pursuits linked to ecotourism can potentially result in adverse consequences for wetland ecosystems. The potential consequences encompassed by these impacts comprise habitat loss, disturbance to wildlife, pollution stemming from tourism infrastructure, and heightened strain on water resources [9, 10]. Hence, the implementation of efficient management techniques and regulations is of utmost importance to mitigate the adverse effects of ecotourism on wetlands and guarantee their enduring sustainability.

The Chilika Wetland, located in Odisha, is the largest coastal lagoon on the east coast of India. It holds the renowned designation of being a 'Ramsar Site of International Importance' Development [11]. This wetland serves a crucial purpose by offering substantial support to the local communities residing in its vicinity. Furthermore, it has a significant influence on their way of life, cultural practices, and ecosystems [12]. Chilika Lake has gained prominence in recent years as a developing ecotourism site, attracting the interest of both local and international tourists who are seeking deep encounters with the natural environment [13, 14]. The notion of ecotourism is in complete harmony with the conservation principles upheld by Chilika since it seeks to offer visitors genuine opportunities to engage with the natural surroundings while simultaneously playing a role in safeguarding its fragile ecosystems. The ecotourism industry in Chilika provides tourists with the chance to discover the captivating scenery of the lagoon, witness its diverse range of flora and fauna, and foster the principles of sustainable tourism. Ecotourism in Chilika offers a range of activities, such as boat rides on calm lakes and birdwatching expeditions. These experiences contribute to a profound understanding and admiration for the ecological wonders of the area. Ecotourism, as it pertains to the concept of sustainable development, continually strives to achieve social and economic progress while minimizing the depletion of limited natural resources [3]. Given the intrinsic characteristics and unique features of ecotourism, it is crucial to employ a proactive and strategic approach in the development and promotion of ecotourism initiatives. The active participation and cooperation of several stakeholders, such as local people, entrepreneurs, and community leaders, is vital in this context [15]. Hence, the primary aim of this study is to comprehensively examine the socio-cultural, economic, and environmental ramifications of ecotourism, as well as the extent of collaboration among stakeholders, within the context of Chilika Lake in Odisha. In this context, this article explores the potential of ecotourism in Chilika Lake and presents recommendations for its future development.

Many previous studies [10, 12, 15–20] have conducted research on ecotourism in Chilika wetland. The majority of the work was focused on Mangalajodi. It is located in the northern region of Lake Chilika and has mostly been the focal point for the development of ecotourism. Tourism and cultural tourism have been developed in other notable locations of the wetland, such as Barkul, Balugaon, and Satapada. The current analysis has focused on these locations, along with Mangalajodi in Chilika. Further, the present study also used a similar methodology that was used by [15–17], but in the context of Mangalajodi only. A thorough analysis has been conducted, taking into account three frameworks: DPSIR, TBL, and Co-C approach. These frameworks together have not been utilized before in any study. Moreover, the study has used mixed methods (both primary and secondary sources) to comprehend the wetland's fundamental social, economic, and environmental aspects. The policy implications of the analysis are to enhance community engagement in ecotourism activities (community-based ecotourism). Stringent laws and certification systems may be established for ecotourism businesses to guarantee compliance with sustainable practices. This includes instructions for the proper handling of

waste, minimizing human-wildlife interactions, and implementing restrictions on the number of visitors to avoid any harm to the environment. It is important to include climate change adaptation techniques in the planning and administration of ecotourism. This may include implementing strategies such as rehabilitating the coastline and constructing resilient infrastructure to counteract the effects of severe weather phenomena such as cyclones or rising sea levels.

The manuscript has been partitioned into five distinct sections, facilitating a comprehensive examination of various aspects. The initial portion provided an overview of the ideas and contextual information relevant to the topic under examination. The subsequent part provides an overview of the research methodology and study structure. The third part of the paper provides a comprehensive overview of several frameworks for ecotourism. Meanwhile, the fourth section delves into an analysis of the key elements and components of the study. The subsequent part will include a comprehensive summary of the results, recommendations, and possible directions for further study.

1.1 Status of tourists and wildlife census in Odisha and Chilika

Figure 1 and Table 2 depict that 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 (Fig. 2). 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 (Fig. 2). Under the supervision of the Odisha State Wildlife Organisation, a census of birds and dolphins was conducted over the last 5 years, from 2017–18 to 2021–22 (Fig. 3). It indicates that the number of birds and dolphins peaked in 2020–21 and then declined in 2021–22. However, the numbers have increased in comparison to the years preceding 2020. This demonstrates that minimizing human interaction and interference benefits biodiversity and wildlife numbers (Table 1).

1.2 Study area

Chilika is well recognized as one of the largest coastal lagoons globally, noted for its abundant species and picturesque landscapes. The study region chosen for this research is Lake Chilika, located at coordinates 19° 28′–19° 54′ N and 85° 05′–85° 38′ E. This selection is based on the lake's notable position within the wetland biodiversity map of India and its importance within the state of Odisha. It is recognized as the biggest coastal lagoon situated on the eastern coast of India. It serves as a vital resource for the state of Odisha and has been officially declared a Wetland of International Importance under the Ramsar Convention on Wetlands since 1981. The lagoon habitats are characterized by a combination of freshwater and seawater, creating a productive environment that supports diverse fish species [27]. The total area of Chilika Lake is 1165 square kilometres, and it is situated within the administrative districts of Puri, Khurda, and Ganjam in the state of Odisha, located along the eastern coastline of India (Fig. 3). The lagoon is surrounded by around

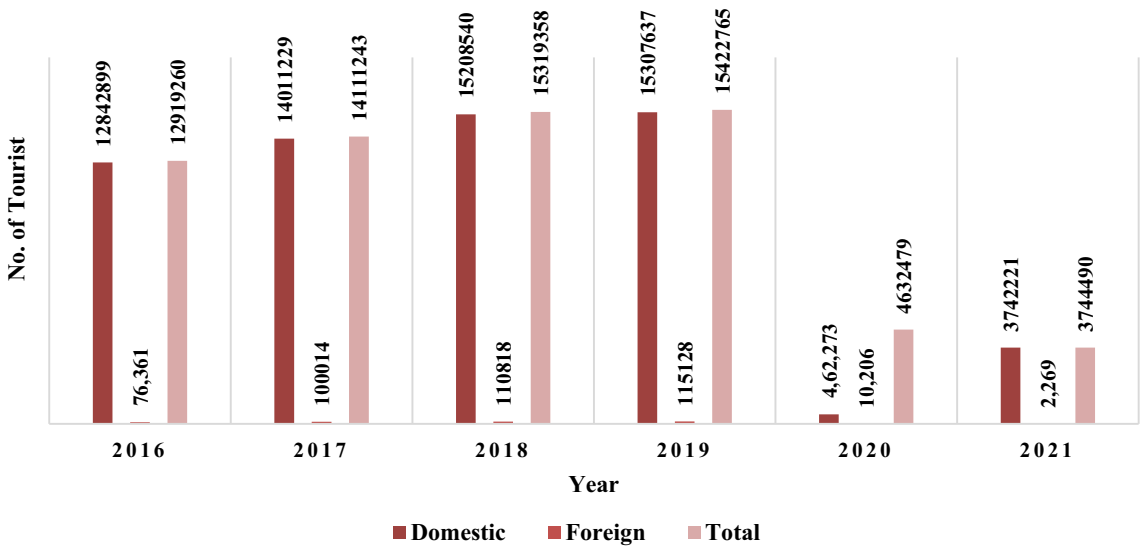

Fig. 1 Tourists visit—domestic, foreign and total (Odisha) (Source: Statistical Bulletin, Department of Tourism, Odisha (2017–2022))

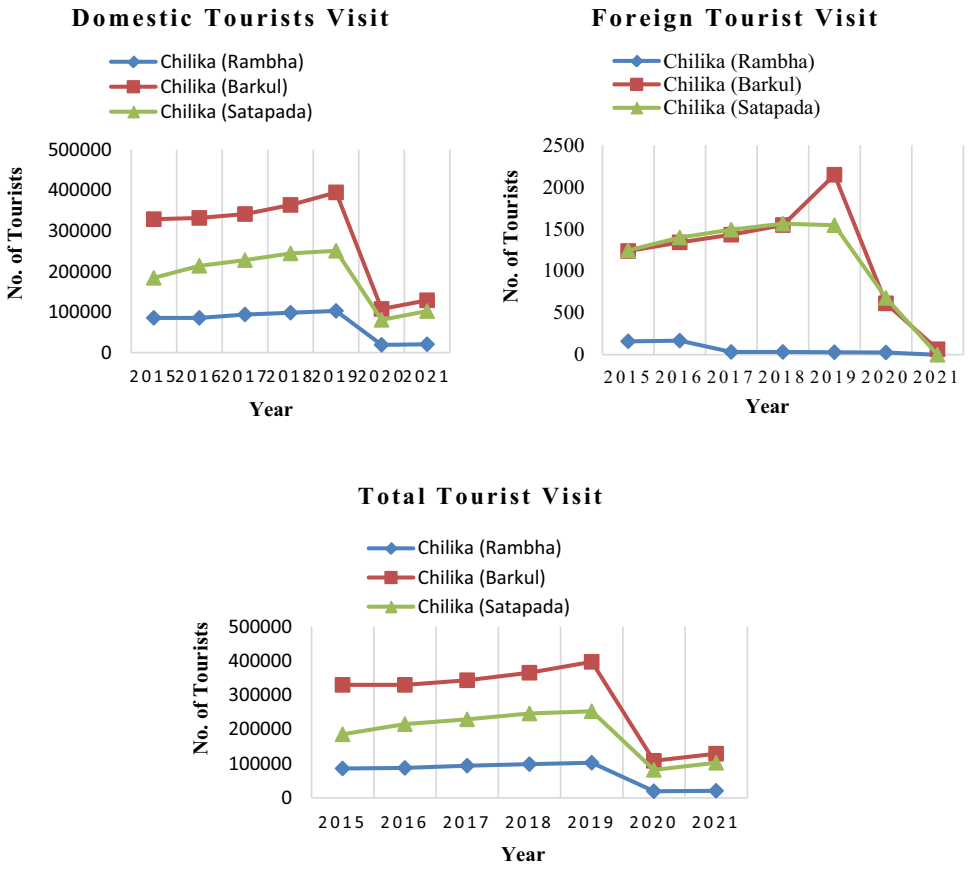

Fig. 2 Tourists visit—domestic, foreign and total (Chilika) (Source: Author's Construction from the Statistical Bulletin, Department of Tourism, Odisha (2017–2022))

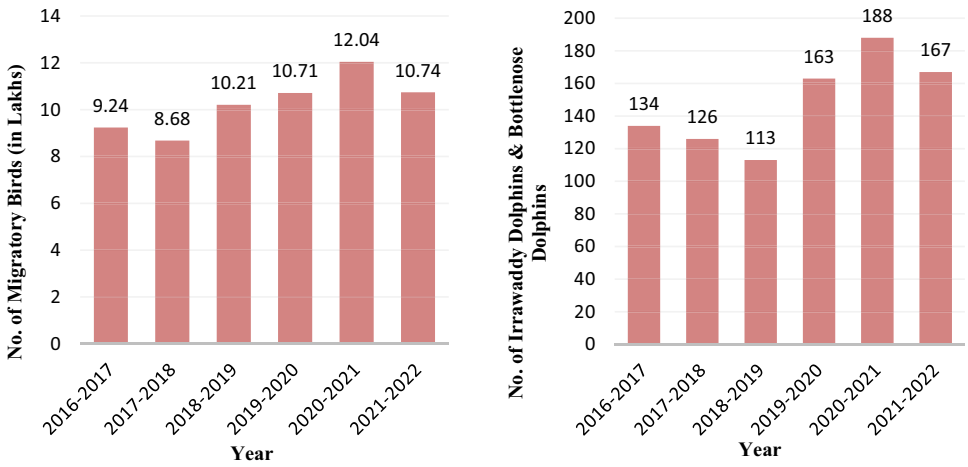

Fig. 3 Wildlife census (birds and dolphins) (Source: Wildlife Odisha (2022) (https://wildlife.odisha.gov.in/Publication))

Table 1 Growth rate of tourists visit in Odisha. Source: Statistical Bulletin, Department of Tourism, Odisha (2017–2022)

Year	Total	Growth (in %)
2016	1,29,19,260	–
2017	1,41,11,243	9.23
2018	1,53,19,358	8.56
2019	1,54,22,765	0.68
2020	46,32,479	−69.96
2021	37,44,490	−19.17

337 communities, of which 150 are specifically designated as fishing villages. The estimated population of fishers in the designated territory is around 400,000, with an approximate distribution of 40,000 households inhabited by fisher individuals.

The lake was surveyed by the Zoological Survey of India (ZSI) from 1985 to 1988. The survey resulted in the identification of a total of 800 fauna species, encompassing a variety of rare, endangered, threatened, and vulnerable species. A total of twenty-four species of mammals, thirty-seven species of reptiles and amphibians have been documented. A total of 726 species of flowering plants, distributed among 496 genera and 120 families, account for almost 25% of the vascular plant species in the state of Odisha. Chilika Lake holds the distinction of being the most expensive wintering habitat for migratory avifauna in the Indian subcontinent. It possesses significant avian biodiversity, particularly for waterfowl species, and showcases a traditional village culture that emphasizes self-sufficiency and little reliance on external resources. These characteristics make it a suitable candidate for ecotourism, as it contributes to conservation efforts and enhances the well-being of local communities [20]. This particular location has a high level of biodiversity within the country. Certain species that are included in the International Union for Conservation of Nature (IUCN) Red List, denoting their status as threatened, are known to occupy the lake during certain stages of their life cycle. Migratory birds have a wide range of origins, including distant locations such as the Caspian Sea, Baikal Lake, and remote regions of Russia, Mongolia, Siberia, Iran, Iraq, Afghanistan, and the Himalayas.

Lake Chilika has been identified as a potential UNESCO World Heritage site based on its adherence to Criterion (IX), which recognizes its distinctive ecological system and the consequential ecological and biological processes that sustain vital communities of flora and fauna. Additionally, Criterion (X) acknowledges Lake Chilika as an exceptional illustration of a significant evolutionary process in the development of marine, brackish, and freshwater ecosystems. Ecotourism activities mostly occur in specific sections of Chilika, namely Rambha Bay, Somolo and Dumkudi islands, Birds' Island, Parikud, Barkul, Mangalajodi, Satapada and the Mouth of the Lake Mangalajodi. Chilika holds significant scientific value owing to its concentrated biodiversity, bio-geographical positioning, and geological attributes, rendering it a focal point for scientific endeavors, particularly in the realm of biodiversity research (Fig. 4).

2 Methodology

The thematic content analysis approach is found to be suitable for the exploratory case study during its first stage. Case studies are the preferred research technique in situations where the investigator has limited control over occurrences and where the primary focus is on contemporary phenomena situated inside a real-life environment [28]. A case study is produced to enhance comprehension of the coherence and entirety of a certain example [29]. The collection of primary data was conducted using the methods of observation and discussions with key informants. The data were collected from August to October 2023 and were meticulously structured to ensure comprehensive and reliable information acquisition. Firstly, an extensive examination of relevant literature and previous research related to the topic was undertaken to provide a strong basis for the survey design. Subsequently, a comprehensive survey was developed, mostly consisting of open-ended questions, to include a wide range of topics on ecotourism. These topics include environmental effects, socio-cultural factors, economic consequences, stakeholder involvement, and sustainable methods. Subsequently, a purposive sample method was used to choose key informants who had the necessary skills and experience related to the objectives of the study. The primary participants in this research consist of many stakeholders from Ecotour Odisha, Chilika Development Authority (CDA), Wildlife Odisha, souvenir shop proprietors, ecotour guides, and members of the local community like boatmen and merchants. Appendix contains a concise overview of the participants' socio-demographic information (Table 6).

Regarding the criteria used to determine the optimal sample size, a total of 42 stakeholders were interviewed for the research. The importance of sample size is justified when a study of lived experience can adequately discover and comprehend the primary issues with the involvement of 10–20 key research participants [30]. In addition, [31] suggests that conducting 12 interviews is sufficient when the study objective is to comprehend shared perspectives and experiences in a homogenous population. According to [32], qualitative interview research needs a minimum of 20 to 30 interviews to be considered for publication. The discussions were carried out with a high level of respect and cultural sensitivity, enabling the informants to openly articulate their viewpoints, experiences, and concerns surrounding ecotourism in the research area. During the data collection period, we made careful and persistent efforts to ensure that the recording of responses was consistent, accurate, and transparent. Each interview session with the informants lasted for almost one hour. Field notes and audio recordings were used as additional instruments to

Fig. 4 Map of Lake Chilika (Source: https://www.chilika.com/how-to-reach.php)

capture contextual elements and enhance the obtained data. In addition, the data-gathering procedure scrupulously followed ethical principles, including obtaining informed permission, ensuring confidentiality, and maintaining the identity of informants.

The secondary data sources utilized in this research work were peer-reviewed studies, Ph.D. theses, and newspaper articles. Additionally, sources such as yearly reports, popular articles, newsletters, and bulletins were also consulted (Table 5 in Appendix). The process involved the identification and extraction of 39 peer-reviewed journal articles from the SCOPUS and Google Scholar databases. This was achieved by utilizing keyword combinations such as 'Ecotourism' AND 'Chilika'. The compilation of secondary literature was conducted by employing identical search phrases in the Google search engine (Table 7 in Appendix).

To establish a sustainable framework for collaboration in the field of ecotourism and effectively accomplish the research objectives, the present study incorporates the DPSIR framework, the Co-C (community-oriented collaborative) approach to ecotourism, and the notion of Triple Bottom Line. Triple bottom Line (TBL) is a concept that duly considers environmental, social and economic aspects in decision-making [33, 34] (Fig. 5). According to [34–37], the tourism sector gains tremendous advantages such as improved efficiency and cost savings, improved market positioning, better stakeholder relationships, improved strategic decision-making, and wider destination benefits and competitiveness through adopting the principles of Triple Bottom Line. The DPSIR framework is used to understand the relationship between the conservation of biodiversity and local livelihood implications in Chilika and to identify and analyse important ecotourism factors of Driver-Pressure-State-Impact-Response [38]. Further integrating the concept of "Co-C Ecotourism Planning" will explore the issues more efficiently rather than providing an ultimate solution. Given the interdependence of ecotourism with many sectors and stakeholders, it becomes imperative to engage in collaborative efforts with these entities, with a specific focus on garnering support and fostering mutual benefits [39]. Hence, the active engagement and dedication exhibited by all relevant stakeholders towards collaborative efforts will successfully address the local concerns and obstacles faced by destinations while also offering a roadmap for the implementation of sustainable ecotourism practices.

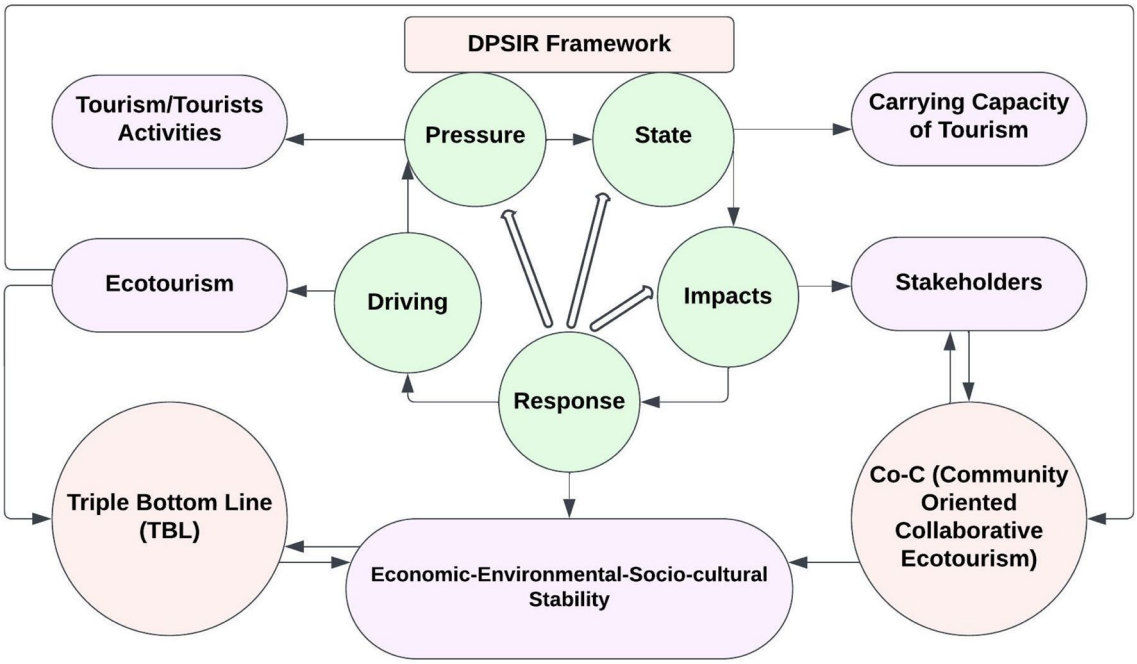

Fig. 5 Conceptual model to guide the study analysis (Source: Authors' construction derived from Swangjang and Kornpiphat [38], Wondirad et al. [37] and Chan and Bhatta [39])

3 Assessment of the DPSIR framework

To achieve equilibrium, it is necessary to implement policies aimed at enhancing and reinstating natural resources and ecosystems. This entails fostering a shift in the attitudes and behaviors of both visitors and stakeholders. Hence, to formulate suitable laws and control mechanisms, it is imperative to take into account the first phase, namely the driving factors (D) that transform during the lifetime of ecotourism. The prioritization of ecological consciousness among ecotourists facilitates an extensive understanding of the intrinsic significance of Chilika's biodiversity. To effectively mitigate the pressures (P) associated with a given issue, it is crucial to emphasize the importance of multi-stakeholder collaboration, effective communication across institutions, active community engagement, and the implementation of appropriate laws and regulations. The state (S) requires an examination of a database about the carrying capacity of ecotourism and any associated alterations in the physical or biological equilibrium of the environment. Furthermore, the effective management of D, P, and S necessitates a proactive approach to managing changes that arise as a result of I (Impact). The interconnections between the various indicators derived from the DPSI phases play a crucial role in informing the development of response (R) recommendations [38]. Therefore, as identified from field observations and key informant discussions, the DPSIR factors of ecotourism on the environment of Chilika Lake are briefly represented in Table 2.

3.1 Drivers

The ecotourism driving forces that affect the Chilika Lake include ecotourism activities (e.g., boating, bird watching), stakeholders' relationships and dependency on natural resources. In the 2000s, the Chilika Development Authority (CDA) started tourism in Chilika as an alternative employment option because of dwindling incomes from fishing, and more villages began asking for support for tourism. The tourism plan drafted by the CDA along with the Integrated Coastal Zone Management Project (ICZMP) supported tourism expansion through infrastructure development, such as building food courts, sit-outs, toilets, parking areas and pathways. Jetties were built in 7 villages for tourism [40]. However, the project focuses entirely on infrastructure development without dealing with existing climate crisis issues, threatened livelihoods, ecological damage and conflicts [41]. Like with prawn culture, tourism was also quickly captured by the elite within the community. For each of the jetties that were built, a boat association was established that manages the operation of the tourist boats [12, 33]. Association membership is only available to people from

Table 2 Factors under DPSIR in the context of ecotourism in Chilika. Source: Author's construction from observations and discussions; Fieldwork (2023)

Drivers	Pressure	State	Impact	Response
Ecotourism activities	Overfishing to meet tourists' demand	Marginalisation in occupation	Threat to wildlife ecosystem	Afforestation to reduce soil erosion
Intra-community relations	Poaching	Reduced access to major tourism sites	Decreasing revenue from tourism	Waste management and sewage treatment
Local–global community relations	Lake pollution	Social and economic instability	Chance of not being listed as a UNESCO World heritage site	Environmental education and awareness
Corruption and political instability	Coastal erosion	Unstable governance	Vulnerable species and change in species composition	Eco-friendly infrastructure development
Top-down approach	Natural disaster	Interruption in bird breeding area	Inefficient stakeholders' collaboration	New employment opportunities
Dependency on natural resources	Siltation[a], eutrophication[b], change in salinity of the lake	Species extinction (e.g., Irrawaddy dolphins)	The underperformance of livelihood assets (human, natural, social, physical, financial)	Establishing cohesion and mutual respect between the stakeholders
Underdeveloped infrastructure	Conflict between institutions		Less or no women's participation	Wildlife conservation and imposing a ban on hunting and poaching
	Use of motorboats to meet tourist demands		Negative perception of visitors	Empowering local people through capacity-building and training programs
	Waste accumulation			

[a]Siltation refers to the contamination of water due to the presence of fine particles of soil or sediment, mostly consisting of silt or clay [43]

[b]Eutrophication is the condition when there is an overabundance of plant and algal development caused by an increase in the availability of one or more growth elements that are essential for photosynthesis, such as sunshine, carbon dioxide, and nutritional fertilizers [44]

that village and to those who own boats. Many of the communities don't own boats. Even other occupations have been restricted to people from the same village, which has further exacerbated intra-community tensions. Moreover, Dalit residents of Padampur village in Chilika pointed out that they had first lost their livelihood as agricultural labour when the fields were converted to shrimp farms, and now they have no space in tourism either [33]. The women, in particular, pointed out that all the tourism jobs (boat driving, shops etc.) are done by men, and women find themselves with no income [12, 40].

There is also considerable ecological harm from tourism. Dolphin-watching guidelines are not enforced, and there is no detailed sensitivity training provided to either the boat drivers or the tourists [10]. The boats have outboard engines with rotor blades running through the water, which can injure dolphins. Additionally, the thousands of boats running through the lake every day not only add fuel discharge to the water but also create a lot of noise [42]. There is also a massive amount of waste generated by the tourism industry that is not adequately managed. Some instances of shortcomings and problems can be presented for various tourist destinations in Chilika that have been studied under the tourism plan drafted by CDA along with the ICZMP. E.g., (1) Rambha: the site is inadequately maintained, and there are no proper activities in and around the sites to engage the tourists. Furthermore, lack of land availability also creates hurdles for any developmental activities; (2) Barkul: limited land availability and lack of coordination between government and private boat associations lead to complexities in the tariff structure; the boats being operated are ill-maintained and provide a very uncomfortable ride to the tourists; (3) Satapada: lack of coordination amongst boat association members, absence of basic tourist amenities, lack of safety measures, negligence of eco-sensitive measures by boatmen and poor maintenance and facilities.

3.2 Pressure

The ecological impact of tourism on Chilika is multifaceted. The adverse pressure on the lake ecosystem is due to a range of factors, including the influx of visitors, the proliferation of tourism activities, and the escalation of construction activities. Over the years, the lagoon has witnessed a significant increase in the number of tourists, both at domestic and international levels. This rise in tourist footfall has put immense stress on the fragile ecosystem of Chilika. Large numbers of tourists contribute to increased pollution through littering and waste disposal. Another significant concern is the disturbance caused to the avian population that relies on Chilika as an important habitat. Growing tourism activities, such as boat rides, loud noises, and increased human presence, have disrupted these avian species' natural behavior and breeding patterns [15]. Moreover, the tourism plan drafted by CDA and ICZMP, considering the carrying capacity of the lake use rate (the spatial spread of lake where boating activity can take place without incurring any adverse impacts on its surrounding sensitive zones), determined that Barkul, Rambha and Satapada zones should maintain 112, 96 and 167 boats respectively. Based on the field observation, the lake use rate in Barkul and Rambha is within the recommended limit, but it exceeds in case of Satapada. Further, the accumulation of solid waste and pollutants poses a threat to aquatic life and affects the overall water quality of the lagoon [45]. The release of untreated sewage from nearby households and fish markets adds to this condition [10]. According to the tourism plan drafted by CDA along with the ICZMP report, total waste generated in various significant tourist destinations was 49.64% higher in 2020 compared to the year 2015, and it is expected that in future, i.e., in 2025, it will increase by 51.23%. Lake pollution and untreated sewage have a measurable impact on the equilibrium of the physical, chemical, and biological aspects of the environment. Furthermore, the construction of infrastructure and tourism-related facilities in and around Chilika has resulted in habitat loss and encroachment on sensitive areas [18]. The economic pressure of tourism on Chilika is also significant. While tourism contributes to the local economy by generating employment and income opportunities, it often leads to unsustainable exploitation of resources. Overfishing, depletion of natural resources, and disruption of traditional fishing practices are some of the adverse effects of unchecked tourism activities [8]. At Chilika, the fishermen have identified several fish species that have disappeared from the lake and noted the changes in the numbers of Irrawaddy dolphins [27]. This not only jeopardizes the livelihoods of local communities but also undermines the long-term economic viability of the region. Therefore, currently, the local stakeholders are actively exploring alternate means to harness natural resources and leverage the environment [16].

3.3 State: understanding the carrying capacity

Due to tourism congestion and tourist activity pressure, carrying capacity (a certain limit on visitor use) needs to be checked to manage the current ecological state of Chilika [46]. Carrying capacity can also be a guiding factor for planning accessibility, infrastructure development, locations of use, number of vehicles, number of boats, number of people visiting etc. It also depends on factors like the length of stay (number of nights) of the visitors, visitors' local expenditure patterns, and the effects on local populations, culture and nature [47].

In this study, the calculation of carrying capacity is considered from the tourism plan drafted by CDA along with the ICZMP, which inferred that all three boating zones, namely Rambha, Barkul and Satapada cluster, are nearing their total carrying capacity. Especially Barkul and Satapada are almost saturated, considering the holding capacity of the lake in terms of boats. Therefore, these zones shall not be further loaded with additional boating activity and hence have been demarcated as Limited Development Zone within the lake. Furthermore, the report has calculated the maximum number of boats that Chilika Lake can contain at a given time without inducing any adverse environmental impacts. A 4F approach has been adopted for carrying capacity-based recommendations for boating, i.e., Flags (on water), Floating (boats), Forum (for Chilika) and Federation (for boat associations). The concept of "floating boats" is proposed for the Satapada Cluster. This concept would involve reserving 25% of the total permissible number of boats from each site to be stored as "floating boats." An online web portal for boating in Chilika Lake with centralized ticketing and a real-time boat tracking system is proposed to restrict unaccounted and uncontrolled boat movements in the lake area. This will also help to reduce the commission charged by the middlemen and eventually benefit the boatmen and tourists.

At Mangalajodi, the three boating stations currently operational are under the Mahavir Pakshi Suraksha Samiti (MPSS), Eco-Tourism Trust and Mangalajodi Conservation Tourism Trust (MCTT), handling a total of 14 licensed boats. If a comparison is made with the value of the lake use rate, the number of licensed boats is within the prescribed limit (15 boats). However, the actual number of boats being operated exceeds the lake use rate according to the tourism plan drafted by CDA and ICZMP. The recommendations framed by CDA for Mangalajodi shall aim at maintaining the following, i.e., boating activity [number of boats to be regulated based on lake use rate (15 boats)] and vehicular accessibility [provisions for regulating and organizing vehicular traffic (based on existing peak traffic load)].

Further, the importance of carrying capacity in ecotourism sites lies in regulating tourist numbers and visitors' participation in sustainable behaviors through environmental awareness programs. According to the field observation, to accomplish this, the Chilika Development Authority and local ecotourism members undertook a variety of instructional. A visitor interpretation center is accessible in Mangalajodi, offering visitors comprehensive knowledge about the area's value, its diverse range of species, and the crucial role of conservation efforts. Visitors are educated about the ecology, animals, and significance of responsible conduct through educational signage such as 'Plastic free Chilika is our motto' and informational boards about migrating birds and tourist sites. Visitors are provided with guided tours and educational activities, as well as internet materials including websites, videos, and photographs, to enhance their knowledge before they reach the location. These resources can highlight conservation initiatives, exhibit regional biodiversity, and provide guidance for conscientious ecotourism.

3.4 Impact: an example of Mangalajodi ecotourism, Chilika

To manage the impact of tourism congestion, multi-stakeholder participation, PPP (public–private partnership) and community participation are the ultimate needs [48] (Table 3). For this, the Co-C (community-based co-management) ecotourism planning approach has been referred to, which emphasizes collaboration and partnership between local communities and other stakeholders [39] (Fig. 6). In this case, Mangalajodi is represented as one of the classic examples of balancing livelihoods and conservation.

The region of Mangalajodi has been officially recognized as an "Important Bird Area" (IBA) by Birdlife International due to its substantial ecological value as a habitat for waterfowl species on a worldwide scale. Within this rural community, the inhabitants have discovered that engaging in poaching serves as an additional means of generating income for their livelihoods, alongside the more conventional farming and fishing techniques. Nevertheless, it is crucial to acknowledge that these acts are deemed unethical. Over time, Mangalajodi has acquired a distinct notoriety as the "poacher's village" [16]. The occurrence led to a substantial decrease in both the population and biodiversity of

Table 3 Stakeholders and their involvement in Mangalajodi ecotourism, Chilika. Source: Author's own elaboration by referring to Kummitha [17] and field observation (2023)

Stakeholders	Involvement in Mangalajodi ecotourism organisation
Sree Sree Mahavir Pakshi Suraksha Samiti and Mangalajodi ecotourism trust (MET)	• Created by ex-poachers for livelihood improvement • Related to capacity building • Motivate to involve other stakeholders • Common objective of village development
IGS (Indian Grameen Services)	• Enhancing the overall development of the destination • Enhancement of capacity-building activities • Encouraging the engagement of additional stakeholders • Associated with the effective management of funds
RBS foundation (Royal Bank of Scotland)	• The promotion of ecotourism on a broader scale • Formulation and administration of policies and financial resources of Mangalajodi Ecotourism Trust (MET)
CDA (Chilika Development Authority)	• Pertaining to the overall development of the project • Engagement across several tiers of the project • Recommendations to enhance the destination
Forest Department, Government of Odisha	• Overall upgrade of the ecotourism project site • Participation across many developmental programs • Recommendations for enhancing the destination
Community-based ecotourism (Mangalajodi ecotourism trust)/other ecotourism institutions)	• Associated with the overall development of the area • Creating connections between various institutions • Shared goal of village development
District-level government departments (revenue, water, fisheries and wildlife department, boat association)	• Implementing community development initiatives • Providing financial and administrative support • Making suggestions towards improving the destination

bird species. To tackle the issue, the Chilika Development Authority (CDA) formed a partnership with the local forest department and sought support from the Wild Odisha NGO, a regional non-governmental organization committed to the preservation of wildlife. In the initial stage, a group of young people hailing from Mangalajodi established a citizen forum known as the "Maa Kalijai Jubak Sangh" to thwart illegal hunting activities and foster the preservation of the natural environment. Wild Odisha volunteers played a facilitating role in the formation of a bird conservation organization, referred to as the "Sree Sree Mahavir Pakshi Suraksha Committee." This committee facilitated the collaboration of individuals with previous involvement in poaching activities and young members of the local community. Their joint endeavors were focused on the preservation of avian species [15].

The collaboration between the CDA, the local forest department, and Wild Orissa continued in Mangalajodi until 2002, as part of their ongoing commitment to conservation endeavors. To address the problem of poaching, the government devised a method whereby individuals active in conservation efforts as well as those engaged in poaching activities were given a monthly stipend. Initially set at 500 INR, the stipend was subsequently increased to 1000 INR to incentivize these individuals. However, these attempts have shown partial success, although they lacked consistency and failed to completely eradicate poaching operations (Field Observation, 2023). The advent of tourism in Mangaljodi from 2002 to 2003 brought about a notable shift in the collective mindset of the village. A group of around 25 young individuals from Mangaljodi, together with participants from neighbouring villages, underwent guide training facilitated by the CDA in collaboration with Wild Odisha. Wild Odisha, in collaboration with the Council of Professional Social Workers (CPSW) and with the backing of the RBS (Royal Bank of Scotland) Foundation India, initiated an ecotourism initiative centered around guided bird viewing [10, 16]. This endeavor aims to cater to the interests of bird enthusiasts and nature lovers, with the assistance of local guides. The ecotourism operations and influx of tourists to Mangalajodi were of limited importance before 2008. In 2009, the RBS (Royal Bank of Scotland) foundation resumed the role of a financial and intellectual collaborator, while IGS (Indian Grameen Services), an NGO for livelihood improvement, served as the implementing partner for knowledge acquisition, skill dissemination, and community advancement [16, 17].

Based on the field observation, the formation of the Mangalajodi Ecotourism Trust (MET) has enabled the indigenous population and local boatmen to receive training in guiding, hospitality, and food services. The group actively engaged in providing boating services to visitors, and a comprehensive campaign was implemented to enhance awareness among the local population [17]. The Mangalajodi Ecotourism Trust (MET) constructed a homestay-type facility intended to

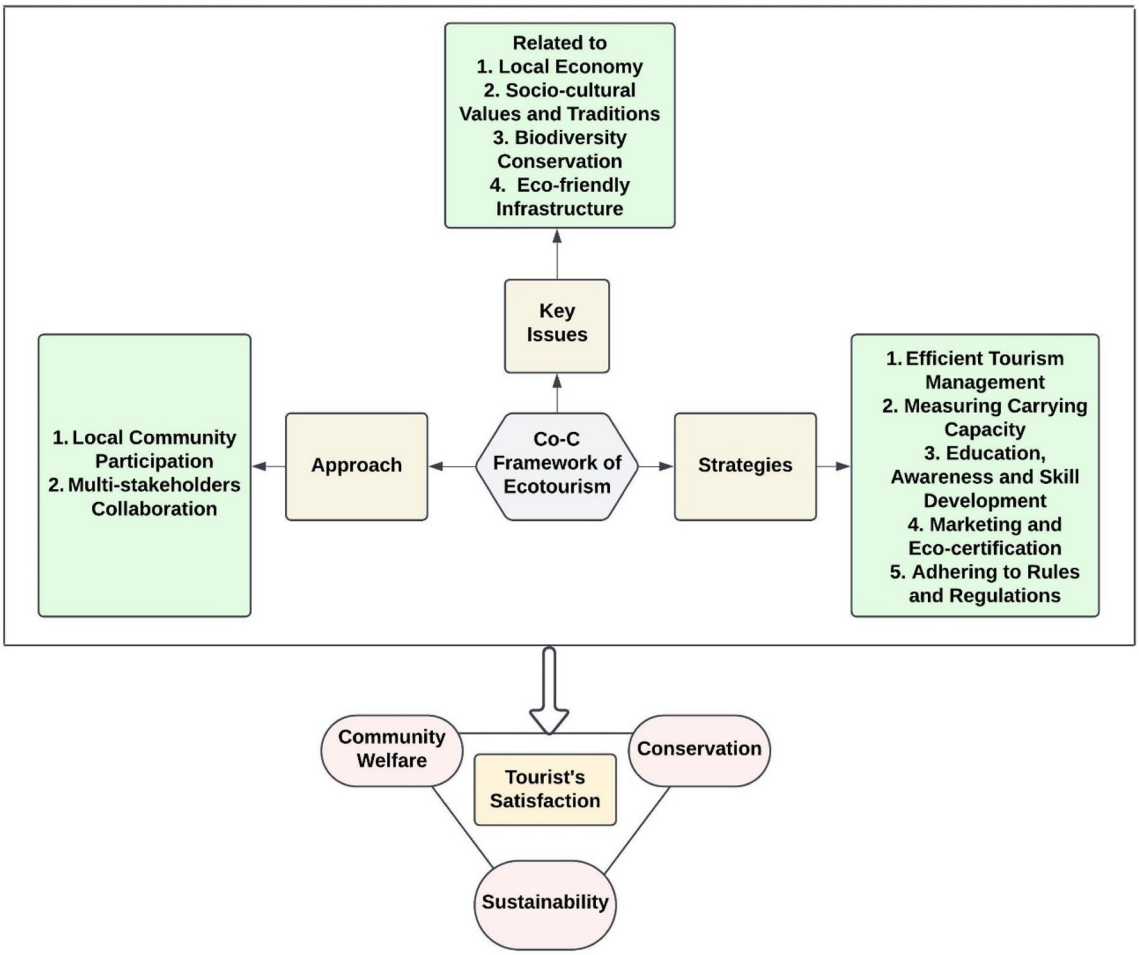

Fig. 6 Community-based co-management framework of ecotourism (Source: Modified from Chan and Bhatta [39])

provide an accommodation option for travelers. Various equipment, such as binoculars, have been offered to enhance the sightseeing experience. Following the established guidelines, individuals have the opportunity to engage in the activity of bird watching while maintaining a minimum distance of 30 feet from the avian species. This was accomplished by utilizing non-motorized boats, therefore minimizing potential disruptions to the birds' natural habitat.

The establishment of strong relationships with tour operators and educational institutions played a significant role in drawing various types of visitors, including tourists, wildlife photographers, travel journalists, and academicians, to the region. The aforementioned features, including the existing connectivity, convenient accessibility to the location, and other relevant considerations, contribute to the successful establishment of Mangalajodi as a prominent ecotourism destination within the region of Odisha.

3.5 Response: nature camps of Chilika

Nature camps serve as a dynamic example of the efficacy of ecotourism in both preserving biodiversity and enhancing the economic well-being of local communities. The Forest, Environment and Climate Change Department serves as the primary agency responsible for the advancement of ecotourism within Odisha. In 2016, the department implemented the strategy of community-based ecotourism in Odisha with the aim of garnering support from forest-dependent people for the conservation of forests and wildlife. The government has authorized a 5-year plan (2016–17 to 2020–21) for the

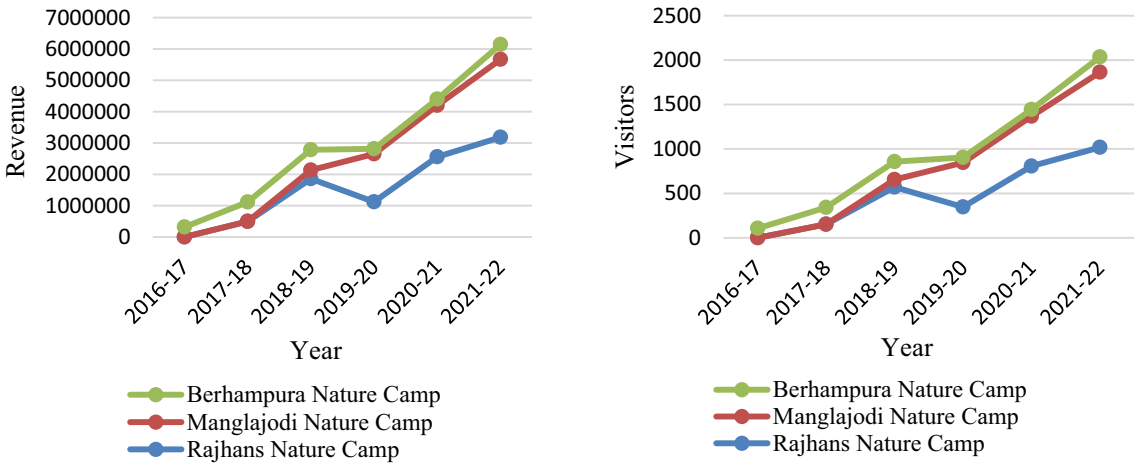

Fig. 7 Financial year-wise revenue and footfall of Chilika nature camps (Source: Wildlife Odisha report, 2022 (https://wildlife.odisha.gov.in/Publication))

promotion of ecotourism, with a financial allocation of Rs. 56 crore [49]. The Institute of Hotel Management (IHM) and Odisha Biodiversity Board (OBB) in Bhubaneswar have been conducting training sessions for the members of the Eco-development Committee (EDC), Vana Suraksha Samiti (VSS) and Ecotourism Groups (ETG). The primary objective of these programs is to offer training and guidance, enhance skills, and facilitate exposure visits that pertain to different facets of the hospitality industry. These include areas such as housekeeping, sanitation, cleaning, communication skills, food cuisine and eco-guiding. The primary aim of these initiatives is to improve the administration of ecotourism nature camps inside the state [50]. The nature camps provide visitors with the chance to engage in guided tours facilitated by a well-informed specialist who possesses expertise in the indigenous plant and animal species present in the surrounding area. In addition, visitors have the opportunity to engage in various activities such as cycling, participating in canopy walks, observing birds, engaging in sports, boating, and accessing a souvenir shop. These activities serve to enrich the overall experience of visitors and facilitate their complete appreciation of the remarkable natural wonders present in the lagoon.

In Fig. 7, it is observed that, 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%) (Fig. 7).

According to the Memorandum of Understanding (MoU) established between the forest and tourism departments, the tourism department is actively engaged in the extensive promotion of Odisha ecotourism inside India as well as on an international level [51]. In ecotourism sites, the use of plastics is prohibited, and there is a strong emphasis on maintaining cleanliness and hygiene. Additionally, measures are implemented to effectively manage traffic pollution and minimize sound pollution. Furthermore, the state government has established an ecotourism unit inside the Forest and Environment Department of the state government. The tourist department, in collaboration with the Forest, Environment and Climate Change department, has developed the 'Odisha Ecotourism Roadmap 2030' as a strategic framework to effectively use the eco-tourism opportunities presented by Chilika and the entire state [51, 52].

4 Conclusion

The DPSIR framework offers a valuable perspective for analyzing the dynamics of ecotourism in Chilika Lake, a prominent wetland ecosystem located in India. The factors propelling the development of ecotourism in Chilika Lake encompass a growing need for nature-oriented encounters and the economic prospects associated with tourism. Nevertheless, this phenomenon also exerts significant stress on the delicate ecological system. The implementation of infrastructure development, such as the establishment of visitor facilities and access points, as well as the promotion of visitor activities like boating and birdwatching, can impose significant pressure on the ecosystems and biodiversity of the lake. Assessing the state of Chilika Lake involves evaluating the health of the ecosystem, including water quality, the abundance of native species, and overall ecological integrity. The impacts of ecotourism can be both ecological, such as habitat disturbance and the introduction of invasive species, as well as socio-economic, with potential overcrowding and imbalanced distribution of benefits. To respond to these challenges, conservation measures must be implemented, including habitat restoration and water quality management. Sustainable tourism practices should be promoted through guidelines for operators and visitors, aiming to minimize ecological impacts and maximize socio-economic benefits. Engaging stakeholders, including local communities and government agencies, is essential for inclusive decision-making and the long-term sustainability of ecotourism in Chilika Lake.

Using the DPSIR framework, the study concentrated on the negative impact of poor ecotourism management, followed by an assessment of various pressures caused by driving factors in some of the most popular tourist locations. Analysis by CDA and ICZMP on carrying capacity has been done as an efficient strategy in the case of the lake use rate of boats in Chilika and bird-watching tourists in Mangalajodi as examples to revive the adverse state of the destinations owing to over-tourism. Furthermore, in Mangalajodi, the collaborative stakeholder structure (Co-C approach) in minimizing the negative impact of drivers symbolizes socio-cultural-economic-environmental balance (Triple Bottom Line). As a result, the efficiency in generating revenue, providing employment and wildlife conservation through nature camps in Chilika gives a classic example of proper ecotourism management while simultaneously providing tourist satisfaction.

Moreover, the assessment of different tourist places done by [53] in collaboration with ICZMP and CDA explains the strength of the site. E.g., Rambha, a prominent tourist destination in Chilika, is famous for its rich cultural history, strong community support and road and railway connectivity. It is also well connected to other tourist destinations; Barkul, which hosts a large number of tourists is a prominent gateway to the lake. Its strength lies in strong community adherence and good connectivity through railway and bus stations. Proximity to a variety of attraction points, such as *Kalijai* temple, Nalabana Bird Sanctuary and Chadheibar, makes way for a strong tourist presence here. The opportunity lies in community adherence can be used effectively to support community-based activities and provide employment opportunities for the locals; Satapada has good connectivity through roads and railways. It is the access point for dolphin watching and visiting surrounding islands and accessibility to many islands and tourist hotspots like Rajhans Island, Red Crab Island and Sea Mouth in the vicinity. Therefore, the strengths and opportunities lie in the music, dance, art and bird festival. Chilika's unique local cuisine can be developed properly, given the presence of interested private groups and NGOs. In a similar line, the success of nature camps cannot be ignored. According to one key informant from Ecotour Odisha,

> *"The introduction of ecotourism has employed local people through ecotourism activities. Furthermore, even during the peak period of COVID-19, the revenue earned by the introduction of nature camps shows a rising trend. The COVID-19 protocol was successfully implemented owing to the involvement of the government and the local community."*

Another staff from the same office narrated the success of nature camps and Mangalajodi ecotourism as it bagged the UNWTO award in 2014 [54]. According to her,

> *"The government will assign more site managers to better manage the nature camps. During the off-season, site managers will get a 10% income share from the government as an incentive to safeguard and market the site. In addition, the 'Odisha Ecotourism Society' has been formed to manage ecotourism in various protected areas and to implement relevant policies through its nominated members."*

A knowledgeable individual affiliated with the CDA provided his insights on the fact that *"Considering Chilika's diverse nature and ecological characteristics, the future of ecotourism is very bright. For example, Mangalajodi created community-based ecotourism with local backing. The former poachers are now eco guides and conservationists".* Furthermore, he emphasized the relevance of dolphin, adventure, and cultural tourism, which can supplement ecotourism for the lake's sustainability.

But, despite the success of Mangalajodi ecotourism, many issues persist in terms of numbers in employment generation, power politics, less participation of women community etc. The viewpoint of another person of higher authority related to CDA emphasised the fact that,

> *"Ecotourism plays an important role in empowering the local community. But it can also destroy biodiversity if not managed properly. Therefore, all stakeholders should work in unison to make this successful. Moreover, the fisher community are the most important stakeholder in Chilika. That is why the success of ecotourism majorly depends on their support and participation".*

Odisha is one of the three coastal states under the federal government's ambitious Integrated Coastal Zone Management Project. One of the main objectives of this project is ecotourism development in Odisha. The Chilika Development Authority (CDA), established in 1991 for the overall development of the Chilika Lagoon, is the implementing agency for this project. The state government drafted a report on its vision and implementation plan for ICZM, in which they recognise the importance of prioritising local communities and ecosystems in their plans [53]. The plan repeatedly emphasises the involvement of the local community in the development of ecotourism-related infrastructure (e.g., sit-outs, handicrafts and handloom centres, and boats), which is to be later handed over to the local communities for operation and maintenance. However, members of the boat association indicated that infrastructure such as tourist camps are outsourced to private players, which takes capital out of Chilika, while other types of infrastructure, including those mentioned in the plan, have not been developed properly [40, 53, 55]. The plan includes many components of sustainable cultural tourism and the description of ecotourism provided by the Odisha Tourism Development Corporation (OTDC). It identifies the role of culture, nature, sustainable and green infrastructure, education, adventure, and, most importantly, the well-being of Indigenous people. However, the reality on the ground reflects a disconnect between these laudable aims and the way ecotourism is being practised. Currently, the ecotourism sector also focuses on dolphins as an attraction for tourists, which represents a missed opportunity for more meaningful involvement of local communities aligning tourism with conservation efforts. Achieving this holistic and ideal vision for ecotourism at Chilika requires translating the plan into action [10].

According to [41], which focused on the conservation of coastal ecosystems by the Ministry of Tourism, it was observed during the audit that despite the construction of five camp infrastructures along the Chilika coast in 2018, with a total expenditure of ₹ 1.46 crore, these facilities were unable to become operational due to inadequate provision of water supply and electricity. The Odisha Tourism Development Corporation (OTDC) undertook a project focused on the development of participatory ecotourism in Chilika, to enhance livelihood security. Upon examination of the records, it was discovered that the OTDC allocated a sum of ₹ 2.97 crores towards the establishment of many amenities such as food courts, public conveniences, parking facilities, and a tourist information centre. These initiatives were undertaken in collaboration with the Eco-tourism Development Society (EDS) to augment the tourism potential in the region. Despite the transfer of these assets to EDS in May 2016, their operational status could not be achieved by EDS as of September 2021 due to the site's inability to attract tourists [41]. To facilitate the development of sustainable livelihoods through ecotourism along the Chilika coast, the Wildlife Division of Chilika procured a total of seven transit boats during the period spanning from March to July 2014. Upon careful examination of the documents, it was revealed that the department operated the seven transit boats for only 11 months. Nevertheless, the lack of ecological viability rendered these vessels impractical for ecotourism purposes, primarily because of their substantial fuel consumption. The initiative was unable to enhance the capacity building of the selected institutes due to a lack of enough personnel. The study also revealed that the current monitoring and protection procedures in place for coastal resources are insufficient [41]. Hence, the ICZM project did not achieve significant progress in enhancing the ability for sustainable coastal management in India's coastal zones.

5 Future actions for further research and recommendations

Given Chilika's ecological sensitivity, measuring carrying capacity is essential. The carrying capacity of boats in the case of Chilika and bird-watching visitors in the case of Mangalajodi has been determined in the report developed by ICZMP and CDA [53]. However, how far it will be implemented has yet to be determined. Furthermore, the carrying capacity of other popular tourist destinations, such as Rambha, Barkul, and Balugaon, has not yet been investigated. As a result, greater knowledge in this area is required to develop Chilika's overall ecosystem. The primary limitation of calculating carrying capacity is that it can only be conducted during the peak tourist season. Therefore, a study on the comparison of carrying capacity in both off-season and peak season will offer a proper notion of the economic and environmental effect of ecotourism on Chilika Lake. Because most literature and key informants have stressed the importance of community-based ecotourism and multi-stakeholder engagement, it is necessary to determine which stakeholder is playing the essential role in managing ecotourism at Chilika. Also, given the political dynamics and hierarchy at the authority level, whether the governance is good or bad must be considered. The major community is the fishing community. As a result, their perspectives are crucial in the introduction of ecotourism. Further, according to observations and various articles, women's engagement in the ecotourism industry at Chilika is very low or non-existent. So, how much they are willing to engage, and if they are, how empowered they are because of the ecotourism enterprise, has to be investigated. Further, the use of clean energy should be promoted to attain sustainable development goals by mitigating carbon emissions in the ecotourism sector [56]. Ecotourism as a conservation technique seeks to maximize local community livelihood prospects [57]. According to the SLF (Sustainable Livelihood Framework), the influence of tourism on the five livelihood capitals (human, social, physical, financial and natural) must be quantified to comprehend the proximity of tourist impact on livelihood and environment. Also, valuation is a much-needed phenomenon to understand the tourists' perception of conserving Chilika Lagoon for sustainable purposes [58].

To ensure the success of the ecotourism development project in Chilika Lake in terms of biodiversity conservation and livelihood improvement, the present study advocates the subsequent measures:

- The promotion of native handicrafts, food, folk songs/music, and economic-generating activities within the community should be supported.
- The allocation of enough funding by both central and state governments is vital for the enhancement of road infrastructure, transit systems, and the establishment of clean and hygienic environments, as well as the provision of safety and security measures at tourism destinations. It is recommended that an annual allocation of funds be designated specifically to develop ecotourism initiatives.
- It is recommended to expand the development of ecotourism infrastructure, including the establishment of additional ecotourism facilities and eco-sheds. These structures should be constructed using environmentally friendly methods such as the utilization of solar energy, adoption of waste recycling practices, promotion of natural cross ventilation instead of relying on air-conditioning systems, and the achievement of a high level of self-sufficiency in food production through the establishment of orchards, ecological farms, and aquaculture operations.
- Organizing ecotourism groups inside schools and colleges can serve as a means to foster awareness and understanding of nature tourism among the younger generation.
- It is recommended that the establishment of an environmental education centre and interpretation centre should be considered in all prominent tourist places of Chilika Lake.

6 Limitations of the study

The findings and conclusions of the case study are limited by a small sample size, which might affect the accuracy of the results. Increasing the size and diversity of the sample might improve the study's validity. The study is constrained by the particular time period in which data was gathered. The dynamics of ecotourism and the roles of stakeholders may vary

over time, and the research may not accurately depict long-term changes or trends. Given the methodological restrictions, the selected study methodologies and instruments have their limits. For example, relying only on interviews or surveys may not comprehensively capture the intricacies of stakeholder relationships. Utilizing supplementary techniques to triangulate data might improve the study's reliability. The case study lacks a comprehensive analysis of the impact of wider tourist developments on stakeholder responsibilities. The study's scope is limited due to constraints in resources, such as time, funds and access to certain stakeholders. These limitations may affect the thoroughness of the investigation and the capacity to include a diverse set of stakeholders.

Author contributions R.S.—conceived and designed the research paper; identified the research objective and methodology; primarily responsible for overseeing interviews and surveys with stakeholders; data synthesis, interpreting the findings, and drawing conclusions; contributed to the development of visual representations, such as charts and graphs, to present key findings. M.D.—collaborated with Author R.S. in refining the research questions and methodology; organizing and structuring the paper, ensuring coherence and adherence to academic standards; refined the paper's conclusions and implications; contributed to the critical review of the paper, offering insights and suggestions for improvement.

Data availability The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request. Data can be found in the Odisha wildlife reports and statistical bulletins of the tourism department, Odisha.

Declarations

Ethics approval and consent to participate Approval was obtained from the ethics committee of the Indian Institute of Technology Bhubaneswar. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

Consent for publication The participant has consented to the submission of the case report to the journal.

Competing interests The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

See Tables 4, 5, 6, and 7.

Table 4 List of the secondary data and sources. Source: Author's own compilation of different sources (2023)

Serial number	Source	Year	Type of source
1	Odisha tourism policy	2022	Report
2	Annual report (ecotourism) retrieved from Ecotour Odisha, Wildlife Odisha and Wildlife Organisation (Forest & Environment Department)	2019–20	Report
3	Tourism master plan of the Chilika and its catchment, Odisha under ICZMP—Odisha received from Chilika Development Authority (CDA)	2014–2017	Report [unpublished]
4	Birds & Dolphin census retrieved from Wildlife Odisha, Odisha Wildlife Organization (iWLMS)	2021–22	Report
5	Tourist visit—domestic, foreign and total retrieved from statistical bulletin, Department of Tourism, Odisha	2017–2022	Bulletins
6	Stakeholders involvement at MET (Mangalajodi ecotourism trust) referred from Kummitha [17]	2020	Research article
7	Chilika newsletter series, volume I–VI, retrieved from Chilika Development Authority and Wetlands International—South Asia	2000–12	Newsletters
8	Doctoral dissertation by Prateep Kumar Nayak [12]	2012	Thesis
9	The Times of India, Business Standard, the Telegraph	2016, 2018, 2024	Newspaper articles
10	Odisha State Forest Headquarters, PCCF & HoFF Odisha, Bhubaneswar, Forest, Environment and Climate Change Department, Government of Odisha	2024	Official website

Table 5 Number of stakeholders interviewed. Source: Fieldwork, 2023; Author's own construction (2023)

Stakeholder	No. of respondents interviewed
Eco guide and boat members	15
ETG workers from nature camps	2
Manager from nature camp	1
Managers from MET	2
Workers from MET	3
Key informants from CDA	3
Activist from MPSS	1
Key informants from Wildlife Odisha and Ecotour Odisha department	3
Tour operators and souvenir store owners at Chilika	4
Boat association members and manager	3
Local community members (local transportation and local shops)	5
Total	42

ETG Ecotourism group, *MET* Mangalajodi Ecotourism Trust, *CDA* Chilika Development Authority, *MPSS* Mangalajodi Pakshi Suraksha Samiti

Table 6 Socio-demographic characteristics of the stakeholders. Source: Fieldwork, 2023; Author's own construction (2023)

Variables	N = 42(%)
Gender	
Male	80.95
Female	16.66
Age (in years)	
< 25	2.38
26–35	9.52
36–45	54.76
46–55	26.19
> 55	4.76
Education	
≤ Primary education	59.52
Secondary school education	19.04
University bachelor's degree	11.90
Master's and Ph.D. education	7.14
Occupation	
Local community member	11.90
Employees in private and non-governmental organisations	57.14
Employees in governmental organisations	21.42
Tourism providers (tour operators, local shops)	9.52

The variable types are referred from Pasape et al. [59]

Table 7 Databases and numbers of journal articles selected for the study. Source: Author's own construction (2023)

Data base	Number of journal articles
Scopus	16 [Chilika (all fields) and Ecotourism (article title, abstract, keywords)]
Google scholar	35 [Chilika and Ecotourism (in the entire manuscript)]
Duplicates removed	12
Manual analysis of total records	39

'[ ]' represents the keywords entered in the search tab of the database

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