



VULNERABILITY TO VIABILITY
GLOBAL PARTNERSHIP

Reflections from Chilika-V2V Field School: A Glimpse into the Blue Economy and Livelihoods of the Chilika Lagoon

V2V Working Paper No. 2024-04

Evans Kwasi Arizi, Chineboaba Araba Afful, Nilushika Gamage, Aini
Nur Furoida, Sigma Dang, Palak Ahuja
with contributions from
Issa Peltier, Zulfikar Al Hafidz, Santanu Sarkar

June 2024



Working Paper Series Editors:

Prateep Kumar Nayak

School of Environment, Enterprise and Development, Faculty of Environment, University of Waterloo, Waterloo, ON, Canada

Derek Armitage

School of Environment, Resources and Sustainability, Faculty of Environment, University of Waterloo, Waterloo, ON, Canada

Editors:

Sisir Kanta Pradhan

School of Environment, Enterprise and Development, Faculty of Environment, University of Waterloo, Waterloo, ON, Canada

Ella-Kari Muhl

School of Environment, Enterprise and Development, Faculty of Environment, University of Waterloo, Waterloo, ON, Canada

Publication design and formatting:

Maha Abdelbaset

School of Environment, Enterprise and Development, Faculty of Environment, University of Waterloo, Waterloo, ON, Canada

How to cite:

Arizi, E. K., Afful, C. A., Gamage, N., Furoida, A. N., Dang, S., Ahuja, P. (2024). *Reflections from Chilika-V2V Field School: A Glimpse into the Blue Economy and Livelihoods of the Chilika Lagoon*. V2V Working Paper 2024-04. V2V Global Partnership, University of Waterloo, Canada.

Contributors:

Issa Peltier, Zulfikar Al Hafidz, Santanu Sarkar

V2V Global Partnership Secretariat

School of Environment, Enterprise and Development,

Faculty of Environment

200 University Avenue West, EV 3

University of Waterloo, Waterloo, ON, N2L 3G1 Canada

Website: www.v2vglobalpartnership.org

Email: v2vglobalpartnership@gmail.com

V2V Global Partnership is supported by the Social Sciences and Humanities Research Council of Canada under its Partnership Grant Program.



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada

V2V Working Paper Series

V2V Global Partnership “Working Paper Series” aims to facilitate the exchange of ideas, mobilize knowledge and generate broad-based discussions on vulnerability-viability themes within the context of small-scale fisheries. The Working Paper Series will provide a collaborative and interactive platform for academics, practitioners, representatives of civil society, and individuals interested in making written contributions to the theoretical, methodological, practical, and policy aspects of small-scale fisheries, both locally and globally. To contribute to the V2V Working Paper Series, please contact v2vglobalpartnership@gmail.com.



Reflections from Chilika - V2V Field School

Small-scale fisheries (SSF) are important social-ecological systems across all parts of the world. Strongly anchored in local communities, SSFs reflect a way of life, and they provide critical contributions. Yet, their efforts and their existence are often overlooked as many SSF communities remain economically and politically marginalized, are highly vulnerable to change, and remain invisible in policy debates. Nonetheless, the continuity of many SSFs suggests certain strengths and forms of resilience. A holistic understanding of what causes vulnerability, as well as what makes fisheries social-ecological systems viable and through what processes is required. This understanding needs to be place based and situated within the SSF context, and the processes surrounding it must be long-term, collaborative and iterative.

The Chilika - V2V Field School aims to provide a creative platform for graduate students and early career scholars and practitioners to deliberate and learn about concepts, approaches and methods helpful to achieving transitions from vulnerability to viability within SSF social-ecological systems. The Field School takes place every year in the Chilika Lagoon, Bay of Bengal, India, where participants gain firsthand experience and creatively engage in furthering their understanding and knowledge of vulnerability to viability transitions, and experiment with concepts and approaches that are novel, transdisciplinary and problem oriented. The Reflections from Chilika - V2V Field School is part of the V2V Working Paper Series that exclusively focuses on documenting the main learnings, insights, reflections gained by the Chilika - V2V Field School participants during their weeklong journey with the fisher communities of Chilika Lagoon.

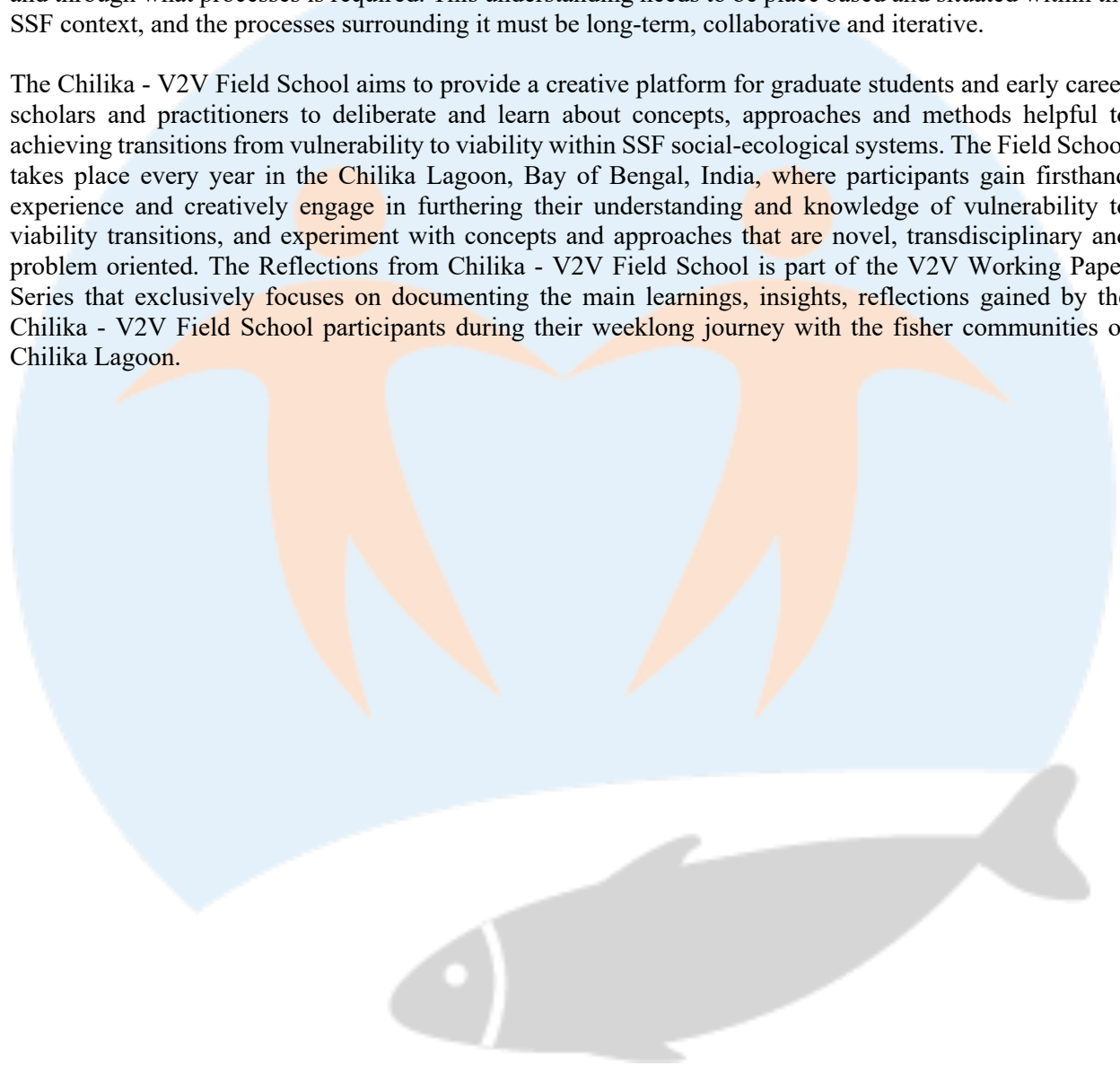
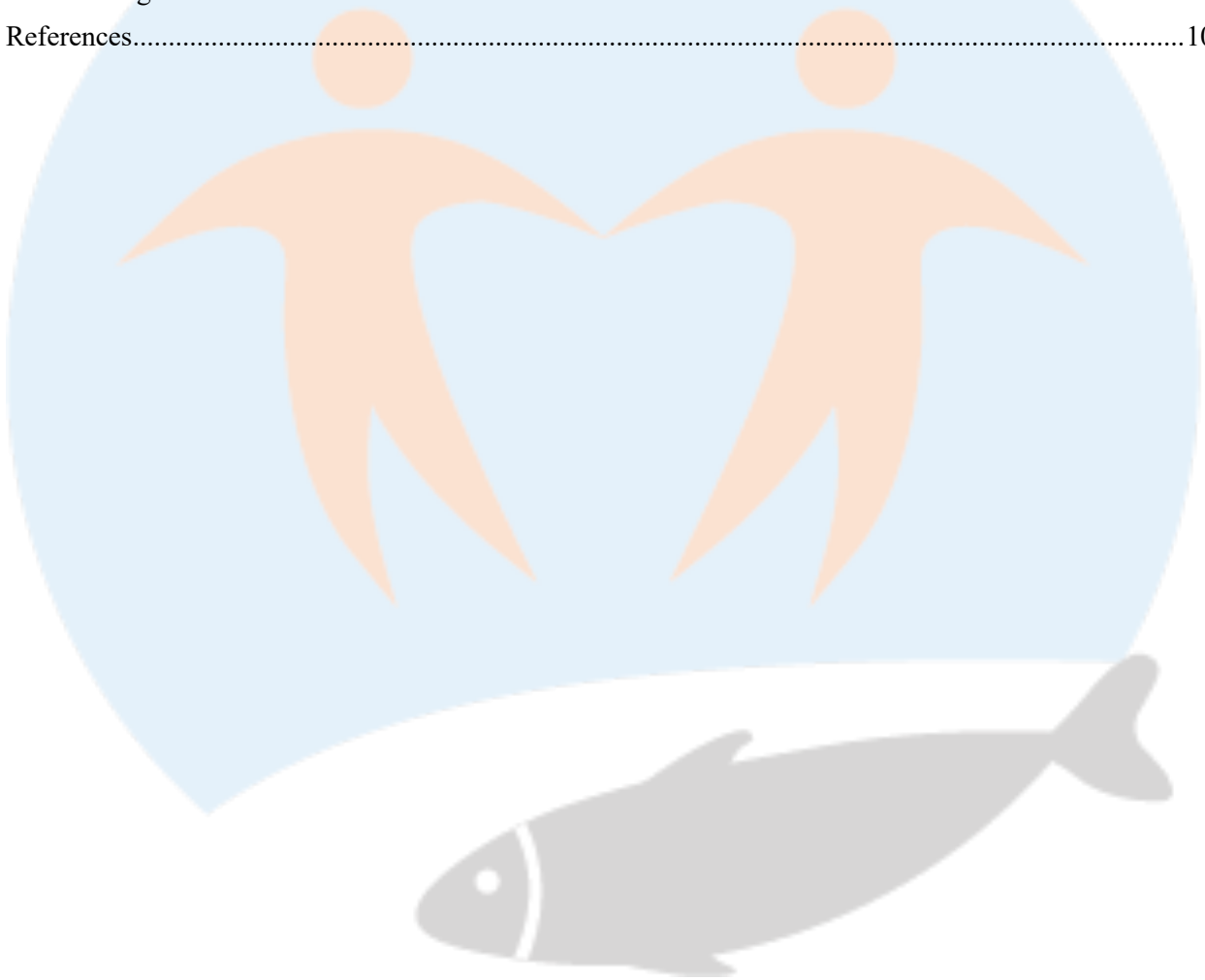


Table of Contents

1. Introduction.....	1
2. Approach to Generation of Reflections	2
3. Reflections on the blue economy and livelihoods related to the Chilika Lagoon	3
3.1 Blue economic activities and livelihoods	3
3.2 Challenges from the economic activities	4
3.3 Diversification of livelihoods	5
3.4 Government interventions and collaboration.....	6
4. Conclusions.....	8
Acknowledgements.....	9
References.....	10



Reflections from Chilika - V2V Field School: A Glimpse into the Blue Economy and Livelihoods of the Chilika Lagoon

Evans Kwasi Arizi^{1,2*} • Chineboaba Araba Afful³ • Nilushika Gamage⁴ • Aini Nur Furoida⁵ • Sigma Dang⁶ • Palak Ahuja⁷

with contributions from

Issa Peltier⁸ • Zulfikar Al Hafidz⁵ • Santanu Sarkar⁷

¹Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

²Centre for Coastal Management, Africa Centre of Excellence in Coastal Resilience (ACECoR), University of Cape Coast, Ghana

³Université Cheikh Anta Diop de Dakar, Senegal

⁴Environment Studies in Sustainability Management, University of Waterloo, Canada

⁵Doctoral Economics Program, Faculty Economics and Business, Diponegoro University, Indonesia

⁶NIRMAN, India

⁷Indian Institute of Technology, Kharagpur, West Bengal, India

⁸University of Waterloo, Canada

* Corresponding author: evans.arizi@ucc.edu.gh

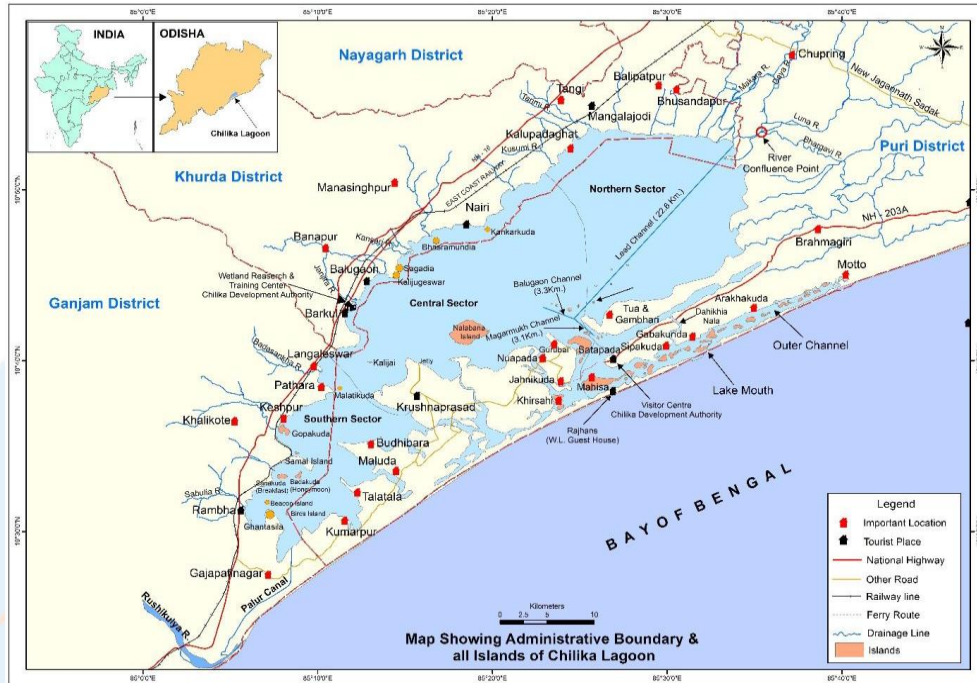
1. Introduction

For the past few years, “Blue Economy” has increasingly become a buzzword for describing the sustainable use of marine resources with maximum economic gain (AU-IBAR, 2019; Lee et al., 2020). According to the World Bank (2017), “Blue Economy” can be defined as the sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving the health of oceanic ecosystems. It encompasses livelihoods such as capture fisheries, aquaculture, tourism, bioprospecting, shipping and renewable energy generation. Nearly a decade ago, the blue economy represented about 5.4 million jobs and generated a gross added value of almost €500 billion per year (World Bank, 2016). The pursuit of the blue economic activities can potentially curtail the excruciating hardship that is afflicting small-scale fishers around the world (Campbell et al., 2021).

Nearly 0.3 million small-scale fishers in over 120 villages directly depend on the Chilika Lagoon for their livelihoods (Shukla et al., 2022). The lagoon is the largest brackish water body in Asia, located in Odisha State on the east coast of India (Figure 1). It covers an area of over 1,000 km² (Chilika Development Authority [CDA], 2020) and it is characterized by spatial and temporal salinity gradients consisting of marine, brackish water and freshwater ecosystems.

Figure 1

Geographical location of the Chilika Lagoon



Source: Chilika Development Authority (www.chilika.com).

Chilika Lagoon serves as a biodiversity hotspot with rare and endangered species (e.g., *Barkudia insularis*, commonly known as the Madras spotted skink) according to International Union for Conservation of Nature (IUCN) red list of threatened species. The lagoon can be recognized as a cultural heritage site given that it has provided fisheries and aquatic resources for several generations of fisherfolk (UNESCO, 2014). Presently, a large array of fishing techniques, nets and gears are being used to harvest fisheries resources in the lagoon. Considering the unique nature of the lagoon, it is essential to understand its associated blue economy initiatives towards improved local livelihoods. Hence, this paper aims at providing insights into the blue economy and the associated livelihoods related to the lagoon. This working paper presents the collective learning and insights gained by the authors during their visits to the riparian fishing communities of the Chilika Lagoon as part of the Chilika - V2V Field School in August 12 - 19, 2023. In this report, our reflections have been organized into four themes: (a) Blue economic activities and livelihoods; (b) Challenges from blue economic activities; (c) Diversification of livelihoods; and (d) Government involvement and collaboration.

2. Approach to Generation of Reflections

This section highlights the approaches that were employed to gather the reflections or the insights. It also captures the location and the duration of the reflection. During the study tour, we visited fishing communities adjacent to the Chilika Lagoon, including Barkul and Rambha, where we interacted with the fisherfolk and also observed some of the socioeconomic activities in and around the lagoon. Learnings were captured through reflections from group meetings, interpersonal interactions, and on-site observations. A desktop literature review on the blue economy and livelihoods related to the lagoon was conducted to triangulate the reflections (Strauss & Corbin, 1998). These reflections were later presented to the fisherfolk at a dissemination meeting.

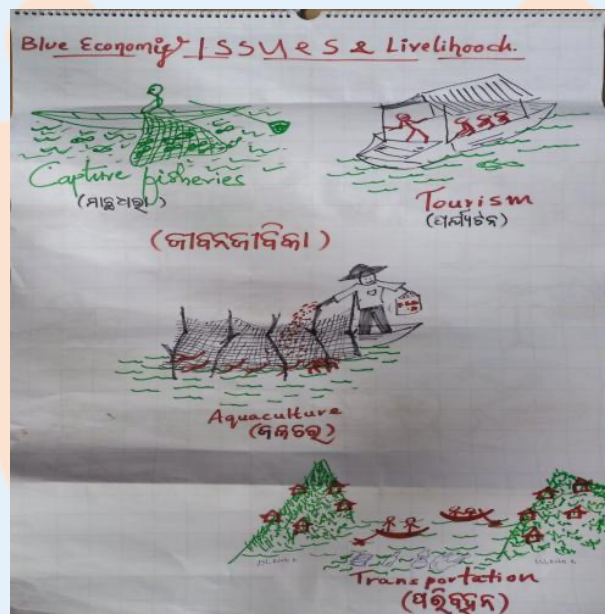
3. Reflections on the blue economy and livelihoods related to the Chilika Lagoon

3.1 Blue economic activities and livelihoods

During the field visits, it was revealed that capture fisheries, fish processing, boat tourism, aquaculture, transportation and navigation were the key blue economic activities done in or around the Chilika Lagoon (Plate 1). These reflections were further confirmed at a dissemination meeting attended by a section of the fisherfolk whose livelihoods greatly depend on the lagoon.

Figure 2

Artistic scene depicting the blue economic activities and livelihoods related to the Chilika Lagoon (captions are in both English and Oriya languages for easy comprehension and knowledge dissemination among both the local people and the broader audience)



Among the foregoing economic activities, boat tourism appeared to be growing rapidly as lots of tourists visit the lagoon to travel in motorboats and/or small boats/canoes for a fee. In Chilika, the tourism industry as part of the blue economy has become a significant source of livelihood alongside traditional fishing. Many fishing boats are now used as tourist boats in response to declining fisheries resources. For instance, fishers from Barkul have embraced tourism as a supplementary source of income. (Plate 2). Furthermore, private organizations have introduced large, motorized boats to aid tourism in the lagoon. However, a worrisome feeling prevails among the villagers regarding these big boats. Not only do they perceive them as a direct threat to their smaller tourist boats, but they also express concerns about the ecological imbalance of the lagoon. For example, local community members have observed that large, motorised boats disrupt the habitats of fish, particularly in the shallow waters of the lagoon. In addition, the opening of a new sea mouth has an adverse impact on fish catch, and some fish species (e.g. *Pristis pectinata*, commonly known as smalltooth sawfish) are becoming increasingly rare (Mohapatra et al., 2015).

Figure 3

Increasing number of tourist boats within the small-scale fisheries of Chilika



Source: The photo was captured during the Chilika-V2V Field School 2023 by Nilushika Gamage

3.2 Challenges from the economic activities

Although the economic activities in the lagoon have been beneficial to few people, they negatively impact the lagoon by causing water pollution and decline in fishery resources with consequent loss of livelihoods leading to poverty and migration.

3.2.1 Pollution

From our own observations, the littoral zones of the lagoon were relatively polluted with food packets, water bottles and abandoned fishing gears. This observation confirms the findings of Skukla et al. (2022). The water pollution is attributed to littering of food and plastic waste by tourists. The majority of the fishing and tourism boats observed have outboard engines. These engines create noise pollution in the lagoon with repercussions for dolphins and other animals inhabiting the lagoon as asserted by De Soto (2016). The fishers indicated that shrimp aquaculture is practiced in the lagoon and therefore the lagoon is a receptacle for the effluents composed of antibiotics that are discharged from the aquaculture farms. The accumulation of these chemicals can potentially alter the chemical properties of the waters in the affected areas with a cascading effect on the biodiversity in the lagoon (Panda et al. 2015; Arenas-Sánchez et al., 2016; Mosher & Kelter, 2023).

3.2.2 Illegal fishing

Illegal fishing has been identified as one of the problems connected to livelihoods derived from the lagoon. According to the fishers, some of their colleagues deploy small mesh-sized nets to exploit the fish stocks in the lagoon. As a result, a lot of fish juveniles are harvested and landed (Mohanty & Panda, 2020). This implies that a lot of the fish are not allowed to spawn at least once in their lifetime before they are harvested. It can therefore be deduced that overfishing is occurring in the lagoon given that the fish stocks have been declining to date. The decline in the fish stocks is evidenced in the dwindling trend of the fish landings from the lagoon. The plummet in the fish landings has also remarkably reduced the income levels of the fisherfolk.

3.2.3 Poverty

The reduction in the fisheries and associated aquatic resources derived from the Chilika Lagoon is increasing poverty levels for fishers. Some of the fisherfolk do not have adequate income to meet basic needs like children's education and medical care. This loss in fishing livelihoods is compelling some of the fishers to either diversify their livelihoods options or migrate to other places for alternative opportunities.

3.2.4 Migration

Fishers migrate to cities and nearby villages to find alternative jobs. While some of the migrants do menial businesses in the cities, others are mostly engaged as farm labourers (Nayak, 2017; McLaughlin, 2018). These migrants visit their hometowns on occasional basis to reconnect with their families, especially during traditional festivals. Unfortunately, these emigrants generally earn lowered incomes which do not equate to the income derived from the Chilika lagoon fishery. In addition, some of these emigrants sometimes get afflicted with sickness or diseases resulting in high expenses on medical treatment which further exacerbates the poor financial and living conditions of the affected families. In some cases, prolonged absence of these emigrants in the village disconnects them from the lagoon leading to eventual weakening of their fishing rights (Nayak, 2017).

3.3 Diversification of livelihoods

The situation in Barkul village reflects a story of adaptation and change within a traditionally fishing-dependent community. The village has transitioned from a heavy reliance on fishing to a more diverse range of livelihoods as a result of dwindling fish stocks. In response to the decline in fish biomass, some members of the fishing community are compelled to either explore alternative livelihoods or leave the village in search of jobs in cities. Our visits to the village revealed that the fishing community has diversified their livelihoods beyond fishing. These livelihoods include toy making, boat tourism, farm labour, construction, crafting leaf plates and poultry farming. Among these livelihoods, boat tourism is rapidly gaining popularity in the Chilika Lagoon. Women we interviewed expressed negative feelings about the decline in the fish stocks which the women attributed to the opening of the sea mouth (Plate 3). Previously, the village women participated in household poultry farming with the support of Self-Help Groups (SHGs) which are community-based livelihoods collectives comprising around 10-15 village women. SHGs are neighbourhood groups who come together to find ways of improving their living conditions (Drishti, 2019; Nichols, 2021). The fisher women now engage in activities such as tourist boats operators, working in agriculture and construction, making toys and crafting leaf plates as alternative livelihoods. Diversification of livelihoods in the communities around the Chilika Lagoon reflects how they adapt to economic and environmental changes, emphasizing the need for sustainable practices and support mechanisms. Moreover, the emergence of toy making from the boat tourism demonstrates the ability of the community to innovate and seize new economic opportunities as they arise. Nonetheless, these alternative sources of income are considered inadequate as compared to the earnings from traditional fishing. This highlights the importance of fisheries to the adjoining fishing communities of the Chilika Lagoon. Here is an interesting yet strong quote we picked from the women at the Barkul village during our interactions with them:

"We are fishers from birth and caste. Anything other than fishing is not our identity."
(Women of Barkul Village near Chilika Lagoon in India)

This quote underscores the profound cultural and identity ties that bind the community to the practice of fishing, even in the face of economic and environmental challenges. The above quotation highlights the deep-rooted cultural identity and attachment to fishing among the villagers. It suggests that for many in the community, fishing is not just a livelihood but an integral part of their identity and culture. For generations, the villagers of Barkul have relied on fishing as their primary source of income.

Figure 4

Team members interacting with some women in Barkul fishing community of India during one of the field visits



One can see the tension between economic development and environmental protection, as well as the challenge of maintaining cultural identity in the face of changing livelihoods. The tension underscores the importance of sustainable practices in the tourism industry, where the needs and concerns of the local community and the ecosystem must be considered alongside economic growth. Additionally, it shows the complex nature of identity and livelihood, where some individuals may struggle to embrace alternative sources of income when their traditional way of life is threatened.

3.4 Government interventions and collaboration

Utilization of aquatic resources in the Chilika Lagoon has led to socio-ecological changes with consequent declines of ecological services. For example, one of the significant modifications to the Mahanadi River system in 1957 was the construction of the Hirakud Dam. Contrary to forecasts, the dam greatly increased the amount of sediment flowing into the lagoon (Rout, 2022). The result of the dam construction was a high rate of sedimentation in the lagoon. Large-scale deforestation, excessive siltation, overgrazing, and illegal logging have occurred in the western part of the region. The growth of intensive shrimp aquaculture also contributes to the disruption of socio-ecological balance given that the culture activities pollute the aquatic environment with the possibility of destructing fish habitats which in turn causes mortality of aquatic organisms (especially fish) and decline in fish landings (Nair & Nayak, 2023).

The consequences of the growth of "blue economy" activities that only focus on improving coastal economy (Voyer et al., 2018) ultimately lead to changes in species composition and changes in food webs in lagoons. Nayak (2014) reported that there are about 11 species of fish that were once available in the lagoon, but they are now extinct. This is due to extensive hydrological, aquaculture changes causing a chain effect. Fishers no longer pay attention to the customary fishing practices that have specific relevance to time, fishing location, fish species, and size. Meanwhile, breaking down of customary norms often results in overfishing and biodiversity loss in the lagoon (Nayak & Berkes, 2011).

In 1992, the Orissa State Government established the Chilika Development Authority (CDA) to carry out integrated lagoon management. CDA adopts a holistic approach that integrates coastal processes and lagoon areas in management planning. The CDA in collaboration with the Forest and Environment Department of the state also manages biodiversity wealth by focusing on species protection, habitat restoration, pollution control and ecotourism development (Peetabas & Panda, 2015).

Principles of adaptive management have been adopted for the management of Chilika Lagoon (Finlayson et al., 2020). Adaptive co-management is described as a governance paradigm supported by iterative learning, aims at building relationships, and sharing rights and responsibilities between stakeholders (Plummer & Armitage, 2007). Adaptive co-management focuses on creating a functional feedback loop between social and ecological systems. It relies on collaboration among diverse actors operating at different levels, often within networks, from local users to municipalities to regional and national or transnational organizations. The following quote from the representatives of the fishing communities indicated that the fisherfolk are poised to cooperate with the government and other stakeholders to efficiently manage the aquatic resources in the lagoon:

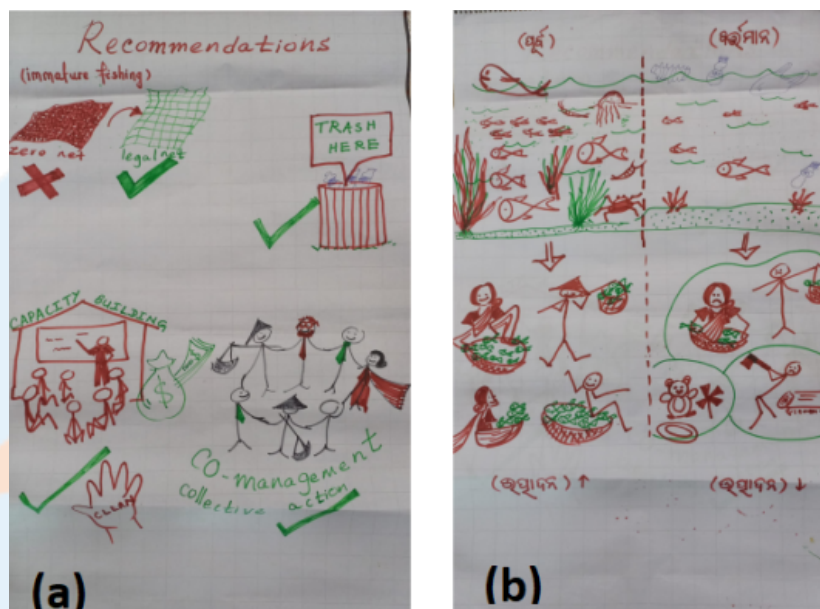
“From us, for us, by us”

This is evidenced in the focus on learning, policy experimentation through diverse programs related to maintaining lagoon-sea connectivity, watershed management, strengthening fishing cooperatives, fostering multi-stakeholder consultations in decision making, communication and outreach. However, there is a wide gap between the intent and practice with greater focus on science and technological approaches lacking place-based adaptation.

During our interactions with fishers we identified mesh size regulation, capacity building in blue economy, proper waste disposal and introducing effective co-management of the fishery in the Chilika Lagoon as some of the key interventions that can possibly revamp and sustain the fishery. As shown in Plate 4a, using appropriate mesh sizes, disposing of waste properly, building human capacity (e.g., in livelihood diversification, fisheries and coastal management), and adopting a co-management approach can help restore the fishery which can aid in transitioning the fishing communities from vulnerability to viability. The dotted vertical line in Plate 4b represents the boundary between the present vulnerable state of the fishery and the fishing communities (on the right-hand side of the line), and the viable state (on the left-hand side of the line). The vulnerable state is characterized by reduction in fish stock and biodiversity, habitat destruction, pollution, fisherfolk shifting to alternative livelihoods such as toy making, and labour work. Whereas the viable state is typified by high biodiversity, abundant fish stock, high fish harvest, restored fish habitat, vibrant fishery and improved livelihoods. There is the need to actively involve the resources users in the management of the lagoon. So, at the dissemination meeting, the aforementioned interventions and their potential benefits were presented to the local stakeholders as recommendations.

Figure 5

Artistic outputs depicting: (a) the interventions and management actions that can potentially transition the Chilika Lagoon fishery from vulnerability to viability; (b) the potential impact of the interventions on the current vulnerable state of the fishery (right side of the vertical dotted line) and the envisioned viable state of fishery (left side of the vertical dotted line)



4. Conclusions

The field observations set out to provide an impressionistic view of blue economy and livelihood activities related to the Chilika Lagoon. We observed a nexus between blue economy and livelihood activities. Blue economy activities affect livelihoods while livelihoods in turn affect the success of blue economy. Capture fisheries, fish processing, tourism, aquaculture and navigation and transportation on water are the major economic activities in the Chilika Lagoon. However, these activities impact the lagoon by causing water pollution and decline in fishery resources with consequent loss of fishing related livelihoods leading to poverty and migration. Given that the adaptive management approach has been poorly implemented for managing the fisheries of the lagoon, the adjacent villages have been compelled to transition from fishing to a more diverse range of livelihoods, including toy making, tourism, farm labour and poultry farming.

The place-based observations made by our group, provide strong case for greater collaborative action and lagoon co-management with improved agency of fishers and resource users. Further, collective efforts are required to bring in place-based effective fishing practices and regulations with greater consideration of cultural norms in response to exploitative fishing practices (e.g., small mesh-sized nets and juvenile fish catch). Measures for preventing food waste and plastic pollution in the lagoon (e.g., installation of trash bins in strategic places) will also help reduce pollution. While working towards arresting blue economic drivers, capacity building initiatives on diversified livelihoods options for local communities will aid vulnerability to viability transitions. Ultimately by reflecting on blue economic activities, livelihoods, challenges and diversification of livelihoods with government involvement and collaboration, we were able to identify and share a series of recommendations for management actions that can potentially transition the Chilika Lagoon fishery from vulnerability to viability.

Acknowledgements

We are very grateful to the riparian fishing communities of the Chilika Lagoon for giving us the needed support and cooperation during the field visits; the warm reception and conducive environment provided for us by the fishing communities are praiseworthy and memorable. We are also thankful to V2V Global Partnership for the diverse and invaluable support, especially the financial assistance provided.



References

- Arenas-Sánchez, A., Rico, A. & Vighi, M. (2016). Effects of water scarcity and chemical pollution in aquatic ecosystems: State of the art. *Science of The Total Environment*, 572, 390-403.
- Strauss, A., & Corbin, J. (1998). Basics of qualitative research techniques.
- Au-Ibar (2019). Africa Blue Economy Strategy. Nairobi: AU-IBAR.
- Campbell, L. M., Fairbanks, L., Murray, G., Stoll, J. S., D'Anna, L., Bingham, J. (2021). From Blue Economy to Blue Communities: reorienting aquaculture expansion for community wellbeing. *Marine Policy*, 124.
- Chilika Development Authority (CDA). (2020). Wetland Study | Chilika Development Authority. www.chilika.com.
<http://www.chilika.com/wetland-study.php>
- Clarke, V., Braun, V., & Hayfield, N. (2015). Thematic analysis. *Qualitative psychology: A practical guide to research methods*, 3, 222-248.
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- De Soto, N. A. (2016). Peer-Reviewed Studies on the Effects of Anthropogenic Noise on Marine Invertebrates: From Scallop Larvae to Giant Squid. *The Effects of Noise on Aquatic Life II*, 875, 17–26.
https://doi.org/10.1007/978-1-4939-2981-8_3
- Drishti (2019). To The Point: Self Help Groups (SHGs). <https://www.drishtias.com/to-the-points/Paper2/self-help-groups-shgs#:~:text=What%20are%20SHGs%3F%201%20Self-Help%20Groups%20%28SHGs%29%20are,desire%20to%20collectively%20perform%20common%20purpose.%20More%20items>
- Lee, K.H., Noh, J., & Khim, J. S. (2020). The blue economy and the United Nations' sustainable development goals: challenges and opportunities. *Environ. Int.*, 137, 1- 6.
- McLaughlin, P. (2018, April 12). *Changes in the Chilika Lagoon*. School of the Environment, Enterprise and Development (SEED), University of Waterloo, Canada.
<https://uwaterloo.ca/school-environment-enterprise-development/blog/changes-chilika-lagoon>
- Mohanty, S.K. & Panda, D. (2020). Fish and Fisheries of Chilika: Post-Restoration Scenario. In Finlayson, C., Rastogi, G., Mishra, D., Pattnaik, A. (eds) *Ecology, Conservation, and Restoration of Chilika Lagoon, India*. Wetlands: Ecology, Conservation and Management, vol 6. Springer, Cham.
https://doi.org/10.1007/978-3-030-33424-6_12
- Mohapatra, A., Mohanty, S.K., & Mishra, S.S. (2015). Fish and Shellfish Fauna of Chilika Lagoon: An Updated Checklist. In K. Venkataraman & C. Sivaperuman (Eds), *Marine Faunal Diversity in India* (pp. 195-224). Academic Press.
- Mosher, M., & Kelter, P. (2023). The Chemistry of Water: Aqueous Solutions and Their Properties. In: An Introduction to Chemistry. Springer, Cham. https://doi.org/10.1007/978-3-030-90267-4_12
- Nair, N. V. & Nayak, P. K. (2023). Exploring Water Quality as a Determinant of Small-Scale Fisheries Vulnerability. *Sustainability*, 15(17), 1-26.
- Nayak, P. K. (2014). The Chilika Lagoon Social-Ecological System: An Historical Analysis. *Ecology and Society*, 19(1). <https://doi.org/10.5751/es-05978-190101>

- Nayak, P. K. (2017). Fisher communities in transition: understanding change from a livelihood perspective in Chilika Lagoon, India. *Maritime Studies*, 16, 13. <https://doi.org/10.1186/s40152-017-0067-3>
- Nichols, C. (2021). Self-help groups as platforms for development: The role of social capital. *World Development*, 146, 105575.
- Panda, U.S., Mahanty, M.M., Rao, V.R., Patra, S. & Mishra, P. (2015). Hydrodynamics and Water Quality in Chilika Lagoon-A Modelling Approach. *Procedia Engineering*, 116.
- Peetabas, N., & Panda, R. P. (2015) Conservation and management of bioresources of Chilika Lake, Odisha, India. *International Journal of Science and Research Publications*, 5 (7), 534 - 537
- Plummer, R., & Armitage, D. R. (2007). Charting the New Territory of Adaptive Co-management: A Delphi Study. *Ecology and Society*, 12(2). <http://www.jstor.org/stable/26267869>
- Rout, H. K. (September 16, 2022). Hirakud Reservoir Has Lost 24 per Cent Water Holding Capacity, Says Latest Hydrology Survey. *The New Indian Express*. <https://www.newindianexpress.com/states/odisha/2022/Sep/16/hirakud-reservoir-has-lost-24-per-centwater-holding-capacity-says-latest-hydrology-survey-2498763.html>
- Shukla, A., Patel, A. E., Ramasubramanian, S., Mishra, J., Das, B. S., Asmat, M. F., Hossain, M. M., Ashokan, A., Manase, M. M., Bhattacharya, S., G. I., & Gautam, M. (2022). Reflections from Chilika - V2V Field School: A Glimpse into the Policy and Governance of the Chilika Lagoon Social-Ecological System. V2V Working Paper 2022-11. V2V Global Partnership, University of Waterloo, Canada.
- UNESCO (2014). Chilika Lagoon. UNESCO World Heritage Convention. <https://whc.unesco.org/en/tentativelists/5896/>
- Voyer, M., Schofield, C., Azmi, K., Warner, R., McIlgorm, A., & Quirk, G. (2018). Maritime security and the blue economy: Intersections and interdependencies in the Indian Ocean. *Journal of the Indian Ocean Region*, 1 - 21. doi:10.1080/19480881.2018.1418155
- World Bank (2016). Blue Economy Development Framework. Oceans 2023: Financing the Blue Economy for Sustainable Development.
- World Bank (2017, June 6). What is the Blue Economy? <https://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy>

Vulnerability to Viability (V2V) Global Partnership

The Vulnerability to Viability (V2V) project is a transdisciplinary global partnership and knowledge network. Our aim is to support the transition of small-scale fisheries (SSF) from vulnerability to viability in Africa and Asia. Vulnerability is understood as a function of exposure, sensitivity and the capacity to respond to diverse drivers of change. We use the term viability not just in an its economic sense but also to include its social, political, and ecological dimensions.

The V2V partnership brings together approximately 150 people and 70 organizations across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand), six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania), Canada and globally. This unique initiative is characterized by diverse cultural and disciplinary perspectives, extensive capacity building and graduate student training activities, and grounded case studies from two regions of the world to show how and when SSF communities can proactively respond to challenges and creatively engage in solutions that build their viability. Further information on the V2V Partnership is available here: www.v2vglobalpartnership.org.

V2V Global Partnership Secretariat
School of Environment, Enterprise and Development,
Faculty of Environment
200 University Avenue West, EV 3
University of Waterloo, Waterloo, ON, N2L 3G1 Canada
Website: www.v2vglobalpartnership.org
Email: v2vglobalpartnership@gmail.com

V2V WORKING PAPER SERIES

