Research Paper

EPRA International Journal of Economic and Business Review-Peer Reviewed Journal
Volume - 9, Issue - 11, November 2021 | e-ISSN: 2347 - 9671| p- ISSN: 2349 – 0187

SJIF Impact Factor (2021): 8.302 || ISI Value: 1.433 || Journal DOI URL: https://doi.org/10.36713/epra2012

ECONOMICS OF FISH PRODUCTION IN CHILIKA LAKE OF ODISHA

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ABSTRACT **DOI No: 10.36713/epra8829** **Article DOI: https://doi.org/10.36713/epra8829**

Objective*-The objectives of the study are to examine the trend and pattern of cost, income and profit from Fish economy in Chilika Lake, to investigate the seasonality and pattern of revenue from tourism in Chilika Lake, to analyze the income and living standards of businessmen and their perception and to assess the developmental activities by Government of Odisha and Chilika Development Authority (CDA) to promote wetland services of Chilika.*

Methodology*-The study is based on environmental impact on Chilika. Approximately 160 species of birds mostly of intercontinental migrant species and Irrawaddy dolphin, the lake is having immense tourism potential.*

Findings*-Chilika as a wetland has a complex and fragile ecosystem unlike other water bodies. Chilika Lake has about 132 fishing villages and it is surrounded by around 273 villages. The population of the fishing villages is more than 0.15 million. Though the country earns foreign revenue by exporting spices fish, prawn, crab its cultivation on crop land is exerting negative impact on the nearby villages and therefore aims at conducting a survey on the socio economic conditions of people involved in fishing activity and the environmental impact of fish cultivation.*

KEYWORDS: *Chilika, Crab, Ecosystem, Fishing, Local businessmen, prawn, Tourism, Wetland*

1. INTRODUCTION

In India, wetlands are classified according to their location (mountainous, inland or coastal), water quality (freshwater or brackish/saline), physiognomy (herbaceous or woody), duration of flooding (permanent or seasonal), and so on. However, the 'type of use' and their economic aspects are missing from the present system of classification (Gopal & Sah, 1995; Government of India, 2007). The classification of wetlands according to their major and minor uses (both consumptive and non-consumptive), and quantifying the benefits from them in economic terms, is crucial for identifying interventions for improving their performance. As Renwick (2001) argues, accounting for economic value of all uses of water within a multiple use system is essential for informed decision making for productive, equitable and sustainable water uses.The Lake Chilika is divided in to three major sectors, north, central and southern. The physio-chemical as well as biodiversity composition of all

these three sectors also vary slightly. Chilika has very rich ecological diversity with over 400 vertebrates of both brackish and freshwater species with the total number of fish species is reported to be more than 225. The species diversity has several endangered, threatened, and vulnerable species including the Barkudia limbless skink.

Both Indians as well as Foreigners conducted several studies in the past on Lake Chilika. Prominent among them were Jhingran (1985); Mohanty (1988); Biswas (1995); Panigrahy (2000); Ghosh and Pattnaik (2005).The origin and geology of the Lake was studied by Phleger (1969); Venkatarathnam (1970); Khandelwal (2008). Ecology of the lake was studied specifically by Panigrahy (2000); Ghosh and Pattnaik (2005). The fish and fisheries of Lake Chilika was broadly studied by Hora (1923); Banarjee and RoyChoudhury (1966); Jhingran and Natarajan (1969).

2. COASTAL MANAGEMENT, ENVIRONMENTAL DEGRADATION AND DISASTER RISK REDUCTION LINKAGES

2.1 Coastal Challenges

The issues that coastal management programmes address are remarkably similar across a wide range of societal and geographic settings. In broad terms, they are the expression of anthropogenic change to coastal ecosystems brought by intensifying pressures from human activities that are expressed as follows: (1) the degradation or destruction of important coastal habitats, (2) declining near shore water quality and changes to the volume and quality of freshwater inflows to estuaries, (3) the inappropriate sitting of shorefront infrastructure and their subsequent high vulnerability to the impacts of floods, storms and erosion/accretion processes, (4) reduced access for traditional users and the public to the shore, wetland and fishing grounds and (5) the decline of fish and associated fisheries (Olsen and Christie 2000). In a regional scenario characterized by mass poverty, underdevelopment and environmental degradation, the socio-economic characteristics of coastal areas present a range of conditions between two extremes: few areas facing noticeable economic development due to urbanization and industrialization; and backward and depressed areas, sparsely populated and lacking in resources (Daconto 1997).

Table-1. Fish, prawn and crab yields (in million tonnes) for Chilika Lake from 2001 to 2021

Year	Fish	Percent	Shrimp	Percent	Crab	Percent	Total
2000-01	3817.81	76.62	1071.38	21.50	93.60	1.88	4982.79
2001-02	9530.03	79.49	2347.78	19.58	111.07	0.93	11988.88
2002-03	8265.16	75.87	2478.82	22.75	149.81	1.38	10893.79
2003-04	10286.34	73.20	3611.37	25.70	155.51	1.11	14053.22
2004-05	8097.77	61.07	5000.71	37.71	161.89	1.22	13260.37
2005-06	7774.81	63.60	4296.02	35.14	154.08	1.26	12224.91
2006-07	6463.92	64.93	3368.97	33.84	122.94	1.23	9955.83
2007-08	6610.23	65.79	3298.08	32.83	139.12	1.38	10047.43
2008-09	6534.85	61.06	3929.68	36.72	237.5	2.22	10702.03
2009-10	7892.98	66.02	3851.49	32.22	210.89	1.76	11955.36
2010-11	7736.54	59.21	5043.18	38.60	285.90	2.19	13065.62
2011-12	7456.03	52.40	6413.91	45.08	358.26	2.52	14228.2
2012-13	7114.30	57.07	5034.05	40.38	318.58	2.56	12466.93
2013-14	7699.71	59.52	4927.66	38.09	308.97	2.39	12936.34
2014-15	7146.77	59.29	4572.32	37.93	334.58	2.78	12053.67
2015-16	7271.95	59.43	4564.54	37.31	398.77	3.26	12235.26
2016-17	12714.95	48.23	13295.39	50.43	351.37	1.33	26361.71
2017-18	11375.26	69.54	4706.71	28.77	276.37	1.69	16358.34
2018-19	11618.05	68.74	4951.37	29.30	331.90	1.96	16900.32
2019-20	11787	72.64	4135	25.48	305	1.88	16227.00
2020-21	9406	72.63	3,300	25.48	244	1.88	12950.00

Source- Annual activity report 2020-21 up to dec2020 (fisheries and animal Resource Development Department, Odisha).

Table-1 implies that fish production is more than total fishery production where as shrimp production is around 25 % and crab production is only 2 to 3 percent which is fluctuating every year.

Table-2 Descriptive statistics(Average in Million Tons)

Statistical Measure	Fish	Percent	Shrimp	Percent	Crab	Percent	Total
Mean	8409.55	65.06	4485.64	33.09	240.48	1.85	13135.62
Standard Error	472.19	1.79	508.58	1.73	20.65	0.13	864.93
S.D	2163.86	8.20	2330.60	7.94	94.64	0.62	3963.62
Kurtosis	0.07	-0.51	10.72	-0.28	-1.44	-0.31	6.26
Skewness	0.34	-0.08	2.74	0.16	-0.05	0.55	1.59
Range	8897.14	31.26	12224.01	30.85	305.17	2.33	21378.92
Minimum	3817.81	48.23	1071.38	19.58	93.60	0.93	4982.79
Maximum	12714.95	79.49	13295.39	50.43	398.77	3.26	26361.71
Count	21	21	21	21	21	21	21

Source- Computed by the Authors using Excel Data analysis

The table-2 shows total fish production is 8409.55 million tons in Chilika lake which is a good amount of production which is 65.06 percent of total production. Chilika is famous for shrimp production which is 4485.64 million ton per year on an average.

Table-3 Export performance during 2019-20 compared to 2018-19

Export Details	2018-19	2019-20	Growth %
Value in Crores	46,662.85	46,589.37	0.16
USD in Million	6,678.69	6,728.50	-0.74
Unit Value (USD/Kg)	5.18	4.83	7.18

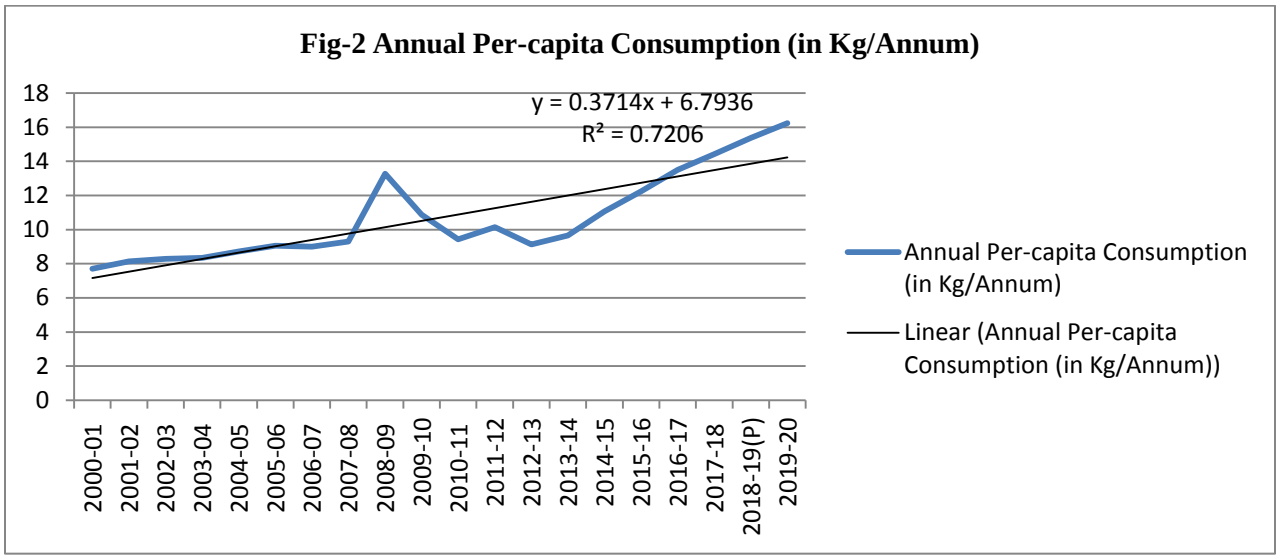
Source- Annual Report of 2019-20 MPEDA

This year the export has improved in rupee term by 0.16%, however the quantity and US dollar value has declined by 7.39% and 0.74% respectively. The average unit value realization of marine products has improved from USD 4.83 to 5.18

Table-4 Year-Wise Annual Per-Capita Consumption of Fish

Year	Annual Per-capita Consumption (in Kg/Annum)	Percentage growth over the previous year
2000-01	7.71	__
2001-02	8.14	5.58
2002-03	8.28	1.72
2003-04	8.35	0.85
2004-05	8.72	4.43
2005-06	9.05	3.78
2006-07	8.99	-0.66
2007-08	9.29	3.34
2008-09	13.27	42.84
2009-10	10.88	-18.01
2010-11	9.42	-13.42
2011-12	10.14	7.64
2012-13	9.13	-9.96
2013-14	9.66	5.81
2014-15	11.06	14.49
2015-16	12.24	10.67
2016-17	13.49	10.21
2017-18	14.42	6.89
2018-19(P)	15.38	6.66
2019-20	16.24	5.59

Source- Annual activity report 2019-20 (Fisheries and animal Resource Development Department, Odisha). The figure-2 indicates increasing trend of per capita fish consumption.



2.2 Root causes of Change in Coastal ecosystem

The root causes of the coastal ecosystem change lie in the social, institutional and political dimensions such as (1) rapid population growth, inadequate physical infrastructure to serve the current population, (2) the increasing concentration of wealth along the richest 20 % of the population, while the poorest continue to live in abject poverty and (3) the social equity issues raised by competition and the inability of the existing institutions and governance. The ecological health, biodiversity and fishery productivity of Chilika was threatened due to monopoly from certain group of people for monetary benefits which were promoting prawn and shrimp gherries. The illegal gherries which has occupied almost entire shoreline of Chilika Lake has drastically impacted the lake biodiversity, hydrology and fishery productivity. In last 2 years, Chilika Development Authority has freed around 151 km2 of lake area which was under the illegal prawn gherries. These gherries have severely affected the water flow in Chilika Lake leading to the reduction in open space available for feeding and breeding grounds for birds and fishes. These gherries have also encroached the area which otherwise are good locations for the development and proliferation of sea grass meadows. The impact of eviction drives was visible in the form of re-appearance of important fauna such as sponges and flora like sea grasses from areas which were encroached by shrimp gherries. Sea grass mapping in year 2018 showed that lake supports rich diversity of sea grasses and around 152 km2 areais under sea grasses. Sea grasses are one of the bio-indicators of the good health of an ecosystem and their luxuriant growth indicates that water clarity, salinity regime, and nutrient conditions are in their optimal range. Seagrasses are well appreciated for their role in water purification through blue carbon sequestration and keep the carbon buried in their sediments. Seagrasses are highly productive sites which also act as feeding, breeding and sheltering grounds of many ecologically and economically important fish species of Chilika Lake.

2.3 Annual Population Estimation of Irrawaddy of dolphins in Chilika Lake

The Chilika Lake is home of the Irrawaddy dolphin (Orcaella brevirostris). The present distribution range of this species is only in Asia i.e. from Chilika to Indonesia within south east Asia and South Asia. The total population of these animals in the world is estimated to be less than 7500 (highest 6400 reported from Bangladesh) and the population in Chilika is considered to be the highest single Lake population. Chilika Development Authority has been carrying out a number of conservation measures for the protection and conservation of Irrawaddy dolphins in Chilika in close coordination with Wildlife wing of State Forest Department for (1) Survey and identification of dolphin habitat in the Lake for proper management, (2) Development of dolphin watching protocol for safe watching of dolphins, (3) Sensitization and training of tourist boat operators, (4) Deployment of dolphin protection squad in the outer channel area through the DFO, Chilika Wildlife Division, (5) Widening and deepening of Magarmukh channel for free movement of dolphins from Outer channel to the main Lake , (7) Acoustic survey of underwater

Behavior of dolphins through deployment of hydro phones in collaboration with Tokyo University

The lake is influenced by three water sub-systems, including the Mahanadi river system. In addition, there are rivers flowing in the lake from the

western catchment, and the Bay of Bengal. Further the lake gets fresh water from almost 52channels. The salinity level in the lake is thus decided by freshwater discharges through rivers during different seasons. The wind as well as the extent of tidal inflow bringing marine water from the Bay of Bengal also impacts the water quality. The lake including the drainage basin have a total area of over 4300 km2 (Das and Samal 1998) though the Seasonality of rainfall also leads to large variations in the size of the lake.

Current and persistent problems Wetlands, especially the coastal lagoons are susceptible to rapid environmental alterations under the influence of natural and manmade events. In Canada, 85 % of wetlands were lost to agricultural conversions since 19th Century.Wetlands of United States also began disappearing after permanent European colonization. Australia has lost more than 120,000 km2 of wetlands during the last 200 years in which >50 % is due to the anthropologic interventions (http://www.deh.gov.au/water/wetlands/index.html).
Loss of inland as well as coastal wetlands in India is growing at a rapid pace due to direct human interference viz. land reclamation for agriculture, human settlement and aquaculture; pollution and natural hazards. As far as the Chilika lake is concerned, the major anthropogenic drivers of degradation are conversion for other uses, overexploitation and destructive harvesting of resources, species invasion and dumping up of the municipal, agricultural and industrial wastes.

3. PERSISTENT AND CURRENT ISSUES OF CHILIKA LAKE

The foremost environmental threat to the Chilika lake is pollution. Addition of biodegradable and non-degradable pollutants is in an ascending order because there is no suitable waste management action plan in and around the lake as well as for the urban area wastes which find their way into this lake. Higher levels of heavy metals and pesticides in water and sediments have been reported in recent years. The persistent solid wastes such as the torn and residual nylon nets, plastic bags and bottles have emerged as new threats to the biotic community of the lake system (Sahu et al. 2013). Fisheries constitute the major economic activity of the lake. The fishermen communities use to earn their livelihood by fishing in the lake as well as engaged in traditional farming in the vicinity areas (Khatua 1984). Conflict between traditional fishers and fish farmer's remains as major unsolved issue over the years despite the fact that the fishing policy of the government evolved in 1991 divided the lake as 60:40 % among the traditional fishers and culturists. Prawn farming in Chilika provides high returns and as such it has attracted many individuals to venture into it (Pradhan and Flaherty 2008). There has been a record expansion of prawn farming undertaken in gheries, pokhories and bandhas. The aquaculture farms in and around Chilika rose to 5,831 km2 in 2004 as against 3,856 km2 in 1994 (Mishra and Griffin 2010). The gheri culture alone has now covered about 11.3 % of the total lake area. Gheri culture used to punctuate the movement of water inside the lake thereby promoting sediment deposition and increase the level of nutrients and chemical pollutants as residues of supplementary feed and chemicals used for weed or pest eradication.
This year the export has improved in rupee term by 0.16%, however the quantity and US dollar
Value has declined by 7.39% and 0.74% respectively. The average unit value realization of marine products has improved from USD 4.83 to 5.18.

4. MARKET-WISE EXPORT

USA continued to be the major importer of Indian seafood with a share of 38.37% in terms of USD. USA imported 3,05,178 MT of seafood in the current financial year. Export to USA has showed a growth of 8.25% in quantity 10.38% in rupee value and 9.30% in USD terms. Frozen Shrimp continued to be the principle item exported to USA with a share of 95.54% in USD value. Exports of Vannamei shrimp to USA showed a growth of 18.94% in quantity and 19.02%in USD terms. The Black Tiger Shrimp exports to USA decreased by 36.69%, 33.69% in terms of Quantity and USD terms respectively. China is the second largest market for Indian Seafood with a share of 20.58% in USD earnings and 25.55%in quantity terms. Exports to China increased by 46.10% in quantity, 69.54% in rupee value and 69.47% in USD terms. Frozen Shrimp is the major item of exports to China accounting a share of 44.22% in quantityand 62.65% in USD earnings. China imported 3, 29,479 MT of Seafood worth USD 1,374.63 million.

European Union continued to be the third largest destination for Indian Seafood with a share of13.12%in USD. Frozen Shrimp continued to be the major item of exports to EU accounting for a share of 44.66% in quantity and 58.53% in USD earnings out of the total exports to EU. Export of frozen shrimp to EU increased by 5.21% and 1.63% in quantity and USD value. South East Asia is the fourth largest market of Indian Marine products accounting for a share of 10.57% in USD terms. Overall exports to South East Asia declined by 50.02% in quantity 53.32% in rupee value and 53.90% in US $ earnings.

Japan is in fifth largest destination for Indian Seafood with a share of 6.32% in USD earnings and 6.09% in quantity terms. Exports to Japan have shown a positive growth of 0.02 % in rupee Value however, shown a decline of 6.63% in quantity and 0.24% USD

earnings. Frozen Shrimp Continued to be the major item of exports to Japan accounting a share of 49.63% in quantity and 78.10% in USD earnings. Exports of Frozen shrimp to Japan increased by 6.31%, 6.92% and 5.91% in quantity, rupee value and USD value respectively. Exports to Middle East have shown a growth of 5.04% in rupee value and 3.82% in USD value, however shown a negative growth in quantity by 4.72%.The exports to Other Countries showed a positive growth of 1.29%, 3.19% and 1.92% in quantity, rupee value and USD value respectively when compared to previous year.

5. ENVIRONMENTAL IMPACT ASSESSMENT OF CHILIKA LAKE

The expanding global concern relating to the environmental effects of the developmental activities aims at minimizing, mitigating or compensating for the adverse impacts on environment and achieving sustainable development on long- 189 term basis Following the passage of the National Environmental Policy Act (NEPA) by US in 1969 various government agencies started considering seriously and integrating the environmental factors, in addition to economic and technical considerations, when they formulated and evaluated developmental projects The concept of Environmental Impact Statement (EIS) for specific projects was then introduced and the NEPA created the Council on Environmental Quality (CEQ) to assist the US President in diverse environmental matters Subsequently. Environmental Impact Assessment (EIA) emerged as the appropriate technique and it was implemented within the European Economic Community as well as in other nations, such as Canada, Australia, Japan and Thailand during the 1970s and first half of the 1980s as a product of the people's concern over environmental degradation generated by the large scale projects (Wathem, 1988) 'Environmental Impact', as defined by Bowonder (1995), is the analysis of any possible alteration of the environmental condition or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration Shukla and Snvastava (1992a) define EIA as a projected change in the value of one or more measures of environmental quality Lee (1989) describes EIA, in general terms, as a process designed to ensure that potentially significant environment impacts are satisfactory assessed and taken into account in the planning, design, authorizations and implementation of all relevant types of action Thus, EIA process is expected to identify and assess impacts upon the environment Balfors (1993) views EIA as one way to gather basic information and to systematize feasible solutions. To consider environmental factors in the decision-making process for socioeconomic development efforts" (Chary, 1995) Normally a 'checklist' is prepared to act as a simple aid to impact identification This presents a list of the specific environmental parameters to be investigated for possible impact (Shukla and Srivastava, 1992a) While preparing a checklist for describing the biological environment in connection with a gas production project in UK, Fearo (1983) included such aspects of the fish communities 190 as seasonal distribution and abundance of pelagic eggs and larvae, seasonal distribution and abundance of juveniles and adults, and fisheries (marine, diadromous and freshwater species) with emphasis on seasonally important areas and fish densities, migration behaviour, spawning requirements and sensitivities to disturbance, and similar aspects in other organisms Hundloe and Miller (1987) developed the guidelines for the application of EIA to the tuna fishing / processing operations in the Pacific islands region EIA has become an integral part of planning for the exploitation, development and management of the marine resources, which involves the scientific and social dimensions (Lakshmmarayana and Jonnavittula, 1989)

In India, EIA was made statutory in January 1994 for 29 specified activities falling under various sectors such as industries, mining, irrigation, power, transport, tourism, etc (TERl, 1997) Although EIA is normally undertaken to predict and evaluate the environmental impacts of the proposed developmental projects, the present study endeavors to investigate into the diverse human activities and other processes operating in Chilika Lake and its catchment area that have direct and indirect detrimental effects on the environment of the lake ecosystem in general and its fishery resources in particular This would furnish the required facts and a proper explanation regarding the escalating decline in the fishery resources of the lake, as is evident from the catch data. Further, Chilika Lake is on the Ted alert" along with 5 other wetlands, out of the 777 RAMSAR sites of the world, identified in the Bnsbane Conference of 1995 where undertaking of EIA was also recommended.

6. CONCLUSION

Chilika Lake's ecology and ecosystem has undergone dramatic changes over the last few years. Several factors have contributed to the degradation of the Lake environment of Chilika. The different lease policies followed by the government of Orissa have divided the Lake into different fishing areas for fisher-folk and non-fisher folk in a way that has strengthened the exploitative power of the mafias. The lease policy pursued by the government of Orissa for shrimp culture in Chilika since 1991 has greatly changed the socio-economic profile and condition of the inhabitants of the villages in and around Chilika with its profound impact

upon ecosystem and environment. The transformation of non-fishermen to fishermen and the rising fishermen population in and around Chilika, introduction of modem fishing techniques with nylon nets and motorized boats, intensive shrimp aquaculture due to its lucrative export market for shrimp (particularly for its brackish water nature) in advanced countries have directly and indirectly contributed to the environmental degradation of Chilika. In other words, the pursuit of economic class interests has degenerated the Lake e11vironment and society. Since, prawn acquired a higher monetary value in international market, both prawn and the business community needed to be controlled by the state which did not take place. Rather, the state became an active supporter of such a process. This not only affected the traditional fishing communities of Chilika but also endangered the Lake ecology. The precipitate pursuit of private profit by different business groups legitimized by clothing in the rhetoric of 'fisheries development', 'foreign exchange' further aggravated the situation.

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