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Climate Change and Marine Fisheries: Stakeholders' Perspective from Coastal District of Odisha, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The marine fisheries sector is severely affected by the impact of climate change. The small-scale fishing communities, their livelihoods and the infrastructure are more vulnerable to the effects of climate change, but it has been occasionally investigated at the regional level. Climate change literature and various reports from government and international agencies indicate that Coastal Odisha is one of the hotspot regions for extreme weather and slow-onset events. In this context, the paper attempts to study how climate change affects small-scale marine fishers through a case of the Kendrapara district of Odisha. The paper attempts to understand the overall fish production scenario. It captures the perceptions of small-scale marine fishers regarding different climate and non-climate drivers through focus group discussions and key informant interviews. The findings from the paper reflect that marine fishers recognize the impact of climate change on the sector in terms of dwindling fish catch, reduction in the number of fishing days, longer fishing trips and damage to boats and nets. The small-scale marine fishers also believe that the impact of climate change in future will be so severe that the sea might engulf their land and settlements.

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1. INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC) latest sixth assessment report, 2021 [1], states in the coming decades, the negative impact of climate change will be felt across all regions of the globe. According to the India Network for Climate Change Assessment (INCCA, 2010) report by the Ministry of Environment and Forest, Government of India [2], Odisha is among 13 coastal states in India, which is more susceptible to sea level rise and cyclones in the country. The report additionally emphasizes that a significant portion of the coastal population relies on climate-vulnerable sectors like marine fisheries and agriculture. The coastline of Odisha is prone to cyclonic disturbances [3-7]. In the last decade, around ten cyclones of different intensities have affected Odisha's State, particularly coastal Odisha. The aftermath was extensive damage to agriculture and its subsectors such as fisheries, telecom and energy sectors [8]. These cyclonic events have affected the livelihood of many vulnerable people dependent on the climate-sensitive sector [6]. Despite the tremendous effort made by the Government of Odisha to minimize the loss of life during a natural disaster, the state suffered significant losses in infrastructure, such as electrical infrastructure, housing, public buildings, and transport infrastructure, including airports, railway stations, ports, and harbour areas [9].

Climate change impacts marine fisheries through various variables, such as rising sea surface temperatures, circulation patterns, ocean acidification and the frequency and severity of extreme weather events [10]. This leads to the migration of fish, breeding behaviour, growth, mortality, and reproduction [11]. The effects of climate change on marine fisheries include alterations in the distribution, quantity, and composition of species and a reduction in biodiversity [12]. As a result, susceptible species may no longer be economically viable, leading to a decline in catches and potentially forcing fishermen to relocate to inland regions [12]. Climate change perceptions studies involving marine fisheries in the state of Tamil Nadu reflect that fishing investments have increased, fish diversity has reduced, and fishing grounds have potentially been lost due to climate change [13]. The studies focusing on fishers' perception in Maharashtra and Tamil Nadu reveal that earlier fishes were found near shore habitats. Still, now the fish are moving into deeper water and new habitats [14]. The shift in fishing locations has resulted in the loss of customary fishing grounds, decreased commercially valuable species, and the disappearance of several other species [15]. Various studies undertaken by International Non-Governmental Organizations (INGOs) in Indian coastal states reveal how seasonal fluctuations have affected the varieties of fish being caught [16] and fluctuations in the arrival of monsoon season and decrease in the number of rainy days are some of the key indicators of changing climate dynamics [17]. Studies centred around the Andhra Pradesh coast, which is a neighbouring state to Odisha, reflect that the wind pattern has changed during the last two decades [18]. The alteration in wind flow within the southern Indian Ocean has a noticeable effect on fishing [19]. Thus, a rise in the velocity of the wind significantly affects fishing vessels and their activities [20].

The fisheries sector plays a crucial role in the socio-economic development of Odisha. Apart from generating income and creating employment opportunities, it also contributes to the development of related industries. This sector serves as a primary source of livelihood for a considerable portion of the vulnerable population of the state. Enhancing the fisheries industry and its ability to withstand the effects of climate change has the potential to address food insecurity and unemployment in the area. However, the prevalence of climate-related natural calamities in the Bay of Bengal region, specifically in Odisha, has made marine fishing a vulnerable livelihood option. This brings into the picture two crucial questions concerning marine fishers and climate change. The two key research questions are as follows:

Research Question 1- what are marine fishing communities' perceptions of climate change?

Research Question 2-How does it impact the fishing communities?

Thus, the paper's objective is to understand the overall fisheries production scenario vis-à-vis marine fisheries status; and to capture fishing communities' perception regarding changing climate change dynamics and livelihood aspects. The paper is divided into four sections. Section one introduces the research title and identifies the study's key research questions and

objectives. The following section discusses the rationale behind selecting the study sites and the research methodology. Section three reflects the results regarding understanding the fish production scenario of Odisha vis a vis Coastal Odisha and identifies the critical climate and non-climate drivers concerning marine fisheries. Finally, the last section discusses the conclusion, where key findings are discussed.

2. STUDY AREA AND METHODOLOGY

2.1 Study Area Description

Kendrapara district in the State of Odisha, India, is one of the vulnerable coastal districts in the context of climate-induced natural disasters such as cyclonic disturbances, flooding, and coastal erosion. The district falls in the high-risk zone category regarding cyclone vulnerability (EM-DAT: The OFDRA/CRED, International Disaster Database and cyclone e-atlas, IMD). The district also falls in the category of high-risk flood zones (Radarsat data of different years). Thus, after analyzing various indicators of climate change, as mentioned above, it can be inferred that climate-induced natural hazards impact the Kendrapara district in a significant way. This article focused on understanding the marine fishing communities residing in the two blocks (Rajnagar and Mahakalpara) in the Kendrapara district of Odisha. The two blocks were chosen purposively because of their proximity to the sea and high vulnerability to climate-induced natural disasters [21,22].

2.2 Methodology

The methodology adopted was qualitative techniques (such as focus group discussions and key informant interviews) for collecting perception data regarding the small-scale marine fisherfolk communities. The authors have undertaken a field visit to Rajnagar and Mahakalpara blocks in the Kendrapara district of Odisha. Eight focus group discussions (FGDs) and around 25 Key Informant Interviews (KIIs) were conducted to understand the perception of climate change and how it affects marine fishing communities and reflect upon other non-climate drivers exacerbating the pre-existing vulnerabilities (Fig. 1). The author utilized their network and the "snowball sampling" technique [23] to reach respondents. While this approach may result in biased sampling and limited generalizability, it is often the only way to access respondents, particularly in developing countries where personal referrals are crucial [24].

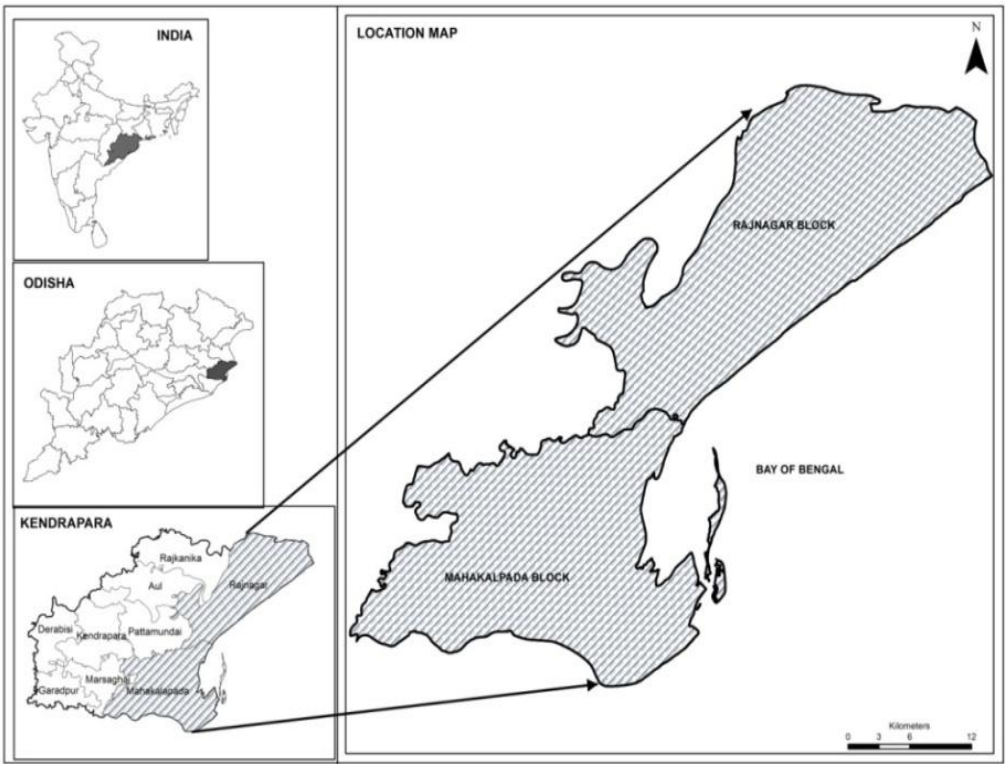

Fig. 1. Study area map

The FGDs included both men and women to consider gendered differences in perception. At the beginning of the discussion, the concept of climate change and its indicators was discussed with the fishing communities to understand their knowledge level and traditional knowledge about climate change indicators and their impacts. The respondents were asked to provide their perceptions regarding indicators and the effects of climate change. Different livelihood groups participated in the FGDs, such as boat owners, shared boat owners, net menders and fish traders.

3. RESULTS

The results section is divided into two parts. The first part focuses on the secondary data on the production of fish, which presents the picture of how the production of marine/capture fisheries has fluctuated over the years compared to total fish production. This part also reflects on the coastal district scenario concerning the fluctuation in marine fish production concerning one of the vulnerable districts, i.e., Kendrapara district of Odisha. The second part of the results section presents the perception of marine fishing communities on climate change. It also corroborates studies from other countries and states in India to validate the study's findings.

3.1 Fish Production in Odisha-Coastal District Scenario

Odisha possesses considerable prospects for inland, brackish, and marine fisheries. With its extensive coastline spanning over 480 km and a substantial continental shelf area of 24,000 sq. km along the Bay of Bengal, the state offers abundant opportunities in the field of fisheries. The fish production in Odisha from 2000-01 to 2020-21 is reflected in Table 1. It shows the quantity of fish production from inland (i.e., freshwater and brackish water) and marine. The Annual Growth Rate (AGR) of fish production from inland fisheries is positive but fluctuates over the period. The growth rate of inland fisheries was 0.70%, lowest in 2013-14 and was 20.84%, highest in 2016-17. The production of marine fisheries is not impressive. The AGR was negative over the three years (2001-02, 2009-10 and 2011-12). In other years, it was positive. The highest growth rate of marine fish production accounted for 10.99% (133211 MT) in 2014-15. On the other hand, the lowest growth rate was negative(-14.37%) in 2011-12. The fish production from all sources (both inland and marine) indicates aggregate production. The aggregate fish production was highest (16.66%) in 2016-17. However, the growth rate dropped to 17.39%, 12.45%, 9.74%and 6.27% in the subsequent years. In particular, the AGR of marine fish production was negative in 2001-02(-5.94%), 2009-10(-4.54%), 2011-12(-14.37%), 2017-18(-1.48%), 2019-20(-0.64%).Overall in marine fisheries, the AGR has been fluctuating and have registered negative growth rates.

The fish production from all sources (both inland and marine) indicates aggregate production. The trend of fish production fluctuated with positive and negative growth rates. The comparison between marine fish production and total fish production in Odisha during 2000-01 to 2020-21 is depicted in Fig. 2. It is apparent that the total fish production has increased consistently, while the production of marine fish has been fluctuating over the period. The fluctuating growth of marine fish production has caused the total quantity of production to grow at a slow rate. The same pattern of observation can be inferred in the year 2019-20, where the AGR was negative(-0.64%). Thus, during focus group discussions and key informant interviews with marine fishing communities in Rajnagar and Mahakalpara blocks, the fishers community were of the view that the fish catch declined during the cyclone-affected years, and they mentioned that in the Bay of Bengal region, the number of depressions/ deep depressions have increased which result in loss of fishing days and subsequently reduces fish catch. Though from the fish production data, we could not validate the above-mentioned findings of the marine fishing community. The marine AGR was negative (-0.64%) in the year 2019-20(the year, the state of Odisha faced the wrath of extremely severe cyclonic storm Fani), but the negative growth rate cannot be directly attributable to climate-induced natural disasters.

The marine fishers believed that their fishing trips had reduced considerably due to the changing dynamics of weather and climate. Due to the deep depression in the Bay of Bengal region, we lose around 35 to 40 fishing days on average. The small-scale fishers believed that 20-25 years back, our trips used to be shorter, and we used to catch a good number of different varieties of fish. But now, the fish catch diversity has also reduced. This has affected our livelihood and earnings from the fisheries sector. The findings from the focus group discussion corroborate with research undertaken by Central Marine Fisheries

Table 1. Fish production in Odisha from 2000-01 to 2020-21 (in M.T.)

Year	Freshwater	Brackish water	Total Inland	AGR (in %)	Marine	AGR (in %)	Grand Total	AGR (in %)
2000-01	125114	13442	138556		121086		259642	
2001-02	147400	20660	168060	21.29	113893	-5.94	281953	8.59
2002-03	154237	19964	174201	3.65	115009	0.98	289210	2.57
2003-04	165594	24477	190071	9.11	116880	1.63	306951	6.13
2004-05	170091	23776	193867	2.00	121929	4.32	315796	2.88
2005-06	179740	23495	203235	4.83	122214	0.23	325449	3.06
2006-07	191632	22951	214583	5.58	128141	4.85	342724	5.31
2007-08	195747	22969	218716	1.93	130767	2.05	349483	1.97
2008-09	213003	26332	239335	9.43	135487	3.61	374822	7.25
2009-10	215803	25508	241311	0.83	129332	-4.54	370643	-1.11
2010-11	224956	27750	252706	4.72	133479	3.21	386185	4.19
2011-12	237470	30062	267532	5.87	114296	-14.37	381828	-1.13
2012-13	261919	29914	291833	9.08	118311	3.51	410144	7.42
2013-14	263862	30007	293869	0.70	120020	1.44	413889	0.91
2014-15	300964	35373	336337	14.45	133211	10.99	469548	13.45
2015-16	336216	40307	376523	11.95	144755	8.67	521278	11.02
2016-17	393730	61268	454998	20.84	153102	5.77	608100	16.66
2017-18	454189	79936	534124	17.39	150839	-1.48	684963	12.64
2018-19	506608	94033	600641	12.45	158321	4.96	758962	10.80
2019-20	543049	116099	659148	9.74	157310	-0.64	816458	7.58
2020-21 (P)	574983	125521	700504	6.27	172469	9.64	872973	6.92

Source: Directorate of Fisheries, Govt. of Odisha, Note- AGR (Annual Growth Rate), MT-Million Tonnes and P-Provisional, Prepared by authors from production data

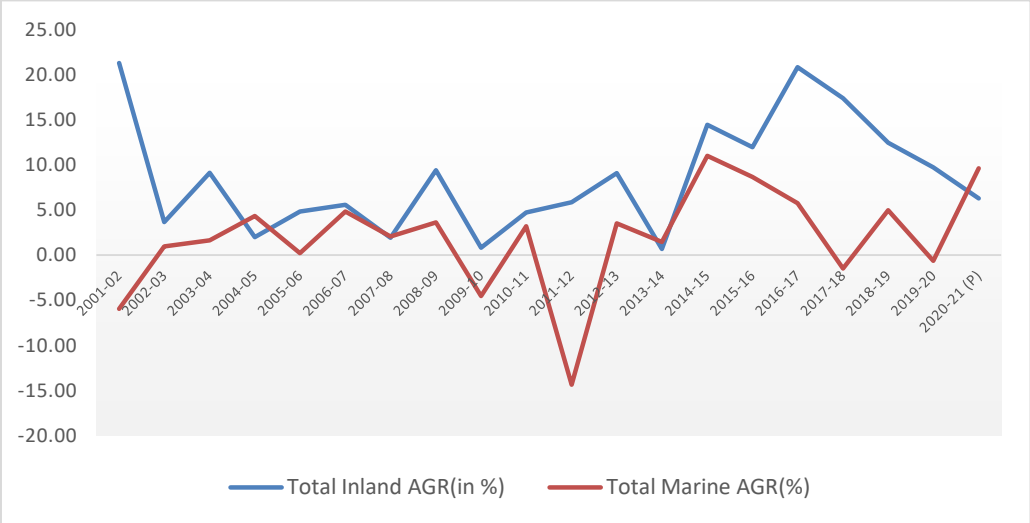

Fig. 2. Annual growth of Inland vis a-vis Marine fishery in Odisha, Directorate of Fisheries, Govt. of Odisha Prepared by authors from production data

Research Institute [25]. Moreover, the focus group discussion findings from the study area are similar to studies conducted by Zacharia et al. on the east coast of India [25].

According to Zacharia et al. a study conducted on the east coast of India has found that various fish species in the region are susceptible to the impacts of climate change. Out of the 68 species studied, 69% were identified as vulnerable to the effects of climate change [26]. These species include Bombay duck, tuna, sharks, different types of shrimp, pomfrets, and catfish. The study indicates that fish living near the surface or inhabiting surface waters, such as tuna, mackerel, and sardines, are the most affected by changes in temperature. Additionally, the research suggests that overfishing contributes to the increased sensitivity of these fish species to climate fluctuations. Thus, the vulnerability of

fishing communities in the area is not only due to changes in climatic conditions but also the pressure from fishing and reduced productivity.

Table 2 below depicts the district-wise marine fish production in Odisha from 2000-01 to 2020-21. The districts are Balasore, Bhadrak, Jagatsinghpur, Kendrapara, Puri, and Ganjam. In the Balasore district, the highest growth rate (18.05%) was recorded in 2014-15 and the lowest (-22.30%) in 2011-12. Similarly, the AGR of marine fish production in Bhadrak district was registered with the highest (13.43%) in 2012-13. In contrast, this district was recorded with the lowest production growth rate (-22.63%) in 2011-12. Likewise, Jagatsinghpur district accounted for 20.52% (36632 MT) as the highest AGR of marine fish production in 2014-15. However, the district has accounted for a negatively high growth rate of fish production (-19.58%) in 2011-12. In Kendrapara district, the highest quantity of marine fish production was 13594 MT in 2001-02, and the corresponding lowest quantity was 4798 MT in 2009-10. Regarding AGR, the district recorded the highest growth rate (52.59%) in 2013-14 and the lowest (-34.84%) in 2009-10. Thus, from the data, we can conclude that marine fish production in coastal districts of Odisha has been fluctuating, with positive and negative growth rates during the last decade.

The trend of marine fish production in Kendrapara district is reflected in Fig. 3 shows a downward trend until 2009-10. However, it started rising after that year, but production kept on fluctuating. Thus, it can be said that marine fish production was not impressive in the Kendrapara district. The decrease in capture fisheries and subsequently fluctuating production prompted the authors to understand the trend and examine the role played by climate-induced natural disasters in fluctuations in production. In the context of the table below, it was observed that marine fish production has fluctuated in the Kendrapara district of Odisha. The table below depicts the picture in a graphical representation.

So, in this context, it is important to understand how different climate and non-climate drivers have affected marine fishing communities. The next section deals with the divers of climate change as perceived by the community and reflects on how non-climate drivers affect the marine fishing communities in the context of the study area.

3.2 Perception of Marine Fishing Communities

3.2.1 Climate drivers

Increase in frequency and intensity of cyclonic storms: The fishermen were of the view that "climate has changed definitely". It has been reflected in terms of the increase in frequency and intensity of cyclonic storms. These storms caused extensive damage to the fishing industry, including infrastructure, fishing gear, and the livelihoods of fishermen [8,15]. Moreover, in the Bay of Bengal, the low pressure-induced depressions bring bad weather, rainfall and cyclonic storms restricting our fishing trips and reducing the number of fishing days. The Odisha coastline has faced the wrath of extremely severe cyclonic storms during the last decade [27-29]. The fishers were of the view that their livelihood gets affected before and after the occurrence of any extreme weather events, especially cyclonic storms. Nevertheless, extreme weather events disturb fishing activities and result in harm to onshore structures [30]. Additionally, variations in the yield of fisheries and other environmental resources adversely affect the strategies for sustaining livelihoods and the overall well-being of fishing communities [31].

To quote one of the respondents- *"It is still vivid in my memory the massive destruction from the 1999 super cyclone. I have also witnessed back-to-back cyclones in the year 2013 and 2014. Now, summer cyclones have become quite a regular phenomenon. Cyclone "Fani" followed by cyclone Amphan has caused huge-scale devastation. One of the prime indicators of climate change is that very few high-value species are seen nowadays. If we set a timeline and observe the trend, 30-40 years ago, there were abundant fish species, but now it hardly comes in our catch" Respondent, Age-55, Rajnagar Block, Kendrapara*.

Rise in temperature and rainfall pattern: The fishermen community who participated in the FGDs have their own beliefs and understanding that climate change is happening. The qualitative data collected from the fishing communities reveals that temperature changes (increase in temperature beyond our carrying capacity, long summer season) and rainfall pattern (decrease in total rainfall, sometimes unseasonal and high/erratic rain over a short span of time) has led to a decline in fish catches. The fishermen's view on observed changes in temperature and

Table 2. District-wise production of marine fish from 2001 to 2020-21 (in M.T.)

Year	Balasore	AGR (in %)	Bhadrak	AGR (in %)	Jagatsinghpur	AGR (in %)	Kendrapara	AGR (in %)	Puri	AGR (in %)	Ganjam	AGR (in %)
2000-01	34915		9350		33899		13206		22939		6777	
2001-02	30341	-13.10	9216	-1.43	28196	-16.82	13594	2.94	25168	9.72	7378	8.87
2002-03	32009	5.50	10405	12.90	28527	1.17	9483	-30.24	26164	3.96	8421	14.14
2003-04	30061	-6.09	10001	-3.88	29344	2.86	10795	13.84	27503	5.12	9176	8.97
2004-05	32400	7.78	10853	8.52	29985	2.18	10923	1.19	27911	1.48	9857	7.42
2005-06	33788	4.28	10856	0.03	31008	3.41	7971	-27.03	28557	2.31	10034	1.80
2006-07	34938	3.40	11854	9.19	33179	7.00	7787	-2.31	30283	6.04	10100	0.66
2007-08	35163	0.64	11973	1.00	33026	-0.46	7289	-6.40	32243	6.47	11073	9.63
2008-09	35916	2.14	12310	2.81	34388	4.12	7363	1.02	34325	6.46	11185	1.01
2009-10	35998	0.23	12811	4.07	33012	-4.00	4798	-34.84	31431	-8.43	11282	0.87
2010-11	35183	-2.26	12631	-1.41	35656	8.01	6853	42.83	31880	1.43	11276	-0.05
2011-12	27338	-22.30	9773	-22.63	28675	-19.58	6339	-7.50	31000	-2.76	11171	-0.93
2012-13	27234	-0.38	11086	13.43	32971	14.98	4898	-22.73	30774	-0.73	11348	1.58
2013-14	29819	9.49	11076	-0.09	30395	-7.81	7474	52.59	30938	0.53	10319	-9.07
2014-15	35201	18.05	11721	5.82	36632	20.52	7009	-6.22	30989	0.16	11659	12.99
2015-16	39327	11.72	12006	2.43	34503	-5.81	9059	29.25	37979	22.56	11881	1.90
2016-17	39490	0.41	12001	-0.04	40284	16.76	9409	3.86	39598	4.26	12320	3.69
2017-18	38017	-3.73	12060	0.49	41319	2.57	8566	-8.96	38906	-1.75	11971	-2.83
2018-19	43133	13.46	13010	7.88	42469	2.78	9475	10.61	38033	-2.24	12201	1.92
2019-20	41100	-4.71	13358	2.67	42725	0.60	9399	-0.80	38165	0.35	12563	2.97
2020-21 (P)	45085	9.70	15583	16.66	43634	2.13	11076	17.84	42000	10.05	15091	20.12

Source: Directorate of Fisheries, Govt. of Odisha, Prepared by authors from production data

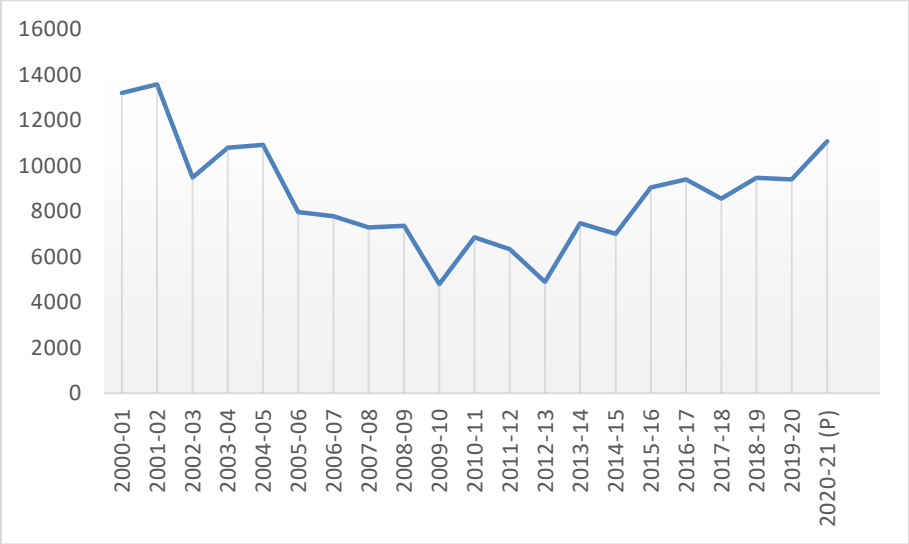

Fig. 3. Marine fish production in Kendrapara district of Odisha, Prepared by authors from production data

rainfall in this study perfectly corroborates with the studies conducted in southeast Bangladesh with respect to marine fishing communities [32]. The perception of marine fishermen on unseasonal rainfall is also observed in climate perception studies conducted in the state of Tamil Nadu, India, concerning marine fishing communities [13].

The small-scale marine fishing communities in the study area also believe that the rise in sea surface temperature plays a significant role in determining the fish catch and types of species being caught. The perception of small-scale marine fishermen is that the increase in sea surface temperature, along with pollution, has significantly impacted the entire sea ecosystem. According to the fishermen, many pelagic species have moved to lower layers of the sea, and many species have disappeared. This viewpoint has been validated by other studies conducted in the Indian coastal region [14,15].

Changes in wind patterns and seasonality: The seasonal wind patterns have changed; winds bringing fish have changed over time [16-19]. The fishing communities rely on the monsoons just as much as the farming communities, and if the monsoons are late or inadequate, it can have significant impacts on them as well. The arrival of monsoons, particularly the southwest monsoon, is crucial for successful fishing. However, the monsoons have become more unpredictable, leading to changes in seasonal patterns and a reduction in the catch of some important fish species.

Coastal erosion: The combination of rising sea levels and extreme weather conditions poses a considerable threat to coastal communities that are already vulnerable. In certain regions of Asia, a mere 30 cm increase in sea level can lead to a substantial erosion of land, reaching up to 45 meters inwards. The east coast of India is particularly susceptible to this risk, primarily because of its flat topography and the presence of numerous deltas [33].

According to the Ministry of Earth Sciences in India, approximately 28% of Odisha's coastline experienced erosion between 1990 and 2016, while half of the coastal area gained sediment. Due to years of shoreline changes and coastal erosion causing involuntary displacement and migration in villages in the Kendrapara district, Odisha [34]. The affected areas were mainly located around the Satabhaya village (Kendrapara district), which was gradually submerged due to cyclones and sea-level rise. As a result, the state government began a planned relocation process in 2011, and by 2016, they had established a resettlement colony 12 kilometres away for the affected families. Interaction with the communities reflects how the sea has engulfed many villages in the Satabhaya region. It has affected their lives and livelihood(as fertile agricultural land was inundated by saltwater intrusion). The

communities are resettled in safer places, but they still miss their fertile lands.

3.2.2 Non-climatic drivers

The climate drivers exacerbate the pre-existing vulnerabilities, such as increased competition has led to the overexploitation of resources by resource-rich players in the fishing sector. Various fishing-related factors worsen the effects of climate change on fisheries. These include the expansion of fishing fleets, with larger vessels equipped with more powerful engines and higher capacities. Additionally, some fishing methods are ecologically harmful and destructive, such as ring nets, as it traps larvae or baby fish [35], which can further exacerbate the negative impacts of climate change. Even in cases where fishing activities do not directly contribute to climate change, they can still have adverse effects on the health of fish populations, making it more difficult for fishers to adapt to the changing conditions.

In addition, the seven-month fishing ban to protect endangered marine species negatively impacts the entire marine fisheries sector [36]. Although the government offers alternative livelihood options to mitigate the ban's effects on fishermen, traditional fishermen believe it is insufficient to compensate for their lost earnings. According to the marine fishermen, although the government has introduced various incentives, subsidies, and welfare programs for them, they believe that it's crucial to focus on developing appropriate landing facilities and sufficient cold storage infrastructure as the fishing industry is highly vulnerable to climate change. Additionally, they suggest that it's essential to undertake skill enhancement initiatives to enable effective diversification of livelihoods (FGDs with marine fishers at study sites).

4. CONCLUSION

The fisheries production data reveals that marine fish production has not been consistent with inland fisheries and has been fluctuating in some districts. But, specifically considering the case of Kendrapara district where the context is different as it needs to deal with fishing bans twice a year (first, to comply with the nationwide fishing ban to conserve fishing resources, and the subsequent fishing ban is to conserve the endangered olive ridley turtles) [37] and also deal with the impact of climate change on marine fisheries. The primary survey of the fishing community reveals that the fish catch has gone down, and one of the critical reasons for this is changing climate dynamics in this part of the world. The climate drivers identified by fishing communities are an increase in frequency and intensity of cyclonic storms, a rise in temperature and uneven rainfall, and changes in wind pattern and seasonality leading to reduced catch from marine fisheries. Though, the fishing communities do not ignore the already existing problems plaguing the sector, such as overexploitation of fishery resources, inadequate incentives from the government and the presence of layers of intermediaries which ultimately take a toll on the margin of the fishing communities. The marine fishers suggest that investing in cold storage infrastructure development and alternative livelihood with a focus on skill development can help strengthen the sector's adaptive capacity.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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