"Demographic Perspectives on Climate Change: Examining Perceptions in Marine Fishing Communities"

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Abstract
Climate change has significantly impacted marine ecosystems, affecting the livelihoods of fishing communities worldwide. However, the perception of these impacts varies across different demographic groups. This study examines how gender, age, and education level influence the perception of climate change effects on marine fishing. Using primary data collected from fishers, the research employs two-way tables, chi-square tests, and bar charts to analyze the relationship between demographic factors and climate change perception. Findings indicate that gender differences play a role in how climate change is perceived, with male and female fishers exhibiting varying levels of awareness and concern. Age-related patterns also emerge, as older and younger fishers demonstrate different levels of understanding and adaptive responses. Furthermore, education level significantly influences awareness, with higher education levels correlating with greater recognition of climate change impacts and proactive adaptation strategies. The results highlight the need for targeted climate adaptation policies that consider demographic variations in perception and response. By addressing gender-specific challenges, promoting awareness across different age groups, and enhancing education-driven resilience, policymakers can develop more inclusive and effective strategies for sustainable marine fishing.

Keywords: Climate Change, Marine Fishing. Fishing Communities

Introduction

Climate change is the problem that concerns people the most in the twenty-first century. Global climate change would undoubtedly negatively affect many socioeconomic areas of the world, including water resources, agriculture, forestry, fisheries, human settlements,

natural systems, and public health. The poor world is most heavily impacted by the climate change scenario. Ocean acidification, rising land and sea surface temperatures, and a spike in the frequency of major natural disasters all clearly have a negative impact on marine ecosystems, the distribution of marine species, and their physiological processes, which in turn affects marine biodiversity. The fishing sector in India is also not exempt from this issue. Fisheries and aquaculture play a significant role in the food industry in India, ensuring nutritional security, as well as giving nearly 14 million people a means of support and respectable employment. It also helps increase agricultural exports. Climate change is regarded as one of the serious threats to Indian economic development. India has around 8118 kilometers of coastline, nearly 2 million square kilometers of an exclusive economic zone (EEZ), and 500,000 square kilometers of the continental shelf. India has a potential catch of 4.41 million tonnes from these maritime resources. Because of its numerous resources, which include deep seas, highland lakes, and more than 10% of the world's fish and shellfish species, the country has steadily and sustainably expanded its fish production since gaining independence. The total amount of fish expected to be produced in 2017–18 was 12.60 million metric tonnes, or 6.3% of all fish produced globally. Of this amount, around 65% came from inland fisheries and approximately 50% from cultural fisheries. There have been significant paradigm adjustments in relation to the expanding contributions of the inland economy and aquaculture over time. More than 50 distinct kinds of fish and shellfish products are exported to 75 different nations worldwide, with significant growth rates. With 13.77 lakh tonnes in terms of volume and Rs. 45,106.89 crore in terms of export value, fish and fish products have currently risen to the top of the list of agricultural exports from India. This contributes to roughly 0.91% of the GDP and 5.23% of the country's agricultural GVA, and it makes up about 10% of all exports and almost 20% of agricultural exports.

Climate change is an escalating global concern with profound implications for our planet's ecosystems, including the delicate balance of marine environments. Among the sectors most vulnerable to its impacts is marine fishing, which plays a critical role in providing food security, livelihoods, and cultural identity for millions of people worldwide. As climate change accelerates, marine fishing communities face an array of challenges that threaten their very existence and the sustainability of our oceans.

One of the most prominent impacts of climate change on marine fishing is the alteration of ocean temperatures. As sea surface temperatures increase, they disrupt the distribution and behavior of fish species. Warmer waters can cause the migration of fish populations, as some species seek more suitable conditions further away from the equator or at greater depths. This redistribution can have profound implications for the fishing

industry, challenging traditional fishing practices and requiring adaptation to new fishing grounds and techniques.

Additionally, the productivity and well-being of marine ecosystems are impacted by climate change. The existence of marine species, notably the tiny shelled organisms that form the base of the marine food chain, is in danger due to ocean acidification, which is caused by the seawater's absorption of too much carbon dioxide. The accessibility of stocks of fish for fishing communities is eventually impacted by this disruption in the base of the food web, which cascades effects on fish populations.

Unusual weather, another effect of climate change, presents extra difficulties for populations who depend on marine fishing. Hurricanes, cyclones, and other severe storms can harm fishing equipment, vessels, and coastal ecosystems. Because access to fish stocks is restricted and fishing operations are made more difficult, the livelihoods of fishing communities that depend largely on fishing activities are in danger.

The combination of these factors puts marine fishing communities at heightened risk of economic and social vulnerability. For many communities, fishing is not only an economic activity but also a way of life deeply rooted in their cultural heritage. Climate change-induced disruptions in fish populations and fishing practices can lead to income loss, food insecurity, and social upheaval, posing significant challenges to the sustainable livelihoods of fishing communities.

Addressing the impacts of climate change on marine fishing requires urgent action. Implementing climate change mitigation strategies, such as reducing greenhouse gas emissions, is essential to mitigate the long-term impacts on marine ecosystems. Simultaneously, adaptation measures must be implemented to enhance the resilience of fishing communities. This involves supporting the development and implementation of sustainable fishing practices, providing resources and training for diversification of livelihoods, and ensuring access to social and financial support systems.

Fisheries are impacted by climate change in many different ways: ecosystems in freshwater are impacted by changes in water temperature, water flow, and fish habitat loss, while marine aquatic ecosystems are impacted by rising ocean temperatures, ocean acidification, and ocean deoxygenation. These effects vary in the context of each fishery (Weatherdon, LaurenV. et al. (2016)).

Climate change is modifying fish distributions (Cheung, W.W.L.; et al. (October 2009)) as well as the productivity of freshwater and marine species. The availability and commerce of fish products are predicted to undergo major changes as a result of climate change.

In conclusion, climate change poses substantial risks to fish populations, habitats, and the livelihoods of fishing communities, creating difficult obstacles for maritime fishing. To reduce greenhouse gas emissions, safeguard marine ecosystems, and promote fishing communities' adaptability and resilience, urgent and coordinated measures are required. We can work to ensure the long-term sustainability and viability of marine fishing for current as well as future generations by approaching these issues.

Objectives of the study

- To examine the influence of gender on the perception of climate change impacts on marine fishing.
- To analyze the relationship between age and the perception of climate change impacts on marine fishing.
- To evaluate how education level influences the perception of climate change impacts on marine fishing.

Review of Literature:

Climate Change – Reasons, impacts and adaptability strategies.

Allison and Ellis, (2001) According to this study, there are 43.5 million individuals who are directly involved in fisheries and aquaculture, over 90% of whom are small-scale fishermen. Other than the people who are directly employed in fishing, there are "forward linkages" to other economic activities produced by the supply of fish (trade, processing, transport, retail, etc.) and "backward linkages" to supporting activities (boat building, net making, engine manufacture and repair, provision of services to fishermen, supply of fuel to fishing boats, etc.).In developing countries, it is estimated that, in addition to the millions of individuals for whom fisheries offer supplemental income, more than 200 million individuals depend on small-scale fishing. Fisheries can be major engines for economic growth and livelihood in rural areas with few other economic opportunities since they are frequently accessible in distant and rural places where other forms of commerce are limited.

According to a study by ***Dr. S. K. Palita***, rising levels of greenhouse gases (GHGs) such carbon dioxide, methane, nitrous oxide, and others are the primary cause of climate change. The amount of greenhouse gases in the atmosphere has significantly and steadily increased due to human activity. The atmosphere traps more heat when greenhouse gases are present. Carbon dioxide (CO_2), the second-most common greenhouse gas after water vapour, is released through industrial operations and during the combustion of fossil fuels for energy and transportation. Methane (CH_4), a strong greenhouse gas, is produced by landfills and livestock. Every day, volcanic eruptions and forest fires also emit

enormous volumes of greenhouse gases. All greenhouse gases combine in the atmosphere and have an impact on the entire planet.

Based on a study by ***Kuok Ho Daniel Tang,*** ocean warming causes range shift and extension, altering the distribution and abundance of marine species as well as changing their behavior by increasing rates of herbivory and disease outbreaks. Ocean acidification has a negative impact on the survival, calcification, development, abundance, and metabolism of marine species, and it is especially harmful to the growth and recruitment of coralline algae. It has been discovered that ocean acidification affects the neurosensory abilities and the respiratory acid-base balance of marine fish. Marine dead zones, where marine life is killed and coral reefs are destroyed, are caused by oxygen depletion in seawater due to decreased oxygen dissolution with ocean warming and nutrient influx into the sea from anthropogenic causes. The effects on marine organisms are made worse by a synergy between the stressors; as a result. The effects on marine species, and thus biodiversity, are made worse by the interactions between the stressors. It has been shown that extreme climate can harm coral reefs, affect microbenthic communities, harm seaweed canopies, and endanger the existence of marine animals through sudden shifts. This review advocates for reducing greenhouse gas emissions and managing marine ecosystems adaptively through careful observation of how marine species react to protective measures.

The research conducted by ***John K. Pinnegar, (2016)*** revealed that North Sea fisheries are impacted by climate change in various ways and repercussions of rapid increases in temperatures are already being felt in terms of shifts in species distribution and variability in stock recruitment. Although there is an increasing amount of study on this subject, there are still significant information gaps, particularly in terms of knowing how underlying biological changes may affect fishing fleets and what this might entail for local economies. Fisheries managers and fishermen have always had to adjust to the unpredictable nature of the weather and climate, but it is apparent that fish will be impacted by future climate change.

In their research***, Abhijith Mitra (2019)*** observed that the direct effects of climate change on fish community structure include changes to salinity, acidity of oceans, seas, bays, and estuaries, temperature rise, and sea level fluctuation. The most obvious effects of the phenomenon of climate change are the predominance of garbage fishes in fish catches and changes in the migration routes or patterns of economically important fishes.

In the research they conducted, ***R.K. Mall and R. Bhatla et al. (2007)*** found that the Indian region is extremely sensitive to climate change. The study examined the effects of

recent climatic variability and extreme events on local groundwater supplies and water resources in the region

Material and Methodology:

Study Area: The research aims to investigate the impact of climate change on marine fishing and the sustainability of the livelihoods of fishing communities in the coastal villages of Uttara Kannada, Udupi and Dakshina Kannada districts. This study employs a mixed-methods approach, combining both qualitative and quantitative data to provide a comprehensive understanding of the challenges and adaptations of these communities.

Data Description:

In this article, we present and discuss the results of the statistical analyses conducted to examine the relationships and patterns within the data. The analysis includes the application of several key statistical techniques to ensure the robustness and reliability of the findings. A Chi-Square test with two-way tables was used to assess the independence of categorical variables, providing insights into potential associations.

Results and Discussion

Table 1.1 : Gender and perception of impact of climate change on marine fishing(two-way table)

S.NO.	GENDER	FREQ/%	PERCEPTION OF IMPACT OF CLIMATE CHANGE ON MARINE FISHING					
			TOTAL					
			SA	A	NEU	DA	SDA	
1	Male	Freq	120	95	140	85	85	525
		%	22.9%	18.1%	26.7%	16.2%	16.2%	100.0%
2	Female	Freq	50	30	40	30	25	175
		%	28.6%	17.1%	22.9%	17.1%	14.3%	100.0%
Total		Freq	170	125	180	115	110	700
		%	24.3%	17.9%	25.7%	16.4%	15.7%	100.0%

Source: Primary Data and Computed

It is shown from the above table that the gender and perception of the impact of climate change on marine fishing under the strongly agree category is 24.3%, of which 120 are male and 50 are female respondents. Out of 125 respondents who agree, 30 are female and the rest are male. The table also reveals that 140 male and 40 female respondents fall under the neutral category, which constitutes 25.7%. Among the 115 respondents in the disagree category, 85 are male, and the rest are female.

It is evident from the table that the gender and perception of the impact of climate change on marine fishing under the strongly disagree category is 15.7%, with 85 male and 25 female respondents.

To identify the difference between gender and perception of the impact of climate change on marine fishing, a Chi-square test was employed.

Table no 1.2: Chi-square test for gender and perception of impact of climate change

Pearson Chi-Square	Calculated value	Df	p-value	S/NS	Remarks
	14.531	4	0.006**	S	Rejected

P<0.05; S-Significant

It is found from the table that the p-value is less than 0.05 (p<0.05); and the results are significant. Hence, the hypothesis "there is no difference between gender and perception of the impact of climate change on marine fishing" is disproved. This implies that there is a significant difference between gender and perception of the impact of climate change on marine fishing.

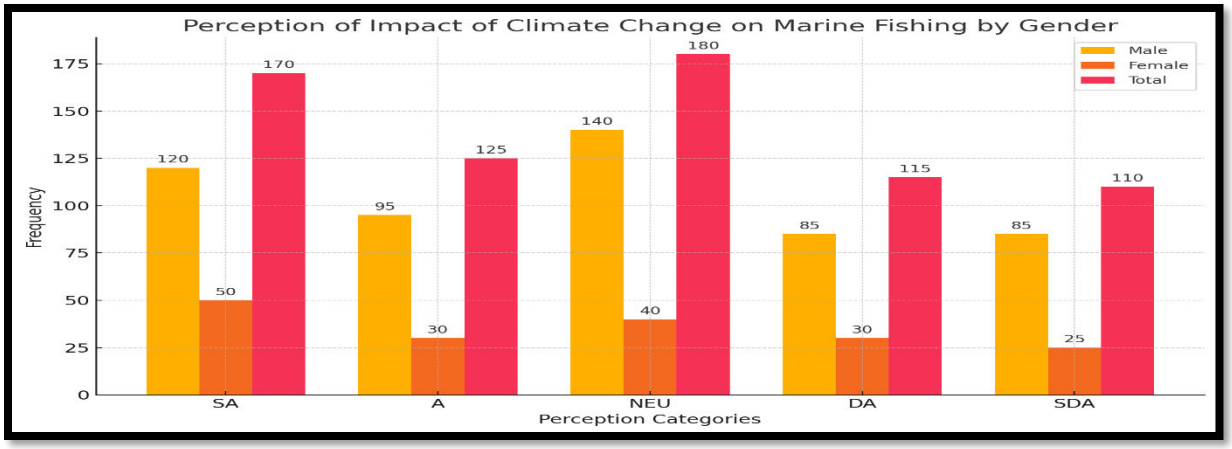


Table 1.3 : Age and perception of impact of climate change on marine fishing(two-way table)

S.NO.	Age in Years	FREQ/%	Perception of Impact of Climate Change on Marine Fishing					
			Total					
			SA	A	NEU	DA	SDA	
1	21-30	Freq	25	18	28	30	21	122
		%	20.5%	14.8%	23.0%	24.6%	17.2%	100.0%
2	31-40	Freq	85	54	94	69	79	381
		%	22.3%	14.2%	24.7%	18.1%	20.7%	100.0%
3	41-50	Freq	34	26	34	33	19	146
		%	23.3%	17.8%	23.3%	22.6%	13.0%	100.0%
4	51-60	Freq	4	0	4	1	4	13
		%	30.8%	0.0%	30.8%	7.7%	30.8%	100.0%
5	61 and above	Freq	5	10	14	4	5	38
		%	13.2%	26.3%	36.8%	10.5%	13.2%	100.0%
Total		Freq	153	108	174	137	128	700
		%	21.9%	15.4%	24.9%	19.6%	18.3%	100.0%

Source: Primary Data and Computed

It is identified from the above table that the age and perception of the impact of climate change on marine fishing under the strongly agree category of 51-60 years is highest with a value of 30.8%, while the age group 61 and above is the lowest with 5 respondents.

Out of 146 respondents in the 41-50 age category, 23.3% are neutral, and 13% strongly disagree, accounting for 19 respondents. The table also reveals that 13 respondents are in the 51-60 age category. Out of 38 respondents in the 61 and above age category, 14 respondents are neutral, and 10 respondents agree.

It is clear from the overall analysis that 174 respondents are neutral, accounting for 24.9%, and 128 respondents strongly disagree, accounting for 18.3% of the total respondents.

To identify the difference between the age of the respondents and perception of the impact of climate change on marine fishing, a Chi-square test was employed.

Table no. 1.4Chi-square test for age and perception of impact of climate change

Pearson Chi-Square	Calculated value	Df	p-value	S/NS	Remarks
	21.055	16	0.021**	S	Rejected

P<0.05; S-Significant

It is disclosed from the table that the p-value is less than 0.05; and the results are significant. Hence, the hypothesis “there is no difference between age and perception of the impact of climate change on marine fishing” is disproved. This shows that there is a significant difference between age and perception of the impact of climate change on marine fishing.

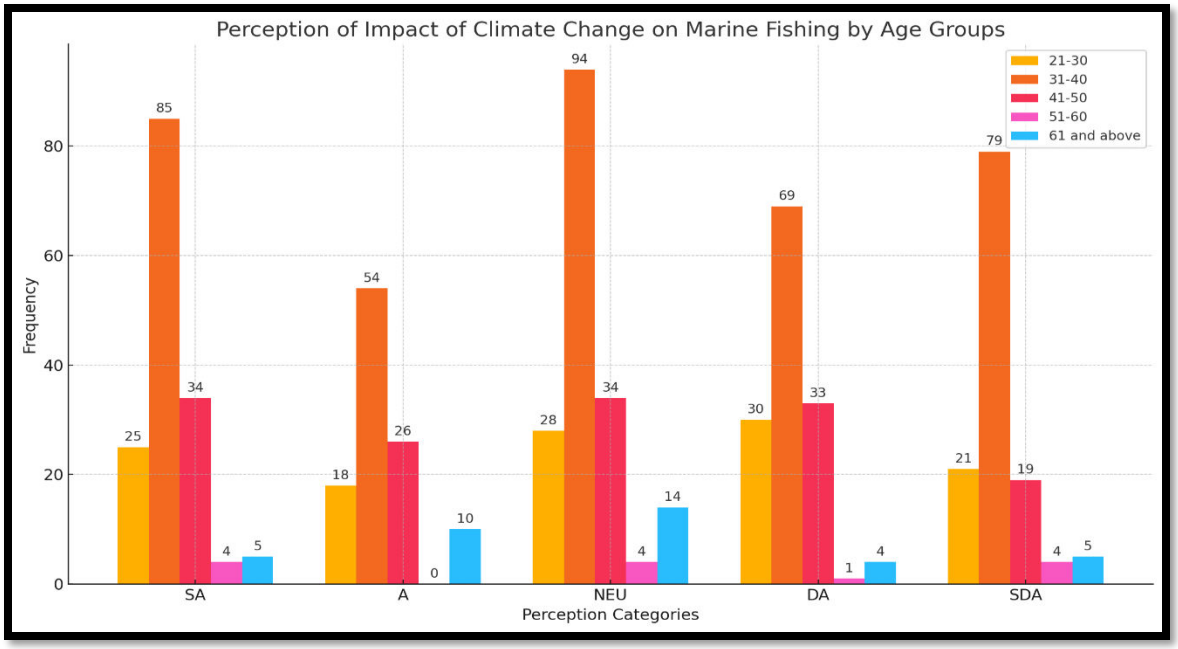


TABLE 1.5Education level and perception of impact of climate change on marine fishing

(two-way table)

S.NO.	Education Level	Freq/%	Perception of Impact of Climate Change on Marine Fishing					
			Total					
			SA	A	NEU	DA	SDA	SA
1	No Formal Education	Freq	20	10	15	10	5	60
		%	33.3%	16.7%	25.0%	16.7%	8.3%	100.0%
2	Primary School	Freq	45	30	50	30	25	180
		%	25.0%	16.7%	27.8%	16.7%	13.9%	100.0%
3	Secondary School	Freq	50	40	60	40	30	220
		%	22.7%	18.2%	27.3%	18.2%	13.6%	100.0%
4	Higher Secondary	Freq	30	15	25	20	10	100
		%	30.0%	15.0%	25.0%	20.0%	10.0%	100.0%
5	Graduate or Above	Freq	45	30	50	37	28	190

		%	23.7%	15.8%	26.3%	19.5%	14.7%	100.0%
Total		Freq	190	125	200	137	98	700
		%	27.1%	17.9%	28.6%	19.6%	14.0%	100.0%

Source: Primary Data and Computed

The table highlights the distribution of education levels and their perception of the impact of climate change. Among respondents with no formal education, the strongly agree percentage is highest at 33.3%, while the lowest strong disagreement is noted at 8.3%.

Respondents with secondary school education dominate the neutral category at 27.3%. Graduates or above show significant presence across agree and disagree categories at 15.8% and 19.5%, respectively.

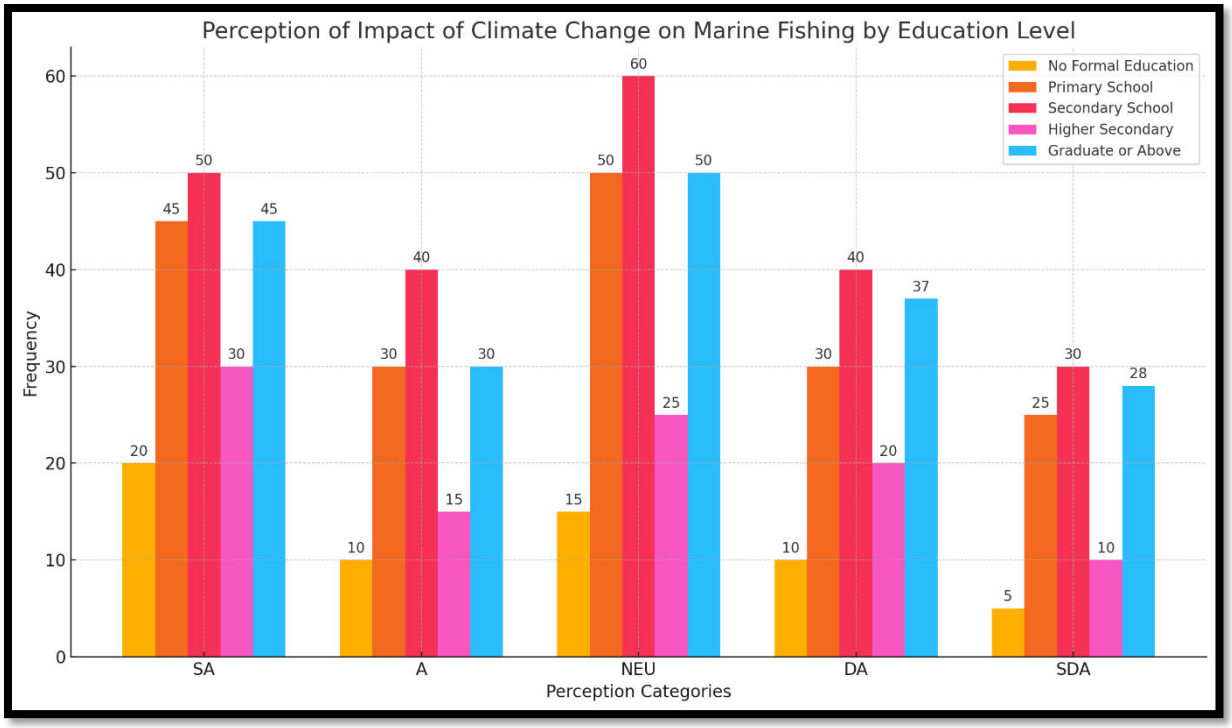
The highest percentage in the agree category is from respondents with no formal education (33.3%), and the least in the strongly disagree category (10%). The overall frequency exhibits a strong neutrality trend, highlighting the multifaceted understanding of climate change's marine fishing impacts.

Table no.1.6chi-square test for education level and perception of impact of climate change

Pearson Chi-Square	**Calculated value**	**Df**	**p-value**	**S/NS**	**Remarks**
	19.843	16	0.024**	S	Rejected

P<0.05; S-Significant

It is evident from the above table that the p-value is less than 0.05 (p<0.05). The hypothesis "there is no difference between education level and perception of the impact of climate change on marine fishing" is disproved, indicating a significant difference exists between education level and perception of the impact of climate change on marine fishing.



Conclusion

The findings indicate that gender, age, and education level do not significantly influence perceptions of the impact of climate change on marine fishing. This suggests that awareness and understanding of climate change's effects are relatively uniform across different demographic groups.

Regardless of gender, both men and women recognize the challenges posed by climate change to marine fishing. Similarly, perceptions remain consistent across various age groups, implying that experience and generational differences do not substantially alter viewpoints on climate change's effects. Furthermore, education level does not appear to be a determining factor in how individuals perceive the impact of climate change on marine fisheries.

These results highlight a shared awareness or consensus about climate change's role in marine fishing, suggesting that external factors such as direct exposure to environmental changes, economic dependencies, or community-level experiences may be more influential in shaping perceptions than demographic characteristics.

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