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Assessing Socio-economic Dynamics and Willingness to Pay for Improved Ecosystem: A Study of Coastal Communities of Korapuzha Estuary, Kerala, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author RA conducted the field studies, conceptualizes the study and designed it. All material preparation, data collection, analysis, interpretation and draft preparation of manuscript were done by the first author. The other authors edited and commented on the manuscript. All authors have read the manuscript.

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ABSTRACT

The present study delved into the socio-economic condition of Korapuzha estuarine community, Kerala, India. The work focused on familiarization of the concept willingness to Pay (WTP) among the respondents and determined significant influence of socio-economic dynamics of respondents

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with their WTP. A survey covered 425 households, comprising of 1713 individuals. The study signified a high educational status of the respondents (97 %). Despite this, only 7% were initially familiarized with the concept of WTP. It was observed that younger generation and men showed more response of positive WTP. Little influence noticed from lower-income households and women community, justifying with their financial constraints and no role in financial implications. The study observed a significant impact of income earning on WTP with higher income earners willing to contribute more in ecosystem revival.

Being a fishing village, a gradual shift noticed in respondent's livelihood preferences from traditional fishing practices to other subsidiaries (86%). A positive response noticed among respondents (60%) towards the WTP after detailing. The respondents (98.2%) showed strong awareness on the estuary's declining health and 99% of respondents advocated for immediate government intervention for estuary revival activities.

The present study highlighted the formulation of gender-inclusive policies, generation of subsidiary income for livelihood enhancement and more concentration on environmental education and awareness, can result in increased involvement of community in conservational and management measures. The study recommends to uplift the socio-economic dynamics of community and ecosystem sustainability leading to a balanced community development along with sustaining ecological health.

Keywords: Estuary; protection; ecosystem; willingness to pay; coastal community.

1. INTRODUCTION

The Korapuzha river is one of the most expansive rivers of North Kerala, India, exhibiting its elegance and significance to the ecological and socioeconomic well-being of the communities residing along its estuarine stretches. The riverine and estuarine stretches act as ecological guardians to aquatic as well as terrestrial ecosystems, despite providing several advantages to the coastal communities thriving along the banks (Amano and Kazama, 2014). The estuaries provide abundant ecological services aiding social, economic and ecological prosperity (Khan *et al*., 2019). The very sensitive ecosystem provides a harmonious co-existence of nature and the communities as a mutual dependence by binding the well-being of the communities with the environmental health. However, the unplanned direct and indirect anthropogenic activities have a greater impact on the ecological services crucial for human well-being. The time has come for mankind to acknowledge its impact on the environment and proactively compensate for the unintentional depletion of ecological services.

It is the need of the hour to understand the value that the local communities place on the Korapuzha ecosystem services, in terms of willingness to Pay. According to DFID (1998), Willingness to Pay is considered as the maximum amount an individual is ready to pay for a service or a product. According to Abdeta (2022), willingness to pay (WTP) concept has an immense implication in ecosystem valuation. Bhat and Sofi (2021) estimated Rs 245.57 ($ 3.32) per year as the household's Willingness to Pay (WTP) for biodiversity conservation in Dachigam National Park, India.

The concept of Willingness to Pay (WTP) is a monetary measure, indicating the community's readiness to invest in utilizing and restoring ecosystem benefits, securing sustainable well-being for the future (Brauman et al., 2007). Hence, WTP is considered as a financial commitment by the communities, which do reflect the value they provide on ecosystem services and thus understand the necessity in preservation and restoration of resources for long term sustainability. Thus, the paying off by the communities embark a consistent and balanced environment for our future generations.

The Korapuzha estuarine stretches and the ecosystem services offered, play a major role as primary sources of income generation among the communities residing along the banks, underscores their large economic significance. Despite this significance, studies stand out as scarce regarding the socio-economic profiling of the Korapuzha estuarine communities which stands high time for its in-depth investigation to fill up this research gap. Accordingly, the present study deals in examining the socio-economic status of the communities residing along the estuarine stretches, assess the communities' interest on ecosystem preservation and restoration of its resources in terms of willingness

to pay (WTP). Besides monetizing WTP, the study focussed on the community's familiarization of the concept 'WTP' and to understand the communities view on estuarine conservational measures. The study also analyzed how the socio-economic factors of the respondents influence the WTP detailing the relationship between the communities and the estuary. Thus, the study fills this knowledge gap by providing extensive focus on the socio-economic status of the Korapuzha communities and helps in promoting sustainable practices in the estuarine stretches with active community engagements.

2. MATERIALS AND METHODS

The sampling site selected was Korapuzha estuary, Calicut, India and the study spanned over 2021 to 2023. The Korapuzha estuary meet the sea at Elathur, a mere 10 kilometers from the Calicut city, Kerala, India. The comprehensive survey focused on the socio-economic status of the communities residing in the estuarine stretches and those actively utilizing its natural resources. A simple random sampling technique was employed with data collection involving direct interviews and specifically purposive sampling methodology with the individuals directly involved in the estuarine resource utilization. Within the sampling site, total of 425 numbers of households were residing. The sampling frame included all households (425) within the study area, with each household was considered as the single unit of study. The survey addressed various socio-economic aspects, including details such as educational qualifications, economic and occupational particulars, sources of income, and enterprise information etc. Statistical analyses were carried down and results were recorded in percentage and frequency calculations.

Furthermore, a survey was conducted among the coastal communities of the estuary in order to assess the knowledge of the concept "Willingness to Pay" among the respondents. This survey aid in understanding the respondent's perception for ecosystem services and the urgency to revive and restore the Korapuzha estuarine stretches. The study was concurrently conducted with incorporation of survey indicators from Vinod *et al.* (2019) and Liu (2020) besides the socio-economic survey. Later the data sets were analysed in accordance with Cortes-Espino *et al.,* 2023.

3. RESULTS

3.1 Social Status of Respondents

In the present study, the social status of respondents was analyzed based on a total population of 1713 individuals within the defined sampling frame. The detailed socio-economic dynamics of the respondents are provided in Table 1. Among them, 901 were females, constituting 52.6%, while 812 were males, accounting for 47.4% of the total population (Fig. 1). During the study, 425 households located close to the vicinity of estuarine stretches, were randomly selected as primary sampling units. When the age distribution of the respondents was considered, the major contribution was in the age class of 30 and above constituting 43% (740 individuals), age class of 18 and above with 20% (342 individuals) whereas age class of 60 and above comprised 18% with 305 respondents. A total of 299 individuals belonged to the age class 18 and above constituting 18% of the total respondents (Fig. 2).

Based on religiosity, 83% of the respondents were believers of Hinduism, while nearly 17% were muslim community (Fig. 3). The survey also looked into the marital commitments of population, showcasing 75% being married and 25% unmarried (Table 1). In terms of family structure and the family size, the average family size was 4.04 individual, with 64.85% of families being nuclear and the rest as joint families (Fig. 4).

The study led insight into the literacy levels of the respondents and stresses on the high literacy level (97%) and 2.59% being illiterate. Educational attainment varied among the respondents with 42.6% having high school education, 20% passed higher secondary, 12.5% having primary education, 9.9% educated till upper primary, 10.8% of graduates, 1.65% holding postgraduation and 2.59% (11 individuals, all above 70 years of age) reported illiterate (Fig. 5).

Among the respondents, 93.63% were having concrete houses, 5.18% with roof-tiled houses and 1.17% with mixed roofing pattern including concrete and roof-tile. Major portion of the community resided in own house (96.46%) whereas 3.53% in rented accommodations. The basic amenities included electricity (100% households), toilet facility (100% households), gas connection (99.05% households) and

virtually all households had drainage facilities (95.2%). 79.95% of the households depend on own wells for water supply, 16.5% relied on government provided water supply and 3.53% responded of utilizing open water sources (Table 1).

3.2 Economic Status of the Respondents

The study showcased that 69% of the respondents as the primary earners, emphasizing their role in financial support whereas 31% are unemployed (Table 1) including the non-working ladies, students, senior citizens etc.

The study examined the income distribution and showcases that 14% of the respondents earns below Rs 5000 on monthly basis, 80% of the respondents earning within Rs 5000 to Rs 10,000 on monthly basis indicating a predominant middle-income group and 16% earning Rs10,000 on monthly basis, with an indication of higher income level (Table 1).

The respondents ascertained that fishing played a major role in communities' livelihood in the past decades with 95% of the population actively engaged in these activities. Our study underscored a significant shifting in livelihood options with 13.91% of the community remains as active fishers and its noteworthy that these active fishers primarily in the age group of 35 to 65. The rest 86% have transitioned to alternative income activities, underscoring a diversified occupational choice within the community (Fig. 6). The study also focused on the total annual average income and found to be Rs 9087 per month.

Among the respondents, 1.41% of the population is engaged in livestock farming, shows very limited involvement. Poultry farming is in higher participation with involvement of 3.3% of the population. Conversely, traditional Agriculture/ Horticulture captures the attention of only 0.23 % of the community. Korapuzha, despite its status as a fishing village situated close to water bodies, pisciculture activities are absent, with no individuals participating in fish culture practices (Fig 7).

In terms of savings, 3% of respondents are not saving for the future, while the remaining 97% adopt various saving strategies. Among them, 54% save less than Rs 5000 per month, 32% save between Rs 5000 and Rs 10,000 per month and 14% engage in savings exceeding Rs 10,000 per month. Regarding the purpose of savings, 38% focus on very short-term goals (less than one year), 53% allocate their savings to short-term objectives (1-5 years), and 9% prioritize long-term savings, particularly for retirement (Table 1).

Besides the saving behavior of the respondents, a study on loans availed was also articulated and 51.1% responded for availing loans, while the remaining 48.9% have not taken any loans (Table 1). This showed diversified financial assistance received among the respondents as 68% of respondents availed loans from nationalized banks, 18% from private bank/ microfinances and 20% from money lenders.

3.3 Economic Security Measures of the Respondents

The study signified the extensive availability of the ration cards among all the households surveyed (100%), of which 52.5% falling in BPL (Below Poverty Line) category and rest in APL (Above Poverty Line) category. The results also showed that there was widespread coverage of Aadhaar cards among all members (100%), with 95% of the respondents also possessing bank accounts. It was often clear from the survey results that there was widespread membership among the communities in fishermen welfare associations (99.9%) and co-operative societies (92%) irrespective of gender indicating a collective approach to economic activities and mutual support among themselves. Despite all this, among the respondents, 92% have memberships in micro-finance institutions, stressing on the active engagement with the alternative financial facets and displaying the active involvement in economic cooperative institutions (Table 1).

3.4 Expense Details of the Respondents

The respondents expense details revealed that nearly 40% of their expenses were met for food whereas educational expenses were the least contributing of 0.2% (Fig. 8).

3.5. Inventory Status of Health Facilities

Within the community, the health facilities were limited to private clinics (2 numbers) and nearby government primary health clinic is 5 kilometers apart and hospital at a distance of 10 kilometers (Table 1).

3.6 Status of the Educational Institutions

The present study encompasses more private and government educational institutions in sampling sites as there are five preschool facilities but a notable absence of higher educational institutions and the nearby option prevails at 5 kilometers apart (Table 1).

3.7 Socio-economic Relationship of the Community to the Existence of Estuary

While, investigating the status of the ecosystem, an alarming 98.2% of respondents expressed concerns, categorizing it as degraded. Exploring the reasons provided by the respondents, including shallowing of the river due to sand and silt deposition, diminished availability of fish seeds, reduced fish quantity, deterioration of water quality marked by frequently localized blooms, increased plastic pollution, etc (Fig. 9).

3.8 Awareness of the Concept "Willingness to Pay (WTP)" among the Respondents

From the study results, it was clear that 48% of the respondents were not having any direct economic usage of the river, 52% do acknowledged conducting several economic activities. Eventually, awareness of the concept of 'Willingness to Pay' was enquired among the respondents revealed 90% were unfamiliar with the term, 7% were aware and 3% refused to answer despite detailed clarification. Subsequently, when questioned about the need for WTP in the context of protection, conservation and revival of estuarine stretches of Korapuzha, 60% expressed very strong willingness, 35% were willing, 2% were indifferent that did not care category, 2% refused, and 1% strongly refused, asserting that nature would rejuvenate on its own. In converse, 30% of respondents emphasized negative WTP, attributed to low monthly income generation and strongly believed that it is the government's responsibility to revive-restore the ecosystem (Table 2).

With the analysis of the respondent's response on positive WTP depicted the commitment of the society over ecosystem conservation, revival and management through financial contributions and lead to the emerging of diversified range of willingness to pay amounts. About 1% of respondents expressed a strong commitment, being willing to contribute an amount exceeding Rs 10,000 per annum. Meanwhile, 13% were prepared to pay between Rs 5,000 and Rs 10,000 per annum, showing a substantial but moderate financial commitment. A larger portion of the respondents, constituting 28%, demonstrated a willingness to contribute in the range of Rs 1,000 to Rs 4,999 per annum. Furthermore, a significant 33% expressed their readiness to pay amounts ranging from Rs 100 to Rs 999 per annum, highlighting a more widespread but modest contribution level. Lastly, 25% of respondents indicated a willingness to contribute an amount less than Rs 100 per annum (Table 2).

Subsequently, respondents were enquired about their perspectives on methods for ecosystem protection in the form of government assistance, by ways of natural resource utilization, by public awareness, commercial marketization of ecological assets, and other potential approaches. Interestingly, 99% of respondents advocated for assigning the responsibility of protection and revival plans for the Korapuzha estuary to the government. In contrast, only 1% of respondents expressed a view of public involvement and mass awareness initiatives (Table 2).

Analyzing the willingness to pay (WTP) among respondents based on gender and age categories yields strong perceptive. Among the male respondents, 82% supported WTP, while the rest inclined towards negative stand. In converse, of the female respondents, 21% welcomed the WTP concept whereas 79% refused to comment, asserting that the major decision depends on male family members as they are the primary income earners. Age-wise categorization revealed that 61% of the positive WTP responses originated from 18 to 38 age groups. Contrary to this, age group of 39 to 59 showed a higher negative WTP responses constituting 93% (Table 2).

3.9 Socio-economic Factors of the Respondents Influencing WTP

There was a significant influence noticed between the socio-economic dynamics of the respondents and their knowledge on willingness to Pay (WTP) concept. Here, the respondent's gender, income, age, education and their relationship with estuary were studied in detail.

Table 1. Tabular representation of social features of Respondents of Korapuzha estuary

1	**Social Features of Respondents**	**Percentage distribution of Respondents**
A	Primary earners	69
	Unemployed	31
	Married respondents	75
	Unmarried respondents	25
	Basic features of houses	
B	**Housing pattern**	
	i) Concrete	93.63
	ii) Roofed	5.18
	iii) Others	1.17
C	**Housing Ownership**	
	i) Own	96.46
	ii) Rent	3.53
D	**Status of House**	
	i) Availability of Electricity	100
	i) Gas connection	99.05
	ii) Water Supply	
	a) Own well	79.95
	b) Panchayat water supply	16.50
	c) Open-water body	3.53
	iii) Drainage facility	95.2
	iv) Toilet Facility	100
2. Economic Status of Respondents		
A	**Economic Security measures**	
	Primary Earners	69
	Not engaged in employment	31
	i) Membership in Co-operative societies	92
	ii) Membership in fishermen welfare association	99.9
	iii) Ration card	
	a) BPL	52.5
	b) APL	47.4
	iv) Aadhaar Card	100
	v) Bank Account	95
B	**Economic Status**	
	Loan	
	i) Availed	51.1
	ii) Non-Availed	48.9
	Source of Loan	
	i) Public bank	68
	ii) Private bank/ Microfinance	12
	iii) Moneylenders	20
	iv)	
C	**Income per Month**	
	i) Below 5000	14
	ii) 5000 to 10000	80
	iii) Above 10000	16
D	**Savings per Month**	
	iv) Below 5000	54
	v) 5001 to 10000	32
	vi) Above 10000	14
	iii) No saving	3
E	**Nature of Saving**	
	i) very short term	38

	ii)	short term	53
	iii)	long term	9
	Daily household Expenditure		
3	**Health status and inventory of health facilities**		**Numbers and distance apart**
	i)	Primary health clinic	Nil
	ii)	Private clinics	2
	iii)	Government hospital	Nil
	iv)	Ambulance service	Nil
	v)	Nearest Primary health clinic	5 km
	vi)	Nearest Government hospital	10 km apart
4	**Inventory of educational institutions**		
	Number of pre-schools available		5
	Number of upper primary school		1
	Number of high schools and higher secondary school		Nil
	Nearest high school and higher secondary school		5km

Table 2. Tabular representation of Respondents' engagement with the ecosystem of Korapuzha and their Willingness to Pay

S. No	Respondents' engagement with Ecosystem	Percentage
1	Economic usage	52
2	No Economic usage	48
	Familiarization with the 'Willingness to Pay' word	
1	Familiar or awared	7
2	Unfamiliar	90
3	Refuse to answer	3
	Willingness for WTP	
1	Strong willing	60
2	Willing moderately	35
3	Do not care	2
4	Refused	2
5	Strongly refused	1
	Financial contribution for WTP per annum	
1	More than Rs10,000	1
2	Rs 5000 to Rs 10,000	13
3	Rs 1000 to Rs 4999	28
4	Rs 100 to Rs 999	33
5	Less than Rs 100	25
	Respondents' perspectives on methods for ecosystem protection	
	Government Involvement	99
	Public Involvement and mass awareness initiatives	1
	WTP perception among respondents based on gender	
	Positive WTP by men	82
	Positive WTP by women	21
	Negative WTP by men	18
	Refused to answer by women	79
	WTP perception among respondents based on age	
	Maximum Positive response by 18 to 38 age group	61
	Maximum Negative response by 39 to 59 age group	93

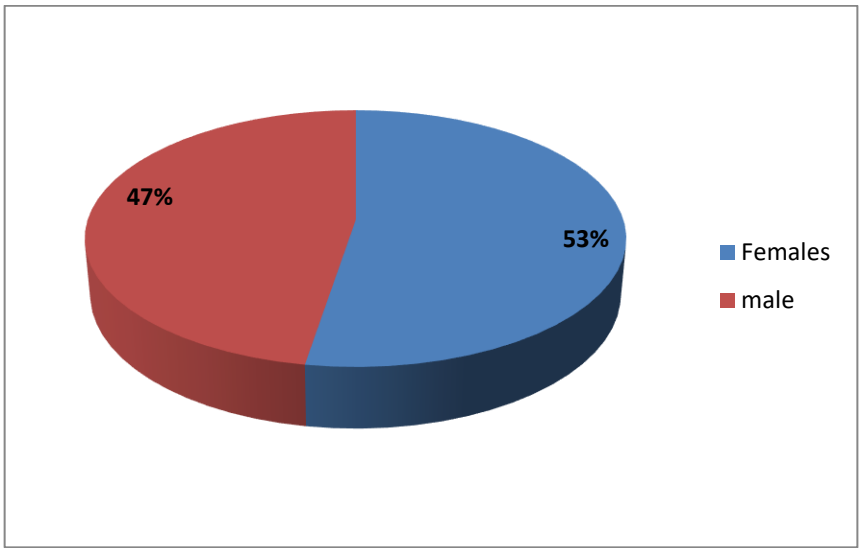

Fig. 1. Percentage distribution of Male and Female in Korapuzha

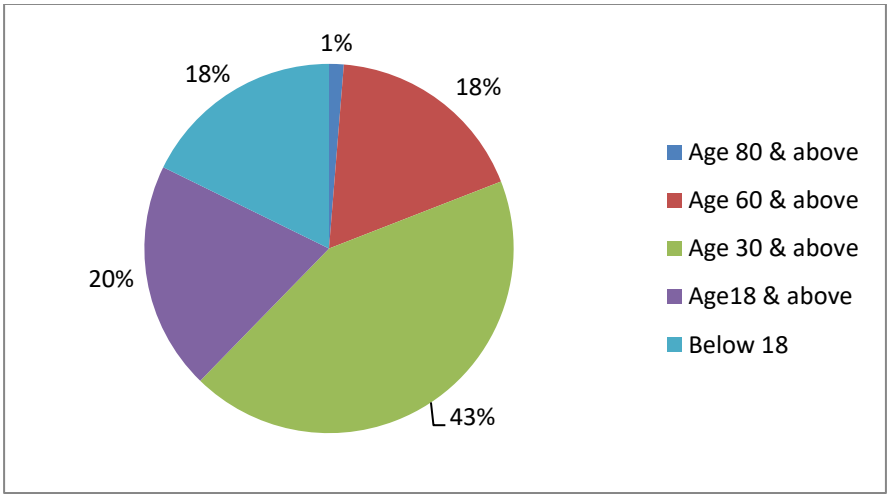

Fig. 2. Percentage Composition of Age Structure of Respondents of Korapuzha

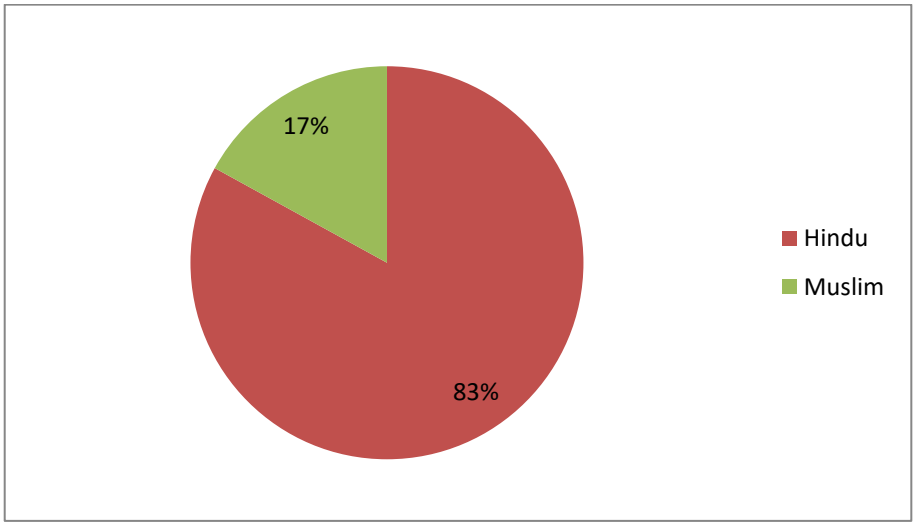

Fig. 3. Percentage Abundance of Religiosity of Surveyed population of Korapuzha

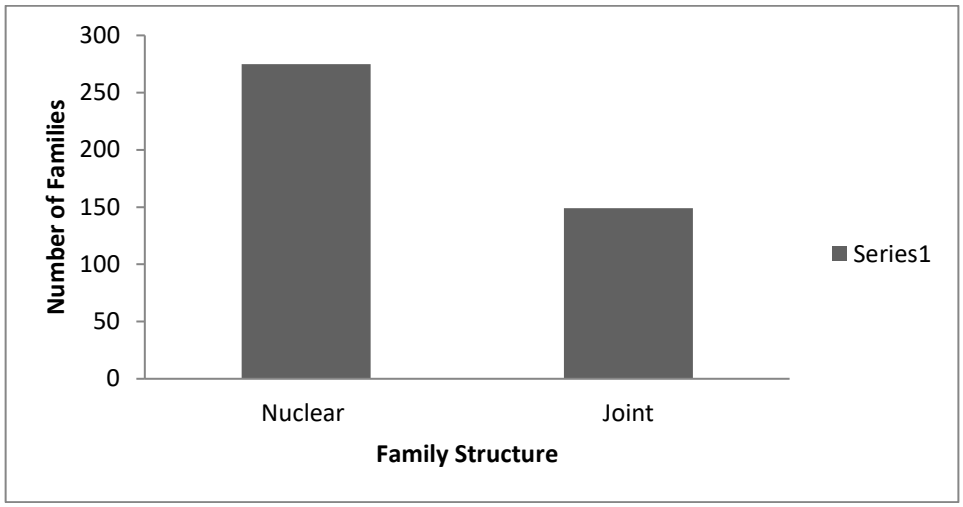

Fig. 4. Distribution of Family Structure of Households of Korapuzha Estuary

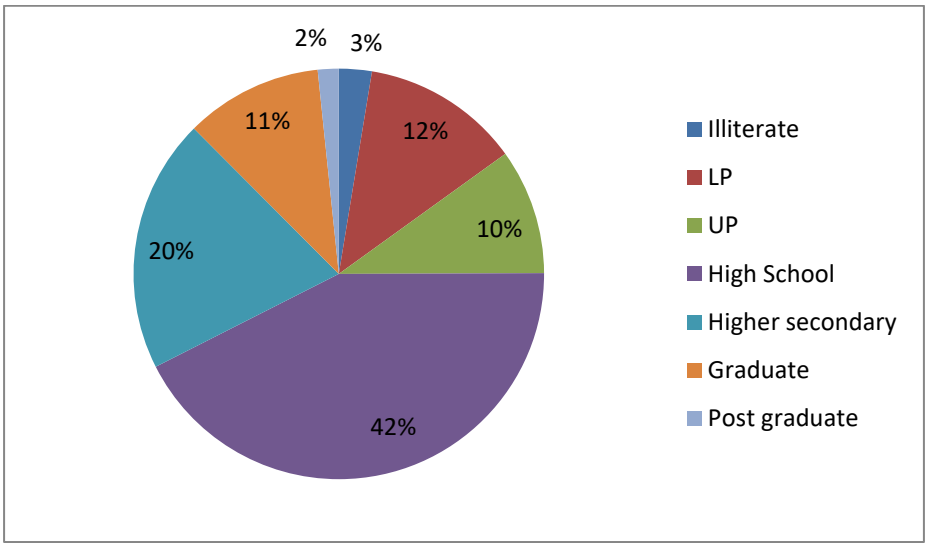

Fig. 5. Percentage Composition of Educational status of Respondents of Korapuzha estuary

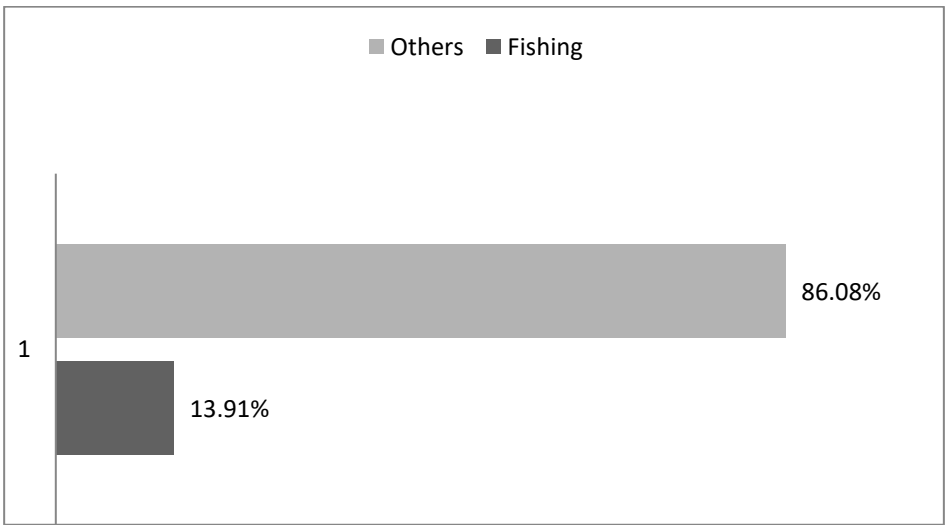

Fig. 6. Occupational Status of Respondents of Korapuzha

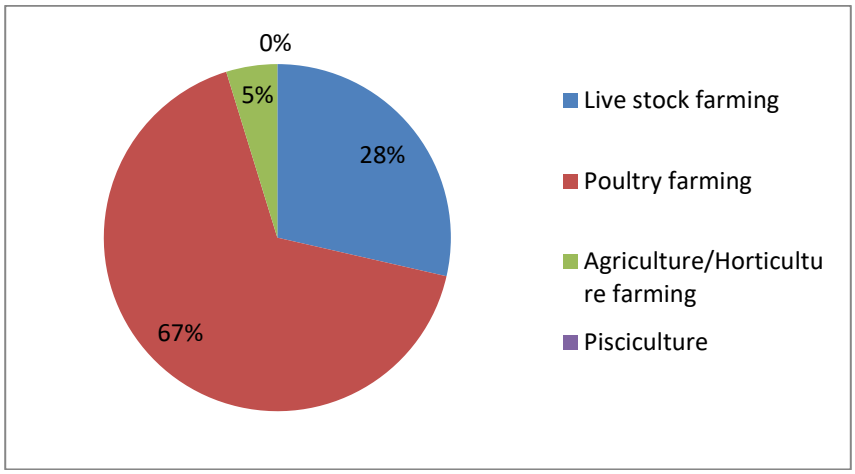

Fig. 7. Percentage distribution of respondents engaged in other livelihood culture practices

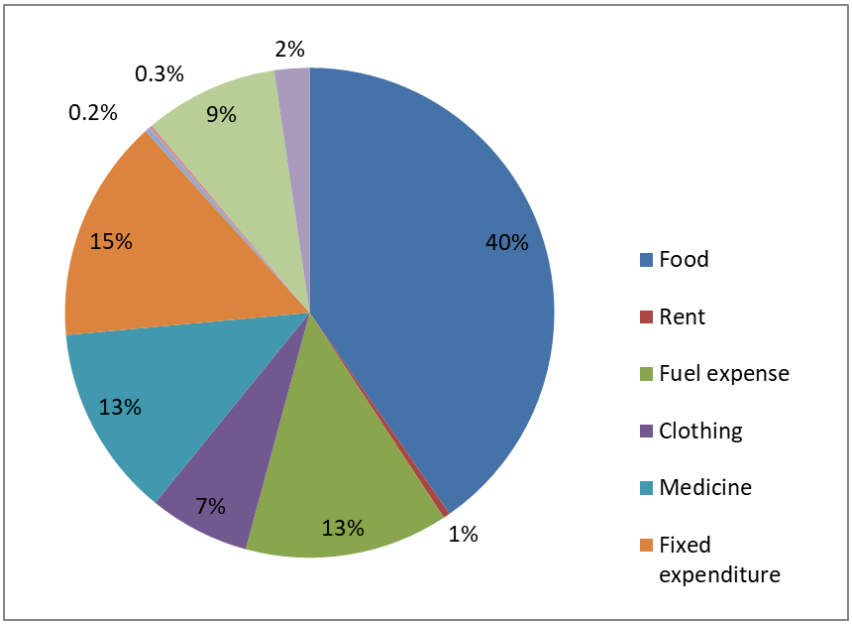

Fig. 8. Percentage distribution of household expenditure per annum

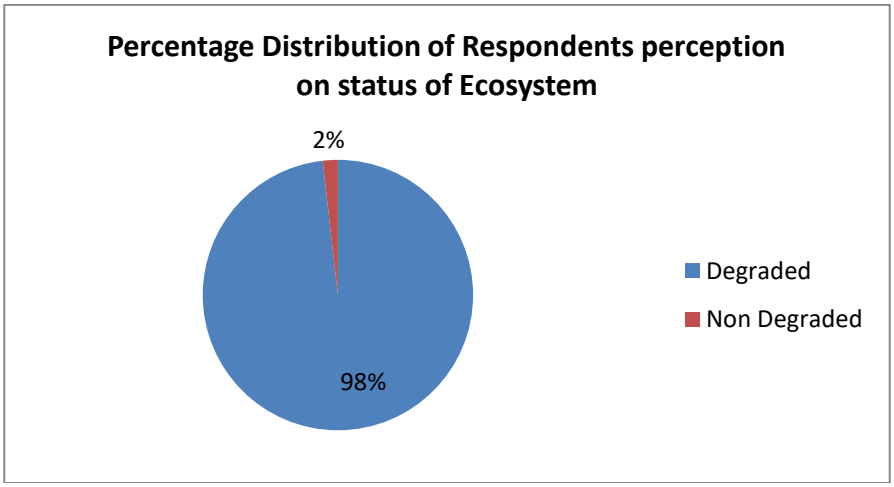

Fig. 9. Percentage Distribution of Respondents perception on status of Ecosystem status

3.10 Recommendations for Policy Guidelines in Uplifting the Socio-economic Dynamics of Korapuzha Estuary and Enhancement of Their Willingness to Pay (WTP) for Sustenance of Ecosystem Services

Several guidelines for uplifting the community's socio-economic conditions are recommended in detail. These policies will enhance the livelihood opportunities and their willingness to pay, thus imparting positive involvement in environmental conservation and management.

4. DISCUSSION

4.1 Social status of the Respondents

The present study analyzed the social status of the respondents within a defined sampling frame of 1713 individuals, ensured balanced gender distribution as well as comprehensive age ranges same as that of findings of Cortes-Espino et al. (2023), who reported a nearly equal distribution of respondents' gender, with 43% men and 57% women, justifying the consistency in gender representation across studies.

By focusing on 425 randomly selected households near the Korapuzha estuarine stretches, the study provided a representative insight into the population's social composition. The respondent's age distribution covered a detailed spectrum, showcasing the diversified community.

Comparatively, our research observations were similar to the demographic dynamics observed in Danti, Gujarat, India (Ujjain and Patel, 2011). Siar (2003) studied how age and gender influence the access to and awareness of the resources. Thus, the study offered valuable insights into the social dynamics of the surveyed respondents.

The present study examined the religiosity of respondents within the surveyed population. The majority identified as Hindu, with a smaller proportion belonging to the Muslim community. Our findings are consistent with Chavan *et al* (2009) reporting similar religious composition among the fishers of Maharashtra, India. The study on religious demographics of the population will provide more interpretation on the social dynamics and cultural practices among the community.

The surveyed population's marital status and family structure explored and reported married, consistent with the findings of Jayaselvi (2016) of majority of respondents being married (86%). The study examined the family structures, resulting predominance of nuclear family types than the joint families, aligning with the finding of Bhargavi et al. (2020) that about 48.7% of the respondents of the survey has less than five members in families whereas 51.3% of the respondents have more than five members. Besides this, the study reported that 64.9% of the respondents have nuclear families. The present study inquired into the educational attainments of the respondents, resulting in high literacy rates, encompassing diverse spectrum of educational experiences from lower primary to postgraduation. Among the respondents, 2.59% of illiterates, particularly elderly individuals, showcases the generational differences in educational levels among the community. These insights offer a comprehensive outline of the socio-dynamics of the respondents.

The study delved into the housing patterns and availability of the basic amenities within the community. This highlights the infrastructural facilities and access to it within the community, thus showcasing the high standard of living conditions.

4.2 Economic Status of the Respondents

The study shed light on the economic dynamics among the respondents, revealing a significant major one as the primary income earners, focusing their major role in financial stability. These results show the diverse economic roles and income classes within the surveyed community, thus stressing the diversified financial circumstances among the population in the vicinity.

The study data denotes a shift in the occupational landscape of the community, mainly fishing activities. This raises more concern of the community regarding exploration of alternative income generation. Overall, this captures attention over the occupational shifts within the community with more emphasizing the decline in fishing as well as emergence of allied income sources. Alam and Yousuf, (2024) observed similar findings of unwillingness of fishers to continue the fishing practices due to the unstable income generation. The study indicated a very drastic disinterest in fishing activities among the new generation. This unwillingness is attributed

to the instability in income generation. This highlight concerns about the sustainability and financial viability of traditional fishing practices. This comprehensive overview captures the evolution of occupational patterns within the community, emphasizing the decline in reliance on fishing as a primary livelihood and the emergence of alternative income sources.

The study delved into the agricultural practices of the respondents, exhibited diverse range of activities and level of participation. There was limited engagement of livestock farming as very few respondents involved in it. Most of the respondents were involved in poultry farming. Despite the community's very proximity to water bodies and being a fishing village, the pisciculture activities are entirely absent and none of the respondents were engaged in fish culture practices. Surprisingly, this absence stands in stark contrast to the outsiders introducing farming practices in the study vicinity. This highlights the blending of local traditions as well as external influences do shape the community's rural landscape.

The study shows that most of the respondents have strong saving behaviour except a few not actively involved. This underscores the financial cautiousness among the respondents and their diverse saving behaviour, projecting their sense of financial stableness and future planning among the community. The study also focused on the loan availing behaviour of the respondents, reflecting diverse borrowing practices. These findings highlight the various financial strategies by the respondents in order to manage their financial constraints effectively.

The study focused on the loan availing behaviour of the respondents, which emphasized on the diverse borrowing practices within the community. These findings stress on the various financial strategies incurred by the respondents so as to manage their financial balances.

4.3 Economic Security Measures of the Respondents

The study presented a comprehensive outlook of the socio-economic aspects within the respondents which is in alignment with Dhande et al. (2017) indicated 83.67% of fishers of coastal India are well equipped with saving accounts in financial institutions. This depicts the importance of financial security measures supporting the economic upliftment of coastal communities.

4.4 Expenditure Detailing of the Respondents

The study focused into the expense patterns of the respondents and also suggests more indication of the food related expenditures incurred. Moreover, this is compared to the educational status of the respondents, depicting potential priorities and financial stability among the community.

4.5. Health Status and Health Facilities

The study observed that there was limited access to health facilities. This scenario raises concerns about accessibility to healthcare services, especially in emergencies, and highlights the need for community health planning and potential collaboration with government authorities to address the existing gaps in healthcare provision. Consideration should be given to implementing health education programs, assessing transportation options, and exploring ways to enhance healthcare accessibility for residents.

4.6. Inventory of Educational Institutions

The study suggests a potential gap in educational continuity for the community's youth, emphasizing the importance of addressing the lack of local secondary education options. This is high time to explore solutions such as establishing local high schools or implementing transportation options to facilitate students' access to external educational facilities. This situation underscores the significance of comprehensive educational planning to ensure a seamless and accessible educational pathway for all residents.

4.7 Socio-economic Relationship of the Community to the Existence of Estuary

The respondents' stated the status of the ecosystem as degraded. These concerns voiced by respondents reflect the community's environmental consciousness and highlight the challenges faced by the ecosystem. This underscores the need for environmental conservation efforts and collaborative initiatives to address these ecological issues and

safeguard the estuarine ecosystem for future generations.

4.8 Communities Knowledge of Willingness to Pay (WTP) Concept

The survey findings reveal a distinct perspective among the respondents regarding their engagement with the riverine ecosystem. Our results are consistent with Atinkut *et al*. 2020. These findings underscore a complex interplay of economic, environmental, and socio-economic factors shaping the community's stand on riverine activities and their commitment to environmental conservation. This distribution of willingness to pay amounts reflects the varied financial capacities and environmental priorities within the surveyed community, emphasizing the collective commitment towards protecting and managing the ecosystem despite varying financial capabilities.

Subsequently, respondents were enquired about their perspectives on methods for ecosystem protection in the form of government assistance, by ways of natural resource utilization, by public awareness, commercial marketization of ecological assets, and other potential approaches. The community's response for government intervention in further conservation and management of Korapuzha estuary stresses on the collective belief in the pivotal role of governmental agencies that creates a faithfulness and reliance on government for the effective conservation efforts.

Analyzing the willingness to pay (WTP) among respondents based on gender and age categories yields strong perceptive and shows that younger individuals might be more future-oriented and concerned about long-term environmental sustainability. This refinement explains the gender and age-related dynamics in respondent's attitudes towards WTP, stressing on the varied perspectives residing in the minds of the surveyed community.

4.9 Socio-economic Factors of the Respondents Influencing WTP

During the survey, it was observed that there was a significant influence of socio-economic dynamics of the respondents with their willingness to Pay (WTP). Here, the respondent's gender, income, age, education and their relationship with estuary were studied.

Age groups of the respondents had a big role towards the acceptance of Concept "WTP". It was very clear that the younger respondents between the age group of 18-38 years were very much supportive for the environmental restoring. This came with 61 % of positive WTP. This shows that they value more in environmental conservation and management. In contrast to this, it was observed that age group of 39-59 were less willing and this may be due to the economic crisis through which they are undergoing.

There was a huge difference observed in opinions of different genders on WTP. It was observed that men showed very positive willingness on WTP compared to women. Here it was observed that 82 % of the male respondents favoured and supported the WTP Concept while 79 % of the women community expressed negative WTP. This may be due to the fact that among the respondents, women have less economic independence. This can be overcome by more empowering the women through awareness on environmental benefits and its sustenance as well as educating them on financial decision making.

The income level of the respondents had a crucial role in acceptance of the WTP Concept. It was observed that respondents with higher income earners supported the willingness concept. From the survey, it was clear that 80% of the respondents were in the middle-lower income earning category with an income generation of Rs 5000 to Rs 10,000 per month. It was observed that the respondents of lower income generation were against WTP. This may be due to their financial crisis while higher income generators were positive towards WTP Concept and ready to pay Rs 10,000/year. This shows that the good economic stability directly influences the willingness for ecosystem revival and contribution towards environmental initiatives.

The respondents had a high literacy rate of 97 %. Despite this, only 7 % of the community have knowledge on 'WTP' concept. Among the respondents, 42.6% had high school education, and 10.8% had higher education. When the concept of the WTP was detailed to them, there was a significant positive lineage of 60% of the respondents expressing willingness to pay for ecosystem services. This shows that creating more awareness can aid in more understanding of the ecosystem services, thus imparting more

WTP contribution. This signifies the need for more environmental education and awareness programs on ecosystem restoration.

In the present scenario, there is a gradual decrease in the active fishers (14%). Despite this, the estuary remains as significant part of their lives. During the survey, 98.2% of the respondents admitted the degradation of the estuary. This was justified with silt deposition, reduced availability of fishes and pollution. On contrary, 99 % of the respondents had a reliance on government to take initiative for ecosystem protection and management. This shows that the respondents are well aware on the environmental hazards and their implication for government led financial initiatives in ecosystem revival incorporating community involvement. Thus, the socio-economic dynamics of Korapuzha estuary have a significant role in fostering the WTP initiatives.

4.10 Recommendations for Policy Guidelines in Uplifting the Socio-economic Dynamics of Korapuzha Estuary and Enhancement of their Willingness to Pay (WTP) for Sustenance of Ecosystem Services

The present study stresses on the fact that there is a need for new guidelines for uplifting the socio-economic conditions of the community which will create more willingness for ecosystem revival. These policy implications can help in long term sustenance of the ecosystem.

1. Considering the Majority of the respondents belonging to middle-lower categories, there should be policies for providing incentives for ecosystem protection and conservation. Thus, these payment for ecosystem goods and services will increase the responsibility towards ecosystem revival.
2. Higher income earners of Korapuzha estuary can be provided more tax benefits for their contribution for Payment towards ecosystem revival. Thus, these policies will encourage them for more financial involvement towards WTP.
3. There is a remarkable gap visible between the respondent's educational achievement and their willingness for WTP. This can be negligible with more educational activities on environmental protection and imparting more awareness programs.
4. The authorities should take initiative in empowering the women community in decision making programs. This can be achieved by more implication of gender inclusive policies focussing on women, leading to more comprehensive engagement of both genders in environmental protection and management.
5. Policies should be implied for more involvement of younger generation in ecosystem management. There should be more educational activities and awareness programs on environmental protection, training in promoting setting up of eco-friendly income generative small-scale subsidiaries, promotion of eco-tourism in coastal waters and training in sustainable advanced fish farming practices. These economic uplifting of the younger generation can lead to long term ecosystem restoration.
6. Policies or guidelines to be implied for collaboration of government-community involvements in decision making. Along with this there should be more public-private collaborations and community-based management programs. This can increase the involvement and responsibility of community in ecosystem revival and thus increase the WTP.
7. Policies regarding creating more employment opportunities and income generation schemes will boost the economic dynamics of the communities, thus more willingness towards environmental efforts can be achieved.

Thus, it is the need of the hour to imply for policies on uplifting the socio-economic dynamics of the community and creating motivation for their involvement in ecosystem sustenance and willingness to pay (Lee, 2021).

5. CONCLUSION

The study focused into the socio-economic status of coastal communities along the Korapuzha estuary, India so as to provide a broad understanding of the economic and social conditions of the community. The study also offered insights over the challenges and opportunities the community faced, thus making it a baseline valuable information for decision making and ways to enhance, uplift the well-being of these coastal communities.

As a conclusion, the survey provided valuable information on the community's interaction with the services of estuary. Through the survey, respondent's socioeconomic status and their willingness to pay for the revival of ecosystem were understood. This creates a holistic assessment of the relation between socioeconomic and the services acquired from the ecosystem.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

All applicable international, national and/or institutional guidelines for the care and use of animals were followed by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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