RESEARCH PAPER

Coastal community awareness, resource utilization, and management strategies of mangrove resources in Tangub City, Misamis Occidental, Philippines

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Abstract

This study aimed to assess the level of awareness, utilization, and management strategies of coastal communities regarding mangrove resources in Tangub City, Misamis Occidental, Philippines. A total of 150 respondents from five coastal barangays were surveyed using an adopted questionnaire. The findings revealed that the coastal communities generally have a moderate to high level of awareness regarding the importance of mangroves, particularly in coastal protection, providing habitat for diverse organisms, and enhancing the aesthetic value of the sea. However, their awareness was lower in terms of the role of mangroves in releasing oxygen and absorbing carbon dioxide, and as a source of medicine and food. The utilization of mangrove resources showed a conservative approach, with limited commercial exploitation and fuel use. Moreover, the communities were actively engaged in coastal clean-up and supported local regulations and research activities. The study highlights the positive efforts made by the communities in preserving mangrove ecosystems, underscoring the importance of community-based conservation initiatives. These findings provide valuable insights for policymakers and stakeholders to promote sustainable management and protection of mangrove resources in the area.

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Introduction

Mangroves are among the most productive ecosystems on the planet, located at the land-sea interface in tropics, subtropics, and temperate zones in more than 118 countries' coastal areas (Sreelekshmi *et al.*, 2021; Giri *et al.,* 2011; Spalding *et al.*, 2010). Mangroves help to control the global climate by storing and sequestering carbon (Donato *et al., 2011)*, provide a home and breeding grounds for numerous animals (Carrasquilla-Henao and Juanes, 2017), provide food and livelihood to residents (Sawairnathan and Halimoon 2017; Barua and Rahman 2019; Quevedo *et al.*, 2020), protect local communities against coastal risks (Hochard *et al.*, 2019), source of raw materials for charcoal making and construction (Nfotabong-Athuell *et al.*, 2011; Sinfuego and Buot 2014; Gonzales *et al.*, 2017), and provides eco-cultural services, such as ecotourism (Spalding *et al.*, 2019). Given their wide range of services, mangrove ecosystems, which connect terrestrial and marine ecosystems, are gaining salience to forestry scientists (Bakhtiyari *et al.*, 2019).

The Philippines has 36,289 kilometers of coastline, with a relatively high diversity of mangrove due to its geographical location. The country is home to at least half of the world's mangroves (Primavera *et al.*, 2004) with approximately 65 mangrove species (Kathiresan and Bingham, 2001). It is considered as one of the top 15 most mangrove-rich countries in the world according to Long and Giri (2011). Despite the ecological and economic services provided by mangrove forests, they decline at an alarming rate. Mangrove forests in South Asia have been lost at a rate of 0.18% per year on average (Richards and Friess, 2016). Over the last three decades, the rate of loss has more than half, from 46,700 ha per year in 1990-2000 to 36,300 ha per year in 2000-2010, and 21,200 ha per year in the most recent decade. Between 1990 and 2020, the global area of mangroves shrank by 1.04 million ha (Leal and Spalding, 2022). As per estimates, mangroves have lost between 0.16% and 0.39% of their global coverage due to rapid coastal development (Hamilton and Casey 2016).

Deforestation and degradation, however, have had a significant negative influence on mangroves, with a loss of 20% to 35% of the global mangrove extent during the past 50 years (Polidoro *et al.*, 2010). Forest clearing, exploitation for raw resources, production of lumber, rapid coastal population increase, and urban expansion, were the main causes of mangrove losses in the 20th century (Richards and Friess, 2016; Thomas *et al.*, 2017). Large-scale conversion of mangroves to shrimp and rice aquaculture ponds has occurred due to economic and political emphasis on aquaculture development in order to capitalize on the increase in global aquaculture demand (Friess *et al.*, 2016).

Local residents have limited awareness about mangrove species and their ecological and economic advantages (Satyanarayana *et al.*, 2012). Knowledge deficits in understanding the mangrove ecosystem and the services it provides (Dencer-Brown *et al.*, 2018). This inadequate knowledge and unsustainable human interventions are the primary obstacles to mangrove conservation and restoration (Biswas *et al.*, 2009). There are few studies that have been conducted in the Philippines to investigate local awareness on mangroves, utilization, and their management strategies. Thus, this study is undertaken in order to assess the level of awareness, utilization, and management strategies of the coastal communities towards mangroves resources in Tangub City, Misamis Occidental. The results of this study serve as baseline information for the policy makers, local coastal communities, and concerned national agencies in formulating management strategies to conserve the mangrove ecosystem in Tangub, City.

Materials and methods

Study area

This study was conducted in Tangub City, Misamis Occidental, Philippines. It is a coastal city in the province of Misamis Occidental. It is situated at approximately 8° 4' North and 123° 45' East. The city has a land area of 162.78 square kilometers (62.85 square miles), accounting for 8.11% of the total area of the province. In the 2020 census, the population of

Tangub City was 68,389 people, with a density of 420 inhabitants per square kilometer or 1,100 inhabitants per square mile (PhilAtlas, 2023). Tangub City is politically subdivided into 55 Barangays, 15 of those Barangays are coastal Barangays. Five coastal barangays cover (San Apolinario, Mantic, Balatacan, Bocator, and Lorenzo Tan) have diverse mangroves were chosen as the sampling areas of the study (Fig. 1).
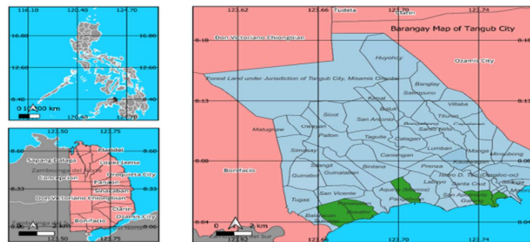

Fig. 1. Sampling sites of the study; map of Tangub City, Misamis Occidental

Table 1. Five-point likert rating scale with verbal interpretation, score point, and range of values for the level of awareness on mangroves to its environmental importance among coastal communities

Verbal Interpretation	Score Point	Range of Values
Not Aware	1	1.00-1.80
Slightly Aware	2	1.81-2.60
Somewhat Aware	3	2.61-3:40
Moderately Aware	4	3.41-4.20
Extremely Aware	5	4.21-5.00

Table 2. Five-point likert rating scale with verbal interpretation, score point, and range of values for resource utilization and management strategies towards mangrove resources among coastal communities

Verbal Interpretation	Score Point	Range of Values
Never	1	1.00-1.80
Rarely	2	1.81-2.60
Sometimes	3	2.61-3.40
Often	4	3.41-4.20
Always	5	4.21-5.00

Research respondents

The respondents of the study were the coastal communities residing in selected 5 coastal barangays in Tangub City - San Apolinario, Mantic, Balatacan, Bocator, and Lorenzo Tan. A simple random sampling of 150 respondents was fixed in the study. Personal interview was conducted to determine the level of awareness, utilization, and management strategies of the coastal communities towards mangrove resources.

Data collection

A courtesy visit was done with the Chairpersons of the selected sampling areas of the study. Data were gathered through personal interview with the aid of an adopted questionnaire excerpted from the study of Baldago and Gomez (2016); Alimbon and Mansequiao (2021); and Quevedo *et al.* (2020) with minor modifications. An adopted questionnaire was divided into 4 parts. First was focused on the demographic profile of the respondents; second was focused on level of awareness among the respondents on the importance of mangroves; third was focused on the resource utilization; and lastly, the management strategies conducted towards mangrove resources.

Data analysis

Descriptive statistics were used to describe the socio-demographic and socio-economic profile of the respondents such as mean, frequency, and percentage. Inferential statistics such as Chi-square test for independence was utilized to ascertain the significant relationship between variables. Moreover, a 5-point Likert scale (Table 1 & 2) was employed to analyze the level of awareness on mangrove resources to its environmental importance, to interpret resource utilization, and management strategies among the coastal communities.

Results and discussion

Demographic profile of the respondents

The survey results indicated in Table 3 that most of the respondents were female, comprising 64% of the total respondents. Regarding the age profile, the largest age group among the respondents were individuals aged 58 years old and above, constituting 25% of the total respondents. This finding suggests that the respondents in the survey participated by older individuals. Most of the respondents interviewed were married (70%). When it comes to educational attainment, the results show that most of

the respondents completed their secondary education, accounting for 48%. This suggests that the survey may have been accessible to a wide range of participants, including those with higher levels of education. However, a significant proportion of respondents (35%) only graduated from elementary school, indicating that the survey reached individuals with varying educational backgrounds. Regarding religious affiliation, most of the respondents (67%) identified as Roman Catholic, while 19% identified as members of Iglesia ni Cristo.

Table 3. Socio-demographic profile of the respondents

Demographic variables	Characteristics	(%)
Sex	Male	36
	Female	64
Age	18-27 years old	9
	28-37 years old	23
	38-47 years old	23
	48-57 years old	19
	58 years old abaove	25
Marital Status	Single	15
	Married	70
	Widowed	15
	Separated	0
Educational Attainment	Elementary	35
	High School	48
	College	17
	Vocational	0
Religion	Roman Catholic	67
	Iglesia Ni Cristo (INC)	19
	Seventh Day Adventist (SDA)	5
	Born Again	9

Table 4. Socio-economic profile of the respondents

Socio-economic variables	Characteristics	(%)
Household size	Less than 5 members	38
	5-10 members	47
	10 members above	15
Occupation	Fisherman	35
	Farmer	3
	Housewife	40
	Business owner	7
	Government Employee	4
	Private Employee	5
	Others	6
Monthly Income	₱ 10,000 below	91
	₱ 10,001 - ₱ 20,000	7
	₱ 20,001 - ₱ 30,000	2
	₱ 30,000 above	0

Economic status of the respondents

In terms of occupation, only 35% of respondents are fishermen, indicating that the majority of the respondents in coastal areas were not involved in fishery-related activities. Housewife accounts for 40% of responses, with businessmen accounting for 7%. Furthermore, the majority of respondents reported to have a monthly salary of Php 10,000 or less (91%), with salaries ranging from Php 10,000 to Php 20,000 accounting a total of 7%.. According to the PSA (2020), the average monthly poverty line for a family of five is less than Php 10, 756.00, implying that the monthly income per family in the area is insufficient to meet their basic food and non-food needs (Table 4).

Level of awareness of the coastal communities on the importance of mangrove resources

Table 5 presents the results of a survey that aimed to assess the level of awareness among coastal communities regarding the importance and various functions of mangrove forests. Mangrove ecosystems are recognized in providing variety of advantages that either directly or indirectly enhance human well-being (Alongi, 2008; Crooks et al., 2017). The findings indicate that the coastal communities generally have a moderate to high level of awareness about several key aspects of mangrove forests. The respondents are moderately aware (mean=3.69) that mangroves prevent garbage from scattering from the seashore to the sea. This reflects a basic understanding of the vital role mangroves play in trapping and filtering debris, which contributes to maintaining cleaner coastal environments. A study of Martin et al. (2019) revealed that mangroves specifically its pneumatophores are likely to filter out trash before it is spread in the marine environment, or if litter from the marine environment reaches the beach, it is unlikely to be washed ashore again due to the presence of pneumatophores. Litter stranded on a beach is typically transported back to the marine environment by winds and regular rise of ocean waters (Martin, 2019)

The respondents demonstrated an extremely high level of awareness (mean=4.24) regarding mangroves' ability to help establish a positive image of the sea. This suggests that the coastal communities recognize the aesthetic and ecological significance of mangrove

forests in enhancing the coastal landscape and creating a visually appealing seascape. The demand for mangrove forest nature tourism is growing globally. Mangrove forests have long been a well-liked tourist attraction (Mialhe *et al.*, 2016). Furthermore, the respondents displayed moderate awareness (mean=4.19) that mangrove areas are inhabited by a variety of birds. This highlights an understanding of the importance of mangroves as critical habitats for diverse avian species, providing nesting, breeding, and feeding grounds for a wide array of birds.

Another notable finding is that the respondents were extremely aware (mean=4.37) of mangroves' role in protecting coastal areas and communities from storm surges, waves, tidal currents, and typhoons. This demonstrates a strong recognition of the crucial role mangroves play in coastal protection, acting as natural buffers that mitigate the impacts of coastal erosion and extreme weather events. Additionally, the coastal communities showed moderate awareness (mean=4.11) that mangroves are essential breeding, nursery, and feeding areas for a vast array of organisms. This indicates an understanding of the ecological significance of mangroves in supporting various marine and terrestrial species' life cycles and food chains. The mangrove trees and canopy above the sea provide habitat for a diverse range of creatures. Birds, insects, mammals, and reptiles are among them (Nagelkerken, 2008). This observation is quite similar to the findings of Alimbon and Manseguiao (2021) and Nagelkerken (2008), wherein the space between roots of the mangroves were considered being a habitat and a nursery or spawning ground for other organisms such as prawns, crabs, and fishes.

While the respondents demonstrated good awareness in several aspects, their awareness levels were lower in certain areas. They showed only slight awareness (mean=2.08) of mangroves' role in releasing oxygen and absorbing carbon dioxide, which are crucial ecosystem services provided by mangrove forests. Similarly, the respondents were slightly aware (mean=1.99) that mangroves help in sustaining clean

groundwater by absorbing impurities and harmful metals, and only moderately aware (mean=3.79) that mangroves provide habitats for a large number of marine and terrestrial fauna, they are slightly aware (mean=2.39) that mangrove resources serve as a recreational grounds for wildlife enthusiasts, and also they possessed a limited awareness of the use of mangroves in making furniture (mean=2.53). Moreover, the respondents exhibited limited awareness (mean=1.41) that mangroves can be a source of medicine for various illnesses, and they were not at all aware (mean=1.72) that mangroves can serve as a food source. Furthermore, the respondents demonstrated somewhat awareness (mean=3.09) that mangroves provide fuel resources, such as firewood and charcoal, but only slightly aware (mean=1.93) that mangroves also provide construction and fishing materials. Lastly, they showed slight awareness (mean=2.00) that parts of the mangrove forests are being dumped with filling materials for reclamation purposes.

Mangrove resources utilization of the coastal communities
Table 6 shows the overall response of the locals in each statement about the utilization of coastal communities on mangroves resources. It was depicted in the study that engaging in recreational activities in mangrove areas, such as bird or bat watching, hiking, and boating, is rare, with a mean of 2.01.

On the other hand, activities involving the commercial use of mangrove resources are almost non-existent among the respondents. These include using mangroves as fishing materials (mean=1.14) and collecting mangrove lumber for sale (mean=1.03). It appears that the local communities are not heavily involved in exploiting mangrove resources for economic gain, suggesting a potential adherence to conservation practices. The findings also show that using mangrove resources for fuel purposes, such as firewood and charcoal are rare (mean=1.97 and mean=1.07, respectively). Similarly, there is limited usage of mangrove parts for medicinal purposes (mean=1.21) or as a dying agent (mean=1.08).

Table 5. Level of awareness of the coastal communities on the importance of mangrove resources

SL	Statement	Mean	Interpretation
1	Mangroves prevent garbage to scatter from the seashore to the sea.	3.69	Moderately Aware
2	Mangroves can help establish a good image of the sea.	4.24	Extremely Aware
3	There are a variety of birds inhabiting the mangrove area.	4.19	Moderately Aware
4	Mangroves protect coastal areas and communities from storm surges, waves, tidal currents, and typhoons.	4.37	Extremely Aware
5	Mangroves are used by a vast array of organisms as breeding, nursery, and feeding areas.	4.11	Moderately Aware
6	Mangroves play an important role in coastal protection by acting as a natural buffer to water erosion from both the land and the sea.	4.14	Moderately Aware
7	Mangroves release oxygen and absorb carbon dioxide.	2.08	Slightly Aware
8	Mangroves provide habitats for a large number of marine and terrestrial fauna.	3.76	Moderately Aware
9	Mangrove helps in sustaining clean groundwater.	1.99	Slightly Aware
10	Mangrove is the habitat for a variety of species.	3.79	Moderately Aware
11	Mangroves serve as recreational grounds for wildlife enthusiasts.	2.39	Slightly Aware
12	Mangrove is a hardwood kind of tree that that is good for making furniture.	2.53	Slightly Aware
13	Mangroves can be a source of medicine for a variety of illnesses.	1.41	Not Aware
14	Mangroves serve as a food source	1.72	Not Aware
15	Mangroves provide fuel resources (e.g., firewood, charcoal)	3.09	Somewhat Aware
16	Mangroves provide construction and fishing materials (e.g., timber, fishing stakes, and fishing boats)	1.93	Slightly Aware
17	There are parts of the mangrove being dumped with filling materials as reclamation areas for wharf or house construction.	2.00	Slightly Aware

*Interpretation range:4.21-5.00 (Extremely Aware); 3.41-4.20 (Moderately Aware); 2.61-3.40 (Somewhat Aware); 1.81-2.60 (Slightly Aware); 1.0-1.80 (Not Aware)

Table 6. The utilization of coastal communities on mangrove resources

SL	Statement	Mean	Interpretation
1	Using mangroves resource as fishing materials (e.g., poles for fish traps, rafts, and boats).	1.14	Never
2	Using mangroves resource as firewood.	1.97	Rarely
3	Using mangrove parts for medicinal purposes.	1.21	Never
4	Using mangroves resource for charcoal.	1.07	Never
5	Using mangroves as a dying agent.	1.08	Never
6	Using mangroves resource for house construction and repair	1.18	Never
7	Collecting mangroves resource as lumber for sale	1.03	Never
8	Using mangroves resource in agriculture	1.05	Never
9	Using mangroves resource for furniture	1.05	Never
10	Using mangroves in recreational activities (e.g., bird/bat watching, hiking, boating, etc.)	2.01	Rarely

*Interpretation range: 4.21-5.00 (Always); 3.41-4.20 (Often); 2.61-3.40 (Sometimes); 1.81-2.60 (Rarely); 1.0-1.80 (Never)

Moreover, the local communities demonstrate little engagement in using mangroves for construction and repair of houses (mean=1.18) or for agricultural purposes (mean=1.05). Similarly, utilizing mangroves for furniture is infrequent (mean=1.05).

Overall, the survey results reveal a conservative approach by the local communities towards the utilization of mangrove resources. The results suggest that these communities are aware of the importance of preserving mangrove ecosystems and are likely taking measures to avoid excessive exploitation.

These cautious behaviors can be attributed to growing awareness of the ecological significance of mangroves, including their role in providing essential ecosystem services, protecting coastlines, and supporting biodiversity. It also highlights the potential success of conservation efforts and community-based initiatives aimed at promoting sustainable practices and safeguarding these critical coastal habitats for future generations.

Management strategies towards mangrove resources among the coastal communities

Table 7. Management strategies by the coastal communities towards mangrove resources

SL	Statement	Mean	Interpretation
1	Selective harvesting	2.89	Sometimes
2	Coastal Clean-up	3.50	Often
3	Mangrove Planting	3.17	Sometimes
4	Monitoring and Evaluation	2.79	Sometimes
5	Supporting local regulation related to mangrove resource	4.13	Often
6	Cooperate in Information, Education and Communication (IEC) Campaign	3.01	Sometimes
7	Disposing of garbage and chemicals responsibly	3.88	Often
8	Supporting research and data collection	4.39	Always
9	Removal of dead wood to grow more seedlings of mangroves	2.13	Rarely
10	Fencing along the intertidal zone to prevent livestock access	1.68	Never

*Interpretation range: 4.21-5.00 (Always); 3.41-4.20 (Often); 2.61-3.40 (Sometimes); 1.81-2.60 (Rarely); 1.0-1.80 (Never)

Table 8. The relationship between the respondents' profile (sex, age, marital status, and educational attainment) and their level of awareness on the importance of mangroves

Variables	Computed x^2 value	Degrees of freedom	x^2 critical value at 0.05	p-value	Interpretation
Sex	8.63	4	9.49	0.07	Accepted
Age	11.14	16	26.30	0.80	Accepted
Marital Status	11.67	8	15.51	0.17	Accepted
Educational Attainment	3.66	9	15.51	0.89	Accepted

H_o : There is no significant relationship between the respondents' profile (sex, age, marital status, educational attainment) and their awareness on the importance of mangroves

Table 9. The relationship between the respondents' profile (sex, age, marital status, and educational attainment) and their utilization of mangrove resources

Variables	Computed x^2 value	Degrees of Freedom	x^2 critical value at 0.05	p-value	Interpretation
Sex	2.00	2	5.99	0.37	Accepted
Age	6.79	8	15.51	0.56	Accepted
Marital Status	5.12	4	9.49	0.28	Accepted
Educational Attainment	2.67	4	9.49	0.62	Accepted

H_o : There is no significant relationship between the respondents' profile (sex, age, marital status, educational attainment) and their utilization of mangrove resources.

Table 10. The relationship between the respondents' profile (sex, age, marital status, and educational attainment) and their management strategies towards mangrove resources

Variables	Computed x^2 value	Degrees of Freedom	x^2 critical value at 0.05	p-value	Interpretation
Sex	3.17	4	9.49	0.53	Accepted
Age	5.48	16	26.30	0.99	Accepted
Marital Status	5.88	8	15.51	0.66	Accepted
Educational Attainment	2.06	8	15.51	0.98	Accepted

H_o : There is no significant relationship between the respondents' profile (sex, age, marital status, educational attainment) and their management strategies towards mangrove resources.

Table 7 showcases the various activities related to mangrove conservation and sustainable resource management undertaken by the local coastal communities. Results showed that coastal clean-up appears to be one of the most common activities, with a mean of 3.50, indicating that it is often carried out by the local communities. This positive trend demonstrates their commitment to keeping the coastal areas free from debris and pollutants, which is crucial for the health of mangrove ecosystems and the surrounding marine environment. Locals often participate in clean-up drives since it is compulsory,

with local leaders spearheading the efforts to promote cleanliness and orderliness in the community. Coastal communities claim that their local officials constantly monitor their compliance on environmental protection activities. It is important that all established initiatives must be closely monitored to ensure their effectiveness, and ongoing evaluation is necessary to examine both the advantages and disadvantages of each project (Tupas and Cacho, 2020). This demonstrates the critical role of barangay officials, as local representatives in spreading information and executing activities that enable their constituents to comprehend and support environmental protection by placing a high priority on environmental sustainability and conservation. Local stakeholders are equally important in the management of these ecosystems as local government units because they are the ones that manage, use, and alter these ecosystems (Muhamad *et al.*, 2014).

Supporting local regulations related to mangrove resources also appears high, with a mean of 4.13, indicating that it is often practiced by the community. This level of involvement suggests that the local communities are actively participating in the governance and management of mangrove resources, likely through adherence to conservation guidelines and regulations. Moreover, coastal communities are responsible in dealing with their wastes, they often dispose their garbage and chemical wastes responsibly (mean=3.88). Furthermore, supporting research and data collection is an activity that is highly valued by the local communities, as evident from its mean of 4.39. This proactive engagement in research and data collection highlights the community's interest in understanding the ecological dynamics of mangrove ecosystems and making informed decisions for their preservation. On the other hand, activities such as selective harvesting (mean=2.89), mangrove planting (mean=3.17), monitoring and evaluation (mean=2.79), and cooperation in information, education, and communication campaigns (mean=3.01) were practiced sometimes. Moreover, removal of dead wood to grow more seedlings of mangroves (mean=2.13) is also rarely performed. Similarly,

fencing along the intertidal zone to prevent livestock access is reported to be a never practiced activity (mean=1.68).

Overall, the findings highlight the positive efforts made by the local communities in protecting and conserving mangrove ecosystems. Activities such as coastal clean-up, supporting local regulations, and engaging in research and data collection reflect their active involvement in sustaining these vital coastal habitats. However, there is still room for improvement in certain areas, such as promoting more frequent selective harvesting, mangrove planting, and implementing measures to prevent livestock access. The findings suggest that community-based conservation efforts play a crucial role in preserving the ecological integrity of mangrove ecosystems.

The association between respondents' profile (age, sex, marital status, and educational attainment) and their level of awareness on the importance of mangrove resources

Table 8 shows the associations between respondents' profile (sex, age, marital status, and educational attainment) and their level of awareness on the importance of mangroves. The findings revealed that, demographic variables such as sex (P=.07), age (P= .80), marital status (P= .17) and educational attainment (P= .89) have no significant relationship to the level of awareness on the importance of mangroves among the respondents. These results contradict to the study conducted by Coulibaly-Lingani (2014) with regards to level of education among respondents that people with higher education are more aware about the services provided by the mangroves forest to the environment. Moreover, with regards to age a study conducted by Nchimbi and Lyimo (2019), it revealed that the age in every household had significant influence on the level of awareness on the importance of mangroves.

The association between respondents' profile (age, sex, marital status, and educational attainment) and their utilization of mangroves resources

Table 9 shows the association between respondents' profile (sex, age, marital status, educational attainment) and the utilization of mangroves resources. Results depicted that respondents' profile such as sex ($P=.37$), age ($P=.56$), marital status ($P=.28$), and educational attainment ($P=.62$) have no significant relationship to the utilization of mangrove resources among the respondents. It means that utilizing mangrove resources not all must be related to a demographic profile of a person it must be dealing of the policies they have.

The association between respondents' profile (age, sex, marital status, and educational attainment) and management strategies of coastal communities

Table 10 revealed that there is no significant relationship between demographic profile (sex, age, marital status, and educational attainment) and management strategies of coastal communities. It means that factors such as sex ($P=.53$), age ($P=.99$), marital status ($P=.66$), and educational background ($P=.98$) of the respondents do not influence how management strategies are carried out. Indeed, the demographic profile is not a determining factor in improving the mangrove ecosystem. In contrary to the studies conducted by Infield and Namara (2001), and Agarwal (2009), the results indicate that socio-demographic attributes such as education and gender have a positive influence on the attitudes of local communities towards conservation, as women respondents are disproportionately affected by resource-use constraints, and respondents with higher levels of education were found to be more conscious and enthusiastic about conservation. It is supported by the study of Creencia and Querijero (2021) when it comes to mangrove resources, services, and conservation techniques, women are more informed and knowledgeable than men.

Conclusion

Mangrove ecosystems provide direct and indirect services to coastal communities in Tangub City, Misamis Occidental. Coastal residents recognize the function of mangrove resources especially in coastal protection (protection from storm surges, waves, tidal currents, and typhoons). This pushes local officials to collaborate with coastal communities to create strategies and implement initiatives to promote environmental conservations. With constant monitoring of barangay officials for compliance on environmental protection activities, locals support on regulations relating to mangrove management, disposed their garbage and chemicals responsibly, and actively participate in clean-up drives. On top of that coastal communities always support research and data collection. Moreover, results revealed a conservative approach by the local communities towards the utilization of mangrove resources. The results suggest that these communities are aware of the importance of preserving mangrove ecosystems and are likely taking measures to avoid excessive exploitation. Furthermore, the study revealed that there is no significant association between demographic profile (e.g. sex, age, marital status, educational attainment) and the responses of the respondents regarding to their level of awareness, mangrove utilization, and management strategies of mangrove resources.

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