

RESEARCH PAPER**OPEN ACCESS****Correlation between the knowledge and awareness on solid waste management and the waste density in the coastal areas of Talibon, Bohol, Philippines****Gerald Rhey Ortega, Nathalie T. Bordios****Bohol Island State University-Bilar Campus, Zamora, Bilar, Bohol, Philippines***Key words:** Coastal Barangays, Knowledge and awareness, Policy implementation, Solid waste management, Waste density**Received:** 17 July, 2026**Accepted:** 27 July, 2026**Published:** 03 August, 2026**DOI:** <https://dx.doi.org/10.12692/jbes/29.2.1-9>**ABSTRACT**

The purpose of this study is to determine the relationship of the knowledge and awareness of solid waste management (SWM) to the actual waste density in the coastal barangays of Talibon, Bohol namely: Santo Niño, San Francisco, Bagacay and San Pedro. Mixed-methods approach was used to explore this relationship, where surveys were conducted to find out residents' knowledge and awareness of SWM and field measurements were taken to measure the waste density in the study sites. The results showed no significant relationship between residents' knowledge and awareness of SWM and actual waste density observed in the coastal barangays. The results suggest that awareness and knowledge are not sufficient on their own to change waste management outcomes. However, despite high levels of SWM knowledge and awareness among respondents, improper waste disposal practices continued to prevail, largely due to weak policy enforcement, inadequate waste management infrastructure, limited garbage collection services and the remoteness of material recovery facilities (MRFs). These findings collectively underscore the importance of institutional and infrastructural factors in influencing waste management practices beyond individual awareness. Thus, the study highlights the need to improve implementation of waste management policies, optimize the waste collection systems, and promote community-based interventions that can successfully translate environmental awareness into tangible waste mitigation outcomes. The findings ultimately provide useful insights to LGUs and environmental organizations in designing more effective, context-specific and sustainable solid waste management strategies for coastal communities.

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INTRODUCTION

The steady growth in the density and volume of non-degradable solid waste produced by human activities has led to a gradual accumulation of marine litter in the oceans, on the sea floor and on coastlines worldwide. Coastal areas are the meeting point of terrestrial and marine ecosystems and are thus vulnerable to the problems of solid waste management, especially where human settlements, economic activities and marine environments are close to each other. With increasing coastal populations, the pressure on these ecosystems is expected to increase, exacerbating the environmental degradation. In addition, low knowledge and awareness of solid waste management (SWM) among community members can lead to poor waste disposal practices that increase the accumulation of coastal pollutants. These concerns are especially worrying because the main sources of ocean pollution are land-based activities like households, agriculture, transportation, septic systems, sediment runoff, and industrial activities.

Consequently, thousands of tons of waste are dumped into the oceans every day, posing a danger to coastal ecosystems and marine biodiversity (Vikas and Dwarakish, 2015).

These global issues are also mirrored in the Philippine setting. Over the past 20 years, the Philippines' coastal areas have experienced increasing environmental stress due to human activities. In 2019, the Philippines was the biggest national contributor to marine plastic pollution, accounting for 36.38% of the world's oceanic plastic waste (Ramos, 2023). As a result, many coastal communities continue to grapple with plastic pollution, poor waste disposal, and the subsequent degradation of marine environments. These national challenges highlight the importance of understanding waste management behavior drivers at the community level.

Despite increasing awareness of these environmental issues, there is a pronounced deficiency of studies dealing with the direct association between residents'

knowledge and awareness of SWM and the actual density of waste in coastal environments. Previous research has mainly studied SWM practices, environmental awareness or waste density as separate research fields, with little attention paid to the interactions of these factors in coastal communities. Thus, it is uncertain whether mere increased knowledge and awareness will suffice to stem the tide of waste accumulation in these environmentally sensitive areas. Filling this research gap is essential to design evidence-based interventions that integrate education, infrastructure and policy implementation.

Faced with this gap, the present study examined the relationship between the residents' knowledge and awareness of solid waste management and the density of waste in the coastal barangays of Talibon, Bohol. Specifically, the study was premised on the assumption that the higher the SWM knowledge and awareness levels are, the lower the waste density should be. Thus, it evaluated the existing knowledge and awareness levels about waste management among the coastal residents and its relation with the measured waste density.

In addition to testing this relationship, the findings of the study have important implications for environmental sustainability, public health and coastal resource management. The results are expected to help LGUs, environmental managers and policymakers design targeted waste management policies, strengthen environmental education programs and improve community-based interventions. In conclusion, the study contributes to the development of more efficient and sustainable solid waste management strategies in coastal areas by providing empirical information on the relationship between human awareness and real environmental conditions.

MATERIALS AND METHODS

Research design

This study used a descriptive-correlational research design to find out the relationship between the level of knowledge and awareness of the respondents in

solid waste management (SWM) and the density of waste collected in the coastal areas. The descriptive-correlational approach was determined as the best research design since the study was aimed to find associations and not causal relationships.

Research environment

The research was conducted in the selected coastal barangays of Talibon, Bohol, namely San Pedro, Santo Niño, Bagacay and San Francisco (Fig. 1).

Talibon is an up-and-coming coastal town where communities have strong ties to the marine environment. The sea is the main source of livelihood and food for many households, often of several generations. These communities are consequently directly exposed to the environmental effects of improper solid waste disposal and thus an appropriate ground to explore the relationship between SWM knowledge, awareness, and waste density.

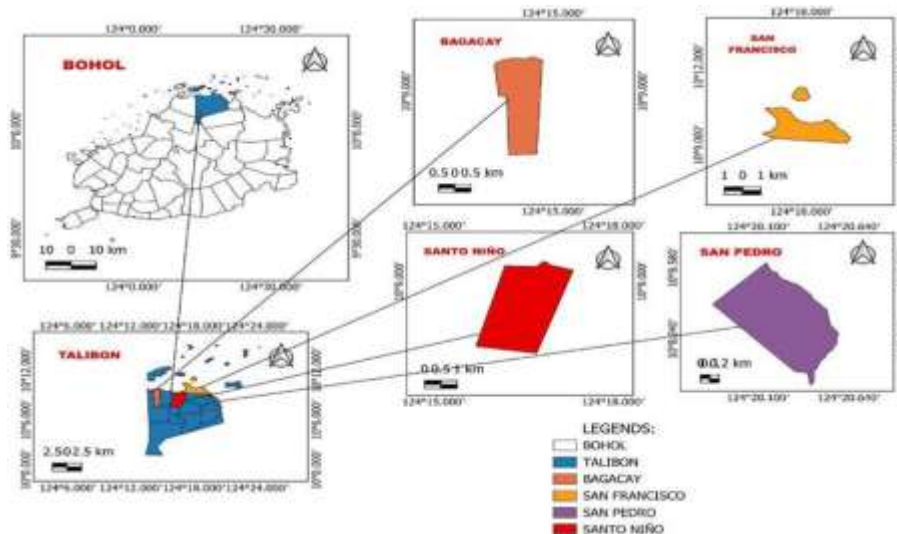


Fig. 1. Location map of the study site

Selection of respondents

Participants were selected using a purposive sampling method to ensure they had direct links to the coastal environment of interest. The study population included all households within 500 meters of the waste sampling sites. This distance was selected according to the work of Jambeck *et al.* (2015) that showed that populations living near coastlines are major sources of marine waste. On this starting point, the researcher selected a 500-m radius, because communities closer to the coastline are more likely to contribute to coastal waste accumulation. The selected respondents were then requested to fill a structured questionnaire on their knowledge and awareness of solid waste management.

Procedures for data collection

Once the study sites and participants were identified, the researcher obtained necessary

approvals prior to data collection. Permission was obtained from the Department Chairperson of Environmental Science, Dean of College of Forestry and Environmental Science and Campus Director of Bohol Island State University-Bilar Campus. Likewise, formal letters requesting permission to undertake the study were sent to the Barangay Captains of San Pedro, Santo Niño, Bagacay and San Francisco.

Ethical consideration

To uphold ethical research standards, each participant was given an informed consent form that detailed the study's purpose, voluntary participation, and confidentiality of all responses. The survey questionnaire was administered to the respondents after obtaining their consent. To help understanding and reduce the language barriers, a version of the questionnaire translated into the

Cebuano language was provided. As a complement of the survey, field measurements were done to find out the density of waste in the selected coastal areas. We set up a quadrat of one square meter along the coast, and all collected waste materials were separated into plastic, non-plastic and hazardous waste and weighed separately. All survey responses and field measurements were collected and sorted for statistical analysis.

Data analysis

The obtained data were analyzed using appropriate statistical methods to achieve the objectives of the study. Descriptive statistics like frequency, percentage, weighted mean and mode were used in summarizing the demographic profile of the respondents. The knowledge and awareness of the respondents on solid waste management was also determined using the weighted mean.

The relationship between the respondents' demographic characteristics (age, sex, educational attainment and attendance in environmental seminars) and their levels of knowledge and awareness was analyzed through multiple regression analysis. Furthermore, multiple regression was used to determine if the respondents' knowledge and awareness have a significant effect on the waste density observed in the selected coastal barangays. Statistical significance was set at the 0.05 level.

RESULTS

Demographic profile of the respondents

Table 1 presents the demographic profile of the 146 respondents. The majority were 30 years old and below (36.3%), followed by those aged 31–40 years (21.2%). Female respondents comprised 74.7% of the sample, while males accounted for 25.3%. In terms of educational attainment, the largest proportion were high school graduates (25.3%), followed by high school level (23.3%) and elementary graduates (17.8%). Most respondents (80.8%) reported that they had not attended any seminars or activities related to environmental protection.

Table 1. Demographic profile of the respondents

Item	Frequency n=146	Percent %
Age		
30 and below	53	36.3
31-40	31	21.2
41-50	25	17.1
51-60	25	17.1
60 and above	12	8.2
Sex		
Male	37	25.3
Female	109	74.7
Highest educational attainment		
Elementary level	24	16.4
Elementary graduate	26	17.8
Highschool level	34	23.3
Highschool graduate	37	25.3
College level	22	15.1
College graduate	3	2.1
Attended seminars or activities on environmental protection?		
Yes	28	80.8
No	118	19.2

Knowledge on ecological solid waste management

The overall weighted mean score was 3.86, interpreted as Highly Knowledgeable. Respondents obtained the highest scores on identifying biodegradable and non-biodegradable waste (4.42), proper garbage disposal (4.38), and the "Clean As You Go" policy (4.38). Conversely, the lowest scores were obtained for knowledge of Republic Act 9003 (2.64) and Republic Act 6969 (2.85), both interpreted as Moderately Knowledgeable (Table 2).

Awareness on solid waste management

Respondents demonstrated a Very Highly Aware level regarding the 3Rs of solid waste management, with an overall weighted mean of 4.27. Among the three dimensions, respondents obtained the highest scores on reducing plastic bag use (4.47), reusing empty jars (4.40), and encouraging recycling at home (4.37) (Table 3).

Waste density

Bagacay recorded the highest waste density (5.86 kg/m²), followed by San Francisco (3.00 kg/m²), Santo Niño (2.16 kg/m²), and San Pedro (1.25 kg/m²). Overall, non-plastic waste accounted for the highest accumulated density (6.29 kg/m²), followed by plastic waste (5.21 kg/m²) and hazardous waste (0.77 kg/m²) (Table 4).

Table 2. Respondents' level of knowledge on solid waste management

Category	WMS	Interpretation
1.Republic Act 9003	2.64	Moderately Knowledgeable
2.Solid Waste Management	3.38	Moderately Knowledgeable
3.Policies on SWM program	3.23	Moderately Knowledgeable
4.Purpose of the management on implementing SWM	3.45	Highly Knowledgeable
5.Importance on SWM	3.71	Highly Knowledgeable
6.Practicing SWM saves money and energy	3.72	Highly Knowledgeable
7.People's roles and responsibilities towards SWM program	3.65	Highly Knowledgeable
8.Implementation will be successful and effective if concerned people will participate	4.07	Highly Knowledgeable
9.Proper disposal of garbage	4.38	Very Highly Knowledgeable
10.Discipline on SWM matters a lot	4.09	Highly Knowledgeable
11.Possible illnesses that you can get whenever trashes are not properly disposed	4.18	Highly Knowledgeable
12.Before throwing garbage, it is a must to read those trashcan label for segregation	4.34	Very Highly Knowledgeable
13.Importance of recycling	4.21	Very Highly Knowledgeable
14.Identification of biodegradable from non-biodegradable	4.42	Very Highly Knowledgeable
15.Importance of segregation	4.26	Very Highly Knowledgeable
16.Waste minimization practices like reuse, reduce, recycle	3.99	Highly Knowledgeable
17.Community's orientation on SWM program	3.64	Highly Knowledgeable
18.Practices on SWM implemented in community	3.88	Highly Knowledgeable
19.Advantage and disadvantage of SWM	3.78	Highly Knowledgeable
20.SWM program is a big help in the environment	4.18	Highly Knowledgeable
21.Degradation/destruction that wastes can cause to the environment	4.18	Highly Knowledgeable
22."Clean As You Go Policy"	4.38	Very Highly Knowledgeable
23.Composting method for organic waste	3.99	Highly Knowledgeable
24.Sanctions for violation of not disposing garbage properly	3.82	Highly Knowledgeable
25.Financial resources which can be generated from wastes	4.01	Highly Knowledgeable
26.Republic Act 6969	2.85	Moderately Knowledgeable
27.Used oil is hazardous waste	3.36	Moderately Knowledgeable
28.E-wastes are hazardous waste	3.60	Highly Knowledgeable
29.Broken glasses and used paints are hazardous waste	4.17	Highly Knowledgeable
30.Medical wastes are hazardous waste	3.92	Highly Knowledgeable
31.Pesticides and its bottle are hazardous waste	4.01	Highly Knowledgeable
32.Hazardous waste should be separated from non-hazardous waste	4.10	Highly Knowledgeable
33.There should be a special partition in MRF for hazardous waste	3.68	Highly Knowledgeable
34.Importance of proper disposal of hazardous waste	4.03	Highly Knowledgeable
35.Proper handling and storage of hazardous wastes	4.01	Highly Knowledgeable
36.Sanctions for violations of not properly disposing hazardous wastes	3.68	Highly Knowledgeable
Overall Average	3.86	Highly Knowledgeable

The level of knowledge was interpreted using the following mean score ranges: 4.21–5.00 as Very Highly Knowledgeable, 3.41–4.20 as Highly Knowledgeable, 2.61–3.40 as Moderately Knowledgeable, 1.81–2.60 as Poorly Knowledgeable, and 1.00–1.80 as No Knowledge.

Relationship between demographics and knowledge/Awareness

Multiple regression analysis showed that educational attainment significantly predicted respondents' knowledge on SWM ($\beta = 0.208$, $p = 0.016$). However, age ($p = 0.468$), sex ($p = 0.064$), and attendance in seminars ($p = 0.249$) were not significant predictors. For awareness, none of the demographic variables significantly predicted respondents' awareness levels ($p > 0.05$).

Correlation between knowledge, awareness and waste density

Table 6 presents the regression analysis examining the relationship between respondents' knowledge and awareness on SWM and waste density. The regression model was not statistically significant ($F = 0.298$, $p = 0.743$), indicating that knowledge and awareness did not significantly predict waste density in the coastal barangays. Accordingly, the study hypothesis was rejected.

Table 3. Respondent's level of awareness on solid waste management

Awareness on 3R's	WMS	Interpretation
A. Reduce		
1. I am aware that reducing the use of plastic bags is environmentally friendly.	4.47	Very Highly Aware
2. Using paper bags is a good alternative of using plastic when shopping.	4.29	Very Highly Aware
3. Reducing stockpile of the use of plastics bottles decreases garbages.	4.19	Highly Aware
4. I am aware that reducing wastes is beneficial to the community.	4.35	Very Highly Aware
5. At home, I encouraged my family to avoid using disposable table wares.	4.14	Highly Aware
B. Reuse		
1. Reusing old clothes is cost-saving and practical.	4.34	Very Highly Aware
2. Reusing scratched papers is economically-friendly	4.23	Very Highly Aware
3. Reusing empty jar for other purposes reduces the generation of non-biodegradable waste	4.40	Very Highly Aware
4. Repairing usable household cleaning tools help save money and decreases household garbage.	4.27	Very Highly Aware
5. Keeping old but usable items save dumpsite space.	4.10	Highly Aware
C. Recycle		
1. Recycling items is cost-saving.	4.24	Very Highly Aware
2. Recycling is the most commonly-used waste management practices.	4.01	Highly Aware
3. It is essential to motivate my family on recycling waste materials at home.	4.37	Very Highly Aware
4. Recycling items provides more opportunities to reduce wastes.	4.32	Very Highly Aware
5. Recycling allows household members to value their belongings and respond to environmental concerns.	4.37	Very Highly Aware
Overall average	4.27	Very Highly Aware
The level of awareness was interpreted using the following mean score ranges: 4.21–5.00 as Very Highly Aware, 3.41–4.20 as Highly Aware, 2.61–3.40 as Moderately Aware, 1.81–2.60 as Poorly Aware, and 1.00–1.80 as Unaware.		

Table 4. Waste density collected

Area	Plastic waste (kg/m ²)	Non-plastic waste (kg/m ²)	Hazardous waste (kg/m ²)	Total (kg/m ²)
Sto.Nino	0.45	1.62	0.09	2.16
San Francisco	1.4	1.32	0.28	3
Bagacay	2.54	3.01	0.31	5.86
San Pedro	0.82	0.34	0.09	1.25
Total	5.21	6.29	0.77	

Table 5. Analysis of demographic variables as predictors of knowledge and awareness on solid waste management

Dependent variable: Knowledge					
Predictors: (Constant), age, sex, educational attainment, seminars					
Model	Understandized coefficients		Standardized coefficients		
	B	Std. error	Beta	t	Sig.
Constant	3.257	.263		12.382	.000
Age	-.028	.039	-.062	-.727	.468
Sex	.223	.119	.160	1.867	.064
Educational Attainment	.079	.032	.208	2.441	.016
Seminars	.148	.128	.097	1.157	.249
Dependent variable: Awareness					
Predictors: (Constant), age, sex, educational attainment, seminars					
Model	Understandized coefficients		Standardized coefficients		
	B	Std. error	Beta	t	Sig.
Constant	3.813	.285		13.392	.000
Age	-.037	.042	-.078	-.891	.375
Sex	.212	.129	.144	1.644	.102
Educational Attainment	.051	.035	.125	1.439	.152
Seminars	.083	.139	.051	.597	.552

Table 6. Analysis on the correlation of knowledge and awareness and the waste density

Model	df	F	Sig.	Interpretation	Decision
Regression	2	.298	.743	Not significant	Failed to reject Ho

DISCUSSION

The demographic characteristics of the respondents provide an important context for the interpretation of the findings of this study. The predominance of younger respondents mirrors the usual demographic makeup of many Philippine coastal settlements, which often have a substantial portion of the population in the economically productive age bracket. Likewise, the higher proportion of female respondents emphasizes the important role of women in household activities such as waste segregation and disposal. Most of the respondents were at least high school graduates but most of them did not attend any seminar or training on environmental protection. This implies that their knowledge on solid waste management (SWM) could have been obtained from formal education, community experiences, media exposure, and information campaigns by the local government rather than specialized environmental training.

Despite low participation in environmental seminars, respondents show high level of knowledge on solid waste management. Respondents are knowledgeable on waste segregation, proper disposal, recycling and environmental conservation. This finding is consistent with the studies of Evaristo *et al.* (2022) and Pimienta *et al.* (2024) which also found that community residents had a high level of knowledge on waste management practices. However, respondents had low knowledge of Republic Act No. 9003 (Ecological Solid Waste Management Act of 2000) and Republic Act No. 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990). This suggests that while residents are generally familiar with practical waste management, they have less knowledge of the legal frameworks governing environmental protection.

Therefore, public awareness of these environmental laws could improve compliance and encourage more community participation in solid waste management programs.

We found a similar trend in environmental awareness as well. The respondents exhibited a very high awareness of the principles of Reduce, Reuse and

Recycle (3Rs) which suggests that environmental consciousness is already well established in the selected coastal communities.

This result is in agreement with the study of Balaba *et al.* (2024) who observed that people with higher environmental awareness are more likely to recognize the importance of sustainable waste management practices. However, awareness should not be regarded as a real environmental behavior. Despite the respondents being clearly aware of the importance of practicing the 3Rs, the continued waste accumulation observed in the study shows that environmental awareness alone is not sufficient to ensure consistent waste management practices in the absence of addressing external barriers.

This is more visible when considering the waste density measured in the four coastal barangays. The study sites varied greatly in terms of waste density; the highest was recorded in Bagacay and the lowest in San Pedro. Such differences are likely to reflect differences in waste management practices, local environmental conditions, and the effectiveness of community initiatives. This dominance of non-plastic waste is also consistent with the findings of Herdiansyah *et al.* (2021), who reported that non-plastic materials constituted a large fraction of coastal waste accumulation. These findings suggest that all types of solid waste should be addressed in coastal waste management interventions, not only plastic pollution. Effective waste collection systems, proper waste segregation and regular clean-ups of the coast are still important to reduce waste build-up in the coastal ecosystems.

The demographic factors analysis also showed that educational attainment was the only variable that was significantly associated with the respondents' knowledge of solid waste management.

Those with higher levels of education generally have a higher level of environmental literacy, as they are exposed to environmental concepts more frequently in formal education. In contrast, age, sex and attendance

in environmental seminars were not significantly related to either knowledge or awareness. Jerimias and Fellizar (2019), and Abushammala and Ghulam (2023) reported similar observations, which found a weak association between demographic characteristics and environmental awareness. The findings suggest that day-to-day experiences, social interactions, media exposure, and community engagement may exert a greater influence on environmental awareness than demographic characteristics alone. Therefore, environmental education should be designed to reach the whole community and not only to target certain demographic groups.

The most important result of this study is that there is no statistically significant correlation between the respondent's awareness and knowledge on Solid Waste Management and the measured waste density in the coastal barangays. The respondents were characterized by high knowledge and very high awareness on proper waste management, but this did not translate to lower levels of waste accumulation. This finding indicates that knowledge and awareness are not sufficient to change real environmental conditions. Rather, the results suggest that more than individual understanding is at play, with a wider range of institutional, infrastructural and behavioral factors influencing waste density. The community members' feedback offers some insight into the absence of this relationship.

Many respondents pointed to a lack of access to waste disposal facilities, the absence of regular garbage collection services, long distances to material recovery facilities (MRFs) and limited waste transport services as major barriers to proper waste disposal. Others acknowledged that, despite penalties for improper waste disposal, lax and inconsistent enforcement of environmental regulations allow undesirable practices to continue. The observations suggest that the residents may be aware of the proper waste management procedures but are not able to consistently apply this knowledge due to lack of institutional support and limited waste management infrastructure.

Similar concerns are also noted in local assessments of Bohol's waste management system, which identified infrastructure limitations and implementation gaps as persistent challenges in effective solid waste management.

The results, in general, suggest that improving the management of coastal waste requires a comprehensive approach that combines environmental education with institutional strengthening. But these efforts must be accompanied by improvement of waste collection services, access to material recovery facilities, adequate waste disposal infrastructure, consistent enforcement of environmental regulations, and continued improvement of public knowledge and awareness.

Strengthening these complementary components would enable communities to translate their existing environmental knowledge into sustainable waste management practices ultimately contributing to cleaner, healthier and more sustainable coastal ecosystems

CONCLUSION

The study found out that the coastal residents in Talibon, Bohol have a high level of knowledge and a very high level of awareness on solid waste management. Knowledge significantly associated with demographic factors was educational attainment only. Age, sex or participation in environmental seminars did not exhibit significant relationships with knowledge or awareness.

However, despite these positive levels of knowledge and awareness, no significant relationship was found between these factors and the measured waste density in the coastal barangays. This means waste minimisation is not just about educated and conscious communities but also better waste management infrastructure, successful policy implementation and stronger institutional support.

RECOMMENDATION(S)

The study recommends that local government units should strengthen the implementation of Republic Act No. 9003 through consistent enforcement of waste

management policies, regular waste collection and improved access to Material Recovery Facilities (MRFs) and other waste disposal infrastructure. Environmental education programs should continue emphasizing proper waste management, but should focus more attention on educating the public on applicable environmental laws. Efforts to involve the community in coastal clean-up activities and waste reduction programs should be continued to encourage responsible environmental behavior.

Finally, future research could examine other factors affecting the accumulation of waste in coastal areas such as institutional capacity, waste management infrastructure, household practices and policy implementation in order to provide a more holistic view of solid waste management in coastal areas.

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