

AQUACULTURE FARMERS' PERCEPTION AND LEVEL OF AWARENESS OF PLASTIC LITTER IN SAN PEDRO, DAPITAN CITY, MINDANAO, THE PHILIPPINES

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Abstract: Aquaculture is an important livelihood sector, and environmental threats to this sector are considered a major concern, particularly those that involve plastic pollution. It has significant impacts on marine and aquatic organisms, yet management, mitigation, and preventive measures are still challenging due to human intervention. This study aims to determine the level of awareness and perception of the impacts of plastic pollution among aquaculture farmers in San Pedro, Dapitan City, the Philippines. Their knowledge of and behaviour towards plastic were obtained through interviews employing a survey instrument utilising the Likert scale. The results show that the respondents are aware of plastic pollution's impacts. Despite the level of awareness, consumption of plastic products persists due to a lack of alternatives. The respondents are also aware of the challenges of conducting clean-up drives. The perceived plastic pollution impacts are a serious concern, especially to their livelihood. As the aquaculture farmers depend on Pulaan River, they want the river to be clean and free from plastic pollution. The level of awareness and perception among aquaculture farmers of environmental threats and their impacts are relevant in mitigating and preventing environmental and human health issues, ensuring the sustainability of the aquaculture sector.

Keywords: Aquaculture, marine pollution, social perception, sustainability.

Introduction

The growth of plastics as a material integral to modern life and as a source of environmental pollution has been widely documented since the mid-20th century. (Zalasiewicz *et al.*, 2016; MacLeod *et al.*, 2021). The Philippines is ranked the third-largest plastic polluter in the world (Jambeck *et al.*, 2015; Omeyer *et al.*, 2022) and the largest contributor of riverine plastics as estimated through the model by Meijer *et al.* (2021). Rivers are pathways for land-based sources of plastics, where they can be distributed by air, inland waterways, and human activities (Vester & Bouwan, 2020; Kießling, 2021; Bergman *et al.*, 2022; Escañan & Bacosa, 2022). Up to 100% of floating litter constitutes

plastics, which make them problematic marine litter (Galgani *et al.*, 2015; Milican & Agarwal, 2021; Gaboy *et al.*, 2022; Requiron & Bacosa, 2022).

The increase in solid waste generation per day is linked to the rapid growth of the global population, and most of these wastes were not collected properly or illegally dumped, especially in water systems (Atienza, 2008; and Braaten *et al.*, 2021; Inocente & Bacosa, 2022; Acot *et al.*, 2022). This can result in the reduction in provisions of different ecosystem services, which can affect the fisheries, aquaculture, recreation, and heritage sectors, leading to dire economic consequences (Beaumont *et al.*, 2019; Aretoulaki, 2021).

Up to three billion people depend on marine and coastal biodiversity resources (OECD, 2020). About 60% of the Philippines' population live in coastal areas, and wastes from their households are the most visible, with other sources being agricultural and industrial activities. (Mundo *et al.*, 2009; Galarpe *et al.*, 2021; Sajorne *et al.*, 2021).

Aquaculture is a fast-growing sector that provides almost 50% of the world's fish supply, with a gross tonnage reaching up to 66.6 million tonnes valued at US\$137.7 billion in 2012, and this amount is projected to rise to 62% by 2030 (FAO, 2014; Barrett *et al.*, 2021; Campbell *et al.*, 2021). The Philippines, as an archipelagic nation, considers aquaculture products as major export commodities. With the booming fisheries and aquaculture industry in the country, fisherfolk and aquaculture farmers have the tendency to use plastic materials in their practices, like most of the aquaculture farmers of Barangay San Pedro in the City of Dapitan. As most of them reside on the riverside, their influence on riverine waste generation is significant, and according to Willis *et al.* (2017), the deposited plastics came from near their sources. Therefore, most plastic litter observed in Pulaan River could be from households and aquaculture farms (Requiron & Bacosa, 2022).

Although there are aquaculture farmers that care for the marine environment, the awareness and perception of the impacts of waste or plastic litter may vary. Similarly, farmers' behaviour and practices on plastic usage and solid waste disposal may differ. Insights from local stakeholders are valuable information on the state of the marine ecosystem to where they are exposed and the changes over time that directly affect them and their livelihood (Pauly, 1995; Kumar *et al.*, 2021; Browning *et al.*, 2021). The aquaculture farmers, which are local people, are the respondents in this study. Although the knowledge of local communities is sometimes disregarded (Bennett & Dearden, 2014; Omeyer *et al.*, 2021), their input is still significant to help decision-makers develop locally feasible solutions and informed

decisions (Leite & Gasalla, 2013; Busch *et al.*, 2021). The worsening problem of plastic pollution, especially from the riverine system, is compelling reason to obtain insights from the aquaculture sector, which is a major beneficiary of marine resources, but can be greatly affected by plastic pollution.

More recently, the problem of plastic pollution in the marine environment is exacerbated by the Covid-19 medical waste mismanagement across the globe (Sham & Manhub, 2021; Silva *et al.*, 2021; Benson & Palanisami, 2021). Discarded face masks can be found in riverine systems and can be a source of microfibrils and vectors of contamination (Wang *et al.*, 2022). Many of these Covid-19-related personal protective equipment (PPE litter), including face masks and face shields, can end up in waterways and marine areas (Chowdhury & Sait, 2021), including the Philippines (Abreo & Kobayashi 2021; Sajorne, *et al.*, 2022).

This study explores the level of awareness and perception of the impacts of plastic litter, as well as the behaviour and practices of aquaculture farmers in San Pedro, Dapitan City, the Philippines. This study can potentially be the basis for the formulation of or improve the implementation of waste management laws, as well as the development of management strategies and programmes connecting stakeholders within aquaculture communities – i.e., state/local policies and farm households (Gutierrez, 2021).

Materials and Methods

Location of the Study

The study was conducted in Dapitan City, specifically in Barangay San Pedro. Dapitan City is located in the northern part of Zamboanga Peninsula, with the approximate geographical coordinates of 8°50' north latitude and 123°30' east longitude. It has a total area of 39,053.1267 hectares. It is bounded in the north by Sulu Sea, in the south by the Municipalities of Mutia and La Libertad, in the east by the Municipalities of Sibutad and Rizal, and in the west by Dipolog

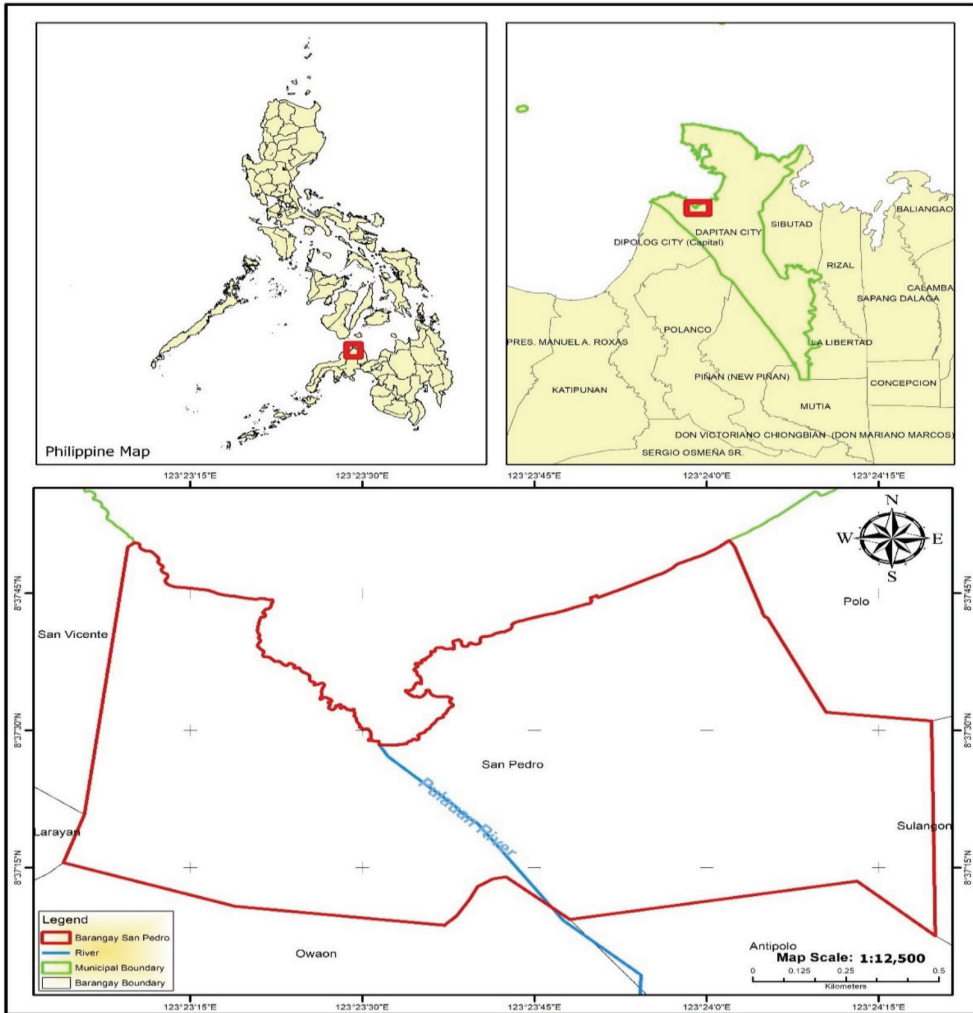


Figure 1: Map of the study area

City and the Municipalities of Polanco and Piñan, all in the Province of Zamboanga del Norte, the Philippines. The topography of the city is described as level to rolling with interiors being mostly mountainous and hilly (CLUP 2014-2024).

Respondents

The aquaculture farmers in San Pedro were the target participants of the survey to determine their level of awareness and perception of plastics and their practices that can lead to the proliferation of macroplastics and microplastics

in the river. The insights of this sector, which are the direct beneficiaries and are dependent on the resources of Pulauan River, are of utmost significance and relevance.

Sampling Method

Purposive sampling was employed to determine the level of awareness and perception of the aquaculture farmers. There were 50 aquaculture farmers identified in the area and all were included as respondents. A “pen and paper” survey was conducted. This was done from August 23 to 27, 2021. The questionnaire was

formulated based on Phelan *et al.* (2020) and Dubey *et al.* (2016), with modifications to identify the practices that lead to the presence of macroplastics and microplastics in Pulauan River. The questionnaire is divided into six parts: (1) socio-demographic profile of the respondent; (2) aquaculture practices; (3) level of awareness; (4) knowledge of marine plastics; (5) behaviour towards marine litter; and, (6) perception of plastics. The data gathering followed the ethical guidelines stipulated under the MSU-IIT Ethics Review Committee (IERC).

Data Analysis

The Likert scale was used to analyse the data. Responses to the questions/statements were coded as indicated:

- a. Level of awareness (Fully aware=5, Aware=4, Moderately Aware=3, Slightly Aware=2, Not Aware=1)
- b. Behavior on marine litter (Never=1, Seldom=2, Sometimes=3, Usually=4, Every time=5)
- c. Perception on plastic litter impact (Not at all serious=1, Slightly serious=2, Somewhat serious=3, Serious=4, Very serious=5)

The median scores were obtained in each part of the questionnaire by finding out the midpoint of all the responses to a question/statement (Sullivan & Artino, 2013). The number of data points in this research is even; the median is the average between the two middle data points in the list (rounded up to a whole number). As the instrument utilised in this research was formulated according to Phelan *et al.*, (2020), the coding procedure is uniform/patterned. This uniformity is strategic as it provided ease of comparability and understanding among localities and studies that utilised the same approach.

Limitations of the Research

This paper deals with the community's perception – stakeholders – on the increasing

problem of plastic waste within the aquaculture environment. There is a physical measure of litter prevalence through actual data collection within the target site. While the plastic litter issue is pressing, and prevention and affirmative behavioural changes are desired consequences in the context of this study, this study cannot provide that sort of behavioural prediction. The line of study applying preventive measures needs to be contextualised in relation to targeted locale ordinances on a post-project analysis. That can be addressed in future studies relative to stakeholders' perception and ecological awareness of resource and environmental sustainability.

Results and Discussion

Socio-demographic

A total of 50 aquaculture farmers were surveyed in this study for 5 days. Most respondents were housewives (female: 66%) because during the interview, their husbands were away for work, or their aquaculture farm is a family business where they, too, are very much involved (Table 1). High school graduates (28%) were predominant, hence their level of awareness and perception was expected to be mostly based on their experiences and their actual observations of their environment. Most of the respondents live on the riverside area to have better access to their farms in the river.

The presence of inhabitants in an area implies the abundance of plastic litter in Pulauan River. Though some of them have other occupations, for most of the respondents, aquaculture is their only source of income that only yields a monthly income of below 5,000 pesos depending on the demand for the products. These aquaculture farmers need government attention or government subsidies to increase their production and income to meet their day-to-day needs.

Table 1. The socio-economic profile of the respondents

Characteristics	Categories	Frequency (N=50)	Percentage (%)
Gender	Female	33	66
	Male	14	34
Age	21-30	3	6
	31-40	13	26
	41-50	9	18
	51-60	11	22
	61-70	9	18
	71-80	5	10
Civil status	Single	2	4
	Married	27	54
	Separated	1	2
	Live-in	10	20
	Widow	10	20
Household Area	Mangrove/Riverside	41	82
	Residential	9	18
Educational Attainment	Elementary level	12	24
	Elementary graduate	5	10
	High school level	6	12
	High school graduate	14	28
	College level	7	14
	College graduate	6	12
Income (monthly)	below 5,000 pesos	29	58
	5,001 to 10,000 pesos	16	32
	10,001 to 15,000 pesos	4	8
	15,000 pesos and above	1	2
Source of income	Government employee	1	2
	Private employee	8	16
	Aquaculture farmer (only)	29	58
	Fisherman	5	10
	Vendor	7	14
Number of years living in the area	Less than 5 years	1	2
	5 to 10 years	1	2
	10 to 15 years	7	14
	20 years and above	41	82

Aquaculture Practices

The study site is characterised as brackish water since it is the confluence of freshwater coming from the tributaries and main river and the marine water as they meet at the mouth of the river. Oysters are the most cultivated livestock in the area, followed by fish and crabs. Monoculture cultivation is mostly practised, while some pursued an integrated cultivation system that raises different kinds of aquaculture species. According to the respondents, in oyster cultivation, bamboo poles are used to make a frame and it is used as a medium where oysters are hanged. Plastic strappings are used to bind the bamboo poles together. For fish pens, bamboo poles were likewise used to make a fish cage and fishing nets were used to cover it to prevent the fish from escaping once trapped. Polyethylene drums were also used as floaters for the fish cages.

Level of Awareness

Table 3 presents the data on the level of awareness among the respondents of topics related to the impacts of plastic litter on the marine and human environments. The top three areas in which the respondents have a high level of awareness are general awareness of plastic waste, local policy, and challenges of clean-up drives, respectively. The respondents are fully

aware of the general knowledge of plastic waste (Rank 1), such as information on the burning of plastics, the practice of throwing away garbage everywhere being harmful, and plastic litter does not necessarily decompose.

They are also aware of the solid waste policies (Rank 2). However, according to some respondents, it is hard for them to implement solid waste-related policies knowing that they cannot control the number of plastic litter that is washed ashore along the riverside. This leads to the challenges of clean-up drives (Rank 3). As most of the respondents live along the riverside area, cleaning plastic litter that drift into their vicinity is a real challenge. Some households do not clean up their own area of responsibility because as they claim that plastic litter will return again as they were carried by the diurnal influence of the tide. These households stopped cleaning up their areas as they plastic litter will just pile up again. In addition to this, existing mangrove areas in the river make access to other river areas difficult.

The aquaculture farmers’ awareness level regarding the impacts on marine life, fisheries, and, aquaculture, as well as human health, were only interpreted as “Aware” based on the mean scores, because they know that plastics produce impacts, but they are not knowledgeable about the specific reasons for these impacts. This

Table 2: Aquaculture practices of respondents

Characteristics	Categories	Percentage (%) (N=50)
Type of livestock cultivated (Primary livestock)	Fish	26
	Oyster	70
	Crabs	4
Type of cultivation	Monoculture	82
	Polyculture	0
	Integrated system	18
Medium of cultivation (Multiple responses)	Pens	6
	Cage	8
	Ponds	18
<i>For oyster</i>	Hanged	90
	Staked	6

Table 3. Summary of the level of awareness of plastic waste among the respondents (N=50)

Topics	Median Score	Awareness*
General awareness on plastic waste	5.00	Fully aware
Impact to marine life	4.00	Aware
Impact on human health	4.00	Aware
Impact on fisheries	4.00	Aware
Ocean literacy	3.00	Moderately aware
Challenges of clean-up drive	4.00	Aware
Policies on solid Waste	4.00	Aware

*Awareness Range: Not aware (1.00-1.80), Slightly Aware (1.81-2.60), Moderately Aware (2.61-3.40), Aware (3.41-4.20), Fully Aware (4.21-5)

implies that there is a need for the academia or any government or private sector to conduct ocean literacy awareness programmes for aquaculture farmers.

Table 4 summarises the respondents’ knowledge of macroplastics and microplastics. Based on our results, most of the respondents do not have any idea about the terms macroplastics and microplastics. A meagre 30% answered yes to the third question, “Do you know where

microplastics come from?”. They ranked plastic bags as the number one source of microplastics. Based on their observation, it is the most abundant type of plastic due to its versatile and varied uses. The second was food wrappers, which include those for junk foods, condiments, candies, and milk sachets. Toiletries involve shampoo and conditioner sachets, and bottles, as well as soap packaging and other hygiene products. Ropes and nets are those used in

Table 4. Summary of respondent’s answers on knowledge on plastic litter

Questions	Yes (%)	No (%)
Have you heard about macroplastics?	32	68
Have you heard about microplastics?	32	68
Do you know where microplastics come from?	30	70
Rank the source of microplastics (mean; N=50)		
Plastic classification	Rank	
Plastic Bag	1	
Food wrappers	2	
Toiletries	3	
Ropes	4	
Nets	5	
Rank the source of information about these plastics (mean; N=50)		
Academia	5	
Television	1	
Internet	2	
Books or magazines	4	
Government policies	3	

their aquaculture activities, which, according to them, have minimal effects on river pollution. Television or radio, followed by the internet, government policies, books, or magazines, and, lastly, from the academia, are their sources of information on plastic litter.

Behaviour Towards Marine Litter

Table 5 shows a summary of the respondents’ behaviour towards plastic litter. They find plastic litter to be a problem, especially for those living along the riverside. They expressed dissatisfaction over plastic litter that are always around the vicinity of their houses, which forced them to clean them up every time.

Generally, respondents sometimes buy products that are wrapped in/use plastics because based on the ranking, there is a lack of alternative packaging and wrapping materials. Besides, they are lightweight, affordable, reusable, and convenient (Table 5). They usually dispose of their garbage, but not all of them practise segregation and “reduce, reuse, and recycle” (3Rs). This is a good avenue for different government agencies to campaign for the proper disposal of these plastic wastes.

Perception of Plastic Litter’s Impact

The perception of the impact of plastic litter was divided into impacts of plastic litter and respondents’ past and future perceptions of the amount of plastic litter they observed in their area.

The respondents perceived the impacts of plastic litter on the marine ecosystem and human health as serious and very serious problems, respectively (Table 6). The results showed that plastic litter can affect their livelihood because the deterioration of the marine ecosystem was given the highest mean score, followed by ingestion of microplastics that cause diseases in humans. This stems from the fact that most of their sources of income come from aquaculture products (Table 1), which can be affected and threatened by plastic litter.

As most respondents lived in the area for more than 20 years (Table 1), they have observed changes in the quantity of plastic litter in the area. On average, they perceived the amount of plastic litter in the past 25 years, 10 years, and 5 years as lower (Table 7) compared with the present amounts.

Table 5. Respondents’ behaviour towards plastic litter (N=50)

Questions	Median Scores	Interpretation*
How frequent do you buy products wrapped in/use plastics?	3.00	Sometimes
How frequent do you dispose your garbage?	4.00	Usually
Do you segregate your garbage before disposing?	4.00	Usually
Do you practise reduce, reuse and recycle?	3.00	Sometimes
Are plastic litters found in your area a problem?	4.00	Usually
Why do you prefer buying products in plastic? (mean; N=50)		
Reasons	Rank	
Lack of alternatives	1	
Reusable	4	
Affordable	3	
Light weight	2	
Convenient	5	

*Interpretation range: Never (1-1.80), Seldom (1.81-2.60), Sometimes (2.61-3.40), Usually (3.41-4.20), Every time (4.21-5.00)

Table 6: Perception on impacts of plastic litters.

Statement	Median Score	Perception*
Microplastics and macroplastics are mistaken as food	4.00	Serious
Entanglement of marine animals on macroplastics	4.00	Serious
Macroplastics are mistaken as habitats by some marine organism	4.00	Serious
Degradation of the marine ecosystem due to plastic litter	5.00	Very Serious
Chemical substances from plastic litter affect marine and human health	5.00	Very Serious
Microplastic exposure to humans through inhalation and ingestion	4.00	Serious
Ingestion of microplastics will cause diseases in humans	5.00	Very Serious
Plastic litter causes the deterioration of marine ecosystem, resulting in the decline in the livelihood of fisherfolk	5.00	Very Serious

*Perception Range: Not serious (1.00-1.80), Slightly serious (1.81-2.60), Somewhat serious (2.61-3.40), Serious (3.41-4.20), Very serious (4.21-5)

Table 7: Past perception of plastic litter.

Question	Median Score	Interpretation
How do you perceive the amount of litter 25 years ago?	2.00	Low
How do you perceive the amount of litter 10 years ago?	2.00	Low
How do you perceive the amount of litter 5 years ago?	2.00	Low

Note: Range: None (1.00-1.75), Low (1.76-2.50), Moderate (2.51-3.25), High (3.26-4)

They also perceived that the number of plastic litter in 5 and 10 years will increase (Table 8). They are hoping that solid waste laws and strategies will be properly and strongly implemented, so that in the coming 25 years, the amount of plastic litter will eventually decrease.

Discussion

With the increasing threat and the widespread impacts of solid wastes, especially plastic litter pollution, human perception and awareness should be incorporated into the planning, development, management, and implementation of strategies and formulation of policies relevant to present and future needs. Due to the increasing demand for and disposal of plastics, several surveys conducted in other countries perceived plastic waste pollution as a major environmental

problem (Gelicich *et al.*, 2014; Hartley *et al.*, 2018b; Lotze *et al.*, 2018; Millican & Agarwal, 2021). The coastal communities in Palawan, the Philippines, perceived that pollution-related issues, including sewage and plastics, will follow a negative trend in the future (Sumeldan *et al.*, 2021). According to Potts *et al.*, (2016), the public identifies pollution or litter as the most serious threat to the marine environment. Therefore, this study determined the awareness and perception specifically among the aquaculture farmers of plastic litter, as well as their knowledge and behavior towards it. The questions were primarily focused on their awareness and perception of the impacts of marine litter.

The results of this study indicate that the respondents are aware of the impacts of plastic litter on humans, the marine environment,

Table 8. Future perception on plastic litter

Question	Median score	Interpretation
How do you perceive the amount of litter in 5 years?	4.00	Increase
How do you perceive the amount of litter in 10 years?	4.00	Increase
How do you perceive the amount of litter in 25 years?	3.00	Slightly decrease

Note: Range: The same (1.00-1.83), Decrease (1.84-2.66), Slightly Decrease (2.67-3.49), Increase (3.50-4.32), Slightly increase (4.33-5.15), Highly increase (5.16-6)

and fisheries, as well as on the solid waste policies and challenge of clean-up drives in Pulaan River. These indicate that aquaculture farmers who are the direct beneficiaries of the resources along the river are aware of the possible environmental problems in the river. Their lack of awareness of ocean literacy shows that information on how long plastic litter can last in the ocean, which is transported by the river, is not widespread. One thing they know for sure is that there are impacts, but they are not knowledgeable enough to determine which factors influence those effects.

Respondents’ knowledge of plastic litter is limited, and is mostly obtained through television. However, for the farmers in this study, observation and experience are the best sources of information. As most of them have cultured livestock for a long time, their general observations on plastic litter is that it brings negative impacts. Although they consider plastics as sources of negative environmental impacts, they still buy plastic products due to their varied uses and versatility (Heidbreder et al. 2019). According to the respondents, they sometimes buy plastic products when needed and because there is a lack of alternatives to plastic as packaging and wrapping materials.

This study also determined the aquaculture farmers’ perception of the impacts of plastic litter on the marine environment. Most of the respondents depend on river resources, hence they take the impacts of plastic litter very seriously, especially if it affects their livelihood. They mostly perceive the number of plastic litter in the river 25 years to 5 years ago as low. The same respondents also see plastics increasing

in the coming 5 to 10 years, with the hope that in 25 years, it will slightly decrease if the implementation of solid waste laws is strict and properly monitored.

City ordinances were passed to keep Dapitan City clean. These ordinances are as follows: a) regulating the throwing, scattering and/or littering of waste papers and other trash or waste matters or whatever kind in any public place or building within the territorial jurisdiction of Dapitan City; b) ordinance on the maintenance of cleanliness and sanitation; c) ordinance adopting the ecological solid waste management program of Dapitan City pursuant to RA 9003; and, d) ordinance regulating the use of plastic carryout bags by retail establishment owners, market vendors, and food vendors. These ordinances are good and were implemented, but they are mostly centred on wastes disposed of or dumped inland areas. The wastes in the river environment are not included, which, based on actual field collection, has an abundant number of plastic litter. The observed factors of the abundance of plastic wastes would be the presence of *sari-sari* stores near the river and residential houses besides the river, with some bins at the littoral part of the river. Another factor would be the behaviour of residents in terms of plastic waste disposal. Most respondents dispose of their garbage at the designated collection points. Others burn or bury their waste as the collection points are far from their home. Most of them also do not practise 3R. This proves that although they are well-aware of the policies involving solid waste, they are not keen on thoroughly following them. The implementation of the policies could also be

a factor, since they are not stringent enough and the penal provisions are not strictly adhered to.

Perception based on demographics, such as their gender, age, educational attainment, and income, can influence perception on issues affecting the marine environment, considering their proximity to the coastal community (Potts *et al.*, 2016). As most of the respondents in this study are only high school graduates, their level of awareness, and perception of the impacts of plastic litter are limited. Though some take conscious efforts to learn, most do not bother at all unless they are already affected. Their proximity to the river is also a factor because they can observe and experience plastic pollution first-hand.

Conclusions and Recommendation

As Pulauan River is very important to the aquaculture sector, aquaculture farmers were surveyed to determine their level of awareness and perception of the issues of macroplastics and microplastic. The results revealed that their awareness is high in terms of general awareness of plastics, local solid waste policies, and clean-up drive challenges. However, they are not well aware of the impact of plastics on marine life and human health, as well as ocean literacy. But they perceive that these impacts are of serious concern. This implies that the aquaculture farmers know that there are plastics do have impacts, yet they are not knowledgeable enough about the specific factors that lead to these impacts. This goes to show that there is a lack of environmental information campaigns and most of them said the problems they see regarding solid waste are through experience and observation. Though policies are made and implemented, their behaviour towards the usage of plastics does not reflect the mandate.

Plastic pollution on land and water are beginning to be a serious threat, and looking at people's awareness and perception, as well as their behaviour regarding plastic litter, certain

facts should be taken into consideration and need to be accepted. People are in control of the supply and demand of plastic products, and they can properly manage plastics disposal. Awareness and perception of environmental problems can help in the formulation of effective management strategies and comprehensive policies.

Though this study only focused on one sector, other sectors should also be given a chance to share their own views on environmental matters. On another point, several segments of society have to consider the policy implementation arm of solid waste consumption and waste disposal – particularly non-biodegradables (plastic waste), which has global impacts on water resources and food production. Furthermore, there is a need to address the disconnect between awareness of plastic problems and community practices among aquaculture-dependent and food producers in general. This study elaborated on the level of awareness of the plastic problem, but there is a vacuum in the active engagement of people to address such a problem, which can be a source of solution for plastic waste reduction in the waterways and the marine environment.

The environment is vulnerable and very susceptible to threats, especially those arising from human activities. Plastic pollution is an example. The plastic debris found in every corner of the environment depicts the severity of its impact on us. The marine environment, more than ever, is now experiencing great threats from plastic pollution, and rivers are the most affected due to land-based sources. The Philippines is not spared from this problem. Hence, more follow-up studies on the Philippines river systems are needed as they are threatened by the unsustainable practices of communities living along the rivers, which are supposed to be the direct beneficiaries of the river ecosystem resources. There is still a wide discrepancy between awareness, knowledge, and perception and desirable actions and outcomes needed to maintain a wholesome environment where these communities live.

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