

# Local Disposal and Coastal Community Behavior towards Waste Management in Ambon City, Indonesia

Irene M. Sohilit<sup>1</sup> and Maxmilyand Leiwakabessy<sup>2</sup>

<sup>1</sup>*Environmental and Disposal Agency of Ambon City, 97126 Ambon, Indonesia*

<sup>2</sup>*Center for Tropical Horticulture Studies, 16129 Bogor, Indonesia*

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**Abstract:** Pollution of plastic and other waste substances has become a pivotal issue for the future of sustainable marine biology ecosystem. It is widely recognized by the global society that most of the marine debris are contributed by waste production on mainland. Moreover, recent studies have shown that mismanagement of waste and density of coastal population are two main factors related to the waste input from land to ocean. This study is aimed to observe the quantity of total waste production in Ambon City and to analyze the behavior of the society on managing their disposal. Data of waste production was collected from January to July 2018 at Integrated Waste Management Center (IPST), the final disposal of Ambon City and an online questionnaire was spread to understand people's behavior towards waste management. The result showed that during the first half of the year, average waste produced by Ambonese community were the lowest on February and highest on April, 157.20 ton and 198.23 ton, respectively. The survey found that most of people in Ambon (70.90% of respondent) disposed their garbage into temporary dump provided by local government, while others personally manage the waste through various methods, such as burned, buried in soil, or thrown into river and coastal area. Furthermore, the result also described that around 95.5% of the respondents claimed to understand the concept of organic and non-organic waste. However, 13.7% of the people were failed to distinguish the organic waste from non-organic waste. Therefore, few actions involving community, public and private sectors need to be conducted in order to improve the waste management in Ambon City, especially to prevent increasing amount of waste flow from the mainland into ocean.

## 1 INTRODUCTION

One of the main problems in marine ecosystem is the increasing of marine debris volume in the ocean. The harmful impacts of non-degradable marine debris towards fish and other marine organisms have long been reported, for instance the disturbance in development and survival of sea turtles (Carr, 1987). Moreover, previous researchers have noted hundreds of debris impacts toward the ecology, with total of 366 cases of perceived impacts due to debris composed of various materials. Additionally, plastic was associated with most of the described perceived impacts (87%), probably because of its persistence in the environment (Rochman, et.al, 2016). It is also estimated that plastic, in the form of micro plastic, can be included into the food chain which is very harmful for human's health. Unfortunately, it was recorded that within 2012 production of global plastic resin

increased up to 620% from 1975 (Nerland, et.al, 2014).

Despite the big impacts of garbage towards marine ecosystem, most of the debris is actually generated in the mainland. Around 80% of the marine debris is originated from the mainland which entering the marine environment through a land-based resource. According to Jambeck et al. (2015) 6.4 billion people who live in a coastal countries produce up to 2.5 billion MT of municipal solid waste in 2010. Besides, the amount of solid waste entering the ocean is also affected by the density of coastal population and mismanagement of the waste (Jambeck et.al, 2015). These facts showed that population of human being, especially who remains around the coastal area, play a big role to the flow of garbage from the mainland to the ocean.

Located at the eastern part of Indonesia, Ambon is one of the richest reef regions because of its diversity, complexity and variety of distribution

pattern which is of crucial importance for development of tropical marine biology. However, many beautiful and important coastal region and off shore reef in this area are now threatened by the growth of human population which leads to more intensive exploitation (Limmon, 1996). Additionally, the increasing amount of population around the coastal area of Ambon Island also affected the production of waste in this area. Statistic-BPS institution recorded that there are 411.617 men and women living in Ambon by 2018, divided into 5 sub-districts, i.e. Nusaniwe, Sirimau, Ambon Bay, Baguala, and South Leitimur (BPS, 2018).

Communities in Ambon has a long history of environmental management. Culturally, Ambonesse people inherit a specific system of environmental management based upon the local wisdom of their ancestor, for instance Kewang. Kewang is a term describing a person or group of people as an institution who is in charge for preservation of natural resources, including prohibition for off-period harvesting of natural resources (Ajawaila, 2014). Unfortunately, this local wisdom and community structure has faded away from its community throughout the time due to a modernization and development of governmental organization. However, this system is currently re-adopted by the local government in order to regain the local wisdom and system of environmental preservation, especially the waste management.

This research was conducted to describe the amount of debris produced by the local community in Ambon City and to analyze the potential flow of waste to enter the ocean from the mainland of Ambon. In addition, this research was aimed to understand the local waste management system, in order to provide a better perspective for the development of environmental preservation in Ambon City, especially to prevent the waste to enter the ocean.

## 2 METHODS

### 2.1 Collection of Garbage Production Data

Data of waste production was collected at Integrated Waste Management Center (IPST) the final disposal of Ambon City from January to July 2018. The data was recorded daily and presented in average ton/day of waste production every month. Data from IPST represents the amount of debris that was disposed within the waste management system provided by the

local government. The amount of debris which was disposed or managed individually was not recorded due to its impracticality, but described and analyzed based on the result of survey of community behavior towards waste management.

### 2.2 Survey on Community Behavior towards Waste Management

An online survey was distributed to understand the knowledge, attitude and behavior of local communities of Ambon towards the waste management. The survey was involving 289 respondents with age range between 17 to over 56 year old who live in five sub-districts of Ambon City, i.e. Nusaniwe, Sirimau, Ambon Bay, Baguala, and South Leitimur. Generally, the settlement of communities in Ambon can be classified into four different geographic specific area, i.e. hill area, sea shore, river banks, and densely populated urban area. The respondents were asked to identify and describe their settlement and place they live in. Furthermore, the survey include questions to describe the waste management facilities, either provided by the government, individually owned, or non-governmental facilities initiated by the communities, located around the settlement. The survey also evaluated people's preferences on managing their garbage to understand the potential scheme of waste entering the ocean. Data was collected through an online form then analyzed descriptively.

## 3 RESULT AND DISCUSSION

### 3.1 Characteristics of Respondents

#### 3.1.1 Characteristics based on Knowledge and Disposal Facilities

Ambon is the capital city of Maluku Province, Indonesia which is densely populated by people from many different ethnics and backgrounds. Despite the fact that it is located on a very small island with at the eastern part of Indonesia, the socio-economy condition of people in Ambon is very diverse (Papilaya and Sugihen, 2006; Tahitu, 2017).

Table 1: Characteristic of Respondent based on the knowledge and ownership of household disposal.

Respondent Characteristics	Knowledge about organic and non-organic garbage			Ownership of disposal in the household	
	Understand	Not understand	Not sure	Yes	No
Gender					
Male	133 (46.02%)	1 (0.35%)	6 (2.08%)	119 (41.18%)	21 (7.27%)
Female	143 (49.48%)	5 (1.73%)	1 (0.35%)	130 (44.98%)	19 (6.57%)
<b>Total</b>	<b>276 (95.5%)</b>	<b>6 (2.08%)</b>	<b>7 (2.42%)</b>	<b>249 (86.16%)</b>	<b>40 (13.84%)</b>
Age					
17-35	190 (65.74%)	3 (1.04%)	5 (1.73%)	170 (58.82%)	28 (9.69%)
36-55	81 (28.03%)	3 (1.04%)	2 (0.69%)	75 (25.95%)	11 (3.81%)
>56	5 (1.73%)	0	0	4 (1.38%)	1 (0.35%)
<b>Total</b>	<b>276 (95.5%)</b>	<b>6 (2.08%)</b>	<b>7 (2.42%)</b>	<b>249 (86.16%)</b>	<b>40 (13.84%)</b>
Settlement Location					
Hill area	91 (31.49%)	2 (0.69%)	3 (1.04%)	81 (28.03%)	15 (5.19%)
Sea shore	69 (23.88%)	2 (0.69%)	1 (0.35%)	65 (22.49%)	7 (2.42%)
River Bank	60 (20.76%)	1 (0.35%)	2 (0.69%)	52 (17.99%)	11 (3.81%)
Urban area	56 (19.38%)	1 (0.35%)	1 (0.35%)	51 (17.65%)	7 (2.42%)
<b>Total</b>	<b>276 (95.5%)</b>	<b>6 (2.08%)</b>	<b>7 (2.42%)</b>	<b>249 (86.16%)</b>	<b>40 (13.84%)</b>

Table 1 showed that most of the respondents have gained basic knowledge on waste management, especially about the differences between organic and non-organic waste. In addition, based on gender and location of household, knowledge about organic and non-organic garbage was distributed evenly in Ambon, even though there were some respondents who have claimed to not understand or not sure about this concept. Around 95.5% of the respondents claimed to understand the differences, while 2,42% other were not sure about it. However, 14.1% of the respondents who claimed to understand the concept of organic and non-organic waste were failing to separate the organic waste from the non-organic waste within the survey.

Table 2: Presence of Community Disposal around settlement in Ambon.

Settlement Location	Distance of nearest disposal to the household			
	0-250	250-500 m	>500 m	absence
Hill area	47 (16.26%)	8 (2.77%)	17 (5.88%)	24 (8.3%)
Sea shore	41 (14.19%)	9 (3.11%)	6 (2.08%)	16 (5.54%)
River Bank	35 (12.11%)	8 (2.77%)	9 (3.11%)	11 (3.81%)
Urban area	44 (15.22%)	4 (1.38%)	5 (1.73%)	5 (1.73%)
<b>Total</b>	<b>167 (57.79%)</b>	<b>29 (10.03%)</b>	<b>37 (12.8%)</b>	<b>56 (19.38%)</b>

Disposal facilities play a big role on supporting the waste management in many cities. These facilities can be provided by the government, individually owned, or non-governmental facilities initiated by the communities. Based on the data (Table 1), there were 40 respondents (13.84%) who didn't have their own trash can or dustbin inside the household. Furthermore, distance of nearest temporary disposal place provided by the local government in many settlements in Ambon is very diverse from each other. Debris from this disposal will be taken by truck and delivered to IPST as the final disposal facility. Most of the temporary disposal located within a close distance (0-250 m) from the household of the respondents. However, there are 56 of the respondents who claimed that there were no temporary disposal facilities found around their neighbourhood, in which 27 of them were living around the sea shore and river banks (Table 2).

### 3.1.2 Practice of Household Daily Disposal

The disposal practice around the world is very diverse in each modern and conventional communities. Out of the most prominent disposal methods around the world (i.e open dumping, sanitary landfilling, incineration and composting), open dumping of solid wastes is practiced extensively in developing countries because it is cheap and requires no planning (Sufian and Bala, 2007). Ambon City of Indonesia also practice the similar waste management system. Therefore, detail facilities within this system is required to be managed properly by the community and government. Previous research in Bangladesh have shown that burning and burying are to most common disposing practice for plastic waste within the community (Sufian and Bala, 2007). On the other

hand, solid waste management in other countries, for instance Singapore and Japan, is a long and complex system involving many parties (Sutanto, 2002; Eeke et.al, 2002).

Based on data collected from the survey (Fig. 1), people in Ambon used various practice to manage their daily waste, i.e. burning, thrown to river, thrown to the beach/sea shore, buried, and collected to temporary disposal. Most of the respondents (65 %) marked that their daily garbage from the house is usually posted to the temporary disposal which then will be delivered to IPST. However, second most popular practice was burning (25 %) which can contributes to air pollution with numerous of hazardous chemical gases produced within the process. Lastly, there are three other practices, i.e. thrown to the river, thrown to beach, and buried. These individual management of personal garbage could be related to the lack of facilities provided around the settlement area in Ambon.

This facts about individual practices of waste management can lead to the miss-management of debris in Ambon area and polluted the ocean, due to its crucial location and coastal area relation. For instance, debris from household which thrown to the river and beach, without any intervention, will flow straight entering the ocean. Additionally, Ambon is a very small island located at an important archipelago in Indonesia. Thus, waste miss-management will produce a high risk of harming the marine ecosystem. Moreover, Ambon is a home for a big population of mangrove which is the buffer of marine ecosystem, but currently facing a big threat due to the increasing of population growth in the Island (Salampessy et.al, 2015).

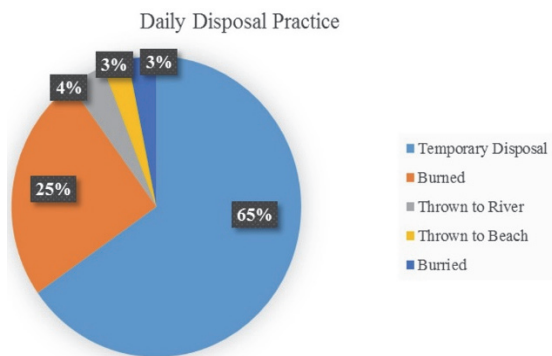


Figure 1: Disposal Practices by Communities in Ambon.

### 3.2 Distribution of Waste Production in Ambon

Final disposal of Ambon City is located at South Leitimur District, running under the name of Instalasi

Pengelolaan Sampah Terpadu (IPST) or Integrated Waste Management Center. It is an official governmental institution to collect and manage the daily waste produce by the society in Ambon. This open dumping center has long served the society to collect the garbage posted at the temporary disposal unit around the city. However, prior to the garbage being posted at the temporary disposal unit is out of the responsibility of IPST. Thus, it was not capable of calculating and managing the individual managed garbage in each households.

Based on the data (Figure 2), highest average of daily garbage collected to IPST within the first half of 2018 was in April, ranged between 167 to 264 ton per day. Volume of garbage in February 2018 was the lowest average volume that was recorded at IPST, range between 146 to 183 ton per day. In Indonesia, average daily personal waste production was estimated around 0.5 kg/person/day. For instance, potency of garbage production in big cities, such as Bandung and Jakarta were predicted around 1300 ton and 5000 ton per day, respectively (Sudrajat, 2006). Thus, production of waste per person in Ambon is moderately lower than other big cities in Indonesia, considering the population in Ambon is around 411.617 within 2018. However, the data collected from IPST was not including the household garbage which were managed individually by the local people. Thus, the representative data of waste production in Ambon is hardly predicted.

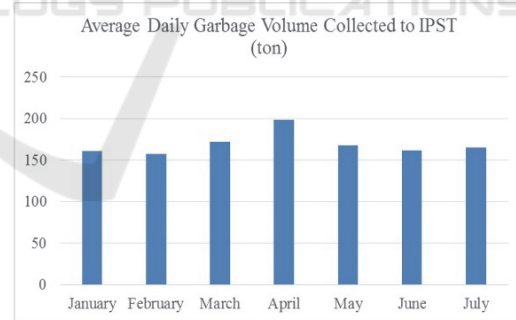


Figure 2: Average volume of garbage collected to IPST Ambon.

### 3.3 Local Wisdom and Regulation on Waste Management

Local government of Ambon have several instruments and regulation about waste management, two of them are Kewang and Retribution or Permi for waste management service. Kewang is a term describing a person or group of people as a social institution who is in charge for preservation of natural resources, including prohibition for off-period

harvesting of natural resources (Ajawaila, 2014). Historically, Kewang has present in the structure of Ambonesse community since a long time ago. Retribution for waste management was necessarily paid as the part of waste management service and system in Ambon City.

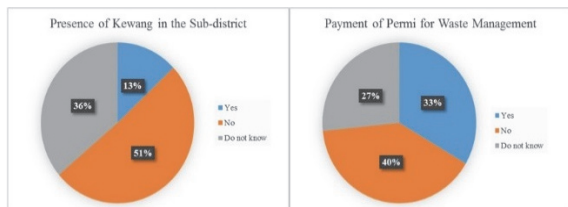


Figure 3: Awareness of the community towards presence of Kewang and Permi for waste management.

The result of this research have shown that most of the respondents are not aware of the presence of either kewang nor waste management permi. Only around 13% and 33% of the respondent, respectively, who are aware of the presence of Kewang and paid the retribution. Additionally, 36% of the respondents were not aware of Kewang. Surprisingly, 40% of the respondents have never paid the retribution and other 27% of the respondent were not aware about this regulation in Ambon City.

#### 4 CONCLUSION

The society of Ambon managed their daily disposal using several practices. Even though most of the respondents were aware and actively practicing good waste management by posting their garbage to the temporary disposal unit provided by the government, several respondents admitted that they also practicing other disposing practices which are harmful for the environment. The absence of temporary disposal unit and other facilities could be related to this waste miss-management. Moreover, awareness of the society towards the regulation about waste management in Ambon City is considerably low.

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