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Externalities of business entities from plastic pollution at Perhentian island, Malaysia

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Abstract

Marine protected areas have been formed by the government of Malaysia to conserve and protect marine environment from human interference and distinction. This article identified the type of pollutants contributed by business entities located in Long Beach, Perhentian Island, Malaysia to its marine environment. A mixed method of research has been adopted in this study involving fieldwork and interviews with business entities located in the coastal area of Long Beach. Results indicate that plastic products are the main type of pollutants in Long Beach. Effective measures have to be taken in order to sustain the development of Long Beach, Perhentian Island.

Keywords: Marine protected areas; Environment; Plastic; Pollution; Business entities.

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Resumen

El gobierno de Malasia formó áreas marinas protegidas para conservar y proteger el medio marino de la interferencia y distinción humana. Este artículo identificó el tipo de contaminantes aportados por las entidades comerciales ubicadas en Long Beach, Isla Perhentian, Malasia, a su entorno marino. En este estudio se ha adoptado un método mixto de investigación que involucra trabajo de campo y entrevistas con entidades comerciales ubicadas en la zona costera de Long Beach. Los resultados indican que los productos plásticos son el principal tipo de contaminantes en Long Beach. Deben tomarse medidas efectivas para sostener el desarrollo de Long Beach, Isla Perhentian.

Palabras clave: Áreas marinas protegidas; Medio ambiente; El plástico; Contaminación; Entidades de negocios.

1. INTRODUCTION

The ocean covers 70.9% of the earth's surface with a volume of approximately 1.35 billion cubic units (WIKIPEDIA, 2020).Human beings are the largest threat to the ocean (UN., 2019) Human activities are responsible for a major decline of the world's biological diversity and the problem is critical given that combined human impacts could accelerate present extinction rates by 1000-10,000 times that of their natural rate (LOVEJOY, 1997). In the ocean, the threat to marine life comes in various forms, such as overexploitation and harvesting, dumping of waste, pollution, introduction of alien species, land reclamation, dredging and global climate change (SNEALGROVE, 1999). In this article, one particular form of human impact that

constitutes a major threat to marine life is given attention: the pollution by plastic debris (DERRAIK, 2002).

Plastics make-up most of the marine litter worldwide (DERRAIK, 2002). Plastic pollution is pervasive in the world's oceans and has gained attention in the media, the public and governments. The urgency of this issue was recognised by nearly 200 countries that signed the U.N. draft Resolution on Marine Litter and Microplastics at Nairobi, in December 2017, encouraging member states and stakeholders to take action (BALLERINI ET AL., 2018).

Plastic production reached 320 million tons in 2016 and is expected to steadily grow by an average of about 4% each year. The constant increase in plastic production followed by a continuous supply of waste in oceans is expected to add to the long-term accumulation of plastic in the marine ecosystem (BALLERINI ET AL., 2018). Plastic materials end up in the marine environment when accidentally lost, or carelessly handled. They also reach the sea as littler carried by rivers and municipal drainage systems (WILLIAMS AND SIMMONS, 1997). There are major inputs of plastic littler from land-based sources in densely populated or industrialised areas; most in the form of packaging (ROSS, 1991). Meanwhile, plastic littler continues to accumulate in the world's oceans and it has been estimated that 8 million tons (mt) of plastic waste reaches the oceans each year. Without any action that volume is projected to double by 2030 and double again in 2050 (BALLERINI ET AL., 2018).

Plastic materials are known for their stability and durability. These properties make plastic very popular giving it a wide range of

use (WEBB ET AL., 2013). Because of their physical and chemical properties, plastic polymers are commonly use in a wide range of products and total plastic production has increased from 2 million tons (mt) per year in the 1950 to 380 mt per year in 2015 (GEYER ET AL., 2017). The counterpoint is that they become persistent waste once they are no longer utilized. When plastics end up in the environment they do degrade, however this process will take decades or even longer (BALLERINI, 2018). Once in the environment plastics biodegrade undergoing photo degradation, with changes in the temperature and oxygen levels they endure thermooxydative degradation, in the presence of water they undergo hydrolytic degradation and even biological degradation from microorganisms and certain types of organism (ANDRADY, 2011). As the use of plastics continues to increase, so do the amount of plastics that pollute the marine environment. Plastic represent between 45% and 95% of marine littler today (NICOLAU ET AL., 2016).

In the ocean, the threat to marine life comes in various forms, such as overexploitation and harvesting, dumping of waste, pollution, alien species, land reclamation, dredging and global climate change (SNELGROVE, 1999). One particular form due to human impact constitutes a major threat to marine life: the pollution by plastic debris (DERRAIK, 2002). However, there is still relatively little information on the impact of plastic pollution on the ocean's ecosystems (QUAYLE, 1992). There is however an increasing knowledge about their deleterious impacts on marine biota (GOLDBERG, 1995). Marine debris affects a significant number of species. It affects at least

267 species worldwide, including 86% of all sea turtle species, 44% of all seabird species and 43% of all marine mammal species (CLEAN WATER ACTION, 2020). The problem may be highly underestimated, as most plastics are likely to go undiscovered given vast ocean areas, as they either sink to the ocean floor or are eaten by predators (DERRAIK, 2002).

Entanglement of aquatic species by plastic debris can cause starvation, suffocation, laceration, infection, reduced reproductive success and mortality. Much smaller micro plastic particles (microbeads) are commonly white or opaque in colour, which are commonly mistaken by many surface feeding fishes as food (plankton). Ingestion of plastics by aquatic organisms is one of the major deleterious environmental impacts in the aquatic environment (XANTHOS AND WALKER, 2017).

Many organisms (whales, turtles, seabirds, shellfish, and fish) swallow pieces of plastic which accumulate in their digestive system. Swallowing of plastic can cause physical damage or blockage of the intestinal tract, which can lead to infection, starvation and even mortality (MATSUGUMA ET AL., 2017). The literature on plastic debris leaves no doubt that plastics make-up most of the marine litter worldwide as evidenced as early as in 1990 that are causing harm to the marine ecosystem and marine parks. The threats from plastic pollution to the marine biota , for example, has escalated where 0.14 to 0.37 million tons may have been washed into the oceans in Malaysia (JAMBECK, J.R ET AL., 2015) that contributes to the potential health

effects of single-use plastics on human and marine life (R. C. THOMPSON ET AL., 2009, FAUZIAH, 2015).

Despite the importance of sustainable management of marine parks, limited attempts have been made to study pollution within marine protected areas in Malaysia. However, a few studies have addressed the biodiversity in marine waters in Malaysia (ISLAM ET AL., 2011) and, the ecosystem and economic issues in selected Marine Protected Area (MPAs) (GJERTSEN, 2005). Due to the growing number of tourists that visit MPAs for water activities such as snorkeling and scuba diving that have been blamed for harm done to the coral reefs, stringent rules or laws are deemed necessary. Increasing environmental protection measures are only expected to regulate impacts of expansion of coastal areas (especially those with coral reefs) into tourism destinations in Malaysia. Additional pressure to ensure responsibility and care towards MPAs are also placed on tourists and tour operators (ALI EL AL., 2013). Hence, the protection of the marine parks is a balancing act between the need to protect the marine environment, and the need for coastal waters development such as construction of new chalets and hotels and, other tourism business opportunities (ALI EL AL., 2013). Therefore, an analysis on marine pollution caused by business entities located within these marine protected areas is conducted to analyze the externalities of business entities specifically plastic pollution in Long Beach, Perhentian Island (a MPA). The aim of this paper is to demonstrate that MPAs are created to protect the marine environment but have indirectly caused marine pollution in its endeavor to preserve marine flora and fauna.

This dilemma is brought upon by businesses supporting tourism activities in those areas.

1.1. Marine Protected Areas (MPAs)

According to the Department of Survey and Mapping Malaysia, there are a total of 878 islands and 510 offshore geographical features in Malaysia (SAZALI ET AL., 2013). Tourism development on these islands are influenced by various factors such as the size of the island, existing resources, physical character, land uses, policies and strategies by the authorities (ALI EL AL., 2013). Tourism linked to the marine and coastal environment, is one of Malaysia's top income earners. In particular, reef-based tourism is a major attraction, and with the popularity of scuba diving and snorkeling increasing in Malaysia, its coastal environments are under increasing pressure from inappropriately planned tourism (TAPPER, 1998). The increased number of visitors has led to the tremendous island tourism development and human/tourists' activities. The uncontrolled activity of tourism development and increasing number of tourists' arrivals to the island are the main reasons for negative impacts on the coral reefs (SAZALI ET AL. 2013). Tourism development and opening of new areas on the island has resulted in multiple issues arising as a consequence of island sedimentation. Resorts and hotels have been built on the islands to cater to the rising number of tourists. The development of tourism infrastructure and facilities such as roads, airports, golf and marinas can also be linked to over-development activities (SAZALI ET AL., 2013). These demonstrate an urgent need

to reconcile tourism development with environmental protection through appropriate planning and environmental management.

2. METHOD

A mix method was adopted in this research by using both qualitative and quantitative approaches. Fieldwork was conducted on Long Beach, Perhentian Island to collect data on the beach. Thereafter, interviews were conducted to confirm the results of the data collected. Fieldwork was conducted four (4) times in 2018 during high and low travel seasons, taking into consideration the number of visitors at Long Beach, during both these periods. Months of March to September are considered as a low travel season due to strong waves and monsoon rain while April to the end of August are considered as a peak travel season because of less rain and calmer seas, which are ideal for snorkeling and diving. Jetsam and flotsam, any sort of debris and beach litter were collected and recorded during the fieldwork period in order to calculate the total number of litter produced along the coastal area of Long Beach, Perhentian Island.

A mixed method was applied in this research because the results and outcomes are more reliable. According to TASHAKKORI AND TEDDLIE (1998), mixed method strategies are intended to maximize the benefits available when applying different approaches in addressing a research question. The justification for the use of mixed methods in social research is based on the pragmatic philosophical position that supports the idea that social realities can be better

understood by using both qualitative and quantitative data collection and analysis method in the same research (CARUTH, 2013). A combination of the methods will help researches to understand the nature of social reality more coherently (Driscoll 2007). It is this pragmatic use of mixed methods, some researchers have argued that help achieve multiple research goals, such as; explanation, confirmation and triangulation in explaining complex social constructs (TASHAKKORI AND TEDDLIE 1998; CARUTH, 2013). Using the mixed methods approach to research, researchers incorporate methods of collecting or analysing data from the quantitative and qualitative research approaches in a single research study (CRESWELL, 2003). That is, that researches collect or analyze not only numerical data, which is customary for quantitative research, but also narrative data, which is the norm for qualitative research in order to address the research question(s) defined for a particular research study (WILLIAM, 2007).

3. RESULT AND DISCUSSION

From the observation of the data below, it is evident that ocean tides affect the total number of plastics collected by the researcher. It is found that high tide and low tide times vary every day and it can be summarized as below: -

Date	**High Tide**	**Low Tide**
30-3-2018	0427 & 1900	0030 & 1112

31-3-2018	0542 & 1900	0110 & 1208
01-4-2018	0700 & 2000	0149 & 1300
02-4-2018	0822 & 2025	0226 & 1354
03-4-2018	0945 & 2043	0302 & 1455
04-4-2018	1104 & 2056	0337 & 1608
05-4-2018	1215 & 2104	0413 & 1738
06-4-2018	1315 & 2058	0450 & 1930
07-4-2018	1405	0520
08-4-2018	1448	0610

Table 1: High tide and low tide levels during low season [30.3.2018-8.4.2018]

Date	**High Tide**	**Low Tide**
06-9-2018	0450 & 1350	0955 & 2134
07-9-2018	0546 & 1440	1104 & 2225
08-9-2018	0637 & 1537	1209 & 2317
09-9-2018	0725 & 1640	1300
10-9-2018	0800 & 1752	0008 & 1401
11-9-2018	0849 & 1912	0100 & 1451
12-9-2018	0924 & 2042	0153 & 1538
13-9-2018	0955 & 2217	0248 & 1622
14-9-2018	1031 & 2351	0347 & 1705
15-9-2018	1044	0454 & 1745

Table 2: High tide and low tide levels during low season [6.9.2018-15.9.2018]

Date	High Tide	Low Tide
27-4-2018	0355 & 1700	0947
28-4-2018	0522 & 1740	0007 & 1040
29-4-2018	0646 & 1805	0037 & 1134
30-4-2018	0807 & 1820	0107 & 1234
01-5-2018	0922 & 1826	0137 & 1346
01-5-2018	1029 & 1815	0207 & 1524
02-5-2018	1125	0237
03-5-2018	1213	0309
04-5-2018	1254	0343
05-5-2018	1330	0420

Table 3: High tide and low tide levels during peak season [27.4.2018-5.5.2018]

Date	High Tide	Low Tide
18-6-2018	1231	0332
19-6-2018	1311	0420
20-6-2018	1346	0500
21-6-2018	1415	0554 & 2201
22-6-2018	0156 & 1420	0639 & 2217
23-6-2018	0404 & 1458	0722 & 2239
24-6-2018	0507 & 1512	0805 & 2304
25-6-2018	0734 & 1521	0855 & 2310
26-6-2018	0843 & 1523	1011 & 2357
27-6-2018	0927 & 1512	1152

Table 4: High tide and low tide levels during peak season

[18.6.2018-27.6.2018]

It was discovered that the variation of high tide and low tide levels affect the accuracy of total rubbish collected along the coastal area of Long Beach. Some of the beach litter along the coastal area was washed away by waves during high tide. An estimated time between high tide and low tide during data collection periods was identified and the collection of data is based on these times. Generally, data collection time was fixed at 6.30 a.m. 12 p.m., 6 p.m. and 12 a.m. Based on the above table, it can be concluded that high tide and low tide periods generally occur twice a day although, sometimes it happens once a day.

In Long Beach, Perhentian Island, it was observed that activities such as scuba diving, snorkeling, tanning, and relaxing generally take place from 8 a.m. to 7 p.m. Activities such as beach parties, fire shows, and other social gatherings will generally begin in the evening until midnight. Business entities such as bistros and bars normally operate until 3 a.m. In these establishments, all kinds of drinks from soft drinks to alcohol are served and multiple items are 'left over' from these activities, such as plastic cups, straws and plastic bottles; all of which have contributed to the increase of litter along Long Beach. Based on the data collected in 2018, the total beach debris collected are as identified below: -

Time	0630	1200	1800	2400
Type				

Plastic cup	190	28	50	270
Plastic bag	223	34	30	201
Plastic cutlery	77	31	49	60
Straw	386	106	123	289
Polystyrene	61	13	8	49
Nylon	14	5	5	10
Food wrapper	98	16	20	80
Aluminum tin	66	31	47	83
Glass bottle	12	3	2	28

Table 5: Total rubbish collected during low season

[30.3.2018-8.4.2018]

Time	0630	1200	1800	2400
Type				
Plastic cup	144	23	40	216
Plastic bag	128	28	44	189
Plastic cutlery	61	12	18	93
Straw	391	48	69	330
Polystyrene	74	18	23	63
Nylon	8	3	4	6
Food wrapper	52	17	31	44
Aluminum tin	38	6	6	29
Glass bottle	8	0	1	6

Table 6: Total rubbish collected during low season

[6.9.2018-15.9.2018]

Time	0630	1200	1800	2400
Type				
Plastic cup	356	53	74	280
Plastic bag	310	33	50	274
Plastic cutlery	181	67	43	138
Straw	581	78	137	501
Polystyrene	93	21	15	124
Nylon	18	4	4	10
Food wrapper	188	32	56	130
Aluminum tin	290	24	41	311
Glass bottle	24	8	8	18

Table 7: Total rubbish collected during peak season

[27.4.2018-6.5.2018]

Time	0630	1200	1800	2400
Type				
Plastic cup	321	39	44	250
Plastic bag	280	53	41	239
Plastic cutlery	143	59	53	100
Straw	490	136	83	398
Polystyrene	77	24	17	50
Nylon	14	8	5	16
Food wrapper	130	67	80	93
Aluminum tin	288	71	40	254
Glass bottle	16	7	5	21

Table 8: Total rubbish collected during peak season

[18.6.2018-27.6.2018]

4. CONCLUSION

In Malaysia, there is no specific legislation governing business entities activities and tourists' behavior to reduce litter especially plastic waste in MPAs. With visitors' lack of awareness and the ignorance of business entities to conserve and protect MPAs have further contributed significantly towards plastic pollution in MPAs. From the data collected and interviews conducted have shown that business entities operating within these MPAs have contributed to water and coastal pollution mostly culminating from plastic wastes that form the majority of beach litter along the Long Beach coastal area. Hence, various measures should include by limiting the total number of visitors in MPAs at any one time and to replace plastic products with other alternatives including implementing legal tools to curb plastic pollution from business entities. Thus, a holistic approach to reduce plastic waste pollution by reviewing national environmental policies and legislative framework remains imperative especially in marine waters. Several state governments and industries in Malaysia have already mobilized initiatives to reduce plastic usage or wastes by deploying action to phase out plastic products within the next 12 years in accordance with the time line laid out in the Roadmap towards Single Use Plastics 2018-2030.

However, efforts and initiatives by the Malaysian government through reducing and banning of single use plastics is not a

synchronous national act and regulatory framework towards reduction of single use plastic is clearly absent from environmental legislation in Malaysia. Thus, to attain reduction in single use plastic will require strong new legal strategies addressing plastic pollution through usage and wastes generation in MPAs by regulating single-use plastics at their point-of-contact with consumers or business entities at Long Beach, Perhentian Island or other MPAs to ensure sustainable environment in these areas.

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