

BEACH DEBRIS ON LABUANGE BEACH, BARRU DISTRICT, SOUTH SULAWESI PROVINCE, INDONESIA

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BEACH DEBRIS ON LABUANGE BEACH, BARRU DISTRICT, SOUTH SULAWESI PROVINCE, INDONESIA.Rantih Isyrini^{1*}, Rahmadi Tambaru, Yuyu Anugrah La Nafie¹, Marzuki Ukkas¹, Muhammad Reza Cordova².

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ABSTRACT

To support the efforts of the Indonesian government in managing marine debris that has a broad potential negative impact in various aspects, beach debris monitoring activities are urgently required in various locations. This research was carried out from June to August 2018 in the west coast region, on Labuange beach, Barru Regency, South Sulawesi Province, Indonesia, which was exposed by the Indonesian Through-Flow. The study aimed to determine the amount, weight and composition of marine debris on Labuange beach. Marine debris was sampled from a permanent line transect with an area of 150 m² (three replications). Samples were then cleaned, sorted, counted, and weighed. The average amount of marine debris was 5.98 + 2.13 items/m² per month, with a total weight was 138.69 ± 91.32 g/m² per month. Plastic and rubber category dominated every sampling period in the location. The abundance of marine debris, both regarding quantity and weight, fluctuated in high amount during the sampling period, which indicated the magnitude of the role of oceanographic factors, including the direction of waves, and lack of community awareness on marine debris impacts and management. The great amount and weight of marine debris and the type of waste, which was dominated by plastic and rubber is a potential threat to humans, marine biota, and the local or global environment.

Keywords: marine debris; impact; management

INTRODUCTION

Marine debris has a broad negative impact, not only on aesthetic, but also on the health and safety of human, economic (Sheavly and Register, 2007), marine biota (Barnes, 2002; Derraik, 2002; Sheavly and Register 2007; Gregory, 2009), and environment (Chiappone et al., 2005; Sheavly and Register, 2007). Various studies showed that plastic waste is a category of waste that dominates coastal marine debris (Santos et al., 2009; Zhou et al., 2011; Zulkarnaen, 2017).

Indonesia is considered as the second largest plastic waste contributor in the world, after China (Jambeck et al., 2015). This problem is not merely a local issue but also potential to become a global issue due to the nature of the conventional plastic that is lightweight, strong and durable. Therefore, plastic waste in Indonesian waters besides creating local impacts, yet can travel and impact other areas.

To support the Indonesian government efforts in dealing with the marine debris problem, monitoring

activities are required in various coastal locations. This monitoring was carried out in the west coast marine debris on the area. Since Indonesian Through-Flow exposes the study location, the study result is expected can broaden the data and information that required to manage marine debris in Indonesia, which potential to become a global issue.

MATERIAL AND METHODS

The monitoring was carried out from June to August 2018 on Labuange beach, Barru District, South Sulawesi Province, Indonesia (119°36'32"E, 4°06'26"S). Monthly observations were conducted on the permanent line transect during low tide. Observation method adapted marine debris monitoring and assessment document from NOAA Technical Memorandum NOS-OR&R-46 (Lippiat et al., 2013; P2O-LIPI, 2018). The line transects were placed in the area which was located between high and low tide areas along three replications of 25 m wide, with 1 m length towards the sea and 1 m length towards the land. Samples collected were then cleaned from muds, sands, and water, then sorted into seven categories, counted, and weighed in the laboratory. The categories used were: (1) plastic and rubber; (2) metal; (3) glass; (4) processed lumber; (5) cloth/fabric; (6) other; (7) harmful materials. This category adapted from the previous study by Kumar et al. (2016). Plastic and rubber were placed in the same category due to their similar synthetical polymer.

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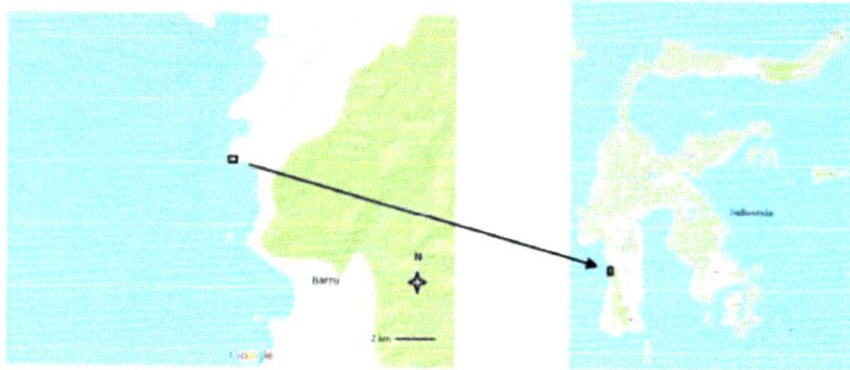


Figure 1. Map of study area in Labuange beach, west coast of South Sulawesi Province, Indonesia.

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Based on the quantity and weight of collected marine debris, the abundance of each item was calculated by dividing the amount and weight of debris to the transect size. While, the proportion of marine debris each month was estimated based on the abundance of marine debris by the quantity.

RESULT AND DISCUSSION

The results showed that the total value of the abundance of marine debris (quantity and weight) on Labuange beach fluctuated during the sampling period. The total amount of marine debris ranged from 4.41 to 8.40 items/m² (mean 5.98 items/m²) and the total weight range was 66.33-242.30 g/m² (mean 138.69 g/m²) (Table 1).

Table 1. Abundance of marine debris (by quantity and weight) during the monitoring period on Labuange beach, Barru District, South Sulawesi Province, Indonesia.

Abundance	June 2018	July 2018	Agust 2018	Average
Quantity (items/m ²)	8.4	4.41	5.14	5.98 ± 2.13
Weight (g/m ²)	241.3	66.3	108.44	138.69 ± 91.32

Beach Debris Condition in June 2018

Plastics and rubber category dominated marine debris at the site in June 2018, which was 6.81 items/m², or 81.1%. Then, followed by debris from

the processed lumber category by 0.93 items/m² (11.1%), as well as cloth/fabric by 0.39 items/m² (4.6%). Metal, glass, other materials and harmful materials were also found in a small number (Figure 2 and 3).

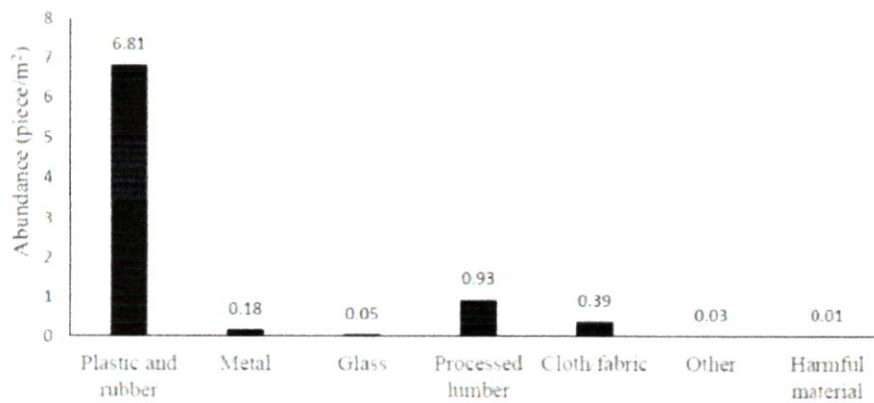


Figure 2. The average abundance of marine debris by quantity in the study area in June 2018.

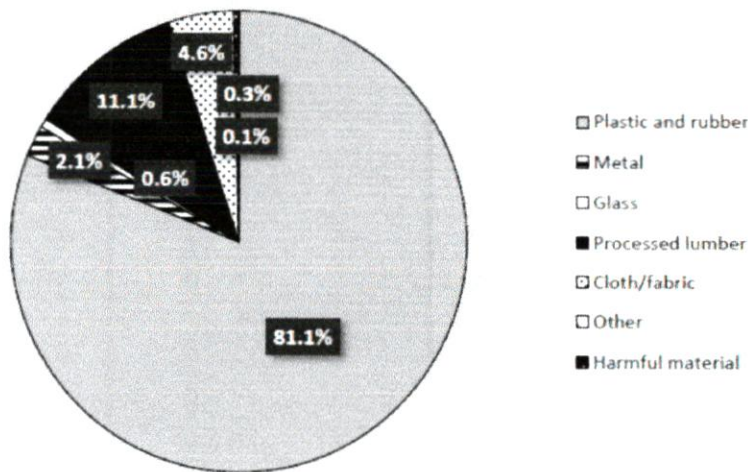


Figure 3. The composition of marine debris in the study area in June 2018.

In terms of weight, processed lumber was the most massive category of found debris (86.93 g/m²), followed by cloth/fabric (60.23 g/m²), plastic and rubber (56.26 g/m²), glass (28.55 g/m²), metal (8.67 g/m²). Other materials, and harmful material were also found but with small weight abundance values (Figure 4). In June 2018, marine debris from thick plastic wrap types dominated marine debris on

Labuange beach with an abundance of 3.17 items/m², followed by plastic cups (0.95 items/m²), and thin plastic bags with an abundance of 0.64 items/m² (Table 2). While processed lumber, has the most significant weight with an abundance of 47.39 g/m², followed by diapers and sanitary napkins (40.77 g/m²), and cardboard cartons (33.82 g/m²) (Table 3)

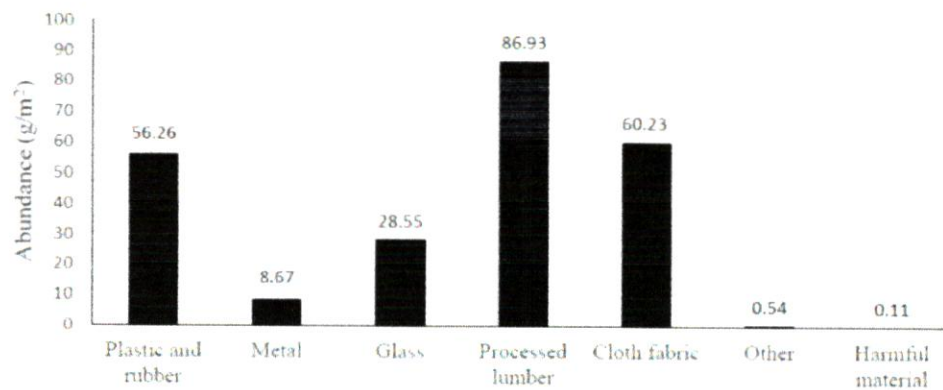


Figure 4. The average abundance of marine debris by weight in the study area in June 2018

Table 2. The average quantity per m² of five densest beach debris types in the study area.

No.	Type of marine debris	Abundance (items/m ²)
June 2018:		
1	Thick plastic bags/wrappers	3.17
2	Plastic cups	0.95
3	Thin plastic bags	0.64
4	Straws	0.41
5	Lumber/building material	0.38
July 2018:		
1	Thick plastic bags/wrappers	2.15
2	Plastic cups	0.47
3	Thin plastic bags	0.42
4	Nylon ropes, fishing line and equipment	0.11
5	Plastic ropes	0.11
August 2018:		
1	Thick plastic bags/wrappers	1.47
2	Thin plastic bags	1.39
3	Plastic cups	0.53
4	Rubber bands, rubber fragments	0.23
5	Nylon ropes, fishing line and equipment	0.17

Table 3. The average weight per m² of five most massive beach debris type in study area.

No.	Type of marine debris	Abundance Weight (g/m ²)
June 2018:		
1	Lumber/building material	47.39
2	Diapers and sanitary napkins	40.77
3	Cardboard cartons	33.82
4	Thick plastic bags/wrappers	25.56
5	Glass fragments	21.38
July 2018:		
1	Thick plastic bags/wrappers	13.67
2	Thin plastic bags	9.24
3	Shoes, sandals, gloves, and their fragments	6.85
4	Diapers and sanitary napkins	6.05
5	Lumber/building material	3.53
August 2018:		
1	Thin plastic bags	24.95
2	Thick plastic bags/wrappers	12.62
3	Clothing and fabric item	10.62
4	Glass bottles	10.07
5	Cans	5.42

Beach Debris Condition in July 2018

Plastic and rubber still dominate marine debris found on Labuange beach, with an abundance of 3.83

items/m² or 87%. While, other categories of debris were also found with abundance values of less than

0.30 items/m² (Figure 5 and 6). By weight, plastic and rubber also had a high abundance value, which was 40.55 g/m², while other debris categories were found in abundances of less than 10 g/m² (Figure 7).

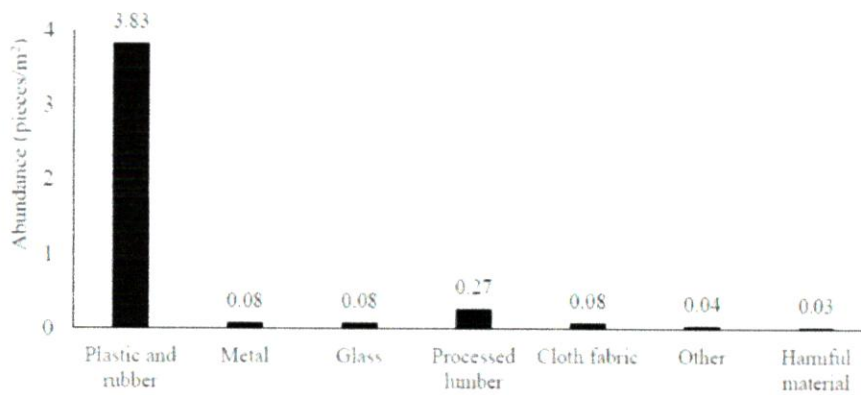


Figure 5. The average abundance of marine debris by quantity in the study area in July 2018.

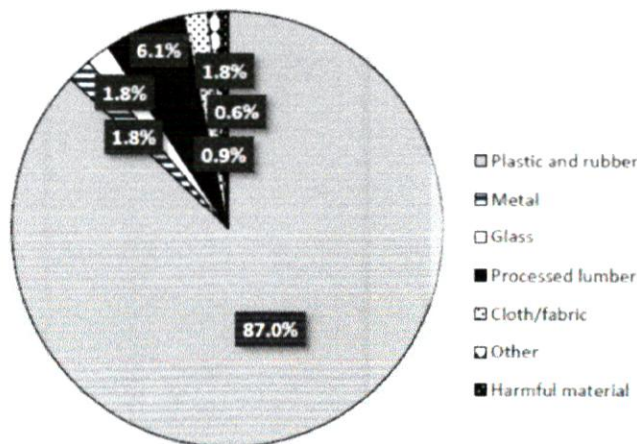


Figure 6. Composition of marine debris in the study area in July 2018.

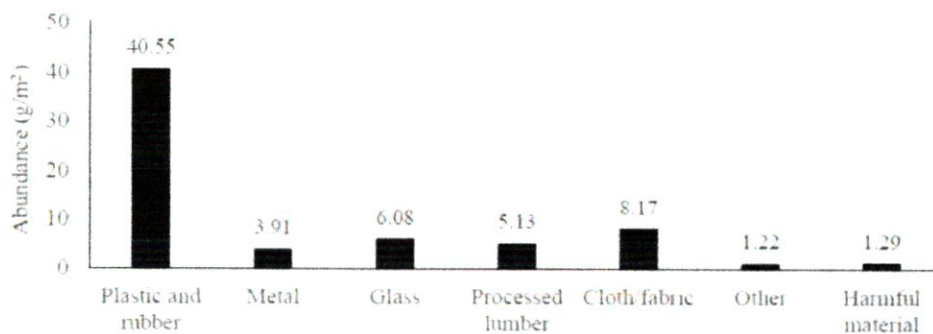


Figure 7. The average abundance of marine debris by weight in the study area in July 2018.

The thick plastic bag/wrappers had the highest abundance and weight values among other types of marine debris (2.15 items/m² and 13.67 g/m², respectively). Plastic cups had the next higher abundances regarding quantity (0.42 items/m²). While regarding weight, thin plastic bags had the second greater abundance, i.e. 9.24 g/m² (Table 2 and 3).

Beach Debris Condition in August 2018

Like the previous sampling period, plastics and rubber dominated marine debris collected on Labuange beach in August 2018. The abundance of plastic and rubber category was 4.58 items/m², or 89.1% of the total debris found. Debris from other categories were found in much smaller quantities, which were less than 0.20 items/m², or less than 4%. No harmful material category found in the study location in this period (Figures 8 and 9).

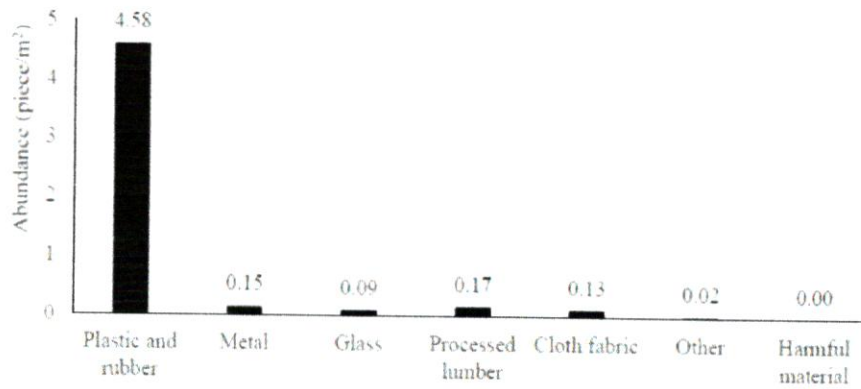


Figure 8. The average abundance of marine debris by quantity in the study area in August 2018

By weight, plastic and rubber was also the largest marine debris category collected in this period (62.14 g/m²). Marine debris from the categories of cloth/fabric and glass were each found with

abundances of about 15 g/m², followed by metal (9.33 g/m²), lumber processed (5.81 g/m²), as well as Other material category (0.81 g/m²) (Figure 10).

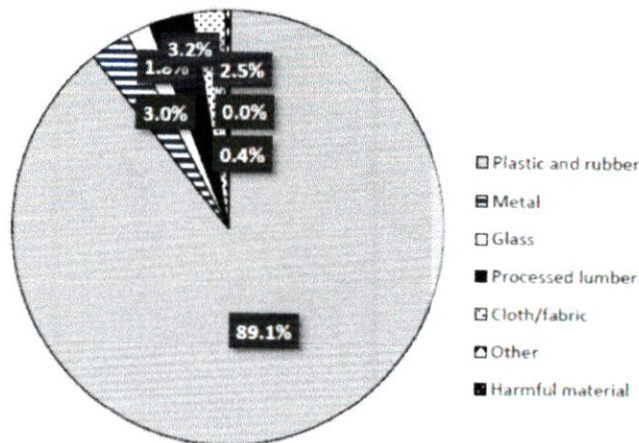


Figure 9. The composition of marine debris in the study area in August 2018.

In August 2018 sampling period, thick plastic bag/wrap and thin plastic bag dominated the type of marine debris found on Labuange beach, with an abundance values of 1.47 items/m² and 1.39 items/m²,

respectively (Table 2). By weight, the thin plastic bag had the highest abundance value (24.95 g/m²), followed by thick plastic bag/wrap with an abundance value of 12.62 g/m² (Table 3).

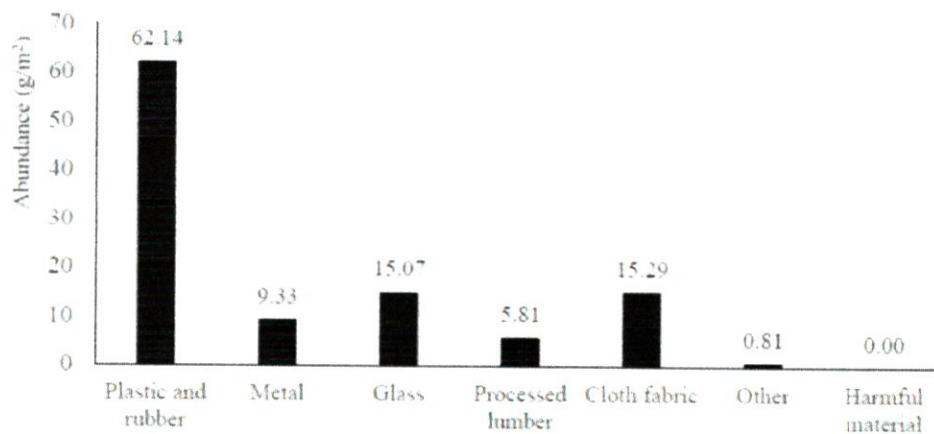


Figure 10. The average abundance of marine debris by weight in the study area in August 2018.

Overall, plastic and rubber category dominated marine debris collected on Labuange beach during the monitoring period (June-August 2018). The result was similar to other studies which concluded the plastic dominance of marine debris over several places, including: on three beaches in Takalar Regency, east coast of South Sulawesi (Zulkarnaen, 2017), and in Korea (Hong et al., 2014).

The total values of marine debris abundance in the study locations ranged from 4.41 to 8.40 items/m² per sampling period, which was much higher than the average abundance found on the coast of the South China Sea as much as 0.032 items/m² (Zhou, et al., 2011), on 20 beaches of Korea that ranged averagely around 2.68 items/m² per bimonthly (Hong et al., 2014), and beaches in Takalar, South Sulawesi, which ranged from 0.48 to 0.80 items/m² (Zulkarnaen, 2017).

The total weight of marine debris on Labuange beach was 66.3-374.66 g/m² per sampling period, which were much significant than those found on the coast of the South China Sea which was 0.2 g/m² (Zhou et al. 2011), or on three beaches in Takalar, South Sulawesi, which weighs as much as 19.48 g/m² (Zulkarnaen, 2017). However, the value found on the monitoring site was similar to that on beaches of Korea that ranged averagely about 786 g/m² per bimonthly (Hong et al., 2014).

Fluctuation of the high abundance values of marine debris both regarding quantity and weight indicate the magnitude of the role of the coastal location: oceanographic physics factor, such as: the direction

and velocity of currents and waves; as well as the contribution of waste disposal from the local population, feasibly due to lack of lack of community awareness on marine debris impacts and management. Labuange beach, is an open beach that locates on the

west coast of South Sulawesi on the Makassar Strait, that is affected by the Indonesian-

Through Flow (ITF). Therefore, the study site would be greatly impacted by a large amount of marine debris drifted through the ITF currents/waves that across the Makassar Strait. Resident custom throwing daily garbage on the beach increases the amount of garbage on the coast.

Great abundance of marine debris on Labuange beach, which was dominated by plastic and rubber category particularly in form of thick plastic bag/wrap and thin plastic bag, and plastic cups, was not only deteriorates the aesthetics but also has the potential to harm human health and safety, as well as threaten marine organisms and the environment, both locally and globally due to the characteristic of conventional plastic that is strong and durable (Ryan et al., 2009). The plastic debris is often mistaken for food by marine organisms, ingested and enter digestive tract injured and can cause the biota to die (Laist, 1997; Derraik, 2002; Sheavly and Register 2007; Gregory, 2009).

In addition, plastic debris can also damage coral reef ecosystem (Donohue, et al., 2001; Chiappone et al., 2005; Sheavly and Register, 2007), inhabited by several types of marine organisms and transported to remote areas and became invasive organisms that can threat the existing diversity (Barnes, 2002; Sheavly and Register 2007; Gregory, 2009).

Plastic debris in the form of plastic rope that was likely to be removed or released from fishing boats was also found in relatively significant quantities in the periods of monitoring, potentially entangle marine organisms, thus inhibit their movement, making them difficult to find food, injure, and inhibit their breathing process (Laist, 1997; Derraik, 2002, Sheavly and Register 2007, Gregory, 2009).

CONCLUSIONS

The total value of abundance of marine debris fluctuated during the sampling period, which ranged from 4.41 to 10.03 items/m² per sampling period, and by weight ranged from 66.3 to 374.66 g/m² per sampling period. Plastic and rubber dominated the beach debris during the monitoring period with a proportion ranged from 78.8 to 89.1%. Thick and thin plastic bag types dominated marine waste.

To minimize the impact of marine debris to humans, marine biota, and the environment, collection of both local disposal and stranded debris, particularly on populated coastal areas and other various beach

designations is crucial. Public education on the impact of waste and its management as well as application of strict rules / regulations on waste management are also imperative.

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REFERENCES

- Barnes, DKA. 2002. Invasions by marine life on plastic debris. *Nature* 416:808-809.
- Chiappone, M., H Dienes, DW Swanson and SL Miller. 2005. Impacts of lost fishing gear on coral reef sessile invertebrates in the Florida Keys National Marine Sanctuary. *Biological Conservation* 121: 221-230.
- Derraik, JGB. 2002. The pollution of the marine environment by plastic debris: a review. *Marine Pollution Bulletin* 44: 842-852.
- Donohue, MJ, RC Boland, CM Sramek and GA Antonelis. 2001. Derelict Fishing Gear in the Northwestern Hawaiian Islands: Diving Surveys and Debris Removal in 1999 Confirm Threat to Coral Reef Ecosystems. *Marine Pollution Bulletin* 42: 1301-1312.
- Gregory, MR. 2009. Environmental implications of plastic debris in marine settings—entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364:2013-2025.
- Hong, S, J Lee, D Kang, HW Choi and SH Ko. 2014. Quantities, composition, and sources of beach debris in Korea from the results of nationwide monitoring. *Marine Pollution Bulletin* 84: 27-34.
- Jambeck, JR., R Geyer, C Wilcox, TR Siegler, M Perryman, A Andrady and KL Law. 2015. Plastic waste inputs from land into the ocean. *Science* 347: 768-771.
- Kumar, AA, R Sivakumar, Y Rutwik, MVB Raja and T Nishanth. 2016. Preliminary study on marine debris pollution along Marina beach, Chennai, India. *Regional Studies in Marine Science* 5: 35-40.
- Laist, DW. 1997. Impacts of Marine Debris: Entanglement of Marine Life in Marine Debris Including a Comprehensive List of Species with Entanglement and Ingestion Records. Pages 99-139 in JM Coe and DB Rogers, editors. *Marine Debris: Sources, Impacts, and Solutions*. Springer New York, New York, USA.
- Lippiatt, S, S Opfer and C Arthur. 2013. Marine Debris Monitoring and Assessment. NOAA Technical Memorandum NOS-OR&R-46 (November). Retrieved from http://marinedebris.noaa.gov/sites/default/files/Lippiatt_et_al_2013.pdf
- P2O-LIPI [Pusat Penelitian Oseanografi - Lembaga Ilmu Pengetahuan Indonesia]. 2018. Pelatihan monitoring sampah laut terdampar di pantai, 19-23 Februari 2018. Laporan Kegiatan P2O-LIPI Tahun 2018. Pusat Penelitian Oseanografi - Lembaga Ilmu Pengetahuan Indonesia.
- Santos, IR., AC Friedrich and ID Sul. 2009. Environmental and Monitoring Assessment 148: 455-462.
- Sheavly, SB, and KM Register. 2007. Marine debris and plastics: Environmental concerns, sources, impacts and solutions. *Journal of Polymers and the Environment* 15: 301-305.

2 Zhou, P, C Huang, H Fang, W Cai, D Li, X Li and H Yu. 2011. The abundance, composition and sources of marine debris in coastal seawaters or beaches around the northern South China Sea (China). *Marine Pollution Bulletin* 62: 1998-2007.

8 Zulkarnaen, A. 2017. Identifikasi Sampah Laut (Marine Debris) di Pantai Bodi Kecamatan Galesong, Pantai Karama Kecamatan Galesong Utara, dan Pantai Mandi Kecamatan Galesong Selatan Kabupaten Takalar. Bachelor's thesis. Universitas Hasanuddin. Makassar, Indonesia.

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