Baseline Study on the Quantity, Composition and Density of Plastic from the Sea-bed Associated with Trawling Grounds in Kuala Pahang, Malaysia

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Abstract: There is very limited information regarding plastic pollution on the sea-bed especially in Malaysia since substantial cost and resources are required to undertake such studies. Thus, in the recent trawl survey to determine the nursery grounds and species composition of sharks and rays at Kuala Pahang, Pahang, East Coast of Peninsular Malaysia, an added activity on the quantification of plastic materials trapped in the trawl net was implemented. This paper presents the quantity, composition and density of macro-plastic from the sea-bed of Kuala Pahang, conducted during the monsoon period using Monsoon Season Trawl Net at nine pre-determined stations. At each station, trawl was conducted approximately 0.75-1.48 km from the coastline for about an hour with a trawling distance of around 3.15 km. Plastic materials collected at each station were categorized into five groups; bags, bottles, fishing gears, household items and others. All plastics were weighed in wet and dry conditions. 'Plastic bags' was the most abundant material collected in this study with the highest weight of 2.844 kg followed by 'bottles' (0.602 kg), 'household items' (0.37 kg), 'fishing gears' (0.25 kg) and 'others' (0.183 kg). The stations with the highest 'plastic bags' contents were Station 3 (0.943 kg) followed by Station 1 (0.668 kg) and Station 2 (0.546 kg). The overall density of plastic observed in the present study was 146.52 kg/km^2 comprising of plastic bags (98.07 kg/km^2), bottles (20.76 kg/km^2), household items (12.76 kg/km^2), fishing gears (8.62 kg/km^2) and others (6.31 kg/km^2).

Keywords: Plastics, Pollution, Solid waste, Trawl net

Abstrak: Maklumat mengenai pencemaran plastik di dasar laut sangat terhad terutamanya di Malaysia memandangkan kos dan sumber yang diperlukan untuk menjalankan kajian berkaitan adalah tinggi. Terdahulu, kajian untuk menentukan kawasan nurseri dan komposisi spesies ikan yu dan pari menggunakan pukat tunda telah dijalankan di Kuala Pahang, Pantai Timur Semenanjung Malaysia. Aktiviti tambahan mengenai kuantiti bahan plastik yang terperangkap di dalam pukat tunda ketika aktiviti penangkapan ikan telah dijalankan. Kertas ini membentangkan kuantiti, komposisi dan ketumpatan bahan plastik yang diperolehi di dasar laut perairan Kuala Pahang. Kajian dijalankan ketika musim tengkujuh menggunakan Pukat Tunda Musim Tengkujuh di sembilan stesen tundaan yang telah ditetapkan. Tundaan di setiap stesen dilaksanakan pada jarak antara 0.75-1.48 km daripada persisiran pantai dengan kelajuan lebih kurang satu jam serta jarak tundaan lebih kurang 3.15 km. Bahan plastik yang diperolehi di setiap stesen dikategorikan kepada lima kumpulan iaitu 'beg', 'botol', 'peralatan menangkap ikan', 'sisa dari dapur' dan 'lain-lain'. Berat kesemua plastik telah ditimbang ketika dalam keadaan basah dan kering. 'Beg plastik' merupakan bahan yang paling banyak dikumpul dengan berat sebanyak 2.844 kg diikuti 'boto' (0.602 kg), 'sisa dari dapur' (0.37 kg), 'peralatan menangkap ikan' (0.25 kg) dan 'lain-lain' dengan berat sebanyak 0.183 kg. Stesen yang merekodkan 'beg plastik' tertinggi ialah Stesen 3 (0.943 kg) diikuti Stesen 1 (0.668 kg) dan Stesen 2 (0.546 kg). Secara keseluruhannya, ketumpatan plastik yang diperolehi di kawasan kajian ialah 146.52 kg/km^2

yang terdiri daripada 'beg plastik' (98.07 kg/km^2), 'botol' (20.76 kg/km^2), 'sisa dari dapur' (12.76 kg/km^2), 'peralatan menangkap ikan' (8.62 kg/km^2) dan 'lain-lain' (6.31 kg/km^2).

Introduction

Since its first introduction in 1960s, plastic production has amplified exponentially due to worldwide demand because of its versatility, sturdiness and it is relatively cheap to produce (Geyer et al., 2017). Plastic production is over 300 million tons every year for use in a wide variety of applications (IUCN, 2021). Generally, about 14 million tons of plastic end up in the ocean every year. The most abundant type of litter in the ocean is plastic debris that making up 80% from the total marine debris found from surface waters to deep-sea sediments (IUCN, 2021). The source of plastic pollution ranges from land-based waste disposal, waste from vessels, abandoned fishing gears and natural and anthropogenic disasters, among others. With the ability to persist in the environment, plastic is harming freshwater and marine ecosystems, marine fauna including zooplankton, cetaceans, seabirds and marine reptiles (Eriksen et al., 2014). The effects of plastic pollution are not only aesthetic but could have serious consequences to marine life either through ingestion or entanglement with these harmful objects. Furthermore, it also affects human health and well-being through ingestion of micro plastics.

Malaysia has the highest annual plastic use per capita, at 16.78 kg per person compared to China, Indonesia, Philippines, Thailand and Vietnam (Kneefel, 2020). In terms of plastic waste, Malaysia ranks second highest in overall generated waste (National Solid Waste Management Department, 2011). A first step to tackle the problem of plastic pollution is to quantify the existing volumes. However, data on the quantification of plastic pollution is generally limited in Southeast Asia including Malaysia (Lyons et al., 2019).

The composition, abundance and quantification of plastic from beaches (Khairunnisa et al., 2012; Fauziah et al., 2015; Mobilik et al., 2015; James Noik and Mohd Tuah, 2015; Chong and Narayanan, 2016; Mobilik et al., 2017; Yin et al., 2019, Azman et al., 2021; Fauziah et al., 2021;) and mangrove forests (Barasarathi et al., 2014) in Malaysia have been reported since 2010. The reports on plastic washed up on shorelines is justifiable because of the presence of sources, ease of access and aesthetic reasons (McGranahan et al., 2007). According to Engler, (2012) deep-sea surveys are equally important because approximately 50% of plastic litter sink to the seafloor and even low-density polymers such as polyethylene and propylene will eventually sink due to the weight of fouling. Information regarding plastic litter on the sea-bed is very limited because of the sampling difficulties, inaccessibility and substantial cost and resources required to undertake such study. That is why there is almost no report on quantification of plastic obtained through trawl surveys in Malaysia although other countries have reported macro-debris (debris with size larger than 20 mm) load including plastic from the sea-bed as early as the 90s (Bingel et al., 1987; Galil et al., 1995; Galgani et al., 2000). On the other hand, literatures on the detection of micro plastic in seawater and seafood from Malaysia were published recently (Sarijan et al., 2018; Khalik et al., 2018; Mat Issa and Ab Rahim, 2018; Hashim et al., 2019; Najihah et al., 2020).

The increase use of plastics warrants greater concern and Malaysia need baseline information in quantification of plastics pollution obtained from the sea-bed although it is noted that the cost to conduct specific trawl survey for this purpose is not inexpensive. Thus, we took the opportunity during the recent survey carried out by the Institute Sains Marine Asia Tenggara (ISMAT), Chendering, Kuala Terengganu to determine the composition of sharks (Hemiscyllidae) and rays (Dasyatidae and

Gymnuridae) species and their nursery grounds in Kuala Pahang, Pahang, the East Coast of Peninsular Malaysia using Monsoon Season Trawl Net or locally known as 'Pukat Tunda Musim Tengkujuh' to record the quantity, composition and density of plastic trapped in the net throughout trawling. To our knowledge, this is the first work that provides the first record of benthic marine plastic from the coastal areas of Kuala Pahang, Pahang, Malaysia.

Materials and Methods

Study areas

Kuala Pahang is the river mouth of Sungai Pahang, which is the longest river in the Peninsular Malaysia (459 km in length). Sungai Pahang starts from the upper slopes of Banjaran Titiwangsa and enters the Jelai river flowing in a south-easterly direction, passing through Kuala Lipis before merging with Sungai Tembeling near Pahang and Terengganu state border. It then flows in a south-westerly direction passing through Kuala Tahan. Jerantut, Kuala Krau, Kerdau and Temerloh. At Mengkarak, the river turns northeast, passing through Chenor and then turning east at Lubuk Paku and Lepar into the floodplain of Paloh Hinai, Pekan and Kuala Pahang before draining into the South China Sea (Figure 1). Throughout its course, Sungai Pahang flows through agriculture farms and human settlements.

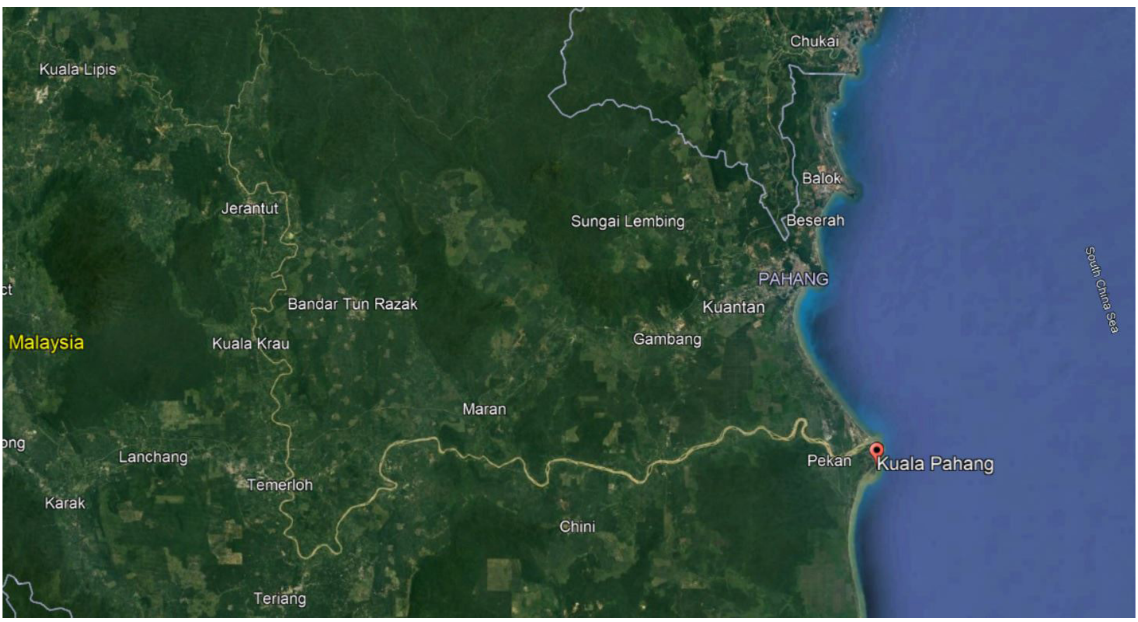

Figure 1: The area of Sungai Pahang

Trawling activities

The data on the quantity, composition and density of plastic was acquired during three trawling activities conducted on the 30th December 2019, 29th January and 30th January 2020 in Kuala Pahang Zone A waters using a private fishing vessel (GRT of 22.03 tones, 13.9 m length, 4 m width with 190 HP engine and equipped with Garmin GPSMAP 585 Plus GPS chart plotter with chirp fish finder and Sonar with GT20 transducer). The gear used was the monsoon season trawl net with a net length of 25.6 m, net opening width of 9.14 m, 36.6 m warp wire, 4.6 m sweep line, 10 m head line and 25 mm cod-end mesh size.

Table 1: Details information trawl activities carried out in the present study

Date	Trawl station	Depth at start (m)	Depth at end (m)	Latitude at start	Longitude at start	Latitude at end	Longitude at end
30/12/2019	1	7.9	7.6	3°32.620′	103°28.311′	3°33.594′	103°26.937′
30/12/2019	2	8.1	7.9	3°33.494′	103°26.965′	3°34.714′	103°25.579′
30/12/2019	3	8.2	7.9	3°34.400′	103°26.115′	3°32.577′	103°27.313′
29/01/2020	4	6.7	4.8	3°32.440′	103°28.293′	3°33.506′	103°26.617′
29/01/2020	5	4.8	7.3	3°33.466′	103°26.606′	3°34.940′	103°25.606′
29/01/2020	6	7.3	8.0	3°34.786′	103°26.703′	3°33.368′	103°27.150′
30/01/2020	7	4.8	6.4	3°31.532′	103°29.398′	3°29.718′	103°29.679′
30/01/2020	8	6.4	3.3	3°29.279′	103°29.685′	3°30.149′	103°29.105′
30/01/2020	9	3.3	9.1	3°29.986′	103°29.225′	3°31.234′	103°29.877′

Trawling time was about 60 min at around 2.5 knots trawling speed. The study was conducted in waters between 3.3 – 9.1 m depth and about 0.75-1.48 km (0.4 – 0.8 nautical miles) from coastline. Trawling distance at each station was about 3.15 km (1.7 nautical miles) with swept area of approximately 0.029 km^2 (0.0091 km x 3.15 km). Information on the trawling stations, exact locations and illustration are provided in Table 1 and Figure 2.

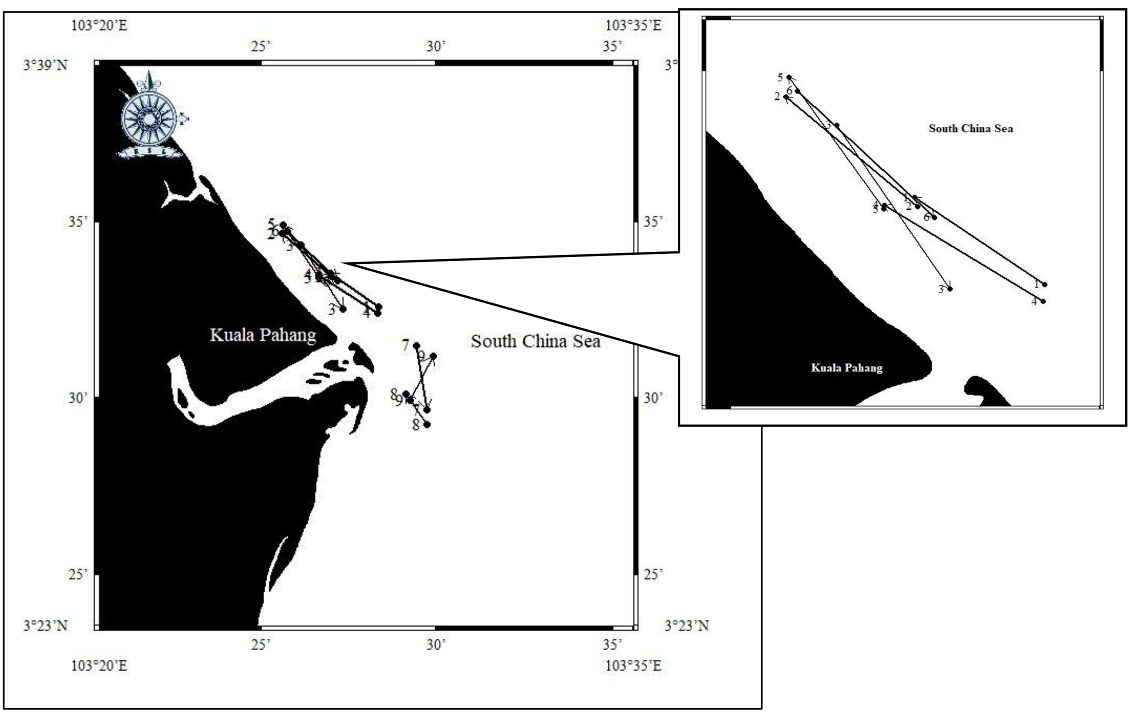

Figure 2: Study area showing trawl stations and trawling direction

Data collection

After trawling, the plastic debris were classified into five categories, namely plastic bags, plastic bottles, fishing gears (nets and ropes), household items and others. Some of the pictures of the plastic debris gathered are shown in Figure 3. Plastic bags group included snack wrap, food packaging, bags and garbage bags. Any types of kitchen stuff made of plastic were categorized under household items. On the other hand, pieces of plastic toys, sharpeners, measuring tapes, agriculture polybags, nursery pots, cassettes, and compact disc (CD) holders were placed under 'others' category. All plastic materials were weighed by categories in wet and dry conditions. This is done because plastic materials in wet condition are mostly covered with mud, sand and sometimes with biofouler (algae and barnacles) and plastic bags may contain water. All these elements would increase the actual weight of the plastics. After removing the water, mud and biofouler, all plastic materials were sun-dried and weighed again.

Results

The quantity of plastic materials collected at each station in wet and dry weight is presented in Table 2. Station 3 recorded the most weight of plastic (1.444 kg) collected, followed by Station 1 (1.158 kg) and Station 2 (0.704 kg). Besides Station 9 (0.290 kg), Station 5 (0.279 kg) and Station 4 (0.174 kg), all others stations counted less weight of plastic debris (< 0.1 kg).

Representative images of the plastic debris gathered are shown in Figure 3. In term of composition, 'plastic bags' recorded the highest weight at 2.844 kg followed by 'bottles' (0.602 kg), 'household items' (0.37 kg), 'fishing gears' (0.25 kg) and 'others' (0.183 kg). The stations with the highest 'plastic bags' contents were Station 3 (0.943 kg) followed by Station 1 (0.668 kg) and Station 2 (0.546 kg). Other stations recorded between 0.039 – 0.285 kg. Understandably for dry weight measurement the pattern was similar to wet weight. Station 3 recorded the highest dry weight of plastic debris of 0.61 kg followed by Station 1 (0.536 kg) and 2 (0.232 kg). Other stations recorded between 0.035 – 0.162 kg.

The details on plastic density from the study is shown in Table 3. The total plastic density (in wet weight) recorded was 146.52 kg/km^2 comprising of plastic bags (98.07 kg/km^2), bottles (20.76 kg/km^2), household items (12.76 kg/km^2), fishing gears (8.62 kg/km^2) and others (6.31 kg/km^2). The greatest density of plastics (in wet weight) was collected at Station 3 with 49.79 kg/km^2, followed by Station 1 (39.93 kg/km^2), Station 2 (24.28 kg/km^2) and Station 9 with 10 kg/km^2. Other stations recorded densities between 1.69 – 9.62 kg/km^2.

The proportion of plastics (wet weight) to total catches by stations is shown in Table 4. In general, plastic constituted only about 1.06% percent of the total catches in this study. The percentage of plastic by stations was in the range of 0.1-7.65% of the total catch. Station 1, 3 and 2 recorded the highest percentage of plastic in the catches of 7.65%, 6.74% and 4.60% respectively.

Table 2: Wet and dry weight of plastic materials collected at each station (weight in kilogram)

	Station																			
	Station 1		**Station 2**		**Station 3**		**Station 4**		**Station 5**		**Station 6**		**Station 7**		**Station 8**		**Station 9**		**TOTAL**	
Category	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	**wet**	**dry**
Plastic bags	0.668	0.172	0.546	0.098	0.943	0.222	0.13	0.088	0.092	0.035	0.039	0.028	0.049	0.035	0.092	0.058	0.285	0.147	**2.844**	**0.883**
Bottles	0.188	0.17	0.058	0.05	0.347	0.245	0	0	0	0	0.009	0.008	0	0	0	0	0	0	**0.602**	**0.473**
Fishing gears	0.172	0.071	0.029	0.018	0.018	0.015	0.031	0.025	0	0	0	0	0	0	0	0	0	0	**0.25**	**0.129**
Household items	0.03	0.029	0.037	0.033	0.103	0.1	0.013	0.01	0.187	0.127	0	0	0	0	0	0	0	0	**0.37**	**0.299**
Others	0.1	0.094	0.034	0.033	0.033	0.028	0	0	0	0	0.006	0.004	0	0	0.005	0.002	0.005	0.003	**0.183**	**0.164**
Total	**1.158**	**0.536**	**0.704**	**0.232**	**1.444**	**0.61**	**0.174**	**0.123**	**0.279**	**0.162**	**0.054**	**0.04**	**0.049**	**0.035**	**0.097**	**0.06**	**0.29**	**0.15**	**4.249**	**1.948**

Figure 3: Representative images of the plastic debris, a. Plastic materials obtained from trawling before sorting, b. Sorting of 'bottles', c. Pieces of toys under 'others', and d. 'Bottles', 'fishing gear' and 'plastic bags' after drying

Table 3: Density of plastic materials in wet and dry condition collected at each station (kg/ km^2). Swept area was $0.029km^2$

Category	Station																		TOTAL	
	Station 1		Station 2		Station 3		Station 4		Station 5		Station 6		Station 7		Station 8		Station 9			
	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry	wet	dry
Plastic bags	23.03	5.93	18.83	3.38	32.52	7.66	4.48	3.03	3.17	1.21	1.34	0.97	1.69	1.21	3.17	2.00	9.83	5.07	98.07	30.45
Bottles	6.48	5.86	2.00	1.72	11.97	8.45	0	0	0	0	0.31	0.28	0	0	0	0	0	0	20.76	16.31
Fishing gears	5.93	2.45	1.00	0.62	0.62	0.52	1.07	0.86	0	0	0	0	0	0	0	0	0	0	8.62	4.45
Household items	1.03	1.00	1.28	1.14	3.55	3.45	0.45	0.34	6.45	4.38	0	0	0	0	0	0	0	0	12.76	10.31
Others	3.45	3.24	1.17	1.14	1.14	0.97	0	0	0	0	0.21	0.14	0	0	0.17	0.07	0.17	0.10	6.31	5.66
Total	39.93	18.48	24.28	8.00	49.79	21.03	6.00	4.24	9.62	5.59	1.86	1.38	1.69	1.21	3.34	2.07	10.00	5.17	146.52	67.17

Table 4: Proportion of plastics in wet condition to total catches by stations. Weight in kilogram

Items	Station 1	2	3	4	5	6	7	8	9	Total
Other catches	13.97	14.61	19.99	52.70	37.80	34.74	87.01	96.14	39.71	396.66
Plastics	1.16	0.70	1.44	0.17	0.28	0.05	0.05	0.10	0.29	4.25
Total other catches and plastics	15.13	15.31	21.43	52.87	38.08	34.79	87.05	96.23	40.00	400.91
Plastic percentage (%)	7.65	4.60	6.74	0.33	0.73	0.16	0.06	0.10	0.72	1.06

Discussion

This study reports data on the quantity, composition and density of plastic from the sea-bed of Kuala Pahang. This study was essentially selective and, in many cases, do not provide definitive conclusions concerning geographical variations and the amounts of plastic actually present. As mentioned in the introduction, most of the previous studies on macro-debris load from the sea-bed, including plastic utilized bottom trawl fish stock assessments (Galgani et al., 2015) to optimise the resources. Similarly, in the present study we utilized the trawl survey to determine sharks and ray's species composition and their nursery grounds in Kuala Pahang to record the quantity, composition and density of plastic of the trawling grounds. According to Galgani et al., (2011), trawling was considered the one of most adequate method to quantify plastic debris when considering net mesh sizes and opening width. However, this method has some limitations especially for rocky habitats or hard substrates. In the present study, trawling was carried out in muddy sediment sea-bed which covers most of the area close to the coast line of Pahang as described in the National Offshore Sand Resources Survey Phase III (Amin Noorasid et al., 2020). This is clearly evidenced from our observation of all the plastic items collected which were covered with fine mud.

Stations 1, 2, 3, 4, 5 and 6 were located in the northern part of Kuala Pahang. Stations 3, 1 and 2 recorded the topmost weight of plastic debris of 1.444 kg, 1.158 kg and 0.704 kg respectively. Besides Station 9 (0.290 kg), Station 5 (0.279 kg) and Station 4 (0.174 kg) all others stations recorded weight of less than 0.1 kg. The main explanation of this observation is trawling at Station 3, 1 and 2 was conducted on 30th December 2019 which was at the peak of Northeast Monsoon season on the east coast of Peninsular Malaysia while samplings at Stations 4, 5, 6, 7, 8 and 9 were carried out after a month i.e. on 29th and 30th of January 2020. Similar observation was described by Lattin et al. (2004) who found that the concentration of plastic waste collected after the storm was the highest particularly at the sampling area closest to shore. Other reasons could be due to current patterns. According to Liew et al. (1987) and Yaacob et al. (1995), current patterns in the South China Sea are monsoon-controlled. The Northeast Monsoon in the east coast of Peninsular Malaysia started from November until March. During the Northeast Monsoon, currents flow southward along the east coast of Peninsular Malaysia with speed varying between 0.1 – 0.2 m/s. In this study, the result shows that plastic debris collected at Station 3 was higher than Station 1 and Station 2. The direction of trawling at Station 3 was towards the south as the current flow. Whilst, the trawling direction at Station 1 and Station 2 was towards north and opposite to the current flow. Additionally, plastic debris from mainland could also be transported to Stations 3, 1 and 2 not only through Sungai Pahang but also several rivers slightly north of Kuala Pahang i.e Sungai Kuantan, Sungai Terus and Sungai Penur. This is also suggested by Lechner et al. (2014) and Rech et al. (2014) who stated that although large rivers are responsible for substantial input of debris to the sea-bed in estuaries, small rivers also transport waste far offshore because of their high flow rate and strong currents.

In terms of composition, 'plastic bags' was the most abundant material collected in this study. Since there is no comparison to any published data of plastic pollution of sea-beds in Malaysia, we tried to compare our findings with studies that focus on the quantifications of plastic from the beaches in Malaysia. Fauziah et al. (2015) also found plastic bags or film as the main plastic debris on the beach of Telok Kemang Beach and Pasir Panjang Beach, Port Dickson, Tanjung Aru Sabah and Teluk Likas, Sabah. Similarly, Yin et al. (2019) reported plastic bags as the largest fraction (2,046 items; 30.3%), followed by plastic sheets (1,343 items; 19.9%) in their study on the anthropogenic marine debris at two urban and peri-urban mangroves in Penang, Malaysia.

Our findings were also in accordance with (Galil et al., 1995; Galgani et al., 1995, 2000; Ramirez-Llodra et al., 2013; Ioakeimidis et al., 2014) who also observed 90% of litter caught in benthic trawls on the seafloor of Eastern Mediterranean, north-western Mediterranean Sea, and Black Seas was plastic. This fact is further reinstated by Pham et al. (2014) whose assessments on the composition of litter in different marine regions of European Seas show that plastics, which include all petroleum-based synthetic materials, make up the largest proportion of overall litter pollution. Similar discoveries were also described in other parts of the world where plastic bags, fishing equipment, food and beverage containers were the most common items and constitute more than 80% of litter stranded on beaches (Topçu et al., 2013). Comparable findings were likewise noted by Law et al. (2010) in North Atlantic Ocean, Thiel et al. (2013) in northern-central Chile and Galgani et al. (2000) along European Coasts.

For 'fishing gears', Station 1 recorded the highest weight of 0.172 kg followed by Station 4 (0.031 kg), Station 2 (0.029 kg) and Station 3 (0.018 kg). 'Fishing gears' were not observed at other stations. Surprisingly 'fishing gears' were 4th in ranking of the type of plastic observed. The results are quite surprising as this stretch of coastal waters is considered as an active fishing ground. Fauziah et al. (2015) observed that fishing gears were the main type of plastic pollution found at a fishing beach compared to a recreational beach. Although the impacts caused by derelict fishing gear was not investigated in this study, numerous studies have shown diverse impacts including ghost fishing and entanglement by sessile invertebrates such as corals. Abandoned gears may also trap more litter resulting in a litter 'depot' that has a bigger impact. Furthermore, most fishing gear is mostly made of highly resistant plastics and will likely persist in the ocean.

The 'household items' and 'others' category were the least plastic materials observed in this survey. For 'household items', Station 5 recorded the highest weight of 0.187 kg followed by Station 3 (0.103 kg), 2 (0.037 kg), 1 (0.03 kg) and 4 (0.013 kg). The household items could be from the settlements along Sungai Pahang including Kampung Beruas, Kampung Permatang Arang, Kampung Pasir Panjang, Kampung Ketapang, Kampung Pulau Maulana and Kampung Pulau Tambun.

Density of plastic bags recorded the highest compared to other categories and the densities varied between stations. The greatest density of plastics (wet weight) was found at Station 3 (49.79 kg/km^2), followed by Station 1 (39.93 kg/km^2), Station 2 (24.28 kg/km^2). It is very difficult to compare plastic density of various coastal areas (with different population densities, hydrographic and geological conditions) obtained from various studies with different methodologies. Nevertheless, common patterns indicate the prevalence of plastics, greater loads close to urban areas and tourism regions (Barnes et al., 2009). As suggested from previous work, the geographical distribution of debris including plastic on the ocean bed is subjected to many factors such as hydrodynamics, geomorphology and human factors (Galgani et al., 1996; Pham et al., 2014). Moreover, there are notable temporal variations, particularly seasonal, with tendencies for accumulation and concentration of marine litter in particular geographical areas (Galgani et al., 1995).

This is our first attempt to quantify plastics debris from the sea-bed. As ISMAT regularly carried out fish resource survey, more attempts could be made in getting more information on plastic debris. Several shortcomings have been identified in the present study will be rectified in future endeavour. Among them is the method in quantifying the plastic. Quantification of plastics items is more appropriate than weighing the plastic. Data expressed as items m^{-2} or km^{-2} are more useful for comparisons with previous work. The interpretation of the available data is also challenging since the plastic distribution is influenced by a variety of factors i.e. human activities, seasonal changes in rivers flow rate, hydrodynamic conditions and sea-bed morphology.

Conclusion

'Plastic bags' was the most abundant material collected in this study followed by 'bottles', 'household items', 'fishing gears' and others. The stations with the highest 'plastic bags' contents were Station 3 followed by Station 1 and Station 2. Our results are very basic to explain the complexity of the problem and highlight the needs for concentrated efforts in order to collect sufficient data to fill the existing gaps in knowledge. The further study is going to be conducted focusing on composition of marine debris using various type of fishing gears.

Acknowledgement

The greatest gratitude for the Department of Fisheries Malaysia for providing financial supports to conduct this study. A special thanks to Mr. Raja Bidin bin Raja Hassan, the Former Director of Southeast Asia Marine Resources Institute and Dr. Ahmad bin Ali, the Former Head of Fishery Oceanography and Resource Enhancement Section, for his guidance in data analysis and preparation of this manuscript.

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