

# Daily accumulation of marine litter in clam aquaculture area in Can Gio District, Ho Chi Minh City

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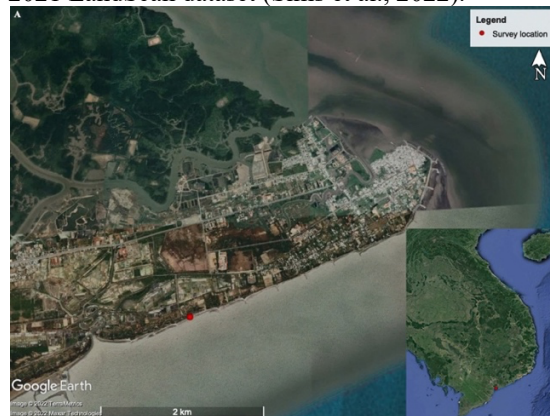
## 1. Introduction

Marine litter has significant impacts on the environment, human health and the economy. Therefore, there is increasing interest in quantifying the scale of the problem. Studying on beach litter accumulation is one of the approaches to investigate its flows to the marine environment. In this study, beach litter composition and abundance in a mussel culture area in Can Thanh Town, Can Gio District was assessed during a moon cycle on a daily basis.

## 2. Material and method

### 2.1 Sampling location

Can Gio beach (10°24'01.96"N - 106° 56'53.57"E) is a sandy beach facing the East Sea that is located in the suburban area of Ho Chi Minh City, Vietnam. The study area was in Can Thanh Town and was impacted by wind-induced waves. The surrounding environment consisted of clam aquaculture area (Fig. 1) with no tourism activity as well as there are few people living around (approximately 86 people/km<sup>2</sup>). Information of population for the study site was obtained from the Oak Ridge National Laboratory's 2021 LandScan dataset (Sims et al., 2022).



**Fig. 1.** Survey location for marine litter accumulation study in Can Thanh, Can Gio District (red dot)

In this study, all litters in transect of 50 m length parallel to seawater line and 10 m width extending from the upper limit (bushes) of the beach were collected. In the transect, the following steps were performed:

- On day 0, all litters were cleared up in the study area as well as the surrounding area within a radius of 200 m.
- Litter accumulation survey was conducted daily from day 1 to day 30 (from December 4, 2021 to January 02, 2022). This period coincided with a lunar cycle. All litter items larger than 2.5 cm on the surface were collected and transferred to the laboratory for further treatment.
- In the laboratory, all of the items were cleaned from the sand, air-dried for 24 hours and each item was classified according to NOAA Marine Debris Monitoring and Assessment Project (MDMAP) Shoreline Survey Guide (Burgess et al., 2021) with modification in litter category, and then the litters were weighted.

### 2.2 Data analysis

In accordance with the BFFP requirements, all the plastic items gathered from daily accumulation surveys were used for parent company audits (BFFP, 2022). In addition, plastic items were categorized into seven plastic resin codes: Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), and Other (O) by scanning each item, plastic resin code was determined (number 1 for PET, number 2 for HDPE, number 3 for PVC, number 4 for LDPE, number 5 for PP, number 6 for PS). In case, there was no clearly printed number of resin code, a decision was given based on methods proposed by van Emmerik et al. (2018) and Fruergaard et al. (2023).

Accumulation rates were reported as number of items or mass, per unit area, per day.

## 3. Results and discussion

### 3.1 Litter type

3,617 items of marine litter weighing 21,456.674 g were collected throughout the continuous 30-day-survey in the study site. Plastics made up 96.77 percent of all litters found in the study area, although there were also a few fabrics (mainly face masks), rubber, glass, wood, and metal. In addition, plastic items were divided into fragments, single-use, tobacco, fisheries, and others. Among plastic, single-use items accounting for the largest proportion (33.51%) of the component

was made up of single-use plastics, followed by others (27.06%), fragments (25.57%) and fisheries (13.23%). Tobacco had the smallest proportion, 0.63%. However, in term of weight, fisheries were the most contributed (31.98%), followed by single-use (29.14%), fragment (19.87%), others (17.51%) and tobacco (1.51%) (Fig. 3). Items with weight less than 1 g accounted for 45.5% and items with weights between 1-5 g contributed to 33.78%, by count. Heavier items with weight > 100 g accounted for a low percentage, only 0.94% by count.

The most abundance item was plastic foam, accounted for 18.81% of total items found. Top 10 items found (89.52% of total) were all plastics such as plastic foam (18.86%), bottle wrapper (18.11%), rope and nets (12.25%), food wrapper (7.05%), bags (6.52%).

### 3.2 Daily accumulation

Daily accumulation rates of litter at study site were highly variable (Fig. 2). This is equivalent to the daily accumulation rate of  $0.24 \pm 0.24$  items/m<sup>2</sup>/day (range: 0.06 – 1.33) or  $1.43 \pm 1.45$  g/m<sup>2</sup>/day (range: 0.17 – 5.7).

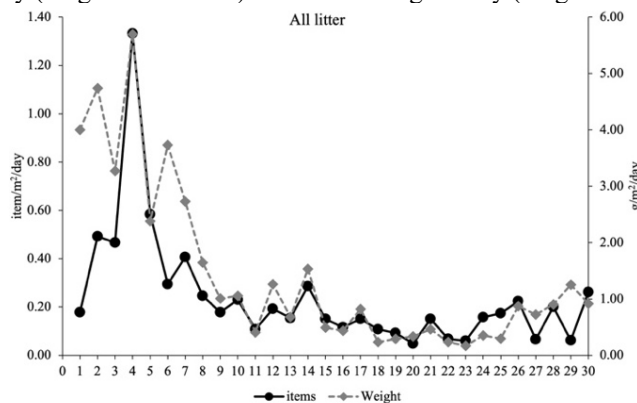


Figure 2. Time-series of the daily accumulation rate of marine litter at study area

### 3.3 Plastic resin code

PP was the most dominant plastic type (26.74%), followed by PVC (21.6%), PS-E (20.05%), O (8.21%), HDPE (8.04%), LDPE (7.21%) and PS (2.43%). In terms of weight, PP was also the most contributed plastic resin (40.58%), followed by O (16.58%), HDPE (12.62%), PS-E (8.28%), PVC (7.82%), LDPE (6.05%) and PS (1.09%).

### 3.4 Brand audit assessment

This study showed that majority of plastic litters was unbranded (75.3%) and top five litter brands found in the study area were: Pepsico (13.46%), CocaCola (1.29%), Tan Hiep Phat (1.14%), Masan (1.03%) and Vinacafé BH (0.86%) (Fig. 3).

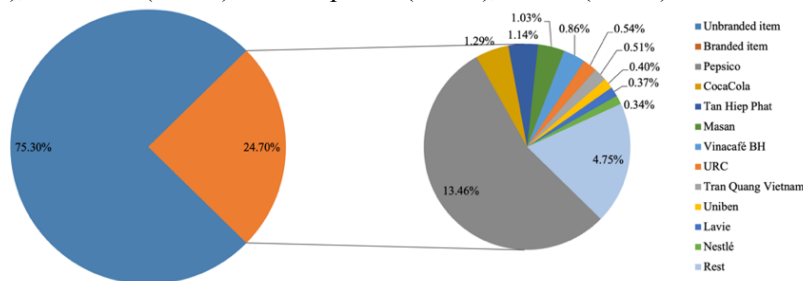


Figure 3. Results of brand audit assessment in this study

## 4. Conclusion

In this study, a modified NOAA litter category was used to assess the accumulation of marine litter in a clam aquaculture area in Can Gio region. The results showed that plastics was the most abundance litters in term of amount and items, in which single-use plastics accounted for the most proportion. In term of branded items, most of them were from food and beverage companies. This study also showed that sea-base source was the main contributor for marine litter in the region; therefore, upstream waste management should be taken more seriously to protect fauna and flora in the biosphere reserve in the region.

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