

## The Characterization of Marine Debris: A Case Study of Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province

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### ABSTRACT

This research aims to study and compare type, quantity and composition of marine debris in each season at Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province and study guidelines for using marine debris according to the International Coastal Cleanup method. Samples were collected 10 times during the summer season in April and the monsoon season in July 2023. Silaphan Beach area has a width of 17 meters and a length of 246 meters. The sampling area was divided into 3 zones as follows: 1) Zone A, the beach area in front of Sinae Phuket Luxury Hotel, 2) Zone B, beach area in front of Plai Laem Seafood Restaurant and 3) Zone C, beach area for sitting and relaxing. The lowest high and low tide levels of the Department of Ornithology is a criterion for collecting samples. From a study of 10 monthly marine waste, it was found that there were a total of 2,024 pieces of debris. General debris was the most common, accounting for 69.20 percent, amounting to 1,401 pieces. Next was recycled waste, accounting for 28.84 percent, 584 pieces, and the least was hazardous waste, accounting for 1.96 percent, 39 pieces. The amount of debris in April (summer) was found to have the most debris, with a quantity of 1,308 pieces. In July (monsoon season), there were 716 pieces. The most common components of marine debris found from sampling included: snack bags, followed by straws, cigarette butts, and plastic bottle caps, respectively, and the most common hazardous waste was lighters. For guidelines and utilization of marine waste from Silaphan Beach include: donating drink straws to the Patong Foundation to further the Earth-saving pineapple pillow project to be used for bedridden patients. Aluminum can lids were donated to Vachira Phuket Hospital to make prosthetic legs and plastic bottle caps were molded into plant pots.

**Keywords:** marine debris; marine debris composition; Silaphan Beach

### Introduction

The problem of marine debris is one of the most important environmental problems on a global level and is considered a cross-border crisis because marine debris can float downstream to different countries and continents. Many countries have begun to realize and find measures to reduce the problem of marine debris. From the database of The World Bank points out that China produces the most municipal marine debris in the world with a huge quantity of 395 million tons per year, followed by United States of America 265 million tons per year. The United States ranks much higher than before. If measured by municipal marine waste production per capita, it was found that waste production was approximately 812 kilograms after Monaco, Moldova, Mongolia, and Denmark, this means that every person in the United States produces nearly 2.26 kilograms of municipal marine debris every day. The amount of waste that humans create will continually increase along with the world population. Most importantly, as people become wealthier between 2016 and 2050, waste is expected to increase by as much as 70%, according to the World Bank [1].

The current marine debris problem tends to increase. It is a result of plastic waste that is not properly managed and flows into the sea. Its origin was 80 percent from land and 20 percent from the sea

during 2016 – 2019. The amount of marine debris in 23 coastal provinces of Thailand increase in quantity but proper management of marine waste also tends to improve. There is waste separation from the source and reuse. In the area of 23 coastal provinces, there was 11 million tons of marine debris. There were 2.86 million tons of improperly disposed waste, of which 343,183 tons were plastic waste (0.34 million tons). These were 34,318 – 51,477 tons of marine debris (0.03 - 0.05 million tons) [ 2 ].

Phuket is another important tourist province in Thailand facing a garbage problem that is increasing every year. From the environmental situation report in 2016, it was found that the prioritization of environmental problems in each province in the Environment Office Region 15 were marine debris. By managing and disposing of marine debris in urban communities in the southern provinces on the Andaman coast in 2016, there was a total amount of marine debris generated approximately 2,661.33 Tons/day, divided into the amount of marine debris that was disposed approximately 1,215.01 tons/day, accounting for 75.24 percent of the amount of marine debris that was collected. Improper disposal of marine debris was approximately 399.77 tons/day, or 24.76 percent of the amount of marine waste The highest amount of marine debris in Phuket was approximately 879.89 tons/day, or 33.06 percent of the total amount of marine debris generated in the southern provinces on the Andaman coast [ 3 ].

Silaphan Beach is located in Village No. 1, Koh Siray, Ratsada Subdistrict, Mueang District, Phuket Province. It has the characteristics of a sandy beach and a rocky beach. With a beach length of 246.30 meters, Silaphan Beach is another place that is a tourist attraction in Phuket Province. From visiting the area to survey the amount of marine debris in Silaphan Beach area, plastic bottles, glass bottles, plastic bags, beverage straws, etc were found. From the above information, the researcher is interested in the problem of marine debris. Because the Silaphan Beach area is a place where tourists go to do the activities, both in terms of recreation and the use of space for occupations such as restaurants, hotels, fishing, etc. The researcher is therefore interested in studying the types, quantity and composition of residual marine debris at Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province to use as basic information in marine waste management for future use.

## **Methodology**

This research is the study of types and composition of marine debris: case study of Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province to know the type, quantity, and composition of marine debris in the Silaphan Beach area. Types and the amount of marine debris in each season were compared and marine debris in the area of Silaphan Beach were brought to use. The study method is as follows: 1) The characteristics of the beach must be in accordance with the criteria and requirements of the ICC ( International Coastal Clean up ). 2) Samples were collected during the summer in April and the monsoon season in July 2023. A total of 10 samples were collected by collecting data at Silaphan Beach which has a width of 17.60 meters and a length of 246.30 meters by dividing the sampling area into 3 zones as follows: Zone A, beach area in front of Sinae Phuket Luxury Hotel, Zone B, beach area in front of Plai Laem Seafood Restaurant and Zone C, beach area for sitting and relaxing, as shown in Figure 1.1 using the lowest tide level of the Royal Meteorology Department as a criterion for collecting samples. 3) Equipment included gloves, boots, face masks, debris picks, black bags, baskets, tent cloth for separating debris, a 50-meter-long measuring tape, recording camera, scale, paper and pen for taking notes. The study area is Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province, as shown in Figure 1.2.

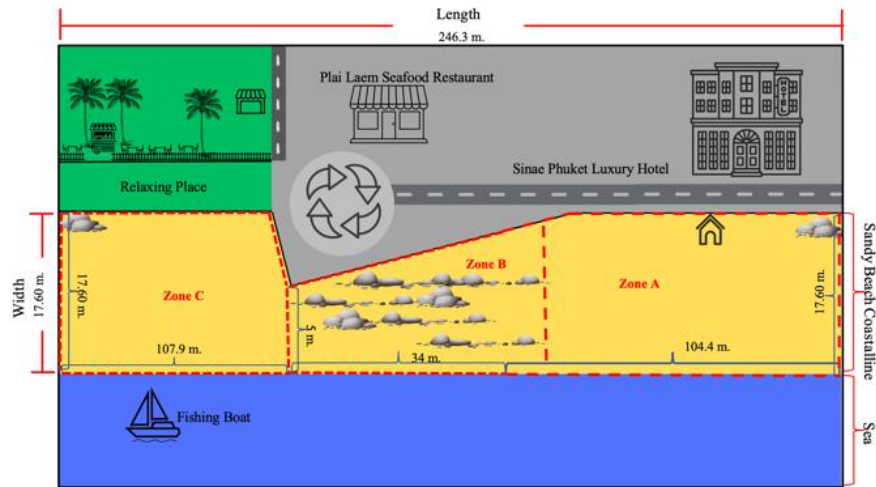


Figure 1.1 The sampling area, Silaphan Beach, Ratsada Subdistrict, Mueang District, Province



Figure 1.2 Satellite image of Silaphan Beach, Ratsada Subdistrict, Mueang District, Province

Source: Adapt form QGIS Program, 2023

## Results and Discussions

### 1. Type, quantity and composition of residual marine debris. Silaphan Beach area, Ratsada Subdistrict, Mueang District, Phuket Province

From the study of the amount of marine debris in Silaphan Beach area, Ratsada Subdistrict, Mueang District, Phuket Province during two seasons: summer in April 2023 and the monsoon season in July 2023, the total amount of debris from 10 sampling times was 2,024 pieces. The most common type of debris was general debris, amounting to 1,401. Recycled debris was 584 pieces and the least found was hazardous waste 39 pieces.

Samples were collected 5 times during Summer in April 2023. The total amount of waste found was 1,308 pieces. The most common waste was 956 pieces of general waste, 320 pieces of recycled waste, and the least common was 32 pieces of hazardous waste. Samples were collected 5 times during the monsoon season in July 2023. The total amount of waste found was 716 pieces. The most common waste was 445 pieces of general waste, 264 pieces of recycled waste, and the least common was 7 pieces of hazardous waste, as shown in Figures 1.3 and 1.4.

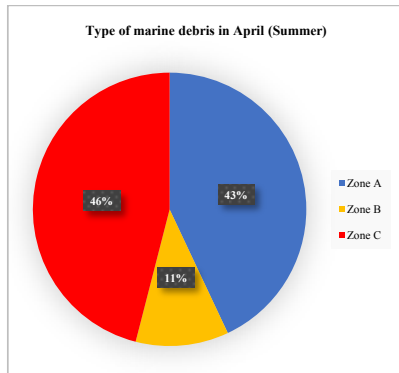


Figure 1.3 Type and composition of marine debris in April (summer)

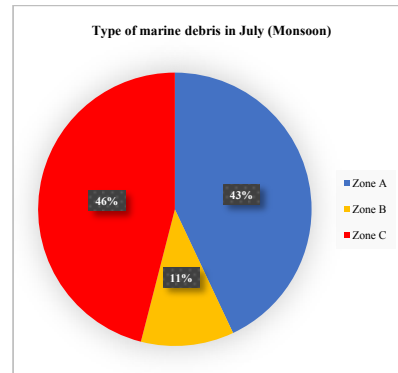


Figure 1.4 Type and composition of marine debris in July (monsoon season)

For the Components of marine waste found from 10 times sampling in both seasons, the most common debris was general waste, with the most frequently found waste being food wrappers/bags (snacks), followed by straws/drink stirrers, cigarette butts, broken glass, and copy-paste bags, respectively. The most common recycled waste was bottle caps (plastic), followed by bottle caps (metal), plastic cups, beverage bottle (plastic) caps and cup covers (plastic), respectively. Hazardous waste found the most was lighters, followed by fishing rods, face masks, and pampers. This was in line with the study of the types and quantities of marine debris on beaches in the Mu Ko Chang National Park area and Khao Laem Ya National Park - Samet Islands [ 4 ] and study of types, quantity and physical composition of marine debris at Gypsy Beach, Ban Laem Tukkae, Mueang District, Phuket Province [ 5 ] which found that the most accumulated residual waste was general waste as well.

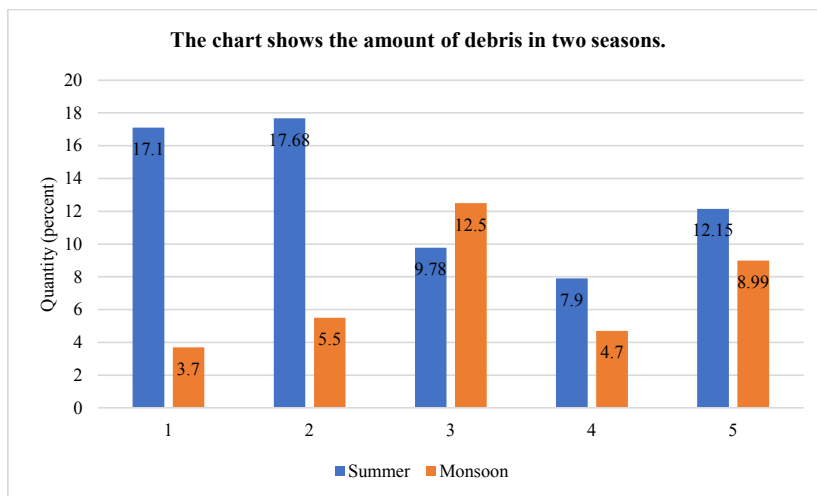
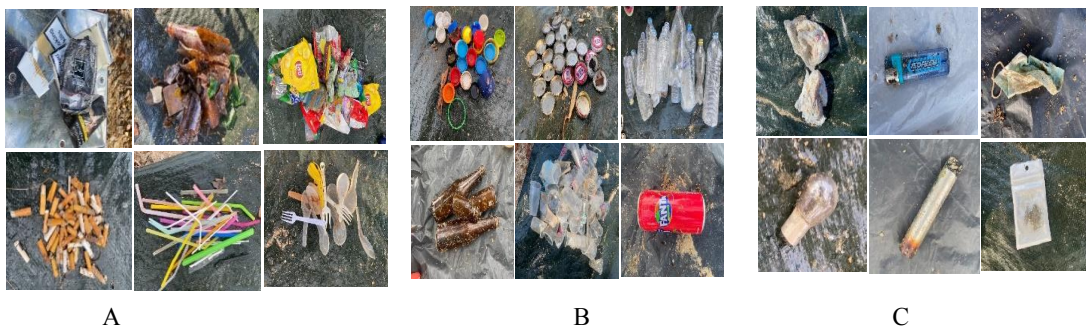


Figure 1.5 amount of debris during two seasons: summer and monsoon



## 2. Type, quantity and composition of marine debris in Silaphan Beach area, Ratsada Subdistrict, Mueang District, Phuket Province

Samples were collected 10 times during two seasons: summer in April 2023 and the monsoon season in July 2023. The most debris was found 1,308 pieces during the summer. The most common waste was general waste, 956 pieces, followed by recycled waste, 320 pieces, and the least found was hazardous waste, 32 pieces. During the monsoon season, the most common waste was found at 445 pieces, followed by recyclable waste at 264 pieces, and the least found was hazardous waste at 7 pieces. During the monsoon season, less marine debris was found due to the influence of the monsoon wind and because on the day before the research sample collection was carried out, there was a rainstorm, causing the waves to carry the debris back into the sea. This was consistent with a study of the types and quantities of marine debris on beaches in the Mu Ko Chang National Park area. and Khao Laem Ya National Park - Samet Islands [ 4 ] which found that the most commonly accumulated waste was general waste. By general debris found in Silaphan Beach, they were mostly straws/drink stirrers, food wrappers/bags (snacks), cigarette butts which was consistent with the study of the type and amount of marine debris in the mangrove forest area, Bang Pu Recreation Area Mueang Samut Prakan District Samut Prakan Province [ 6 ] and the study of the types and quantities of marine debris in the area of Sai Ri Sawi Beach, Chumphon Province [ 7 ]. The majority of marine litter was originated from coastal and recreational activities. The composition of each marine debris type found can be shown in Figure 1.6.



**Figure 1. 6** components of general waste (A), recyclable waste (B), and hazardous waste (C)

The amount of residual marine debris in April 2023 during the summer season in Zone A, Zone B, and Zone C can show the percentage of the type and the amount of marine debris. The most marine debris was found in Zone C, beach area for sitting and relaxing, with a value of 67 percent, followed by Zone A in front of Sinae Phuket Luxury Hotel, with a value of 27 percent. The least amount of marine debris was found in Zone B in front of the Plai Laem Seafood restaurant next to the beach, with a value of 6 percent as shown in Figure 1.7.

For the amount of marine debris in July 2023 during the monsoon season in Zone A, Zone B, and Zone C, the most marine debris was found in Zone C, beach area for sitting and relaxing with a value of 46 percent. The lower marine debris was in Zone A, in front of the Siena Phuket Luxury Hotel, with a value of 43 percent, and the least amount of marine debris found was in Zone B, in front of the Plai Laem Seafood restaurant next to the beach, with a value of 11 percent as shown in Figure 1.8.

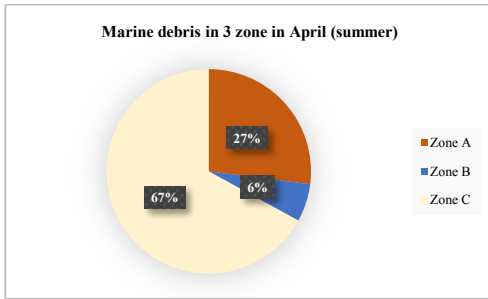


Figure 1.7 Marine debris in 3 zone in April

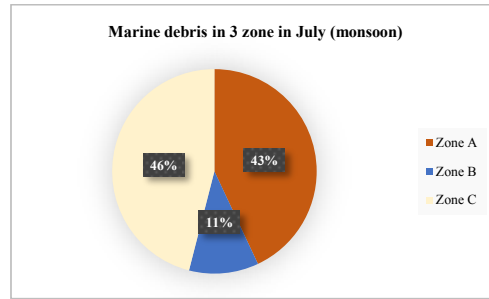


Figure 1.8 Marine debris in 3 zone in July

### 3. Implementation of marine debris use in Silaphan Beach

From the study of marine debris utilization, there were guidelines of processing waste into new things, arts and crafts as follows:

In Phuket Province, marine waste management has been a role model in resource conservation by reducing waste and impact on coastal ecosystems. Therefore, waste has been recycled in various products such as art and handicrafts from marine waste, etc.

In the area of Silaphan Beach, Ratsada Subdistrict, plastic water bottle caps had been delivered to the school, Lanta Ratchapracha Uthit to be recycled into plant pots to reduce the amount of plastic water bottle caps and reduce the impact on rare marine animals. Aluminum cans were donated to the Prosthetics Foundation to produce prosthetic legs for disabled groups and the straws were donated to the Patong Foundation to support the world-friendly pineapple pillow project to produce pillows for bedridden patients. In addition, it has been found that the plastic bottle caps from marine waste in other areas had been used to make skateboards as well.



pineapple pillow project



skateboard

Figure 1.9 pineapple pillow project to produce pillows for bedridden patients and skateboard

In Thailand, there is innovation and use of waste to add value and reduce waste as much as possible to lessen impacts on rare marine animals. Therefore, recycling waste have been invented into various products, such as taking plastic bags, water bottles, water bottle caps, straws, beverage cans, fishing nets and turning them into new products like fishing nets in a Net Free Seas project by the Environmental Justice Foundation. The aim of the project is to dispose of fishing net scraps and send them to the project for recycling and reuse into various consumer products such as kitchen equipment and home appliances.



**Bags, Souvenirs From The Sea**



**Shopping bags from marine debris**

Upcycling the Oceans Thailand, 2563

#### 4. Suggestions

The study of types, quantity and composition of marine waste in Silaphan Beach area, Mueang District, Phuket Province has the following suggestions:

- 1) There should be adequate space for waste collection and appropriate waste disposal points especially in the recreational area (Zone C ) to accommodate waste from tourists and people in the Silaphan Beach area.
- 2) There should be a place to discard cigarette butts by making sand pots in front of Siena Phuket Luxury Hotel (Zone A), including the area in front of the Plai Laem Seafood restaurant (Zone C). Therefore, drivers who pick up and drop off tourists and people who come to rest can leave their cigarette butts in sand pots, which are more easy to deal with.
- 3) There should be signs campaigning for vacationers or tourists to help keep the Silaphan Beach area clean. The campaign signs should be in both Thai and English so that foreign tourists can understand.

#### Conclusion

Study of the composition of marine debris at Silaphan Beach, Ratsada Subdistrict, Mueang District, Phuket Province during two seasons: summer in April 2023, monsoon season in July 2023 found that the most common waste was general waste, including food wrappers/(snacks) bags, straws/drink stirrers, cigarettes butts. From comparing the composition of marine debris left over at Silaphan Beach and the nearby beach, Gypsy Beach, the most common component of marine debris was food bags (snacks). However, the composition of the debris found was different such as cigarette butts, because Silaphan Beach has a hotel establishment. As a result, there are activities that generate more trash especially cigarette butts than the Gypsy Beach area. There were no sand pots for discarding cigarette butts, thus there were more cigarette butts than Gypsy Beach.

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### Reference

- [ 1 ] Katharina Buchholz . ( 2022 ). **marine debris problems** (online). Retrieved from: <https://www.salika.co/2022/03/28/world-of-waste-big-problem/>. Information accessed on 10 March 2023 .
- [ 2 ] Department of Marine and Coastal Resources. ( 2021 ). **Marine debris situation in 2021** (online). Retrieved from: <https://km.dmcrc.go.th/c/260/d/19461> . Accessed information on 29 December 2022 .
- [ 3 ] Andaman Sea and Coastal Resources Research and Development Center. ( 2018 ). **Marine debris** (online). Retrieved from: <https://www.dmcrc.go.th/downloadLib/> . Data accessed on 21 March 2023 .
- [ 4 ] Kittingphong Huabonrin et al. ( 2017 ). **Studying the types and quantities of marine debris on beaches in the area of Mu Ko Chang National Park and Khao Laem Ya - Mu Ko Samet National Park**. (Online) Retrieved from: proceeding\_final .pdf ( buu .ac .th ). Accessed information on 22 February 2023.
- [ 5 ] Nisachon Jaisudee and Suthirat Sritannan. ( 2022 ). **Study of the type, quantity and physical composition of marine debris in the Gypsy Beach area. Ban Laem Tuk Kae, Mueang District, Phuket Province** (online) Retrieved from: Latest Research P'Dream.pdf . Accessed information on 13 October 2023 .
- [ 6 ] Witchuda Prasatkaew. ( 2021 ). **Study of the type and quantity of marine debris in the Bang Pu Recreation Area. Mueang Samut Prakan District Samut Prakan Province** (online) Retrieved from: file:///C:/Users/windows%2010 . Accessed information on 12 March 2023 .
- [ 7 ] Natthawadee Bantiwiwatkul et al. ( 2016 ). **Study of types and quantities of marine debris. Sai Ri Sawi Beach area, Chumphon Province** (online) Retrieved from: proceeding\_final .pdf ( buu .ac .th ) Information accessed on 12 March 2023 .