

# MANAGEMENT OF MARINE LITTER AND COASTAL PLANTS IN ITOSHIMA PENINSULA, FUKUOKA, JAPAN

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Through the pre-investigation of the survey sites environment and the observation of marine litter and coastal plants in Nagahama Coast, Fukuoka City and Niginohama Coast, Itoshima city, the pattern of coastal use was typified for the Itoshima Peninsula, and the survey results shows that more frequent human activities, the harder it is for coastal plants to grow and reproduce. Moreover, it is important to realize that the use of the coast by humans also has an impact on the ecological environment of the coast. For instance, the traces of perennial human activities at the entrance to the coast have changed the topography of the sandy land and are not conducive to the growth and reproduction of coastal plants.

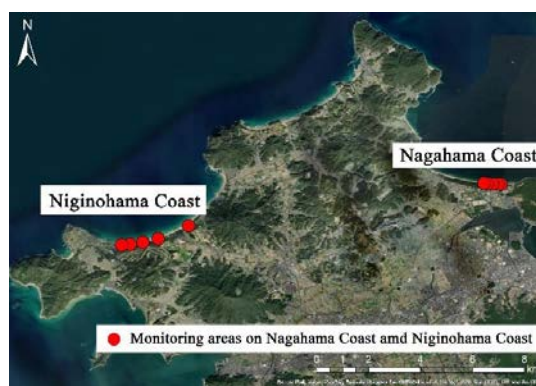
**Key Words:** *marine litter, coastal plants, coastal utilization, human activities, ecological environment*

## 1. INTRODUCTION

The rapid demise of natural coasts due to erosion, direct destruction, human disturbance and pollution in recent years. In particular, marine litter that is discharged directly or indirectly on the coast every year is also an important factor that cannot be ignored. In addition, with the increasing frequency of human activities on the coast, coastal plants have also been extensively and severely affected. Without coastal plants, beach sand would be more easily carried away, and maintaining the current dune terrain would be impossible, it can also be said that the current dunes were created by coastal plants. There are not only coastal plant communities on the coast, but also marine litter, in order to protect the coastal environment, we should consider the ecological restoration of coastal plants as well as the marine litter recycling business.

The Genkai-nada coast in Itoshima Peninsula is an important coastal area in western of Fukuoka Prefecture, within the administrative jurisdictions of Itoshima City and Fukuoka City (**Fig.1**). In this study,

through the pre-investigation of the survey sites environment and the observation of marine litter and



**Fig.1** Monitoring areas on Nagahama Coast and Naginohama Coast

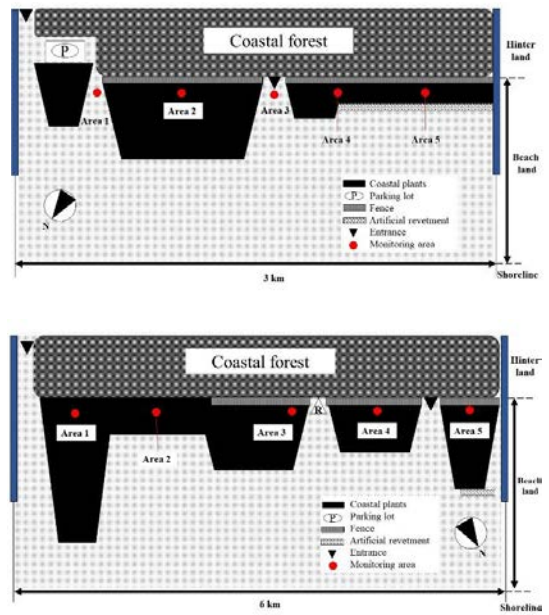
coastal plants in Nagahama Coast, Fukuoka City and Niginohama Coast, Itoshima city, to categorize coastal use patterns for the Itoshima Peninsula, and

in order to protect the coastal ecological environment, some suggestions are made on the protection of coastal plants and the treatment of marine litter.

## 2. SURVEY METHOD

### (1) Pre-investigation for survey sites

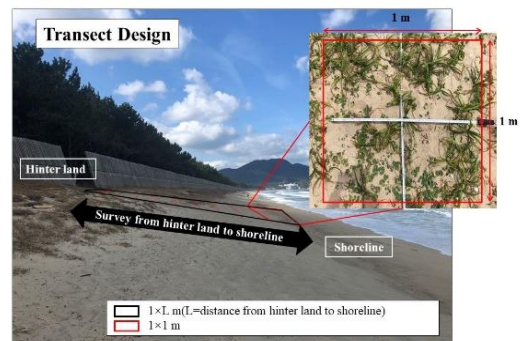
The two survey sites in this study are the Nagahama Coast and the Niginohama Coast in Itosima Peninsula. The Nagahama coast faces the semi-open bay of Hakata Bay, which is greatly affected by tidal currents, the coast is about 3 kilometers long. The Niginohama coast faces the open bay of Karatsu Bay, which is about 6 kilometers long, and the dynamic changes of the coastal environment are more intense. Through on-site inspection and reference to Ms. Oshida's (2004) research on "distribution characteristics of coastal plants in relation to zonation and their influential factors." Combined with human activities and other influences, the relevant elements of coast use are divided into three major categories: coastal entrance location, coastal plant distribution area, facility configuration, and use the different combinations of the three types of elements distinguish the coast use patterns and characteristics of different seaside observation areas, as illustrated in **Table 1**. Through the concrete description of the relevant elements of coast utilization, the observation areas of the two coasts can be easily distinguished, as shown in **Fig.2**.



**Fig.2** Coastal utilization patterns of monitoring areas on Nagahama Coast (up) and Niginohama Coast (down)

### (2) Investigation on the distribution characteristics of marine litter and coastal plants

The survey on the distribution characteristics of marine litter and coastal plants has been completed from March to November 2020. According to the Line Transect Method, each monitoring area was divided from the hinter land to shoreline into a number of  $1 \times 1$  m observation squares and recorded the quantity and types of marine litter and coverage and quantity of types of coastal plant in each square as shown in **Fig.3**.



**Fig.3** Transect design in survey

**Table 1** Relevant elements of coastal utilization

	① Full area configuration	② Partial area configuration	③ No entrance
Entrance configuration	Entrance		
	① Full area configuration (All coastal areas can be accessed) ② Partial area configuration (parts of the coast can be accessed) ③ No entrance (no direct access to the coast)		
	① Mostly distributed	② Partly distributed	③ No distribution
Plant distribution area	The distribution area of beach plants (accounts of the beach area) ① Mostly distributed (more than 50%) ② Partly distributed (less than 50%) ③ No distribution (less than 5%)		
	① Adjacent configuration	② Isolation configuration	③ No facility
Facility configuration	The facility is ① Adjacent configuration (adjacent to the coast or within the coast) ② Isolation configuration (separated from the coast by a road) ③ No facility (no facilities on the coast and surrounding areas)		

### 3. SURVEY RESULTS

#### (1) The distribution of marine litter and coastal plants

The coastal plants in the monitoring area 1 of Nagahama Coast have a wide distribution area, and the density of the communities near the fence is greater. The garbage is mainly accumulated in the plant community area and the vicinity of the shoreline. The monitoring area 2 has normal natural features, coastal plants have a wide distribution area and rich in species, mainly distribute on the area close to the inland, which is also the main distribution area of marine litter. The area where the coastal plants coverage is close to zero and near the shoreline also have a small place of marine litter accumulation, which is considered to be affected by the sea wave and wind. Monitoring area 3 is the entrance to the coast, due to the perennial impact of human activities, the beach terrain is difficult to maintain a stable state, which is also difficult for coastal plants to take root and multiply here. The coverage of plants is almost zero, but the marine litter is distributed in a wide range and a small part concentrated near the shoreline, that is still considered to be affected by the sea waves. Because the monitoring area 4 is the starting point of the artificial revetment, the coastal plants are mainly distributed in the narrow area near the fence, and because there is no sudden height difference with the sandy terrain, the marine litter is evenly distributed, and there are local accumulation areas near the shoreline. Coastal plants in the monitoring area 5 are mainly distributed in the narrow area between the

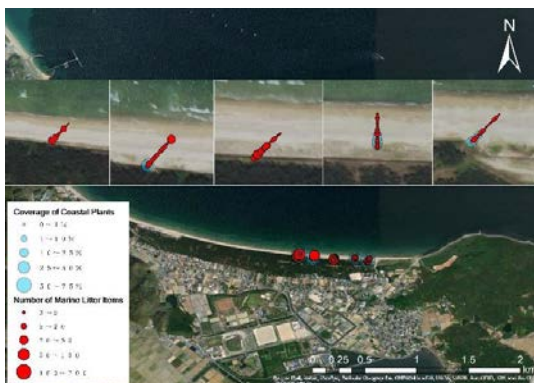


Fig.4 Distribution of marine litter debris and coastal plants on Nagahama Coast

artificial revetment and the back artificial fence, where also marine litter distributed. Due to the height difference caused by artificial revetment, plant seeds are difficult to spread and root extension is limited,

but it blocked part of the marine litter moving inland under the influence of the wind, and some marine litter accumulates near the shoreline, as shown in Fig.4.

Monitoring area 1 is located in the part of Niginohama Coast with the widest coastal plant distribution area. Although the marine litter is locally distributed in the plant distribution area, it is mainly distributed in the beach area with low vegetation coverage. This distribution feature is considered due to the large beach area and the influence of waves and wind is limited. The monitoring area 2 has a primitive natural coast style, with a mountain on the back and facing the sea. Marine litter is mainly distributed in areas with a large coastal plant coverage, especially around the zero-vegetation coverage area. The distribution area of coastal plants in the monitoring area 3 is relatively large, and a small amount of marine litter is accumulated in the plant community, and part of it is accumulated near the shoreline. It is considered that the coastal slope of the plant community distribution area is large, which is not conducive to the accumulation of marine litter. Monitoring area 5 is located near the main entrance to the coast. The distribution of coastal plants in the monitoring area 4 occupies nearly one third of the entire area, and marine litter is mainly distributed in the area between the plant community and the shoreline, considering the impact of coastal slope and wind. The distribution coverage of coastal plants is sharply reduced at the position of artificial revetment, while the distribution of marine litter is divided into two main areas due to artificial revetment. One is the area with large vegetation coverage, the another is the area near the shoreline, as shown in Fig.5.



Fig.5 Distribution of marine litter debris and coastal plants on Niginohama Coast



## (2) Correlation between the distribution characteristics of marine litter and coastal plants and the pattern of coastal utilization

Among the five monitoring areas of Nagahama Coast, the most affected by coastal utilization factors are the monitoring area 1, 3 and 5. Monitoring area 1 is one of the coast entrances and a parking lot is built nearby. Due to the construction of the parking lot on the left side of the monitoring area, the sandy terrain and the location of the growth area of the surrounding coastal plants have also changed. The terrain is more inclined and rugged than the right side, and the plant community is more concentrated near the parking lot, as shown in **Fig.6**.



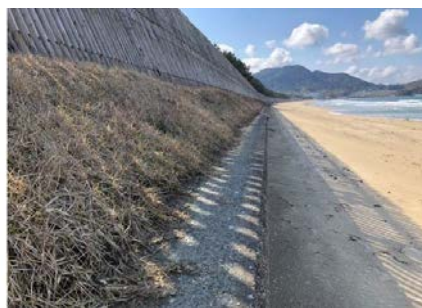
**Fig.6** Area 1 on Nagahama Coast near the parking lot

Monitoring area 3 as shown in **Fig.7**, is the main entrance to the coast. The beach cannot maintain a stable topography due to perennial trampling. It is difficult for coastal plants to take root and reproduce either. It has formed a significant difference with



**Fig.7** Entrance to Nagahama Coast in Monitoring area 3

the sandy land on both sides. The marine litter cannot be affected by the plant community to form a local accumulation, under the influence of the wind, part of the garbage enters the interior again through the entrance. The artificial revetment in monitoring area 5 as shown in **Fig.8** directly limits the growth range of coastal plants, and also has a negative impact on the development of species diversity of plant communities.



**Fig.8** Artificial revetment in area 5, Nagahama Coast

On Niginohama Coast, the monitoring areas 3 and 5 are more affected by coastal utilization factors. Marine debris is easy to accumulate in the low-lying land formed by the erosion of coastal sandy land by the estuary near the monitoring area 3 as shown in **Fig.9**.



**Fig.9** Marine litter accumulated at the outlet of river on area 3, Niginohama Coast

Monitoring area 5 as shown in **Fig.10** is the main entrance to the coast. The sandy terrain is difficult to maintain a stable state due to frequent human activities, and the types of marine litter are the most in the five monitoring areas. The density of coastal plant communities has also plummeted at the artificial revetment site. However, the coast



**Fig.10** Entrance to Niginohama Coast in Monitoring area 5

utilization of Niginohama Coast is significantly less than that of Nagahama Coast, and most areas still maintain a good ecological environment and natural

features.

#### 4. DISSCUSSION

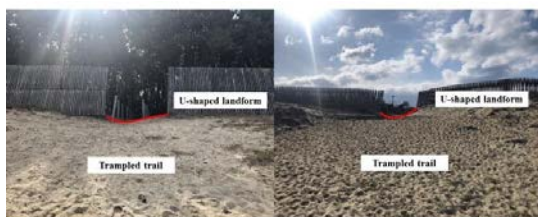
There are four main factors that have a significant impact on the ecological environment of the coast, the outlet of river, entrance setting, artificial revetment and parking lot.

There is an obvious phenomenon of concentrated accumulation of garbage at the outlet of the river.

The area set up at the main entrance to the coast is affected by frequent human activities:

(a) Long-term trampling has a negative impact on the stable growth of coastal plant communities.

(b) Under the dual effects of losing of the wind-proof and sand-fixing effect of the plant community on the beach terrain and the long-term trampling, sand dunes could not accumulate to form a sloping coastal topography, and finally formed a U-shaped landform with low middle and high sides as shown in Fig.11. Although the parking lot facility have an impact on the surrounding terrain and environment, it has not produced any obvious negative effects.



**Fig.11** Trampled trail and U-shaped landform of area 3 on Nagahama Coast (left) and area 5 on Niginohama Coast (right)

The construction of artificial revetment:

(a) Limiting the growth range of the plant community.

(b) The plant growth area has both inland and coastal plants, the change of soil properties limits the development of the diversity of seaside plant species.

#### 5. CONCLUSION

This research focuses on management of marine litter and coastal plants in Itoshima Peninsula. From the above investigation results, we can see that the utilization rate of Nagahama Coast and Niginohama Coast is not high, but there are various factors

affected by human activities:

(a) Monitoring and processing of floating garbage near the river outlet on the coast.

(b) The maintenance of the dune terrain near the coast entrance and the regeneration of seaside plants.

(c) The evaluation of the impact of artificial revetment construction on the ecological soul crystal.

(d) The management and maintenance of the surrounding environment of the coastal parking lot, if the above works could be taken seriously, under the influence of factors, there is a high possibility that the coastal ecological environment can be preserved or regenerated.

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#### REFERENCES

- 1) Schlacher, T. A., *et al*: Sandy beaches at the brink, *Diversity and Distributions*, Volume 13, Issue 5, p. 556-560, 2007.
- 2) Davenport, J., Davenport, J. L.: The impact of tourism and personal leisure transport on coastal environments: A review, *Estuarine, Coastal and Shelf Science*, Volume 67, Issues 1-2, March 2006, Pages 280-292.
- 3) Kabir, A. H. M. E., *et al*: Microplastics pollution in the Seto Inland Sea and Sea of Japan surrounded Yamaguchi Prefecture areas, Japan: Abundance, characterization and distribution, and potential occurrences, *Journal of Water and Environment Technology*, Vol.18, No.3: 175-194, 2020.
- 4) McNeill, J. R.: Something new under the sun: An environmental history of the twentieth-century word (The global century series), *W. W. Norton*, p. 149, 2001.
- 5) Jambeck, J. R., *et al*: Plastic waste inputs from land into the ocean, *Science*, Vol.347: p.768-771, 2015.
- 6) Oshida, K., Kamihogi, A.: An examination of the factors that influence the present condition and species of coastal plants in the Osaka Bay area, *J-STAGE*, Volume 66, Issue 5, p. 559-564, 2003.
- 7) Oshida, K., Kamihogi, A.: Research on distribution characteristics of coastal plants in relation to zonation and their influential factors, *J-STAGE*, Volume 67, Issue 5, p. 531-536, 2004.

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