MARINE LITTER DISTRIBUTED ON IKINOMATSUBARA COAST WITH THE EFFECT OF BEING CAPTURED BY COASTAL PLANTS COMMUNITIES IN FUKUOKA, JAPAN

Yawen SONG[1], Jinzuo LIU[2], Satoquo SEINO[3]

[1]Student member of JSCE, Graduate School of Eng., Kyushu University
(744 Motooka, Nishi Ward, Fukuoka, 819-0395, Japan)
E-mail: song.yawen.035@s.kyushu-u.ac.jp
[2]Student member of JSCE, Graduate School of Eng., Kyushu University
(744 Motooka, Nishi Ward, Fukuoka, 819-0395, Japan)
E-mail: liu.jinzuo.756@s.kyushu-u.ac.jp
[3]Member of JSCE, Professor, Graduate School of Eng., Kyushu University
(744 Motooka, Nishi Ward, Fukuoka, 819-0395, Japan)
E-mail: seino@civil.kyushu-u.ac.jp

The distribution characteristics of marine litter debris on the coast are not only related to coastal topography, wind, and waves but are also influenced by the coastal plant communities distributed on the coast. In this study, we analyze the correlation with the distribution of marine litter by observing the coastal topography and sand particle size distribution characteristics, and vegetation cover, and discuss the effect of coastal plant communities in capturing marine litter debris.

Key Words: *marine litter, coastal plants, coastal topography, capture effect*

1. INTRODUCTION

Ikinomatsubara Coast in Hakata Bay, Fukuoka City has a large area of coastal plant communities, and the dominant populations vary from area to area. However, marine litter is also distributed on all corners of the coast. While the distribution characteristics of marine litter are generally related to coastal topography, wind, and waves, this research focuses on whether the presence of coastal

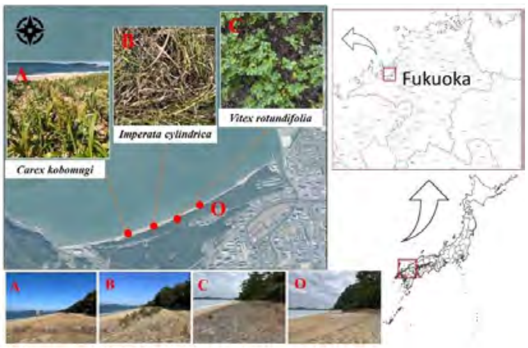

Fig. 1 Survey location and observation area

plant communities have an impact on the distribution of marine litter. Therefore, this research analyzes the correlation between various elements from the topographic relief and sand size distribution characteristics, and the coverage of different dominant plant communities (A1-*Carex kobomugi*, A2-*Imperata cylindrica*, A3-*Vitex rotundifolia*), the distribution of marine litter on the coast, and examines the effect of coastal plant communities on capturing marine litter, and finally concludes whether it is possible or not for coastal plant communities to prevent marine litter from entering inland again of causing repeated pollution.

2. DOMINANT PLANT POPULATIONS IN THE OBSERVATION AREA AND SURVEY METHODS

(1) Dominant plant populations in the observation area

Carex kobomugi, long creeping stems extend into the sand, with stems emerging from various locations to the surface, and the underground stem is well developed, growing upward as it burrows into the sand and spreads horizontally at the same time.

Fig. 2 The dominant plant community in each observation area

Imperata cylindrica is a perennial herb that grows in clumps. Long, white, nodular underground stems creep horizontally, reproduce by producing fine roots, and produce a small number of leaves in clusters in some places.

Vitex rotundifolia, a deciduous shrub that often grows in clumps in coastal sandy areas, stems crawl on the ground, growing half buried in the sand.

(2) Survey methods

a) coastal topographic analysis

Measurement lines were set up from the shoreline to the hinterland boundary in each observation area, and the topography of the coast was surveyed at one-meter intervals with RTK-GNSS. In addition, five observation areas were set up on Ikinomatsubara Coast. A1~A3 were coastal plant observation areas, each with different dominant plant communities, and A0 was the control area without any coastal plant distribution.

b) observation of coastal plant community coverage

Along the same measurement line, a square framing of 50×50cm was set at the center of each one-meter measurement point, and the coastal plant community was photographed with a COOLPIX P950 camera directly above, and then the coastal plant coverage within the framing was calculated by using Adobe Photoshop combined with the binarization method.

c) analysis of the grain size distribution of coast surface sand

Surface sand samples were collected along the same measurement line and in the same position of the square framing, and then brought back to the laboratory and dried at 70℃ for 12 hours or more. The dried sand samples were sampled again by the quadrat method (100±0.5g) and then sieved into seven classes: above 2mm, 2mm~1mm, 1mm~850μm, 850μm~425μm, 425μm~250μm, 250μm~106μm, 106μm~75μm, and below 75μm. The sieving intensity was 50 and the duration was 10 minutes.

d) marine litter abundance analysis

The sand that had been size analyzed was collected again and put back into the dried sample, and then sieved into three classes: above 2.5cm, 2.5~0.5cm, and below 0.5cm, with a sieving intensity of 50 and a duration of 10 minutes. Then record the type and number of marine debris for each size.

3. RESULTS AND DISCUSSION

(1) Topographical features of the Ikinomatsubara Coast

It can be seen that the observed areas with plant community distribution have significantly higher topography than those without plant community distribution from Fig. 3. The common feature of coastal plants is their well-developed root systems to extract sufficient water in sandy areas with poor water storage capacity. Therefore, the three coastal plants in this research can not only extract the required water but also fix sand through their coiled root systems under the beach surface. The topographic variation of the plant community distribution area is also more obvious than that of A0, which may be since A0 is also one of the major coastal entrances and exits, and the terrain tends to be flattened under the long-term and frequent human

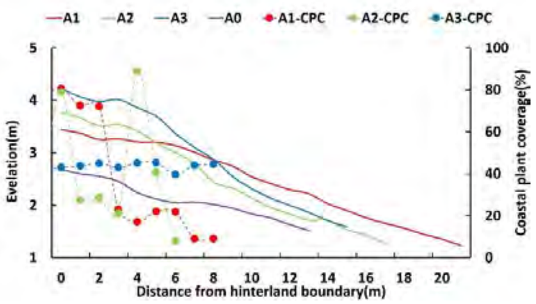

Fig. 3 Coastal topography and plant community cover

trampling. In addition, the distribution of plants in A1, A2, and A3 is in the back half of the coast near the inland part, and there is a tendency for the topography to drop at the plant distribution boundary, which may provide a topographic barrier for the debris that drifts to the coast by the action of waves and wind to re-enter the inland and cause repeated pollution and the debris that tends to accumulate here should also become a priority area for coastal cleanup. From Fig. 4, it can be seen that most of the sand types on the Ikinomatsubara Coast are medium sand. By comparing the proportion of various grains of sand in the section with plant distribution (Y) and the section without plant distribution (N) of each plant community observation area in Fig. 5, it can be found that the sands in section Y are coarser than those in section N.

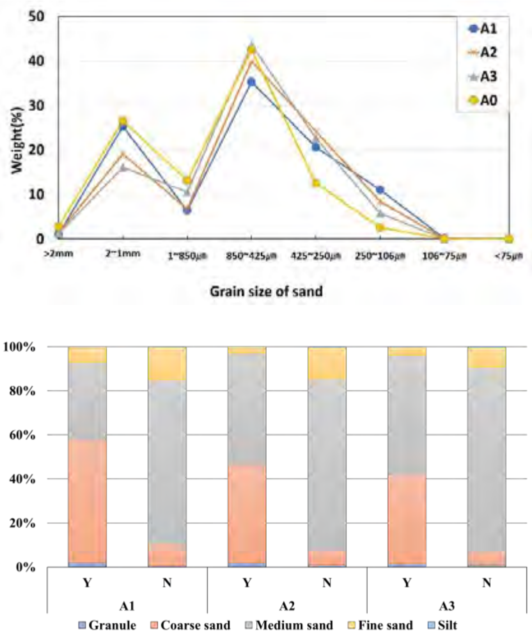

Fig. 4 Distribution of surface sand size and species

(2) Distribution of coastal plant communities

The plant community cover on the coastal surface is divided into two types, leaf cover, and stem cover, in this research, A1, and A2 are leaf cover and A3 is stem cover, this is because Vitex rotundifolia is a deciduous low shrub, and leaf residue is almost invisible during the fall survey time. It can be seen from Fig. 3 and Fig. 6 that the leaf-covered plant community is more effective in wind protection, especially A2, while the A3 of the stem-covered plant community has higher terrain and its sand fixation effect is more obvious.

(3) Distribution of marine litter

Marine litter generally tends to accumulate in three areas: near the shoreline, at the junction of coastal plant distribution, and inside the plant community, while marine litter near the shoreline is dried up after a brief stay, and then moves inland mainly under the influence of wind. From Fig. 7 and Fig. 8, it can be seen that the marine litter floating on the coast is mainly plastic debris, and the abundance of marine litter staying inside the community is greater at A1, A2, and A3, which are influenced by the high topography of the back of the coast and the coastal plant community.

In contrast, the debris in the areas without plant communities is evenly distributed, and it is assumed that the total amount of debris collected in different areas of the same coast should be approximately the same, so some of the debris at A0 may have entered inland again under the action of wind. From Fig. 9, it can be seen that the lightweight and small size of Styrofoam debris is more likely to accumulate in the interior of the community, followed by plastic bag debris.

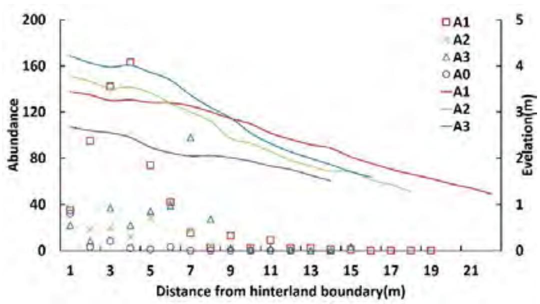

Fig. 5 Marine debris abundance and coastal topography

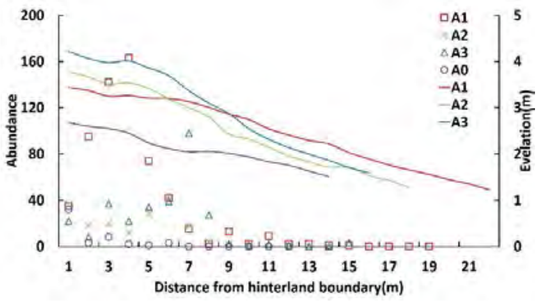

Fig. 6 Marine debris and coastal plants coverage

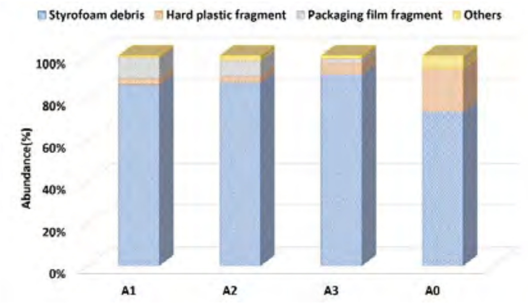

Fig. 7 Distribution of marine litter types in each observation area

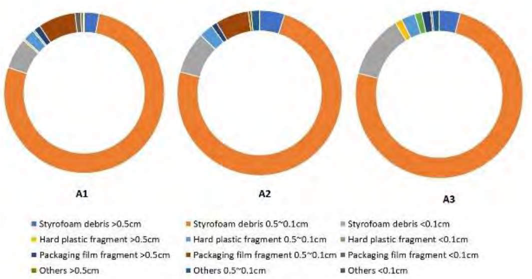

Fig. 8 Representative marine litter distribution by the observation area

4. SUMMARY

The distribution of coastal plant communities maintains coastal topography through sand fixation, forming a higher-lying seaside back area, which becomes a natural barrier to prevent marine debris from re-entering the interior and causing repeated pollution. And the different dominant species communities of coastal plants formed different distribution characteristics through the influence of leaf coverage (A1, A2) and stem coverage (A3) on the distribution of marine litter debris, comparing the dominant species communities of *Carex kobomugi* and *Vitex rotundifolia*, the leaf cover of *Carex kobomugi* community had a more obvious influence on the abundance of marine litter debris, and this influence was especially greater for Styrofoam debris.

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