

maintain a steady level. On a seasonal basis, however, the monthly fluxes of most of the water quality variables exhibit significant mass during wet seasons and lower fluxes during dry seasons, except the ammonia flux, which exhibits an opposite trend. Further analyses demonstrate that the monthly mass fluxes are mainly controlled by the runoff; while the annual fluxes are mainly affected by the concentrations.

Rehabilitation and eco-environmental protection of the Yangtze Estuary

The Yangtze is the largest river in China, the world's famous "Treasure House of biota", and the "Golden Waterway" connecting the east, middle and west part of the nation. Located at the joint of the Yangtze Economic Zone and the Coastal Economic Zone, the Yangtze estuary occupies an essential position in China. Along with the fast economic growth in the past decades, the pollution discharge in the basin has been increasing rapidly leading the deterioration of water quality in the estuary region. As a result, the Yangtze estuary and its adjacent sea area has become one of the most serious places of "Red tide" occurring in west Pacific Ocean. After completion of the Three Gorges Project and the Water Transfer from South to North Project as well as a number of hydropower projects in the upper reaches, the temporal and spatial distribution of water resources in the basin will be alternated, which will exert significant impacts on the ecosystem and environment in the estuary region. In order to preserve the ecosystem and environment, the Rehabilitation Planning of the Yangtze Estuary has been compiled to protect the important wetland and bio-diversity in the region, control the water pollution and the salt-water intrusion to ensure the safety of water supply in the mean time of maintaining the deep channels for navigation.

Investigation of microbial diversity and its degradation potential to PAHs in the sediment in Bohai Bay, China, by PCR-DGGE

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In order to investigate the biodegradation potential of the indigenous microorganisms in the sediment in Bohai Bay, China, an improved understanding of the diversity and structure of the microbial communities in the sediment is required. Seventeen sediment samples were collected in Bohai Bay (117° 41' -117° 60' E, 38° 33' -39° 00' N). DGGE analysis of PCR-amplified 16S rDNA gene fragments confirmed that there was a remarkable different in the composition of the bacterial community in some different station. The

content of polycyclic aromatic hydrocarbons (PAHs) in the sediment was also investigated. The presence of common bands for microbial species in the native sediment DNA indicated that some strains could be potential in situ PAH-degraders.

Ecological characteristics of the macrobenthic community in the Changjiang Estuary and its adjacent waters

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Spatial distribution and evolution of macrobenthos in the Changjiang estuary and its adjacent waters were presented in this study. Samples were collected from 86 stations in four investigations during 2005~2006. Among all the samples, a total of 330 macrobenthic species were identified including in the number of species: 122 Mollusca, 83 Polychaeta, 67 Crustacea, 23 Echinodermata, 28 Pisces and 7 other species. Total average abundance of macrobenthos in the study area was 146.4 ± 22.3 ind/m², the mean biomass (AFDW) was 2.31 ± 0.41 g·m⁻², and the mean secondary production was 2.48 ± 0.38 g (AFDW) m⁻² a⁻¹. The average values of Shannon-Wiener's, Margalef's and Pielou's indices were 1.72 ± 0.16 , 1.37 ± 0.19 , 0.64 ± 0.04 respectively.

The results showed that the macrobenthos of the study area could be divided into 3 levels from west to east, or from nearshore to offshore. In the most westward area named the Hekou subarea and the Hangzhou Bay subarea, the species composition of macrobenthos was very simple, and the indices of biodiversity were very low, indicating that the community structure was very susceptible. In the Kouwai subarea and the Zhoushan subarea close to the central part of the research region, the species composition of macrobenthos was more complex than that in the most westward area, and the indices of biodiversity were higher, indicating that the community structure was relatively steady. In the most outside area named the Jinhai subarea, the species composition was most complex in the whole research region, and the indices of biodiversity were highest, indicating that the community structure was most steady.

Comparisons of the present results with those of other sea areas in China make it clear that the macrobenthos usually has low production in estuary area where the environments are usually

hard physically and chemically to the macrobenthos; the secondary production decreases with the depth in the expansive ocean areas where the environments are usually steady; the mean P/B ratio of the macrobenthos in the study area was $1.48 \pm 0.06 \text{ a}^{-1}$, indicating that most species here were usually with small individuals and high renewal.

During the recent 50 years, the total biomass of macrobenthos in the Changjiang estuary and its adjacent waters showed little variation with its value being around 20 g/m^2 or so. However, the dominant species in the research region changed distinctly from then on. In the diluted waters of the Changjiang estuary, the enchinodermata that always having big individuals and long life cycles dominated significantly fifty years ago, now the polychaeta that always having small individuals and short life cycles became the most important species instead.

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Study of the establishment of countermeasures for marine litter in the Seto Inland Sea

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Introduction

Marine litter produces a variety of environmental problems in terms of marine pollution, waste treatment, marine ecosystems, scenic beauty and fishing industry operations. Measures must be established to deal with this type of litter. Moreover, to implement these measures, the current situation must be determined based on scientific knowledge. However, there are few case studies in which marine litter has been investigated and studied from a comprehensive perspective. Accordingly, this study was conducted, focusing on the Seto Inland Sea, the largest enclosed coastal sea in Japan and one in which the problem of marine litter has become obvious.

The Study

The field study determined the quantity and type of litter in 261 coastal locations of the Seto Inland Sea (representing approximately 1.25% of the entire length of the Seto Inland Sea coastline) from May through November 2006, in order to study the spatial distribution of litter washed up on the coast (beached litter). Moreover, in order to determine the spatial and temporal distribution, a monitoring survey has been conducted once per month at four locations (since July 2006) using an indicator method¹, with four types of beached litter as indicators: disposable cigarette lighters, plastic bottle and other types of cap, oyster cultivation pipes and golf balls.

Other efforts were also conducted, including studies in which geological data were used to estimate the distribution and total quantity of litter, simulations to determine the source of the litter, questionnaires aimed at understanding the problems and challenges of marine litter.

Results

The distribution of beached litter tended to be highest in the western part of the Seto Inland Sea (at Aki-nada and locations further west) and in the eastern part at Osaka Bay and Harima-nada. Very few of the special pipes used for oyster cultivation in certain areas of the western part of the Seto Inland Sea were found in the eastern part.

Temporal changes in the quantity of beached litter were greatest on the western-facing coasts in the wintertime (west coast of Awaji Island). On the other coasts, the quantity of litter tended to be greatest from summer through autumn.

Discussion

Marine litter does not drift in a uniform manner in the Seto Inland Sea. The drifting pattern can be divided into two types: one for the western part and one for the eastern part.

In the Seto Inland Sea region, it is common for seasonal winds to blow from the west during the winter. Seasonal fluctuations in beached litter, in accordance with the direction that the coast faces, are thought to result from the litter having been blown by the wind.

Conclusions

The results of the study indicate that the manner in which marine litter washes ashore is not uniform in either spatial or temporal terms. For this reason, any measures taken should treat the Seto Inland Sea as a whole rather than targeting individual prefectures or other administrative units.

Studies should be continued in order to propose