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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

measures to deal with marine litter and to inform and educate the general public.

Nursery grounds of Green Tiger Prawn (*Penaeus semisulcatus*, De Haan) in the busherh coastal waters, Persian Gulf

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The survey plan for *Penaeus semisulcatus* nursery grounds was designed to encompass the main coastal prawn catching in Bushehr waters, Persian Gulf, from July 2003 to March 2005.
Sampling stations were selected in the shallow waters < 10 m deep and collections of juveniles were made from a small vessel powered by a 150 hp outboard engine that was equipped with a small beam trawl net with 10 mm stretch mesh. Prawns less than 15 mm carapace length were classified as juvenile.
The catches of *P. semisulcatus* juvenile were abundant at only a few sites in the shallow waters around southern (Motaf) and middle (Helaileh) regions of the study area. The maximum number of juveniles occurred in June and November 2003 and April and June 2004. Juvenile abundance was higher in vegetated sites as compared to non-vegetated sites during this study.
Finding from the present study support the facts that the extensive shallow reef of flat and open coastline sea grass and algae communities are therefore likely to be critically important for the fishery and should therefore be afforded protection from pollution, fishing gear damage and industrial development.

Modeling of phytoplankton production in Ise Bay, Japan: application of nitrogen isotopes to identification of DIN Sources

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An important aspect of the nitrogen cycle in coastal environments concerns the source of the nitrogen used in primary production. The continual input of external nitrogen can determine the total capacity of a bay to produce a sustainable fish harvest within the system. Our target area is Ise Bay, which is one of the most eutrophic coastal areas in Japan. Phytoplankton production in Ise Bay is supported by external nitrogen derived from rivers and ocean, and nitrogen regenerated within the bay. The objectives of this study are to clarify the characteristics of DIN in each source including riverine, oceanic and regenerated nitrogen, and to evaluate the contribution of each DIN source to primary production in time and space. In this study, therefore, the three-dimensional ecosystem model including nitrogen isotopes was developed based on the precise observations as follows. First, seasonal observations for identifying endmenber values of riverine DIN were conducted in the lower part of the Kiso Rivers, which empty into the head of the bay. Second, the oceanic DIN endmenbers were determined by the seasonal observations at the bay mouth. Third, the magnitudes of isotope effects by nitrification and denitrification on ^{15}N dynamics were estimated at the central part of Ise Bay to clarify the seasonal changes in regenerated DIN inside the bay. Finally, nitrogen dynamics in Ise Bay were elucidated by the ecosystem model, which could reproduce the DIN concentrations and their isotope signatures obtained by the observations. The model results indicated that phytoplankton production is mainly supported by the internal DIN cycle rather than the external DIN supply. This would be the main reason for sluggish recovery of water quality in the system.

Field observation of water environment characteristics for restoration of the Amagasaki Canal, Japan

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