

## Exploring Characteristics of Beach Environments and Issues of Coastal Management through Analysis of Drift PET Bottles along the Shores of Fukuoka/Hakata Bay, Japan

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Despite new legal measures to deal with drift trash on ocean beaches, the problem continues to dramatically worsen. Efforts confined to the local level are approaching their limit, and everywhere a feeling of resignation is invading as the situation reaches impasse. Thus, it is essential to pursue programming that maintains the continuous interest of local citizens and waste management authorities and leads them to adopt original strategic countermeasures. To do this, it is best to break away from the former focus on trash collection and pursue a line that involves local citizens in a process that leads from field surveys to countermeasure creation while connecting locally-based knowledge with oceanography, etc. Marine area management responsibilities fractured among various sectors has obstructed effective measures heretofore; we now need cooperation among them not reactively, but pro-actively in the form of scientific data-based management.

Hakata Bay has been a port city since ancient times; material and humans have long been carried to and from here by ocean currents and seasonal winds. These natural phenomena have now placed it squarely on the route of marine drift trash. The watersheds of the rivers flowing into Hakata Bay have also been urbanized, meaning wind-scattered trash and apparently illegally discarded wastes have also become trash sources. Drift trash originating from in and outside Japan lies intermingled along the Fukuoka/Hakata Bay coastline; its topography provides a good example for considering not only the issue of foreign trash but also the responsibilities and duties of local citizens. This study examined the mechanism of drift trash movement in this area by monitoring drift trash PET bottles for country of origin (starting in 2008, twice a year in September after the typhoon season and March after seasonal winter winds, with about 100 PET bottles collected at each of 6 sites) and interviewing people and authorities involved.

The results of the monitoring survey showed three patterns of drift trash PET bottles on the Fukuoka/Hakata Bay shoreline. We consistently collected (1) mostly domestic bottles in upper Hakata Bay, (2) fewer than 10% foreign-made bottles on south-facing beaches at the harbor mouth, (3) 20% - 40% foreign-made bottles at the harbor mouth (in Fukuoka Bay from the Itoshima peninsula to Shika Is.). The number 3 pattern was also observed outside the bay on beaches facing north towards Japan Sea, but these are sandy beaches strongly affected by winter seasonal winds.

We learned from interviews that large volumes of drift trash are found particularly after the summer flooding season at the estuary of the Tataru River at the head of the bay, and on the beaches opposite this rivermouth on the bay side of the Itoshima peninsula. The monitoring survey is carried out every September just after the season when floods are common, and thus can be considered as reflecting the influx of trash from rivers. Also, the harbor mouth is in a rural area where there is less trash originating from the city. Most of the bottles found at the rivermouth are domestic, having been carried down from the urban areas at the head of Hakata Bay. These bottles continue not only to float out of the bay, but also to impact fishing communities, swimming beaches and nationally designated park areas within city limits. Hakata and Karadomari are harbor areas where foreign vessels have historically berthed, and the particularly large proportion of foreign-made bottles is an interesting historical link.

Because of the divisions among the management authorities for various marine areas, a bay-wide examination such as this has been difficult for the City of Fukuoka government, and so far no strategic plan of action based on a synthesis of information has been attempted. From here on we would like to take the differences in external forces affecting this coast that have attracted attention so far as a "hypothesis" to explain the sources of drift trash and "verify" it together with citizens and authorities through a process of information gathering and observation of the interplay of external factors such as coastal and river currents, winds, etc. and shoreline topography.

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