How much ocean litter do we have? Where does this litter come from? Observations from Dongsha Island and backward-tracking origins of ocean litter.

Ocean litter has accumulated rapidly, causing damage to local, regional and global marine ecological environments and the accompanying services they provide to human beings. The impacts of ocean litter on marine life are of particular concern, and the associated effects can be wide-reaching, including harmful ingestion and entanglement, bioaccumulation of contaminants, physically changing habitats, and new habitat formation for non-native species colonization. There is a limited understanding of the effects of accumulated ocean litter at consistent sites with regular sampling or long-term time scales. It is necessary to have accurate estimates of the abundance of ocean litter and the drivers of litter movement in the water at different spatial scales to develop the appropriate response measures.

The Dongsha Atoll National Park, which was established on 17 January 2007, is the seventh national park in Taiwan and is located in the north of the South China Sea, approximately 400 kilometers from the island of Taiwan. The current principal objectives of the Dongsha Atoll National Park include focusing on the conservation and restoration of environmental resources and on the development of profound marine academic studies. The two main parts of the park are the Dongsha Atoll and Dongsha Island. Shaped like a full moon, the completely developed Dongsha coral atoll features rich marine life and unique geographical and ecological characteristics. Dongsha Island, which is 2.8 km long and 865 m wide, has no apparent topological coverage; however, short tropical bushes flourish everywhere.

This study, which used a monthly frequency, collected data from Dongsha Island over 5 years to assess the macro ocean litter dynamics, identify source countries of individual plastic bottles, and analyze the origins of the litter by a backward-tracking model simulation that considered the effects of both current velocity and wind.

Moreover, ocean litter is becoming a major component in solid waste and requires urgent action. This study also proposed action plans for the development of effective ocean litter management at regional and global spatial scales, as understanding management at different scales is vital for improving and restoring the health and sustainability of the oceanic environment.

Suggestions include (1) incorporating the techniques into existing environmental or wildlife monitoring programs to obtain “win-win” opportunities; (2) banning the dumping of onboard litter from vessels at sea, encouraging the use of environmentally friendly fishing gear or plastics instead of Styrofoam, and establishing recycling areas in fishing ports for fishing gear, fishing nets, and waste; (3) strengthening national information exchanges, acknowledging and fulfilling oceanic environmental protection plans through trajectory tracking, and strictly co-implementing the litter disposal provisions for vessels; and finally (4) raising public awareness and action, such as limiting use of disposable items, increasing re-use behaviors, and modernizing the legal system.

Figure 1. (A) A wide variety of macro ocean litter found on the coasts of Dongsha Island, mostly in undegraded forms. (B) The staff of the Marine National Park, the Coast Guard Administration, and the Dongsha Atoll Research Station provide continuous labor and equipment support during field investigations.

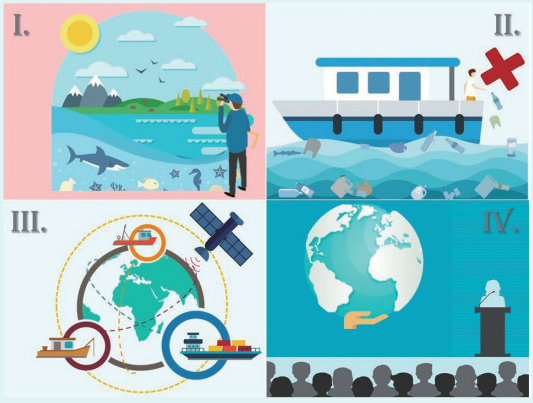

Figure 2. Schematic diagrams of the four main regional to global management action plans proposed in this study.

References

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Gallium (Ga) and indium (In) used in semiconductor manufacturing and the electro-optical industry: their inhibition of rice plant growth in paddy soils

Gallium (Ga) and indium (In) are widely used in semiconductor manufacturing and the electro-optical industry, and the rapid growth of high-tech industries raises the concern that large amounts of wastewater derived from associated manufacturing processes may easily become a potential source of environmental contamination; thus, these two elements are recognized as emerging contaminants. Once industrial wastewater containing Ga and In is discharged into farmland through irrigation systems, it may affect the growth and yield of crops. Moreover, humans may be exposed to Ga and In through the food chain, which could pose severe health risks. Rice (*Oryza sativa* L.) is the staple food for most of the population in Asia. Rice consumption is a potential route of Ga and In exposure in humans, especially in agricultural areas near high-tech industrial parks. However, limited information is currently available on the effects of Ga and In on the growth of rice plants. Therefore, Professor Dar-Yuan Lee and his students Mr. Jeng-Yan Su and Dr. Chien-Hui Syu investigated the growth effects and uptake of