

Supplementary Materials:

A) Videos are Available at the Correspondent Link:

- SanRossoreWOWENG.m4v at <https://box.ifc.cnr.it/index.php/s/rzv985aTk3GHtGp>
- Before&3-10dayafter.avi at <https://box.ifc.cnr.it/index.php/s/SoNpEZJcxZfbe53>

The first link is for a brief movie used mainly for outreach and environmental education activities, which illustrates the integrated approach of scientists and citizens in environmental monitoring activities (citizenscience). It describes the UAV used to monitor marine litter accumulation in a marine protected area, and the way we extract information about their spatial and temporal distribution from the ortho-photos.

The second link is for a very short movie that shows the comparison between the state of the area monitored in the present study (an MPA) before the Arno river flood, immediately after it, and about 10 days later highlighting the role of the sea in accumulating but also in removing materials from the coast.

B) 3-D Maps of the Beach and Possible Application for Further BML Study

By using the digitally recorded data from UAVs, it was possible to produce the 3D maps of the studied area, for each date of the surveys. 3D images are useful for providing various types of information. It is possible, for example, to implement such a capability of the UAVs camera and software to evaluate the volume, and not just the section area of the beached objects. The resolution of our digital images is sufficiently good to allow 3D reconstruction, even for relatively small objects (see photo below). In future studies, we hope that the 3D reconstruction could allow us to overcome the problems encountered, above all, in the winter period, when the presence on the beach of many natural objects, such as trunks and plant material, carried by storm surges and exceptional sporadic events (floods of rivers), does not allow one to have a “clean” 2D vision of the objects stranded on the beach. To summarize the potential of the three-dimensional orthophoto reconstruction, we show, in Figure S1a (here below) a relatively large section of the beach, with the largest BML in evidence, while in Figure S1b a smaller area from the selected beach section has been enlarged. The resolution of this method is high enough to identify even small objects in a large area.

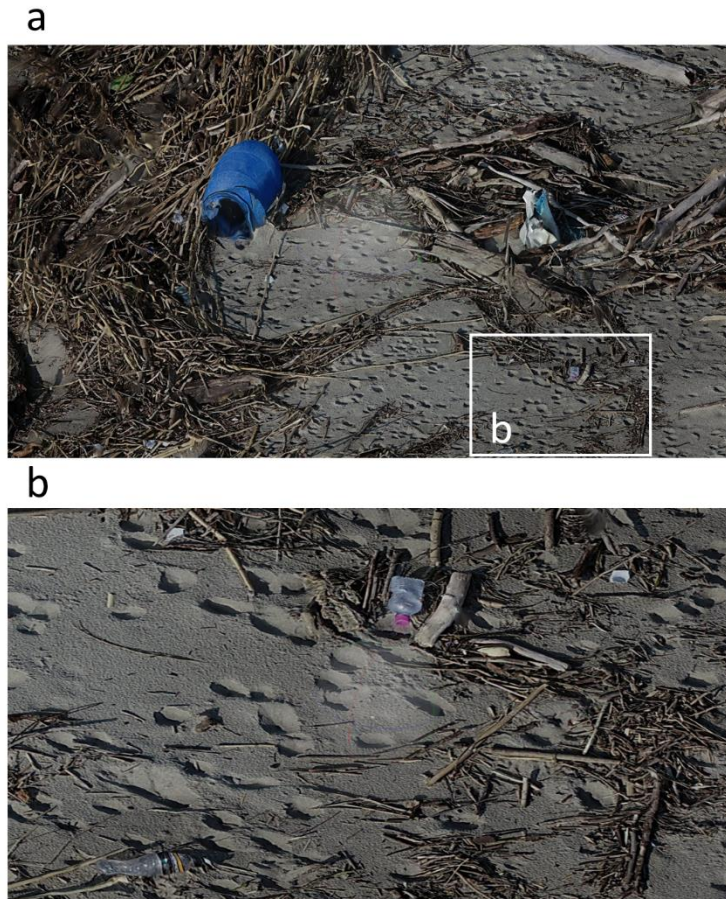


Figure S1. The figure summarizes the potential of the three-dimensional orthophoto reconstruction. In (a) a relatively large section of the beach is shown, with the largest BML in evidence, while in (b) a smaller area of the selected beach section has been enlarged. The resolution of this method is high enough to identify even small objects in a large area.

Three-dimensional images could also be useful to estimate the accumulation dynamics of the BML on the beaches, in terms of mass. This further step requires an accurate identification of the material of which the BML are composed, and therefore, knowledge of their average specific weight, as suggested by [43]. The automatic identification of the type of BML from orthophotos, by using machine learning software (a recent field of research [40,41,43,44]), could be very effective.