

Geopaparazzi-based participatory sensing tool used to monitor marine litter: from USA to Kenya

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Abstract. Monitoring plastic flows is crucial for the identification and quantification of the amount of pollutants that are permitting the marine system and to assess the ecological impacts and dislocated effects of plastic use and consumption. Tracking plastic at sea requires a combination of sampling approaches and datasets, as multiples are the sinks and the dynamics of the plastic inputs to the marine environment [1]. Novel approaches to marine data collection are increasingly involving citizen science and crowdsourcing, especially in areas with limited data and monitoring capacity. A prominent applied methodology includes participatory sensing methodologies to exchange data through the collaboration of mobile users, thus obtaining a direct mechanism with individuals [2], that use mobile devices to form sensor networks and enable interactive, participatory involvement of public and private users to collect, analyze and share local knowledge [3].

In this study, the results of a participatory sensing application tool are applied in two case studies: (i) Imperial Beach, San Diego (California, USA) and (ii) Dunga Beach, (Kisumu, Kenya). Our research involved local groups (students, children, and volunteers) to map and visualize marine litter using the mobile app Geopaparazzi (by Hydrologis®). This tool allows users to develop fast qualitative technical and scientific surveys [4]. The sorting protocol provides the in-situ assessment and quantification of plastic litter via litter counting through visual inspection of debris, and litter separation by material type, and debris classification. Our work involved local community groups of students, professors, children, youth and volunteers aged 10-65 years old to map marine litter using the mobile app Geopaparazzi, to develop fast hybrid quantitative/qualitative, technical, and scientific surveys. The sorting protocol provides the in-situ assessment and quantification of plastic litter via litter counting through visual inspection of debris, and litter separation by material type and debris



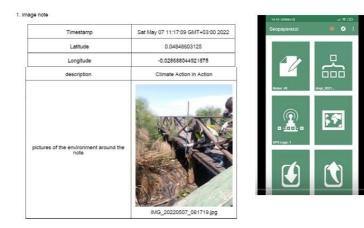
classification.

Figure 1 and Figure 2 shows the data collected including marine litter amounts (count and weight), marine litter density (kg/transect), field notes, photographic evidence of sampling conditions, and location (GPS coordinates) of the littered transects. Data collected with Geopaparazzi were then combined with transect data collected during the field surveys, and imported into standard WGS84 GIS formats. Finally, we merged our dataset with existing data related to water quality and georeferenced information on the local context to provide a more comprehensive picture of our sampling sites.



Figure 1. Example of the application of the sorting protocol on the beach litter collection in Imperial Beach, California, USA

(A)





	_	MetaD	ata		Core Dataset						
ID	De	te	Time (PT) GMT+3	Site	Latitude	Longitude	Weather conditions	Surveyor	Material	Litter item	Count (N)
	1	05/07/2022	11:17:09	Kisumu, Kery	0.04848603125	-0.028688044921875	Sunny				
	2	05/07/2022		Kisumu, Kery	0.04848603125						
	3	05/07/2022		Kisumu, Kery	0.04848603125						
	4	05/07/2022		Kisumu, Kery	0.04848603125						
	5	05/07/2022		Kisumu, Kery							_
	6	05/07/2022		Kisumu, Kery							-
	7	05/07/2022		Kisumu, Kery							
	8	05/07/2022		Kisumu, Kery							
	9	05/07/2022	11:33:12	Kisumu, Kery	-0.14513	34.737815	Sunny				
	10	05/07/2022	11:38:58	Kisumu, Kery	-0.1450216667	34.73781	Sunny				
	11	05/07/2022	11:41:39	Kisumu, Kery	-0.14496	34.73787167	Sunny				
	12	05/07/2022	11:42:25	Kisumu, Kery	-0.1449566667	34.73786167	Sunny				

Figure 2. A. Geopaparazzi app interface. B. Data collection format.

Based on our results, this study provides guidance for industrial stakeholders and policy makers to support strategic interventions on pollution management and evaluate their effectiveness over time.

Keywords. Marine Litter; Citizen Science; Participatory Sensing; Geopaparazzi; Imperial Beach; Dunga Beach.

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