

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)

1. Image note

Timestamp	Sat May 07 11:17:09 GMT+03:00 2022
Latitude	0.04848603125
Longitude	-0.028688044921875
description	Climate Action in Action
pictures of the environment around the note	 <p>IMG_20220507_081719.jpg</p>



(B)

MetaData				Core Dataset							
ID	Date	Time (PT) GMT+3	Site	Latitude	Longitude	Weather conditions	Surveyor	Material	Litter item	Count (N)	
1	05/07/2022	11:17:09	Kisumu, Kenya	0.04848603125	-0.028688044921875	Sunny					
2	05/07/2022	11:17:59	Kisumu, Kenya	0.04848603125	-0.028688044921875	Sunny					
3	05/07/2022	11:19:28	Kisumu, Kenya	0.04848603125	-0.028688044921875	Sunny					
4	05/07/2022	11:23:47	Kisumu, Kenya	0.04848603125	-0.028688044921875	Sunny					
5	05/07/2022	11:25:33	Kisumu, Kenya	0.04848603125	-0.028688044921875	Sunny					
6	05/07/2022	11:27:42	Kisumu, Kenya	-0.1449766667	34.7378183333333	Sunny					
7	05/07/2022	11:28:26	Kisumu, Kenya	-0.1449933333	34.737825	Sunny					
8	05/07/2022	11:30:11	Kisumu, Kenya	-0.1449816667	34.73782833	Sunny					
9	05/07/2022	11:33:12	Kisumu, Kenya	-0.14513	34.737815	Sunny					
10	05/07/2022	11:38:58	Kisumu, Kenya	-0.1450216667	34.73781	Sunny					
11	05/07/2022	11:41:39	Kisumu, Kenya	-0.14496	34.73787167	Sunny					
12	05/07/2022	11:42:25	Kisumu, Kenya	-0.1449566667	34.73786167	Sunny					

Figure 2. A. Geoparazzi 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; Geoparazzi; Imperial Beach; Dunga Beach.

References

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