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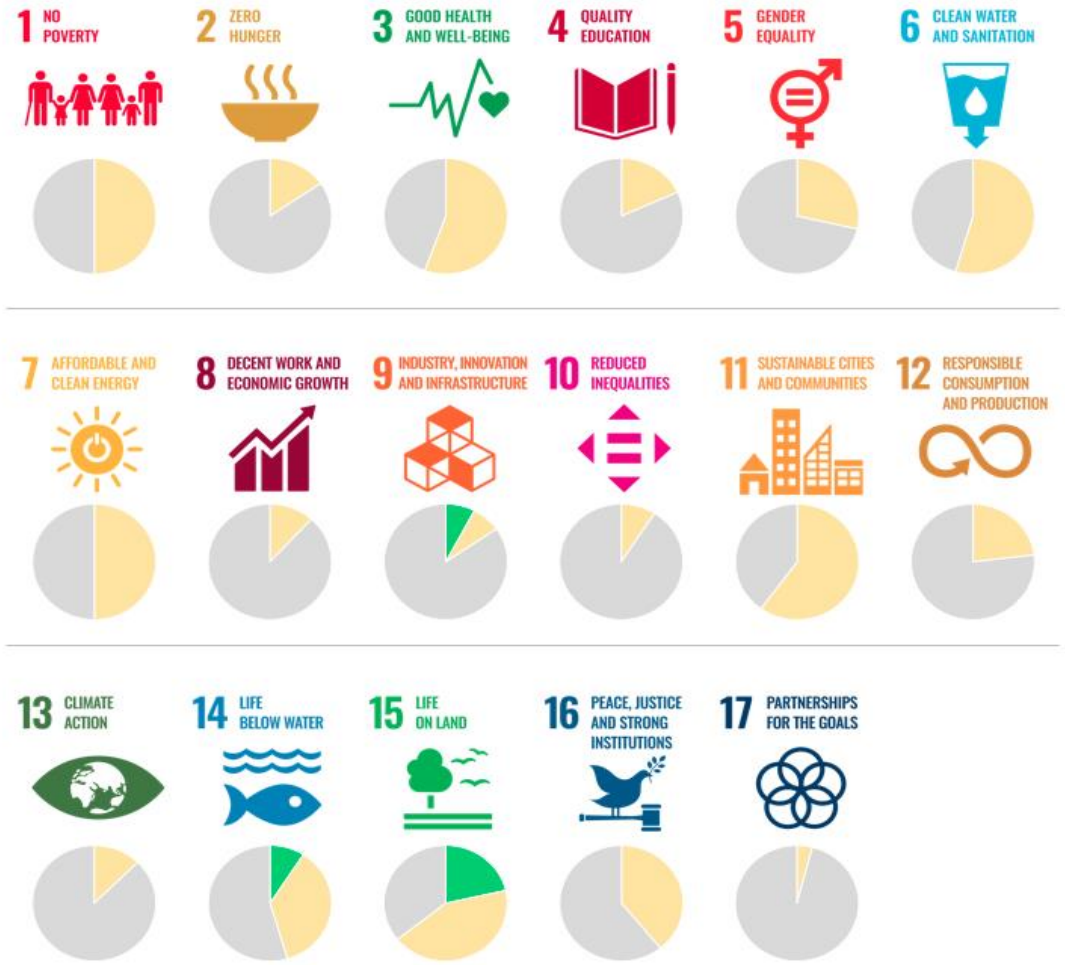
How Citizen Science has Changed SDG Monitoring of Marine Plastic Pollution in Ghana

Linda See, Dilek Fraisl, Omar Seidu, Kwame Boakye Fredua, Sarah Weller, Tyler Kobla-Amalgo, Dany Gafari, Ian McCallum

How it all began

- Citizen science/SDG mapping work led by Dilek Fraisl
- Project funded by UN SDSN Trends to facilitate use of citizen science by the Ghana Statistical Service (GSS) for SDG monitoring – led by Dilek Fraisl
- First part of the project was to identify potential indicators and areas of interest from the GSS

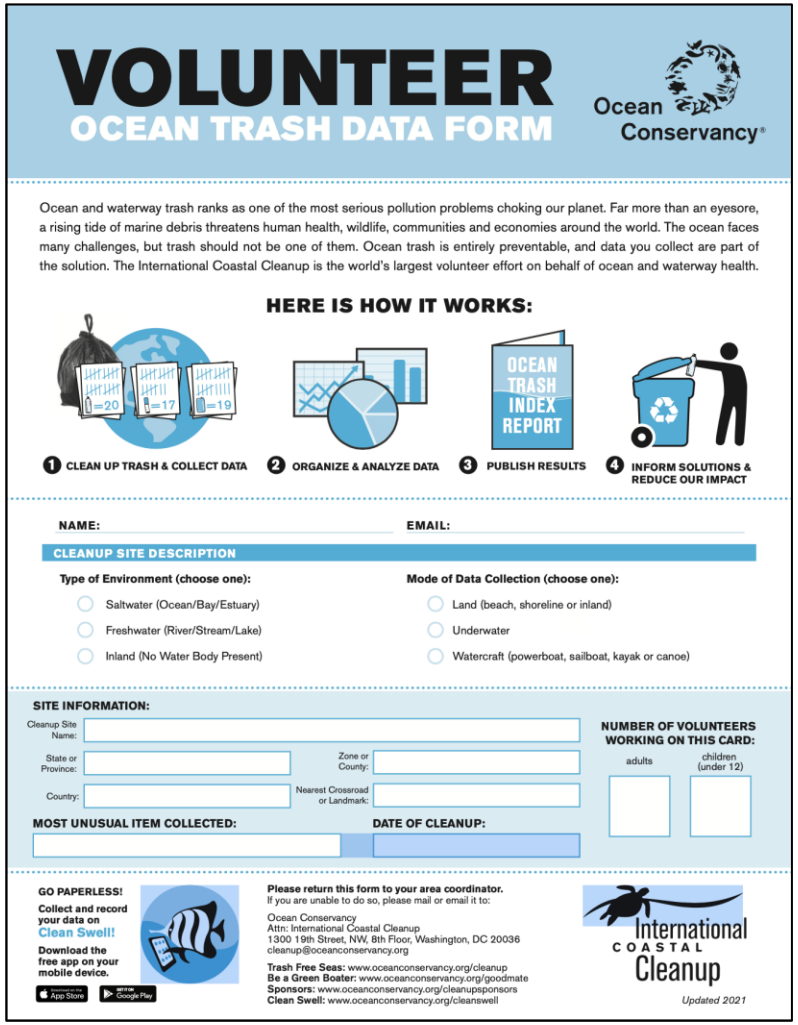


Fraisl, D., Campbell, J., See, L. *et al.* Mapping citizen science contributions to the UN sustainable development goals. *Sustain Sci* **15,** 1735–1751 (2020).

Marine plastic pollution

- Marine plastic pollution is a serious, global problem but one that adversely affects Ghana, so this was a clear area of interest by the GSS but also Ghana's Environmental Protection Agency (EPA)
- Hence, the focus turned to SDG indicator 14.1.1.b on plastic debris density
- Already established networks of dedicated citizen scientists collecting litter and conducting beach cleanups using protocols from the International Coastal Cleanup/Ocean Conservancy

Data collection forms



VOLUNTEER
OCEAN TRASH DATA FORM

Ocean Conservancy

Ocean and waterway trash ranks as one of the most serious pollution problems choking our planet. Far more than an eyesore, a rising tide of marine debris threatens human health, wildlife, communities and economies around the world. The ocean faces many challenges, but trash should not be one of them. Ocean trash is entirely preventable, and data you collect are part of the solution. The International Coastal Cleanup is the world's largest volunteer effort on behalf of ocean and waterway health.

HERE IS HOW IT WORKS:

1 CLEAN UP TRASH & COLLECT DATA
2 ORGANIZE & ANALYZE DATA
3 PUBLISH RESULTS
4 INFORM SOLUTIONS & REDUCE OUR IMPACT

NAME: EMAIL:

CLEANUP SITE DESCRIPTION

Type of Environment (choose one):
- Saltwater (Ocean/Bay/Estuary)
- Freshwater (River/Stream/Lake)
- Inland (No Water Body Present)

Mode of Data Collection (choose one):
- Land (beach, shoreline or inland)
- Underwater
- Watercraft (powerboat, sailboat, kayak or canoe)

SITE INFORMATION:
Cleanup Site Name:
State or Province:
Zone or County:
Country:
Nearest Crossroad or Landmark:
MOST UNUSUAL ITEM COLLECTED:
DATE OF CLEANUP:

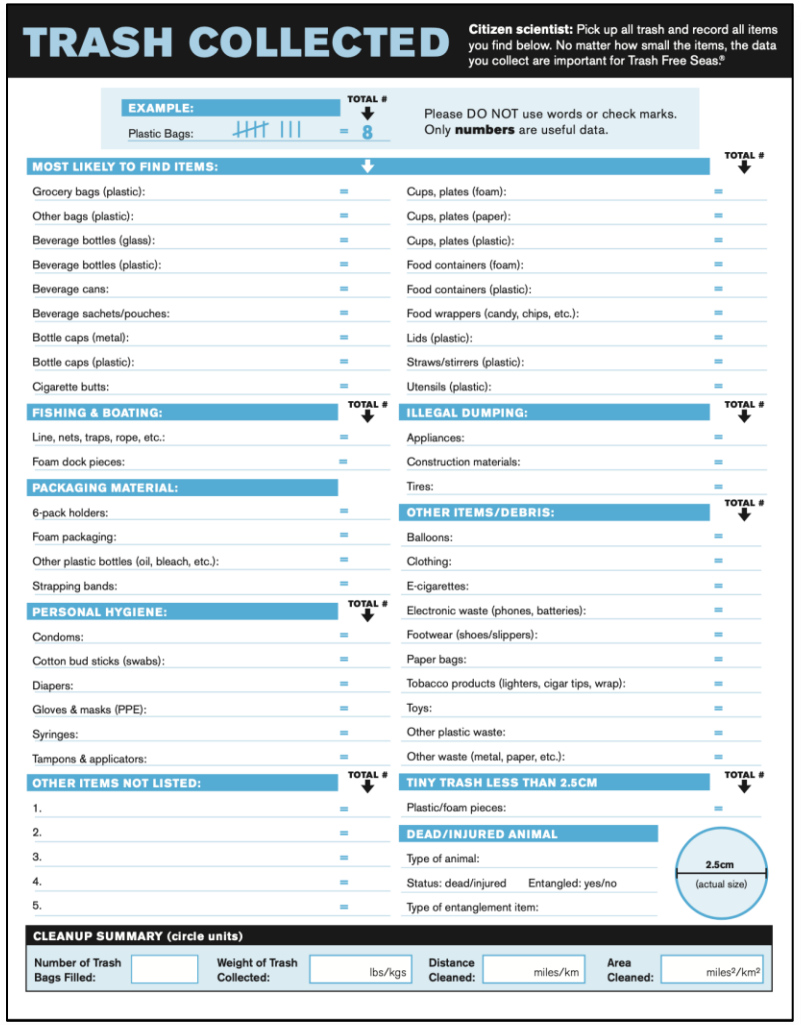
NUMBER OF VOLUNTEERS WORKING ON THIS CARD:
adults
children (under 12)

GO PAPERLESS!
Collect and record your data on Clean Swell!
Download the free app on your mobile device.
App Store Google Play

Please return this form to your area coordinator.
If you are unable to do so, please mail or email it to:
Ocean Conservancy
Attn: International Coastal Cleanup
1300 19th Street, NW, 8th Floor, Washington, DC 20036
cleanup@oceanconservancy.org

Trash Free Seas: www.oceanconservancy.org/cleanup
Be a Green Boater: www.oceanconservancy.org/goodmate
Sponsors: www.oceanconservancy.org/cleanupsponsors
Clean Swell: www.oceanconservancy.org/cleanswell

International COASTAL Cleanup
Updated 2021



TRASH COLLECTED

Citizen scientist: Pick up all trash and record all items you find below. No matter how small the items, the data you collect are important for Trash Free Seas.®

EXAMPLE: Plastic Bags: 𝍸 | | | = 8 (TOTAL #)

Please DO NOT use words or check marks. Only **numbers** are useful data.

MOST LIKELY TO FIND ITEMS: (TOTAL #)
Grocery bags (plastic):
Other bags (plastic):
Beverage bottles (glass):
Beverage bottles (plastic):
Beverage cans:
Beverage sachets/pouches:
Bottle caps (metal):
Bottle caps (plastic):
Cigarette butts:

FISHING & BOATING: (TOTAL #)
Line, nets, traps, rope, etc.:
Foam dock pieces:

PACKAGING MATERIAL:
6-pack holders:
Foam packaging:
Other plastic bottles (oil, bleach, etc.):
Strapping bands:

PERSONAL HYGIENE: (TOTAL #)
Condoms:
Cotton bud sticks (swabs):
Diapers:
Gloves & masks (PPE):
Syringes:
Tampons & applicators:

OTHER ITEMS NOT LISTED: (TOTAL #)
1.
2.
3.
4.
5.

Cups, plates (foam):
Cups, plates (paper):
Cups, plates (plastic):
Food containers (foam):
Food containers (plastic):
Food wrappers (candy, chips, etc.):
Lids (plastic):
Straws/stirrers (plastic):
Utensils (plastic):

ILLEGAL DUMPING: (TOTAL #)
Appliances:
Construction materials:
Tires:

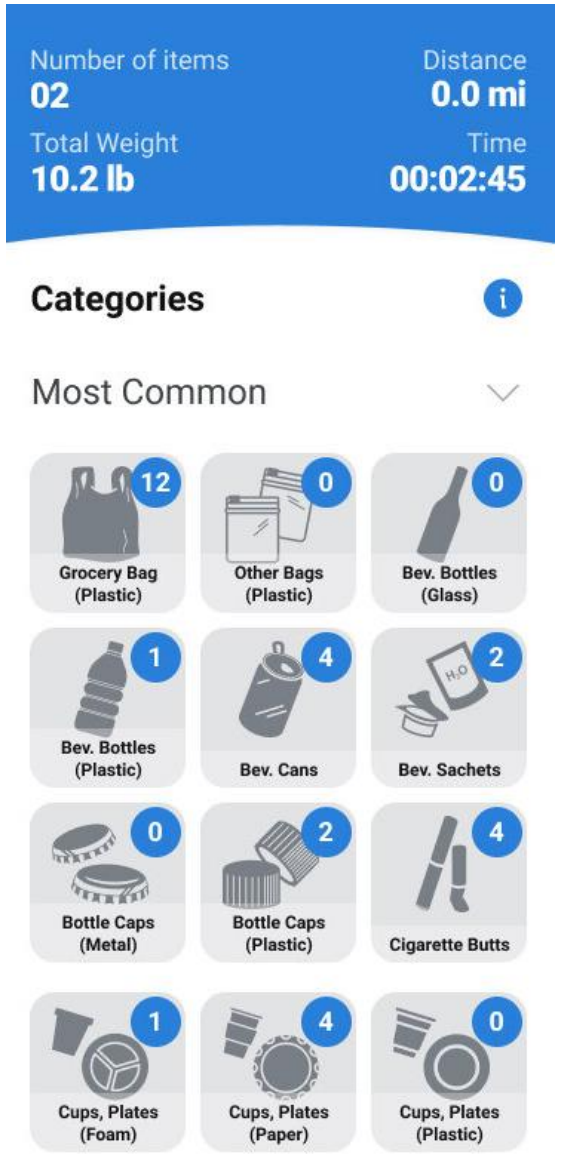
OTHER ITEMS/DEBRIS: (TOTAL #)
Balloons:
Clothing:
E-cigarettes:
Electronic waste (phones, batteries):
Footwear (shoes/slippers):
Paper bags:
Tobacco products (lighters, cigar tips, wrap):
Toys:
Other plastic waste:
Other waste (metal, paper, etc.):

TINY TRASH LESS THAN 2.5CM (TOTAL #)
Plastic/foam pieces:

DEAD/INJURED ANIMAL
Type of animal:
Status: dead/injured Entangled: yes/no
Type of entanglement item:

2.5cm (actual size)

CLEANUP SUMMARY (circle units)
Number of Trash Bags Filled:
Weight of Trash Collected: lbs/kgs
Distance Cleaned: miles/km
Area Cleaned: miles²/km²



Actors/platforms involved in the process

Project Partners

- Environmental Protection Agency Ghana
- Ghana Statistical Service
- International Coastal Cleanup (ICC)
- Smart Nature Freaks Youth Volunteer Foundation
- UNEP
- Woodrow Wilson International Center for Scholars

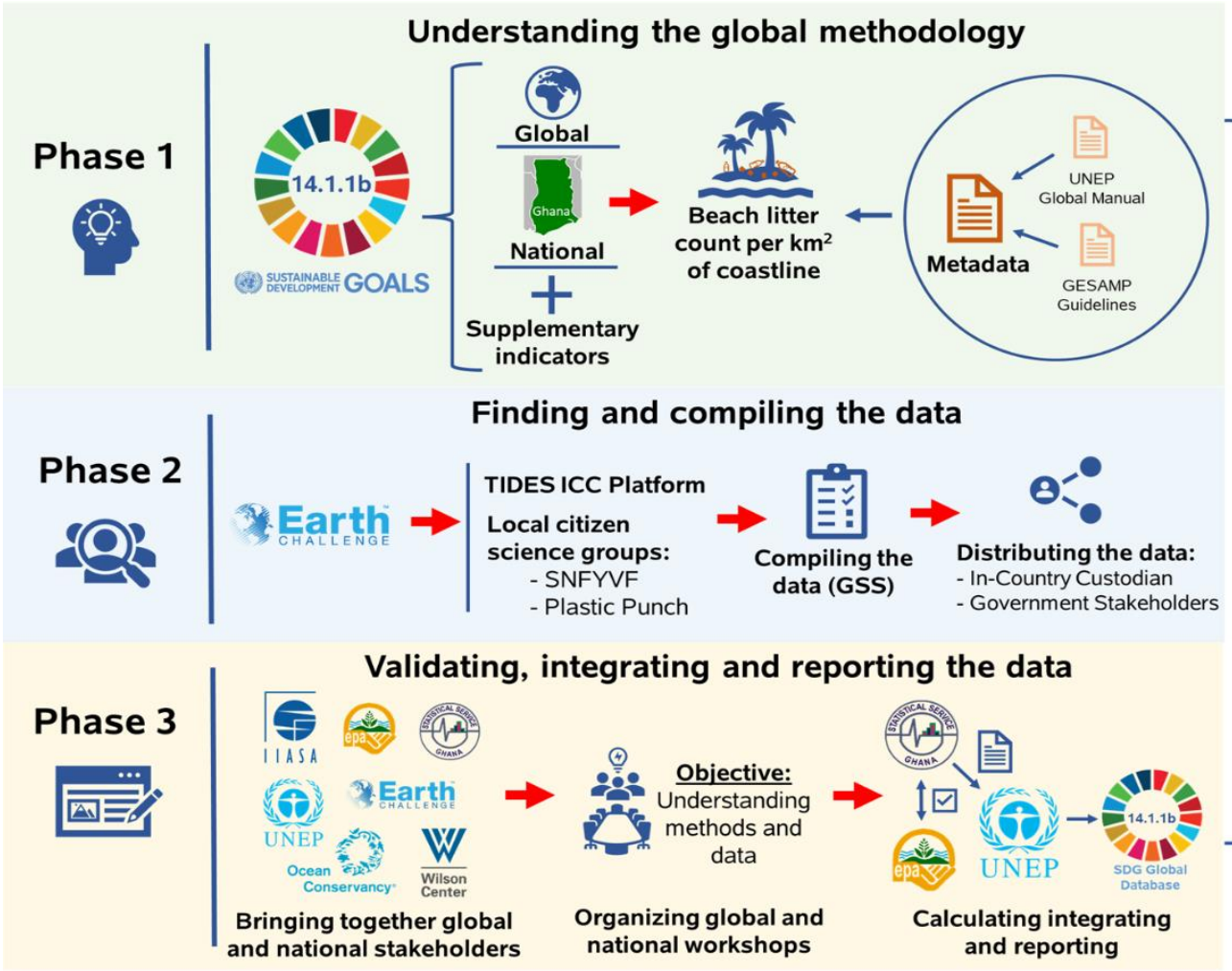
Actors involved in Policy Roundtable

- Ghana Ministry of Environment Science Technology and Innovations
- Ghana Ministry of Fisheries and Aquaculture Development
- Ghana Ministry of Sanitation and Water Resources
- Ghana Ministry of Planning
- Ghana National Development Planning Commission

Platforms

- Global Earth Challenge Marine Litter Data Integration Platform
- Trash Information & Data for Education & Solutions (TIDES) Database
- UN SDG Global Database

The process of citizen science data integration on marine litter for SDG indicator 14.1.1b reporting



Source: Fraisl et al. (2023)

Most frequently found items

- Plastic and foam pieces
- Cigarette butts
- Plastic bottles and bottle caps
- Take away containers (plastic and foam) and plastic lids
- Plastic cups and cutlery
- Straws
- Diapers
- PPE (from 2021 onwards)
- Tires

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The officially reported values for indicator 14.1.1b *Number of plastic items per square kilometer of beach*, reported by Ghana

	2016	2017	2018	2019	2020
14.1.1b Ghana validated beach litter data	33,579,283	56,875,108	Not Reported	179,760,103	152,134,672
Number of CSOs Contributing to the Data	2	1	Not reported	2	3
Number of Beach Cleanups	2	7	Not reported	11	3

Table S2: Checklist for the process of leveraging existing citizen science data for 14.1.1b reporting

Phase 1: Understanding the global methodology for indicator 14.1.1b on *plastic debris density*

- ☐ Examine the global methodology for SDG indicator 14.1.1b with a focus on beach litter - average count of plastic items per km^2;
  - ☐ Review the SDG Indicator 14.1.1b Metadata (UN 2021);
  - ☐ Review the Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1. (UNEP 2021);
  - ☐ Review the GESAMP Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (GESAMP 2019);
- ☐ Identify additional aims beyond SDG monitoring, if applicable. Examples include:
  - ☐ Policy formulation;
  - ☐ Education and awareness raising;
  - ☐ Supporting citizen science initiatives for future data collection activities.

Phase 2: Finding and compiling the data

- ☐ Create a list of key stakeholders for in-country, as well as global engagement, e.g., NSO, line ministries, CSOs, academia, UNEP, ICC, etc.;
- ☐ Explore if there are existing citizen science projects, local citizen scientist networks or citizen science data available in the country. Examples of data platforms include:
  - ☐ Global Earth Challenge Marine Litter Data Integration Platform (Earth Day Network 2021);
  - ☐ ICC TIDES database (Ocean Conservancy 2022).
- ☐ If data are available, investigate issues, such as:
  - ☐ The number of beach litter collections per year;
  - ☐ The dispersion of the locations of the data collection activities;
  - ☐ The classification of litter into plastics and non-plastics as per the global methodology;
  - ☐ Completeness of the data; whether area covered is captured or needs to be approximated;
  - ☐ Any outlier values available in the data set.

Phase 3: Validating, integrating, and reporting the data

- ☐ Bring key stakeholders together and ensure their engagement by providing a platform to communicate needs, motivations, and concerns;
- ☐ Ensure both national and global level coordination and collaboration that goes beyond the data validation activity;
- ☐ Organize several workshops with clear goals, such as:
  - ☐ Understanding the methodologies developed by the citizen science projects;
  - ☐ Determining how these methodologies were implemented by local citizen scientist networks and CSOs;
  - ☐ Understanding the eligibility of coastal sites:
    - ☐ Identifying any geographic areas of policy interest and any existing litter prevention interventions;
    - ☐ Discerning between sites with land- or ocean-sourced litter flows.
  - ☐ Clarifying any open issues with the data set;
  - ☐ Identifying areas of future improvements of the methodologies or their implementation;
  - ☐ Understanding the limitations and challenges of citizen science data and how to overcome them or minimize their effect;
  - ☐ Ensuring that the data produced are of sufficient quality for informing the SDG indicator 14.1.1b, as well as policy action;
  - ☐ Ensuring that the ethical principles are followed while developing and using the methodology, e.g., data privacy, etc.
  - ☐ Determining whether citizen science methodologies could be integrated into future policy monitoring.
- ☐ Gather a small team of statisticians and thematic experts for data validation;
- ☐ Identify any shortcomings related to the data set. Some of the questions that can be asked here include:
  - ☐ Does the citizen science methodology align with the global 14.1.1b methodology?
  - ☐ Was the area covered captured during data collection?
  - ☐ Were the data collection sites selected using a sampling method or opportunistically (with no sampling design)?
  - ☐ If opportunistically, could the data be representative of the overall country?
- ☐ Calculate the indicator, with support from UNEP and other partners if needed;
- ☐ Follow the in-country structures and regulations to communicate the results, e.g., official communique between government agencies;
- ☐ Consider reporting the results to the UN SDG Global Database and in the Voluntary National Review, once approved;
- ☐ Use the results for policy development or improvement.

Checklist of actions that can be used by other countries interested in replicating this approach

Why was this successful?

- National legislation that recognizes the value of citizen science data
- GESAMP guidelines that recommend use of citizen science data for SDG monitoring of plastic pollution
- Political will within Ghana (GSS, EPA) and recognition of the value beyond SDG reporting → input to Ghana's Integrated Coastal and Marine Management Policy
- Engagement of national and international stakeholders including the custodian agency for this SDG indicator (UNEP)
- Existing network of citizens engaged in marine litter collection following international protocols for data collection
- Strong project leadership

Some lessons learned

- Rather than the time- and resource-intensive process of designing a digital mobile app from scratch, used off-the-shelf solutions such as data collection cards and CleanSwell, requiring fewer resources to implement and enabling the reuse of historical data
- Such a project can influence protocols, leading to a change in Ocean Conservancy's data collection to make it more usable for SDG reporting
- By tapping into **Smart Nature Freaks Youth Volunteers** and **Plastic Punch**, who are already established and sustainable networks, data could be efficiently compiled as a by-product of existing activities
- Importance of creating time and space for the government, international organizations and NGOs to meet, in order to **build trust**, common goals and **ownership** over the results

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Sustainability Science
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ORIGINAL ARTICLE

The contributions of citizen science to SDG monitoring and reporting on marine plastics

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Abstract
The accumulation of plastic litter in marine environments is a major environmental challenge along with the difficulties in their measurement because of the massive size of the oceans and vast circulation of plastic litter, which is being addressed as part of the United Nations (UN) Sustainable Development Goals (SDGs). Citizen science, public participation in scientific research and knowledge production, represents a potential source of data for SDG monitoring and reporting of marine plastic litter, yet there has been no evidence of its use to date. Here, we show how Ghana has become the first country to integrate existing citizen science data on marine plastic litter in their official monitoring and reporting of SDG indicator 14.1.1b for the years 2016–2020, which has also helped to bridge local data collection efforts with global monitoring processes and policy agendas by leveraging the SDG framework. The results have been used in Ghana's 2022 Voluntary National Review of the SDGs, and reported on the UN SDG Global Database, as well as helping to inform relevant policies in Ghana. In addition, here, we present a pathway that can be adopted by the relevant government authorities in other countries that have an interest in following a similar citizen science data validation and reporting process for this indicator and potentially others.

Keywords Citizen science · Data · Official statistics · Sustainable Development Goals (SDGs) · SDG monitoring · Beach litter · Marine plastics · Plastic pollution · Policymaking

Fraisl, D., See, L., Bowers, R. *et al.* The contributions of citizen science to SDG monitoring and reporting on marine plastics. *Sustain Sci* (2023). https://doi.org/10.1007/s11625-023-01402-4

Citizen Science for the SDGs Story Map

https://dataforchange.net/strengthening-measurement-of-marine-litter-in-Ghana

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Thank you!
Questions?

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