

Marine Debris Research in Coastal Zones

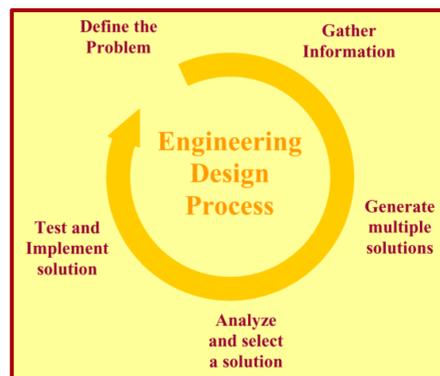
The definition of 'coastal zone' varies in the literature from inter-tidal zones to 100 miles from the shore. Research in coastal zones emphasize surface water and sediment sampling. This focus is partially due to limitations of current marine debris sampling methodology to collect samples in-situ adjacent to urban centers. Standard methodology in the United States have spatial requirements that are not meet in some coastal zones. This means the global marine debris data set lacks data from high impact zones. In this research 'coastal zones' are defined as within one mile of the shore. Developing technology to sample marine debris and engage citizen scientists has multi-faceted benefits to science. It can increase public support of research and fill in gaps in the global data set.

Engaging Citizen Scientists

Standard US sampling methods are not conducive to effective citizen science engagement. The learning curve and time commitments deter volunteers from partaking in research. Low engagement is also due to the discrete impact of marine debris pollution on day to day life.

Evidence technology can engage citizen scientists:

- Developed technology reduces the learning period
- Research can be conducted in accessible locations



Design Theory

Design theory is similar to the scientific process

- Iterative process to address a question
- Process driven by interactions with past solutions
- Engineers consider end users to identify solution
- End user defines the interactions with solution
- Defines key principles and design parameters

m-PARR: Design Theory in Practice

m-PARR is a prototype instrument for use by citizen scientists to sample micro-plastics in coastal zones. Key principles of the m-PARR design were 1) usability and 2) accessibility.

Design parameters were set to meet key principles:

- 1) Low-cost
- 2) Portable
- 3) Easy to Use



Figure 1 Digital rendering of m-PARR (A-C) showing the simplicity of the instruments design and (D) the current prototype.

m-PARR: Data Representation

Representation of data had it's own design phase

- Visual that presented data's spatial variation
- Visual that easily compared multiple tests

Rose plots were utilized to represent spatial data
Bar charts compare tests by light sensor

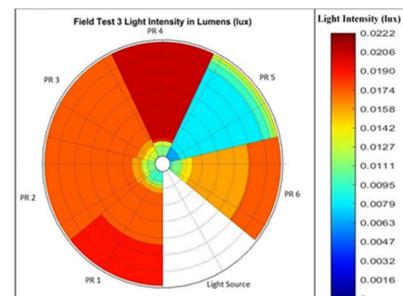
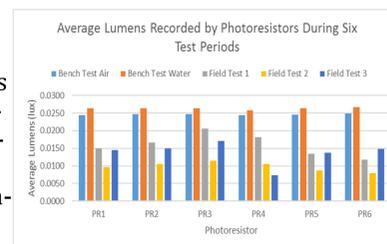


Figure 2 Rose plot of light intensity recorded by each light sensor during testing. Light sensors are physical oriented with respect to the light source. Frequency of light intensity is represented by the width of bands in the rose.

Ask me to see the sensor!

Figure 3 Average lumens measured by light sensors during sampling periods. This visualization allows comparison of variation in light intensity by sensor between tests This visualization lets us identify unique sample parcels.



m-PARR: Current Status

- Functional prototype
- Maker movement materials
- Code accessible through open source program
- Per unit cost <\$200
- Field data with identification of turbidity variation

Areas for Further Research

- Unique particulate identification
- Ease-of-use by citizen scientists
- Deployment mechanisms and instrument size
- Code interactions
- Innovative sampling devices in citizen science
- Impact of technology on stakeholder partnerships

Where does this work go from here?

My thesis is a continuation of this work, please share an idea!

- Ask me for a sticky note
- Write your thoughts in a few sentences
- Include contact information if you feel inclined
- Put the stick note in the space below

Thank you!

Key Words

- Innovative technology
- Citizen Science
- Sampling in coastal zones
- Design theory
- Stakeholder engagement
- m-PARR



Contact:
kmball1@asu.edu
actionsandoceans.tumblr.com

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Contribute your thoughts on where this research goes next!