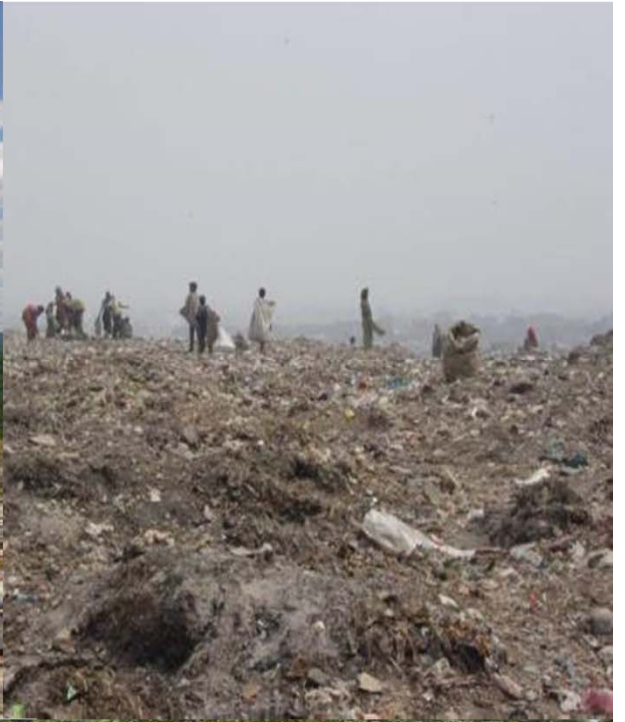


**Solid Waste Management (Plastic) & Upstream Solutions
US EPA Trash Free Waters Webinar, June 27, 2017**

Jenna Jambeck, PhD, Associate Professor of Environmental Engineering, University of Georgia
Director, Center for Circular Materials Management, New Materials Institute, UGA





Waste Management in the USA in early 1970's





Photos and © Jenna Jambeck



Plastic to Microplastic



← This

Becomes



<http://dailynews.openwaterswimming.com/2011/01/swimming-against-plastic-tide.html>

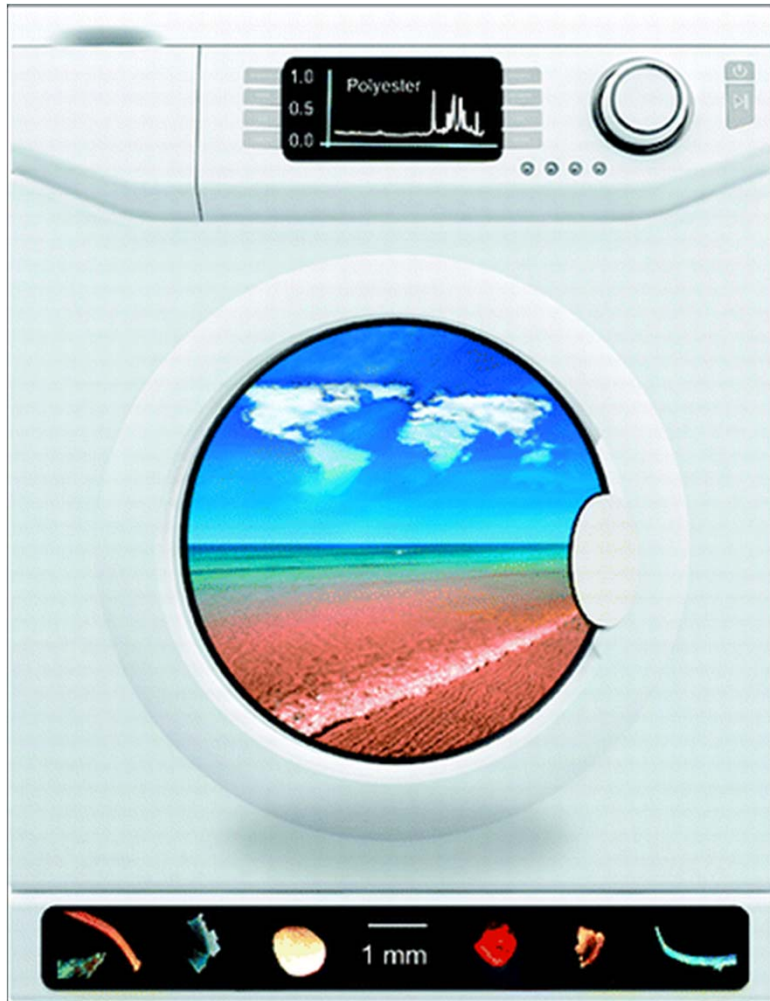


<http://marinedebris.noaa.gov/info/plastic.html>



<http://greencitychallenge.org/blog/live-green-blog/microplastic-wastes-in-our-oceans/>

Microfibers/Cleansing Beads



Browne et al., 2011

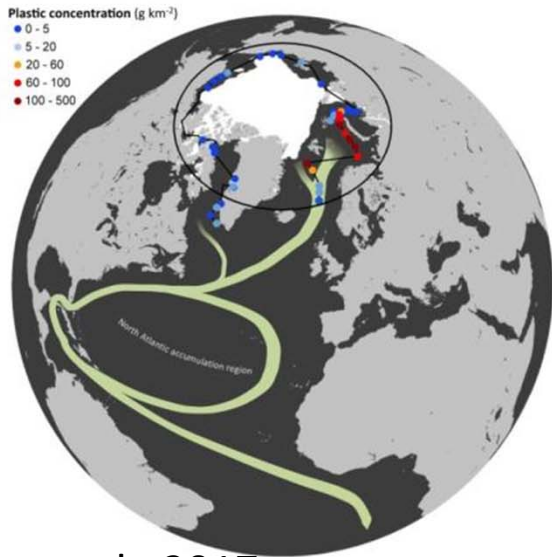


Microbead-Free Waters Act of 2015

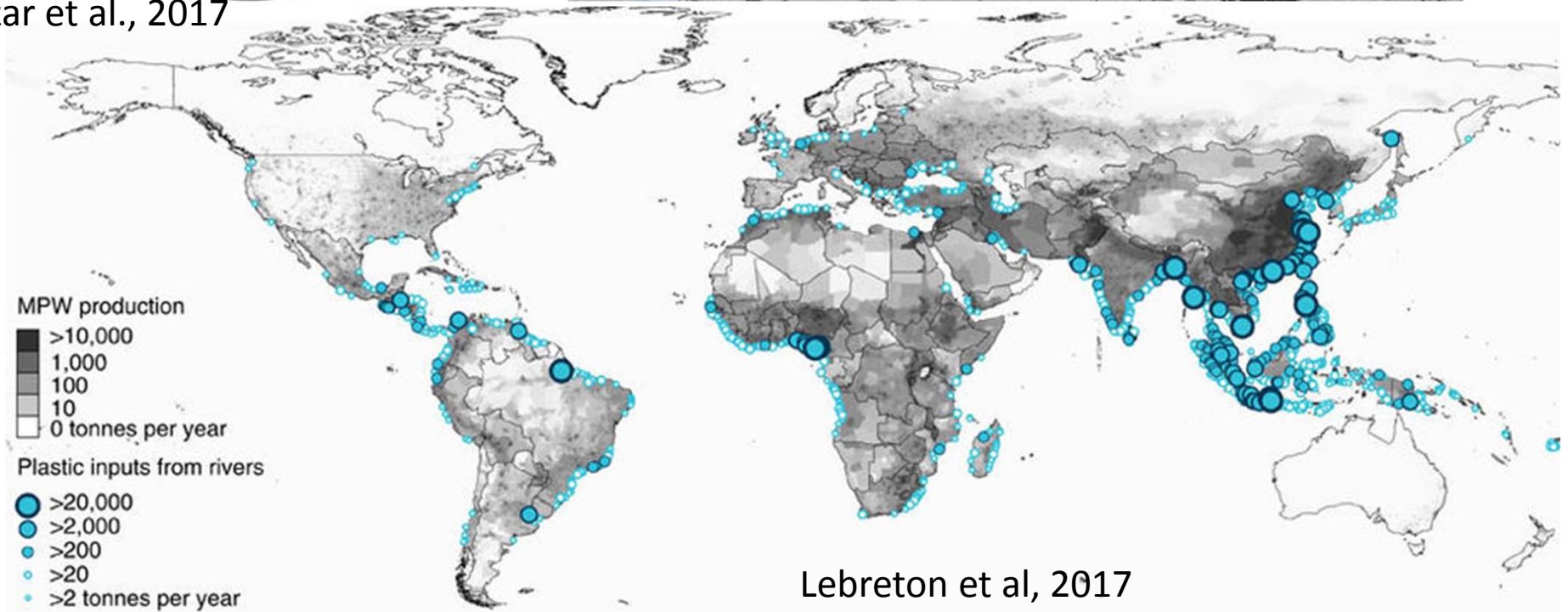
July 2017 – No manufacturing

July 2018 – No sales

Accumulation Areas and River Sources



Cozar et al., 2017



Lebreton et al, 2017

To the depths...

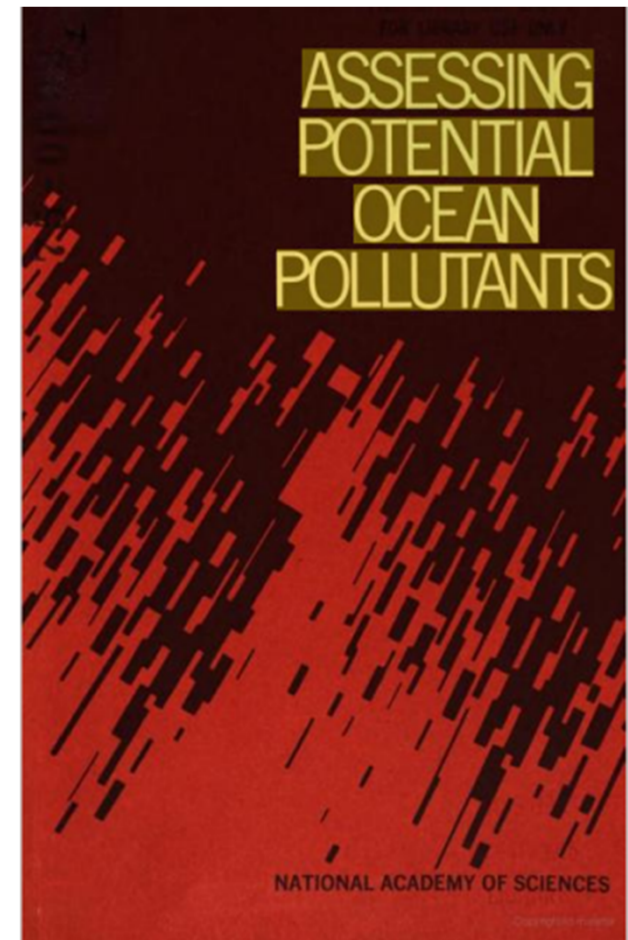
Bergmann and Kalges (2012) found the amount of trash, primarily plastics, on the Arctic seafloor has more than doubled in the past decade. [*Marine Pollution Bulletin*]



Photo of plastic waste, taken by the OFOS system in the HAUSGARTEN area in July 2012. (Credit: Alfred Wegener Institute)

How "big" is the issue? (from the land)

- NCEAS working group funded by the Ocean Conservancy
- The last time waste quantification into the ocean was completed was 1975
 - Before MARPOL
 - All ocean-based waste
- The first time land-based global input has been estimated
- Primarily focusing on plastic



Methods

Coastal countries
coastal buffer



*



*

Per capita waste
generation



*

Percent plastic in
the waste stream



*

Percent inadequately managed



(

+

Percent littered



)

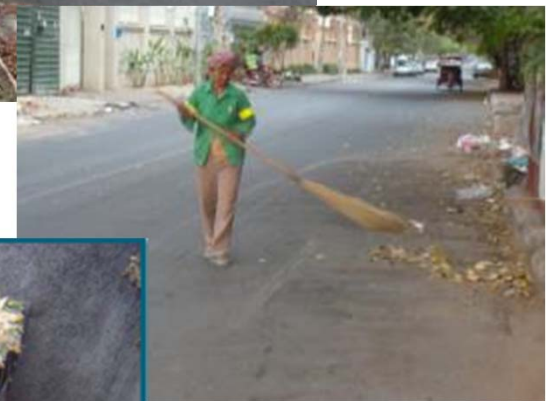
Percent that enters
the ocean



=

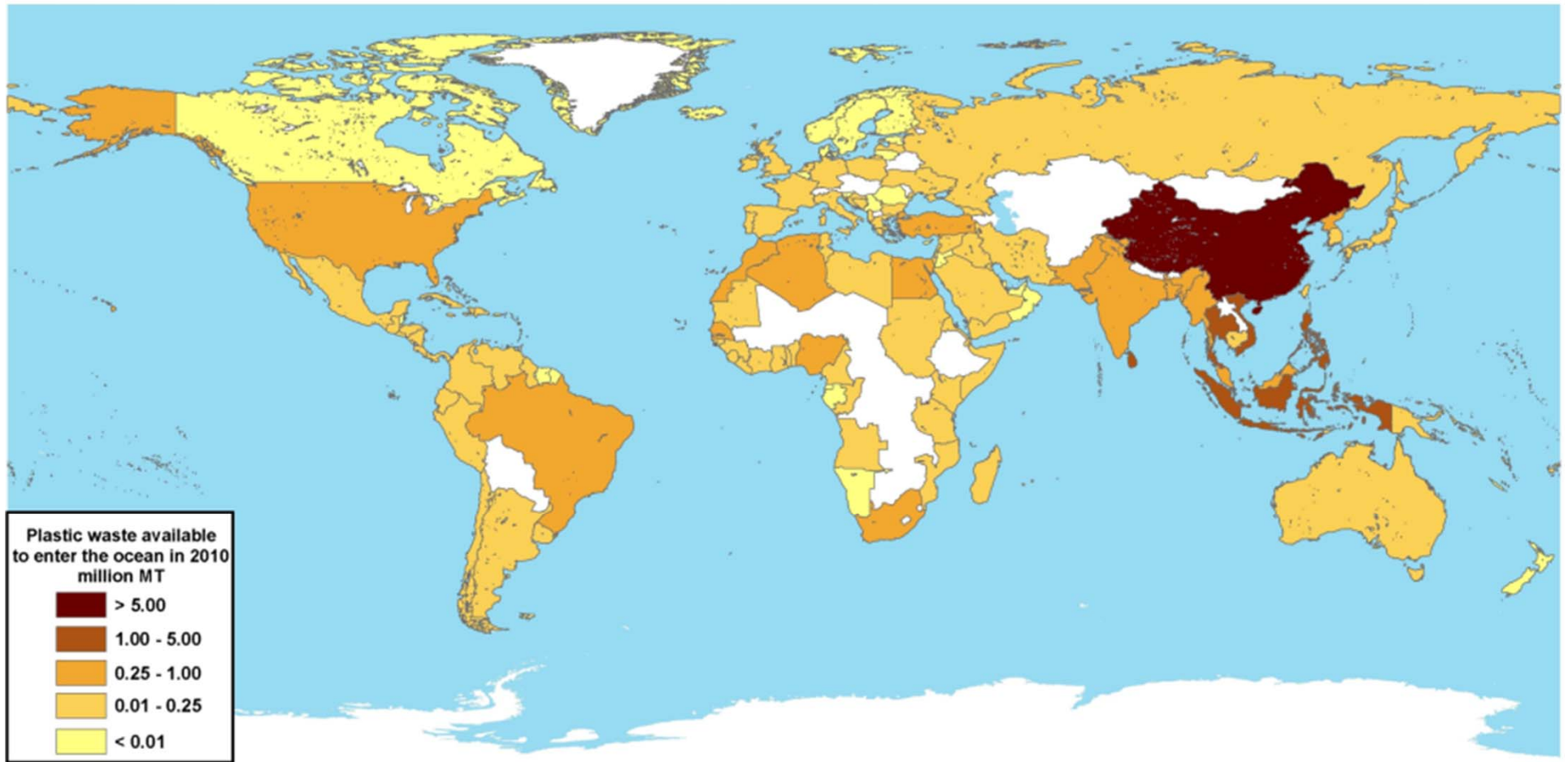
Percent that Enters the Ocean

- Not collected by street sweeping
- Not collected by stormwater catchments
- Not picked up in litter removal or cleanup
- = Available as input to the ocean
 - Blown
 - Washed in by storms
 - Washed in by tides





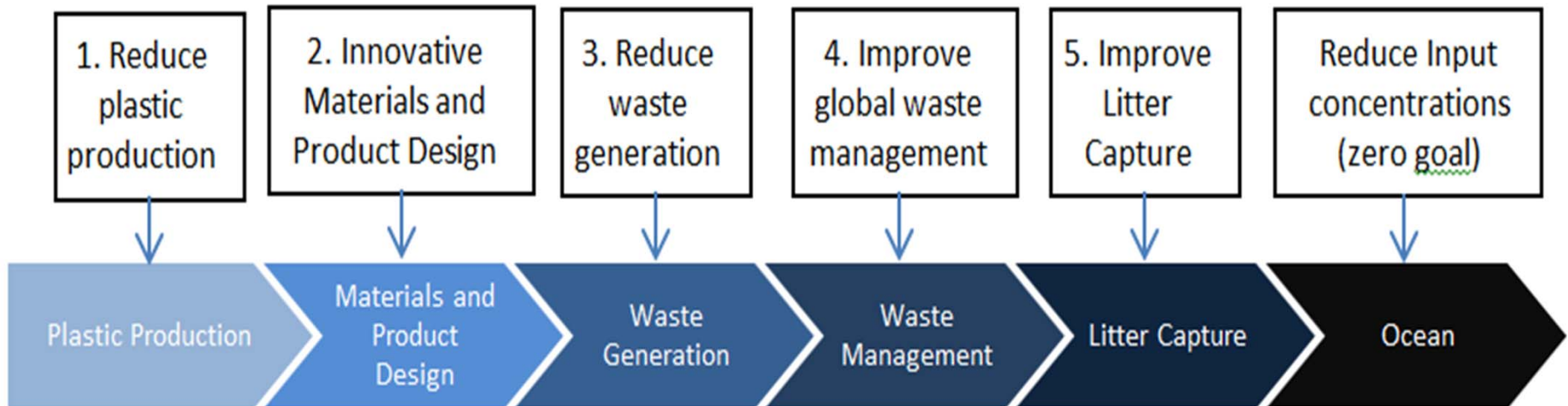
*Plastics Europe, "Plastics—the Facts 2013" (2010 data)
**Gözar et al., 2014; Eriksen et al., 2014



[Jambeck, J.R.](#), Andrady, A., Geyer, R., Narayan, R., Perryman, M., Siegler, T., Wilcox, C., [Lavender Law, K.](#) , (2015). [Plastic waste inputs from land into the ocean](#), *Science*, 347, p. 768-771.



Photos and © Jenna Jambeck



1. Industry-led or reduce demand
2. Green Engineering, Circular Economy
3. Reusable items, Sharing/Collaborative Economy
4. Context-sensitive Solid Waste management Infrastructure
5. Litter Capture and Clean-up

Jambeck, J.R., Committee on Environment and Public Works, Senate Testimony, May 17 2017.
<https://www.epw.senate.gov/public/cache/files/8074ded1-5986-4a9b-b033-2eb69e66993f/jambeck-testimony.pdf>

1. Consumer Choice - Reduce Demand

- Advocate for the change you want to see
- Use less disposable (e.g., plastic) items
 - Reusable water bottles
 - Reusable bags
 - Reusable straws (stainless steel or glass)
 - Reusable picnic materials
 - Choose products with less plastic packaging
 - Choose products without microbeads



1 & 3. Collaborative, Sharing Economies



Ride

Bike share is great for quick trips around town or leisurely rides through the park. Use it to commute to work or school, run errands and explore the city.

I do not need a drill.
I need a hole in the wall



<http://www.cruxcatalyst.com/wp-content/uploads/drill-hole.jpg>



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Dresses (3557)

SORT BY RECOMMENDED ▾



ABOUT » MEMBERSHIP » INVENTORY » 3D PRINTS & LASER CUTTING YOUTH » WORKSHOPS » MEDIA » DONATE »



EASY UPCYCLING PROJECTS FOR KIDS

TTL Kids! happily situates itself in The Maker Movement, which can be broadly defined as a collective of people around the world who are employing do-it-yourself or do-it-with-others techniques to develop unique products and devices. Tinkering, coding, building, creating and innovating - together. This movement rests on makers making their designs open-source and available for anyone to reproduce off Internet sites such as Instructables or Thingiverse. We believe that getting kids involved in areas that teach the skills and thought processes...

2. Consider End-of-Life at Design Stage



PET BOTTLE

NO!

CAP
Thermoset
PS
PVC
Metal

LINER MATERIAL AND ADDITIONAL SEALING
PVC
METAL

BOTTLE
Coated
Chemicals
Additives

LABEL
PVC
PET
Oriented PS
Solvent adhesive
HotMelt
Heavy metal inks



YES!

CAP
HDPE
PP

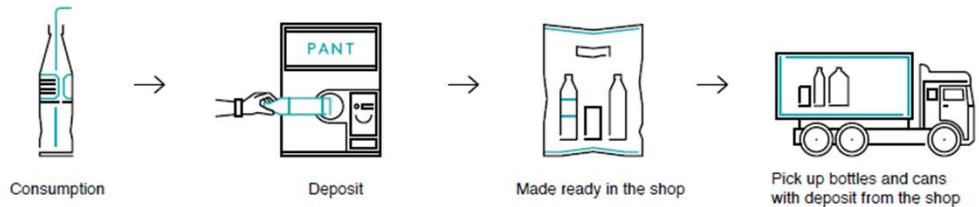
LINER MATERIAL AND ADDITIONAL SEALING
PE
EVA

BOTTLE
PET

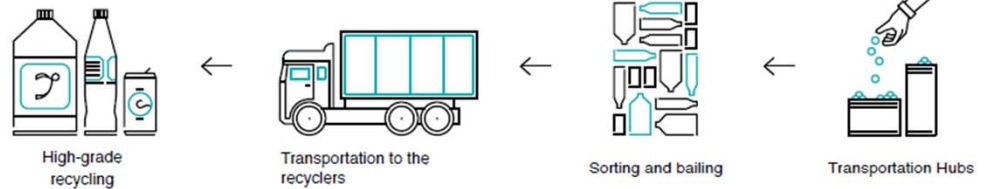
BARRIERLAYERS
Glaskin
Bestpet

LABEL
Paper
OPP
Density lower than 1 (should float)

GLUE
Water solvent
Recyclable HotMelt



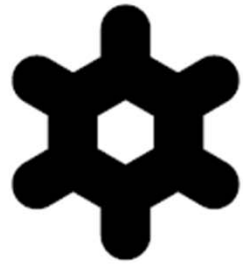
Shared Producer Responsibility



Extended Stakeholder Responsibility

2.

 THE UNIVERSITY OF GEORGIA
New Materials Institute



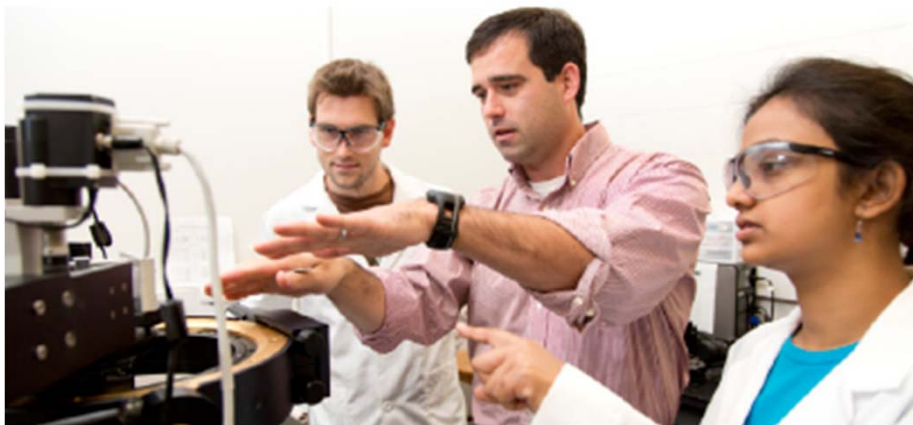
**Advanced
Fiber + Coating
Technologies**



**Circular
Materials
Management**



**Novel
Biodegradable
Polymers +
Additives**





2 & 3. Green Engineering Principles

1. Designers need to strive to ensure that all materials and energy inputs and outputs are as inherently nonhazardous as possible.
2. It is better to prevent waste than to treat or clean up waste after it is formed.
3. Meet Need, Minimize Excess
4. Minimize Material Diversity: promote disassembly and value retention.
5. Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.

Anastas, P.T., and Zimmerman, J.B., "Design through the Twelve Principles of Green Engineering", *Env. Sci. and Tech.*, 37, 5, 94A-101A, 2003

4. Improve Waste Management Infrastructure Globally

- Collect



- Capture



- Contain



4. NMI Industry Partner: Norton Point



Dell and others...

5. Last Chance Capture...

(but need infrastructure to manage & should capture data for upstream solutions)



<http://www.postlandfill.org/baltimore-water-wheel-floaty-trash-meets-match/>



saunie @saunieindiego · Feb 11

@Care4Ocean @DebrisTracker Thousands of miles away, same kinds of plastic litter.



👍 2 ❤️ 1



MUVE @muvemiami

12 |

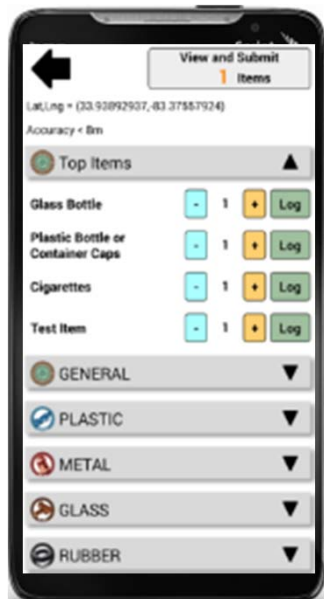
#Volunteers are collecting and logging #marinedebris today at #VirginiaKey with @DebrisTracker. #getmuving pic.twitter.com/evk2zLSyFX



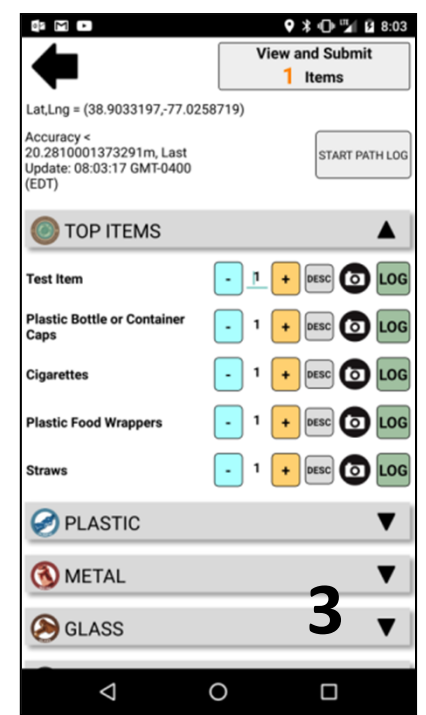
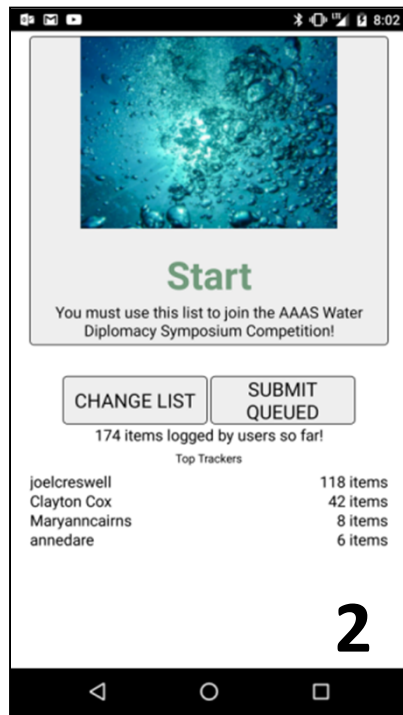
Marine Debris Tracker

Tool for Data Collection

- Less error without paper & pen
- GPS coordinate for every debris item
- Near real time data gathering/upload
- Easy download (Excel) and mapping
- Used by researchers, citizens or citizen scientists



Website: <http://www.marinedebris.engr.uga.edu/>



View and Get Data

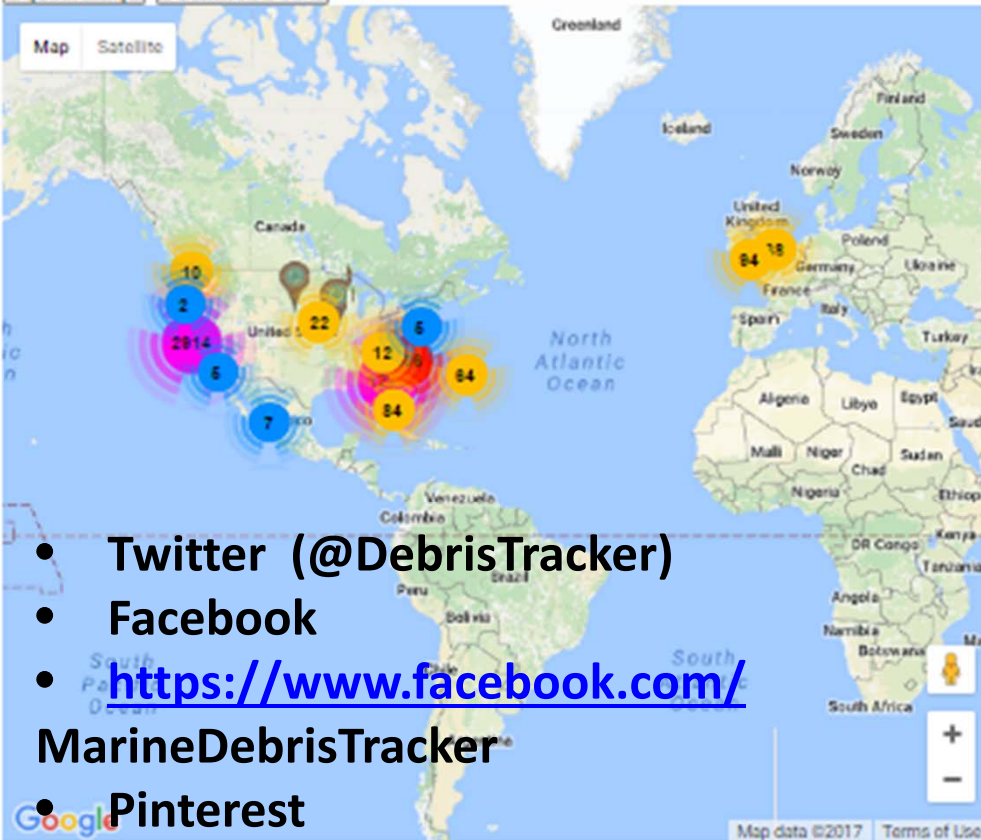
Marine Debris Items

Ocean Conservancy IOC List
 Internacional Coastal Cleanup Lista en espanol
 AAAS Water Diplomacy Symposium List







From: To:

Enter your Marine Debris Tracker login information if you want to download only your data

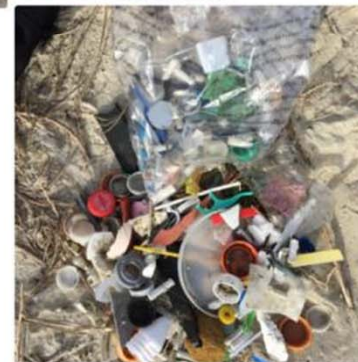
User: Password:



- Twitter (@DebrisTracker)
- Facebook
- <https://www.facebook.com/MarineDebrisTracker>
- Pinterest

User	Description	Items Logged	Entries	Badge
 GSTC Citizen Science	The Georgia Sea Turtle Center is a marine turtle rehabilitation, research, and education facility on Jekyll Island. The Center's Marine Debris Citizen Science participants keep Jekyll Island's beaches free of marine debris.	229136	35736	
 OldMarketPhoto	Old Market Photo has a passion for photographic light and to take 18,000 steps a day. The path behind him is cleaner than what faces him because he picks up litter and documents it all with MDT! Find him on Twitter @oldmarketphoto.	85087	10591	
 muvemiami	Museum Volunteers for the Environment (MUVE) is Patricia and Phillip Frost Museum of Science volunteer based restoration project. Conserving coastal habitats in South Florida.	39460	6903	

 IslandLife @Care4Ocean · Feb 15
 @DebrisTracker This won't end up in our ocean!

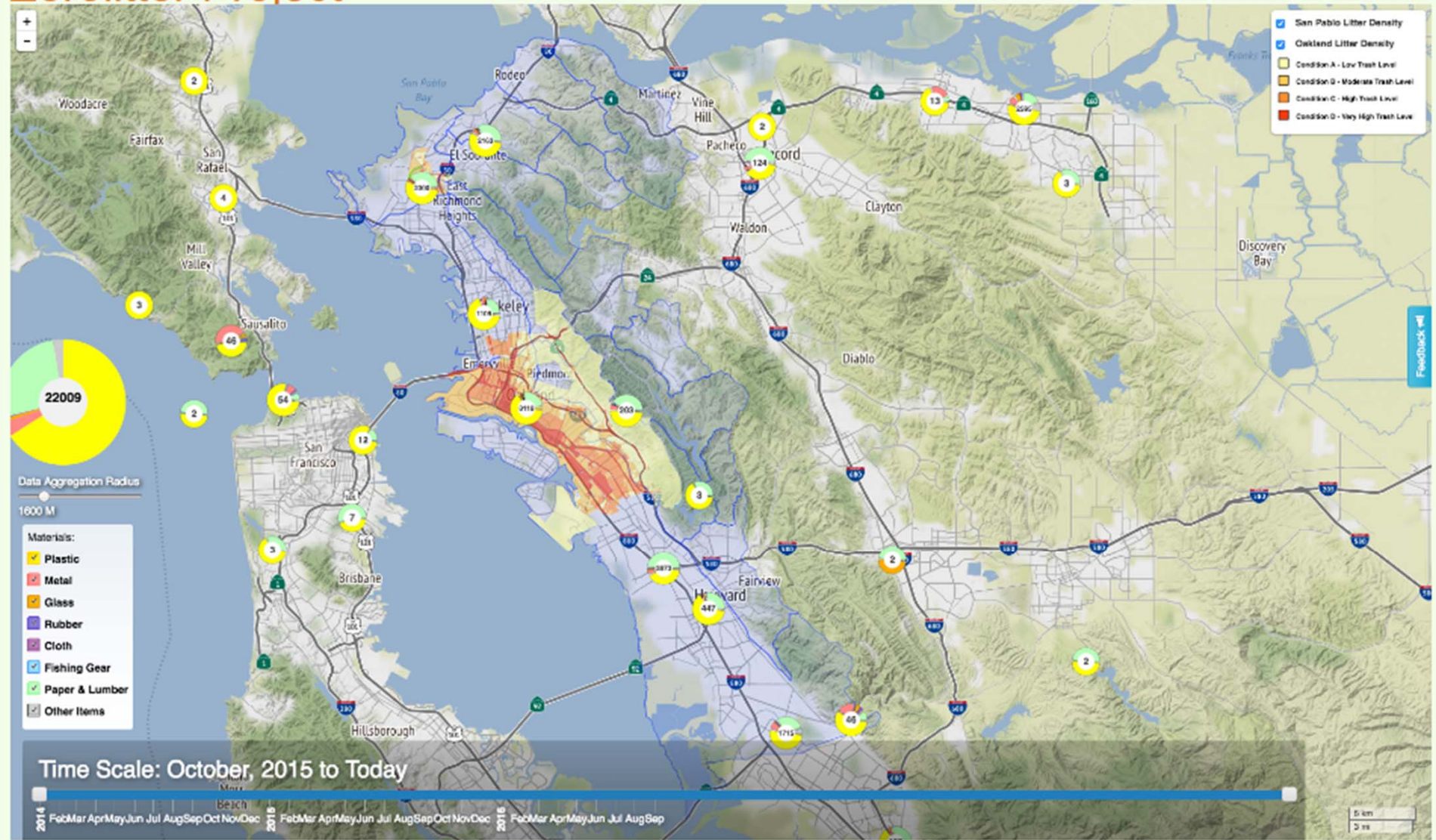


 saunie @sauniediego · Feb 16
 Here's my Valentine's Day litter pick up from the sand dunes at #Glamis!  #DebrisTracker #plasticrecyclables



EarthTeam students, San Francisco Bay

Zerolitter Project



<http://www.earthteam.net/zerolitter-project>

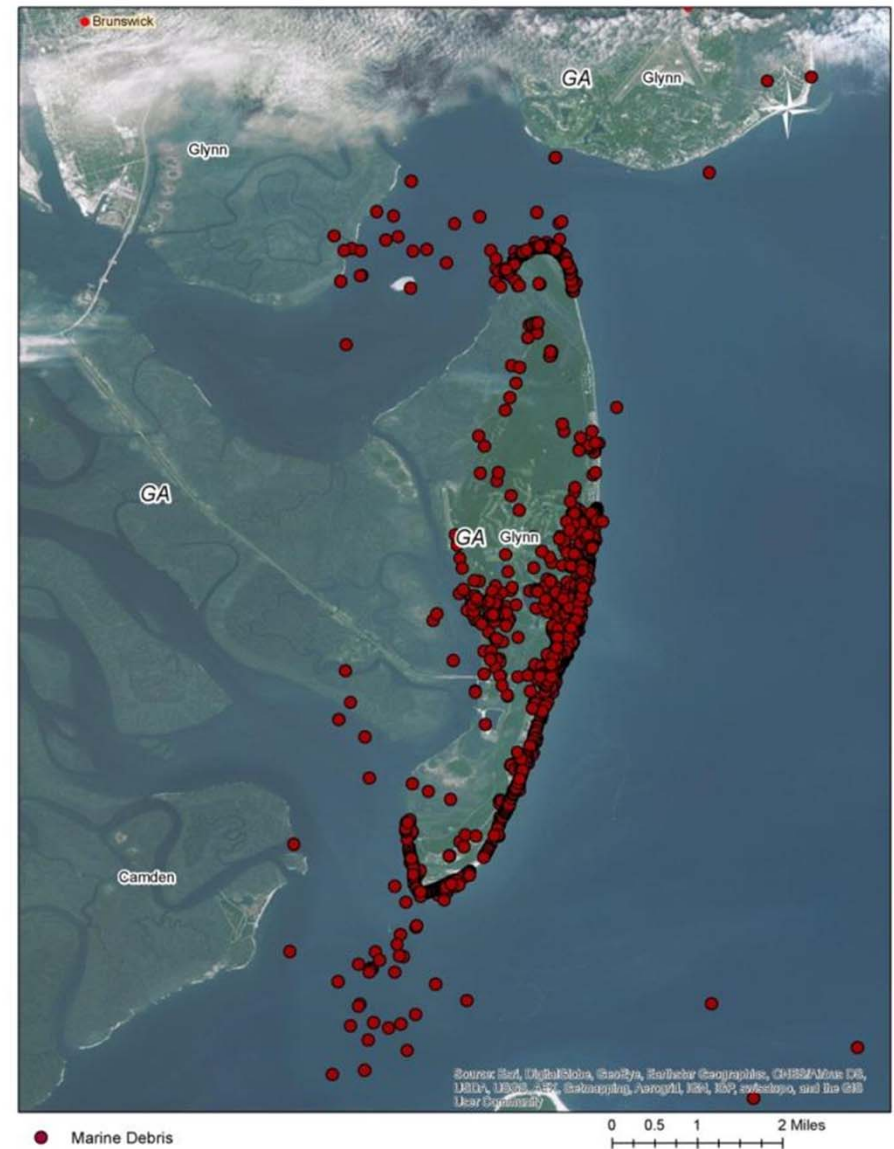
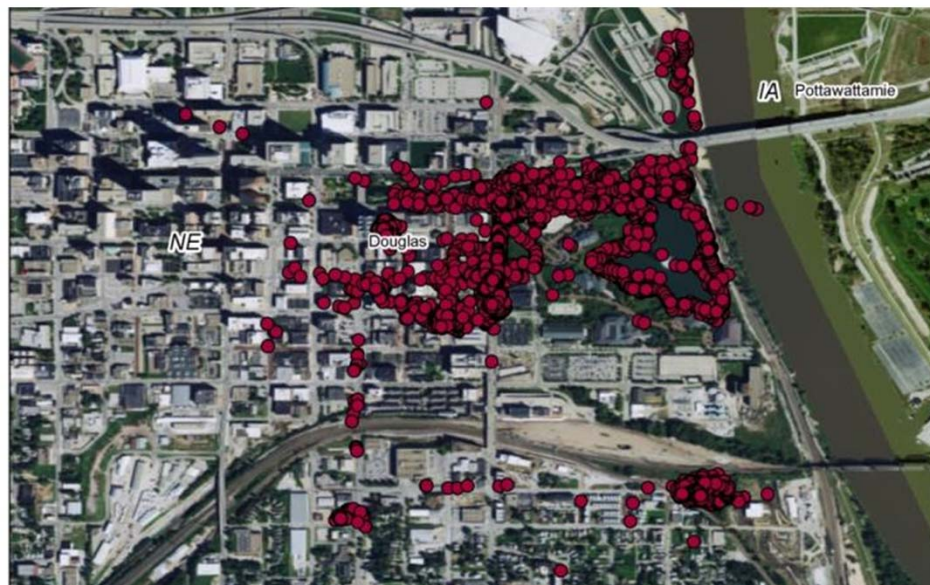
CITIZEN SCIENCE



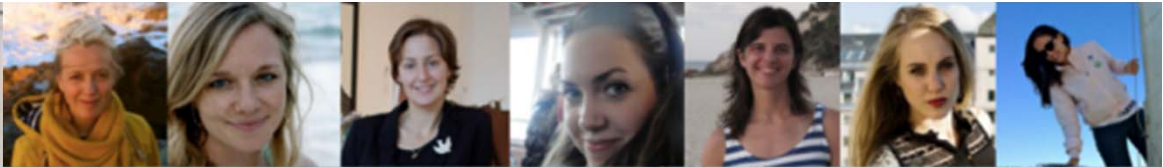
Citizen-Based Litter and Marine Debris Data Collection and Mapping

Jenna R. Jambeck and Kyle Johnsen | University of Georgia, Athens

The monitoring of litter and debris is challenging at the global scale because of disconnected local organizations and the use of paper and pen for documentation. The Marine Debris Tracker mobile app and citizen science program allows for the collection of global standardized data at a scale, speed, and efficiency that wasn't previously possible.



Jekyll Island, Georgia
Marine Debris Tracker Data

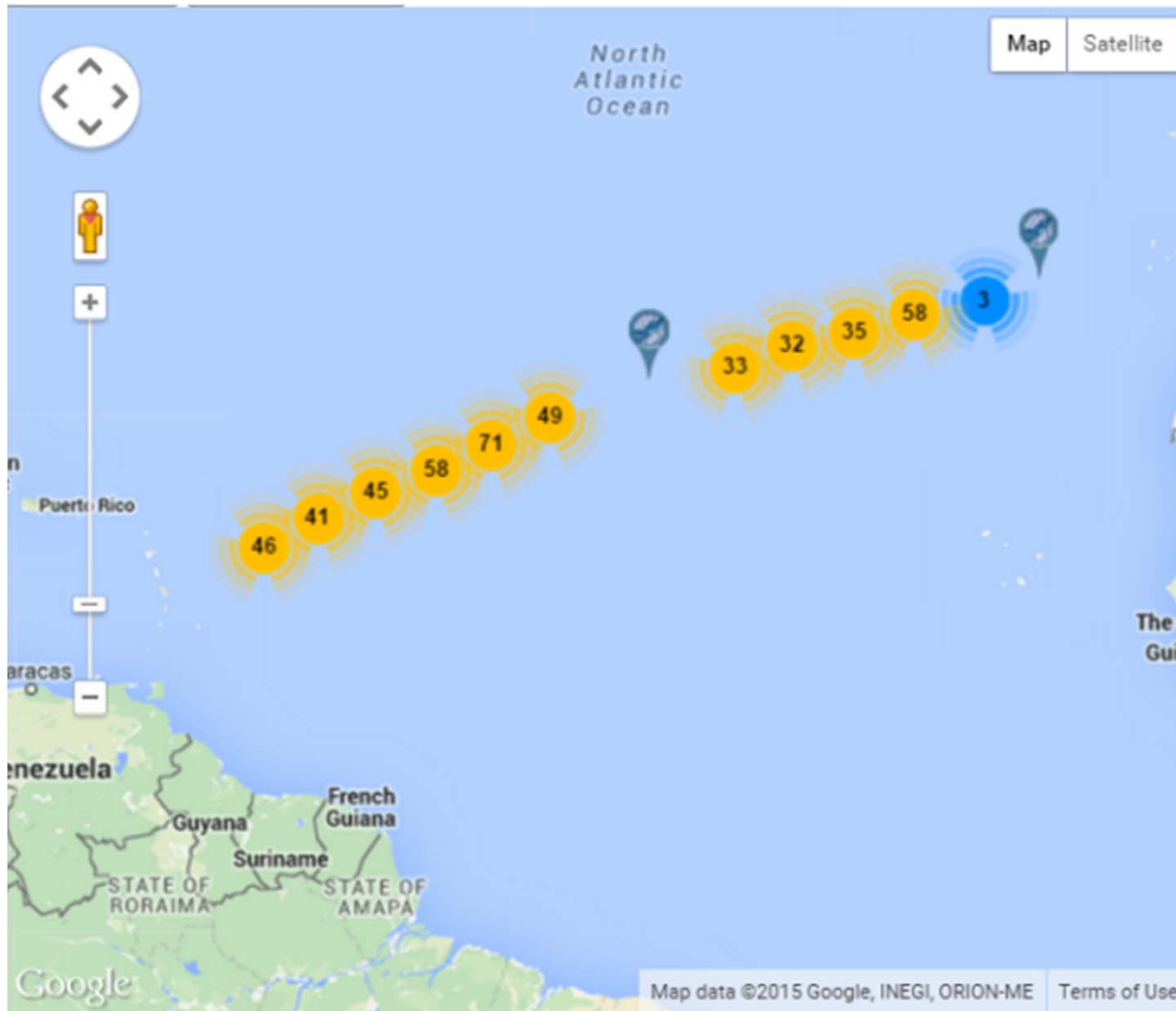


Marine Debris Tracker

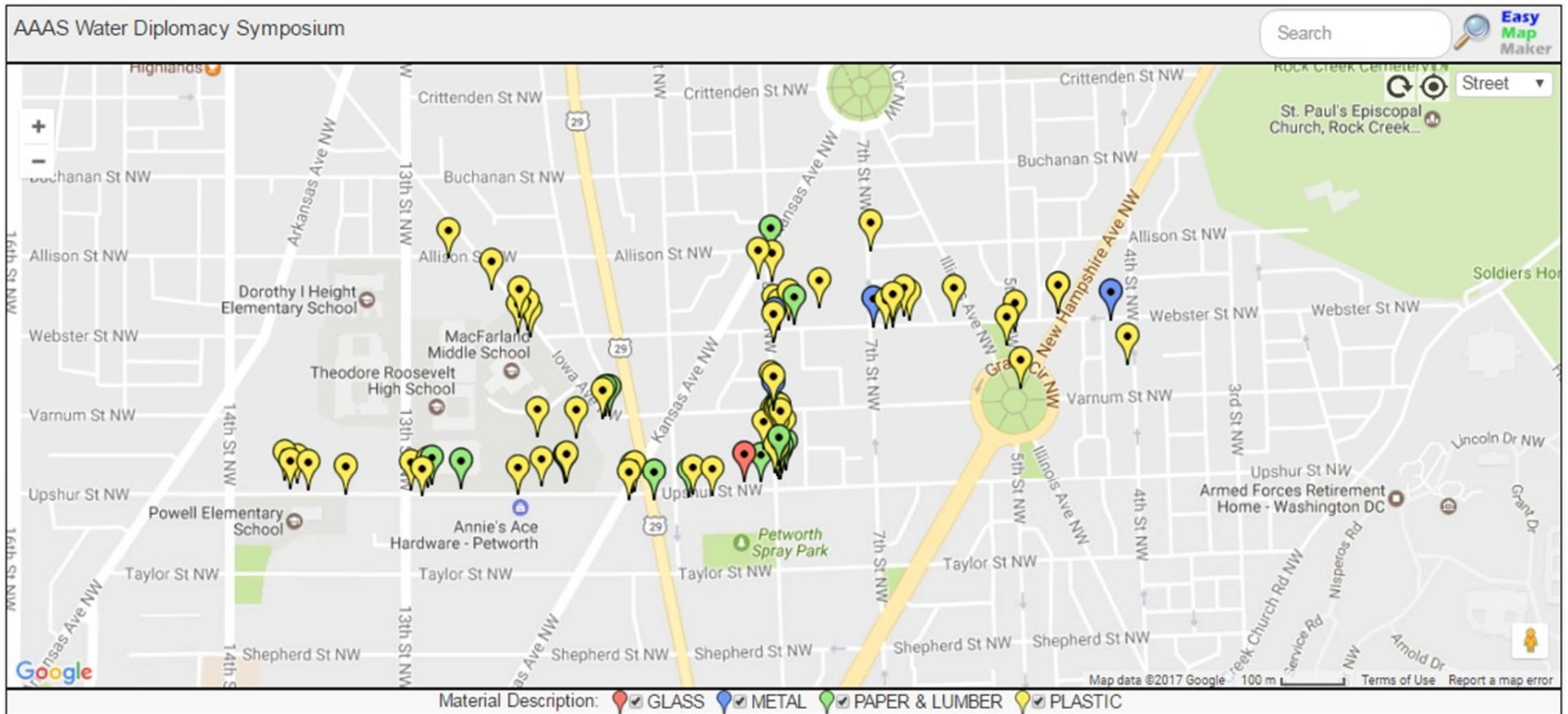
Off-Line Tracking, Open Ocean Microplastic Sampling



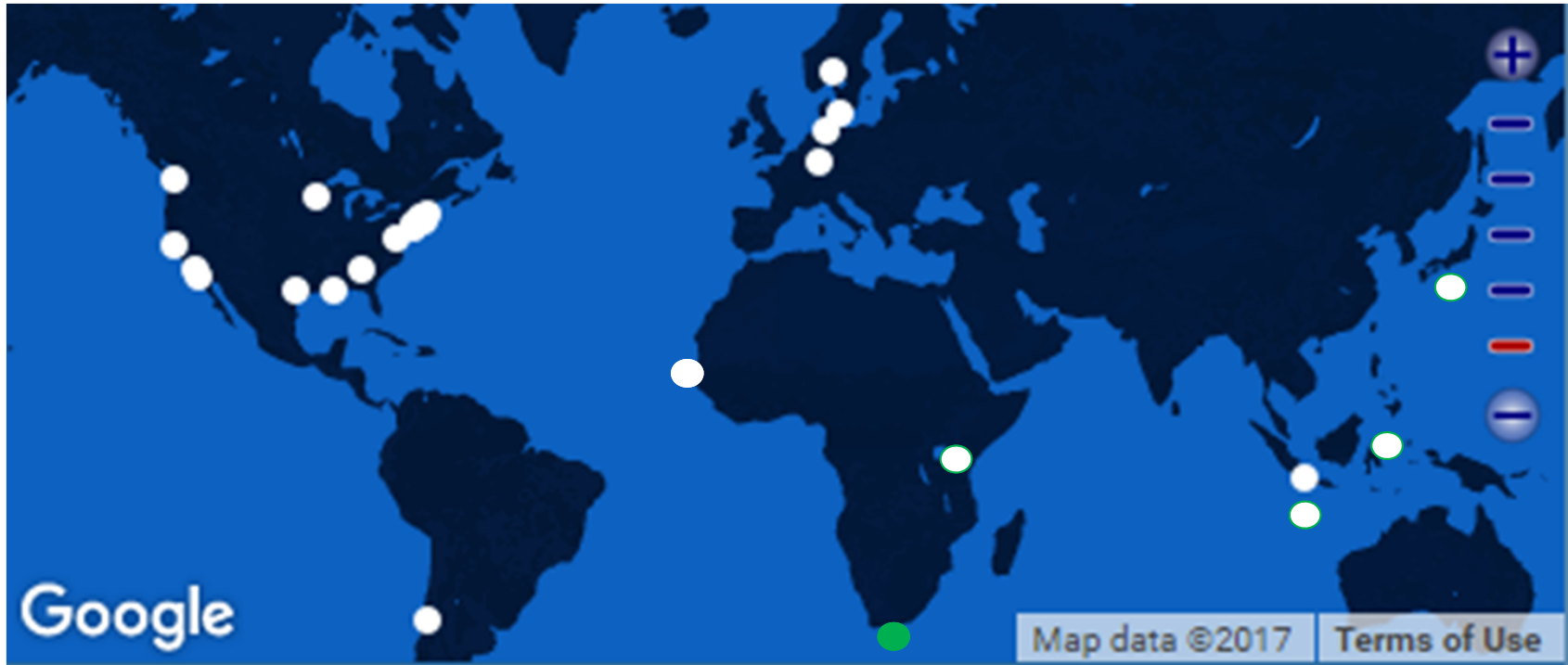
11TH HOUR RACING



Data Informing Solutions Example

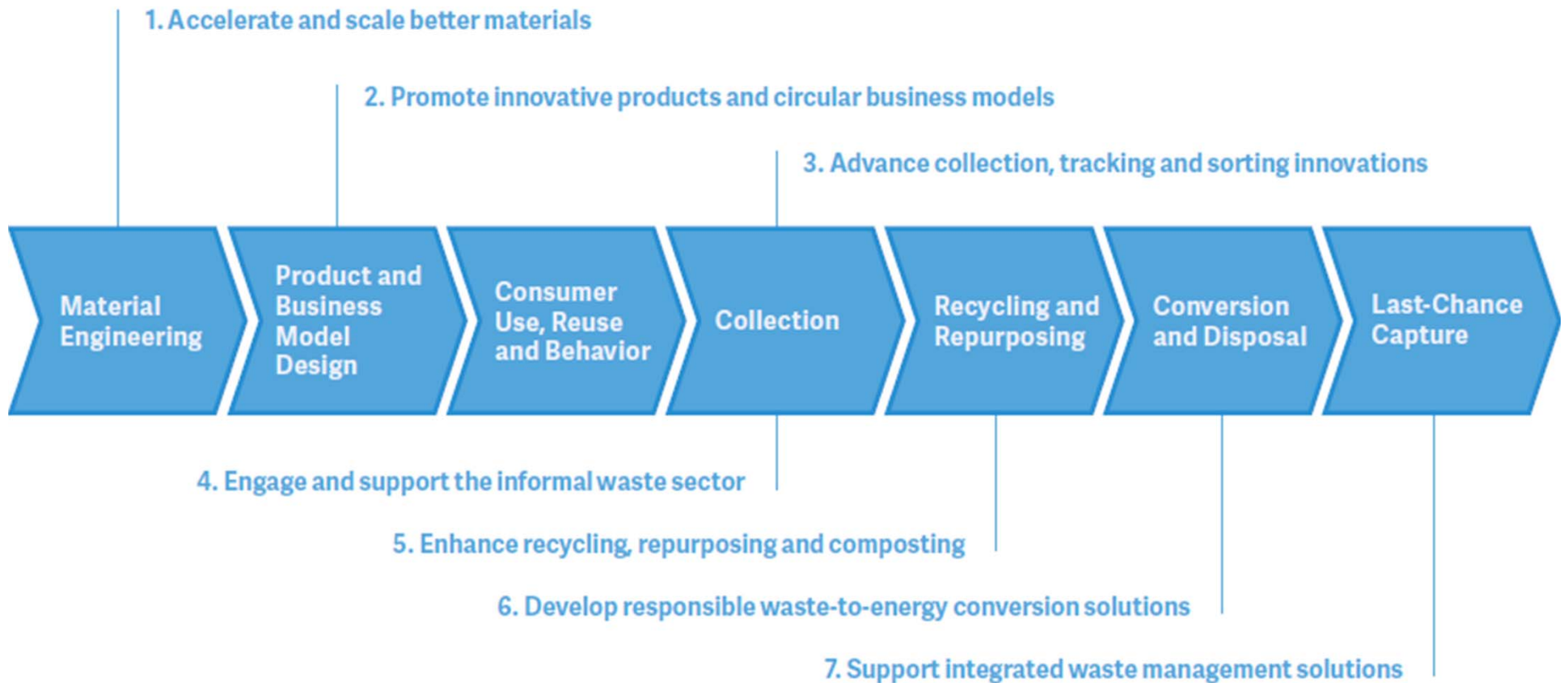


Global Outreach, Diplomacy, Policy Initiatives



US State Dept. Chile, Philippines, Indonesia, Japan *Future:* S. Africa
World Bank, G7, G20, APEC (+OC)
UNEP - Clean Seas, Global Convention (?)
Other Countries: Denmark, Norway, UK, Canada, *Netherlands*
USA: Save our Seas Act: Local and Global Goals
ISU – Ellen MacArthur Foundation Design Competition (Judge)

Global Investment Strategies



Moss, E., Eidson, A., and Jambeck J., 2017. Sea of Opportunity: Supply Chain Investment Opportunities to Address Marine Plastic Pollution, Encourage Capital on behalf of Vulcan, Inc., New York, New York.



MARINE LITTER NETWORK

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[POLICY AND ACTION](#) ⌵

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Welcome to the new Marine Litter Network

Hosted by the Global Partnership on Marine Litter, this is the place for the most up-to-date information on marine litter worldwide. Come here for recent news, [global projects](#) and state-of-the art [science](#).

What's Happening? Marine Litter in the News.

- [Plastic debris inundates remote UK coasts endangering wildlife](#)

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What's Happening? Marine Litter in the News.

- [5 Things You Probably Didn't Know About Singapore's Waters](#)

Source: Marine Debris | Published on 2017-06-15

- [Cleaning Cayman's beaches](#)

Source: Marine Debris | Published on 2017-06-14

- [Community action targets **marine debris**](#)

Source: Marine Debris | Published on 2017-06-14

- [Long Beach Island Grade School's 'Waves of **Debris**' Installation Merges Art and Environmentalism](#)

Source: Marine Debris | Published on 2017-06-14

- [Are bans on plastic the solution to **marine litter**?](#)

Source: Marine Litter | Published on 2017-06-13

- [Pacific voyage reveals depth of plastic pollution crisis](#)

Source: Marine Debris | Published on 2017-06-13

- [Pacific voyage reveals depth of plastic pollution crisis](#)

Join the #marinelitter
#marinedebris
conversation.

Tweets



MUSTARD SEED

@MAZHAR_ALI

#Ocean plastics fm #Haiti's beaches recycled for laptop #packing
[newscientist.com/article/213433...](#) via @anita_makri #marinelitter #BreakFreeFmPlastic



Ocean plastics from Haiti's...
Laptop packaging is an unlik...
[newscientist.com](#)



3h



Aquarius Systems

@AquariusSystems

Fisheries & Marine Institute challenging residents to help tackle threat facing ocean: litter



New Materials Institute
UNIVERSITY OF GEORGIA

<http://marinedebris.engr.uga.edu>



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<https://www.facebook.com/jenna.jambeck>