



Ocean Cleanup

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Cleanswell App : Beach Cleanup Data

The screenshot displays the Cleanswell App interface. At the top, there are three tabs: HOME, MY HISTORY, and PROFILE. Below the tabs is a blue header with the text 'Before you begin...'. Underneath, it says 'Tell us about your cleanup.' and lists several fields: Date (02/29/2020), Number of People (1), Group (Test), and Type of Cleanup (Land (beach, shoreline...)). A large blue button at the bottom says 'Start my Collection!'. To the right of the form is a grid of 16 trash categories, each with an icon and a count. The categories are: Cigarette Butts (0), Balloons (0), Toys (0), Fishing Gear (0), Plastic Bags (0), Food Wrappers (0), Containers (Plastic) (0), Containers (Foam) (0), Beverage Cans (1), Bottle Caps (Plastic) (0), Bottles (Plastic) (0), Bottles (Glass) (0), Cups, Plates (0), Lids (0), Straws (0), Utensils (1), Plastic/Foam Pieces (0), Personal Hygiene (0), Other Packaging (0), and Other Trash (1).

Category	Count
Cigarette Butts	0
Balloons	0
Toys	0
Fishing Gear	0
Plastic Bags	0
Food Wrappers	0
Containers (Plastic)	0
Containers (Foam)	0
Beverage Cans	1
Bottle Caps (Plastic)	0
Bottles (Plastic)	0
Bottles (Glass)	0
Cups, Plates	0
Lids	0
Straws	0
Utensils	1
Plastic/Foam Pieces	0
Personal Hygiene	0
Other Packaging	0
Other Trash	1

Target Customers

- Non-Profit Ocean Cleanup Organisations
- School children
- People that live near the beach
- Businesses located near the beach
- The tourism industry business in various states

1

Exploratory Data Analysis

- State-wise analysis
- Type of trash collected
- The effect of individuals and groups on beach cleanup

3

Prediction

- Prediction of human resources for ocean cleanup in the US in the future.

2

Recommendations

- Organization
- CleanSwell apps
- Technology like floating garbage collectors and plastic detecting drones



1. State-Wise Analysis

1

Which states perform a **highest** number of cleanups and which perform the **lowest**?

2

Which are the states that produce the maximum and minimum trash (in pounds)?

3

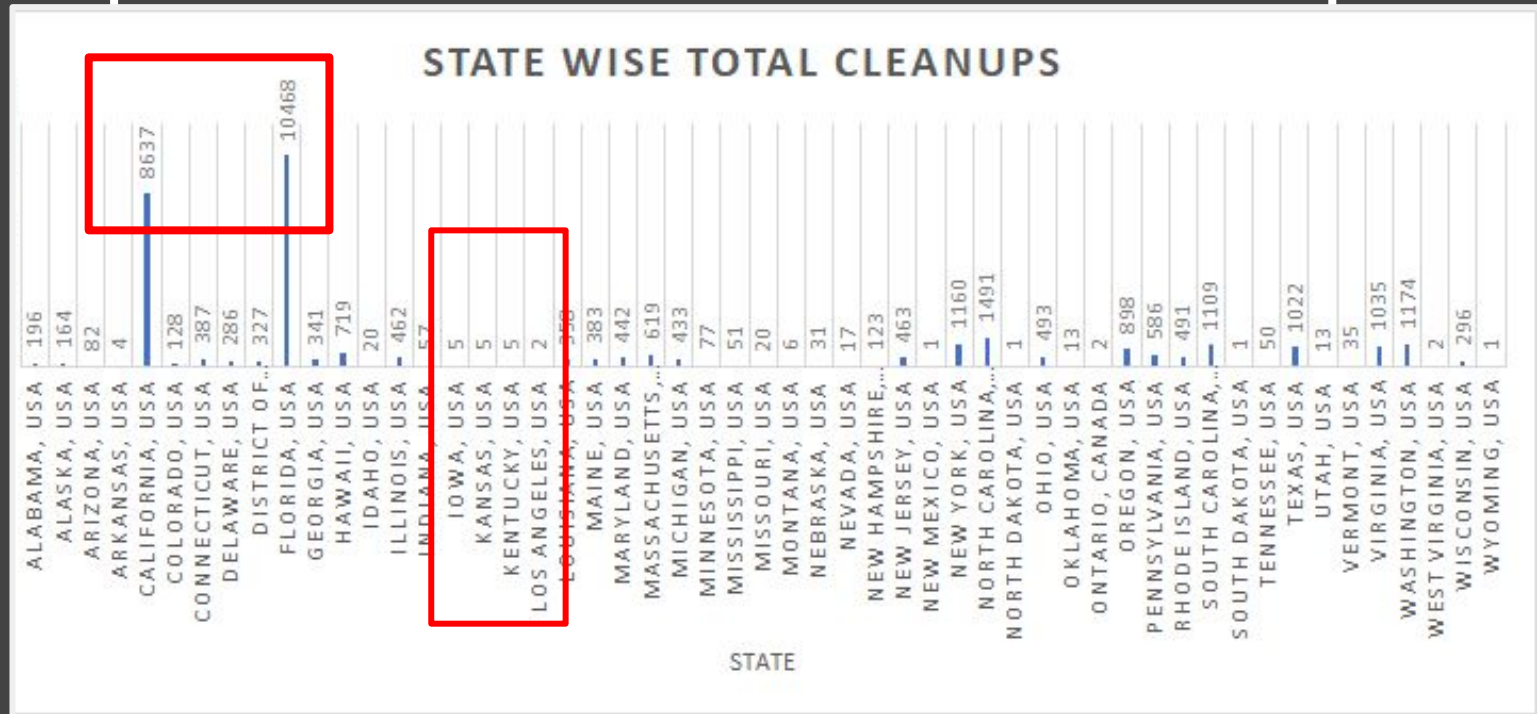
Which states might have problems of human resources allocation for ocean cleanup?

Which states are actively cleaning?

California and Florida:

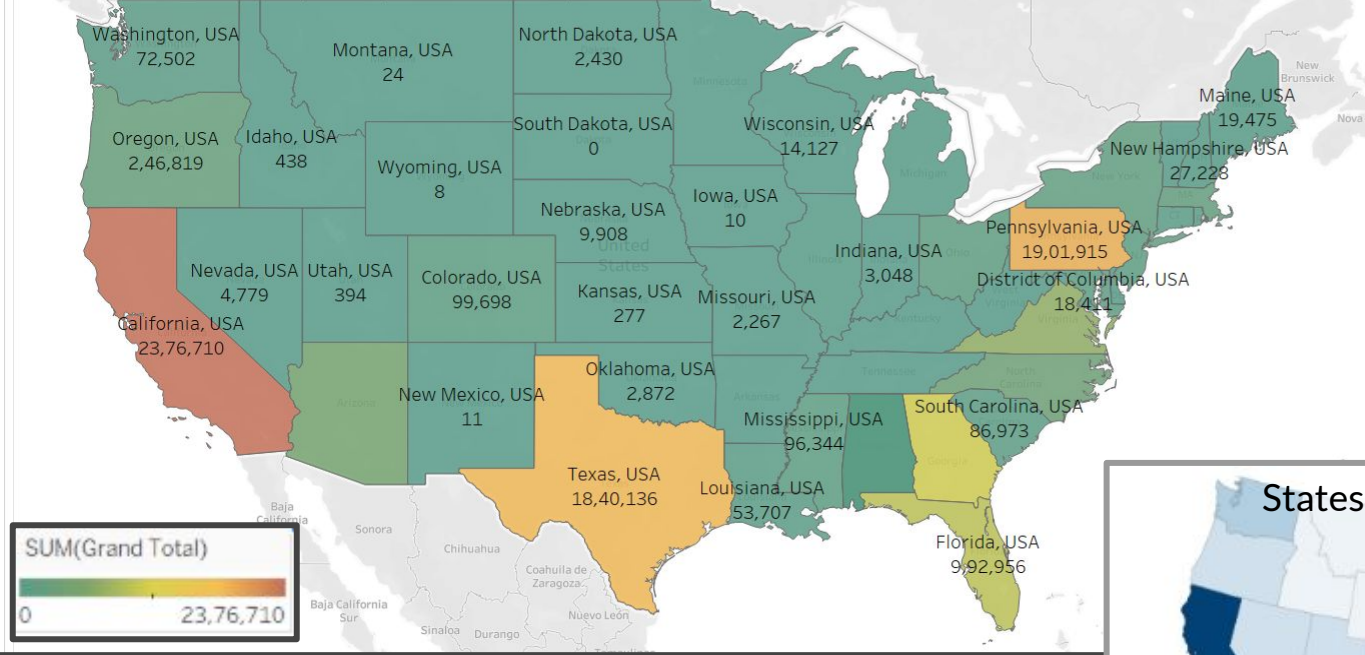
- Have more than 8000 cleanup records
- 3000 more cleanup records than all the other states combined

Pounds	Frequency
0-1000	44
1000-5000	6
>5000	2



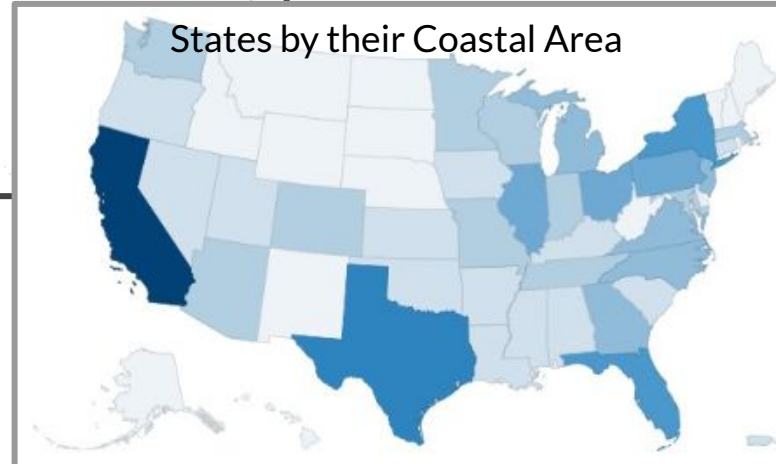
Which states collect what amount of trash(in pounds)?

Total Pounds Collected in Each State(2015-2019)



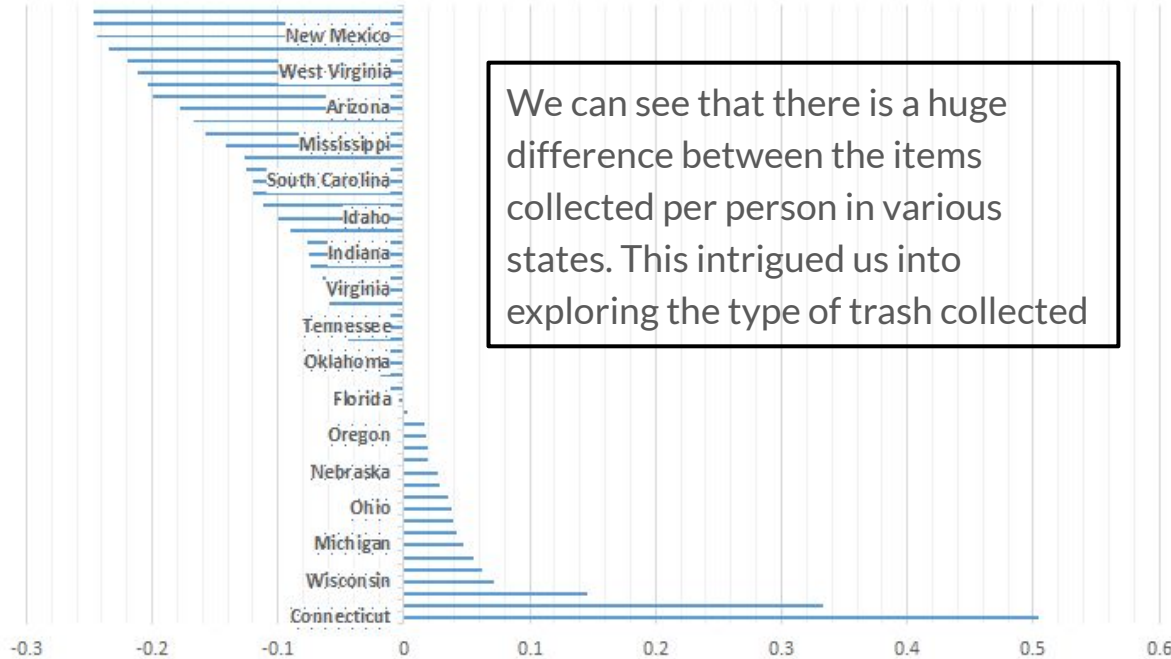
- High population density areas such as: DC, New York, have very low number of pounds collected, but these states do have a good no. of lake and river bodies population density

States by their Coastal Area



With **253,343,400 pounds of trash** on the US beaches alone, all the states combined, have been able to collect only **4.77%** of all this trash, according to the dataset.

Average Items Collected Per Person



We can see that there is a huge difference between the items collected per person in various states. This intrigued us into exploring the type of trash collected

Are we collecting the same items per beach cleanup or are you slower?

Florida has collected a lot of beach trash through a lot of beach cleanup events actually see each person collecting very few trash items

$$\text{Items Collected Per Person} = \frac{\text{Total Items collected}}{\text{No. of people}}$$



2. Trash-Type Analysis

1

Which types of trash are collected in each state?

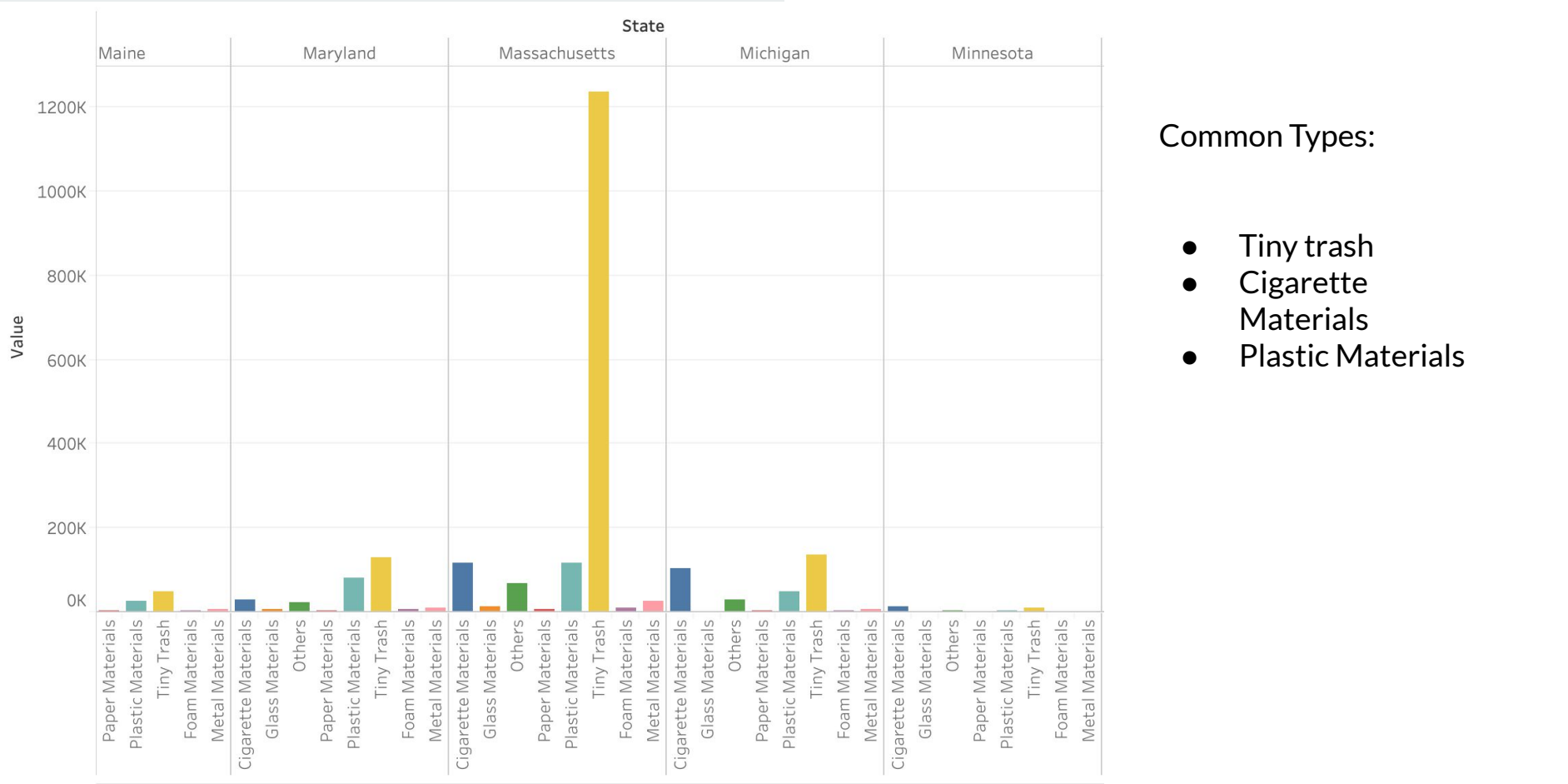
2

How has trash collection changed over time by trash types?

3

Does collecting Tiny trash require more human resource compared to Larger trash?

Number of Trash Items In each State For Each Type



Types of Trash over time

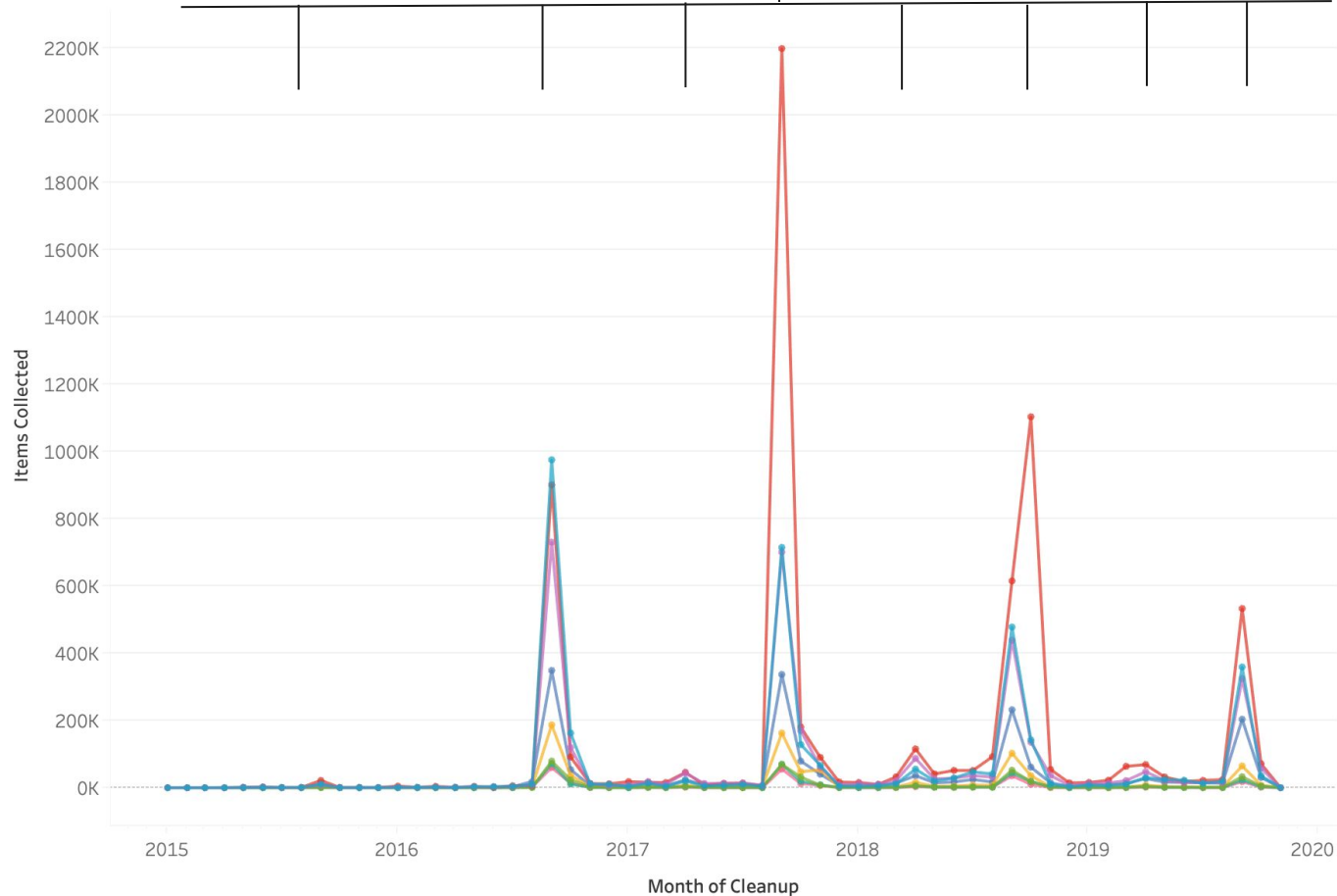
Massive Cleanup Event Dates:
ICC Day
Earth Day
National Cleanup Day
World Cleanup Day

Trash Types



- Cigarette Materials
- Foam Materials
- Glass Materials
- Metal Materials
- Others
- Paper Materials
- Plastic Materials
- Tiny Trash

Massive Cleanup Event Dates



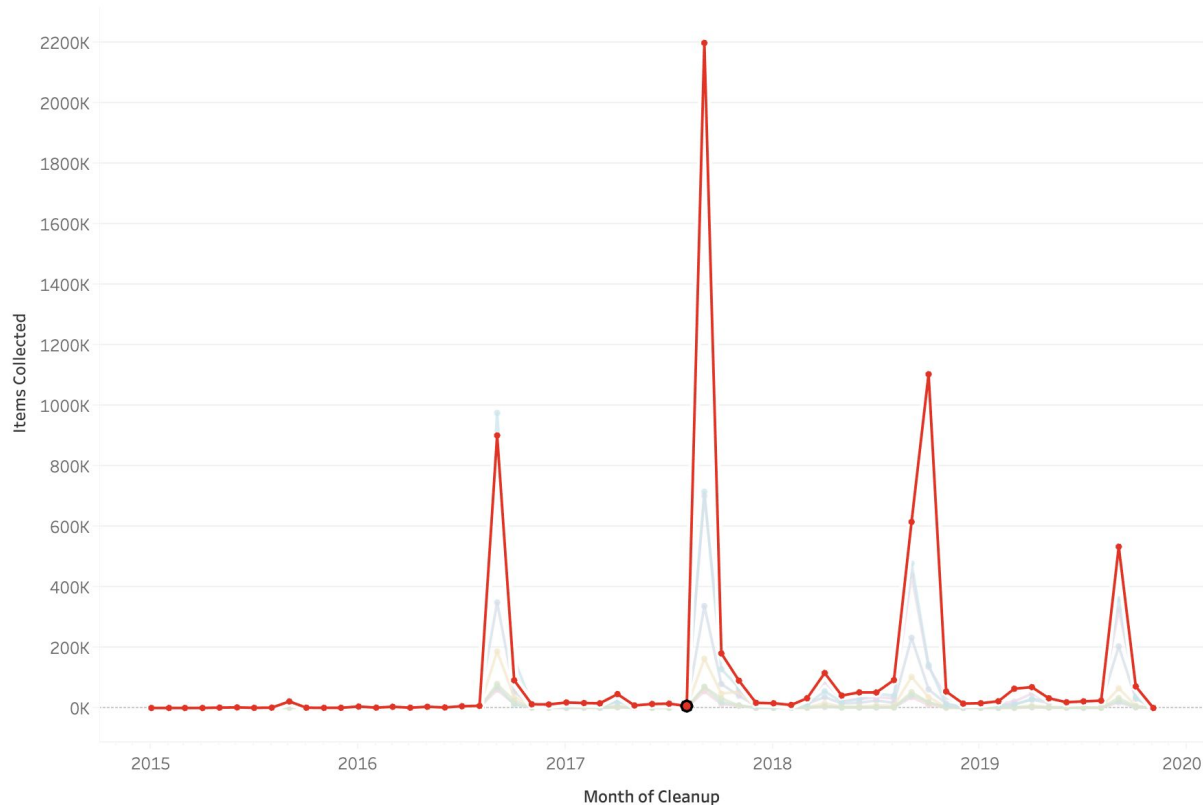
Tiny Trash Items collected over time



Tiny Trash

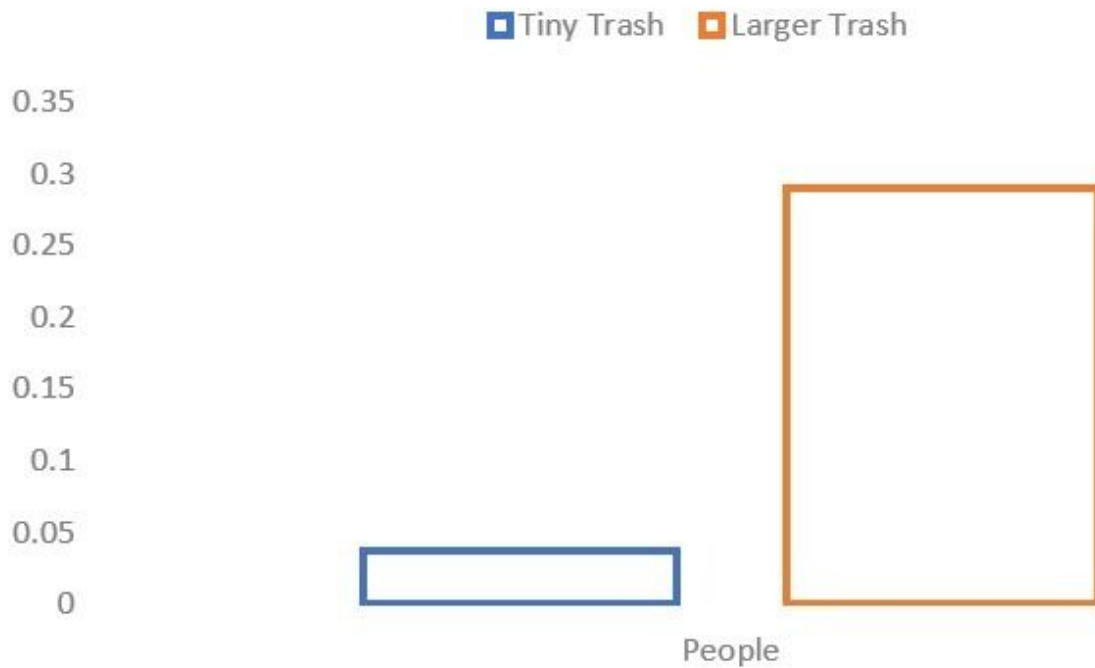
= Less Than 2.5 cm pieces:

- Foam Pieces
- Glass Pieces
- Plastic Pieces (the most out of the three)



Correlation

In general, less people collect Tiny Trash.

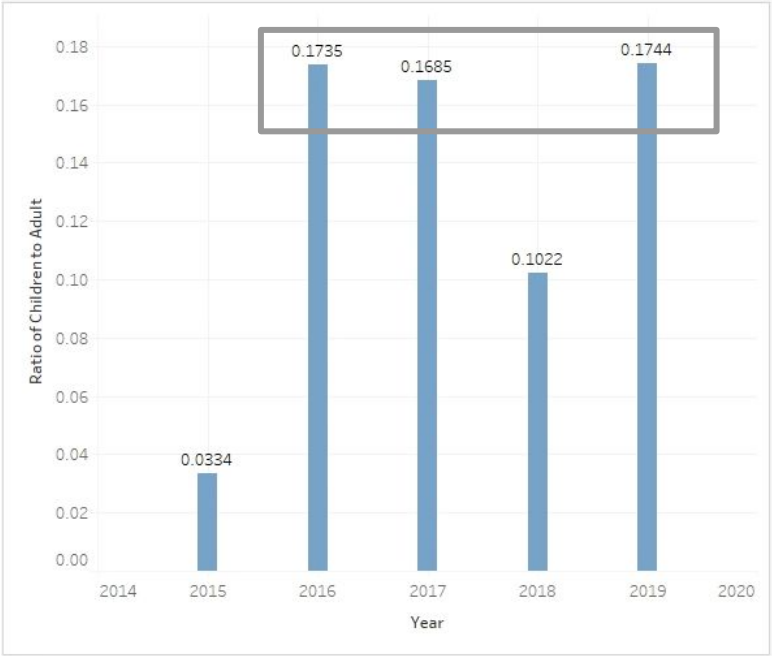




3. Organization Analysis

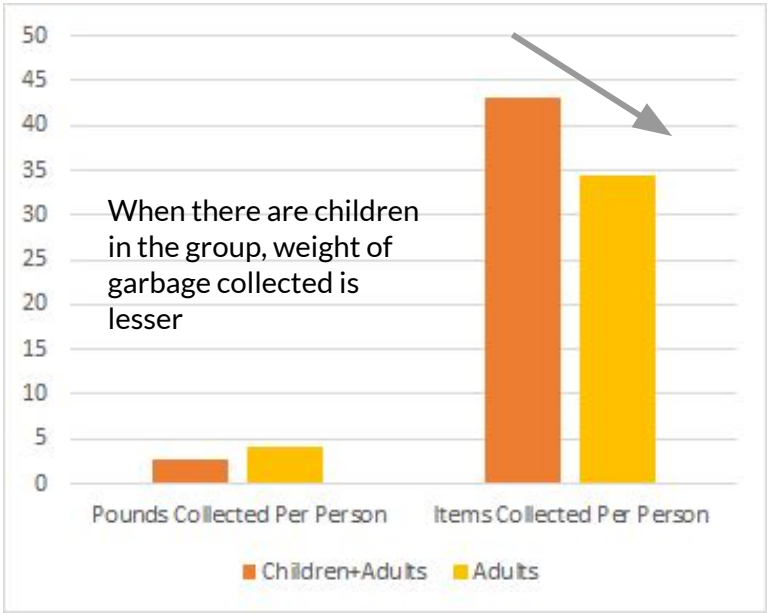
- 1 Are children the main power to cleanup?
- 2 Does children engagement increase the cleanup efficiency of group?
- 3 Do individuals, on average, work more efficiently than groups?
- 4 What's the relationship between group size and beach trash collection performance?

Children Effect: What's the children effect on cleanup?



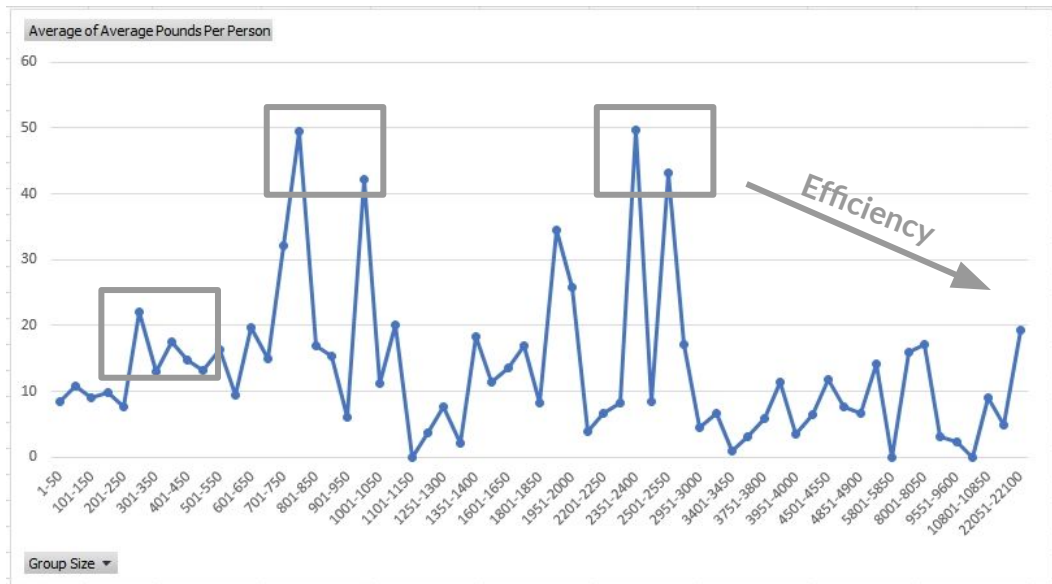
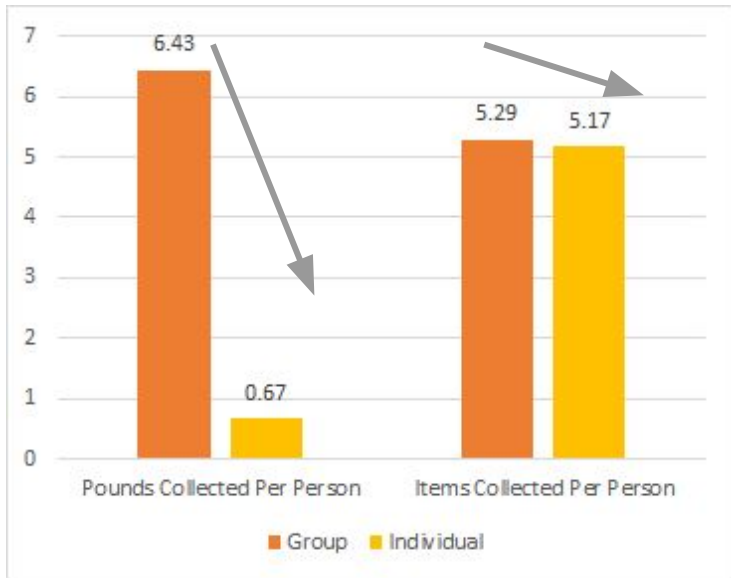
Do children have a positive influence on teams' behaviors?

Adults, but not children, are the majority contributors of ocean cleanup.



If there are children in a group,
Group members prefer to collect light-weight
trashes rather than heavy items and they have
motivation to spare more effort on beach cleanup.

Group Effect: Does group affect the efficiency of cleanup?



- Efficiency: Group > Individual
- Heavier garbage removal undertaker: Group

Does group size matter?

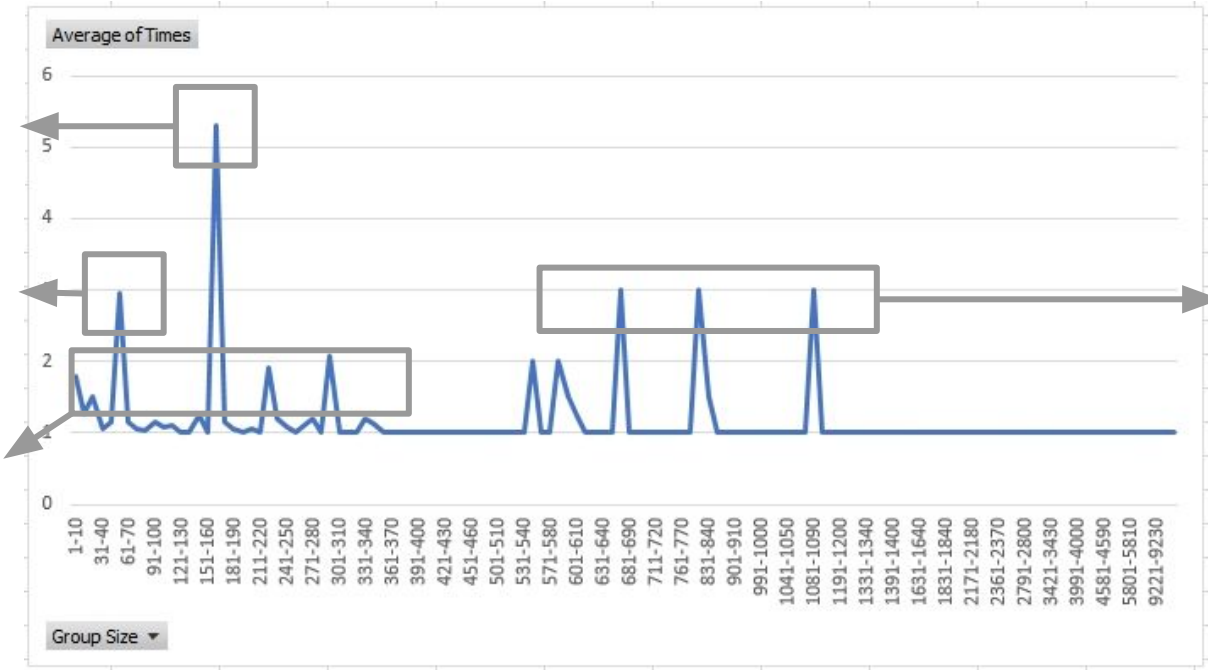
- The size of groups impacts cleanup efficiency
- Three peaks: 250, 800 and 2400
- Cleanup efficiency & extra benefit of one more members: size to be controlled under 800.

Group Effect: How often do different size groups do cleanup?

Most frequent
cleanup
organizations :
Keep Pandolph
County Beautul

cleanup
organizations
contributing
most: SOLVE

Irregular
Behaviour of
smaller groups



Not representative
data: each range
contains insufficient
number of groups

Prediction

Ocean cleanup organizers want to predict:

With **an estimated amount of trash** (number of items, number of pounds),
on **weekend**, in **August**, within **five miles**.

=> how many people needed to do the cleanup?

Prediction



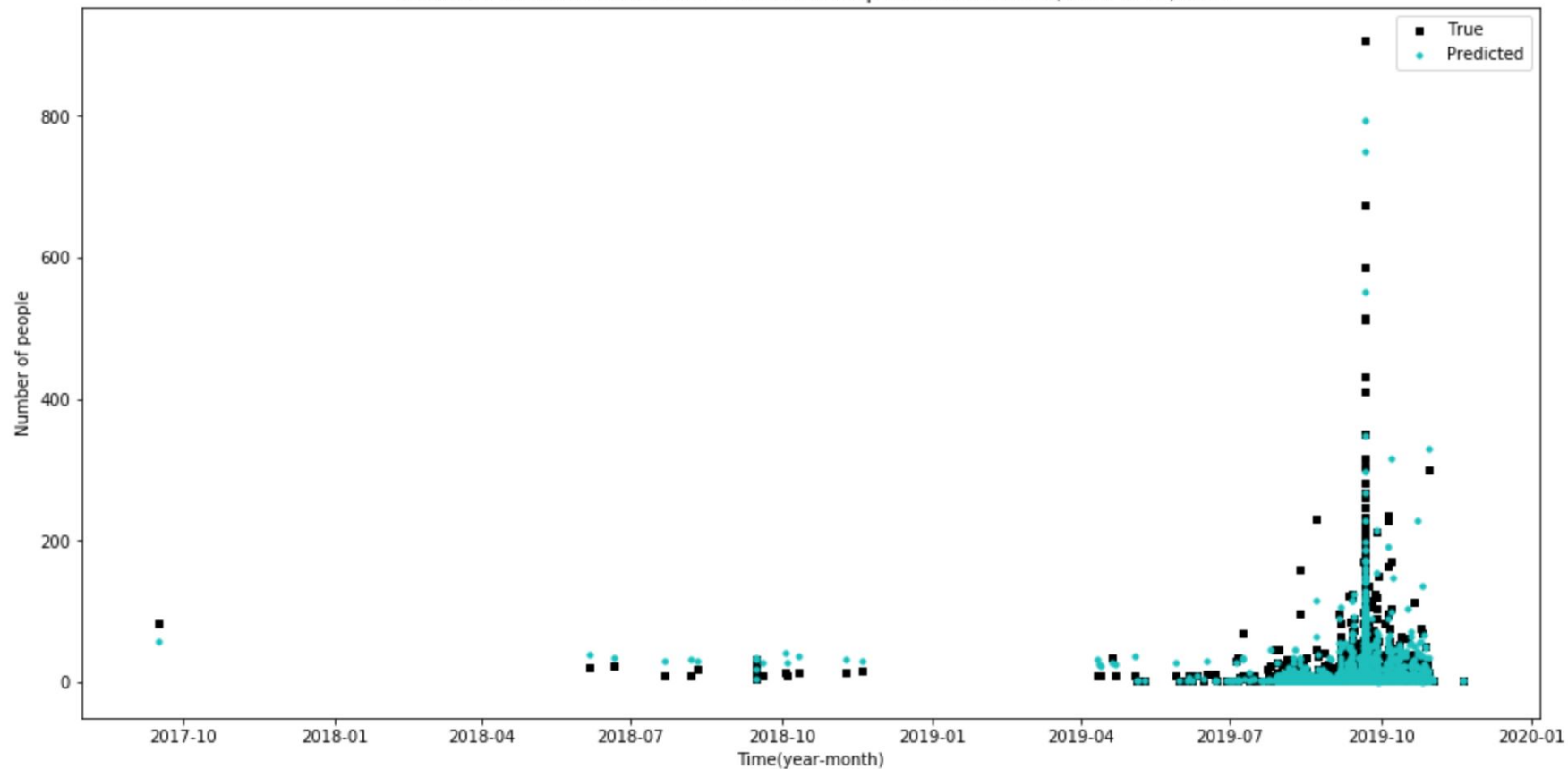
- Data Preprocessing
- Exploratory data analysis
- Data Normalization
- Missing-value treatment
- Feature engineering
- Model development

(please see our jupyter notebook file)

Prediction



Prediction of human resources for ocean cleanup in the US from 10/2017 to 10/2019



Prediction



Data

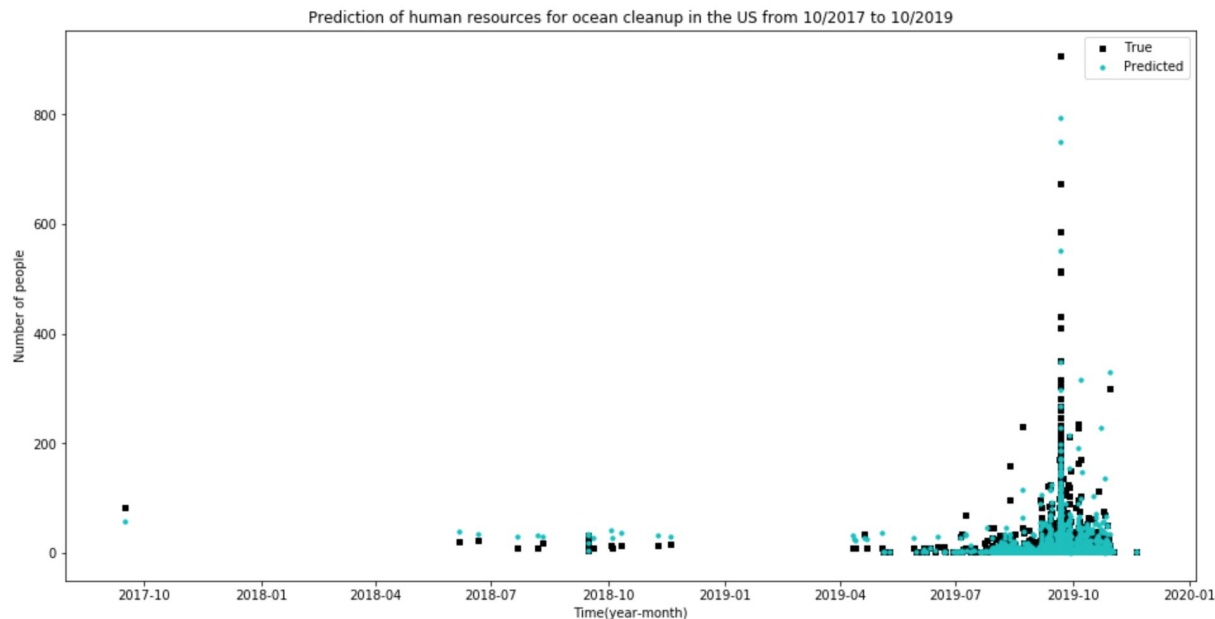
Training set: 75%
Test set: 25%
10-fold cross-validation

Metrics: RMSE

RMSE baseline: **163.47**
RMSE of our model:
+ **Xgboost: 83.57**
+ **Lasso linear regression: 86.77**

Features

- + Total Items Collected
- + Month
- + Weekend
- + Pounds
- + Miles





Recommendations

Data collection process

Improve Cleanswell Apps:

- There should be fields that need to be mandatorily filled and some fields should be entered numerically
- Trash Types: No need to sub-classify items collected to a very specific level; rather classify broader categories that people would easily understand, would minimum user effort and increase data quality
- Synchronize Trash categories with website form
- Create a landing webpage that connects users with nearby beach cleanups

The screenshot displays a list of user reviews for the Cleanswell app. The reviews are organized into two columns. The left column contains reviews from Andre T Gomes, Jariel Padilla, and Julia Kurczynska. The right column contains reviews from Ross Headifen, Jesse Castaneda, and Sami Nortje. Each review includes a star rating, a date, the user's name, a profile picture, and the review text. Below each review is a 'Was this review helpful?' prompt with 'Yes' and 'No' buttons. The reviews provide various suggestions for app improvement, such as adding search filters, refining data entry, and improving the user interface.

Andre T Gomes 3/16/19
It would be great to be able to search for community cleanup initiatives near me that I could join.

Jariel Padilla 2/26/19
excelente

Julia Kurczynska 2/17/19
very useful, but some things can be improved such as the option to share with friends. also materials needed before hand to prevent any accidents, and possible rules to the pick up method.

Ross Headifen 12/9/17
Great Idea, need a bit of refinement. Need to be able to edit the clean data or delete last clean if need be, to fix entry errors that occur. Otherwise all the data is corrupted. What does group mean?

Jesse Castaneda 8/12/17
Aloha

Sami Nortje 7/22/17
How can I delete cleanups which I accidentally duplicated?

State-Wise Analysis

- We should have more beach cleanup activities in high population density areas
- We should have more beach cleanup activities in inner states with significant water bodies like lakes and rivers

Trash Analysis

- Distribute cleanup events more evenly throughout the year
- Leverage Machines for the huge amount of tiny trash
- Human Resource should be concentrated on picking up larger trash

Organization Analysis

- Improve the group's diversity by teaming adults and children
- Upon adding a new member to a large group, it does not improve the cleanup efficiency, so medium sized groups(<800) need to be formed
- People perform cleanup more frequently when with NGOs compared to private groups. So, people should be encouraged to join NGOs for beach cleanups

Prediction



Estimate the human resources allocation for a certain area based on the estimated amount of trash (number of items, number of pounds), date, and seasonality.

=> recommendation system that will be potentially helpful for environmentalists to estimate and optimize human resource recruitment in their campaigns.

Recommendations - Technical solutions that enhance the human resource



Ocean cleanup machine for **tiny trash** from Da Nang beach in Vietnam.

Floating trash collectors for tiny trash



These can be set up a little distance from beach shore lines so that trash is not washed away into the deep waters but rather collected and recycled

Beach Cleaning Drones

These AI driven drones have the capability of detecting plastic in the sand

This way people can pinpoint their clean-up efforts

Eg: This drone could fly on a handful of beaches and record data about how much plastic waste exists on each beach. This way cleanup groups/individuals can more efficiently select beaches to clean.



How would we broadcast this newly found information?



- Reddit/ Other Social Media
- Reach out to various targeted customers and present this newly found information to them
- Reach out to the tourism industry and businesses/govt agencies located near beaches
- With due respect to the upcoming elections, we could reach out to prospective candidates who are proposing environmental friendly policies





Questions?



Thank you.

