Marine Litter-ature

Final Project ECS-272 Information Visualization

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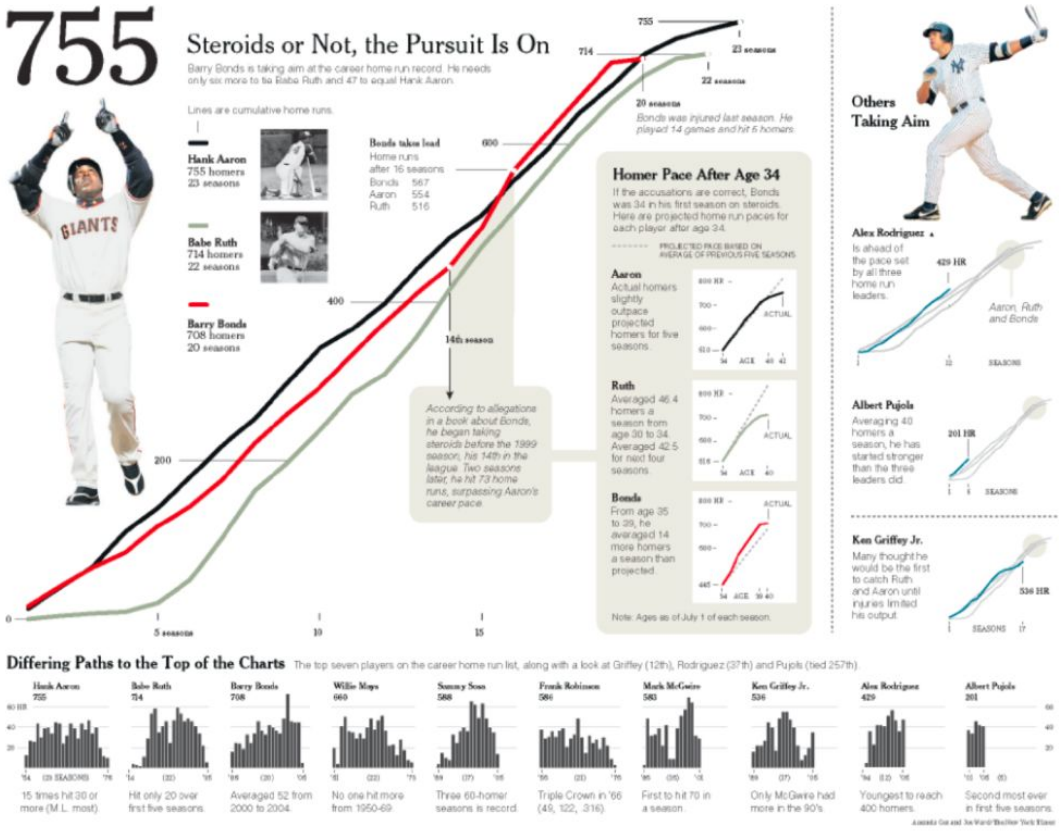
Objectives & Motivation

Objectives

Our objective for this project is to educate the viewer about marine litter and also the groups dedicated to cleaning it up around the world. In addition to providing education, our other objective was to bring a more creative approach into the visualization assignments for this class. We titled our project, “Marine Litter-ature”, as a pun on “litter” and “literature” to express our efforts to put forth education on marine litter cleanups in a playful manner.

Motivation

We were initially inspired by the sample visualization we viewed in class about baseball and steroid use titled, “Steroids or Not, the Pursuit Is On”. We were drawn to the organization and layout of this particular visualization. It reminded us of posters and images from books we had seen growing up. Despite the lack of interactivity that can be achieved with a static visualization, our attention was attracted to it and we felt inspired.



Baseball and steroids inspiring an ocean clean-up visualization project..?

Part of our motivation to continue to pursue a mostly static visualization, was also our itch to get creative with graphics and our struggle with using Javascript and D3. Both of us come from a background in using Python for data visualization. We will discuss more about this in the report sections that follow.

We knew that both of us were drawn to that particular visualization but the original topic idea wasn't as clear initially. When we first began to think of a topic to cover for our project, Charlie was immediately driven to want to do something nature or biology-related. The aforementioned visualization had given her a strong nostalgia for the books on marine life she had read growing up.

Driving application and datasets

Wanting to choose a biology or marine inspired topic, we searched for datasets pertaining to ocean life on Kaggle.com. Here we were able to find the dataset we used in our project. This dataset, Marine Litter Watch: Litter on the beach, was provided by the Marine LitterWatch (MLW) community. This community comes from the support of an application by the same name. Marine LitterWatch came from the European Environment Agency.

The dataset that we worked with contained the following features:

- Name of the organizing community.
- Name of the beach where an event happened.
- Country Code.
- Name of the sea.
- Length of the beach.
- Type of (washup) beach location.
- Type of the beach.
- Date of the event.
- Type of the event.

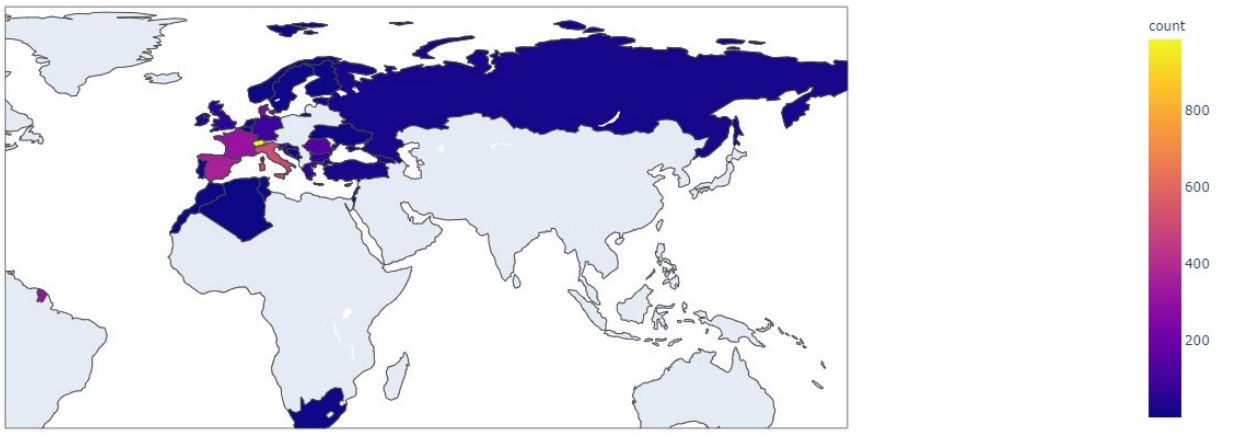
Challenges to address

The biggest challenge we faced in doing this project was handling Javascript and D3. As mentioned previously, we had both come from non-Javascript backgrounds. We also encountered issues with Node. To address those challenges, the team members split work based on ability and individual strengths.

The map challenge

In our original design plan, we wanted to plot the locations that were denoted in the data onto a geographic map. However, we had a great deal of trouble getting D3 to draw countries and also plot the

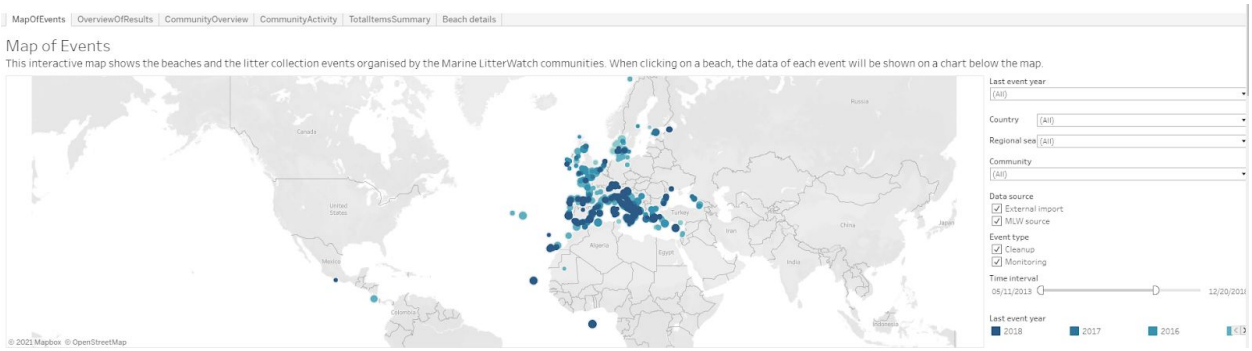
data. Frustrated, we turned to our roots in Python to use Plotly to generate a map. We also moved from plotting points to coloring countries as a choropleth map.



Our Plotly map that was implemented in Python. If we were presenting a Python notebook, you would be able to zoom, pan, and hover on a country to access more information.

A minor challenge we faced here was that the country codes used in this dataset were encoded to be two-letter country codes instead of the typically more-standard three-letter country codes. We discovered that most map plotting libraries in Python do not recognize the two-letter country codes. To generate the above visualization, the county codes had to be changed manually to their three-letter counterparts.

Upon further research, we also found out that the MLW website actually has a much more superior Tableau interactive map.



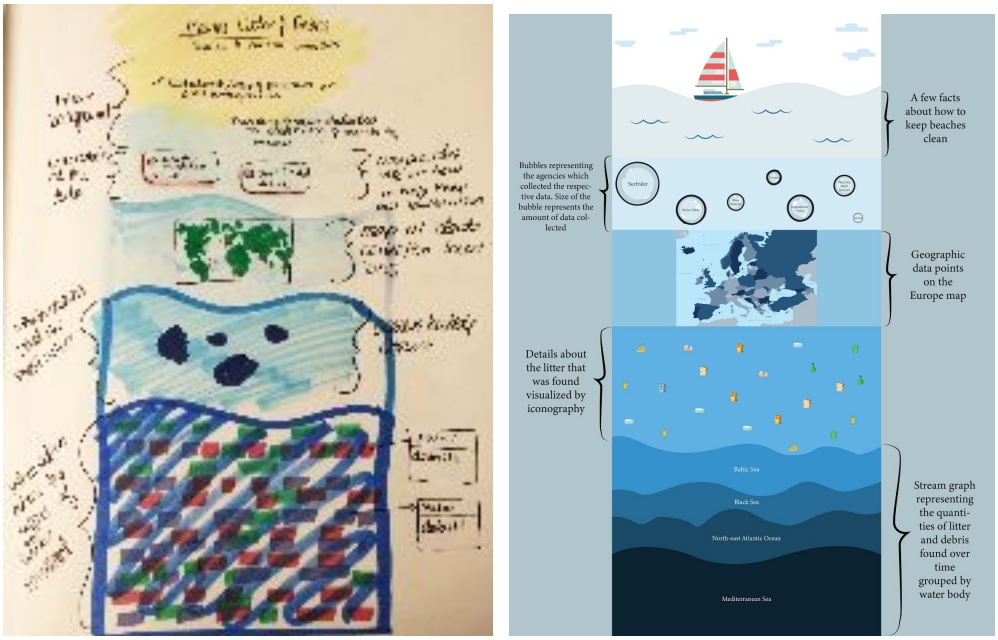
MLW's map implementation can be found here:
https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/marine-litterwatch/data-and-results/marine-litterwatch-data-viewer

Despite this setback, we still wanted to use our processed data for a map visualization. In the theme of creativity, Pratibha came up with the idea of a pirate's treasure map to depict our plotly generated map.

Litter ahoy!

Design and methodology

We started with a basic oceanic theme of starting on the surface of the water and then going "deeper". Going deeper was to be implemented in the spirit and style of "scrollytelling". This would allow for us to tell a story as the user dives deeper. The visualizations would become more interactive as the user scrolls down in order to maintain the structure of a martini glass structure of information delivery.



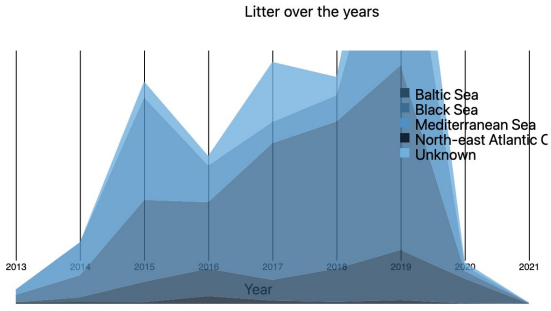
Our original storyboard (left) and the refined storyboard (right).

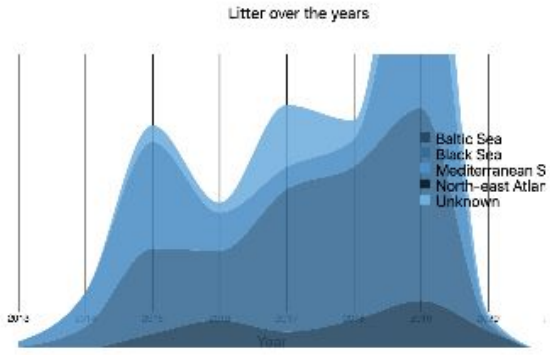
Inspiration worth noting

A large part of our design inspiration came from one particular visualization by Sonja Kuijpers who does some absolutely stunning visualization work. Her visualization project, “A view on despair”, inspired us to incorporate meaningful and thematic iconography into our visualization. We included a link to this particular data visualization project of hers in our reference section and highly encourage you to view it.

Incorporating the ocean

We included some subtleties in our implementation of the design as well. As you can see below, we altered the traditional stream graph to have rounded, flowing peaks rather than sharp ones to further convey the movement of water in our oceans:

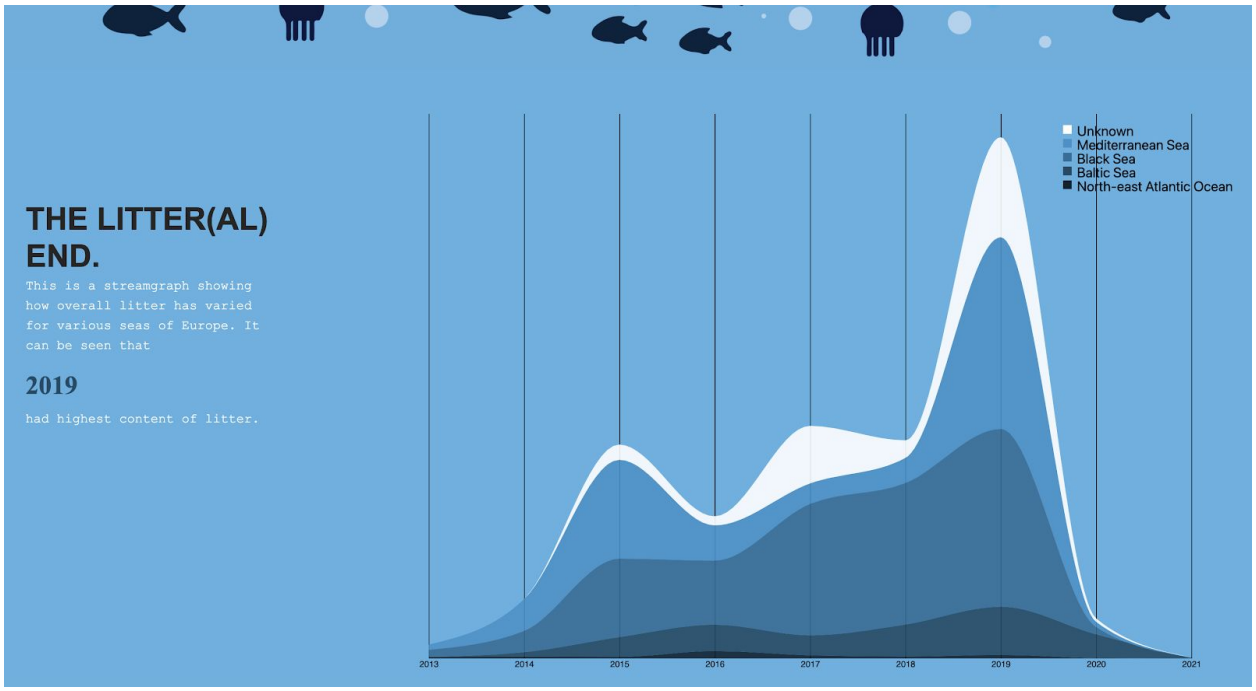




Before: Angular peaks and valleys.

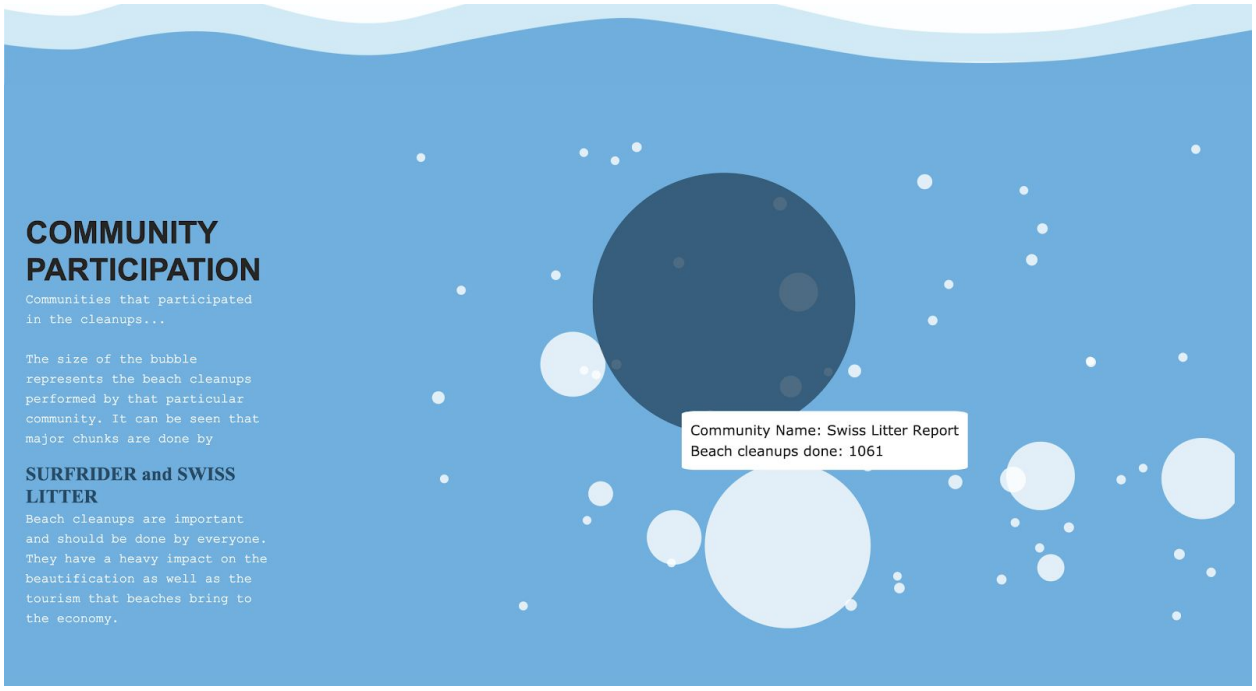
After: Ebb and flow.

Eventually the design of our stream graph became more of a “wave graph” as the visualization resembled more of a wave.



The final iteration of our "wave graph".

To continue our aquatic theme, we also included a bubble graph with actual bubbles that drift upon the page; where the size of bubbles represent the number of cleanups done by respective communities.



You'll have to open the project up yourself to see them drift.

Implementation considerations

Snap Scroll

We decided to implement the snap scroll feature in our webpage. It aids the user to view the next frame with a slight scroll. For this, we used **css-scroll-snap-polyfill**. The challenge here was with the different frame sizes. Our visualizations were of a particular size while our small illustrations weren't the same size. So we manually set up snap scroll actions for different frames.

Magnifying property

Since our geo visualization was not a programmatically derived one and hence couldn't be zoomed into, we decided to come up with the magnifying glass feature of CSS which would enable the user to magnify into different parts of the map and view it more clearly.

Bubble movement

To make the bubbles look more natural, we decided to put the transition property on them and let them align themselves randomly for which we used a random function for their x and y coordinates.

Methods and Results

We implemented 3 programmatically generated visualizations but could only display 2 of those on our webpage directly. We used D3 and javascript for two while Python plotly for the other one.

Bubble chart

To represent the different cleanups done by various communities, we decided to implement a bubble chart where the size of the bubble represents the number of cleanups done by that particular community. The x and y position of the bubble have no significance and are randomly generated. This chart was generated using D3 and Javascript. We also added a tooltip to it which shows the name of the community for easy interpretation.

Geovisualization

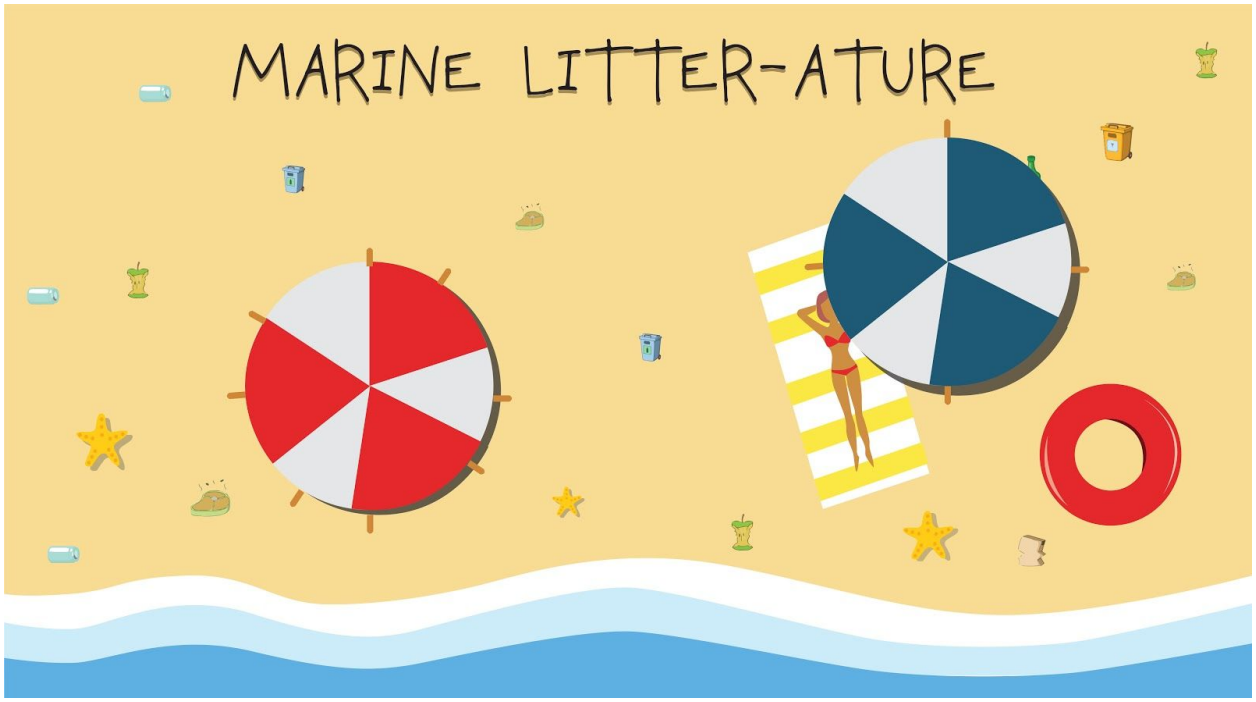
To create our geovisualization, we first engineered geographical data as mentioned above in our Map Challenges section. We translated the data into an illustration to fit the theme of our nautical story. Finally, we also implemented the zoom using the magnifying property mentioned above.

Stream graph

To represent the total litter gathered over the years, we decided to implement a streamgraph in D3. It shows how the litter has varied over the years in different seas around Europe. It would help the user understand as to how the litter has been increasing over the past few years with increasing negligence towards cleanliness of oceans. For this chart we also implemented a hover function wherein on hover that particular sea's stream is highlighted. For this we used the opacity feature. From a color scheme perspective, we used different shades of blue which makes it look like waves as well as makes it soothing to the eyes.

Other

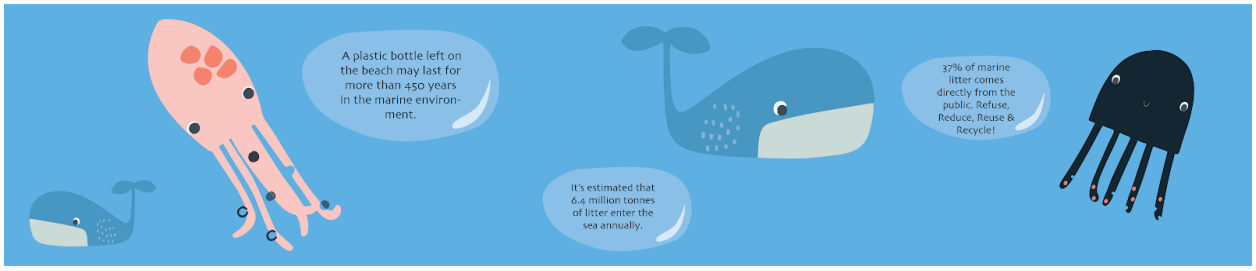
Apart from the above methods, there were a few small things that we implemented to make the webpage look and feel like marine. We decided to use various puns on the descriptions of our visualizations. We also designed a cover for our webpage which helps the audience understand the entire theme. For this purpose, we designed a beach illustration with icons of different kinds of litter such as food, cans, plastic, recyclable wastes etc. This not only gives an interesting view to the audience but also a brief insight into what they would see on scrolling further.



Marine Litter-atture

We also gave the entire webpage a blue colored background for a more marine feel. In the end, we designed a visualization to show the ocean bed which also has the same litter icons that were used in the beginning which also depict how the litter has been gathering at the bottom of the ocean and harming marine life.

To make the entire story more creative, we also decided to put illustrations of pools of fishes in between visualizations and put a few facts about marine litter in water bubbles to keep the audience engaged.

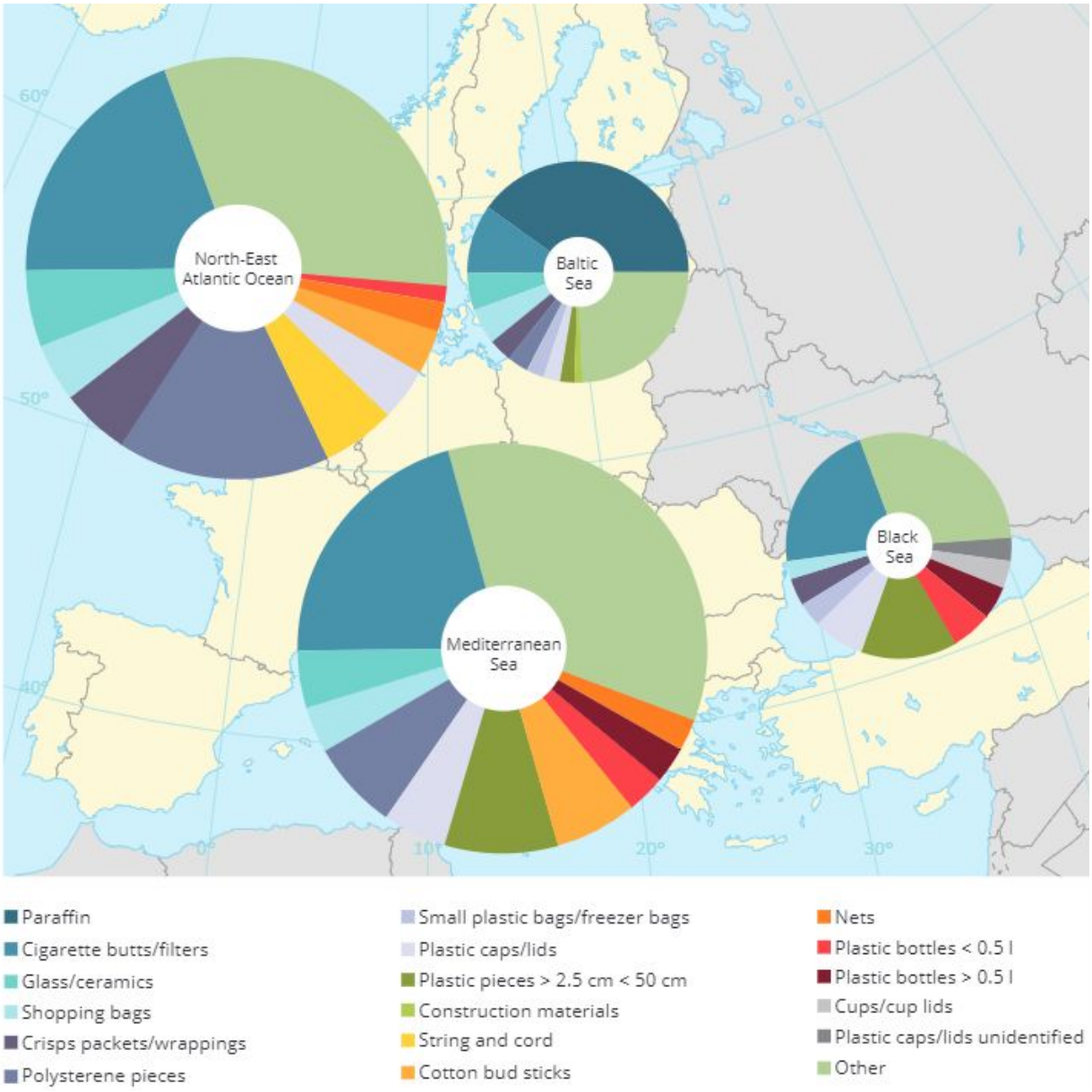


Fish Facts!

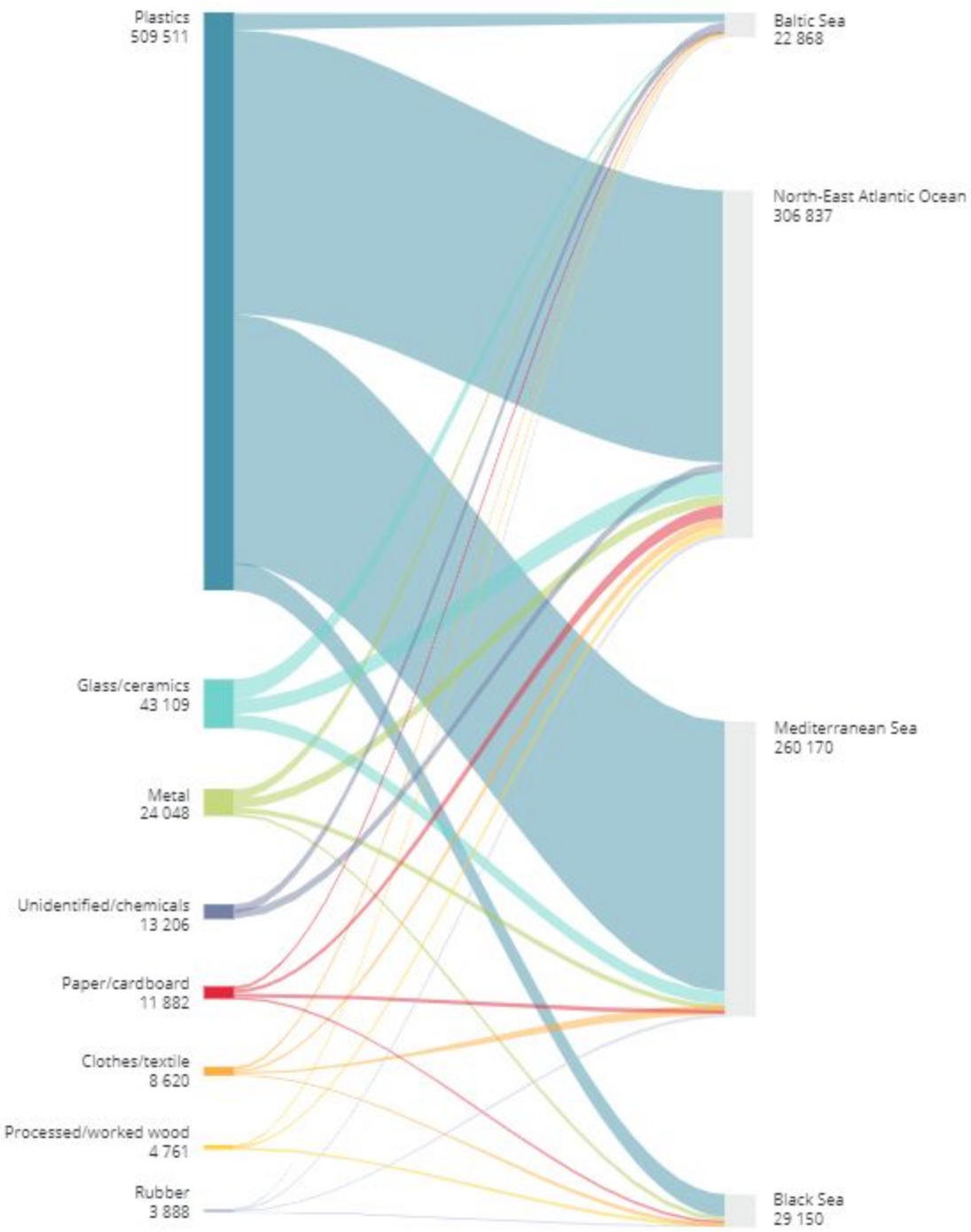
Our Ocean bed.

Related work

The MLW report from the European Environment Agency actually contains some spectacular visualizations. A link to the report is included in our references. We will also place some of their visualizations here for the convenience of your viewing.



Litter composition throughout regions with data.



Distribution of marine litter by material type.

Directions for further work

This visualization project feels complete. Perhaps a dynamic and interactive map visualization would improve upon the one that we created. We would have liked to include even more information about the groups that worked on the actual data collecting and cleanup efforts. There was also some quantitative data that could have been interesting to explore (such as length of beach).

In lieu of presenting in this report any more directions for future work on the visualization project, we would like to instead talk about directions for further work in environmental protection and marine cleanup efforts.

If you are interested in getting started with marine cleanups and ocean conservation, we encourage you to visit the Surfrider Foundation website at https://www.surfrider.org/. The Surfrider Foundation is a 36-year-old nonprofit environmental organization dedicated to the protection and enjoyment of the world's oceans and beaches. They have an incredible history of projects and activism that has led to real policy change and making a huge difference in how we take care of our oceans and beaches. If you are interested in participating in environmental conservation, please feel free to sign up to volunteer with a local chapter.

Cleanups in the time of COVID-19

You don't need to be part of a group or even live near a beach to participate in a beach cleanup. The San Diego chapter of the Surfrider Foundation shared a guide on how to do your own COVID-friendly beach cleanups here: https://sandiego.surfrider.org/solo-cleanups/

A solo beach cleaner (during the pandemic) and a group of volunteers (from before the pandemic) both at Ocean Beach in San Diego, CA. This is where Charlie's family lives.

References

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