

# RipRap Project

## 2021-2022



### **Senior Mentors:**

Aelish Mullaney, Madeline Novatt, Giovanni Nunez,  
Nicholas Pabotoy, Marifer Sanchez

### **Junior Leaders:**

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New York Harbor SEAL's

New York City

Spring 2022

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# Introduction

## **SEALs Mission Statement:**

Our purpose is to bring together student Civic Scientists to monitor the health of the Hudson-Raritan Estuary, educate the public, and create the conditions to help bring the harbor seal back to New York City.

## **RipRap Project:**

Our current project within SEALs is the Rip-Rap project, a data-collection and environmental cleanup procedure. The goal of the project is to gain a data-oriented understanding of the trash that washes up on Governors Island's rocky coast.

We have developed methods for collecting, organizing, and storing samples compiled. This includes weighing the samples, classifying the materials, and later disposing of them. This project originated through a collaborative effort between Harbor SEALs and Earth Matter, after years of noticing the overwhelming amount of debris on Governors Island students took initiative to clean and record debris washed up on this historic land sights border.

# Vocabulary

**Marine Debris**: Refers to anything that is man-made, which includes but is not limited to fishing gear, plastics, needles, foam, rubber, and glass, smoking paraphernalia, organic debris, and metals.

There are 5.25 trillion pieces of plastic debris in the ocean. Of that mass, 269,000 tons float on the surface, while some four billion plastic microfibers per square kilometer litter the deep sea. (Parker, 2015).

**Riprap**: A human made barrier of stones and/or concrete made to protect shorelines from erosion. (The Merriam-Webster.Com Dictionary, n.d.)

**Combined Sewage Overflow (CSO)** : When rainwater overflows the capacity of the sewage system, causing a discharge into a body of water. (EPA, n.d.)

**Quadrat**: A square or rectangular plot of land used to mark off at random a physical area to isolate a sample and determine the percentage of vegetation and animals occurring within the marked area. (*Biology Online, 2019*)



# **Data Specific Vocabulary**

**Plastics**: insert definition here

**Others**: insert definition here

**Foam**: insert definition here

**Mixed Materials**: insert definition here

**Organic Matter**: insert definition here

# Locality



**Governors Island:** an island in Upper New York Bay, New York., off the southern tip of Manhattan. Its area is 172 acres and served as a military installation in the late 1700s till the late 1900s. The island was then opened to the public in 2003.

**Sampling on Governors Island:** Harbor SEALs has collected samples from numerous locations on the RipRap along the western side of the island.

# **Limitations, Assumptions, & Risks**

## **Assumptions:**

- Debris has not previously been collected in the areas SEALS is sampling
- Debris is washing up due to natural ebbing/flowing
- Data stored after collection can be tampered with as it is located near the general public

## **Limitations:**

- We are only sampling 1-2 times a week and with limited amount of replicates
- Sampling can only occur when weather is optimal
- Team sizes are limited
- The timeline and resources of this project only allowed for a minimal amount of Governors Island to be searched for debris and tide often affected whether or not debris could be picked up

## **Risks:**

- Risk of injury (falling off the ladder, falling on the riprap, getting punctured or hurt by debris, using chemicals incorrectly for phys chem)
- Risk of Injury using drone (overcharging battery may lead to static electricity)

# What is the Physical Chemistry team?

The Physical Chemistry team throws a bucket with a line attached to it over the RipRap or will use a drone (DJI-Inspire 2.0) to collect water samples. The samples water quality will then be tested for pH, Ammonia ( $\text{NH}_3$ ), Nitrite ( $\text{NO}_2$ ), Nitrate ( $\text{NO}_3$ ), Dissolved Oxygen (DO), etc. The results for each water quality test will be inputted into a data sheet and will then be analysed for abnormalities.



# WHO ARE WE: PHYSICAL CHEMISTRY



**Giovanni Nunez — Project Quality Assurance Manager**  
12th Grade

Hello, I joined SEALs for fun, due to my loss of ambition and feelings of confusion. Covid caused 2 years of online school and while I lost most of my motivation I still had the drive to do science. So I joined SEALs and really enjoyed it through hands-on projects after only doing virtual schooling.

I'm going to college at Penn State University and am studying computer science, while I didn't necessarily enjoy doing school online I did enjoy learning about computers and SEALs have helped me prepare by learning how to work in teams and on problem-solving. I aspire to become a software engineer and potentially travel the world in the future.



# WHO ARE WE:

## PHYSICAL CHEMISTRY



**Isaac Castillo — Project Manager**  
11th Grade

Hello, I joined SEALs because I wanted to use my knowledge of Drone tech to help accomplish much greater goals specifically in the science field. After looking through all the Harbor School programs, SEALs was the only program that gave me the opportunity to not only fly a drone but to learn how to work as a team with others. Once graduated from High School, I hope to pursue working with drones in the military or possibly even being the pilot an F-22 Raptor.

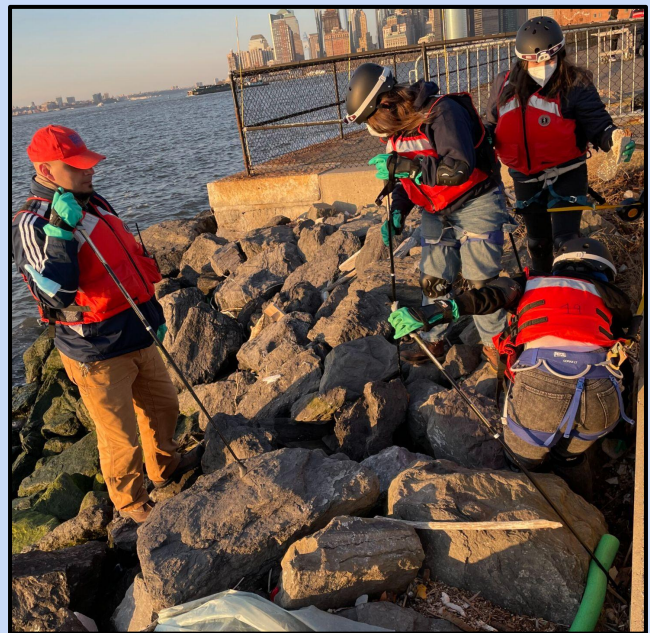


**Sebastian Koko — Project Manager**  
11th Grade

Hello, I joined SEALs because I aspire to be a Marine Scientist and I realized that SEALs was the best way for me to get applicable experience in that field of science when compared to all of the other after-school programs at Harbor. After high school, I plan on pursuing Marine Science in college, further education, and a career in general.

# What is the Marine Debris team?

The Marine Debris team plays a major role in the project. This team goes over the RipRap after putting on their gear to collect debris. The debris that's collected will be placed inside buckets and are handed to the Data Analysis team. The Marine Debris team will continue to collect debris until it's time to wrap up. During wrap up the team will take off all gear and help to pack up or assist other teams as needed.



# WHO ARE WE: MARINE DEBRIS



**Aelish Mullaney — Project  
Quality Assurance Manager**  
12th Grade

I joined SEALs in my freshman year to have a better understanding of marine science to prepare myself for a marine biology career. After graduation I will be attending Stony Brook University in the fall of 2022 where I will major in marine science to continue to pursuing my passion.



**Julia Purrazzella — Project  
Manager**  
11th Grade

Hello, I wanted to be a part of SEALs because I love to learn and have a passion for science. Being able to be part of these hands-on projects was really important to me and provided me with lots of experience. I want to go on to study marine biology and follow on with it throughout college and further education!



# What is the Data Analysis team?

After the debris is collected by the Marine Debris team, it is rushed over to the Data Analysis team. Who then sorts each item collected into different categories and record this information, in terms of tallies and weight, in a data sheet. Once sampling days are over this team digitizes the data collected and creates graphs and statistics back in the lab.



# WHO ARE WE:

## DATA ANALYSIS



**Marifer Sanchez-Gaspar —  
Project Quality Assurance  
Manager**

12th grade

I joined SEALs my freshman year of high school to gain experience in research. I soon learned how important our research was to advocating for our waters and educating the public. I will be a part of the 2026 graduating class at Providence College, pursuing Health Policy and Management as a pre-med student. While I may not be going into marine biology, the advocacy and research skills I have acquired through this program will ensure my success in a STEM career.



**Maddie Novatt — Project  
Quality Assurance Manager**  
12th grade

I joined SEALs the end of my freshman year mainly because of my interest for marine biology. I soon realized how important research was and wanted to be involved a professional science setting. I am attending Emory University as the class of 2026, planning to major in public health and pre-med. The skills SEALs has provided me have made me so incredibly passionate about science and aware of my impact on the environment.

# WHO ARE WE:

## DATA ANALYSIS



### **Anna Sheehan - Project Manager**

11th Grade

I joined SEALs during my Sophomore year because it provided me with an exceptional learning experience where I can develop my skills as a scientist. This summer I will be interning for the Lamont-Doherty's Secondary School Field Research Program with Columbia University researchers. I look forward to my senior year and my future as a scientist.



### **Jaylen Boyce - Project Manager**

11th Grade

I joined SEALs because I want to be a marine biologist in the future and I thought that joining SEALs and the Marine Biology Research Program would allow me to get a better understanding of science and research. After graduating in spring 2023 I plan on attending college and studying Marine Biology. During the summer I will be spending two weeks doing the Sea Education Association summer at sea program



# WHO ARE WE:

## DATA ANALYSIS



**Sara Guevara — Volunteer Intern**

9th grade

I joined SEALs because I want to become a marine biologist. SEALs allowed me to learn more things about not only what kind of projects they do but as well as get a glimpse of what students in the Marine Biology Research CTE Program will take part in. I'm planning on studying marine biology in college and hopefully be able to be part of the MBRP for my next three years of high school.

# What is the Communications team?

This team communicates directly with the Harbor SEALs stakeholders/sponsors to organize events and discuss due dates as well as manages communications through SEALs as a whole. They also oversee/manage all social media coverage.



# WHO ARE WE: COMMUNICATIONS



**Nicholas Pabotoy — Project  
Quality Assurance Manager**  
12th Grade

I joined SEALs in my junior year at Harbor School because I was interested in furthering my education in the marine biology research program and maximizing my experience in the program. I chose to participate in this year's program because in my senior year I sought to mentor the underclassmen with the knowledge I have gained. After graduation, I will be attending The University of Rhode Island in pursuit of higher education, I will be majoring in marine biology.



**Arlo Kane — Project  
Manager**  
11th Grade

I have been in SEALs since my freshman year. I originally joined the Harbor SEALs to learn more about what a career as a scientist would look like. Since then SEALs has become a core aspect of my life and the work we've done is something I'm genuinely proud of and admire. Now I want to go to college to study pharmacology.



# Procedures & Materials



An explanation of the steps and procedures taken by each team for this study, and what materials were used

# Materials -

## PHYSICAL CHEMISTRY

Materials	Quantity	Function
PFD	4	Safety precaution
Test strips containers	3	To test the water quality
Headlamp and batteries	4	To see what we are working on
Gloves	4 pairs	To protect our hands from contaminants and debris
Winkler method kit	4	To test the water quality
Buckets	2	To collect water samples
Line	2	To connect to the bucket
Cart	1	To carry materials to the rip rap
Clipboard	4	To write on
Datasheet	4	To write down data and notes



# Materials -

## PHYSICAL CHEMISTRY

Materials	Quantity	Function
Waste container	1	To dispose of test strips and chemicals used
Stop Watch	4	To time the water quality tests and test strips
Boathook	1	To pick up line or bucket in case it cannot be reached
Buoy	1	Safety precaution
Thermometer	2	To test the water temperature
Lab coats	4	Personal protective gear

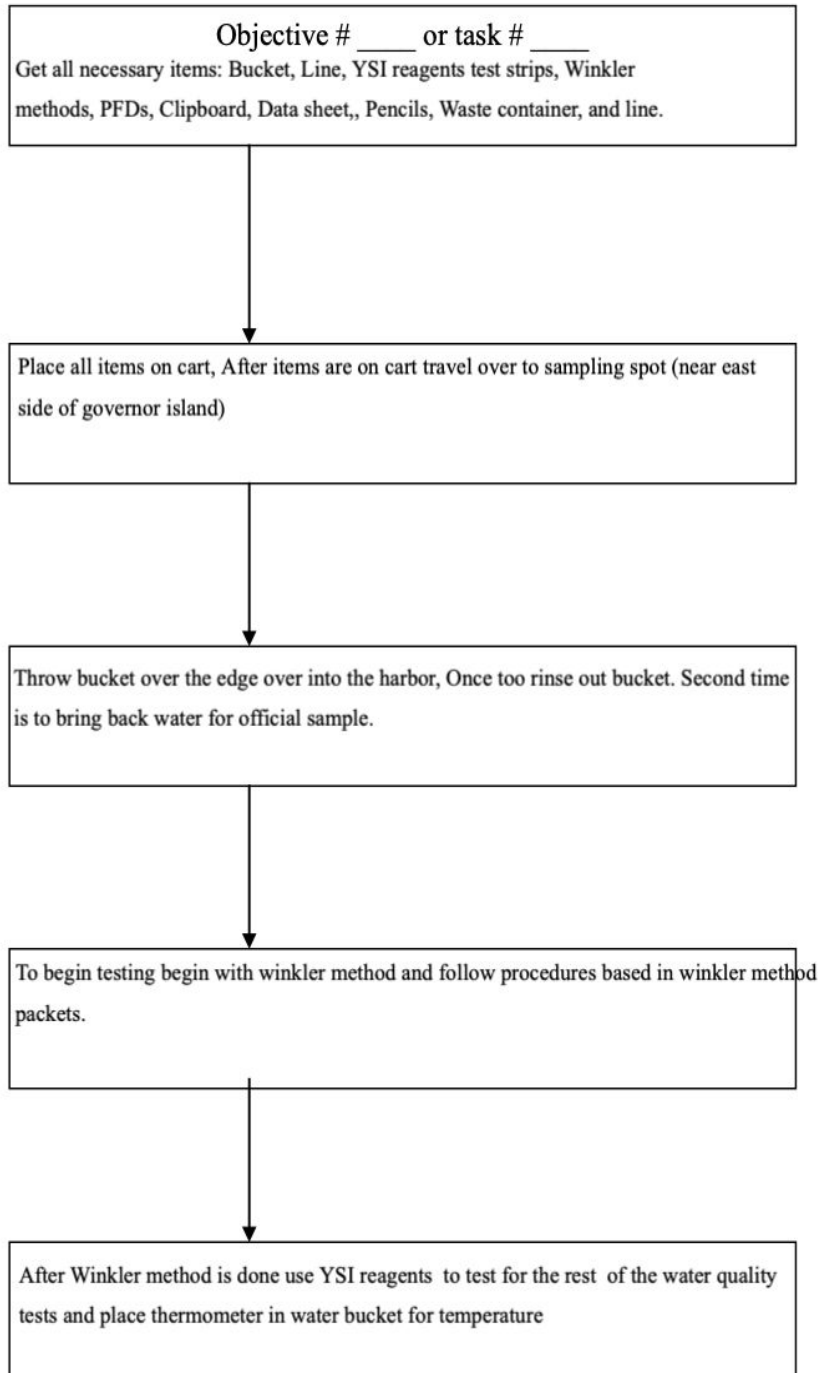
## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Gio,Isaac,Sebi Date: 5/18/2022 Grade: 9-12

Procedure Title: Phys-Chem Procedure List

**Add Materials  
and timeline  
on the sides  
of the boxes**



Objective # \_\_\_\_ or task # \_\_\_\_

Record all data on paper, After recording; clean up place all water in winkler methods kits and test strips into waste container and dump water back into the ocean.



Empty rectangular box for notes or additional information.



Empty rectangular box for notes or additional information.

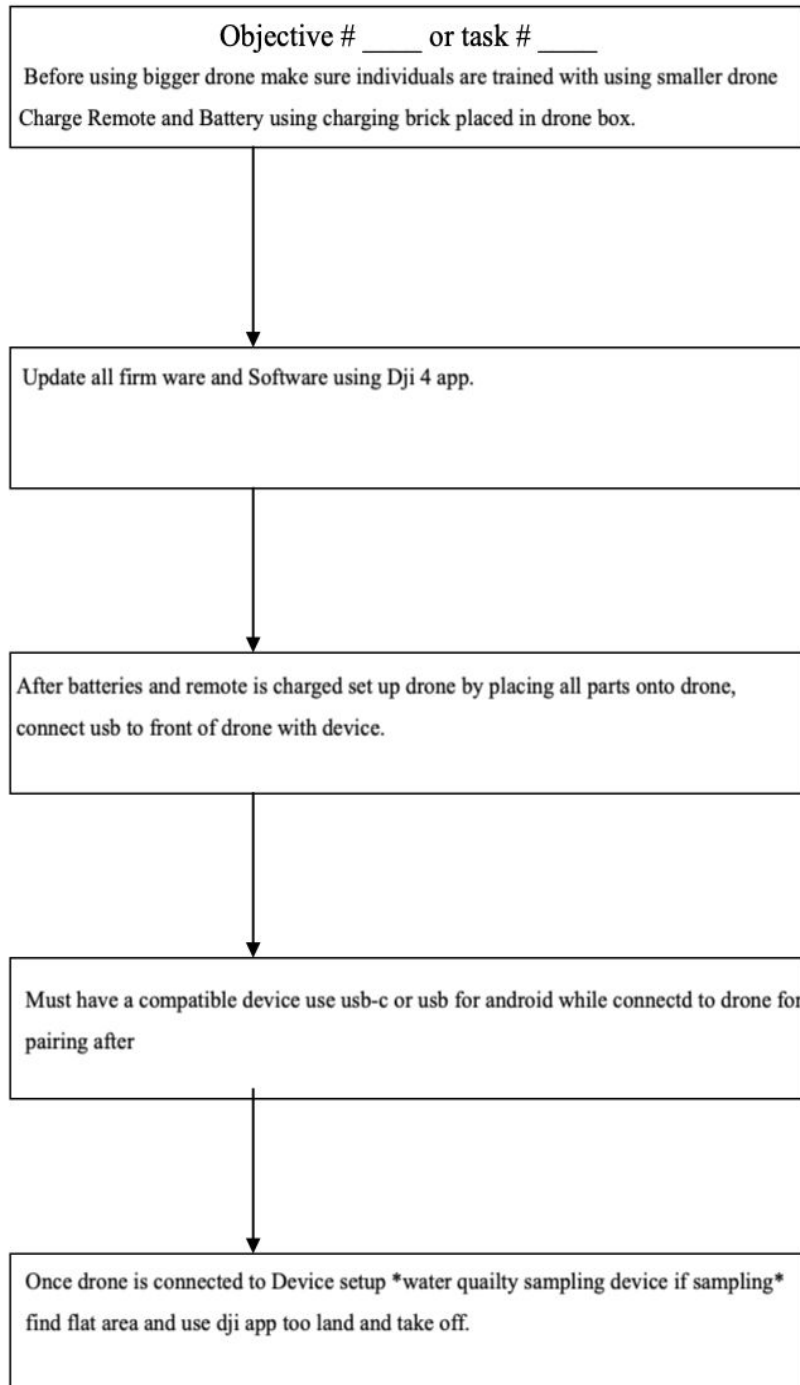
## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Gio,Isaac,Sebi Koko Date: 5/18/2022 Grade: 9-12

Procedure Title: Larger Drone Procedure list(Water quality and basic flight)

**Add Materials  
 and timeline  
 on the sides  
 of the boxes**



Objective # \_\_\_\_ or task # \_\_\_\_  
For sampling go over body of water and swiftly go down and back up to obtain sample



For landing use app and find flat area and be prepared make sure water quality sampling device is taken off take off water quality sample first then take off device/ then land drone make sure you are wearing PPE.



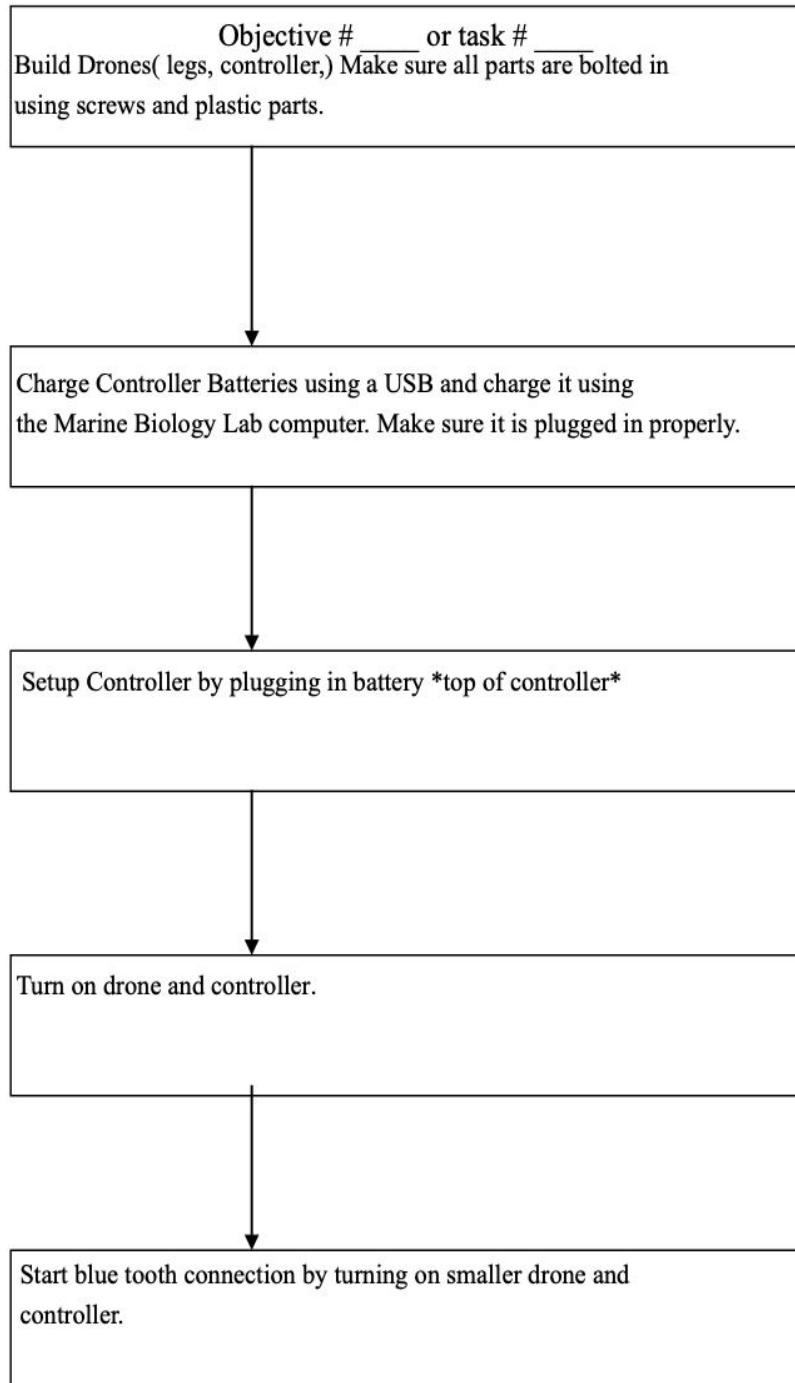
## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Gio, Isaac,Sebi Date: 5-18-2022 Grade: 4

Procedure Title: Smaller drones

**Add Materials  
and timeline  
on the sides  
of the boxes**



Objective # \_\_\_\_ or task # \_\_\_\_  
After drone is properly connected fly drone\*Recommended too keep smaller drone in the air for at-least 5 minuets without crashing before use of bigger drone\*



Atfer drone is in the air for 5 minuets make sure area is prepared for landing preferably large flat area\*basketball court etc.\*



Remove battery from controller and parts for drone and disassemble drone and place back in box.



# Materials - Marine Debris

Materials	Quantity	Function
Ladder	1	To get over the fence and reach the rip rap safely.
PFD	3	Safety precaution
Helmets	3	Safety precautions
Pads (elbow, knee, wrist)	3 of each per person	Safety precaution
Clamps	2	To hold the ladder in place to prevent it from shifting
Harness	4	Safety precaution
Shoe cover	3	To protect shoes in rain and other weather and other safety precautions.
Headlights with batteries	4	In order to see objects and as a safety precaution
Safety lines	2	Safety Precaution
Buckets	2	To collect debris in



# Materials - Marine Debris

Materials	Quantity	Function
Quadrat	1	A square to mark and determine the areas we are collecting from.
Gloves	2-4 Pairs	To make sure hands stay dry and safe from debris
Drill and Drill Box	1	Drill later on to keep it in place
Epoxy	1 container - as much as needed	To glue on reflector
Reflectors	1	Designate where quadrat was
Walking sticks	4 - one per person	To help with stability when walking on the riprap
Grabbing sticks	4 - one per person	To pick up debris from hard to reach places
Life preserver	1	Precaution in case injury occurs
Charged GoPro (Quadrat only)	1	Placed on quadrat to take pictures of debris within that area

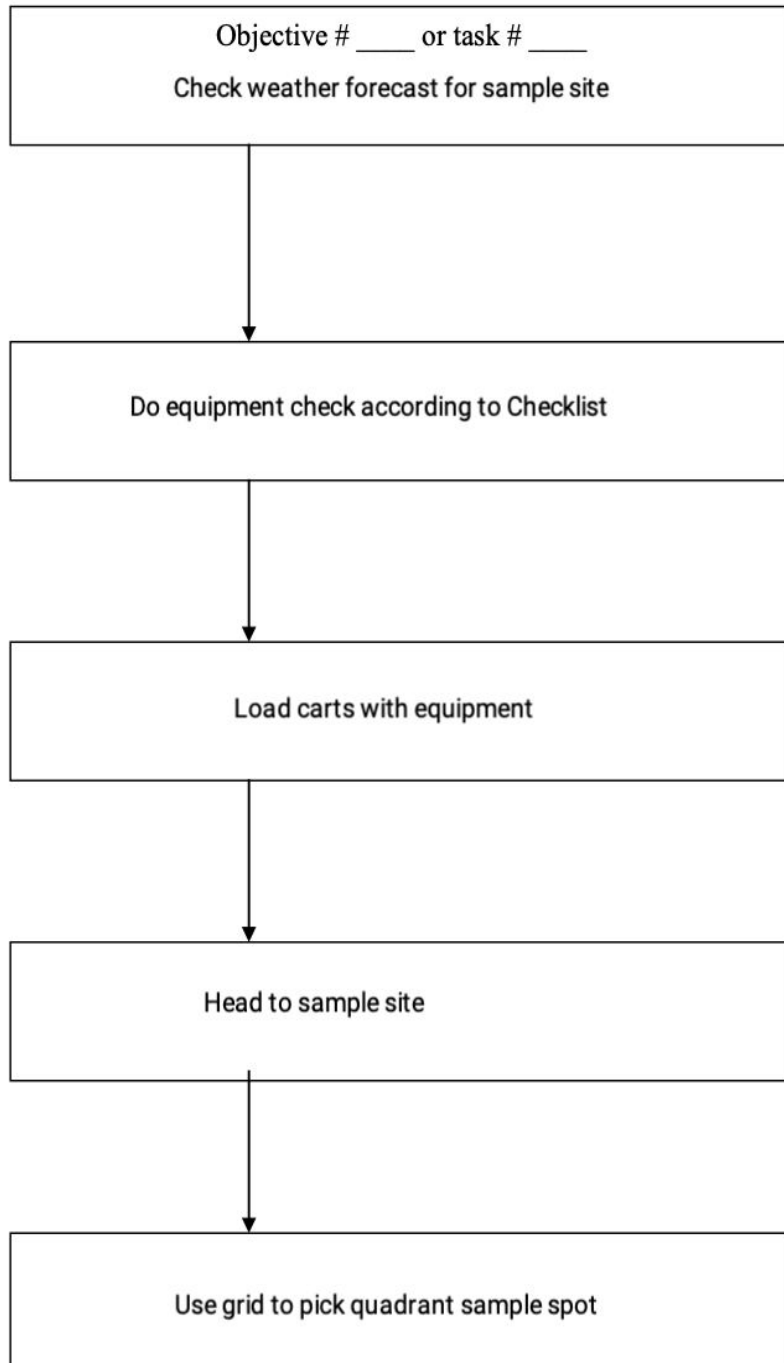
## Step 07. Protocol Flow Charts

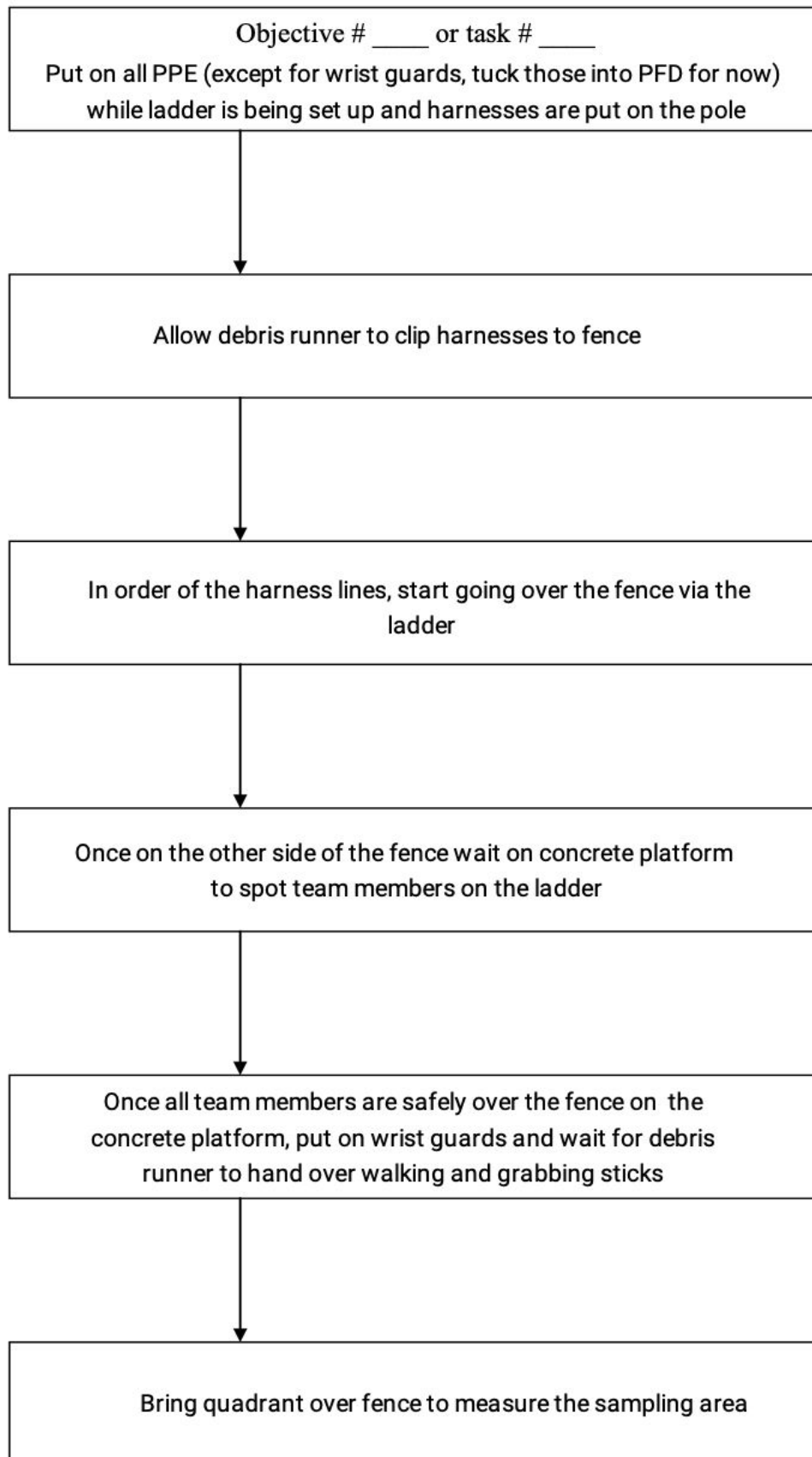
Mr. M. Gonzalez

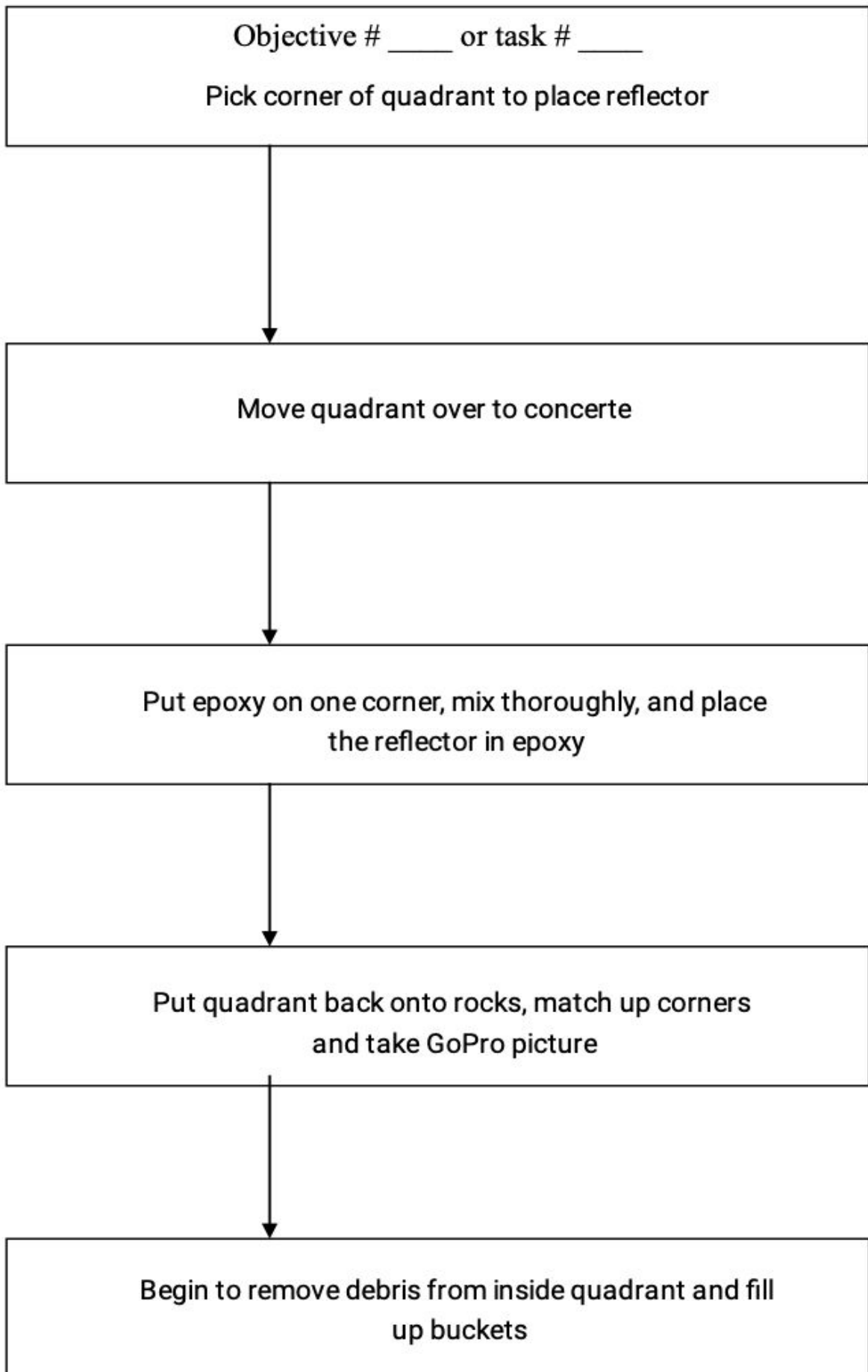
Name: Aelish Mullaney & Julia Purrazzella Date: 05/17/2022 Grade: 11 & 12

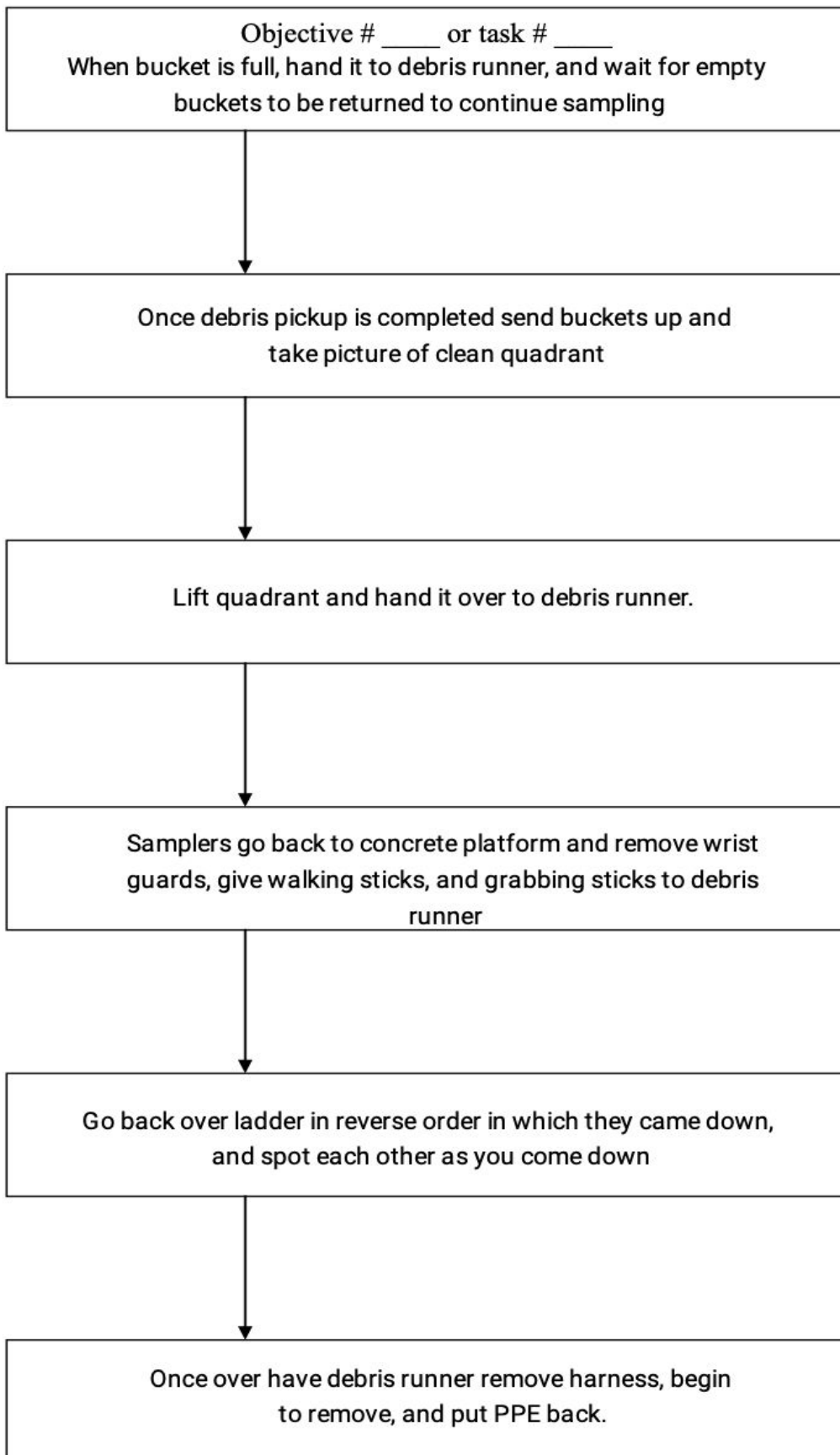
Procedure Title: Marine Debris Team Procedures

**Add Materials  
and timeline  
on the sides  
of the boxes**









# Materials - Data Analysis

Item	Qty.	Purpose
Tarp	1-2	Debris will be counted and categorized on this
Gloves	As many as needed	To prevent contamination from debris
Digital Scale	1	Used to weigh smaller debris
Hand Scale	2-3	Used to weigh large debris
Data Sheets	2 blank packets (view reference)	Used to tally and categorize debris
Buckets	2-3	Debris will be transported from riprap to data analysts through this
Weighing Trays	2-3	Holds small debris when weighing on digital scale
Medical Waste bin	1	Items such as needles will go here

# Materials - Data Analysis

Item	Qty.	Purpose
Disposal Bins	1-2	To dispose of debris in plastic bags
Flood lights (Seasonal)	1	To sort in the dark during winter days
Clip boards	As many as needed	Used to record data
Generator	1	Used to power the flood lights and digital scale
Extra Pencils and Erasers	As many as needed	For accidents with writing utensils out on the field
Burlap Sacks	As many categories as there are	Will hold unweighted and weighted debris when unable to dispose of it
Plastic Bags	As many as needed	Used to dispose of the debris
Wind Blocker	1	Prevents the wind from tampering with weight

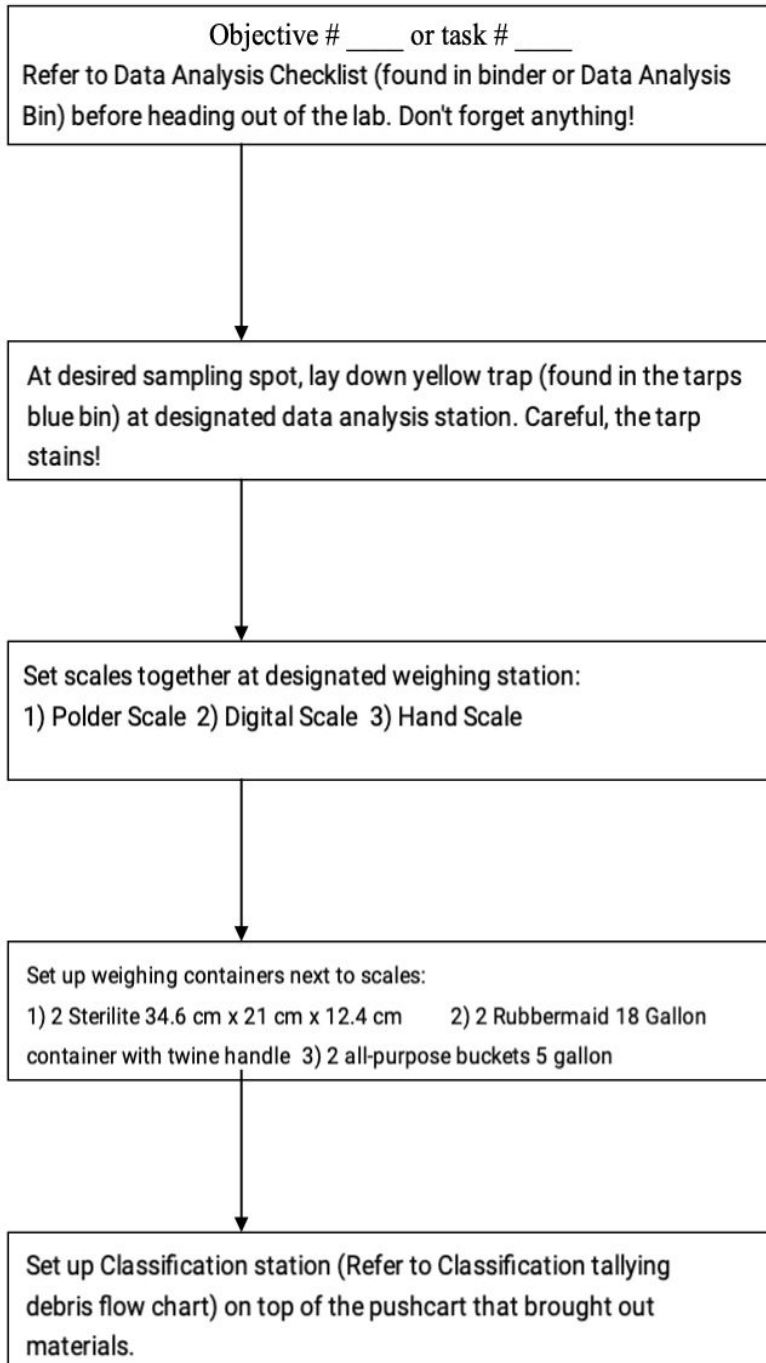
## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Marifer Sanchez Date: 05/18/22 Grade: 12th

Procedure Title: Set-Up (Data Analysis)

**Add Materials  
 and timeline  
 on the sides  
 of the boxes**



- Polder scale and Sterilite 34.6 cm x 21 cm x 12.4 cm used for weighing small items such as balls
- Digital Scale and Sterilite 34.6 cm x 21 cm x 12.4 cm used to weigh light objects such as
- Hand Scale and all-purpose buckets 5 gallon are used for weighing heavy items such as tarps, or rope
- Hand Scale and 2 Rubbermaid 18 Gallon container with twine handle used to weigh items either too abundant to tally or significant enough to weigh such as pieces of styrofoam or copious amounts of water bottles



Objective # \_\_\_\_ or task # \_\_\_\_  
Match the labeled burlap sacks and lay them on the yellow tarp. There are two sacks for each category  
(e.g. plastic, foam, metal, etc. ) 1) labeled "weighed" 2) labeled "not weighed"



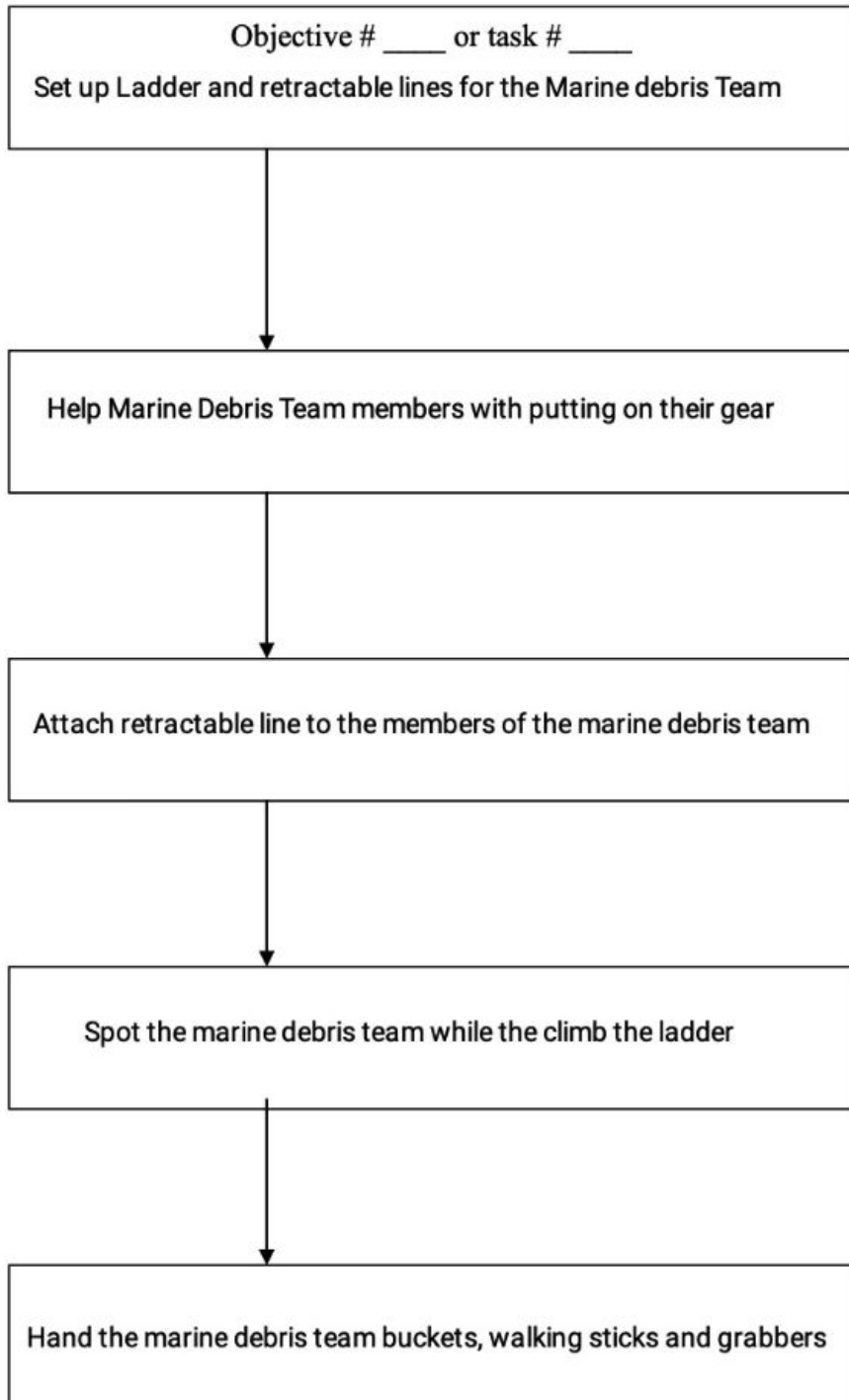
## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Jaylen Boyce Date: 220518 Grade: 11th

Procedure Title: Debris Runner (Data Analysis)

**Add Materials  
and timeline  
on the sides  
of the boxes**



Objective # \_\_\_\_ or task # \_\_\_\_  
Take buckets from the marine debris team when full and bring to the Data analysis team to be sorted and weighed (repeat until sampling is complete)



Point out and unseen debris to the Marine Debris team as well as incoming waves



## Step 07. Protocol Flow Charts

Mr. M. Gonzalez

Name: Marifer Sanchez Date: 05/18/22 Grade: 12

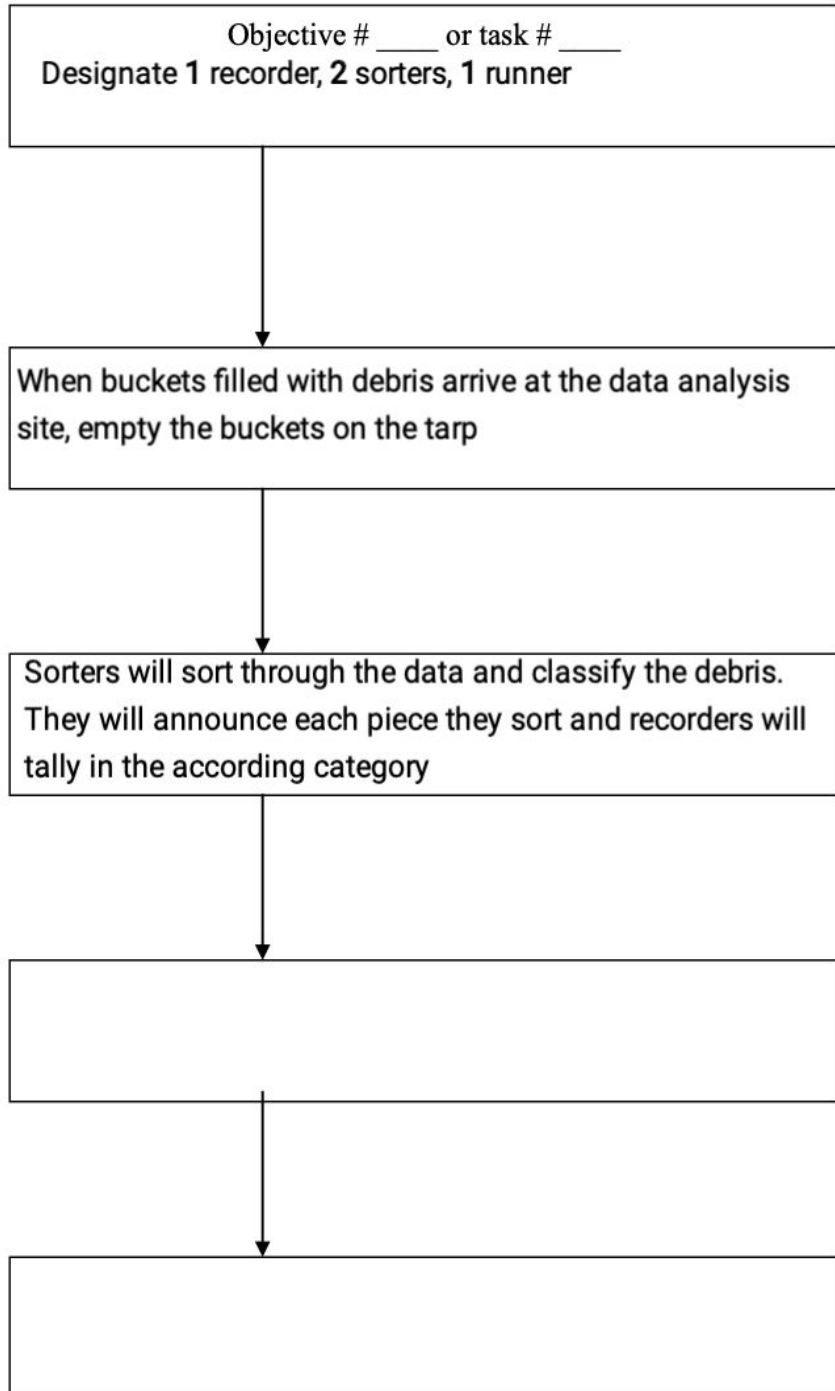
Procedure Title: Classification and recording amount of debris (Data Analysis)

**Add Materials  
and timeline  
on the sides  
of the boxes**

**Recorder:** Will tally the amount of debris, on data sheet, called out by the sorters

**Sorter:** Will categorize the debris and announce amount and classification to recorder

**Runner:** Will bring buckets of debris to the data analysis site



# Reference Data Sheet

The following - pages are an example of a “blank packet” listed on the materials list for data sheets. This is exactly what was used out on field for recording data.

SAMPLE DAY _____ SAMPLE DATE _____
---------------------------------------

Check if digitized Digitized on: _____
---

Quality Control Check on (date): _____
---

## RipRap Data Collection Sheet

LOCATION (GPS): \_\_\_\_\_ STATION: \_\_\_\_\_  
Sorter's name: \_\_\_\_\_ Date: \_\_\_\_\_

Categories	Tally	Comments	Mass -Kg (Digital scale)	Mass -g (Polder Scale)
<i>Plastic</i> - Bottle caps				
<i>Plastic</i> - Bottles				
<i>Plastic</i> - Garbage bags				
<i>Plastic</i> - Nets				
<i>Plastic</i> - Straws				
<i>Plastic</i> - Single use bags				
<i>Plastic</i> - Rope				
<i>Plastic</i> - Fishing Gear				
<i>Plastic</i> - Other _____				
<i>Glass</i> - Bottles				
<i>Glass</i> - Miscellaneous Shards				
<i>Glass</i> - Other _____				
<i>Rubber</i> - Condoms				
<i>Rubber</i> - Rubber bands				
<i>Rubber</i> - Hair-ties				

<b>Rubber - Other</b> _____				
<b>Medical - Masks</b>				
<b>Medical- Face Shield</b>				
<b>Medical - Covid Testing Packaging</b>				
<b>Medical - Needles</b>				
<b>Medical - Other</b> _____				
<b>Foam - Styrofoam</b>				
<b>Foam - Packing Peanuts</b>				
<b>Foam - Other</b> _____				
<b>Organic Matter - Wood</b>				
<b>Organic Matter - Feathers</b>				
<b>Organic Matter - Animal Waste</b>				
<b>Organic Matter - Seaweed</b>				
<b>Mixed Materials - Other</b> _____				
<b>Smoking - E-cigarettes</b>				
<b>Smoking - Cigarettes</b>				
<b>Smoking - Lighters</b>				
<b>Smoking - Other</b> _____				
<b>Metals - Bottles Caps</b>				

<b>Metals -</b> Miscellaneous Scraps				
<b>Metals - Other</b> _____				
<b>Shipping and Product Packaging -</b> Cartons				
<b>Shipping and Product Packaging -</b> Takeout Food Containers (Plastic)				
<b>Shipping and Product Packaging -</b> Take-out Food Containers (Paper)				
<b>Shipping and Product Packaging -</b> Food wrappers				
<b>Shipping and Product Packaging -</b> Other _____				
<b>Other -</b> _____				
<b>Other -</b> _____				
<b>Other -</b> _____				
<b>Other -</b> _____				
<b>Other -</b> _____				

# Materials - Communications

Materials	Quantity	Function
PFD	5	Safety precautions
Phones/Cameras	4	Documentation
Banners	1	symbol of where sampling is taking place.
Pamphlets	10-20	Make before going out to hand to people interested
Drones	4	Photography sampling.
Go-Pro	1	Photography.
Heavy lift drone	1	Photography and sampling.



# Data and Data Analysis



Our findings and its analysis

# Data - Physical Chemistry

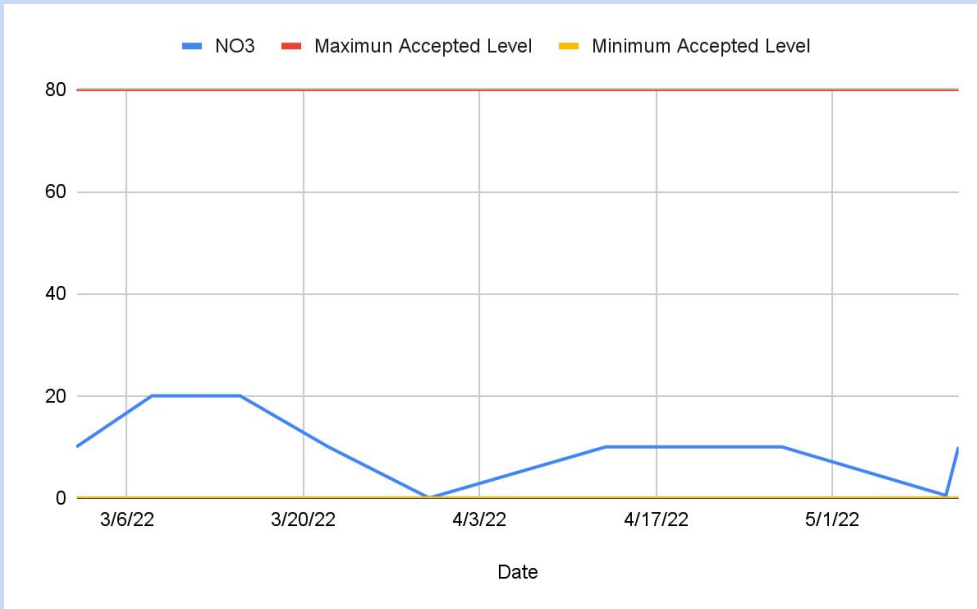


Figure 05: **NO<sub>3</sub> Data of West Side of Governors Island** NO<sub>3</sub> levels all far below the maximum acceptable. Fluctuations throughout.

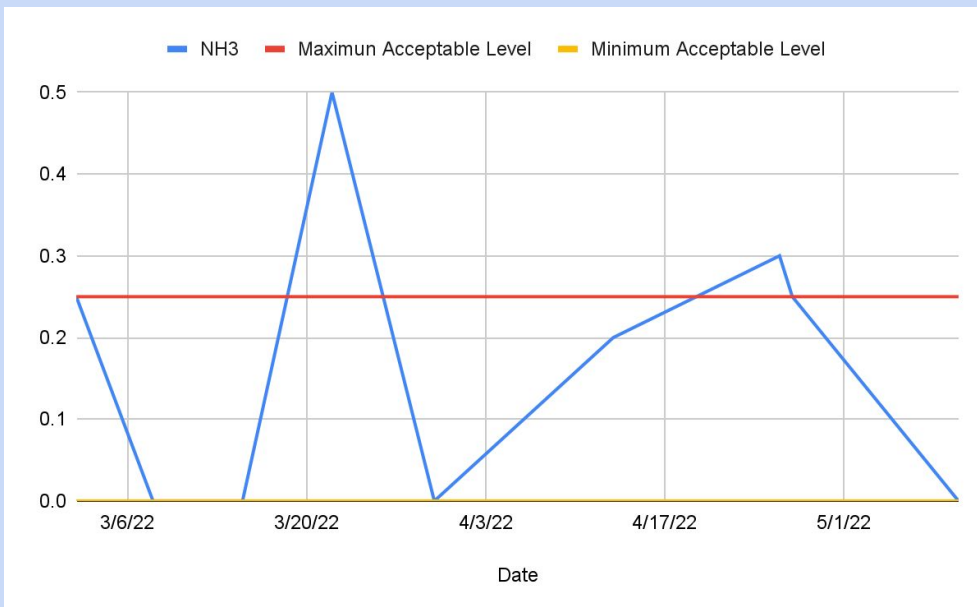


Figure 06: **NH<sub>3</sub> Data of West Side of Governors Island** NH<sub>3</sub> levels stay primarily under the maximum acceptable level but has spiked above it twice.

# Data - Physical Chemistry

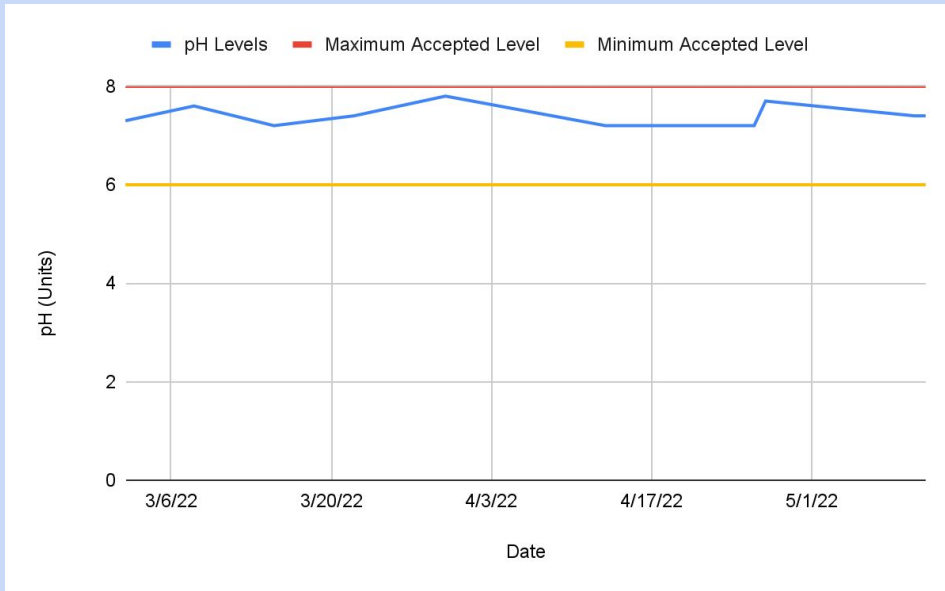


Figure 07: **pH Data of West Side of Governors Island** pH levels stay within acceptable levels of NY Harbor. Acceptable levels gained from Harbor SEALS site based on acceptable levels for Striped Bass.

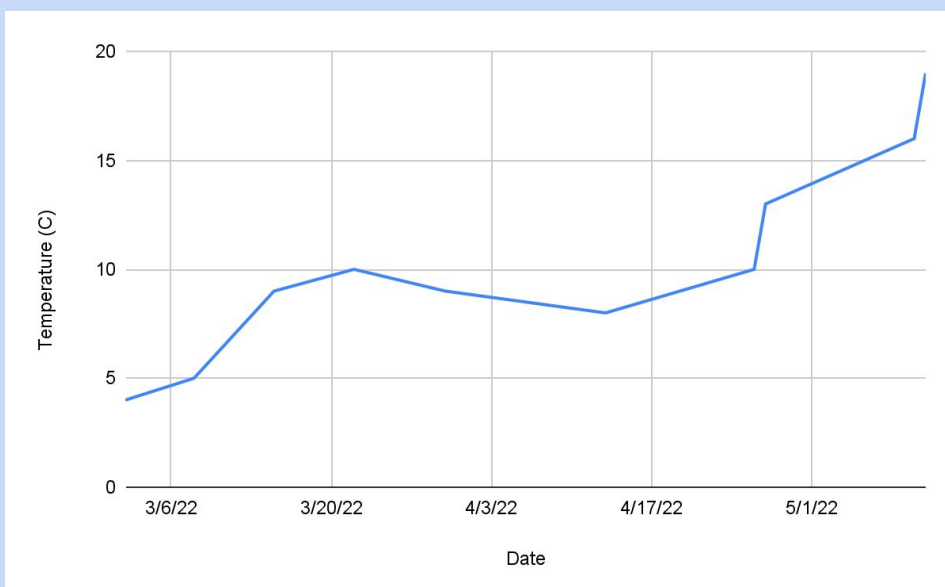


Figure 08: **Water Temperature Data of West Side of Governors Island** Water temperature increases as the date gets closer to summer.

# Data Analysis - Physical Chemistry

- pH stayed within acceptable levels without even dipping above or below 7. The highest pH recorded was 7.8 while the lowest was 7.2 meaning it had a range of 0.6 (Figure 07)
- Water temperature increased as it is closer to summer, which correlates with seasons, so as air temperature increases, water temperature increases as well (Figure 08)
- $\text{NO}_3$  stayed well under the maximum acceptable level of 80ppm and some fluctuation but not an incredible amount. The highest  $\text{NO}_3$  recorded was 20ppm while the lowest was 0 meaning it had a range of 20. (Figure 05)

# Data - Marine Debris (Quadrat)

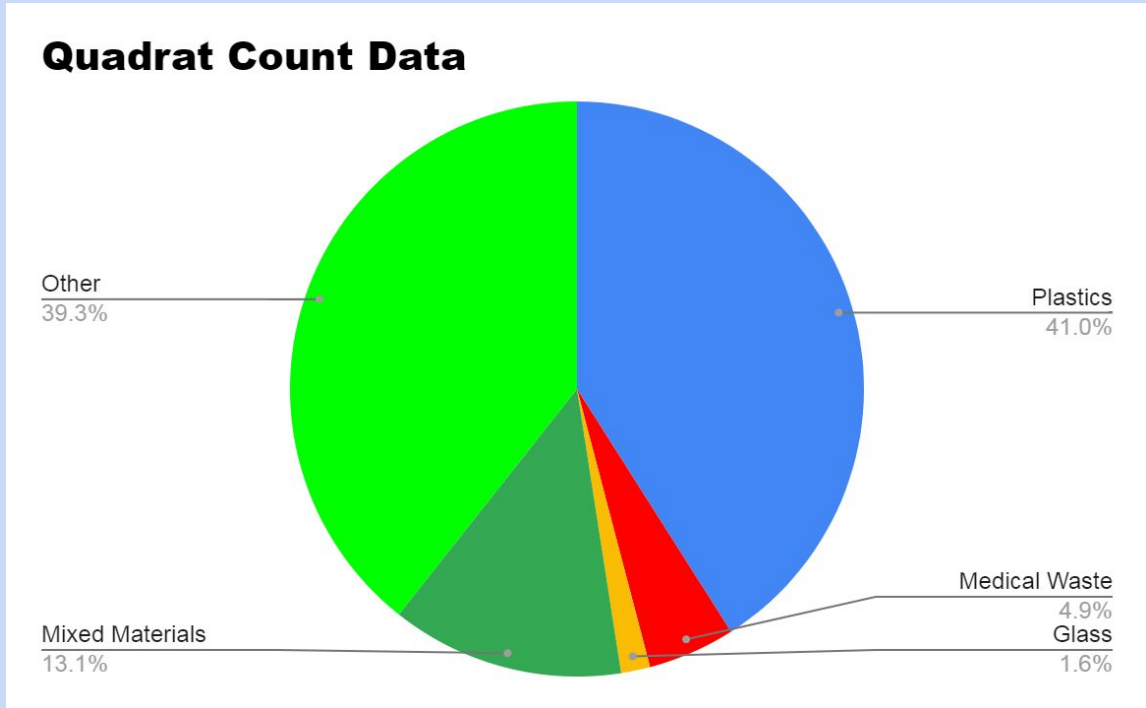


Figure 01: **Quadrat Count of Debris Collected on the WestSide of Governors Island** The majority of the debris found was “plastics” (examples found on page-)

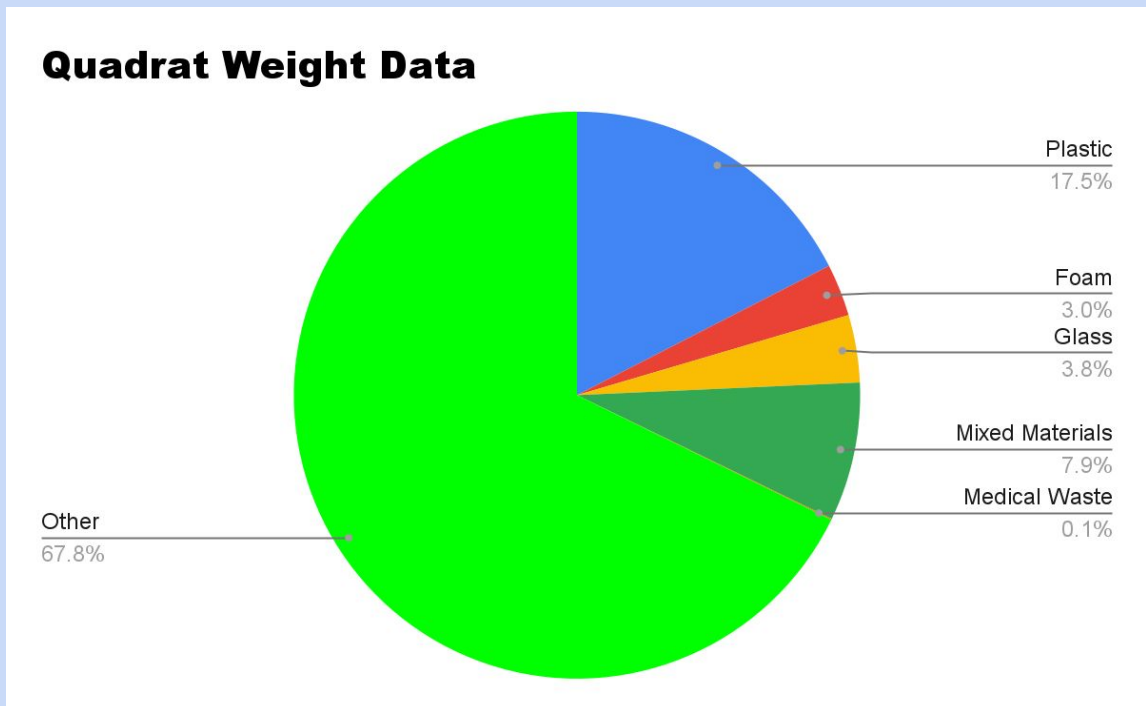


Figure 02: **Quadrat Weight of Debris Collected on the Westside of Governors Island** Majority of the weight collected was “other”

# Data Analysis-

## Marine Debris (Quadrat)

- Graphs are formatted as a percentage of total debris collected.
- Some types of debris could not be tallied due to their overwhelming quantity.
  - Foam
  - Straws
  - Pens
  - Other Small Miscellaneous Items
- Vast majority of debris collected did not belong to a predetermined category.
- Plastic was the most common material found taking up 41% of total quadrat debris collected.
- Data was not consistent with theories going into the project.
- Despite making up such a small amount of the total weight, foam had the highest volume of all categories.

# Data- Marine Debris (Non-Quadrat)

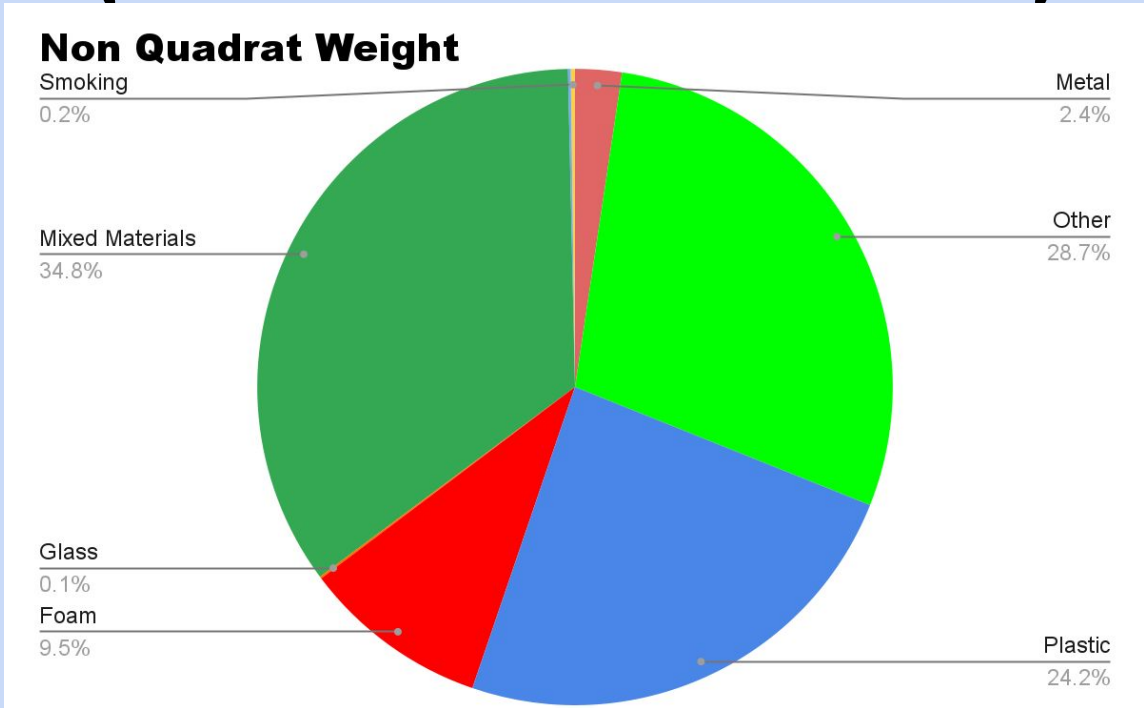


Figure 03: **Non Quadrat Weight of Debris Collected on the Westside of Governors Island** Mixed Materials, Other, and Plastics (In descending order ) are the heaviest items weighed and retrieved over a span of sampling dates.

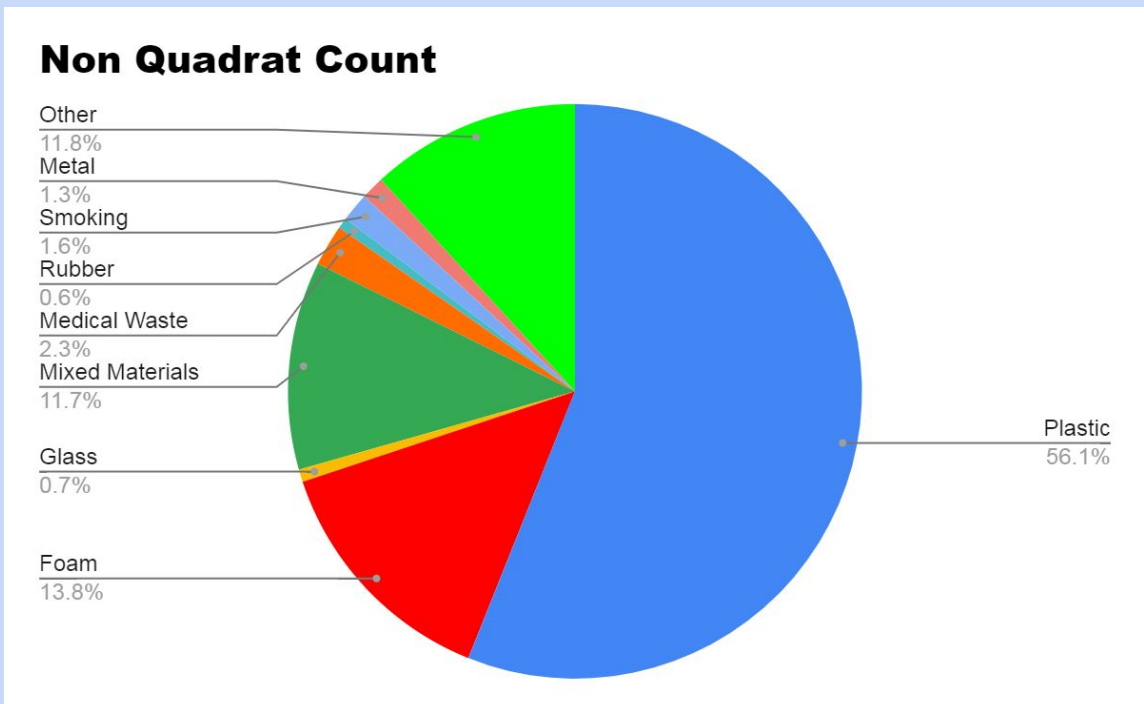


Figure 04: **Non-Quadrat Count of Debris Collected on the WestSide of Governors Island** Plastics was the debris most frequently found



# Data Analysis-

## Marine Debris (Non-Quadrat)

- Non quadrat data helps us assess what is washing up rather than how often debris is washing up.
- Non quadrat samples have significantly more volume
- Mixed material debris takes up the vast majority of non quadrat weight.
- Plastics make up the majority of non quadrat count.
- Contrary to student theory, medical waste made up only 2.3% of total non quadrat waste.

# Conclusions

- Physical chemistry data remained consistent with previous water quality survey findings.
- By continuing study of garbage congregation in future years we can better understand the current state of pollution in the New York Harbor.

# How You Can Help?

GET INVOLVED – Little things go a long way



- Meet with your Councilmembers to discuss issues with marine policy.
- Volunteer at beach cleanups, or local places.
- If you see garbage pick it up!
- Wait until you are back at the shore to dump your waste in a safe place so that it will not get into our waterways.
- Use all-natural and non-toxic cleaning products for your boat and house.

# How You Can Help?

GET INVOLVED – Little things go a long way



- Introduce renewable energy sources into your boating
- Wind, Solar, and hydroelectric energy to power necessities for things like lighting, refrigeration, etc.
- Testify at your local government hearings and discuss the issues of climate change and pollution policy.
- Share our work, and raise awareness

# Thanks To All of Our Sponsors



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