Impacts of Microplastics on Corals

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Global Oceanic Pollution

- As the world continues to develop and industrialize, more and more debris is being produced
- Unfortunately, a lot of pollution is released within the ocean
- This pollution includes the following:
  - Plastics
  - Garbage
  - Industrial Waste
  - Sediments (Dredging)

Oceanic Dumping Regulation

- Before 1972, the United States had little to no legislation dictating Ocean Dumping
- The Marine Protection, Research, and Sanctuaries Act was passed in 1972
  - Also known as the Ocean Dumping Act
- It regulates the dumping of materials that causes any of the following affects:
  - Detrimental to Human Health
  - Negatively Affect Welfare or Amenities
  - Destructive with regards to the Marine Ecosystem, Ecological Systems, or Economic Potentialities

Why are Plastics a BIG Issue?

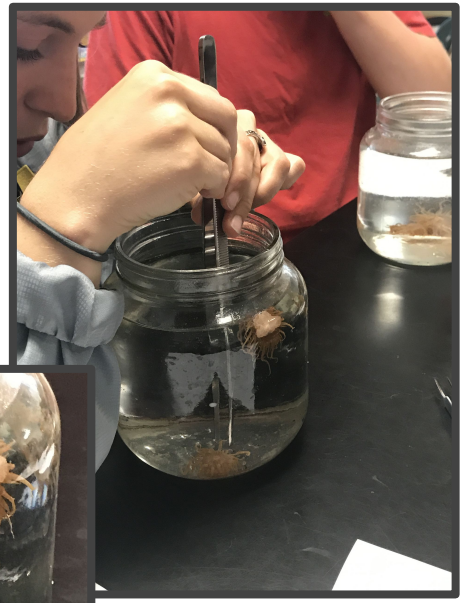
- 8 Million tons of plastics are dumped into oceans each year.
- Sharp plastic fibers cut coral organisms, while other plastic fabrics smother them and block light and oxygen.
- Being cut by the microplastics causes wounds and leads to infections and a higher rate of disease.
- Bioaccumulation and Biomagnification

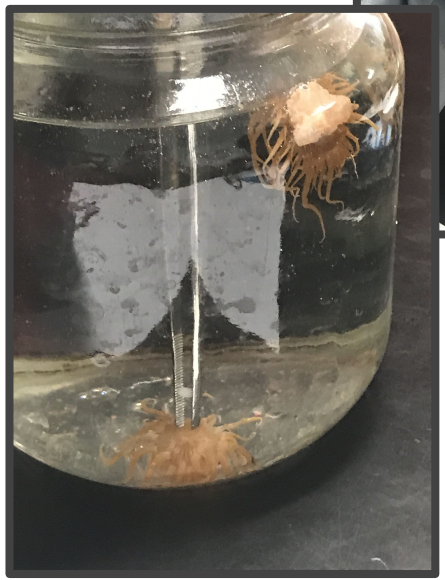
Why the Plastics?

- Plastic can not be easily removed because they are so persistent; instead, they accumulate in organisms and persist much longer than on land.
    - It takes an average of 500 years for a plastic bottle to biodegrade.

Independent Research

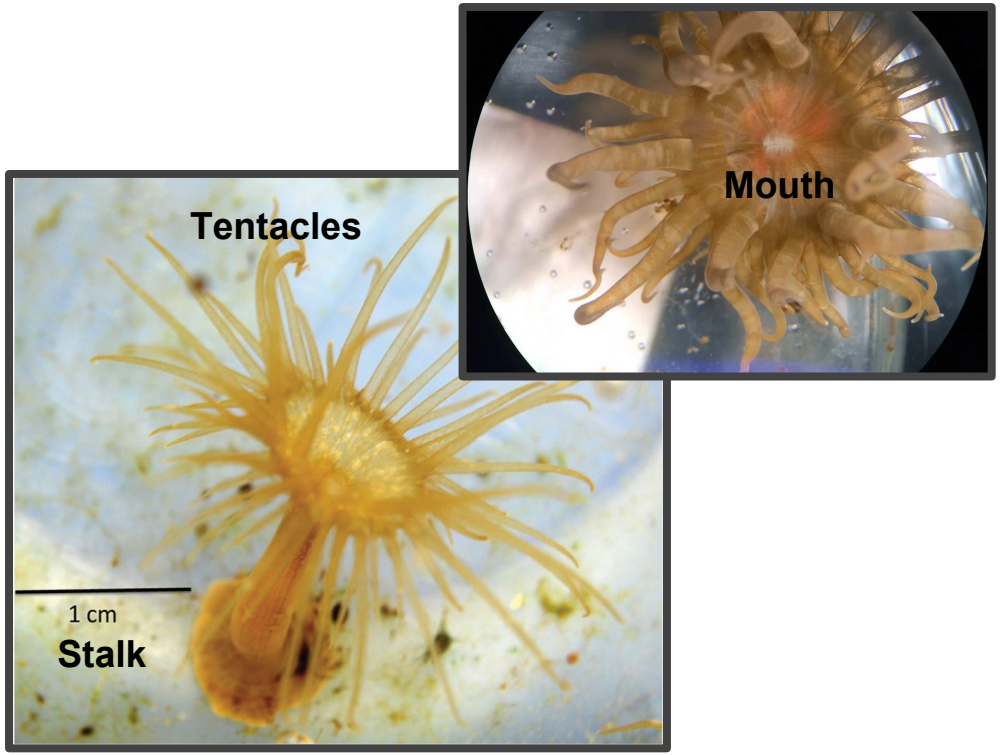
- Regarding research and experimentation with the effects of plastic on corals, there is very little data
- James Cook University in Australia conducted experiments with corals from the Great Barrier Reef
- Dr. Mia Hoogenboom fed corals microplastics via similar methods to our experiment
- She found that the corals ate the plastics at a rate only slightly less than what they feed on marine plankton, their natural food source



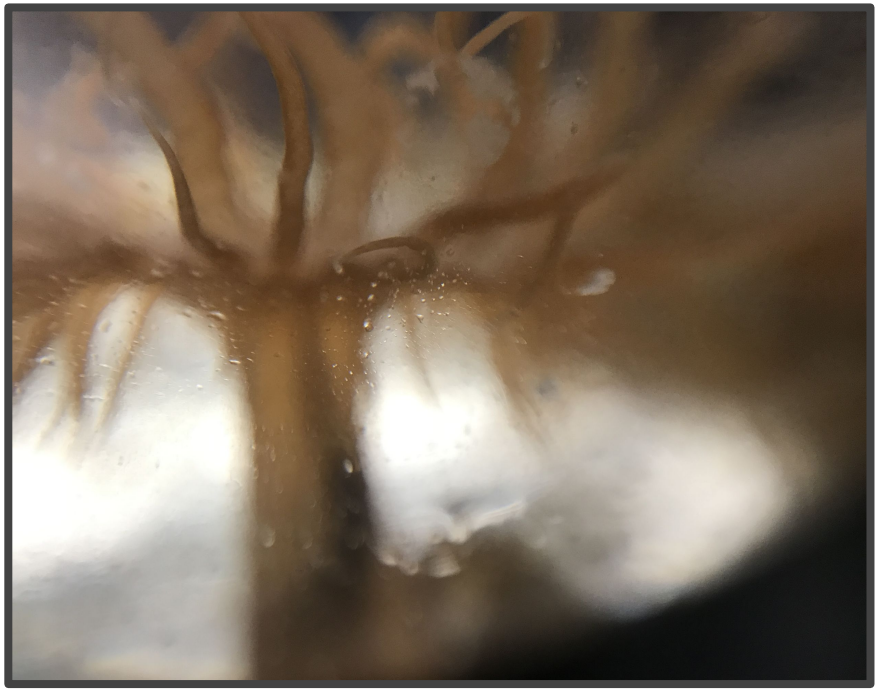


Anatomy of an Anemone

- The anemone used throughout our experiment is *Aiptasia pallida*
- The **Stalk** of the anemone attaches it to a substrate
- The **Tentacles** collect food for the anemone to eat
- The **Gastrovascular Cavity** digests food particles
- The **Zooxanthellae** are photosynthetic symbiotes which allow the anemone to gain food through photosynthesis



Why Are Anemones Susceptible to Eating Plastics?



- When plastics come from factories it has tons of chemical additives.
- Some of the chemicals act as a stimulant that would appeal to coral.
- Anemones feed on drifting matter, which is why they tend to eat microplastics
- They feed by touch, not sight, so they can easily mistake microplastics for phytoplankton

Purpose of the Experiment

- The purpose of this experiment is to determine which type of material *Aiptasia pallida* will prefer
- The types of material include the following
  - Styrofoam
  - Marine Debris Plastic
  - Plastic Bag
  - Plastic Pellets

Hypothesis

- We hypothesized that *A. pallida* would eat plastics, and that it would prefer the marine plastics because they could potentially have algal or planktonic growth on them-- natural sources of food for anemones

Procedure

- Various types of microplastics that pollute our oceans were used to test which type of microplastics sea anemones are more attracted to.
    - The sea anemones were fed marine debris (hard plastics), pieces of plastic bags, pre production pellets, and styrofoam with forceps so oils and chemicals on our hands did not get on the plastics, possibly affecting the outcome.
- Once the sea anemone ingested the plastic fed to them, we started the timer and timed how long until the sea anemones eject the plastic.
    - This tells us which plastic pollutant the sea anemones prefer: The longer the sea anemones kept, the more they prefered it.

Group Analysis

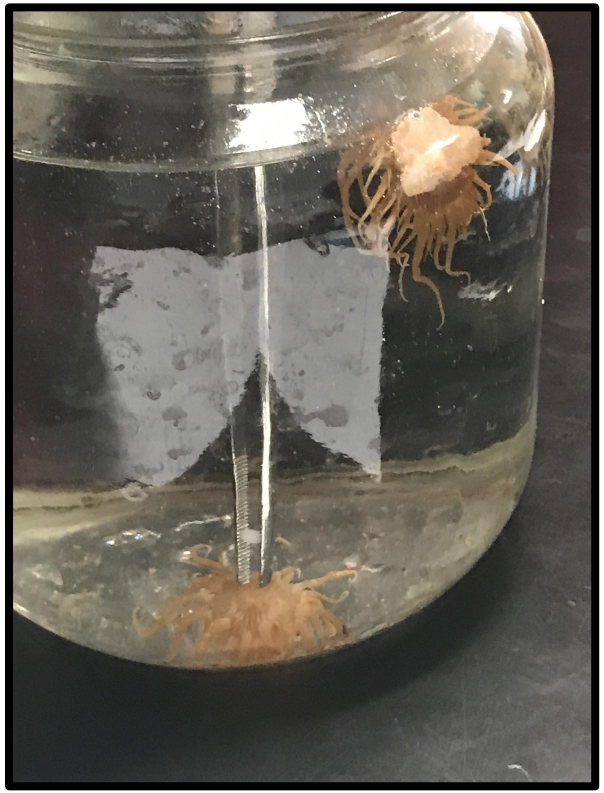
- Percentage attached:
  - Our group's data showed that all samples of plastic pollution (plastic bag, marine debris-hard plastics, styrofoam, and plastic preproduction pellets) were 100% attached to the A. *pallida* when offered to it
- Percentage Ingested:
  - Based on our group's data:
    - 100% of the preproduction pellets that were offered to A. *pallida* were ingested
    - 66.67% of the marine debris that was offered to A. *pallida* was ingested
    - 50% of the plastic bag that was offered to A. *pallida* was ingested
    - 33.33% of the styrofoam that was offered to A. *pallida* was ingested

Group Analysis Cont.

- Average time ingested:
  - Based on our group's data:
    - The average time of ingestion of the preproduction pellets was 74 minutes
    - The average time of ingestion of the marine debris was 46.5 minutes
    - The average time of ingestion of the plastic bag was 20 minutes
    - The average time of ingestion of styrofoam was 22 minutes

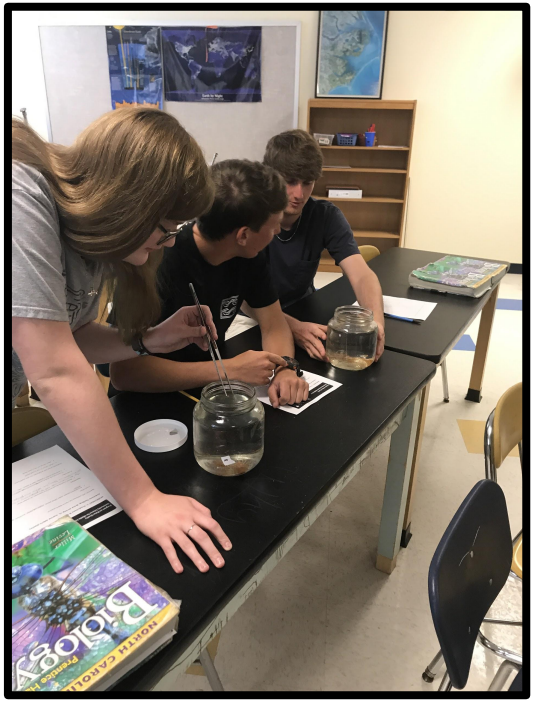
Class Analysis

- Percentage attached:
  - The class's data showed that all samples of plastic pollution (plastic bag, marine debris-hard plastics, styrofoam, and plastic preproduction pellets) were 100% attached to the A. *pallida* when offered to it
- Percentage Ingested:
  - Based on the class's data:
    - 93% of the preproduction pellets that were offered to the A. *pallida* were ingested
    - 78% of the marine debris that was offered to the A. *pallida* was ingested
    - 76% of the plastic bag that was offered to the A. *pallida* was ingested
    - 57% of the styrofoam that was offered to the A. *pallida* was ingested

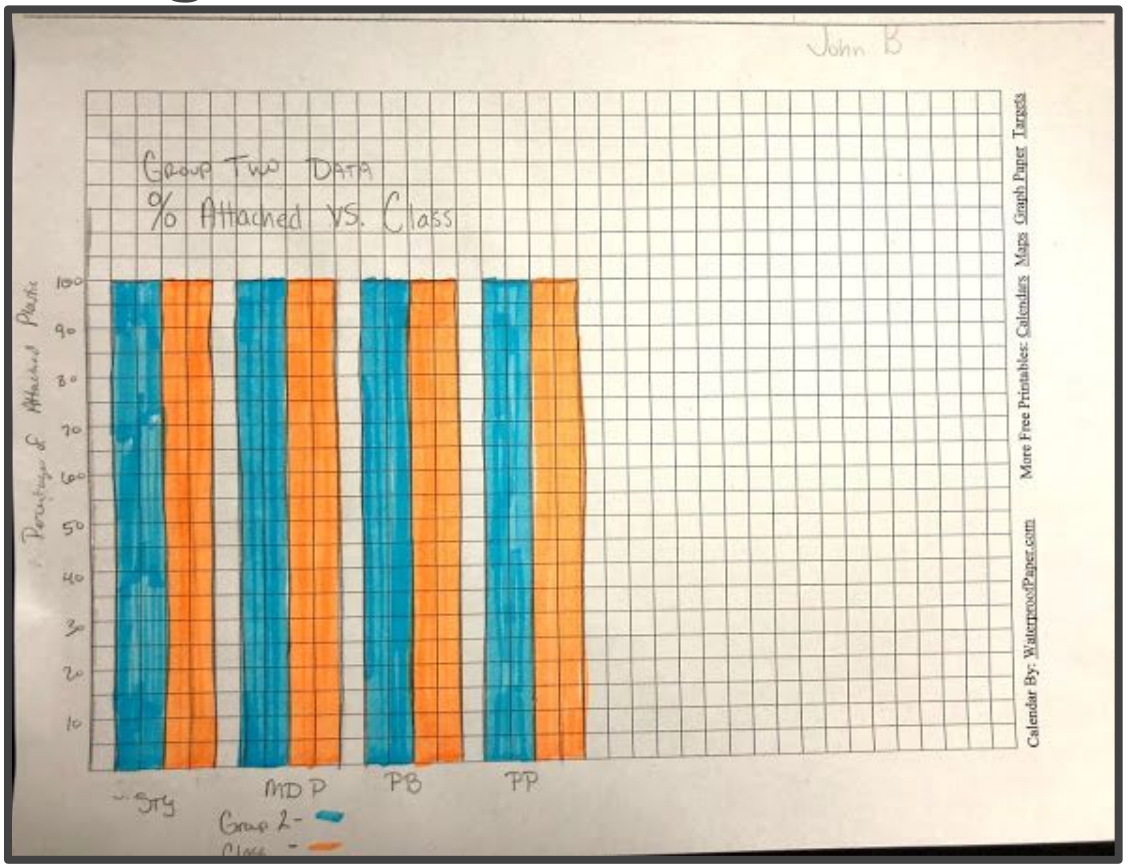


Class Analysis Cont.

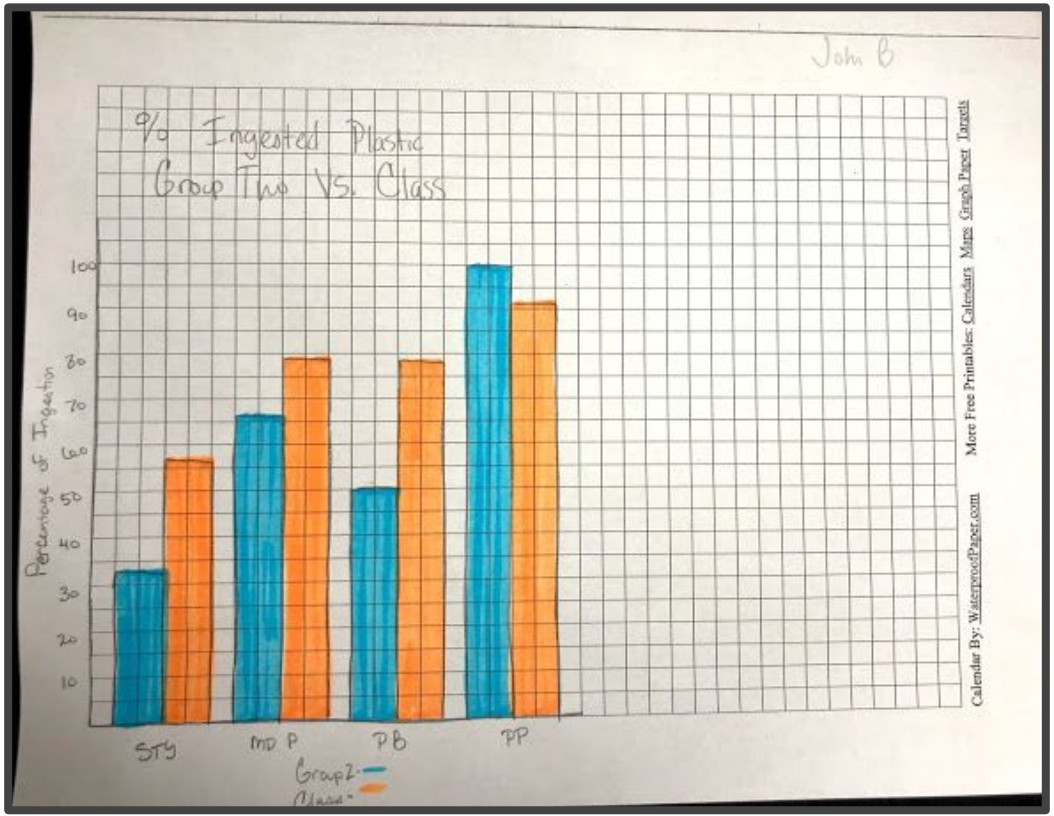
- Class data results:
  - Average time ingested:
    - Based on the class's data:
      - The average time of ingestion of the preproduction pellets was 77 minutes
      - The average time of ingestion of the marine debris was 72 minutes
      - The average time of ingestion of the plastic bag was 45 minutes
      - The average time of ingestion of styrofoam was 37 minutes



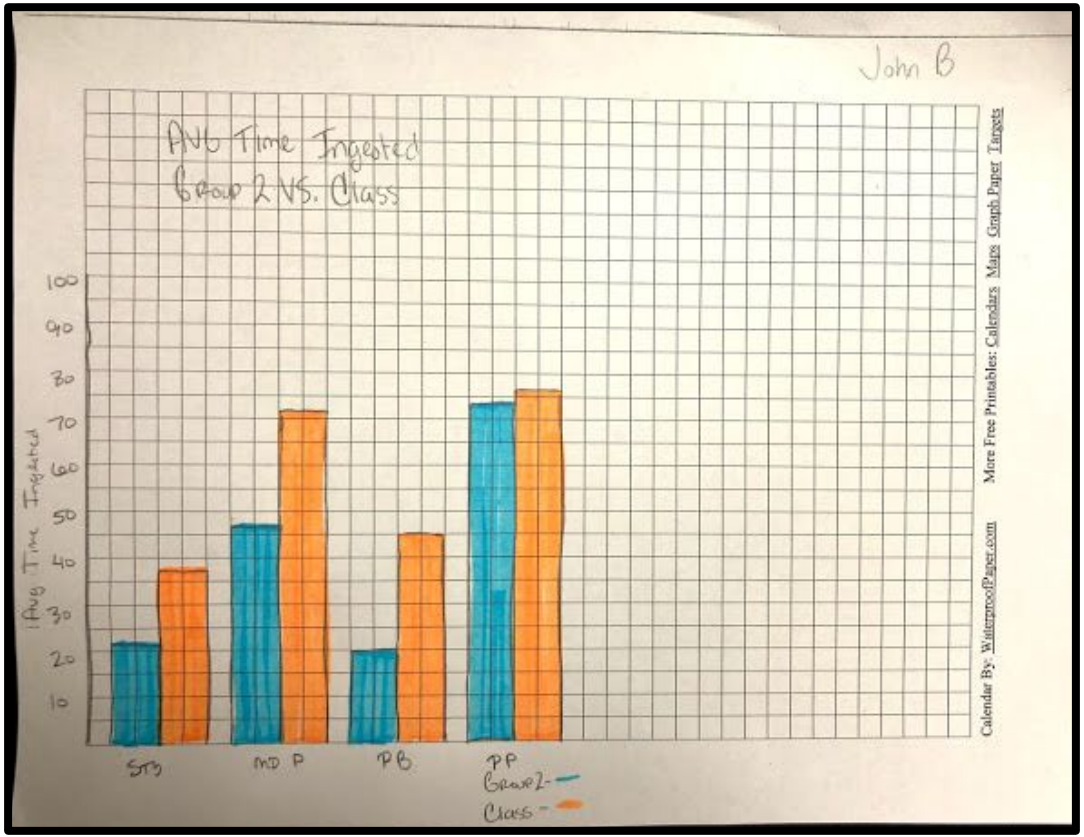
Percentage Attached: Group vs. Class



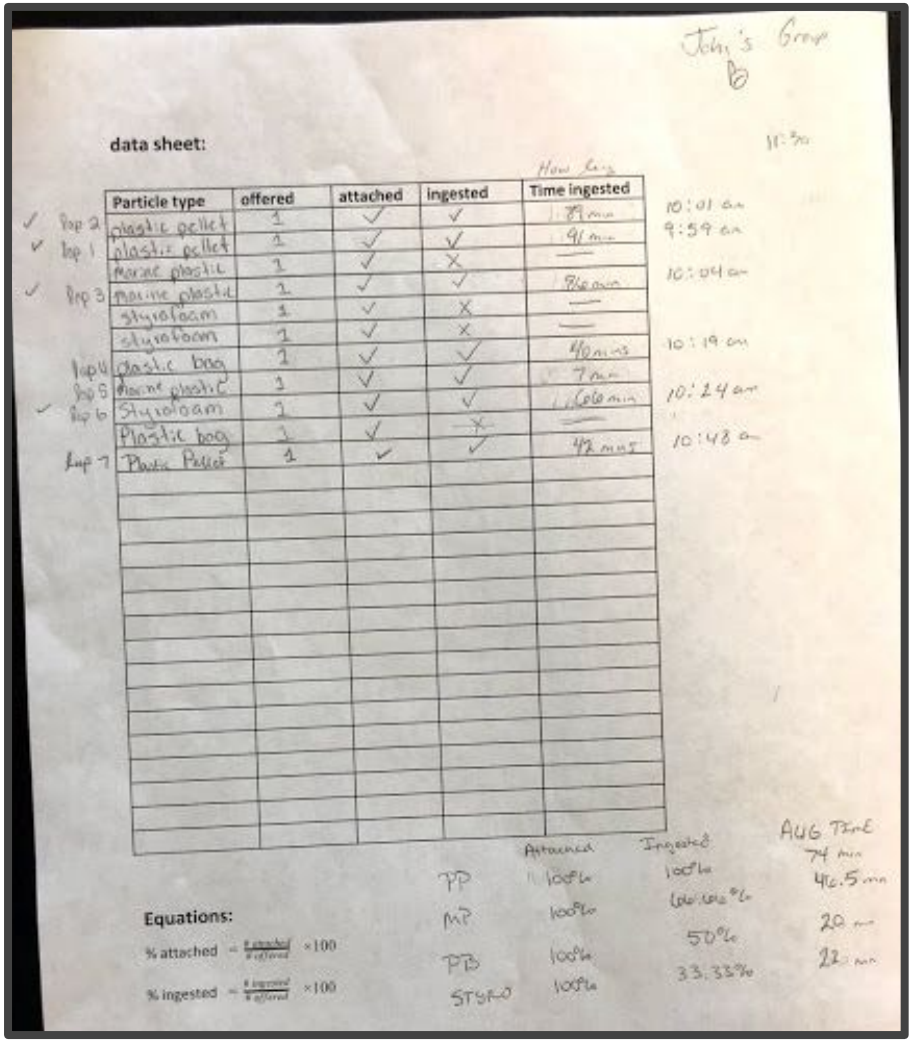
Percentage Ingested: Group vs. Class



Average Time Ingested: Group vs. Class



Collective Group Data



John's Group B

data sheet:

Particle type	offered	attached	ingested	Time ingested
Pop 2 plastic pellet	1	✓	✓	81 min
Pop 1 plastic pellet	1	✓	✓	91 min
marine plastic	1	✓	X	—
Pop 3 marine plastic	1	✓	✓	86 min
styrofoam	1	✓	X	—
styrofoam	1	✓	X	—
Pop 4 plastic bag	1	✓	✓	40 mins
Pop 8 marine plastic	1	✓	✓	7 min
Pop 6 Styrofoam	1	✓	✓	660 min
Plastic bag	1	✓	X	—
Pop 7 Plastic Pellet	1	✓	✓	42 mins

How long

10:01 am
9:59 am
10:04 am
10:19 am
10:24 am
10:48 a

	Attached	Ingested	AVG Time
PP	100%	100%	74 min
MP	100%	66.66%	46.5 min
PB	100%	50%	20 min
STYRO	100%	33.33%	22 min

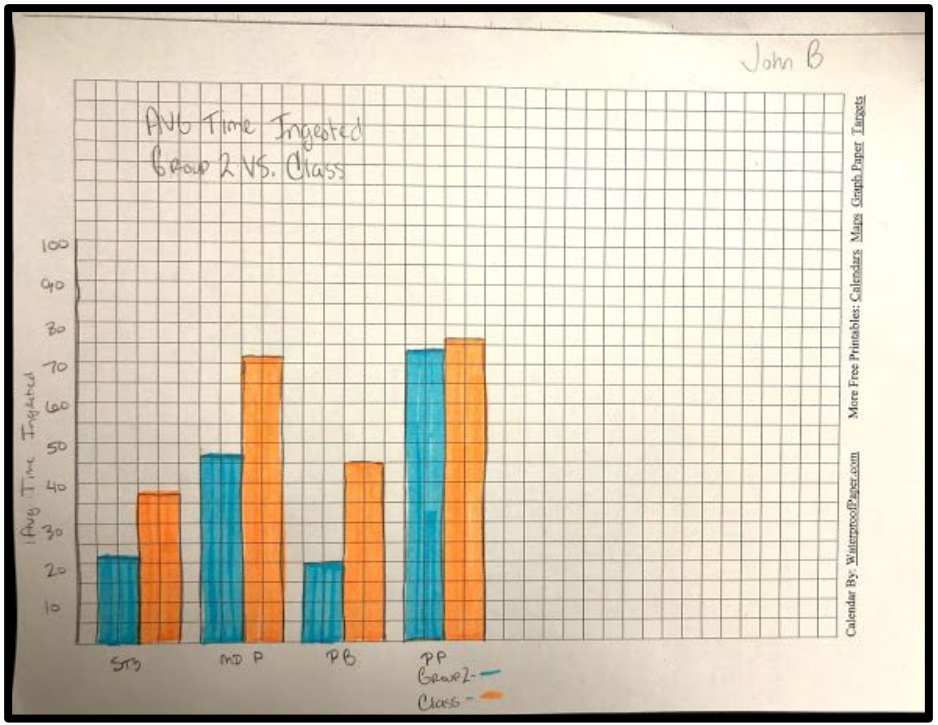
Equations:

% attached = $\frac{\text{\# attached}}{\text{\# offered}} \times 100$

% ingested = $\frac{\text{\# ingested}}{\text{\# offered}} \times 100$

Conclusion

- We found that corals will eat plastics
- Our hypothesis stating that A. *pallida* would prefer the marine debris over the other plastics was falsified by the data collected by the group and class.
- Based on the data collected, the A. *pallida* prefers to consume the plastic pellets compared to the other plastic pollution samples.



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