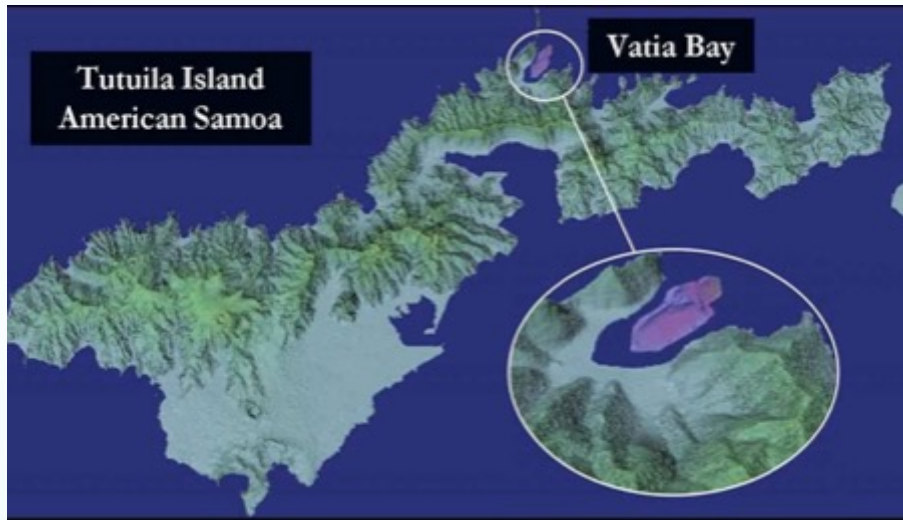


Effect of Stream Nutrients on Benthic Algal Overgrowth in Vatia Bay



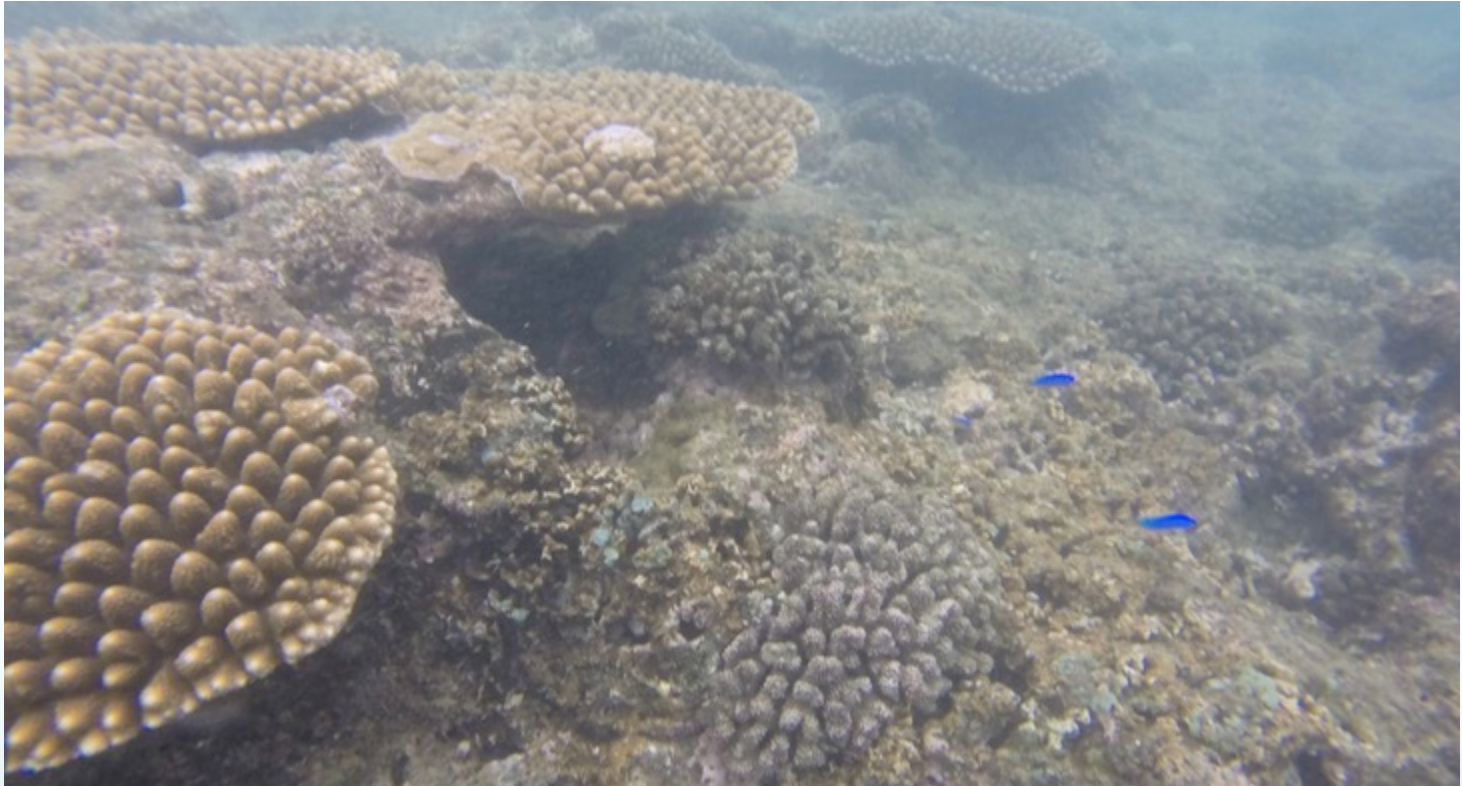
By: Gabrielle Langkilde
Mentored by: Visa Vaivai-Tapusoa

Vatia Bay, American Samoa



Vatia Bay is located on the island of Tutuila, American Samoa's largest Island. The bay is isolated on the north side of the island, away from the majority of the population.

Vatia Bay, American Samoa



Vatia Bay is home to various coral species, which a recent NOAA study has found to be in danger due to harmful algae blooms.

Problem

- Vatia Bay is experiencing an unusual overgrowth of benthic algae.
- An overgrowth of benthic algae can be caused by excess nutrients in the ocean, specifically nitrogen and phosphorus. These algal blooms threaten to outcompete coral reefs, which are unique, economically-valuable ecosystems.

Streams Feeding Vatia Bay



Vatia Bay is fed by several streams, that run down through the village of Vatia.

Streams Feeding Vatia Bay



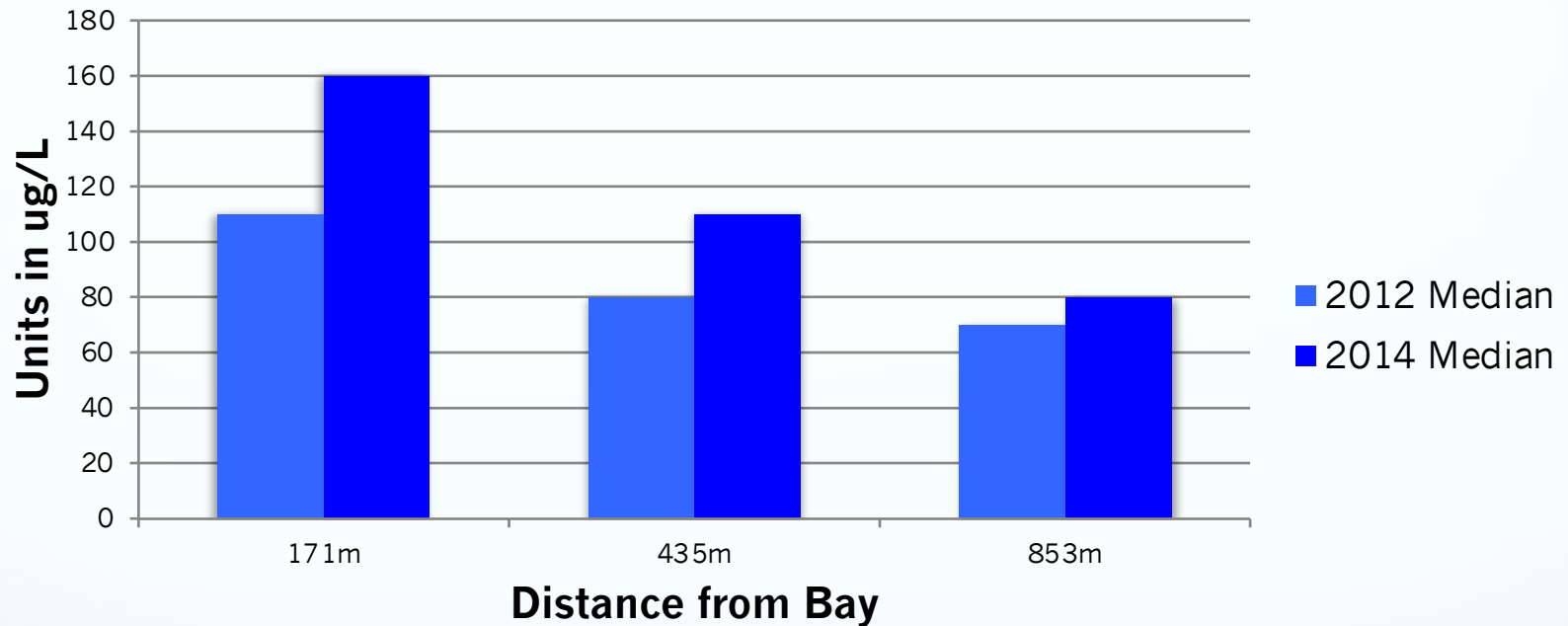
- Inventory and Monitoring Pacific Island Network (PACN) water quality data on the streams feeding Vatia Bay indicates high nutrient levels.

Purpose

This project is aimed at examining whether there may be a relationship between high nutrient levels coming from the streams and the overgrowth of algae in the Bay.

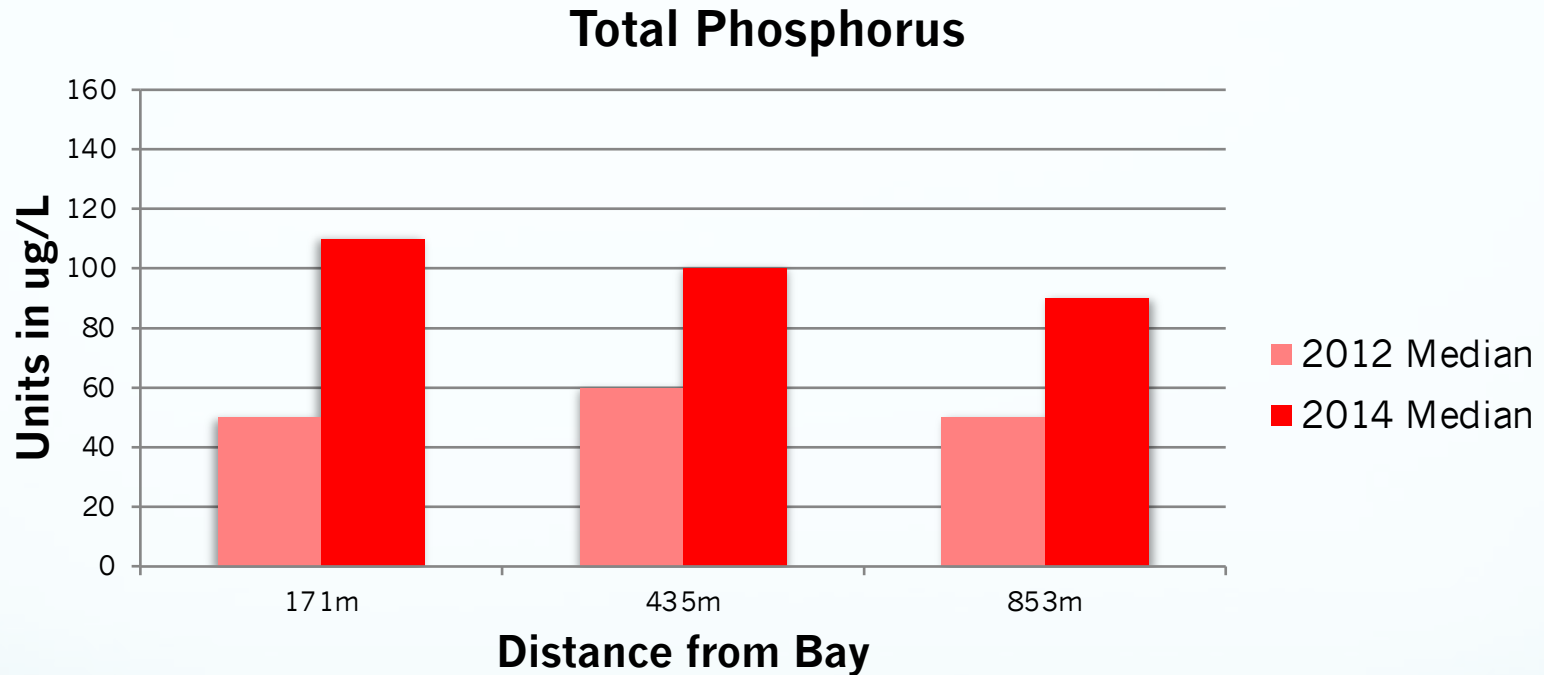
Stream Nutrients- Nitrogen

Total Nitrogen



- Inventory and Monitoring PACN water quality data shows a median increase in levels of **nitrogen** from 2012 to 2014. Data for 2016 was unavailable for purposes of this study.
- This data shown was collected from three different sites along the streams at different distances from the Bay.

Stream Nutrients- Phosphorus



- Inventory and Monitoring PACN water quality data shows a median increase in levels of **phosphorus** from 2012 to 2014. Data for 2016 was unavailable for purposes of this study.
- This data shown was collected from three different sites along the streams at different from the Bay.

Stream Mouths

Stream 1

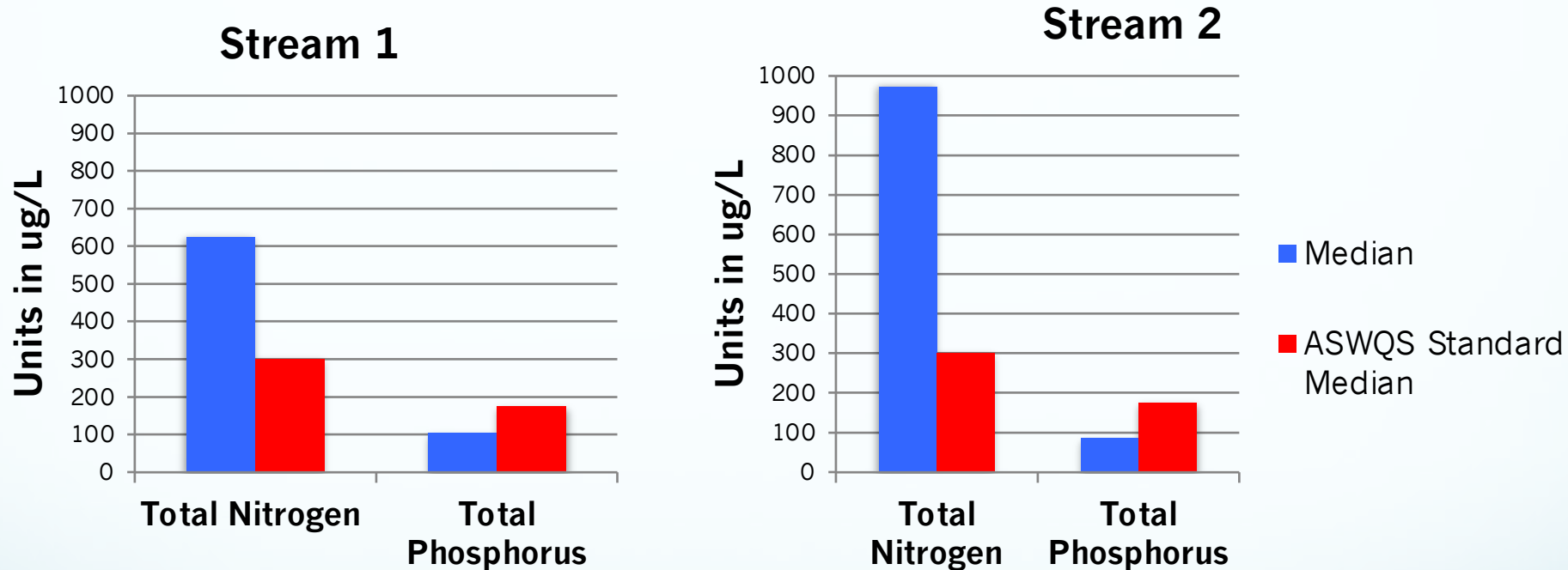


Stream 2



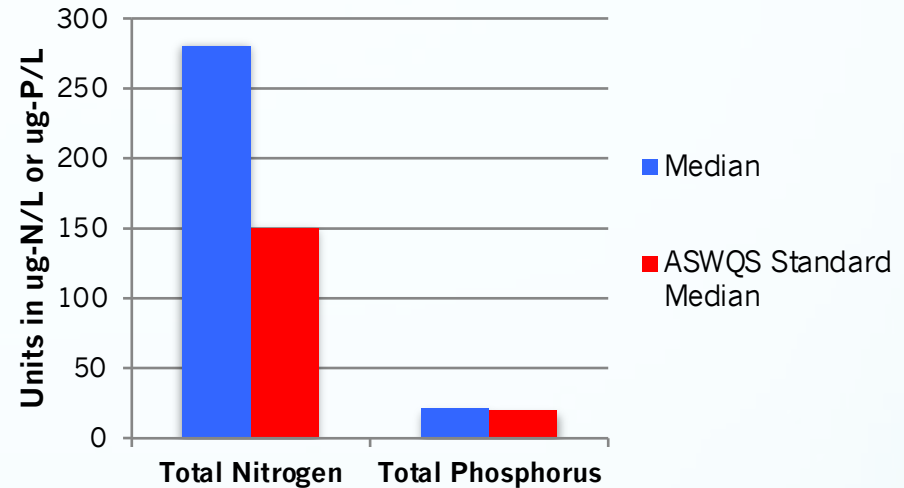
Two streams feeding the Bay, shown as Stream 1 and Stream 2, were identified for this project.

Stream Mouth Nutrients (2015)



According to NOAA data collected from the mouth of these two streams, levels of nitrogen far exceeded American Samoa Water Quality Standards (ASWQS).

Vatia Bay Nutrients (2015)



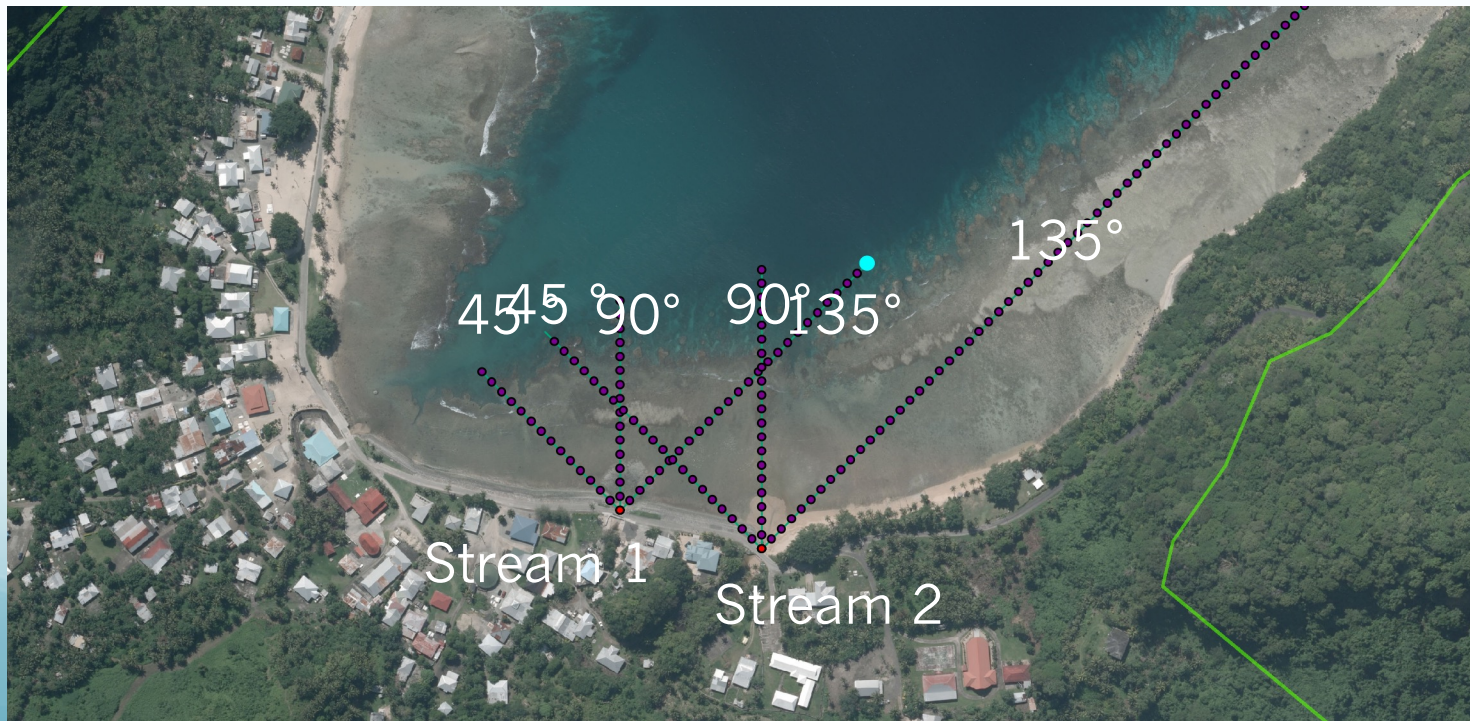
According to NOAA data collected from Vatia Bay, levels of nitrogen and phosphorus exceeded American Samoa Water Quality Standards (ASWQS).

Hypothesis

In examining whether there may be a relationship between the feeding stream nutrients and benthic algal growth, **we hypothesized that the percentage of benthic algae on the ocean floor would decrease as the distance from the mouths of the streams increased.**

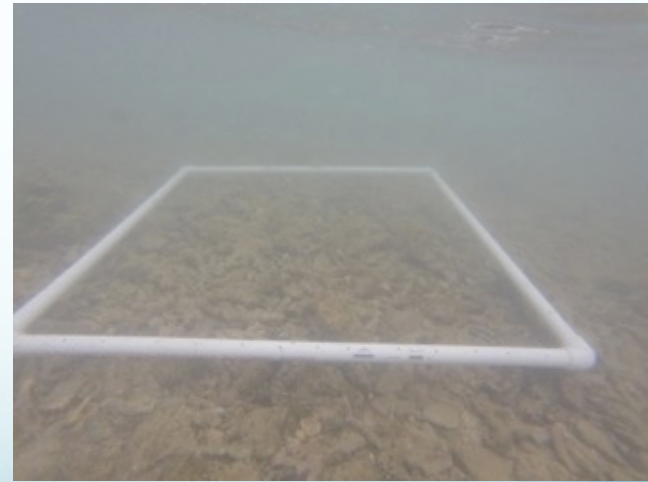
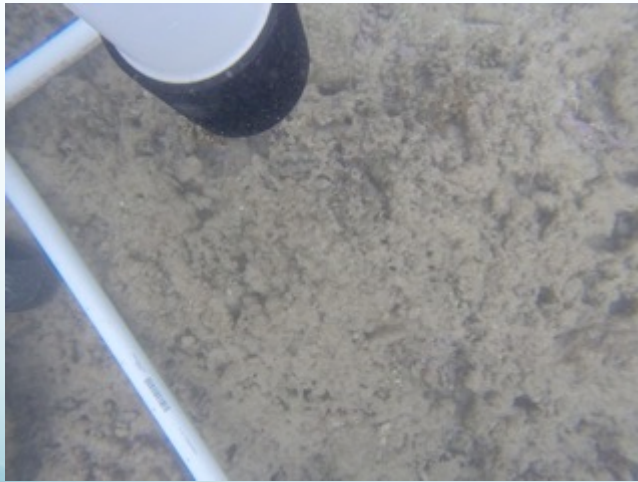
Procedure

Three transects, extending from each stream mouth to the edge of the reef at 45, 90, and 135 degree angles were mapped, with points 20m apart.



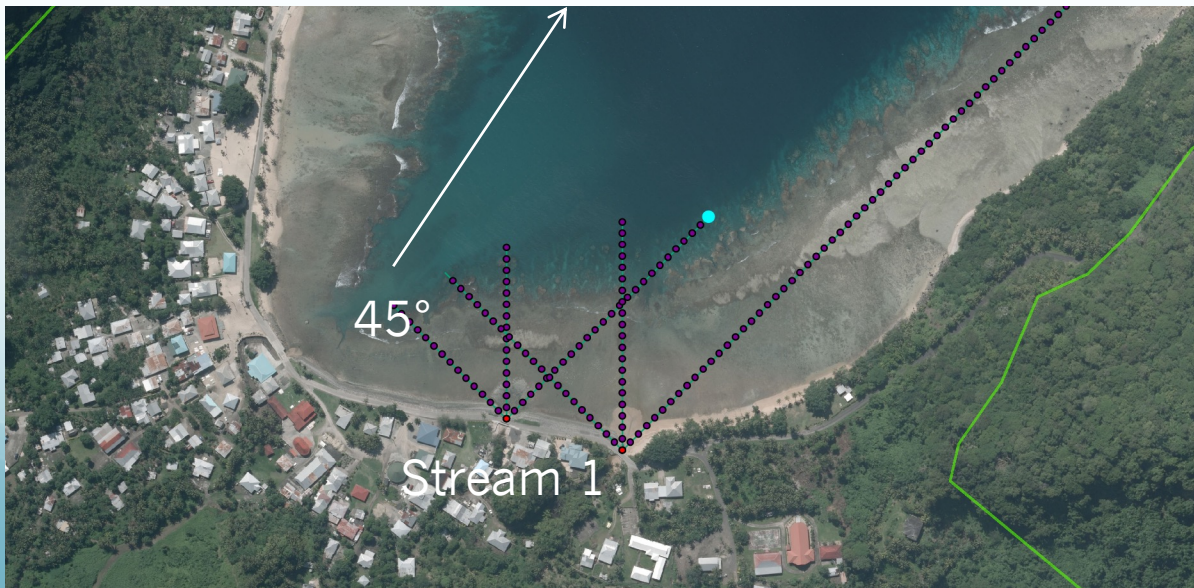
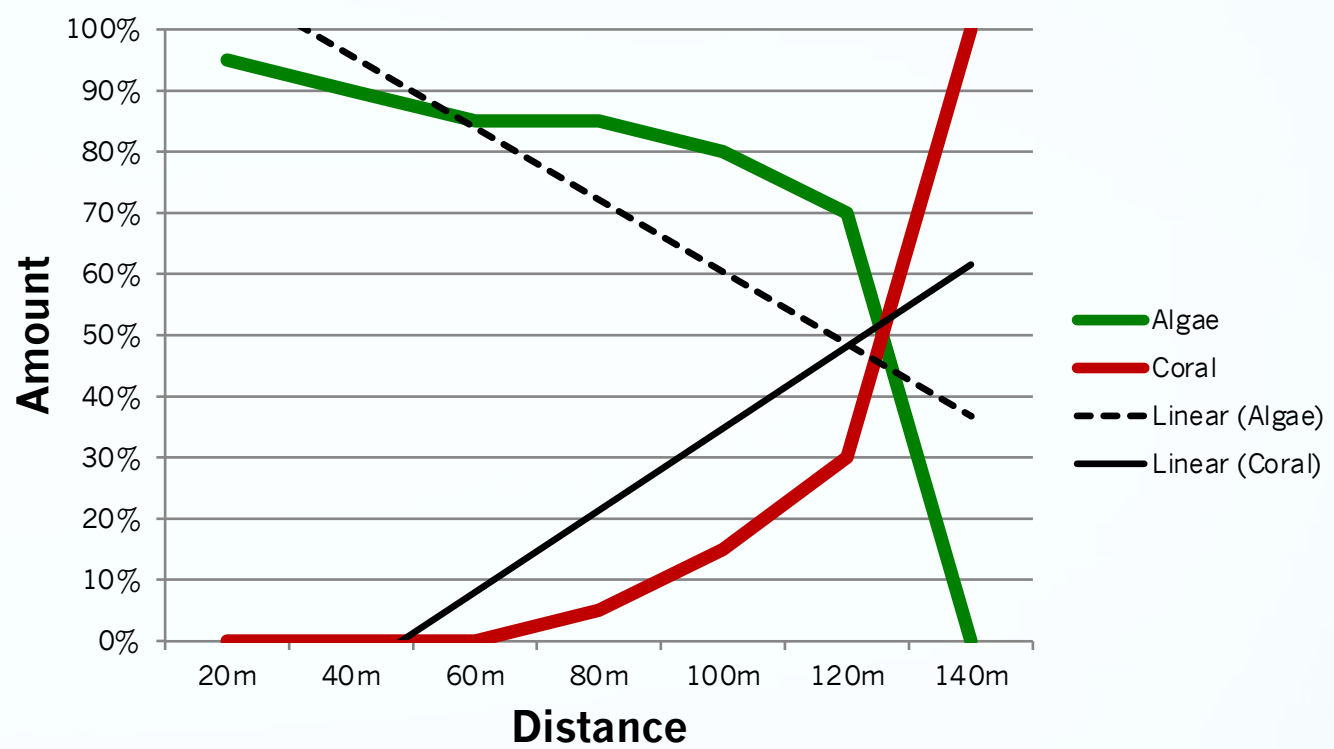
Procedure

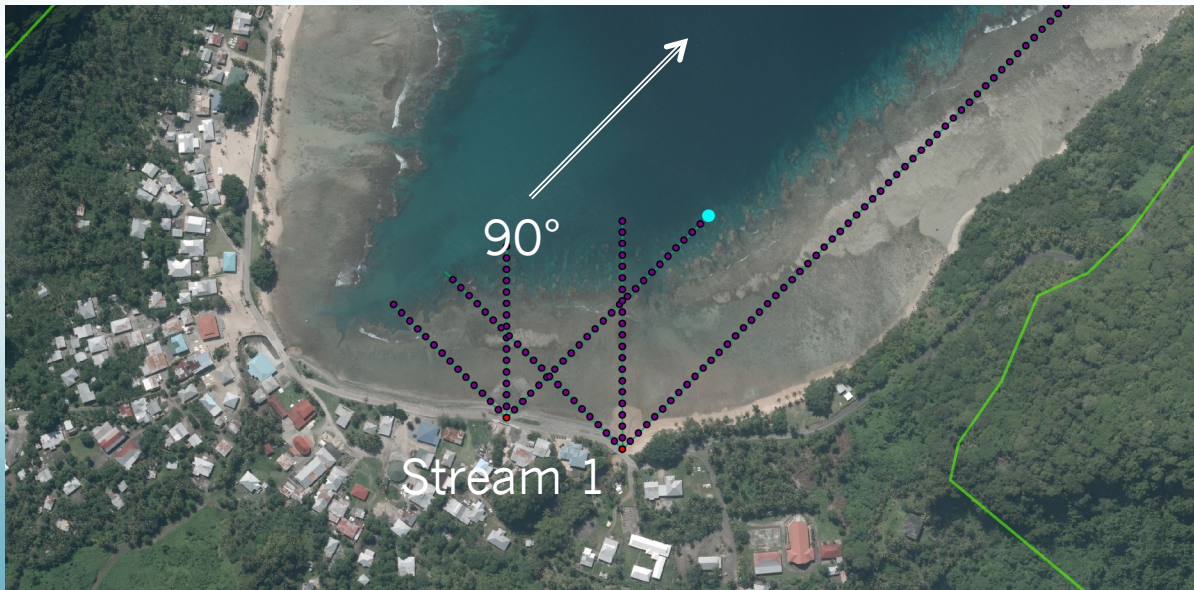
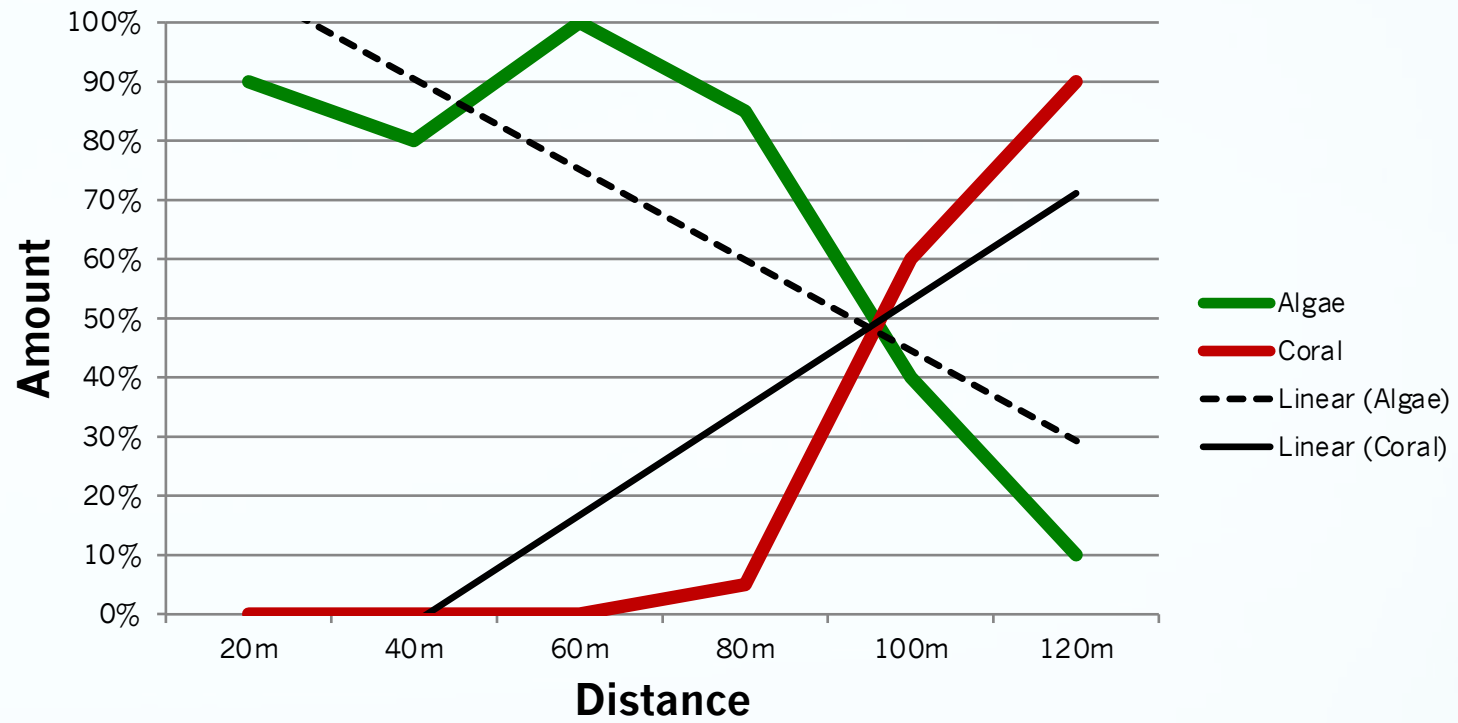
At each of these points, a 1m by 1m quadrat was laid on the ocean floor. Using an aqua-scope to view the material, the percentage of algae, coral, sand, and other material was estimated.

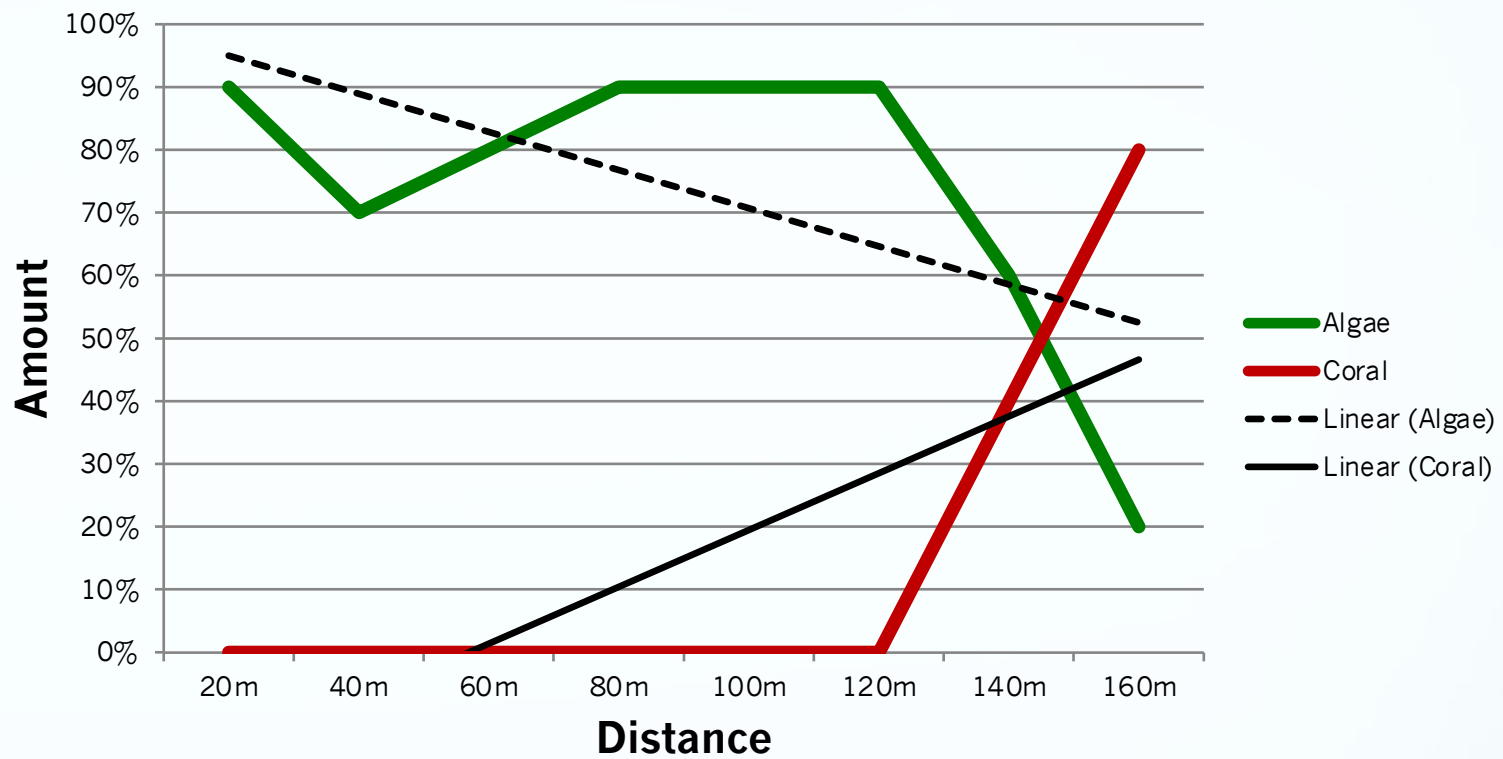


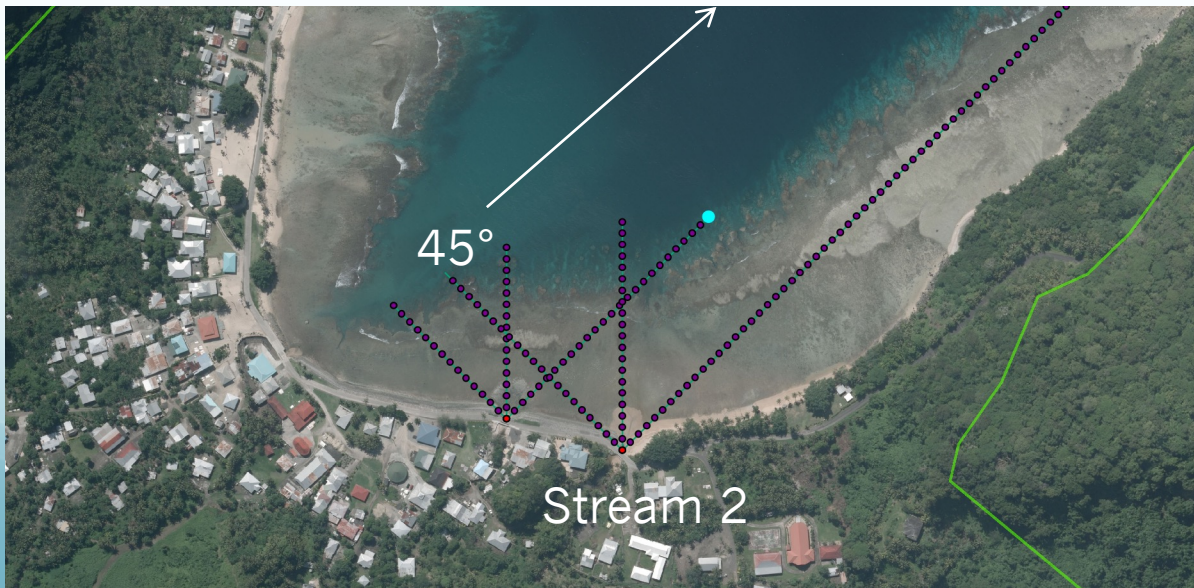
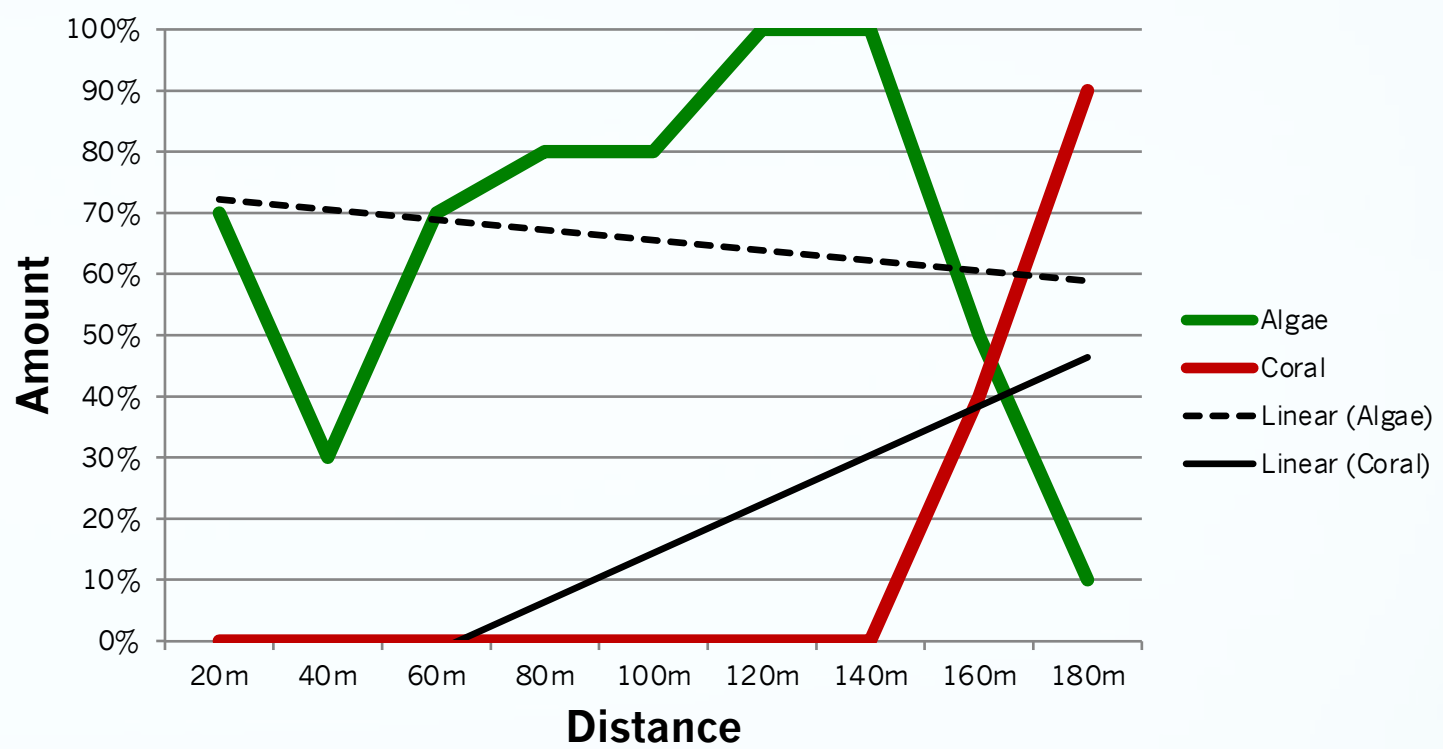
Procedure

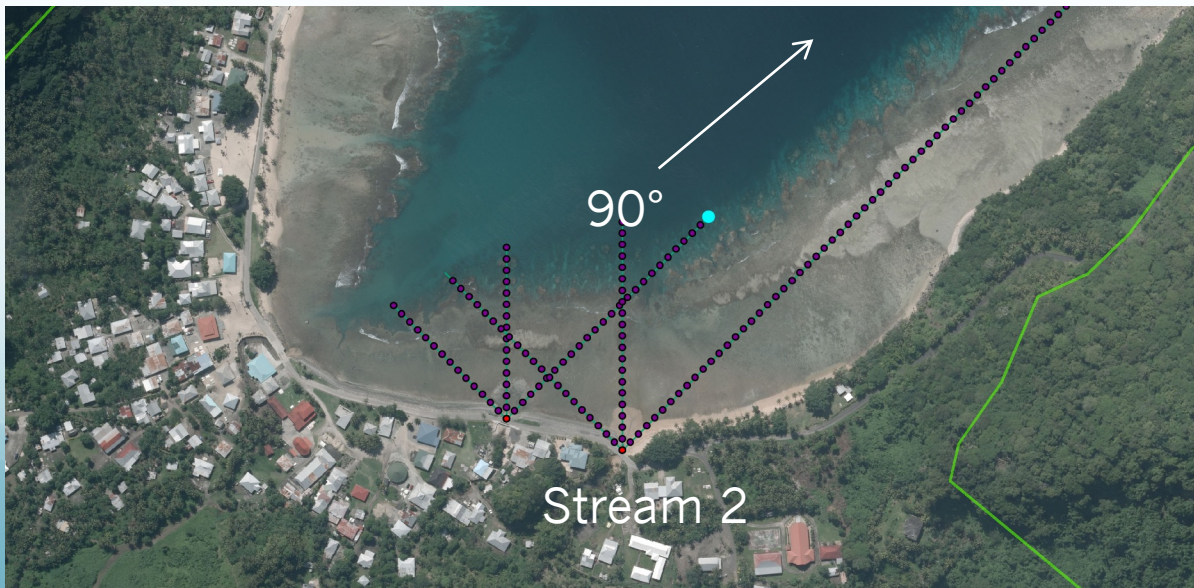
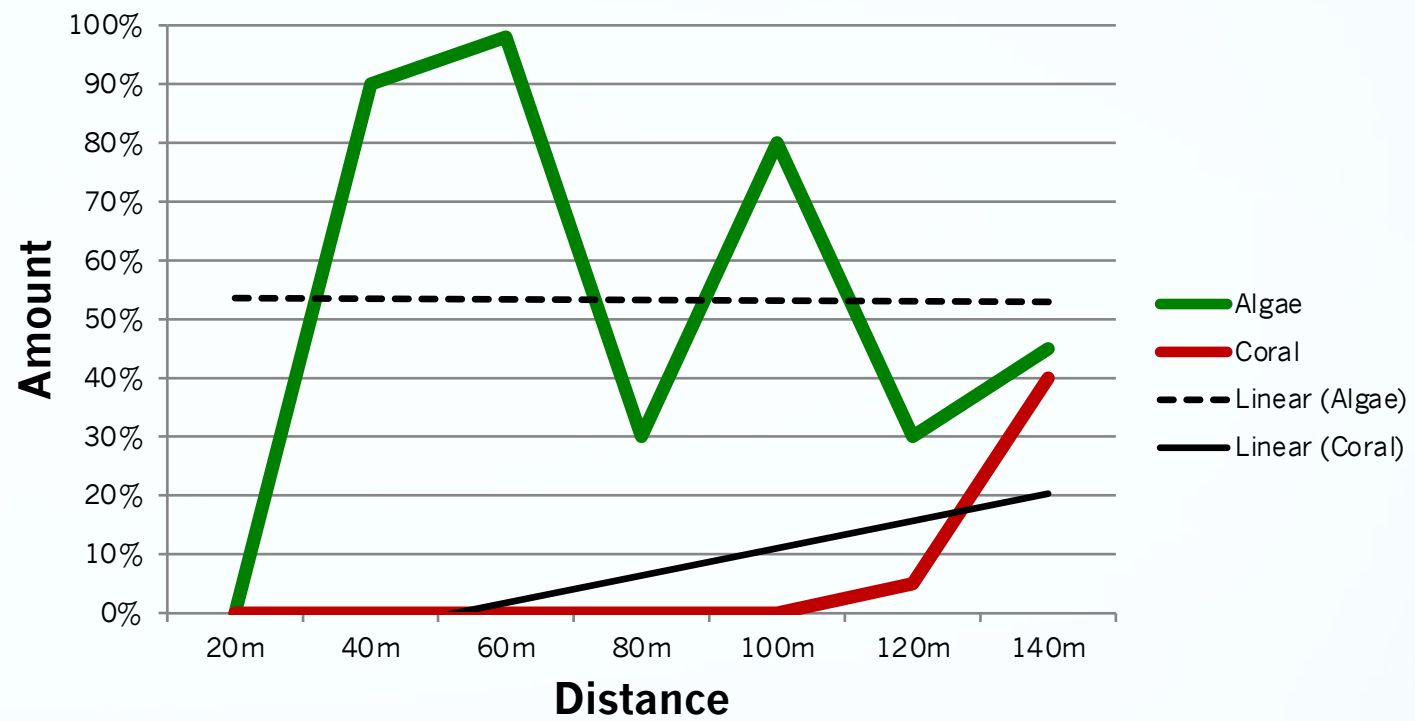
- The data collected was graphed to show the relationship between the amount of algae and coral vs. the distance from the stream.
- From the data, a linear line of best fit was graphed to show the general trend/slope of the data.

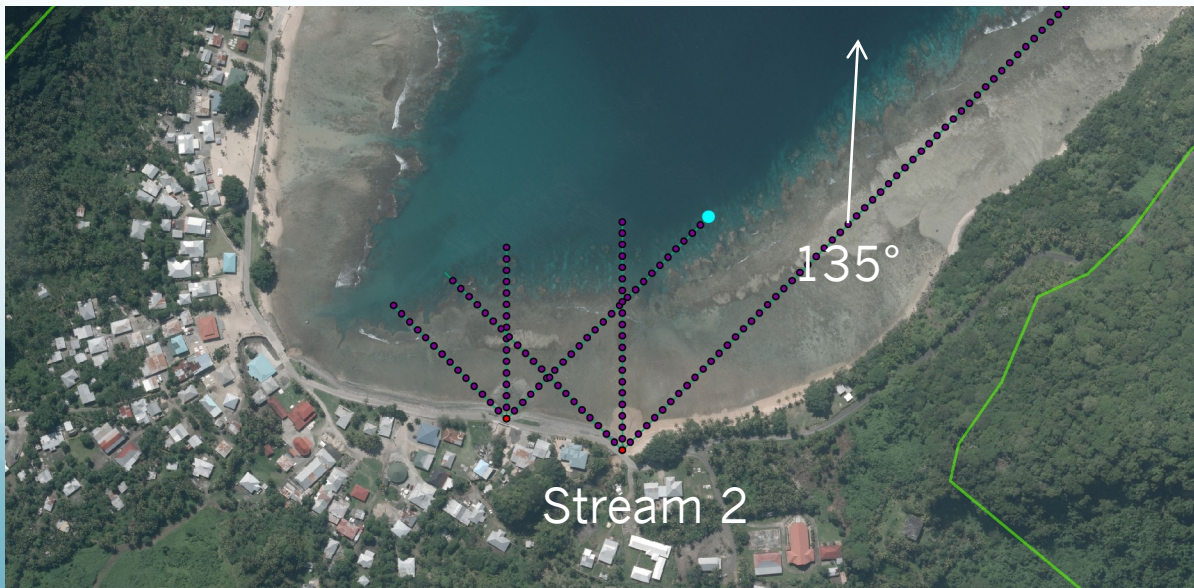
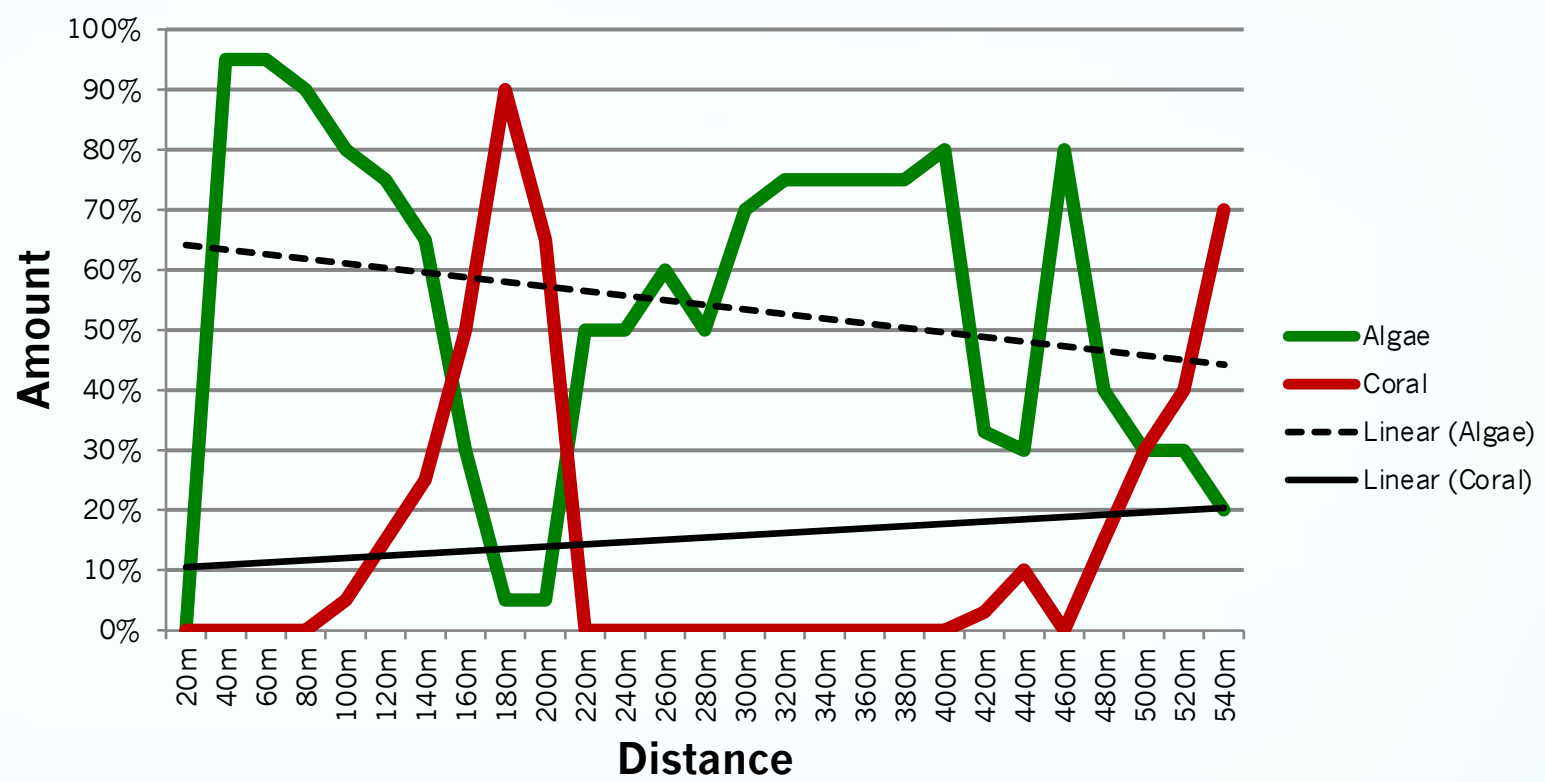












Overall Results- Algae

- **Percentage of Benthic Algal Cover vs. Distance from Stream**
 - Stream 1:
 1. 45 degree transect = -0.1179
 2. 90 degree transect = -0.1529
 3. 135 degree transect = -0.0607
 - Stream 2:
 1. 45 degree transect = -0.0167
 2. 90 degree transect = -0.0011
 3. 135 degree transect = -0.0077
- **The average slope of the six transects = -0.0595**

Overall Results- Coral

- **Percentage of Coral vs. Distance from Stream**
 - Stream 1:
 1. 45 degree transect = 0.1339
 2. 90 degree transect = 0.1814
 3. 135 degree transect = 0.0905
 - Stream 2:
 1. 45 degree transect = 0.0800
 2. 90 degree transect = 0.0464
 3. 135 degree transect = 0.0038
- **The average slope of the six transects $\approx$ 0.0893**

Conclusion- Algae

- The overall average slope of the “Percentage of Benthic Algal Cover vs. Distance from Stream” for both streams was **negative**.
- **A negative slope supports our hypothesis, indicating that as the distance from the streams increases, the percentage of algae generally decreases.**

Conclusion- Coral

- The overall average slope of the “Percentage of Coral vs. Distance from Stream” for both of the streams was **positive**.
- **A positive slope shows that, as the distance from the streams increases, the percentage of coral generally increases.**

Management Implications

- Land-based pollution sites- piggeries, septic tanks, and agricultural fertilizers- are most likely the source of these high nutrient levels in the streams, possibly causing this algal overgrowth in the Vatia Bay.
- A solution to this problem would be to enforce and implement ASEPA and other governmental policies, reducing nutrient pollution in the Bay's feeding streams.

References

- Curtis, Meagan- Department of Marine and Wildlife Resources American Samoa- (2016) “Nutrient Dynamics of Vatia Bay, American Samoa” (unpublished).
- Inventory and Monitoring Pacific Island Network (PACN) Water Quality Data (2009-2014).
- Whitall, David & Piniak, Greg (2015) “Nutrient Dynamics and Changes to Benthic Communities in Vatia, American Samoa”.
<https://coastalscience.noaa.gov/projects/detail?key=245>

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STEP-UP Program

American Samoa National Park Service

Thank You!