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**EFFECT OF CLIMATE CHANGE
ON THE MACROINVERTEBRATES
POPULATION
IN MARACUTO STREAM
IN CAROLINA, PUERTO RICO**

Introduction

- Climate change is a significant and lasting change in the statistical distribution of weather which affects the environment. In this investigation we will focus on the effects that this have in the macroinvertebrates populations.



- Macroinvertebrates are great indicators of water quality, and they are also an important part of the aquatic food chain. With this information we can infer about the pollution of the stream because they have longest life cycles, and they are sedentary than other organisms. Also, they show the biological, chemical and physical conditions of the rivers.

- Since Maracuto stream is one of the tributaries of the Rio Grande de Loíza, this investigation will show us the health and how the climate change affected this river. By monitoring the macro invertebrates of this stream, we can measure important parameters of pollution like excess of nitrogen, phosphorus and also total suspended solids.



- The rainfall event that was measured in this research was the passing of the hurricane Sandy by the Caribbean. This hurricane did not make a great impact in Puerto Rico like it did in New York. In Puerto Rico the amount of rainfall caused by the cyclone was of 1.15 inches.

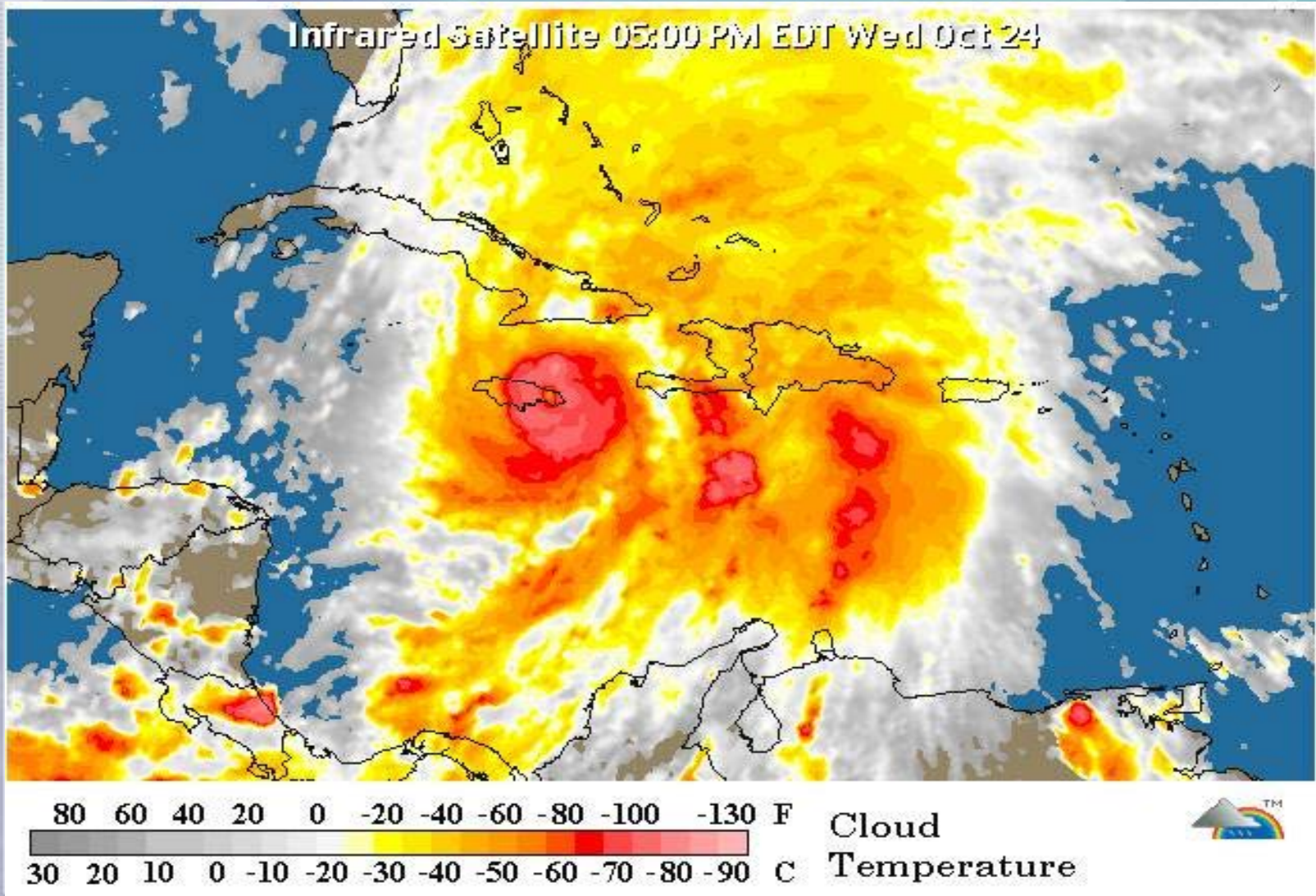
Abstract

The Maracuto River located in Carolina, Puerto Rico, was visited prior to a significant rain event. Macroinvertebrates were collected and data of the temperature and pH were taken, along with water samples to measure nitrogen, phosphorus and total suspended solids. After the passing of a storm event or significant rainfall the river was again visited twice to determine how the macroinvertebrates populations were affected.

After significant rain event macroinvertebrates populations were greatly reduced and there was great presence of indicators of pollution: catfish. Macroinvertebrates populations are significantly affected after intermittent rain event and climate change.



Hurricane Sandy passing through the Caribbean



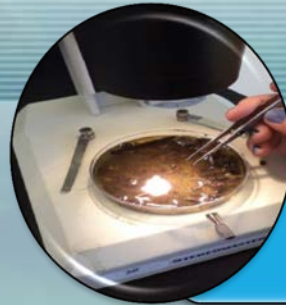
Stream Location



N 18.35980
W 65.95508

50 m
200 ft

Methodology



SAMPLES CLASSIFICATIONS

- Class
- Order
- Family



SAMPLES

- Macroinvertebrates



WATER QUALITY

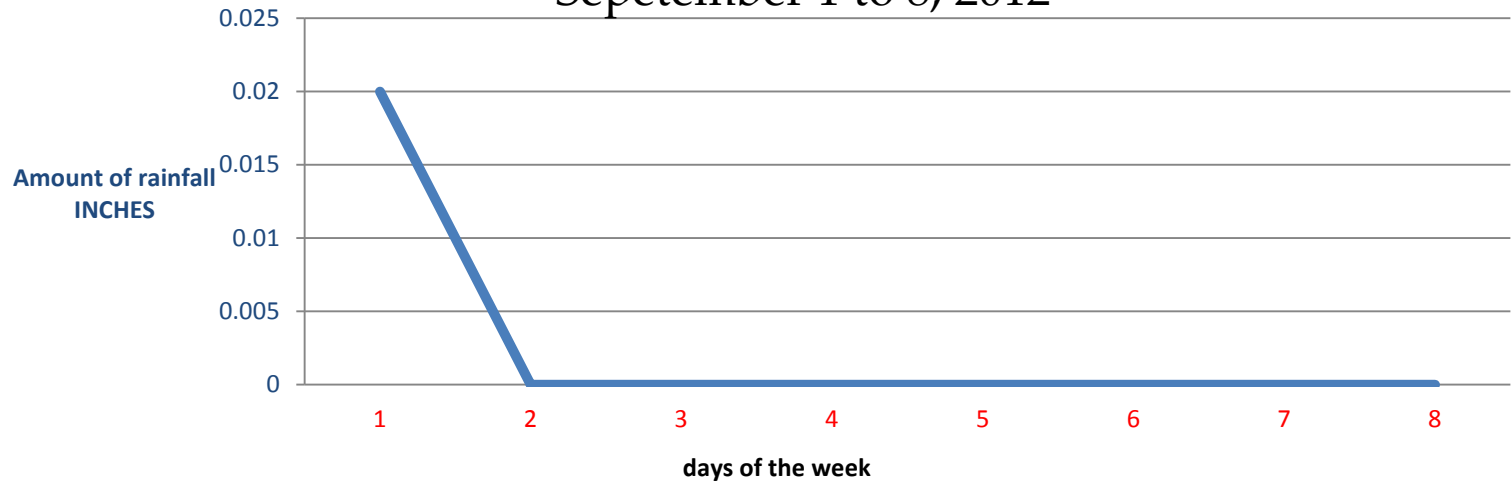
- pH
- Temperature
- Phosphorus
- Total Suspended Solids
- Nitrogen



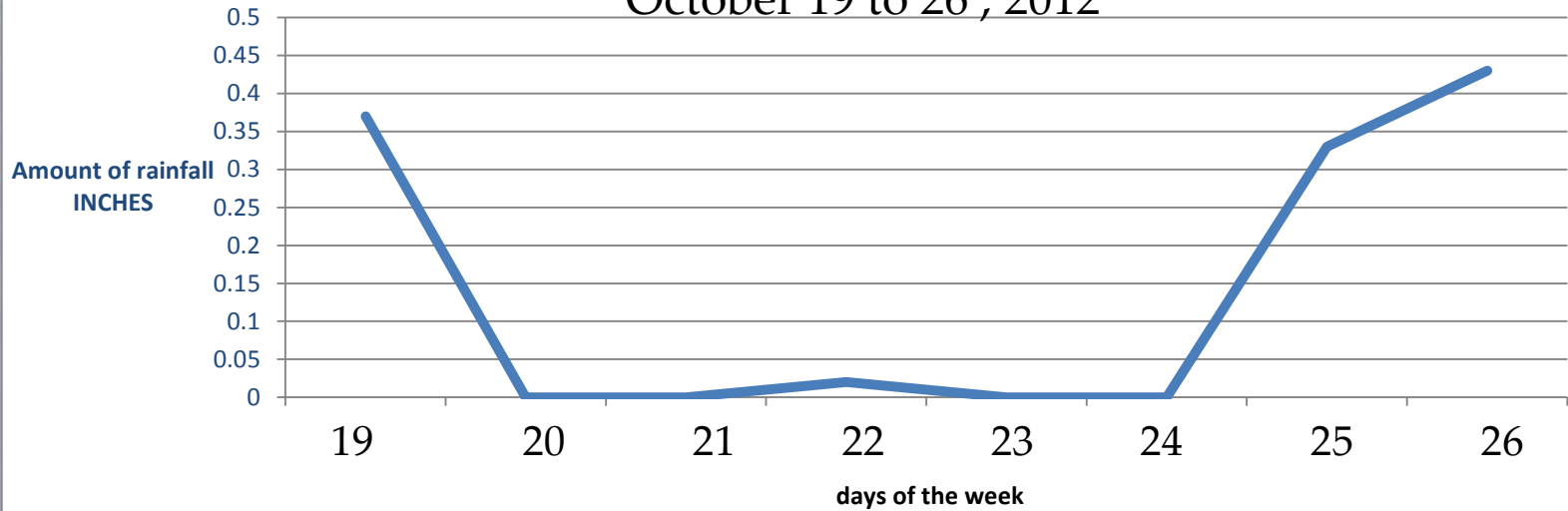
STREAM ASSESSMENT

- Perimeter
- Pebble count
- Calculate flow
- Riffles

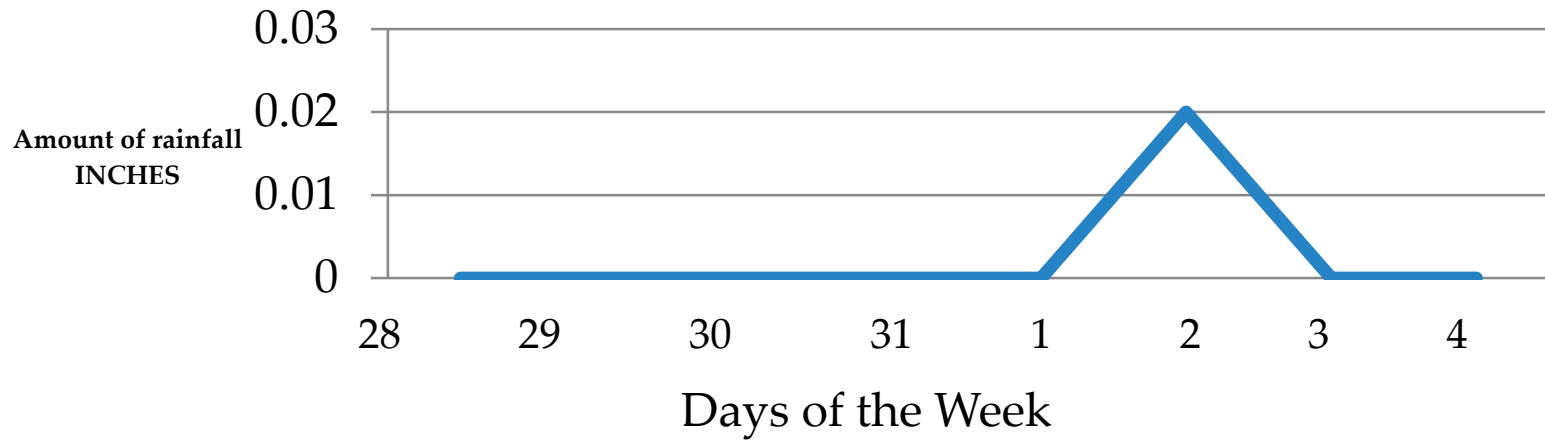
Precipitation: Sepetember 1 to 8, 2012



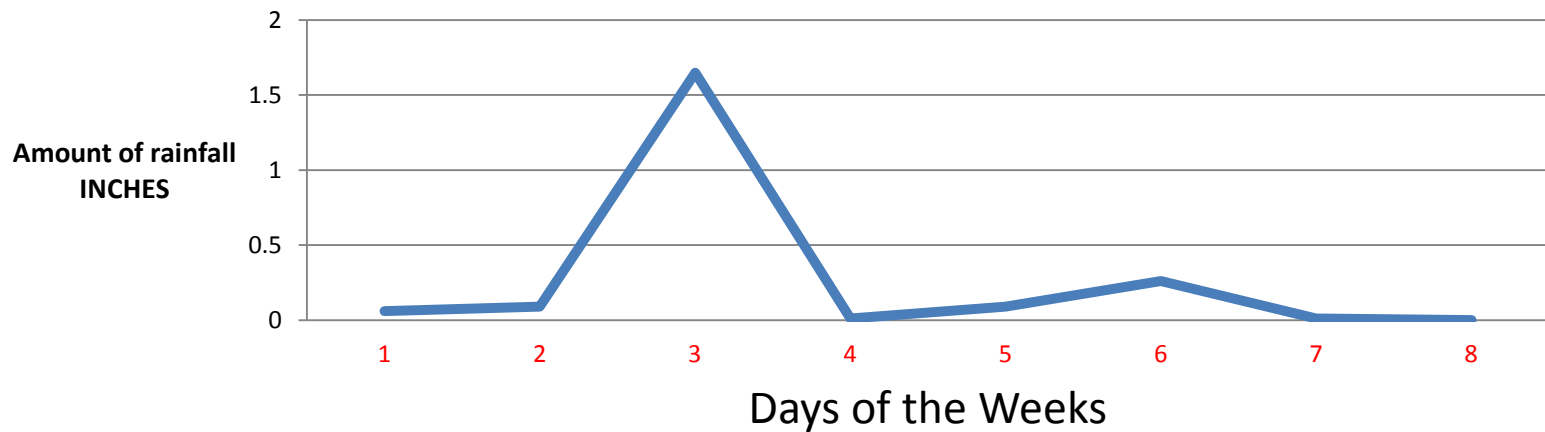
Precipitation: October 19 to 26, 2012



Precipitation: October 28 to November 4, 2012



Precipitation: December 1 to 8, 2012



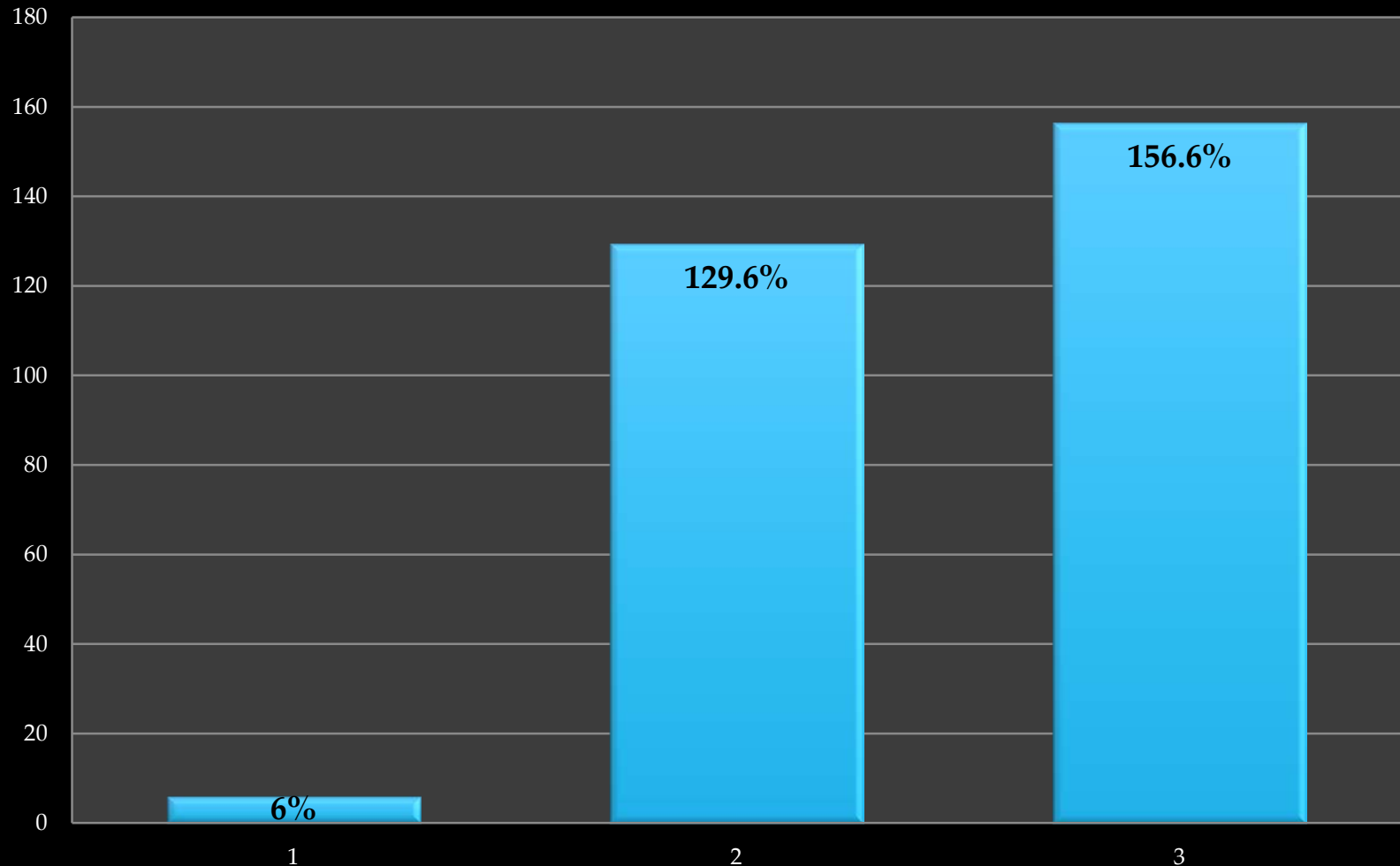
pH and Temperature

- ◎ First visit:
 - Temperature → 28.4°C
 - pH → 8.9
- ◎ Second visit:
 - Temperature → 27.6°C
 - pH → 8.5
- ◎ Third visit:
 - Temperature → 25.6°C
 - pH → 8.8

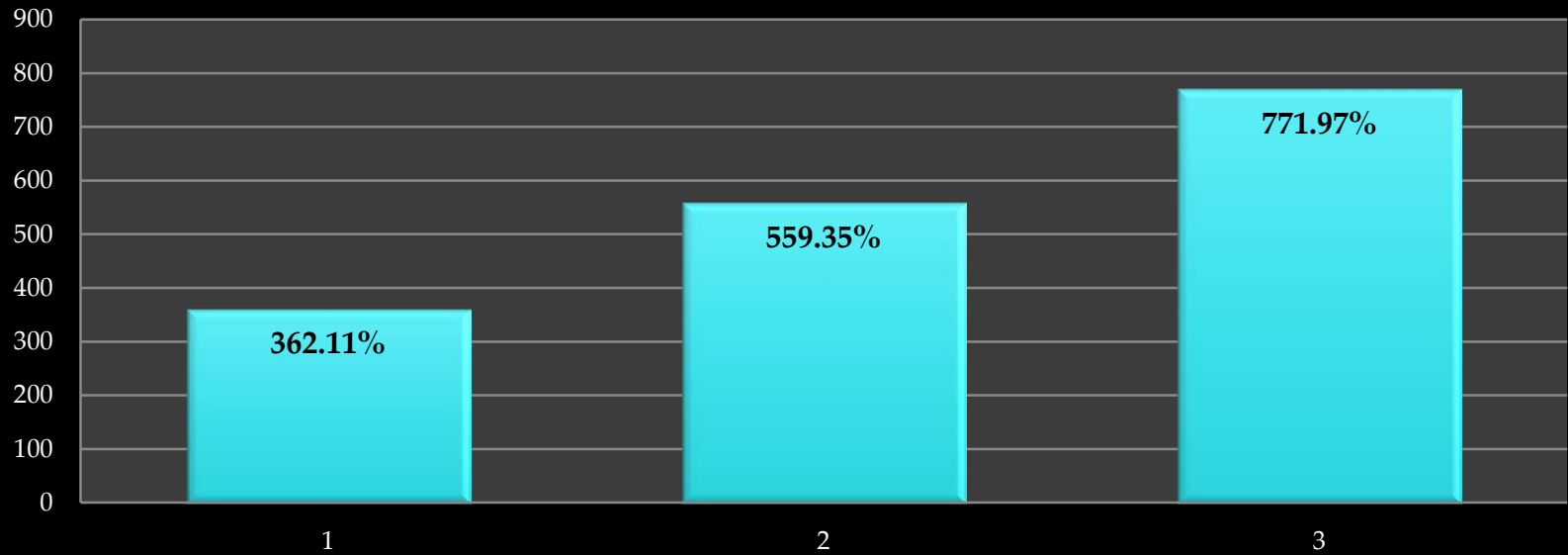


Water quality samples

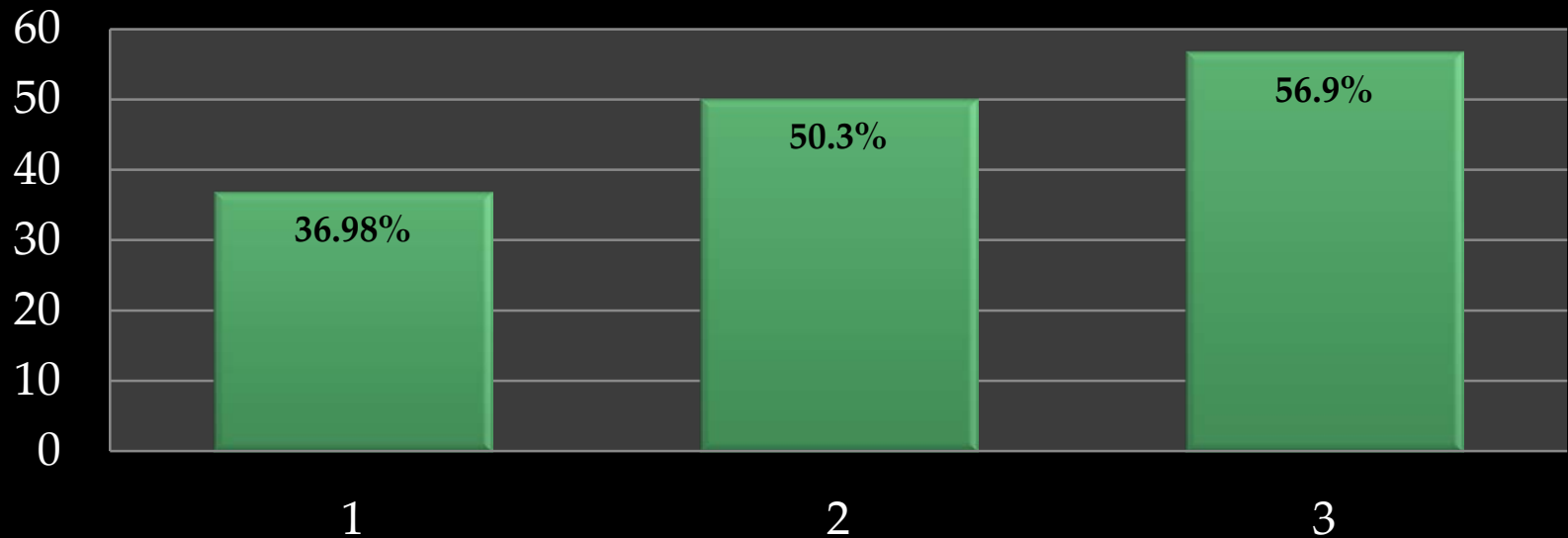
Total Suspended Solids in the Stream



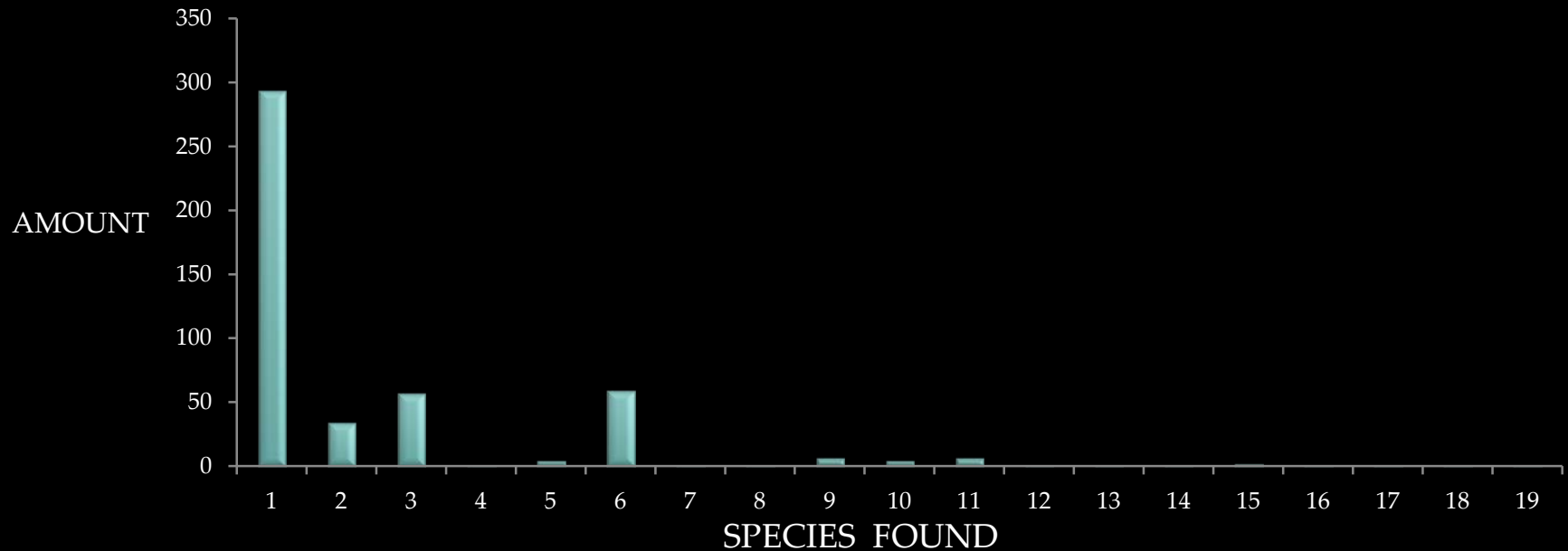
Nitrogen in the Stream



Phosphorus in the Stream



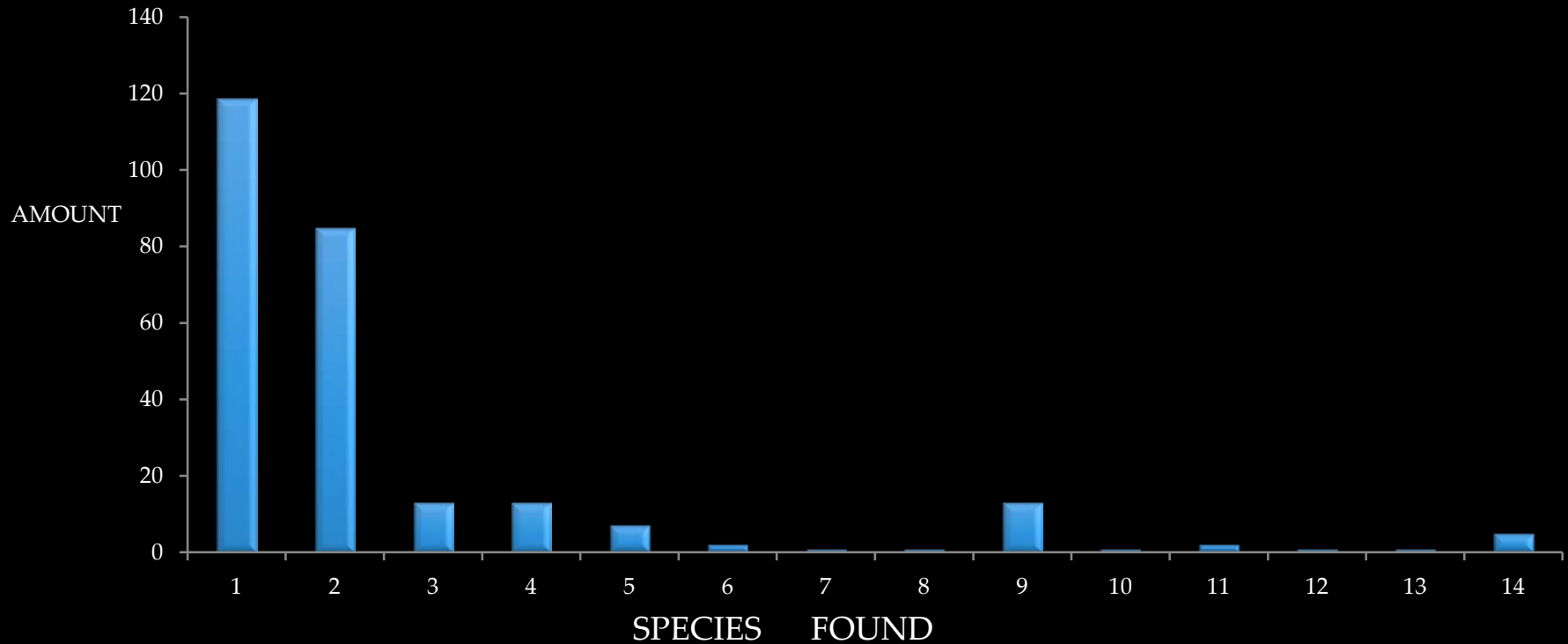
Macroinvertebrates recollected on the First Visit



Legend:

- | | |
|---|--|
| 1) Gastropoda; Pleuroceridae- 294 | 12) Insecta; Diptera; Ceratopogonidae- 1 |
| 2) Malacostraca; Decapoda; Palaemonidae- 34 | 13) Insecta; Trichoptera; Hydroptilidae- 1 |
| 3) Insecta; Ephemeroptera; Baetidae- 57 | 14) Insecta; Odonata; Aeshnidae- 1 |
| 4) Insecta; Coleoptera; Dytiscidae- 1 | 15) Insecta; Diptera; Stratiomyidae- 2 |
| 5) Insecta; Lepidoptera; Pyralidae- 4 | 16) Arachnida; Aranae; Pisauridae- 1 |
| 6) Gastropoda; Hydrobiidae- 59 | 17) Insecta; Diptera; Chironomidae- 1 |
| 7) Insecta; Trichoptera; Psychomyiidae- 1 | 18) Insecta; Coleoptera; Hydrophilidae- 1 |
| 8) Insecta; Diptera; Psychodidae- 1 | 19) Insecta; Diptera; Ptychopteridae- 1 |
| 9) Insecta; Trichoptera; Limnephilidae- 6 | |
| 10) Gastropoda; Viviparidae- 4 | |
| 11) Insecta; Coleoptera; Elmidae- 6 | |

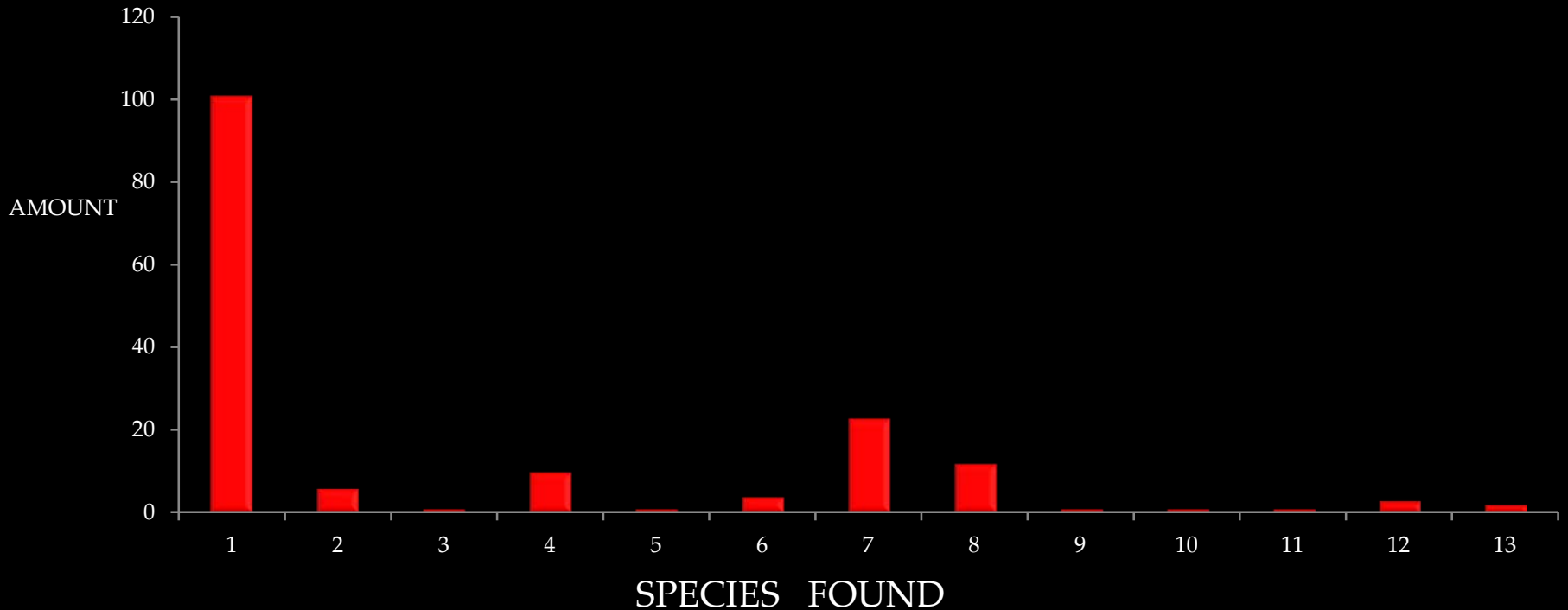
Macroinvertebrates Recollected on the Second Visit



Legend:

- | | |
|--|--|
| 1) Gastropoda; Pleuroceridae- 119 | 9) Insecta; Trichoptera; Limnephilidae- 13 |
| 2) Gastropoda; Hydrobiidae- 85 | 10) Insecta; Diptera; Ceratopogonidae- 1 |
| 3) Insecta; Coleoptera; Elmidae 13 | 11) Insecta; Lepidoptera; Pyralidae- 2 |
| 4) Insecta; Diptera; Chironomidae-13 | 12) Insecta; Ephemeroptera; Baetidae- 1 |
| 5) Gastropoda; Viperidae- 7 | 13) Insecta; Odonata; Aeshnidae- 1 |
| 6) Insecta; Trichoptera; Hydropsychidae- 2 | 14) Malacostraca; Decapoda; |
| 7) insecta; Megaloptera; Corydalidae- 1 | Palaemonidae- 5 |
| 8) Insecta; Diptera; Simuliidae-1 | |

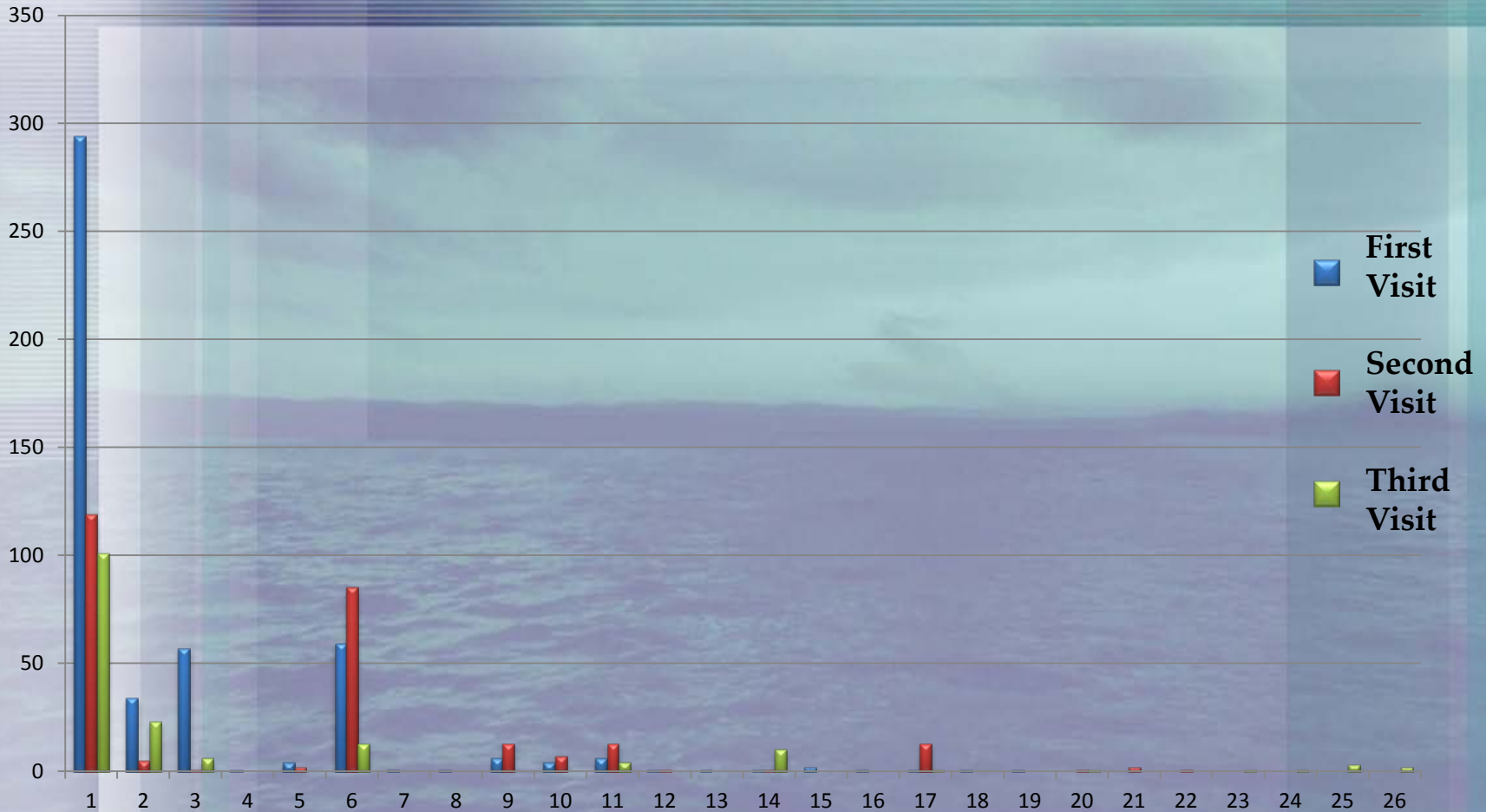
Macroinvertebrates Recollected on the Third Visit



Legend:

- | | |
|---|---|
| 1) Gastropoda; Pleuroceridae- 101 | 9) Insecta; Diptera; Chironomidae- 1 |
| 2) Insecta; Ephemeroptera; Baetidae- 6 | 10) Gastropoda; Hydrobiidae- 1 |
| 3) Insecta; Coleoptera; Dryopidae- 1 | 11) Insecta; Hemiptera; Corixidae- 1 |
| 4) Insecta; Odonata; Aeshnidae- 10 | 12) Insecta; Trichoptera; Philopotamidae- 3 |
| 5) Insecta; Megaloptera; Corydalidae- 1 | 13) Insecta; Coleoptera; Psephenidae- 2 |
| 6) Insecta Coleoptera Elmidae- 4 | |
| 7) Malacostraca; Decapoda; Palaemonidae- 23 | |
| 8) Gastropoda; Hydrobiidae- 12 | |

Macroinvertebrates Species found on the three visits



Results

Increase on
the nitrogen,
phosphorus
and total
suspended
solids on the
water

Gastropoda
class was the
most
abundant
(snails)

Stream
morphology
changed
dramatically

Reduction of
the macro
invertebrates
populations

Conclusion

RIVER POLLUTION

- Presence of the *Liposarcus multiradiatus* (cat fish)
- Abundance of the *Gastropoda* class and reduction of population of sensitive species

INCREASE ON THE NITROGEN, PHOSPHORUS AND TOTAL SUSPENDED SOLIDS

- Causing eutrophication
- In excess it causes to decrease the dissolve oxygen

DECREASE ON THE MACROINVERTEBRATES POPULATIONS

- Significant storm event and continuous rain events
- The food chain is alter

SIGNIFICANT CHANGE IN OVERALL STREAM MORPHOLOGY

- Increase in river flow
- Riparian vegetation drastically affected

Future Work

Compare with
the Bayamon
River

Compare
with last year
investigation

Add
measurements
of Dissolve
Oxygen and
Turbidity

Record the
daily
temperature
of the river

Acknowledges



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Questions ?