Aquatic Invertebrates and The Health of The Slough

Jorge Juarez(1,2), Xianjia Huang(1,2), Joshua Jimenez(1,2),
1). Pajaro Valley High School, Watsonville, CA
2). WATCH (Watsonville Area Teens Conserving Habitats) Program, Monterey Bay Aquarium

Introduction

We investigated whether or not aquatic invertebrate species richness (biodiversity) and species evenness (the relative abundance of species) would indicate if a watershed was a healthy aquatic ecosystem. Aquatic invertebrates are very important because they make good indicators of watershed health and provide a variety of services to the environment. A diverse aquatic invertebrate community means the body of water is healthy and sustainable for life. The West Branch of Struve Slough drains into the Monterey Bay. Thus, if the water quality of the wetlands is not healthy, it also would affect the Monterey Bay. Polluting the watershed which can harm these creatures could create a domino effect that could potentially damage our ecosystems, and eventually humans as well.

A decline in biodiversity of aquatic invertebrates would have a negative impact in an entire ecosystem. We wanted to see if there was a correlation between water quality and aquatic invertebrate biodiversity. We predicted that the upper part of West Struve Slough (the beginning) would have the healthiest water quality of the three sites (beginning, middle, and end of West Struve Slough) indicated by higher richness and evenness of aquatic invertebrates. The middle will not have water quality as healthy as the beginning indicated by moderate richness and evenness of aquatic invertebrates. The end will have the lowest water quality health indicated by low richness and evenness of aquatic invertebrates.

Figure 1. Map of our testing sites.

Materials and Methods

Our data collecting site was West Branch Struve Slough. Our group tested the beginning, middle, and end of the slough. We modified a protocol that the Watsonville Wetlands Watch uses for collecting aquatic invertebrates so that the protocol tied into our project. We collected aquatic invertebrates using a dipper until we no longer found new aquatic invertebrates. Once we saw that we were not finding any new aquatic invertebrates for two minutes, we stopped collecting. We wanted to find results for any kind of urban or agricultural impact in Struve Slough so we tested for levels of phosphates, nitrates, dissolved oxygen, turbidity, and pH.

- **Water Testing Materials**
  1. CHEMetrics Phosphate K-8510 CHEMets kit
  2. CHEMetrics VACUettes kit model K-6904D (Nitrates)
  3. LaMotte Dissolved Oxygen kit model EDO
  4. PASCO Turbidimeter model PS-2122
  5. Macherey-Nagel pH-Fix 4.5-10.0

- **Other Materials**
  1. GPS
  2. Nokia phone
  3. Thermometer
  4. Meter stick
  5. A vial for turbidity
  6. An aquatic invertebrate collecting kit

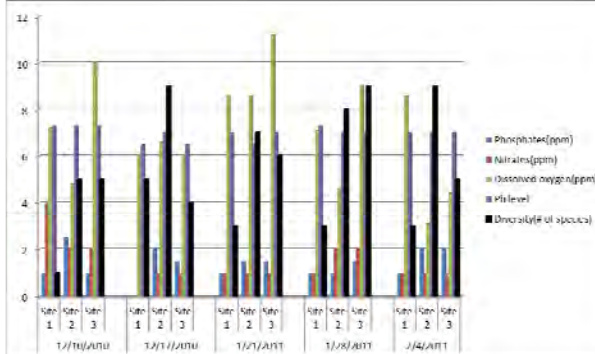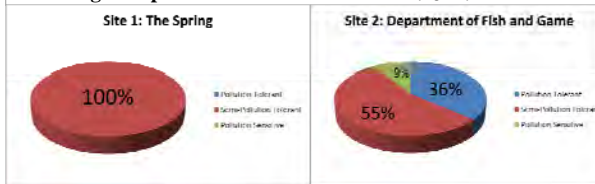## Results of water quality testing.

Figure 2. Water quality and biodiversity of each site on the testing dates.

Percentage of Species Tolerance to Pollution (Figure 3)

Percentage of pollution tolerant, semi-pollution tolerant, and pollution sensitive species in the total number of species (6) in site 1.

Percentage of pollution tolerant, semi-pollution tolerant, and pollution sensitive species in the total number of species (11) in site 2.

Percentage of pollution tolerant, semi-pollution tolerant, and pollution sensitive species in the total number of species (10) in site 3.

Pollution Tolerant Species
- Water fleas
- Flat Warm
- Pouch Snail
- Mosquito Larva

Semi-Pollution Tolerant Species
- Dragonfly Larva
- Backswimmer
- Copepod
- Amphipod
- Dragonfly Nymph
- Water Strider
- Water-boatman
- Crayfish
- Clam

Pollution Sensitive Species
- Riffle Beatle

Results

According to what is considered healthy water, our data shows relatively healthy levels of turbidity, dissolved oxygen (D.O.), nitrates, and pH level. However, levels of phosphates are slightly higher. The aquatic invertebrate biodiversity at the beginning of Struve Slough was low, and biodiversity in the middle and end of Struve slough was high. A healthy water quality would be 7ppm of D.O., pH level of 6.5 to 8.5, less than 3ppm of Nitrate, and 0.1 to 1.0ppm of Phosphates. There was a low level of diversity at site 1 on 12/10/2010 and a high level of nitrates (Figure 2). The change in D.O. did not seem to affect the diversity of aquatic invertebrates (Figure 2). The pH level was consistent throughout our field research dates (Figure 2). Although the level of phosphates in the water was high, it did not seem to affect the diversity of the aquatic invertebrates (Figure 2). We only found semi-pollution tolerant species at site 1 (Figure 3). Site 2 had 9% of pollution sensitive species, 55% of semi-pollution tolerant species, and 36% of pollution tolerant species (Figure 3). Site 3 has 70% of semi-pollution tolerant species and 30% of pollution tolerant species (Figure 3). The diversity of sites 2 and 3 is higher than site 1 (Figure 4).

Discussion

Our results show that the water quality of the slough remained relatively healthy. Site 1 is isolated compared to sites 2 and 3 and acts like a ecological island. It is also a much smaller body of water, which could explain why that site had the least number of aquatic invertebrates. Sites 2 and 3 had the most biodiversity. We inferred that the presence of detritus (organic matter) at site 2 serves as food for microorganisms which in turn are fed on by aquatic invertebrates. Our field days consisted of mainly sunny days except for 12/10/2010 and 12/17/2010. These days compared to the rest had lower levels of dissolved oxygen. We determined that this was because of little or no sunshine, since the less sunlight there is, the less plants photosynthesize. Another reason for the low biodiversity at site 1 could be due to less vegetation growing in the water due to its muddy substrate.
The Shannon-Weiner Diversity Index confirms that the diversity of sites 2 and 3 are better than site 1 (Figure 4). The Shannon-Weiner Evenness Index shows that site 3 has the most evenness. Site 1's sample was too small of a sample size to be valid (Figure 4).

Acknowledgements

Conclusion

Based on our results, our hypothesis was disproved. We predicted that site 1 would have the healthiest water quality and the most biodiversity and the remaining two sites' water quality would decline as you move down the slough. This is due to the impact of PVHS runoff to sites 2 and 3 having many urban and agricultural impacts. Aquatic invertebrates are vital to the food web because they are near the base of the web and many species in the slough rely on them. Some recommendations for future continuation of our project would be to collect data at more sites, different seasons, different times of the day, and to increase the frequency. We believe it would make the project stronger and have more information to compare. Those are the type of changes that we would like to do but couldn't due to our limited time. Our action plan to help get others involved in our project is to educate the community, starting with the kids and students at our school. We will collaborate with Mr. Martindale to design a field trip and lesson plan for his AP Environmental Science class involving aquatic invertebrates and the Shannon-Weiner Diversity Index. This will help educate Mr. Martindale's AP Environmental Science class students for years to come.

Shannon-Weiner Diversity & Evenness Index

Figure 4. Results of the index on a random sample collected at our testing sites.

	Site 1	Site 2	Site 3
Amphipod	1	6	5
Copepod	1	17	6
Water Flea	0	24	7
Backswimmer	0	1	1
Water-boatman	0	0	1
S - Species	2	3	5
H - Diversity	0.693	1.055	1.3744
E - Evenness	0.9997	0.761	0.854

H Range
0-4 ; 0 being 1 species in the whole slough and 4 being the most diverse.

E Range
0-1 ; 0 being the worst and 1 being the perfect population evenness.

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