Assessing the water quality at Pescadero Creek, CA: does water turbidity and the creek's composition affect the water quality?

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ABSTRACT

Right now in the world, there are many factors affecting the world's environment, Environments, ecosystems, and weather throughout the world are changing due to the anthropocene. Humans are affecting the water quality of creeks and rivers throughout the United States, often through pollution and agricultural run-off. Large amounts of nitrogen in water can affect a creek's ecological surroundings. With the water quality changing, aquatic species and its ecological surroundings are now being affected as well. In my research, I studied the water quality at Pescadero Creek to find the relationship between water turbidity and the creek's composition, to the water quality. My research suggests how "murky" water contains large amounts of ammonia, compared to clear water. This is because the sediment contains amounts of ammonia in the sediment of the creek is affecting the aquatic life and ecological surroundings of the Pescadero Creek. My research also suggested how the nitrite levels levels at sandy surroundings. This may be causing there to be less nitrite levels at sandy compared to water in rocky surroundings.

INTRODUCTION

Environments, ecosystems, and weather are all changing around the world. These changes have to do with human involvement in climate change. Life in the anthropocene is creating a novel or new environments through pollutants, land changes,

and more. Research has shown us how urbanization and agriculture are two human activities that have been affecting the water quality at rivers across the whole United States (Edwards G. Stets, Lori A. Spargue, Gretchen P. Oelsner, Hank M. Johnson, Jennifer C. Murphy, Karen Ryberg, Also V. Vecchia, Robert E. Zuellig, James A. Falcone, and Melissa L. Riskin, 2020). Due to the anthropocene affecting water quality in rivers and more, species could be affected as well. With everything now changing throughout the world, species are now facing a dramatic decline, estimating that around 1 million plant and animal species are now being threatened with possible extinction (Sustainable Development Goals, 2019).

One animal that has faced rapid population declines is the steelhead trout (oncorhynchus mykiss). Steelhead trout are native to the US west coast and for 35 years, outrageous amounts of steelhead trout have been dying (Canadian Science Publishing, larger amounts of ammonia levels. The large 2017). Steelhead trout are very abundant in fisheries and make up a large portion of their economy. But the steelhead trout population has been declining especially in California (Jacob Katz & Peter B. Moyle & Rebecca M. Quiñones & Joshua Israel & at rocky surroundings were larger than nitrite Sabra Purdy, 2013). A majority of steelhead trout populations are associated with a creek in California due to all the fertilizers and sewage in the that runs from Santa Cruz and San Mateo countries. water sinking into the sediment of the creek, called Pescadero Creek. They believe that the steelhead trout at Pescadero Creek has decreased surroundings since there is lots of sediment over the years through rainfall and other natural occurrences, the sand barrier reopened, which had been closed off for years. Since the sand barrier had been closed off for so long, this change caused some chemical and physical changes in Pescadero Creek (Chandra M. Richards, Oliver Moal, Celine Pallud, 2017), as well as factors like climate change and anthropogenic impacts (Paul J. Wood and Patrick D. Armitage, 1997). These factors are why the water quality at Pescadero Creek is important, it's affecting aquatic life in the creek.

It's important to understand the water quality of the type. The first three samples that I collected were Pescadero Creek, to better understand how changing surface water, then the second three samples were nutrient compositions could be affecting steelhead collected after creating a high turbidity mixture, by trout and other aquatic species dependent on this kicking up the sediment from the creek, to better habitat. Water quality is classified by the amounts understand macronutrients that had settled in the of different chemical compounds found within the creek bed. Location A was a portion of the Pescadero water, as well as the acidity/basicity of the water. creek near the ocean, location B was a portion of the These compounds found within the water can either creek that was between the ocean and the larger harm or help water quality. As well as how nitrogen part of the creek, and location C was of the larger in water helps with the growth of plants, but too portion of the creek, Samples from each location much nitrogen in water adds excessive amounts of were collected within a 15-foot span. The samples nutrients (USGS). Approximately 78% of steelhead were collected within five days of each other on July trout is projected to be killed off in the next century 8th, 10th, and 12th. All of the water samples were (Jacob Katz & Peter B. Moyle & Rebecca M. Ouiñones collected in plastic containers and were stored in & Joshua Israel & Sabra Purdy, 2013). Water quality, a large cooler to ensure that living organisms in especially in creeks and rivers, is something that the water samples don't use up all the nutrients. I can be fairly influenced by human activities. My tested the water samples the day after collection. research question is: how does the water turbidity I used JNW Direct Aquarium 150 Tests Strips and and the creek's composition affect water quality at Pescadero Creek?

METHODS

I collected water samples from three locations water sample and compared to the color on the along the Pescadero Creek: location A (37.26669, color chart provided. I also used an API Pond-Pond -122.411802), B (37.266523, -122.411634), and Master Test Kit to test each water sample. I poured C (37.266400, -122.410833). At each location, the water sample into 4 vials and then added the samples were obtained from both sides of the creek, number of drops from each chemical directed by which varied in river composition (rocky and sandy the instructions. I shook the vials and then would terrain). Six samples were collected from each terrain wait for 5 minutes for ammonia and nitrite vials, 3

API Pond-Pond Master Test Kit for my water sample testing and followed the protocol included in the instructions. Briefly, I separated all the water containers by location, then used one test strip for each sample. Each test strip was submerged in a

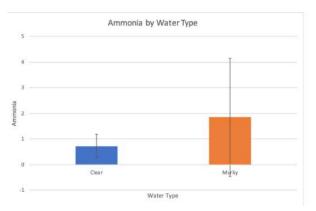


Figure 1: Ammonia levels in clear and murky water types, Ammonia levels were higher in the "murky" water type, or within water that had a higher turbidity than clear water (t(106)=3.47, p=0.0007). The total of ammonia in murky water types averaged to 1.8426 ppm (sd = 1.347), while ammonia levels in clear water types averaged to 8.093 (sd = 1.53).

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minutes for phosphate vials, and would just shake water quality, as well as comparing the water quality the phosphate vial once. I then used the color chart provided by API Pond-Pond Master kit to compare my sample. I ran my samples outside of my home because I was dealing with chemicals and didn't want something to go wrong inside of my home.

RESULTS

In total, 108 water samples were collected throughout a five-day period. Using the JNW Direct Aquarium 150 Test Strips and the API Pond, Pond Master Test Kit, I was able to test Pescadero Creek's macro- and micro-nutrient composition, general hardness, total alkalinity, carbonate, and pH. The average for each one of those elements are iron (0), copper (0.5), nitrate (1.53), nitrite, (0.03), general hardness (282.4), free chlorine (0.6), total alkalinity (80.65), carbonate (91.76), and pH (7.2). While the API Pond, Pond Master Test Kit tested wide range (pH), ammonia, nitrite, and phosphate. The averages from these elements were wide range (8.02), ammonia, (1.3), nitrite (0.02), and phosphate (0.05). I ran these tests on each water sample because I know that pH, ammonia, nitrite, and phosphate are all important chemicals in water quality. Once I finished all of my data, I also ran t-tests to see if there were differences between the turbidity of the water and

with the creek's composition at both sides of the creek. Two tests were significant. Ammonia levels in murky water was higher than ammonia levels in clear water (t(106)=3.47, p=0.0007). Nitrite levels were significantly different from each other when comparing different creek bed terrains. The rocky side had higher nitrite than the sandy side (t(106)=2.099, p=0.038).

DISCUSSION

My study suggests that the turbidity of the water and ammonia levels (Figure 1) have a relationship. I found ammonia levels in murky water were much larger than the ammonia levels found in clear water. When I went to Pescadero Creek to collect the water samples, I had to kick up the sediment from the creek, in order to get murky water. By kicking up the sediment from the creek, larger levels of ammonia were found. Ammonia is commonly found in sediment due to bacterial decomposition, so our results were consistent with this understanding. When bacterial decomposition happens the matter builds up in the sediment (EPA). The amount of nitrogen in creeks can either help the creek, or negatively affect the creek. Some level of nitrogen is important in water because it helps with the growth

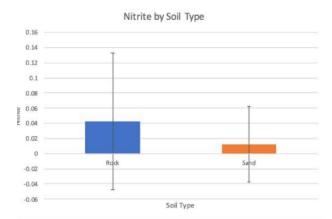


Figure 2: Nitrite levels in rocky and sandy soil types. Nitrite levels were higher in rocky soil types than sandy soil types (t(106)=2.099, p=0.038). The total of nitrite in rock soil averaged to 0.0426 ppm (s = 0.0918 ppm), while nitrite levels in sand soil types averaged to 0.012 ppm (sd = 0.0549 ppm).

affect the health of organisms in the water and it's impacting the water quality. ecological surroundings (USGS). The sediment in the murky water containing ammonia levels is affecting the water quality at Pescadero Creek. Potentially ACKNOWLEDGMENTS harming organisms and the ecological surroundings Thank you to the Headwaters Science Institute for at the creek.

Nitrite levels found in rocky surroundings were project and thank you to my mentor Anne Espeset larger than nitrite levels found in sandy surroundings for accompanying me throughout this journey. (Figure 2). Nitrite levels come from fertilizers and sewage water (EPA). Why would there be more nitrite levels in rocky surroundings, rather than sandy surroundings? When I had gone to Pescadero 1. (n.d.). Retrieved August 14, 2020, from https://www. Creek to collect water samples, I noticed how the usgs.gov/special-topic/water-science-school/science/ water near rocky surroundings had less sediment. Rather than how the water near sandy surroundings had more sediment. Due to bacterial decomposition, from https://www.epa.gov/caddis-vol2/ammonia the matter builds up in the sediment (EPA). So all the fertilizers and sewage in the water all go down with the sediment. Explaining how the sandy surroundings have less nitrite levels since all the https://www.researchgate.net/profile/Peter_Moyle2/ nitrite goes down with the sediment, while the water near rocky surroundings stay in the water since Salmon Steelhead and Trout Salmonidae in California/ there is little to no sediment in the water.

Since we know that nitrogen can affect the ecological 4. Richards, C., Moal, O., & Pallud, C. (2017, November 21). surroundings of a creek, there could be a relationship between ammonia levels in murky water and nitrite levels at rocky areas. When I collected water at the rocky side of the creek, it was much harder to kick up the sediment from the creek because it would sink down rapidly. The answer for this can be related to how the nitrogen and the ammonia levels in the sediment can affect the ecological surroundings of 6. Steelhead trout population declines linked with the creek. Causing there to be much more nitrogen poor survival of young fish in the ocean. (2017, June in the water with rocky surroundings, than sandy surroundings.

I found water turbidity and creek-bed composition at Pescadero Creek is affecting the water quality. Ammonia and nitrate levels significantly differed, which could be due to sediment settling. Knowing U.S. Rivers. Retrieved 2020, from https://pubs.acs.org/ that the turbidity of the water increases ammonia levels in Pescadero creek, creek turbidity through human-activities may be having effects on aquatic life. For instance, when human activities draw up creek sediment, steelhead fish may be exposed to higher levels of nitrogen. This higher level of nitrogen may affect the health of the steelhead fish, possibly leading to death. It's not safe to say that these results are true for the entire creek, but these results do suggest that for the portion of the creek Biological Effects_Fine_Sediment_lotic_Environment_ that I collected the water samples from, ammonia I Wood_Armitage_1997.pdf

of plants and animals, but too much nitrogen can evels in sediment and nitrite levels in rocky soil are

this amazing opportunity to create my own research

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