Stream Health Assessment of Courtland Creek, Oakland California

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Introduction

Courtland Creek is an East-West trending stream located in the cities of Berkeley and Oakland, California. (Figure 3). It flows from the Oakland hills to the East Creek Slough where it enters the San Francisco Bay (Figure 4). Like many of the creeks in urban Oakland, development as altered the riparian habitat. The stream is culverted for much of its course and is exposed intermittently. We studied exposed sections paralleling Courtland Avenue between Thompson Street and Brookdale Avenue. Courtland Creek flows through a residential neighborhood with private properties extending to the upper reaches of banks in some sections and swaths of parkland in other portions. We set out to determine overall health of this stream using chemical and ecological assessment tools. We conducted dissolved oxygen, nitrate and benthic macroinvertebrate studies at three sites along Courtland Creek.

Methods

We collected nitrate samples at each sample site on July 17th, 2012 using the Aquarium Pharmaceuticals (API) Nitrate Test Kit. The kit reads total nitrates in parts per million (ppm) which are equivalent to milligrams per liter (mg/L) from 0 – 160 ppm. We also collected dissolved oxygen samples on July 17th at each site and used a LaMotte Dissolved Water Quality Test Kit to determine concentrations. We collected samples for Benthic Macroinvertebrates on July 19th, 2012. We classified benthic macroinvertebrates into three groups based on their sensitivity to pollution. To collect samples we performed kick samples using a Surber net at Site 1: Courtland Avenue & Thompson Avenue, Site 2: Courtland Avenue between Tyrrell Street and Congress Avenue & Site 3: Courtland Avenue between Fairlawn and Brookdale Avenue (Figure 3). To perform the kick samples we located a riffle and moved downstream to a flat area where the net can be submerged and good flow into the net can be achieved. We then placed the net across the flat area, and began timing (1 minute sample time). For the first 30 seconds, we picked up rocks or cobble within a 1-foot square area in front of the net, and scrub with gloved hands to remove attached organisms. For the second 30 seconds, we dug the gloved hands into the substrate within the 1-foot square sample area in front of the net. At the end of the sample time, we removed the net from the creek, making sure to sample into the back of the net. We then carefully rinse the entire sample obtained from the kick sample into back of the net, then flipped the net inside-out and washed the sample into a white dish, using clean water from the creek. The sample was then rinsed into the bin where we analyzed the sample by pouring an aliquot of the pasted sample through a sieve placed in a white dish bin. We then removed organisms to a tray and identified them using a key. The number of taxa in each of the sensitivity groups were tallied and assigned a score. The scores were then summed to yield a score which was used as an estimate of the quality of life in Courtland Creek.

Results

Figure 1 demonstrates that Courtland Creek has high levels of nitrites. 40 ppm. throughout all sites. This level would be toxic to vertebrates and stressfull for many invertebrates.

Dissolved Oxygen is also low and will affect the population of invertebrates and vertebrates in the creek. Testing at Peralta Creek, in the same watershed and with comparable depth revealed dissolved oxygen to average at 7.5ppm using the same testing. Data should be collected for Courtland Creek throughout the year to determine seasonal fluctuations in dissolved oxygen.

Figure 2 demonstrates that Courtland Creek’s dissolved oxygen levels range from sufficient to stressful for most species. Site 1 is 5.3ppm sufficient for most species. Site 2 is 4.5ppm stressful to most aquatic species. Site 3 is 5.5ppm sufficient for most species. Dissolved oxygen is lower than expected for a stream but is not the limiting factor for species in this creek. Site 2 shows a dissolved oxygen level of 4.5ppm, stressful to most species.

Figure 3 shows research site locations at Courtland Creek.

Figure 4 shows research site location in SF Bay Area.

Discussion

Courtland Creek is a stream in poor health according to our findings. Nitrate levels are high and would be toxic to fish populations if they were present. Fertilizer and animal waste inputs close to streams can cause high levels of nitrates in streams. We noticed dog waste present at Site 1 and Site 2 and 3 appeared to have human encampments along the creek. This human and animal presence may influence the levels of nitrates in the creek but further testing along other areas of the stream should be conducted. Data collected for Sausal and Peralta Creeks reveal expected 0 ppm for nitrate levels. Dissolved oxygen levels are also low and will affect the population of invertebrates and vertebrates in the creek. Testing at Peralta Creek, in the same watershed and with comparable depth revealed dissolved oxygen to average at 7.5ppm using the same testing. Data should be collected for Courtland Creek throughout the year to determine seasonal fluctuations in dissolved oxygen.

This Biotic Index Value demonstrates that pollution intensive and intermediate pollution sensitive organisms dominate Courtland Creek. However, so few organisms were collected that the application of this or any other Index Value is inappropriate. The small sample size does not provide enough evidence to make clear evaluations. The presence of pollution sensitive mayflies generally indicates a healthy freshwater ecosystem but the low amount of individuals may point to an unhealthy system. This Biotic index value records presence of taxa and does not take into account population size. Benthic macroinvertebrates test resulted in a poor rating for Courtland Creek. Numbers of individual invertebrates were low at each site as well as taxa present was low. At Sausal Creek, Oakland numbers for individual organisms are often counted in the hundreds, a recent survey counted more than 900 black flies. It may be that substrate conditions may be a limiting factor in this urban creek. Much of the creek is culverted and areas of riffles may be sparsely interpersed throughout the system. Further analysis of the substrate at each site should be conducted. This initial assessment of Courtland Creek revealed an unhealthy system. Further data should be collected across the length of the creek and throughout the year to get a comprehensive understanding of the dynamics of this system. Restoration efforts by the Friends of Courtland Creek should be supported and expanded. The Friends of Sausal Creek has conducted extensive restoration and research in their watershed with great improvements in overall health of creeks in Oakland, California and serve as a model for community led stream improvement.