An Analysis of Crayfish Populations in the Rouge River Compared with Select Water Quality Parameters

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Abstract

The Rouge River watershed of Southeastern Michigan is encompassed within a region that has become highly urbanized during the past century. The development has led to a significant number of fragmented ecosystems and has decreased species biodiversity. The wetlands, backwaters, and tributaries of the Rouge River make up a variety of smaller sub-ecosystems, each with a set of unique characteristics. There must be adequate research into the species that inhabit these smaller regions if we hope to restore, preserve and protect the species that remain. The crayfish is one caustacean that inhabits these inland waters and branches of the Rouge River. Crayfish are considered a keystone species in many aquatic ecosystems. They control plant and fish populations and are needed food source for many aquatic biota. The crayfish's diet is varied, ranging from small vertebrates to small aquatic plants and aquatic invertebrates. The current study was conducted over two months using minnow traps that were designed, engineered and deployed to monitor crayfish populations in two branches of the Rouge River - the Lower and Middle Branch. Data was also simultaneously collected on air and water temperature, dissolved oxygen, and turbidity using Vernier LabQuest 2 sensors. During this research, crayfish populations were monitored throughout the autumn of 2021 - crayfish were trapped, measured, identified, and returned to the river. As autumn progressed and temperature dropped, the quantity of crayfish collected increased. Only one crayfish species was trapped in both areas of the Rouge River during sampling - the G. b. lineatus. Virile Crayfish (Orconectes virilis - dark blue line) and crayfish populations (green line). The graph shows a strong negative correlation between air temperature (dark blue line) and crayfish populations (green line). The graph illustrates a slight negative correlation between crayfish populations (green line) and turbidity (brown line). The graph also shows little to no correlation between crayfish populations (green line) and turbidity (brown line). These correlations are most clear in data points 4 - 6. The graph shows a strong negative correlation between air temperature (dark blue line) and crayfish populations (green line). The graph illustrates a slight negative correlation between crayfish populations (green line) and turbidity (brown line). The graph also shows little to no correlation between crayfish populations (green line) and turbidity (brown line). These correlations are most clear in data points 4 - 6. The graph shows a strong negative correlation between air temperature (dark blue line) and crayfish populations (green line). The graph illustrates a slight negative correlation between crayfish populations (green line) and turbidity (brown line). The graph also shows little to no correlation between crayfish populations (green line) and turbidity (brown line). These correlations are most clear in data points 4 - 6.

Methodology

Crayfish are aquatic crustaceans found in inland bodies of water around much of the world. They have a varied diet of small organisms including insects, tadpoles, fish, snails, plants, and even decaying material (Hattalo). This wide-ranging diet allows them to fill in a niche where energy is transferred within aquatic food webs. However, this varied diet means some crayfish species are more adaptable and more successful. Common crayfish species include the Virginian Crayfish (Orconectes virilis) and the Red Swamp Crayfish (Procambarus clarkii). Crayfish are also important biotic factors where their population numbers correlate heavily to its specific environmental conditions. As a result, their populations can be used as a sign of a change in a certain condition of an aquatic ecosystem. According to Dr. Lucas, some of these indications include indicators of a growing industrialized society. If crayfish are disturbed, greenhouse gases entering our atmosphere annually. We are now seeing an increase in greenhouse-gases due to the immense amount of greenhouse gasses entering our atmosphere annually. As our society continues to develop, we need to do our part in monitoring and keeping track of how it affects our local ecosystems. Crayfish are a great indicator species for water quality degradation. This experiment was designed for the purpose of determining the health of our local river system through the capture of these species compared to their habitat. Results have found trends that varied from the lower and middle branch tested. The aspects that were shared by the two sites was that populations of crayfish increased as surface temperature went down. The two sites contained the same species, the Virginian Crayfish, and they both had a majority of females caught. The trend for global temperatures in the world is expected to increase due to increases in the release of greenhouse gasses entering our atmosphere annually. Since our data shows that crayfish populations far better in cooler temperatures, this global warming trend is not good at all. Crayfish must learn to adapt or they are in danger of a growing industrialized society. If crayfish are disturbed by higher temperatures, whole food chains can collapse.

Results

1. There is no difference in crayfish species and their numbers found in these (2) branches of the Rouge River.
2. There is no correlation between crayfish numbers and dissolved oxygen levels.
3. There is no correlation in crayfish numbers and turbidity.
4. There is no correlation between temperature values and crayfish numbers.

Discussion

The Middle Rouge Branch seemed to not correlate with temperature as closely as the Lower Branch had. The Middle Rouge Branch’s crayfish population seemed to slightly decrease as fat progressed, rather than correlating with measured temperature. Crayfish of the Lower Branch seemed to highly correlate in all air and water temperature, the captures of crayfish in the Middle Rouge seemed to decrease as temperature dropped. However, the graphs of the two branches seemed to be inconclusive and more data and research would be needed to determine the correlation. The Lower Rouge on the other hand, had a strong correlation between temperatures and crayfish capture rates. As temperatures dropped, so did crayfish numbers and activity. However, the trend is not as consistent as the Middle Rouge Branch. The Middle Rouge Branch did seem to have a slight positive correlation with temperature, however, it was not as strong as the Lower Branch. During the seven-week testing period, where each week saw a decrease in temperature there was a corresponding decrease in crayfish numbers. As the temperature dropped, so did crayfish populations.

Conclusion

As our society continues to develop, we need to do our part in monitoring and keeping track of how it affects our local ecosystems. Crayfish are a great indicator species for water quality degradation. This experiment was designed for the purpose of determining the health of our local river system through the capture of these species compared to their habitat. Results have found trends that varied from the lower and middle branch tested. The aspects that were shared by the two sites was that populations of crayfish increased as surface temperature went down. The two sites contained the same species, the Virginian Crayfish, and they both had a majority of females caught. The trend for global temperatures in the world is expected to increase due to increases in the release of greenhouse gasses entering our atmosphere annually. Since our data shows that crayfish populations far better in cooler temperatures, this global warming trend is not good at all. Crayfish must learn to adapt or they are in danger of a growing industrialized society. If crayfish are disturbed by higher temperatures, whole food chains can collapse.

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