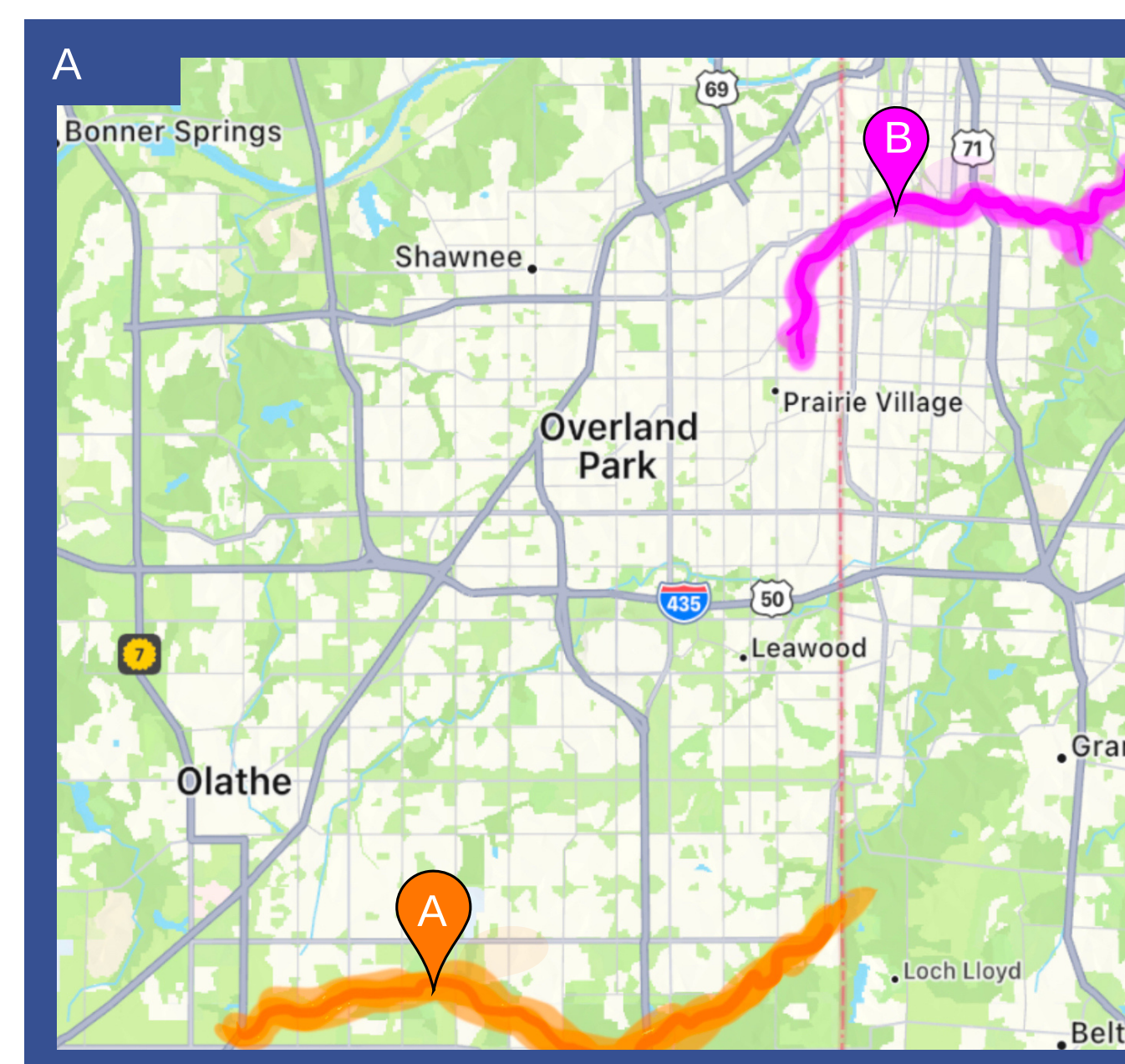


## Abstract

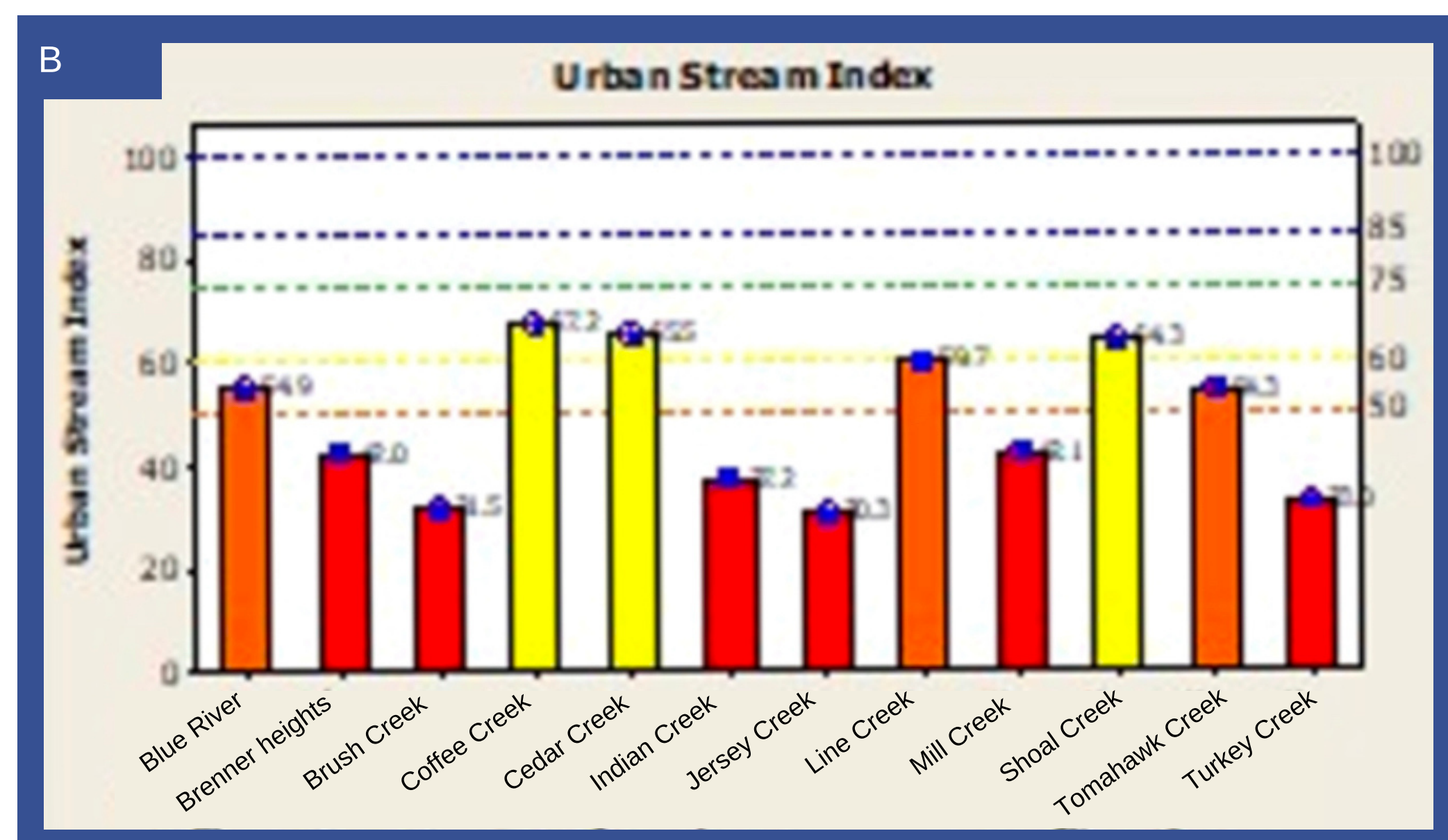
Water pollution is a primary facet of anthropogenic environmental degradation. Marine plants and animals are devastated by the plethora of toxic wastes, invasive species, and chemical contaminants humans have introduced into their habitats. We examined the impact of water quality in local streams on planarian: an aquatic invertebrate from the phylum Turbellaria. By using two different species of planaria (*Schmidtea mediterranea* and *Dugesia japonica*), we examined the impact water quality concentrations from local streams had on the worm's livelihood. **We hoped to find convincing evidence that we could use these worms as bioindicators of water quality and biodiversity in the future. We found that both species used in the experiment were indeed suitable organisms for in-lab testing and the results of the local water quality affecting planaria helped determine which stream was worse than the other.**

## Background

### Sample Selection Factors

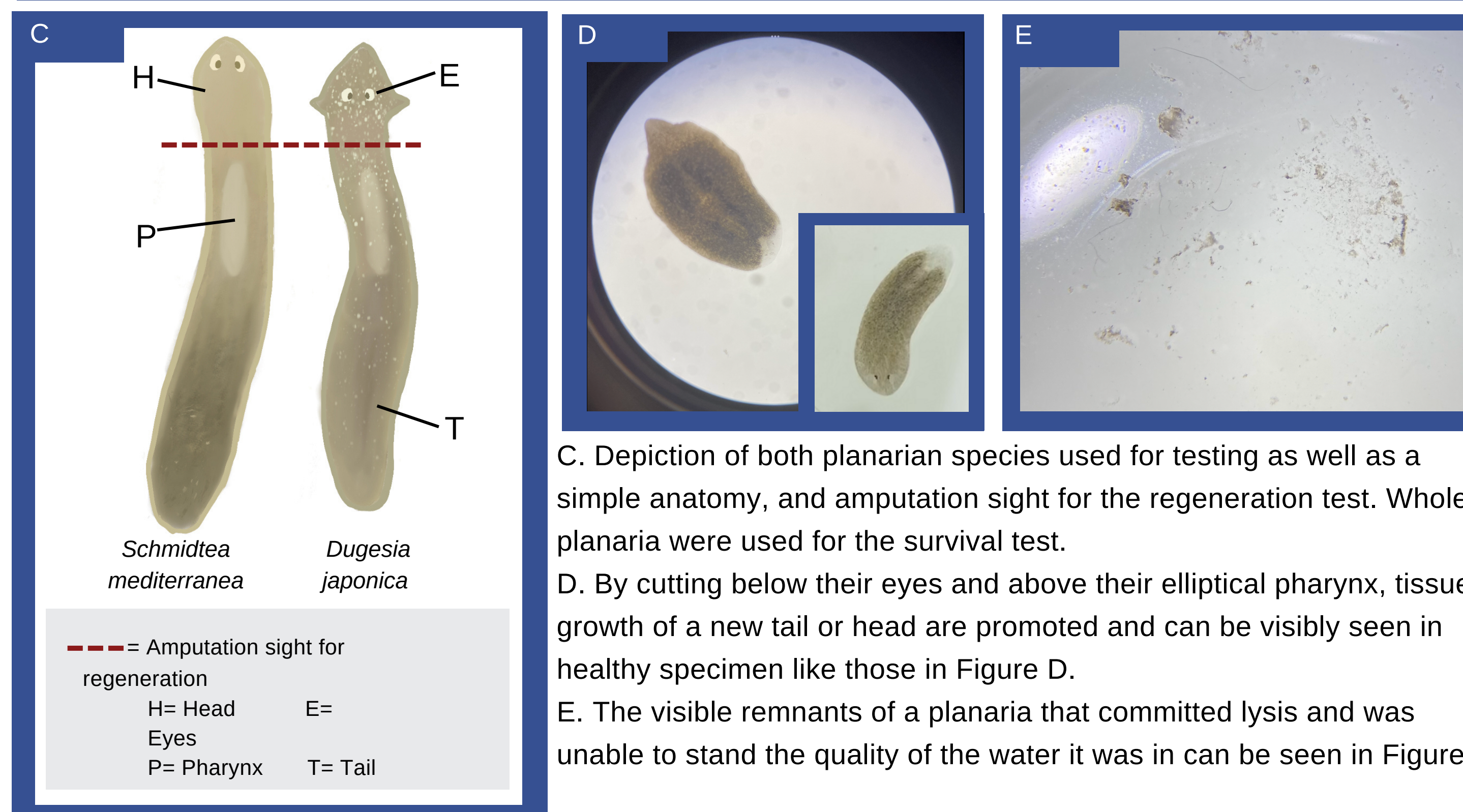


A. Map of the greater Kansas City area highlighting the streams used for this research project and their corresponding sample sights. They were chosen due to their urban stream index rating out of all the other streams in the area as seen in Figure B. Stream A was the highest rated while Stream B was the lowest. As a result of the data, its conclusive that **Stream A= good** and **Stream B= bad**.



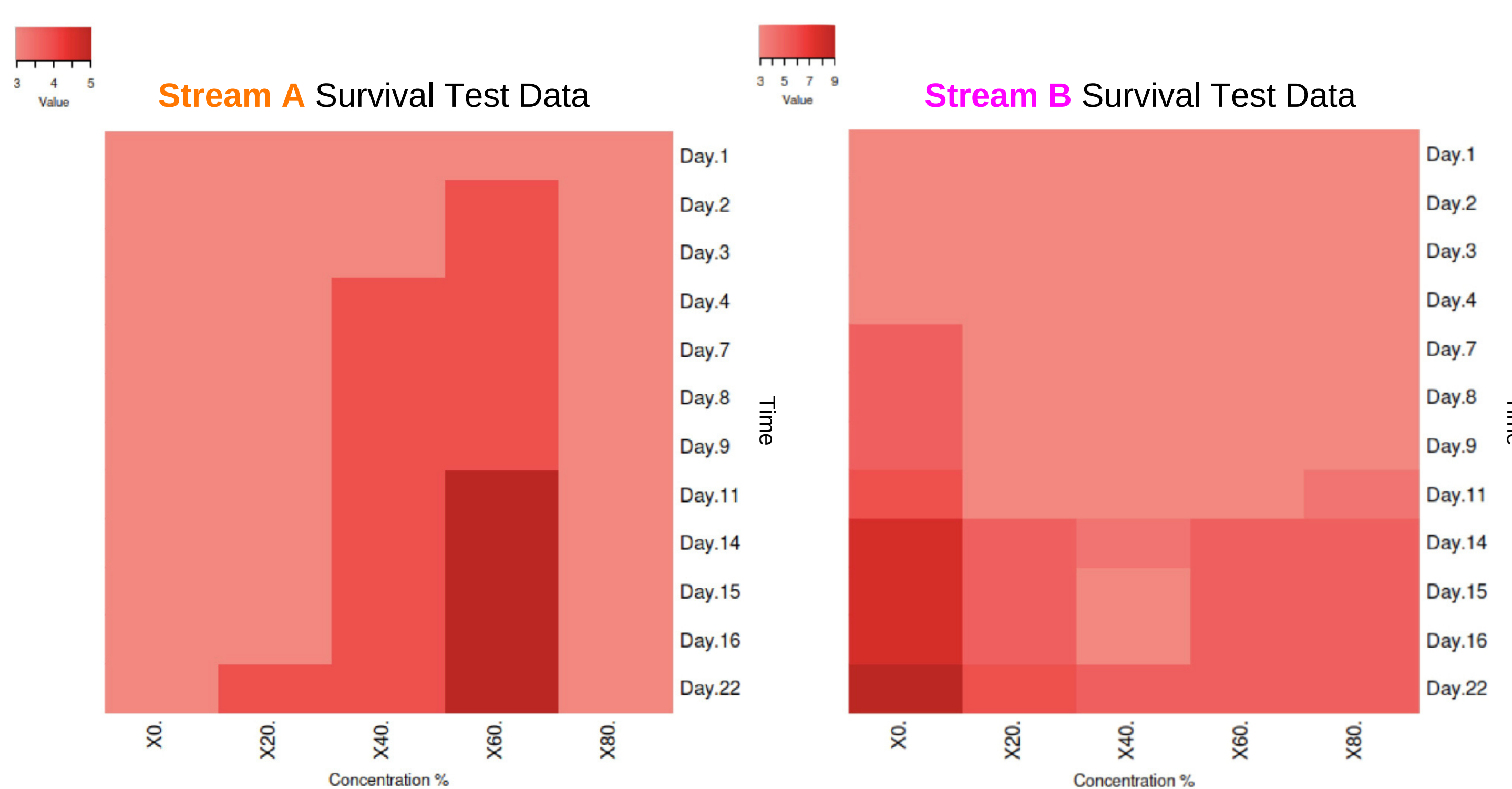
B. A bargraph comparing the urban stream index scores of all the local streams in the greater Kansas City area.

## Methods and Results



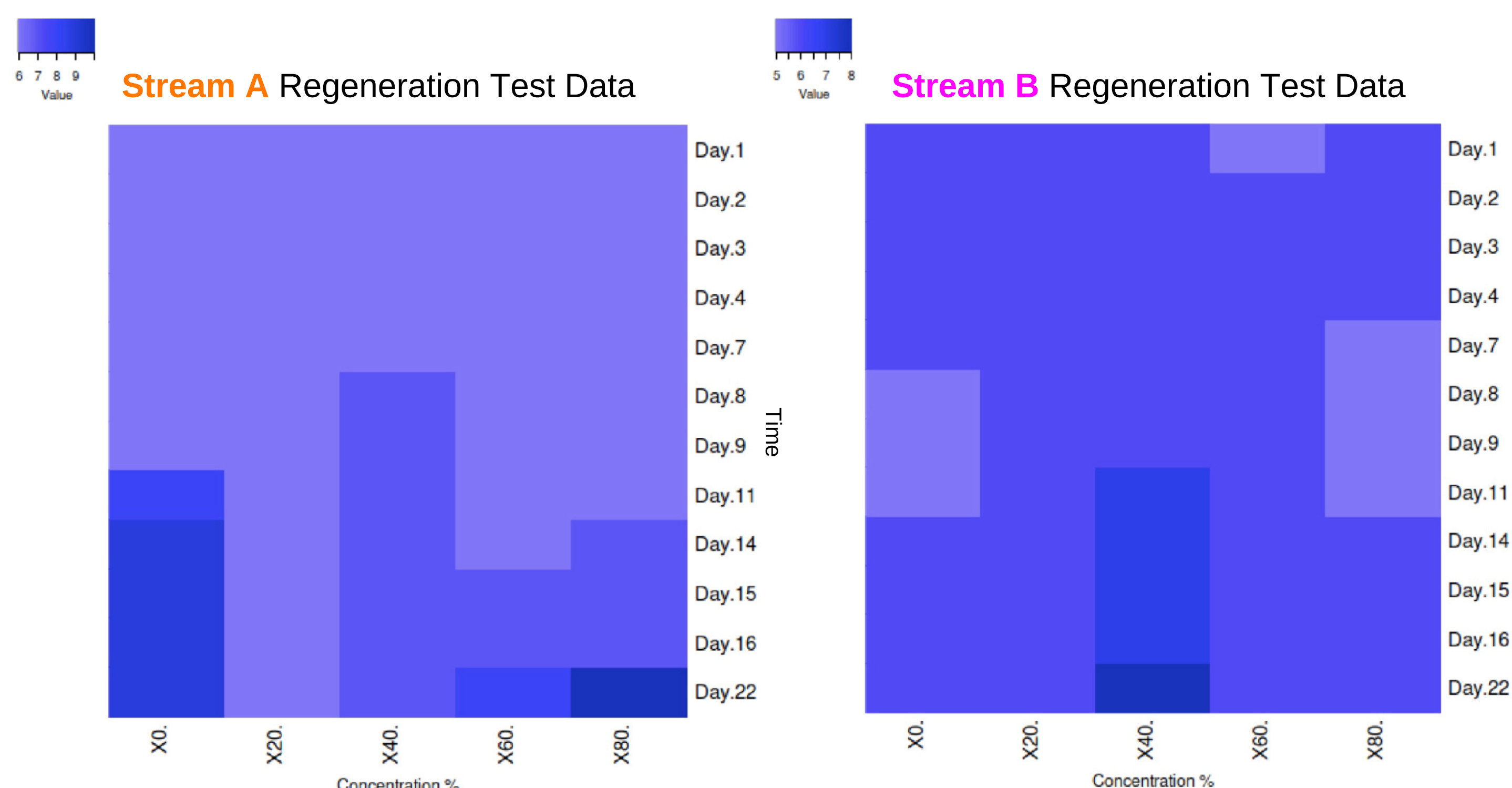
C. Depiction of both planarian species used for testing as well as a simple anatomy, and amputation sight for the regeneration test. Whole planaria were used for the survival test.  
D. By cutting below their eyes and above their elliptical pharynx, tissue growth of a new tail or head are promoted and can be visibly seen in healthy specimen like those in Figure D.  
E. The visible remnants of a planaria that committed lysis and was unable to stand the quality of the water it was in can be seen in Figure E.

### Survival Heatmaps



The figures above represent test data through heat-maps and compares survival rates of planaria in stream A vs. stream B. Theses graphs contain data from the *Schmidtea mediterranea* experiments and visibly show the correlation of survival in certain stream water concentrations over time.

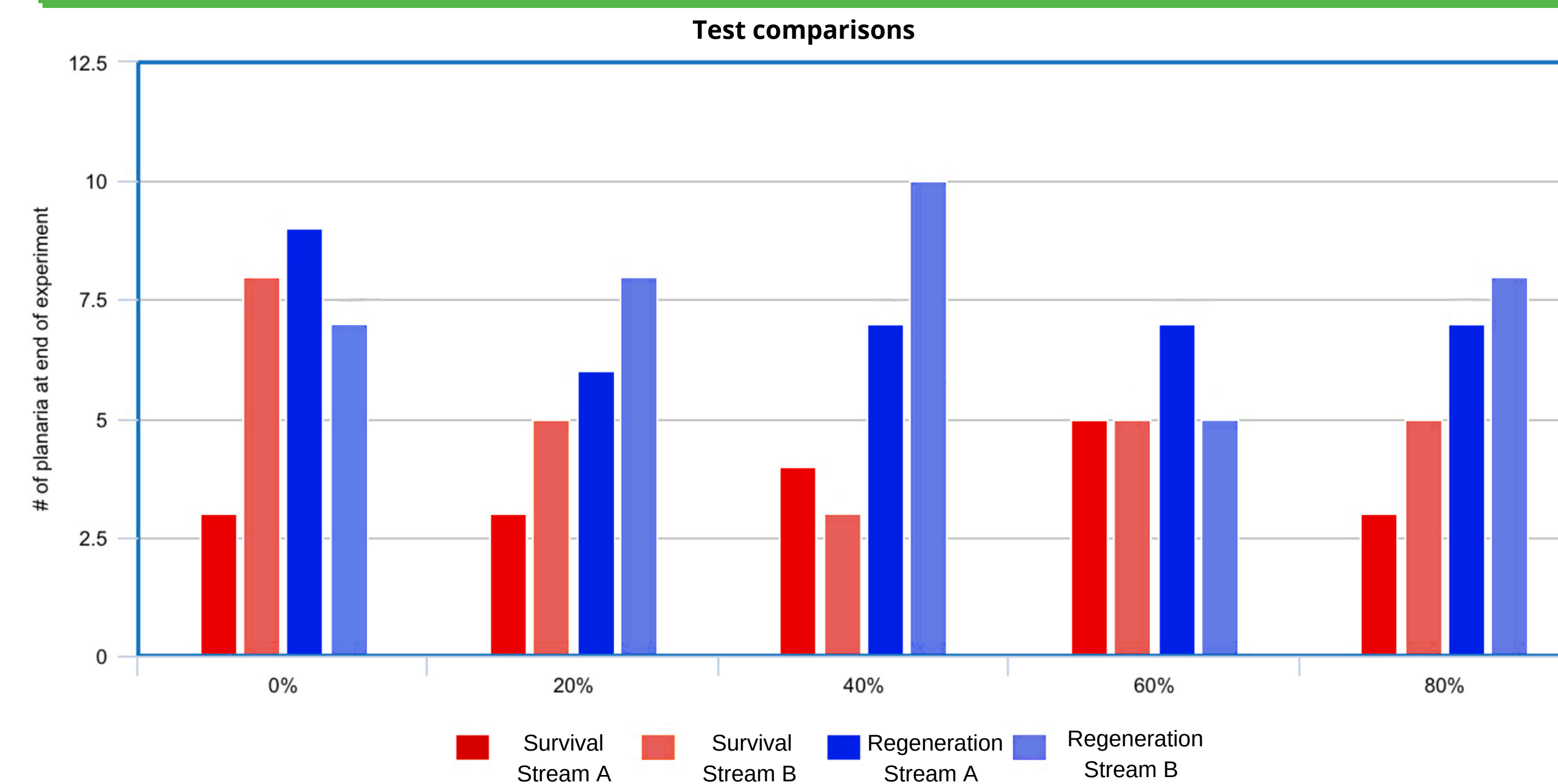
### Regeneration Heatmaps



The figures above compare the regeneration rates of cut planarians. They contain data from the *Schmidtea mediterranea* experiments and show the correlation of regeneration in certain stream water concentrations over time.

## Conclusion and Discussion

### Quantitative Heat Map Comparison



The figure above represents the total amount of planaria at the end of the tests. This graph correlates with the data shown in the survival and regeneration heat maps under the Methods and Results section.

### Qualitative Heat Map Comparison

Similarities with streams A and B	Differences with streams A and B	Conclusion
<ul style="list-style-type: none"> <li>Planaria survived in all concentrations</li> <li>Both streams had reproduction occur in 20%, 40%, and 60% concentration</li> </ul>	<ul style="list-style-type: none"> <li>The only planaria that died was in stream B</li> <li>Stream A had the highest survivability and reproduction in 60% concentration</li> <li>Stream B had the highest survivability and reproduction in 0% concentration</li> </ul>	In conclusion stream A was a better environment for the planaria than stream B. A death occurred in stream B and planaria didn't reproduce as much in the higher concentrations compared to those in stream A.
<ul style="list-style-type: none"> <li>Planaria survived in all concentrations</li> <li>Both streams had regeneration occur in 0%, 40%, 60%, and 80% concentrations.</li> </ul>	<ul style="list-style-type: none"> <li>3 deaths occurred in stream B in 0%, 60% and 80%.</li> <li>Stream A had the highest survivability and reproduction in 80% concentration</li> <li>Stream B had the highest survivability and reproduction in 40% concentration</li> </ul>	In conclusion stream A was a better environment for the planaria than stream B. 3 deaths occurred in Stream B before any reproduction had occurred in those concentrations. Stream A was also able to maintain a steady survivability overall.

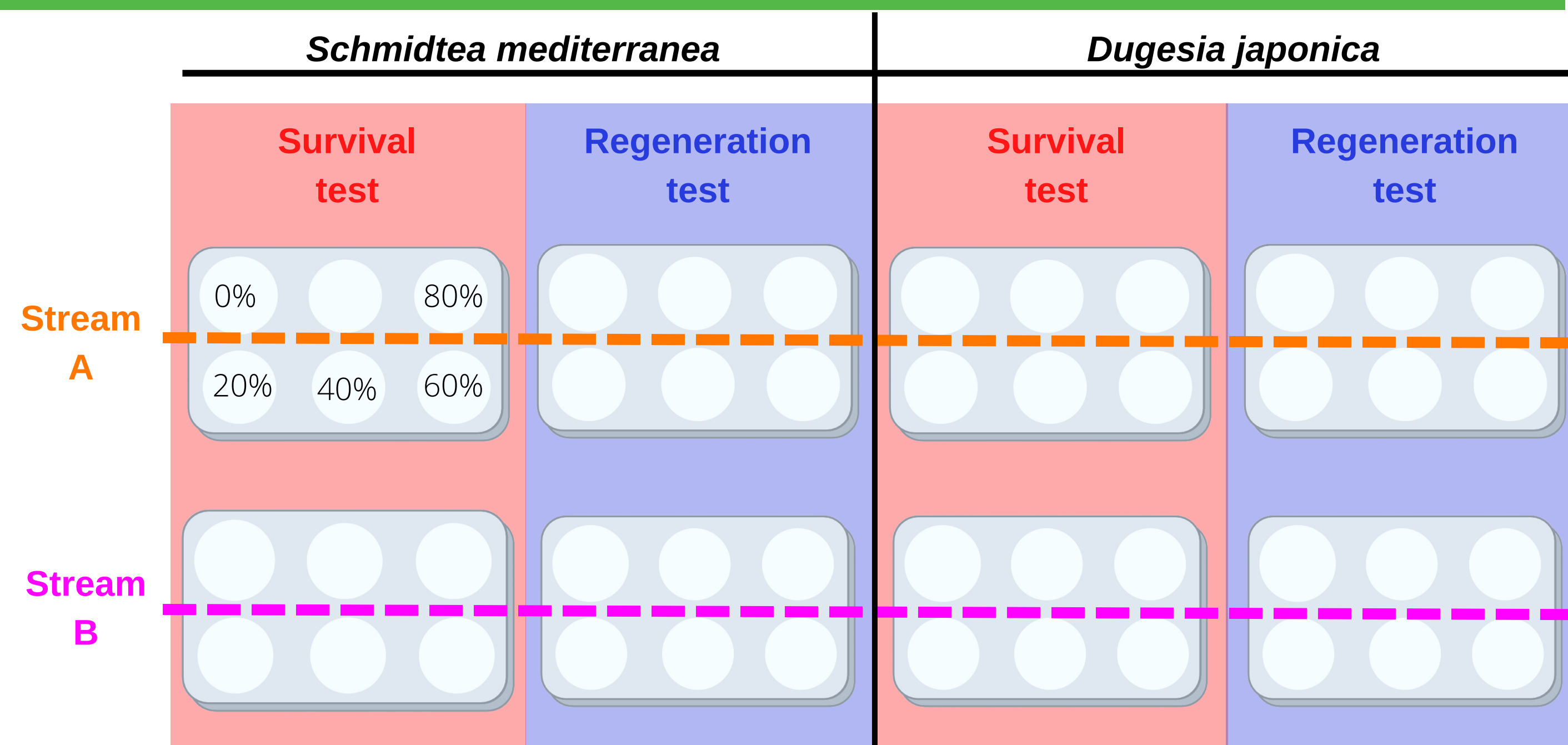
### Main Conclusion

**When comparing the day-to-day totals of the original planaria that survived we can conclude that stream B was indeed worse for the planaria, as was predicted.** However, all planarians were clearly agitated and under stress in all stream water concentrations higher than 20% after the first day of experimentation. This is clearly seen in them moving slowly, adopting a 'scrunched' posture, as well as curling up which was seen primarily in the 80% concentration. Continued research about the quality of streams in the greater Kansas City area is vital to protect our ecosystems. An effective first step would be to test all major streams in the greater Kansas City area and, subsequently, find the most endangered ecosystems. This will allow environmental activists, ecologists, and conscious lawmakers to allocate their resources to the areas with the most urgent needs.

### Acknowledgments

I'd like to thank Julianna Haug for taking the time to be my designated scientist and helping me with my project setup and with the knowledge she was able to provide. I would like to thank Dr. Biff Mann from the Alejandro Sánchez Alvarado lab at the Stowers Institute for his time and guidance throughout the entirety of this project as well as the amount of information on planaria he was able to provide for me. I'd like to thank Laura Webb from the Environmental area. I would also like to thank my teacher Mr. Eric Kessler for the help he provided as well as believing in my search to find a meaningful project. Finally, I would like to thank my mom for always believing in me.

## Experimental Design



The figure above represents the set up for the tests. It depicts the different concentration setups in each of the wells in the 6-well plate as well as the different tests in relation to one another.