

INTRODUCTION

Years ago, near the commencement of my surfing life, there was a certain surf break I would go to contained within the Pillar Point Harbor in Half Moon Bay, California. As time went on, I proceeded to call that break home - knowing every last corner of the area. One day, I was devastated to find out that there was something in the water, and then I saw a sign reading: "Contaminated Water. Keep Out." From then on, I noticed an increase in coastal pollution at treasured surf breaks all over the San Mateo County. Surfers find refuge at these spots and the continuous pollution threatens their sanctuary. However, the majority of people choosing to recreate in these areas are completely unaware of the contamination and the dangers that present themselves with the problem.

There is a problem with contamination of coastlines around the world. Despite attempts at protection of coastlines and various research being done to determine the cause of the pollution, these coastlines continue to be contaminated with microbes present in the water that could make people sick (Nevins, 2017). This problem poses a threat to people who choose to enter the water - they may face health issues as a result of the bacteria in the contaminated area. A possible cause of this problem is irresponsible disposal of waste, which may flow into the ocean as well as insufficient research being done to pinpoint the problem. Perhaps work being done to educate the public about these issues, talking to executives related to the problem and increasing awareness at the physical locations through markings can help remedy this issue.

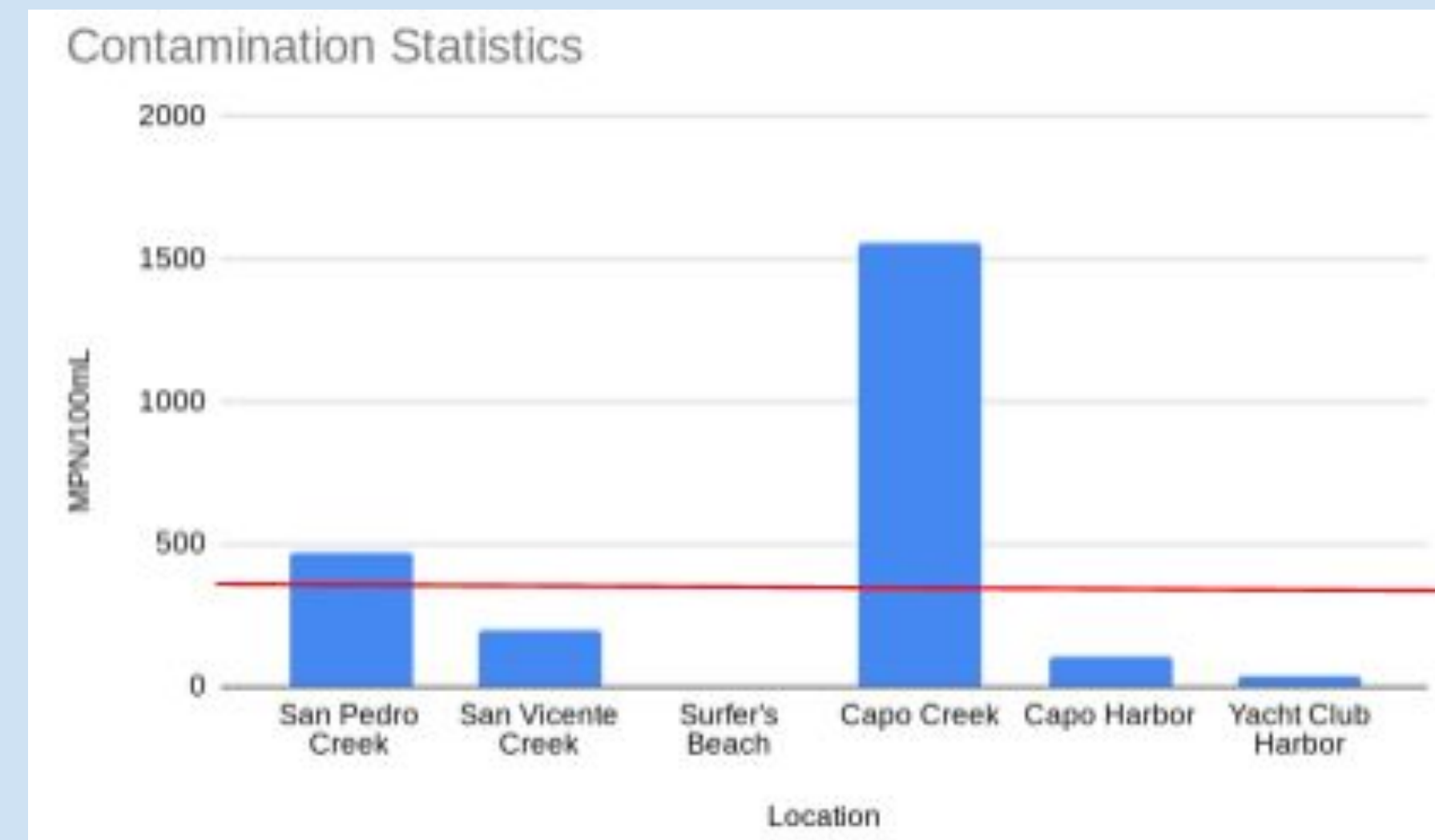
RESEARCH METHODOLOGIES

A hybrid study approach was followed throughout my research - this hybrid consisted of an inquiry approach of action research. I will do physical data collection and research, but with this research my main goal in mind will involve taking action in order to address the main problem. What is meant by this is that with my data findings I talked to certain county officials and tried to persuade them to make changes or even grant me permission to make changes myself (putting up warning signs, etc). Action research also helped me measure my success to a much greater extent because I was able to summarize my work through communication.

With respect to data collection tools, I incorporated the use of descriptive statistics to analyze the physical data. Additionally, I used both qualitative and quantitative data in order to fulfill the needs of my project. Quantitative research was used to detail the degree of contamination through data tables and more. Qualitative data, on the other hand, enabled me to describe where the contamination was coming from, and list other specific observations that were critical to my project. As my project developed, I discovered that there was an increasing need for both qualitative and quantitative data in order to persuade people of the degree to which contamination is a major problem - sometimes only numbers do not have a significant enough effect to bring real change.

My project does not directly correlate with a certain specific population; rather, it is directed towards visitors and local populations surrounding the coastlines. The final goal was to improve the lives of citizens, recreators (surfers, swimmers, and more), visitors, and animals living within the contaminated water. In technicality, I also studied the population of bacteria present within these contaminated sites. This group of bacteria was included in the smaller subset group I was studying - again, my project has to do with the bigger picture: data collection involving bacteria is a critical component, but further action was taken to bring awareness to the issue. This is where I defined my success.

DATA AND FINDINGS

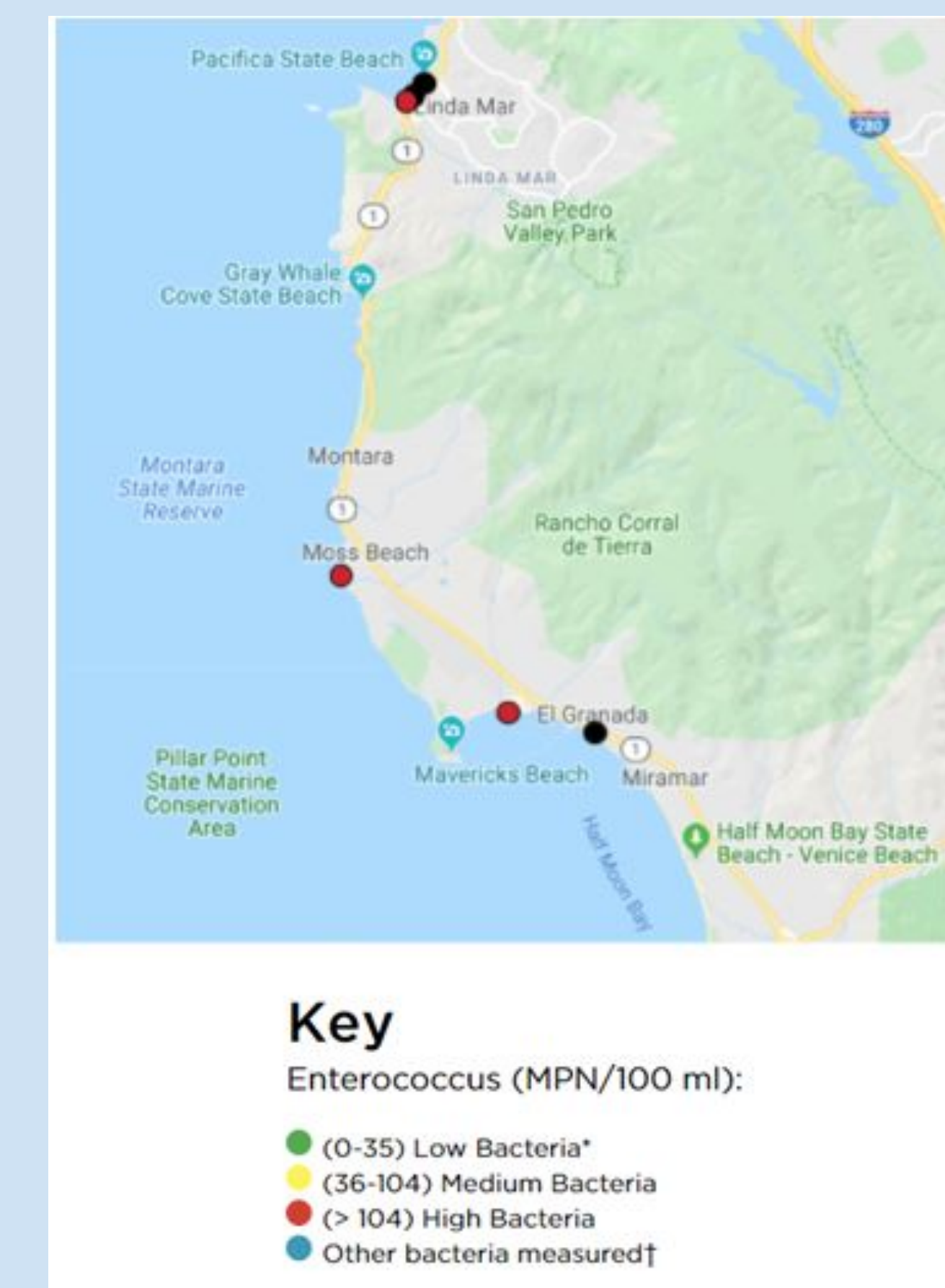


Enterococcus Mpn/100 mL contamination results. The red line indicates the limit for safe recreational bacteria standards. Various locations contain bacteria levels up to 4 times higher than the maximum safety standard. It is important to note that these levels fluctuate - this graph pictures average data numbers over the course of two samples taken during a dry period. An increase in rainfall will subsequently lead to an upward fluctuation in contamination.

Pictured here is the physical contamination data, as well as where this contamination is with respect to a map. It is apparent that the majority of the contamination is located within populated areas, leading to the conclusion that there is a direct relationship between enterococcus levels and human activity (runoff, septic failure, etc.). As apparent from the map, many of these highly contaminated sites are highly used for recreation.

February 2020

Water Test Site	02/07/2020	02/15/2020	02/21/2020	02/27/2020	Avg
San Pedro Creek	473	122	31	31	164
San Vicente Creek	473	52	318	31	219
Capistrano Outfall	15531	150	97	63	3960
Capistrano Beach	109	10	52	158	82
Surfers Beach	0	30	10	0	20

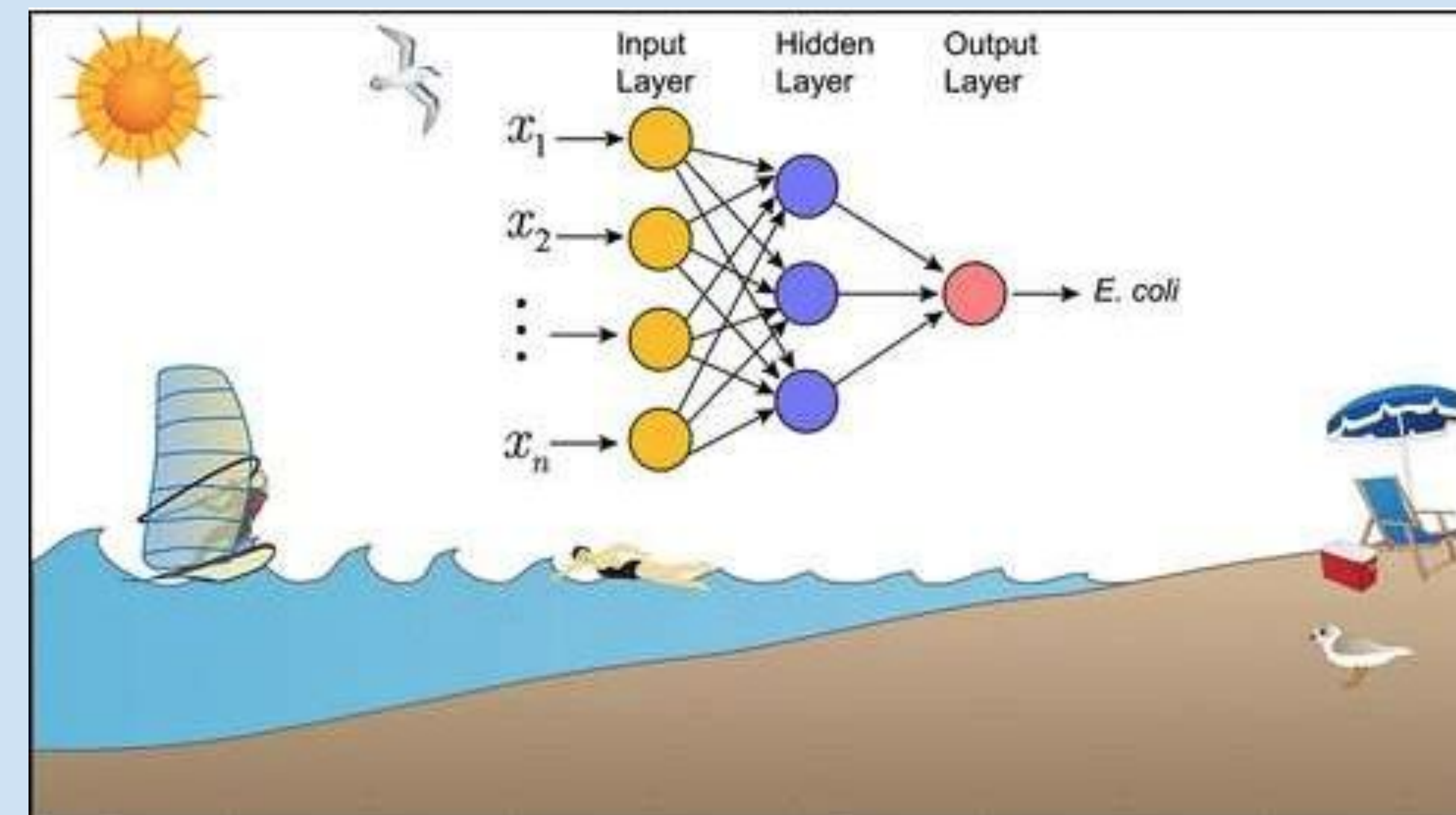


IMPLICATIONS AND NEXT STEPS

Ideally, eradicating this problem to the greatest extent possible would be ideal: this would be done by controlling septic issues, preventing runoff, and more. However, with a limited access to resources and materials, a more logical approach would be to *predict* when the harmful periods of water quality would come and go, and advise the public about this. Simply put, a day at the beach *should not make you sick*, so a combination of future mitigation of contamination as well as awareness of the issue is the most logical approach. A lack of public awareness is evident: however, this is majorly a governmental issue. Close to no signs are posted along the coastlines warning recreators about the dangers of the pollution. Further steps include getting involved in the legislative process, including persuading county officials the importance of putting up more warnings.

CONCLUSIONS AND ANALYSIS

In conclusion, there is a clear health threat to ecosystems and recreators because of the mistreatment and negligence of septic tank issues and runoff, and limited public awareness with respect to the health effects of this contamination. In order to combat these issues, it is logical to forecast when these dangerous periods of contamination will arise, because simply enjoying the ocean should not make one sick.



A model describing the formation of bacteria such as e. coli and enterococcus, which can be used to forecast future contamination. Courtesy of NowCast.

ACKNOWLEDGEMENTS / REFERENCES

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