Tijuana River Valley: A Study of how Pollution Effects Marine Life

Scott Wagner

ENV S 40 - Critical Thinking and Reason

Prof. Martin

TA: Ada Olumba

November 27, 2024

Abstract:

The Tijuana River has been facing ongoing pollution challenges impacting the health of the environments around it. This study aims to assess the impact of pollution from the river on marine organisms as it flows into the ocean. Data was collected through water samples and wastewater flow statistics from multiple different governmental and environmental protection agencies. The samples were then analyzed and evaluated for expected impact on marine organisms. The studies found high volumes of wastewater spill during overflow events and concentrations of chemicals and heavy metals exceeding standards for baselines implemented for the protection of marine organisms. These findings suggest that the current water management practices are ineffective at protecting the life of local marine organisms, causing significant damage to the ecosystem as a whole. The study concludes that urgent action is necessary between the United States and Mexico in order to mitigate pollution and protect the health of the ocean at the end of the Tijuana River.

Introduction:

Making its way through a busy city, the Tijuana River carries more than just water. It transports the burden of human impact through pollution caused by toxic chemicals, heavy metals, and untreated sewage. The effects of this degradation can be seen far downriver. As the contamination spills into the coastal waters of Southern California, the marine ecosystems are taking a detrimental blow, potentially fatal. This leads to my research question and the scope of my project. What are the ecological impacts of the Tijuana River Valley pollution on local marine life? I chose this topic because it is close to my heart; the ocean has been a driving force

in many aspects of my life, and I feel the need to advocate for it. This is also a very current and disputed event that I have wanted to learn more about; this project has allowed me to do so.

Methods:

Research Design

This study uses a cause and effect approach to assess pollution levels in the Tijuana River Valley and their subsequent impact on marine ecosystems. The research focused on three primary areas, volume of wastewater flow, individual contaminants present in the river's discharge, and expected impact on marine life in adjacent coastal ecosystems. Water sampling data was collected from multiple different sources, dates, and locations along the river.

Data Sources

- California Coastal Commission
- International Boundary and Water Commission (IBWC)
- California Water Boards
- Tijuana River National Estuarine Reserve (TRNERR)

Results:

- Approximately 8,340 gallons of wastewater is lost from the Tijuana metropolitan area wastewater collection system per minute, flowing directly into the Tijuana River. (California Coastal Commission, 2023)
- Between 1/07/2022 and 3/11/2022 over 3 billion gallons of wastewater flows were detected across multiple locations including Stewart's Drain, Goat Canyon, and the

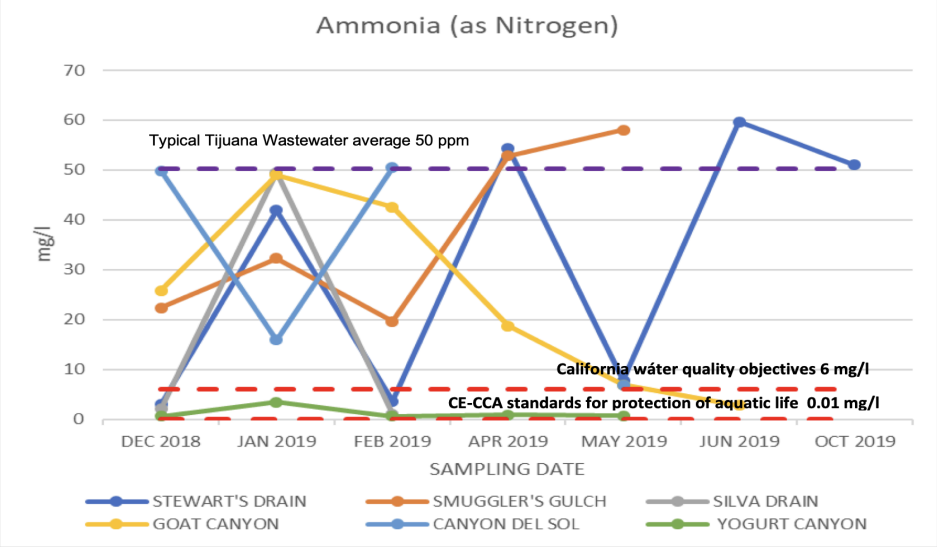
Tijuana River Main Channel across only a 2 month span. (California State Water Resources Control Board, 2024)

Figure 1: *2022 Transboundary Flow Reports* (California Water Boards)

Start Date	End Date	Volume (Gallons)	Location	Reported Cause
01/07/2022	01/08/2022	942,480	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/08/2022	01/09/2022	643,280	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/09/2022	01/10/2022	13,164,800	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/10/2022	01/11/2022	17,054,400	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/11/2022	01/12/2022	8,213,040	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/12/2022	01/13/2022	2,677,840	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/13/2022	01/14/2022	2,244,000	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/14/2022	01/15/2022	1,196,800	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/15/2022	01/15/2022	718,080	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/15/2022	02/09/2022	921,000,000	Tijuana River Main Channel	Shutdown of Pump Station CILA to Relieve Pressure on International Collector
01/19/2022	01/19/2022	44,880	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
01/28/2022	01/28/2022	842	Goat Canyon	Planned Maintenance at Laureles Pump Station in Mexico
01/30/2022	01/30/2022	97,240	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
02/07/2022	02/07/2022	78,540	Stewart's Drain	Leak from the Deteriorated Section of the International Collector in Mexico
02/15/2022	03/11/2022	2,100,000,000	Tijuana River Main Channel	Storm Event

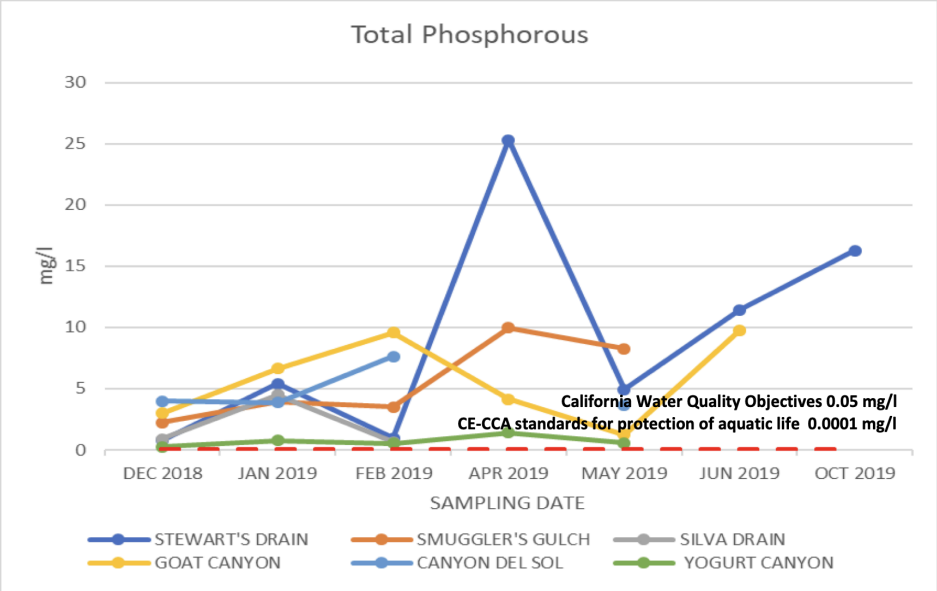
- Between December 2018 and October 2019 Nitrogen levels greatly exceeded the maximum level for protection of aquatic life of 0.01 mg/L. (IBWC, 2023)

Figure 24: *Tijuana River Watershed map* (International Boundary and Water Commission, 2023).



- Between December 2018 and October 2019 Phosphorus levels greatly exceeded the maximum level for protection of aquatic life of 0.0001 mg/L. (IBWC, 2023)

Figure 26: *Tijuana River Watershed map* (International Boundary and Water Commission, 2023).



- Heavy metals such as copper (present in concentrations of 30ppb), nickel (present in concentrations of 30 ppb), and zinc (present in concentrations of 90 ppb) all exceeded the maximum values for protection of aquatic life at 7.5, 8, and 54 ppb respectively. (IBWC, 2023)

Discussion:

In addition to the high volumes of wastewater that enter the river, the individual water samples failed in multiple parameters dictated by the maximum value for marine life protection. Present in the water samples were high concentrations of nitrogen, phosphorus, three types of heavy metals, and indicators of raw sewage. High concentrations of nitrogen and phosphorus are

indicators of eutrophication in marine areas. Nitrogen, in particular, fuels algal blooms, which when they die, consume large amounts of dissolved oxygen. This consumption of oxygen creates hypoxic, or even anoxic conditions in the surrounding areas, causing fish and other invertebrates who rely on oxygenated water to die. Copper, zinc, and nickel were all also present in numbers exceeding the maximum value for the protection of marine life. Copper is considered the most toxic to marine organisms, causing impaired growth, reproductive issues, and disruption of physiological functions. It particularly impacts invertebrates such as corals, sea anemones, and crustaceans. However, all metals can bioaccumulate in the tissues of marine organisms, negatively affecting those higher in the food chain, such as birds and large mammals outside of the water. On the topic of birds, the river valley is the host to over 370 different bird species, many of which are either threatened or endangered (TRNERR). Ecosystems work as a domino effect; with the damage currently done to the local marine life, there are sure to be signs outside of the water as well. But what is the leading cause of the failing samples? Much of the current water treatment infrastructure is deteriorating, and similar to our Southern California oil platforms, there has been minimal improvement over the last few decades. Examples such as faulty pumps and corroded pipes are just the beginning of the problem for spills; common components are often unmaintained and consistently fail. Additionally, Tijuana has a rainy season that brings storms, which often flood and completely overwhelm the current infrastructure. For example, in the first figure, from 2/15/2022 through 3/11/2022, roughly 2.1 billion gallons of wastewater made its way into the river from one storm event alone. The storms bring runoff from agriculture, industry, and residential areas, eventually leading to the surrounding coastal waters. Over the years, there have been attempts to improve the

infrastructure conditions, but most have failed due to high costs and the joint jurisdiction necessary between the United States and Mexico.

Conclusion:

In conclusion, the pollution of the Tijuana River presents a significant and ongoing threat to local marine life and the broader ecosystem, with consequences extending beyond the water itself. The lack of maintenance and investment, coupled with the joint ineffective jurisdiction between the United States and Mexico has resulted in a system that is unprepared to manage wastewater flow. Addressing the pollution requires urgent action to modernize and rebuild infrastructure, implement more effective management strategies, and strengthen cooperation between the two nations. The health of our oceans and marine organisms is essential, acting as a carbon sink, regulating global climate change, and providing a primary food source for billions of people. If we continue our current habits and neglect protection efforts for the ocean we risk the threat of biodiversity loss and far-reaching consequences for both wildlife and human populations that depend on it for their livelihood.

References:

California Coastal Commission. (2023, October). *Tijuana River pollution crisis in San Diego County (Appendix)*. Retrieved November 2024, from https://documents.coastal.ca.gov/reports/2023/10/W6b/W6b-10-2023-appendix.pdf

International Boundary and Water Commission (IBWC). (2023, September 1). *Binational report: Tijuana River Watershed (Min. 320)*. Retrieved November 2024, from https://www.ibwc.gov/wp-content/uploads/2023/08/Min320_Binational_Report_TJ_River_Watershed_with_Appendix090120.pdf

San Diego Regional Water Quality Control Board. *International Boundary and Water Commission Transboundary Flow Reports.* International Boundary and Water Commission Spill Reports | San Diego Regional Water Quality Control Board. Retrieved November 2024, from www.waterboards.ca.gov/sandiego/water_issues/programs/tijuana_river_valley_strategy/spill_report.html

Tijuana River National Estuarine Research Reserve (TRNERR). (2013). *Existing conditions*. Tijuana River National Estuarine Research Reserve. Retrieved from http://trnerr.org/wp-content/uploads/2013/04/trv_existing_conditions.pdf