

Ranchers and Residents: Do both affect Aquatic Life?

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1. A brief statement of my study in Spanish

Soy estudiando la calidad de la agua en Las Juntas. Concretamente yo estudie los niveles del población totales de Bacteria y observado a una indicación de bacterías coliformas. Mi Pregunta original era, Cuales la calidad de el agua cerca de los ganados alrededor de Las Juntas? Mi pregunta tenga una cambio poquito porque de la locación y distribución de el agua tenia la potencial a contribuir a los niveles de bacteria. Ahora mi pregunta nueva es Como es los niveles de bacteria coliformas y la cumulativa población de bacteria afectada por el pueblo y los rancheros.

2. Importance of study

It is important to find out the answer to my question primarily because the watersheds and rivers are used by most of the local inhabitants. It is important for their personal health and knowledge to know what types of organisms they are exposed too, so they can further understand the results of their exposure. It is through this understanding that they can take preventative methods of exposure to the bothersome bacteria and to further improve their waste management strategies.

3. The Plans of Data Acquisition

The aspects of aquatic health that I am going to be studying are the coliform bacteria presence and the overall population of bacteria presence in the town's waters. I have used 2 sampling kits that were made for the use of these specific intentions. In addition to these methods I have conducted interviews and I have had quick conversations with some locals and our guides about how locals manage their waste. Specifically I talked to the town's people and cattle ranchers on the topics of how their personal waste and waste from their business was managed.

4. Background Information

The existence of bacteria and coliform bacteria in watersheds and rivers is due to a culmination of several factors. The coliform bacteria that pose a problem to the community in Costa Rica is, “found in the intestinal tracts of warm-blooded animals” like cows and humans. (Vermont Department of Health, 1) The bacteria are an indication there is fecal matter exposed to water sources exposing potential sources for bacteria pollution. Improper waste management, the lack of forests and warm temperatures in waters contribute to coliform bacteria growth. From students reports and my own personal observation, I have learnt that the drainage system of Las Juntas has very little filtration structures set up coming from the town entering into the river. The town has an open drainage system composed of open gutters, which effectively carry all contents to the river. So garbage, paint, old food, and animal feces are freely carried by the rain, which can substantially clear out the gutters, into the town’s river. In some areas the separation between the soils where mining is done in correlation to the rivers, is virtually inexistent causing the harmful bacteria and other harmful material to go in and populate the water. Coliform bacteria maintain its existence off of a source of food in warm and moist areas. (Welowner.org 2005) A low level of these bacteria is not a tentative threat to ones health but if there is a mention of these bacteria in drinking water immediate action needs to be taken. (Vermont Department of Health, 1) The exposure to coliform bacteria can lead to unpleasant health issues.

“Health symptoms related to drinking or swallowing water contaminated with bacteria generally range from no ill effects to cramps and diarrhea (gastrointestinal distress). Two common waterborne diseases are giardiasis and cryptosporidiosis; both cause intestinal illness. *E. coli* 0157:H7 has also been associated with drinking contaminated water and can cause intestinal illness. In very rare cases, it can cause hemolytic uremic syndrome, a serious kidney condition.” (Vermont Department of Health, 1)

In order to check for the bacteria two tests are usually performed, one done to test for the total amount of coliform bacteria. If this test shows an entire amount of coliform bacteria then the first test is double-checked for signs reflection a fecal derivation. (Vermont Department of Health, 1)

The business of cattle ranching is one of these that contribute to the bacteria population in the water. Janette Steets a student who participated in this colleges program in 1999 lays out a further incite on the reasons for bacteria's presence in the water. She states, "Cattle farming contributes to massive deforestation due to massive erosion along the river banks. Deforestation leaves a lack of trees along the river causing fewer trees and shrubbery to be along the edge of the bodies of the water. This shrubbery and forest served helped absorb potential pollutants to the water." (Steets 1999:3) One can then conclude that these zones play a crucial role in the limiting of water bacteria. Cattle have bacteria in their feces that can make people sick. One of such organisms is E.coli, which can induce symptoms of bloody diarrhea and can also cause severe disease in some children and the elderly. (Illinois Department of Public Health, 1) Cow feces are also known to contain another type of organism by the name of Cryptosporidium. (The Ohio State University, 2002) This parasite reproduces asexually in the small intestine and disperses itself through the feces in the form of oocysts. It is through this egg we are infected by this organism and given a mild case of diarrhea, which can worsen without medical attention. (The Ohio State University, 2002)

The structure of the riparian buffer zone helps address the problem of bacterial pollution. One of the primary purposes for creating a riparian buffer zone is to reduce pollution into streams and regulate other aspects of the environment. The riparian buffer

zone is an “area of trees, shrubs and other vegetation, along a stream, river, or shore line that is managed to maintain integrity of the waterway, to reduce pollution, and provide food, habitat, and protection for fish and wild life” (NRCS, 1). This structure provides a basis for reasons why less pollution may exist in an area where a forest separates a cattle ranch from a water source affirming the buffer zone as a source that reduces coliform pollution. If ranchers could limit the distance of their herd to the water and not be so aggressive for clearing land, levels in bacteria would show a noticeable decrease.

5. The Data Collection: A. Physical Data Collection, B. Verbal Data Collection.

In collecting the physical data collection I went to 9 different locations to run two tests at each location on the quality of the water. The procedure for testing for coliform in the bodies of water one must gather a small sample of water and put into a vial provided by the test kit up to the 10 ml marker. The procedure for testing the over all bacteria levels is done by taking the bacteria test strip and inserting it into a cup of the water for 5 seconds and then placing the strip into the tiny zip lock bag in the kit making sure not to get any air into it. Through running these tests I also thought I could also draw correlations by examining physical characteristics of the environment surrounding the water and the level of bacteria in the water. Before the analysis of the two tests one must wait forty-eight hours for all cultures to develop. In analyzing the coliform tests one is testing for either a positive result indicated by a yellow color or negative result indicated by a red color. For the coliform test I also have added a strong or weak section noting the strength of the sample taken. For the over all bacteria sampling test there is on the side to the bottle a series of six pictures, labeled between zero being the weakest and five being the strongest, showing the intensity of the bacteria level.

A. Physical Collection

Location 1: High School Bridge

This location was adjacent to the town, right by the local high school. In the walking down to the river I noticed that there was trash scattered about the area and I also saw that animals have had exposure to the location due to the presence of some animal feces, which I noticed. This leads some indication that animal waste plus other materials have easy access to the water. In this area there is not much of a buffer of forest between the town and the aquatic environment. I would say that there are no more than a few meters of forest on each side. **At this location the over all bacteria level reached the level of 5 the highest the test can go, and the coliform indication displayed a positive result but it displayed a weak presence.** A weak presence is shown through either of the color tests by not fully coming into a full yellow indicating a strongly positive result or a deep red indicating a strong negative result. This test had a weak positive result based on the fact that the solution was a light lemonade color.

Location 2: Aguas calientes- Hot Springs.

This sampling site was right beside the road. On the side closest to the road where the sample was taken from, there were approximately three to two meters of forest and on the other side there seem to be five or so more meters of forest. I noticed that there was some evidence of trash around the area and that there had been left over burnt debris. This demonstrates that there is a direct interaction between humans and this section of river. **The overall bacteria population yielded a result of level 5 and the coliform test demonstrated a positive but weak presence.**

Locations: 3.Town Water, 4.Monte Tabor

At these locations water came was collected in the sink from both locations of the town and Monte Tabor. The water from both locations has its origins in a small water treatment plant located in the Cuenca, watershed, and then is sent down to be distributed through the local area. Based on my observations the treatment of the water is not a highly technical involved process such as the structure of an US treatment plant but has set up structures to filter the water making it almost healthy for the areas usage. **The Town Water yielded the results of a strong, positive indication of coliform bacteria and an overall bacteria level of 0.5. At Monte Tabor there was a strong, positive indication of coliform presence and a level of three for the population of total bacteria.**

Location 5: Gloria

In this place there was housing located adjacent to the river. These houses looked like the residents had constructed their dwellings themselves and may not have had the proper facilities for appropriate waste management. On the other side there was a presence of forest that might have posed as a buffer for contamination. The results for this location **yielded the indication of strong, positive presence of coliform bacteria and a level of 3 for total bacteria population**

Location 6: Ecomuseo

This piece of river is located up closer to the watershed and where the water is then distributed to La Sierra, Las Juntas, and the surrounding area. This is an area located in a forest where not too many humans interact with the area. There is a pasture approximately fifty feet away from this area but there seems to be a solid division of

forest between the pasture and the water source. The **coliform test shows a strong positive result and the total bacteria test came out to a level of 3.5.**

Location 7: Second Crossing

This location was completely surrounded by forest, there are paths where only a man and possibly a horse could traverse. The water at this location does not seem like it has been affected by a lot human and animal exposure. The tests show that **total bacteria level came out to be a level of three and a strong positive presence of coliform bacteria is existent in this area.**

Locations: 8. Aguas Claras below the toma, 9. Boston

These two locations intersect with each other in the same area. The water from Boston has come in contact with miners and other individuals and the water from Aguas Claras below the toma could have had exposure to cattle. When briefly talking to Joaquin in a group setting I believe he gave this piece of information out when he was talking about the water quality of la cuenca. The Results for Aguas Claras below the toma were **a strong positive coliform indication and a level four in total bacteria measurement.** The stream Boston **had a total bacteria level of three and demonstrated a strong positive development for coliform bacteria.**

B. Verbal Data Collection.

In order to gain some insight on the cattle ranching business I conducted an interview with a rancher by the name of Don Vincente with the help of our guide Dina. It is through this interview that I learnt a great deal about the general operation of a cattle rancher and I have summarized the following conversation. “He said that his ranch is a pastor land divided into pieces where the cattle are rotated around fields about every three

days. He only lets the cows feed on the grass and does not clean up the cow excrement because it is nothing but natural fertilizer. He has his herd of cows broken into smaller groups so they are easier to manage. On his property he has four to five streams where he has set up pipes taking water from the source and bringing it to the cows. He explained that other ranchers have a similar behavior of rotating their herds and watering them. Don Vincente mentioned that he and the other ranchers of the local area also use the structures of living fences to help preserve the integrity of the environment and effectively manage their cattle. On the ranches he and his fellow peers have employed the tactic of living fences between the pasture and the water source to prevent water contamination from their herds.”(Don Vincente)

I also visited a Rancher/Farmer by the name of Don Medesto to see how he had his ranch/farm organized. “He said he followed the example like other local ranchers of rotating the herd, maintaining a living fence, and bringing the water to the herd. In addition told us of his comprehension that the entire community needed to use the river, which was separated from his pasture by his living fence.”(Don Medesto) It is also my opinion that he could have allotted more land for living fences because it did not seem that he had enough of a natural barrier.

In order to gain some further insight on the towns waste management system I had a quick conversation with our guide Dina. “I found out in each home in town had to have a septic tank for waste to go into. For the most part they all have solid structures because they are put in professionally and have been very few incidents of leakage.”(Dina)

7. Conclusions

In conclusion I have found through my study that there is a significant presence of coliform bacteria in the water of Las Juntas and the Surrounding area due to the fact that all samples indicated a positive result. I also have found the average amount of total bacteria to exist in this area to come to a level of 3.33.

8. Reflections

In regards to this study I feel that there is much more to be studied in the areas of coliform bacteria and the total population itself. At the very most I feel that I have only found an indication that coliform bacteria in the water exists, but I was not able to identify any specific type of coliform bacteria or the source where it was derived.

“ Coliform bacteria may enter the environment as a result of fecal contamination from humans, domestic animals and wildlife, as well as runoff from agricultural land, inadequate septic systems or sewer overflow. Coliform bacteria in the environment may themselves represent a health risk or indicate the possible presence of other potential human pathogens such as the hepatitis A virus.”(Belinda Barnes and David Gordon, 2004)

I am not able to make any strong conclusions or statements because I have no real solid knowledge where it has resonated.

“All coliform species are genetically diverse and a significant fraction of the genetic diversity observed in most species is explained by ecological factors related to the host or the external environment where the host lives.”(Belinda Barnes and David Gordon, 2004)

At the very most I have uncovered an issue that needs to be further studied. Not getting to identify specific groups of bacteria.

Through my interviews with the ranchers and interaction with other individuals I found that all have come to the realization that the forests need to be protected. From presentations made from my other classmates I have learnt that the school children have an elementary knowledge that they need to treat the environment with respect. Don

Vincente said that he took classes taught by an organization called MINAE covering topics of sustainable development and management as well as classes to effectively manage cattle having an environmental conscience. This is a very good start I feel that all members of the community must attend environmental education classes in order to fully understand the proper course of action to effectively clean up the local environment. Even further I believe everyone should have a good comprehension to preserve the integrity of his or her own environment. For example Don Medesto was knowledgeable of his business and the negative byproducts that are produced from his herd but I still think that he should double his buffer of forest between the cows and the river and needs to understand the reasoning for this. Education of the total community is a very effective start of exposing health problems to all, helping start the path solving these issues.

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