Students:

Órla McCarthy

Holly Murray

Anna Brinkmann

Tides Of Contamination

The Effects of Tidal Estuaries on Water Quality of Local Beaches

Stand number: 5527

School: Mount Saint Michael Secondary School, Rosscarbery, Co. Cork.

Judges' Page

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Abstract

Our objective in this project is to investigate E. coli levels on a beach with an estuary (The Warren Strand) compared to neighbouring beach without (Owenahincha Strand).

In February we began testing rivers feeding into the lagoon in Rosscarbery for nitrates using dip tests and assessed river water quality using two-minute kick samples. We have continued testing monthly until November. The consistent results from these tests have led us to believe that agricultural runoff is not the leading cause of E. Coli in our local beaches as if slurry were the primary cause, nitrate levels would show significant increase during springtime when fertiliser (which would be included in the run-off) is spread. We then pointed towards storm water drainage and poor sewage discharge systems as the main cause of pollution.

We then tested the Estuary, Owenahincha and the Warren Beach as well as the streams feeding into the estuary for E. Coli and Nitrates. We took various samples and sent them to Acorn Waters in Bandon to be assessed. We sampled water on three separate occasions using 12 samples in total. We took samples on ongoing tide, low tide, and outgoing tide after a period of heavy rainfall.

From these results we can conclude that beaches located at the mouth of a tidal estuary show higher readings than one that is not and that E. Coli outbreaks occur after periods of rainfall.

Introduction

Our project investigates the effects of tidal estuaries on water quality of our local beaches. Our initial aim of this project was to investigate the levels of E. Coli in local beaches during winter compared to summer, as beaches are only tested during the 'bathing season' of June, July, and August. After having a better understanding of the recent E. Coli outbreaks, we have changed our focus of this project towards how tidal estuaries influence water quality. Our project is based on research as well as our own testing and assessment of water quality.

We live in a small coastal town called Rosscarbery which is a vital part of West Cork. The centre of Rosscarbery is the Warren, which is a small, rural sandy beach located at the mouth of the Tineel River (Warren estuary). For years, The Warren was a hive of activity, hosting Water Safety camps, lifeguard training, yoga and activity lessons, surf lessons, tourist leisure, local business development as well as pitch & putt activities.

In 2019, however, it all came to a stop. Suddenly the articles rolled in, 'Swimming at West Cork beach may cause illness' and 'Make sure to avoid going for a swim on the Warren Beach.' Our beautiful beach was being polluted due to lack of care, and it suffered badly. The Warren became very sparse and not the prosperous beach it once was. It slowly became less polluted and by the start of the next year it was thriving again. Summer 2020 rolled around, and the Warren was once again hit by huge levels of E. coli causing the tourist destination to suffer, again in 2022 and once again in the summer of 2024. At the start of this year, our group took initiative and began water testing in rivers, in hopes to discover the cause of this issue and return our local beach to the safe and vital location it once was.

For five years, E. coli has polluted our local beaches, damaging swimmers' health, and tourism-dependent businesses. These outbreaks have made national news this summer. Although discussed in large cities such as Paris, where news on the pollution of the River Seine was worldwide this summer during the 2024 Paris Olympics, our project proves that water pollution is equally detrimental in smaller communities. Estuaries collect sediment of agriculture runoff, sewage, and stormwater, which, during spring tides, flows into the ocean, increasing E. coli levels on nearby beaches, especially in warmer months when bacteria thrive.

In response, we are investigating levels of E. coli in waters of a local beach with (the Warren strand) and without a tidal estuary (Owenahincha strand), to see if tidal estuaries influence water quality. The Warren holds special significance to our community, providing a retreat from daily life and a place to educate people on water safety. As the Warren strand is a prominent place for many, we have a responsibility to protect it from the critical dangers of harmful pollution.

Literature review

The essence of our project relies on research and physical sources as well as digital evidence. To fully immerse ourselves in our topic we did a great deal of research, which is vital evidence in our project.

What is E. coli?

E. coli (ExPEC) is a group of bacteria that can cause infections in your gut (GI tract), urinary tract and other parts of your body. E. Coli has six strains. Some strains can live in your gut without harming you, while others can make you sick with symptoms such as diarrhoea, vomiting and fever. The most likely of these strains to cause serious illness is Shiga toxin-producing E. coli (STEC). *'Despite the diversity of ExPEC causing infections, previous studies have shown the connection between specific E. coli lineages and their resistance profiles, and severity of the infections.'* (da Cruz Campos, 2021)

E. coli O157:H7 is mostly transmitted to humans through the consumption of contaminated foods, such as raw or undercooked ground meat products and raw milk as well as faecal contamination of water and other foods.

STEC has been isolated from bodies of water (ponds, streams etc.), wells and water troughs, and has been found to live for months in sediments of manure and water-trough. Waterborne transmission has been reported, from both contaminated drinking-water as well as from recreational waters. (WHO, 2018)

What is the importance of good water quality?

The importance of good quality water cannot be understated. In parts of the world without access to safe and clean drinking water, humanity suffers from malnutrition, dehydration, and death from preventable diseases. Good water quality is a human right.

The US Congress established the scientific agency known as the United States Geological Survey, or USGS. It researches and disseminates knowledge of our ecosystems, natural dangers, as well as the environment on Earth. Water that will not hurt anyone who encounters it is considered clean and safe by the USGS. *'According to The World Health Organisation (WHO), 26% of the world's population lacks access to safely managed drinking water services that are both contaminant-free and conveniently situated for them to use when they need it*.' (Bensen, 2022)

How are coastal areas commonly polluted?

‘As a result of urbanization in metropolitan areas, water contamination increases. The main contaminants in agnatic habitats are agricultural, residential, and industrial wastes. When sewage is dumped into freshwater, it is the most polluting. Sewage is society's watery waste. Moreover, the amount of untreated sewage dumped into a river is enormous and potentially hazardous.’ (Ahmad Khan, 2012)

How is wastewater treated in reference to coastal areas?

Treated wastewater is discharged several kilometres into the ocean, where it is mixed with seawater by diffusers which are placed on the seabed. However, in this process, freshwater is pushed to the surface of the sea, forming so-called lenses. This strategy could pose a risk to those who swim in beaches near these diffusers, discharging wastewater into the sea. Factors such as hydrological conditions or wind direction can cause freshwater lenses to return towards beaches, which would also transport microorganisms, such as pathogens that may pollute bathing water. (Wolska et al 2022).

What is causing Irish beach pollution levels to rise?

According to reports we read; the cleanliness of Irish beaches has decreased in recent years, due to ‘*heavier climate-related rains which increased pollution, and toxic blue-green algae blooms. A water expert has warned that growing pressures on Ireland's bathing waters are a "ticking time bomb in terms of public health"’* (Corr, 2024)

What effects can pollution have on the body?

Different water pollutants, for example: agriculture, sewage, oil, fracking, and rubbish all have different effects on the human body, like illness, harm of organs, and hormonal disruption.

According to The World Health Organization '*approximately two billion people consume water sources contaminated with faeces across the globe. The consumption of faecal contaminated water can cause the spread of bacterial diseases, such as polio, cholera, diarrhoea, hepatitis A and dysentery.'* (Zinni, 2021)

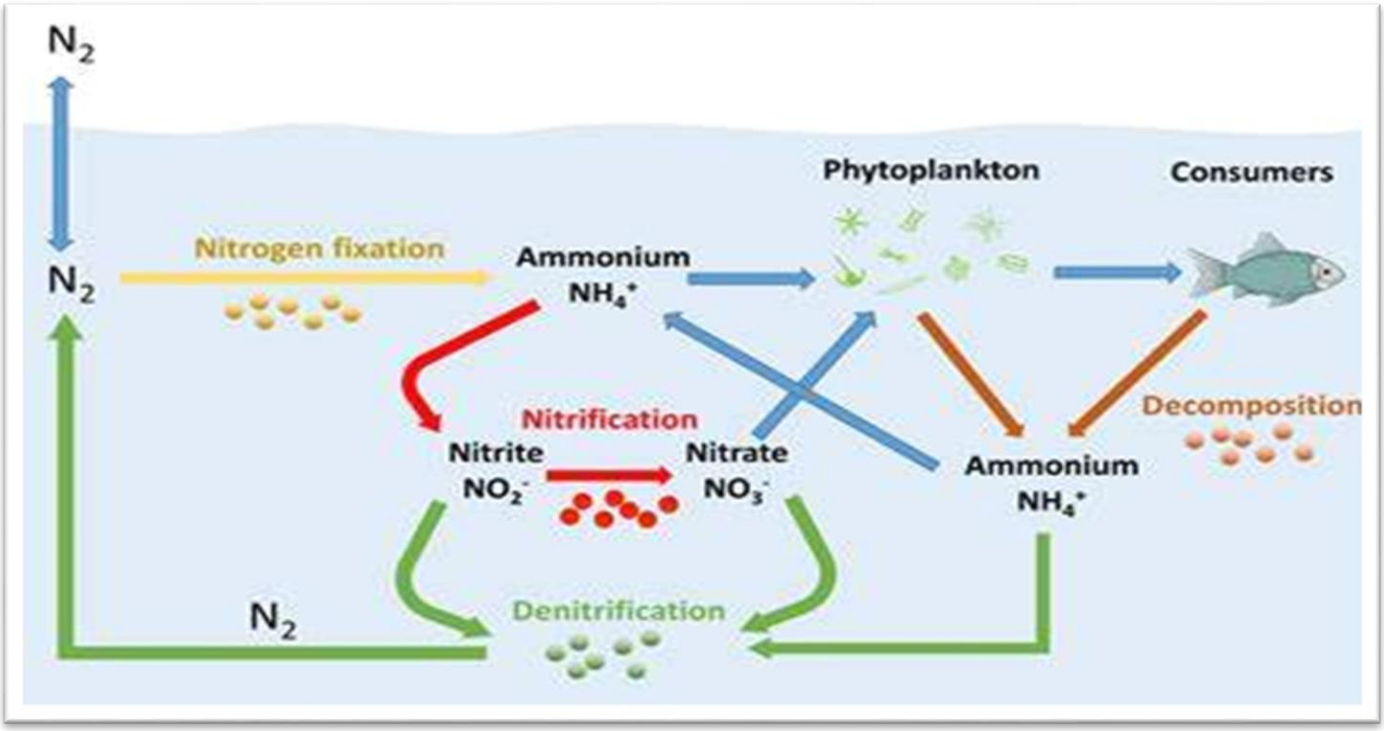
What influence do tidal estuaries have on nearby coastal areas?

We have found that, the river flow is one of the main factors responsible for the transport of sediments, nutrients, and land runoff. It tends to influence the inner locations of estuaries more than the outermost areas. The river flow, however, depends on the current weather conditions, being higher with intense rainfall (as is also observed with land runoff). '*This means that the area of the estuary most affected by the river outflow may vary, as well as the spatial and temporal distributions of the parameters directly dependent on the fluvial variation.'* (Nascimento et al, 2021)

The Marine Nitrogen Cycle:

According to studies we have read, the nitrogen cycle on the Earth has evolved over three billion years through biogeochemical and microbial processes as well as natural help that keeps the nitrogen cycle of the oceans in balance and content. Recent research, however, points to an

imbalance in the amount of nitrogen in the oceans, with larger losses than inputs. The disruption of the nitrogen cycle caused by burning fossil fuels and the creation of synthetic fertilisers. '*The extra nitrogen disrupts the N balance in marine systems, fuels eutrophication of coastal oceans and supports extension of hypoxic zones. These sites act as an additional, poorly quantified, source of nitrous oxide (N_2O).'* (Falkowski et al 2010).



What is stagnant water and why is it bad?

Often referred to as “standing water,” stagnant water is water that is left sitting for extended periods of time.

With no movement and aeration, stagnant water becomes a prime breeding ground for a collection of bacteria or fungi. ‘*Left untreated, stagnant water often becomes home for dangerous diseases and pathogens such as Legionella, E. Coli, Nontuberculous mycobacteria, Pseudomonas-related pneumonia.’ (Zinser, 2021)*

Deaths from dirty water:

According to our research, sadly, the consumption of dirty water causes the death of a human being every 10 seconds. Each year 3,575,000 people die from diseases related to water and 2.2 million of these people are children. ‘*Unclean water and poor sanitation have claimed more lives over the past 100 years than any other cause.’* (The World Counts)

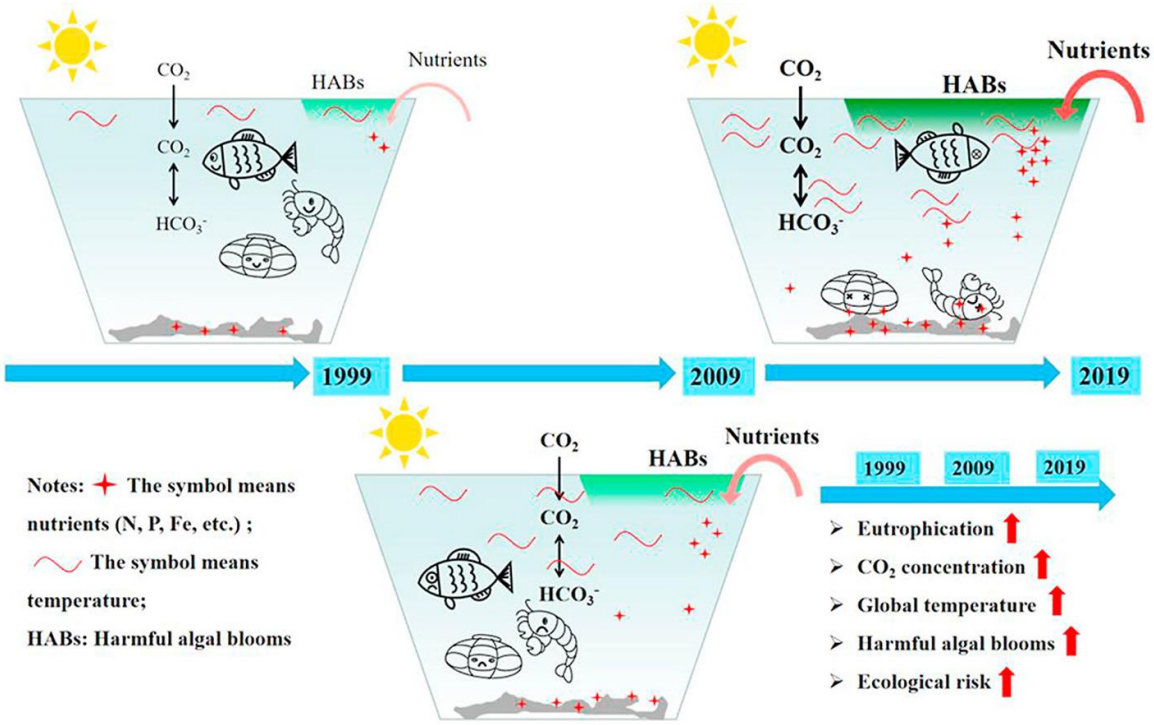
What is sea foam?

Seawater stores dissolved salts, proteins, fats, dead algae, detergents and other pollutants, as well organic and artificial matter. Sea foam forms when the ocean is agitated by wind and waves. Each coastal region has differing conditions that affect the formation of sea foams. Algal blooms are one common source of thick sea foams. When large blooms of algae decay offshore, vast amounts of decaying algal matter often wash ashore. Foam forms as this organic matter is churned up by waves and brought ashore. The majority of sea foam is not harmful to humans and is often a sign of a productive and thriving ocean ecosystem which is very important to coastal areas that harvest large amounts of biodiversity and wildlife e.g. West Cork '*Although, when large harmful algal blooms decay too near shore, there are potential for impacts to human health and the environment.'* (National Ocean Service, 2024). This shows us that when the amount of 'eutrophication' becomes too large it begins to threat environmental health, human health and safety and acts as an indicator for ocean ecosystem wellbeing.

The effect of Harmful Algae Blooms (HABs)

Many studies have proved that excessive algal bloom growth as well as climate change both play important roles in the frequency and duration of HABs. Since the 20th century, with the increase of population and the development of industry and agriculture, a large amount of domestic sewage and industrial sewage have been discharged into the ocean, lakes, rivers, and reservoirs. This heightens the amount of excessive algal bloom growth or 'eutrophication.' '*At the same time, HABs are more often*

reported in these waters, where the nutrient load increases sharply. Since eutrophication and climate change are both global issues, these results showed that HABs are globalising.' (Jun Sha et al 2021)



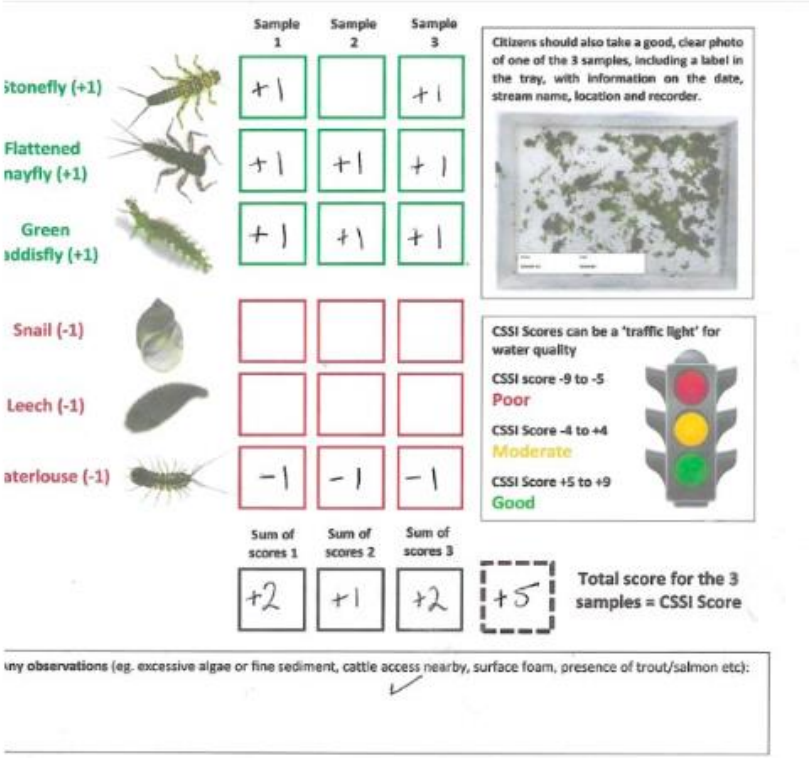
How to test for E. Coli?

Apart from algal blooms, water samples should be taken 30 cm below the water surface, in water which is at least 1m deep and where most bathers are expected (typically the centre of the beach). Samples should be transported as soon as possible after collection in a cool box so that they arrive at the laboratory within 24 hours. Bacteria samples are to be taken using a sterile bottle. To avoid accidental contamination, the sampler is to employ an aseptic technique. (Simplex Health)

Methodology

We began testing the rivers and streams feeding into the estuary in February using kick samples, which assess river water quality based on indicator species living in the river. We also used dip tests which test for river nutrients including nitrates (NO3) and have continued our monthly tests since. For biological parameters, we use key and two-minute kick samples identifying indicator species, evaluating water quality with the Citizen science stream index (CSSI). Chemical parameters include pH measured with universal indicator strips, and 14 chemicals in groundwater detected with dip test strips, nitrate tubes, and colour charts. Physical parameters such as water temperature and transparency are also assessed in our tests. The results of these tests so far have been consistent meaning the feeder streams into the estuary are not primarily being polluted by agricultural run-off.

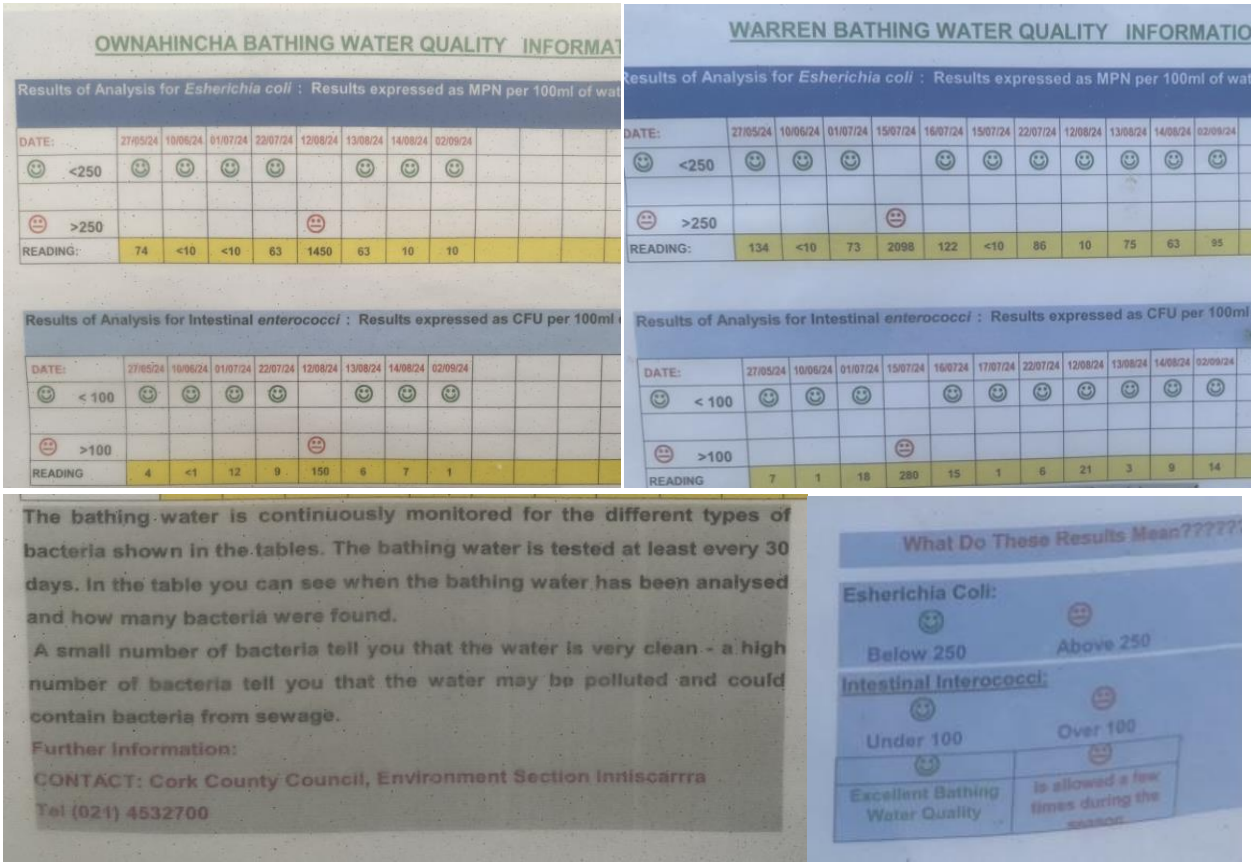
Calculating the Citizen Science Stream Index (CSSI)



[Developed for CitizenScience -Local Authority Water Programme (lawaters.ie)](lawaters.ie) by UCC

Monthly E. coli test results which are displayed on local beach notice boards show significantly higher readings at the Warren (beach with tidal estuary), compared to Owenahincha (beach without tidal estuary).

We have consulted local businesses such as Surf N Sup surf school and The Lagoon activity centre to find out how the closure of beaches in recent years has affected their business. Both business owners have informed us that besides the beach closure, they have not experienced a decrease in customers in recent years due to E. Coli outbreaks. We have also reviewed recent Annual Environmental Reports, news articles regarding this issue as well as the Owenahincha discharge license.



OWNAHINCHA BATHING WATER QUALITY INFORMA

Results of Analysis for *Esherichia coli* : Results expressed as MPN per 100ml of wat

DATE:	27/05/24	10/06/24	01/07/24	22/07/24	12/08/24	13/08/24	14/08/24	02/09/24
<250	☺	☺	☺	☺		☺	☺	☺
>250					😐			
READING:	74	<10	<10	63	1450	63	10	10

Results of Analysis for Intestinal *enterococci* : Results expressed as CFU per 100ml

DATE:	27/05/24	10/06/24	01/07/24	22/07/24	12/08/24	13/08/24	14/08/24	02/09/24
< 100	☺	☺	☺	☺		☺	☺	☺
>100					😐			
READING	4	<1	12	9	150	6	7	1

WARREN BATHING WATER QUALITY INFORMATIO

Results of Analysis for *Esherichia coli* : Results expressed as MPN per 100ml of wat

DATE:	27/05/24	10/06/24	01/07/24	15/07/24	16/07/24	15/07/24	22/07/24	12/08/24	13/08/24	14/08/24	02/09/24
<250	☺	☺	☺		☺	☺	☺	☺	☺	☺	☺
>250				😐							
READING:	134	<10	73	2098	122	<10	86	10	75	63	95

Results of Analysis for Intestinal *enterococci* : Results expressed as CFU per 100ml

DATE:	27/05/24	10/06/24	01/07/24	15/07/24	16/07/24	17/07/24	22/07/24	12/08/24	13/08/24	14/08/24	02/09/24
< 100	☺	☺	☺		☺	☺	☺	☺	☺	☺	☺
>100				😐							
READING	7	1	18	280	15	1	6	21	3	9	14

The bathing water is continuously monitored for the different types of bacteria shown in the tables. The bathing water is tested at least every 30 days. In the table you can see when the bathing water has been analysed and how many bacteria were found.

A small number of bacteria tell you that the water is very clean - a high number of bacteria tell you that the water may be polluted and could contain bacteria from sewage.

Further Information:

CONTACT: Cork County Council, Environment Section Inniscarrra

Tel (021) 4532700

What Do These Results Mean?????

Escherichia Coli:

☺ Below 250 😐 Above 250

Intestinal Interococci:

☺ Under 100 😐 Over 100

☺	😐
Excellent Bathing Water Quality	is allowed a few times during the season

We found that meeting with people who knew a lot about this subject was vital in helping us learn current information about how E. Coli affects people and businesses as well as how wastewater is treated in Rosscarbery.

We talked with Paul O'Callaghan, a water technology scientist from Blue Tech Research who informed us of different methods of testing water for E. Coli.

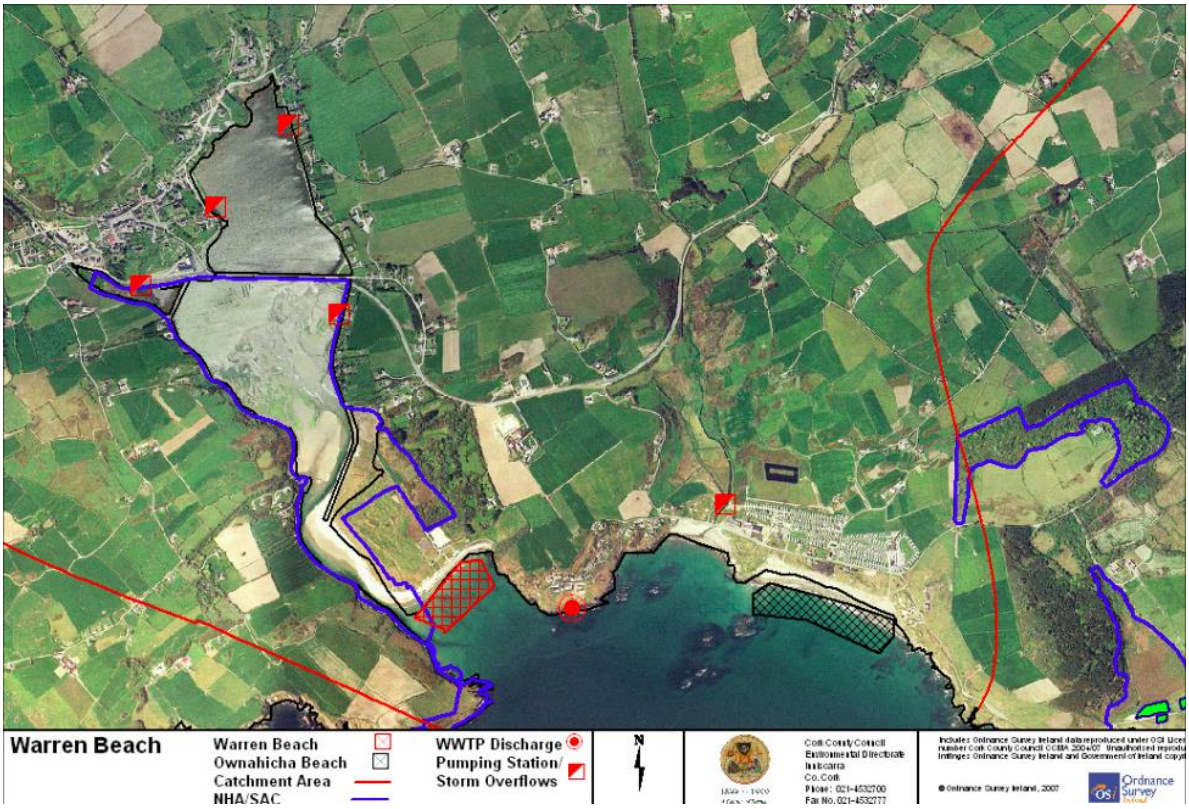
We met Paul Melody, the owner of Rosscarbery's Lagoon Activity Centre, who has sources of some vital information regarding how the estuary influences beach water quality and how the treatment plant works. He informed us about how raw sewage was once pumped into the lagoon. He also believes that the estuary is being polluted by storm water overflow due to issues in pumping storm and wastewater.

We met with Cllr Isobel Towse from the Social Democrats Party, who has recently been successful in advocating for year-round beach testing. By showing our support for her motion "that this council will test bathing waters weekly following a 'do not swim' notice, and fortnightly all year round in areas that had a red flag raised at least twice during the bathing season" the council have agreed to discuss at the Environment Strategy Policy Committee, which she is also a part of. She also helped us contact Cork County Council by mentioning us and our goal in that Councillor meeting.

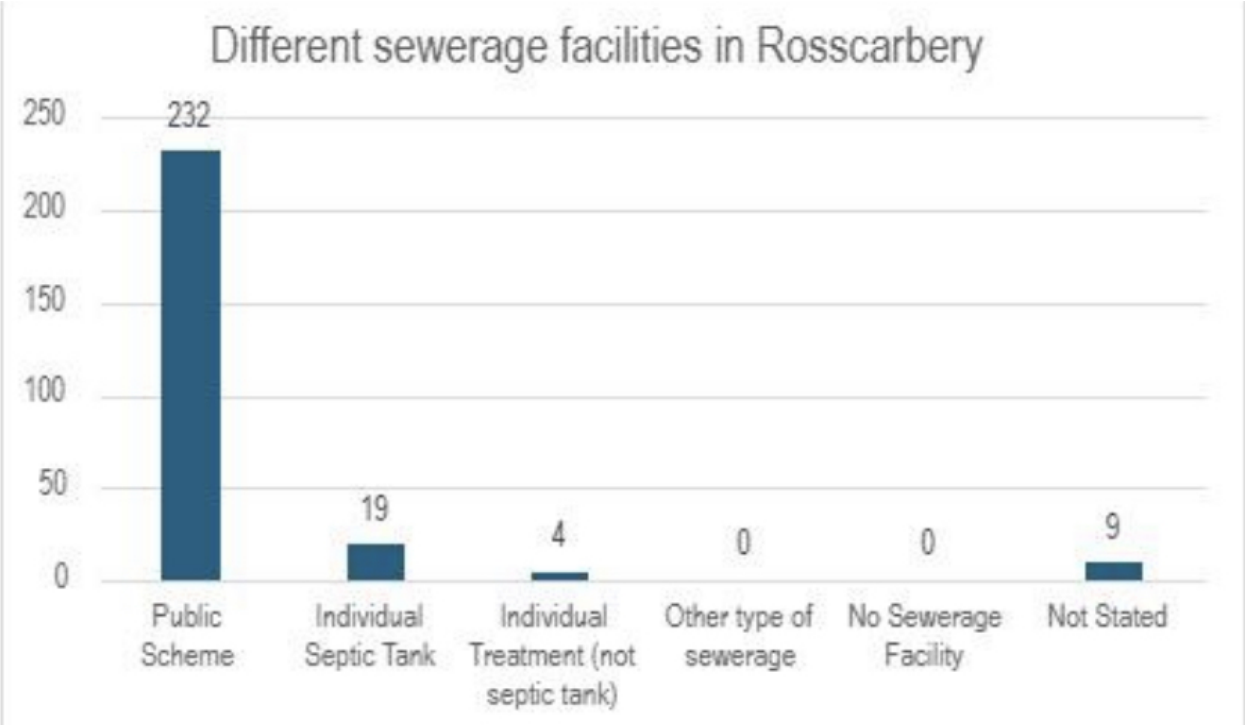
When meeting local lifeguards working in the Warren strand, we were informed that nearby wastewater settling tanks are ineffective due to chemical contamination, preventing anaerobic digestion. Through meeting these people and organisations this topic is extremely relevant and is an ongoing issue that needs to be solved.

7. CLLR ISOBEL TOWSE
"That this council will test bathing waters weekly following a "do not swim" notice, and fortnightly all year round in areas that had a red flag raised at least twice during the bathing season."
Deferred [09/09/2024]

Initially, we hypothesized that agricultural runoff carried E. coli into the bay via four streams feeding into the estuary. We have been monitoring nitrate levels monthly since February 2024 and have been continuing our research throughout the project. When the beach closed again in August 2024 due to E. coli, our data helped local farmers prove to Cork County Council that runoff was not responsible. Our new hypothesis points to the Cregganne agglomeration as the source. According to the Warren beach profile, which can be found on beaches.ie; wastewater and stormwater are discharged into the estuary (shown in image below) feeding into the Warren strand. The Warren beach profile also states potential causes of water pollution and its risk. Agricultural runoff was labelled 'moderate risk,' while the 'wastewater treatment' as well as 'Pumping Station / Combined Storm Overflows' were both labelled 'high risk.'



We have also done research on the Creganne treatment plant. According to the Annual Environmental Report of 2019, the facility is recognised as a septic tank rather than a treatment plant. The report also recognises the storm water overflowing the tank and affecting treatment from taking place. After emailing Census Ireland, they have provided us with the statistics of what treatment facility the population of Rosscarbery uses. We made a bar chart using this data as shown below. We have also found that there are 5 Pumping Stations/Combined Storm Overflows associated with the plant and that there is also a storm overflow at the treatment plant. These overflows feed into the estuary as shown on the previous page.



In October we began testing for E. Coli and nitrates in the Rosscarbery estuary as well as in the streams feeding into the estuary. We took a water sample of the warren estuary as well as these feeder streams at an ongoing tide. We then took these samples to Acorn Waters in Bandon to be tested for E. Coli and Nitrates. We tested again for E. Coli and Nitrates in November on two occasions, the warren estuary and Owenahincha beach at low tide as well as the warren beach, estuary and owenahincha on an outgoing tide after a period of heavy rainfall. We took these sample in the middle of the two beaches and from a small slip before the pier in Rosscarbery to sample water from the estuary.

We visited the Acorn Waters labs in Bandon, Cork in November. We learned how water is tested for E. Coli and Nitrates and even tested for Nitrates individually as shown in photographs below. We brought in our samples from sampling the evening before to be assessed. We also learned how our water samples are tested for E. Coli. We learned that the sample is placed in a selective growth medium, to allow E. Coli to grow while inhibiting other bacteria. These inoculation plates are then incubated at 37 degrees Celsius for 24 hours. Then, colonies grown on the medium are examined.

Results

- **Reading: Satisfactory E. Coli levels. (<200 cfu/100ml)**

  Satisfactory Nitrate levels. (<8 mg/l)

- **Reading: Unsatisfactory E. Coli levels. (>200 cfu/100ml)**

  Unsatisfactory Nitrate levels. (>8 mg/l)

We took 12 samples on three occasions; an ongoing tide, an outgoing tide and low tide. Each sample was also taken at different rainfall conditions. These samples were brought into Acorn waters in Bandon to be tested for E. Coli and Nitrates. E. Coli is measured in colony forming units (cfu) per 100ml and nitrates are measured in milligrams per litre (mg/l).

Test results from 18th October:

We sampled water from the estuary as well as the streams feeding into the estuary. We took 6 samples between the four streams, testing the middle course of all streams and the lower course of two. At the time of sampling, it was raining as the rain had only begun hours before sampling, it would not have enough time to show a poor reading on the estuary.

Tide at time of water sampling:

- Last low tide: 12:33
- Next high tide: 18:20
- Time of sampling: 1:30-2:00 (tide was low but coming in which may affect reading)

1. **Sample location: Vincents stream – Low Flow**

- E. Coli: >2000 cfu/100ml
- Nitrates: 10.4 mg/l

2. **Sample location: Padraig's river**

- E. Coli: 782 cfu/100ml
- Nitrates:16.5 mg/l

3. **Sample location: Ardagh east tineel**

- E. Coli: 320 cfu/100ml
- Nitrates: 10.8 mg/l

4. **Sample location: pier road**

- E. Coli: 8 cfu/100ml
- Nitrates: <1mg/l

5. **Sample location: upper tineel**

- E. Coli: 430 cfu/100ml
- Nitrates: 20.6 mg/l

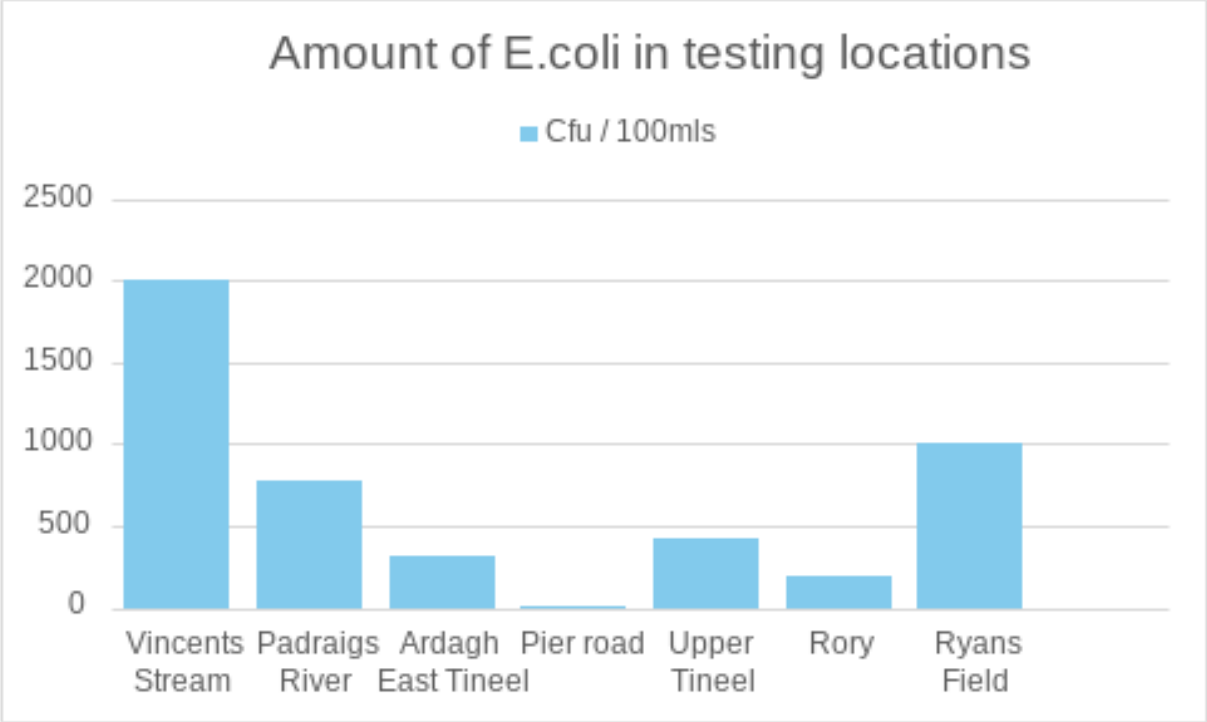
6. **Sample location: Rory stream**

- E. Coli: 190 cfu/100ml
- Nitrates: 8.63 mg/l

7. Sample location: Ryan's field – Low Flow

- E. Coli: 1013 cfu/100ml
- Nitrates: 19.1 mg/l

Results represented on a bar chart:



Results from 15th November

We tested the water again on the 15th of November at low tide (0.6m). We sampled water from Owenahincha strand and the Warren estuary and brought them to Acorn waters to be tested for E. Coli and Nitrates that evening. The weather prior to sampling has been dry resulting in low readings of E. Coli.

Tide at time of water sampling:

- Last low tide: 10:17
- Next high tide: 16:02
- Time of sampling: 10:20 (tide was at lowest)

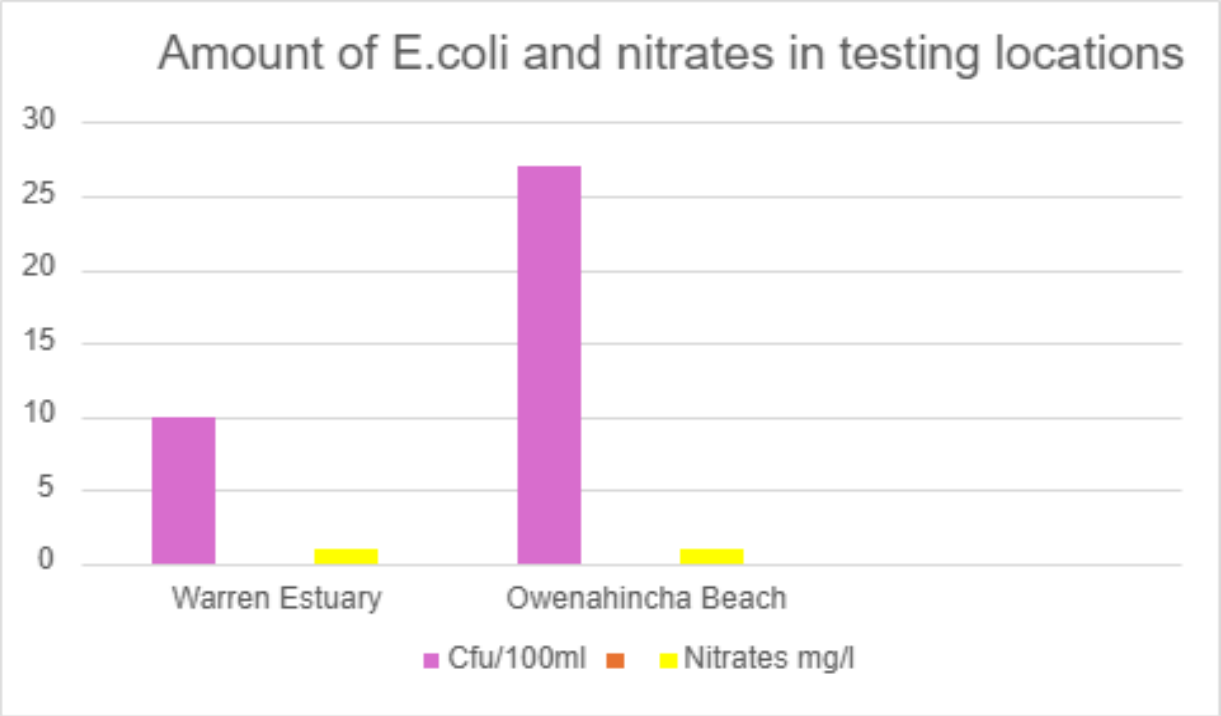
8. **Sample location:** Warren estuary

- E. Coli: 10 cfu/100ml
- Nitrates: >1 mg/l

9. **Sample location:** Owenahincha beach

- E. Coli: 27 cfu/100ml
- Nitrates: >1 mg/l

Results represented on a bar chart:



Test results from 24th November – Outgoing tide after period of heavy rainfall 5:00pm

Finally, we tested the water on the 24th of November at an outgoing tide after a period of rainfall (storm Bert). We sampled water from Owenahincha strand, the Warren estuary as well as the Warren strand and brought them to Acorn waters to be tested for E. Coli and Nitrates the following morning.

Tide at time of water sampling:

- Last low tide: 05:49
- Next high tide: 00:27
- Time of sampling: 17:15

10. **Sample location:** Warren estuary

- E. Coli: 1450 cfu/100ml
- Nitrates: >1 mg/l

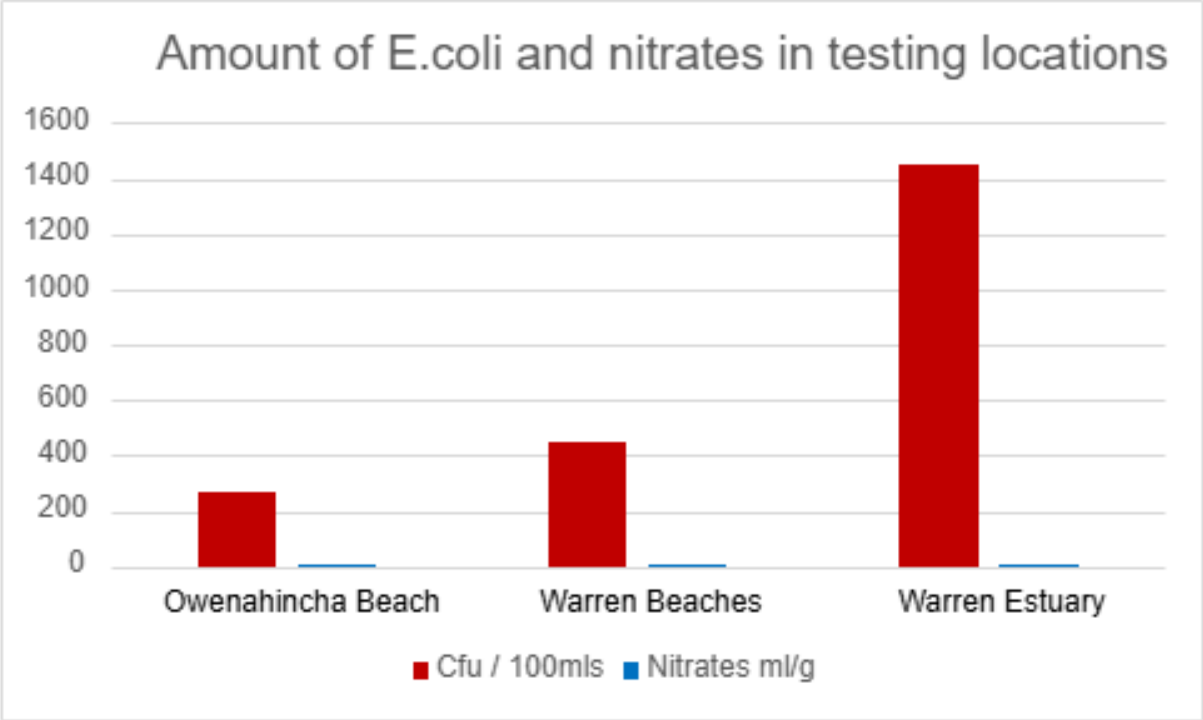
11. **Sample location:** Owenahincha beach

- E. Coli: 270 cfu/100ml
- Nitrates: >1 mg/l

12. **Sample location:** Warren beach

- E. Coli: 450 cfu/100ml
- Nitrates: >1 mg/l

Results represented on a bar chart:



Results represented on a map locating results to area of sampling:

Discussion

From our first results testing the estuary we found low levels of E. Coli due to the tide coming in at the time of testing as well as the strong flow of water. We found that the areas with the least flow of water contained the highest E. Coli levels such as Vincent Stream with over 2000 cfu/100ml.

From our second results testing the Estuary this time at low tide we found low levels of E. Coli in both Owenahincha strand and the Warren Estuary. We believe this is due to the dry weather prior to sampling.

From our third results testing the Estuary this time at low tide after heavy rainfall (Storm Bert) we found unsatisfactory levels of E. Coli in all three places sampled. We found that the estuary had the highest reading followed by the Warren and Owenahincha receiving the lowest reading. These results have let us to believe that E. Coli readings are higher after periods of rainfall.

Unfortunately, we did not have enough samples to do several trails on testing the streams as we originally only planned to test the two beaches and the estuary as each water sample cost approximately €60. If we were to do a continuation of this project, we would certainly continue testing these streams.

What were our strong / weak points:

A strong point of our method would be that we chose a project that was relevant and possible to do as we had access to the help and advice we needed. The recent E. Coli outbreaks which influenced us to choose this topic for our project are extremely relevant in not only Rosscarbery, but all over the world. All of us have an appreciation for science so we were all determined to succeed. One thing that made our project a success was the help of people around such as our science teachers and various contacts who provided u with information and helped us in testing for E. Coli as well as nitrates.

Our project faced difficulties due to the unpredictable results of water testing. From our first results testing the estuary we found low levels of E. Coli due to the tide coming in at the time of testing as well as the strong flow of water. This unexpected result however proves that tides affect E. Coli levels and outgoing tides contain higher E. Coli levels. Fortunately, our final test results prove our hypothesis to be correct that "beaches with located at the mouth of an estuary will show higher readings of E. Coli compared to a beach that is not, especially after a period of heavy rainfall."

What do we hope to do in the future:

We have enjoyed doing this project very much and hope to do well in BTYSTE 2025. We also hope to include this project or a similar project in Global Citizenship in 2025 where we travel abroad to display our project. We also will include our project in SciFest in Cork in April which is a National STEM fair project for schools.

Conclusion

From all our research, sampling, and testing, we can conclude that Precipitation is a leading factor causing E. Coli outbreaks in our local bathing waters.

After significant rainfall events, there was an upsurge in E. Coli levels which is borne out by our results. From these results we can conclude that E. Coli outbreaks occur after a period of heavy rainfall. Because of this, we advise that public organisations such as Cork County council test local beaches for E. Coli the days following rain rather than a random day in the month, or even daily to get the best data and results possible. We would also advise to not swim in the ocean for at least 3 days following rain until our wastewater treatment facilities improve.

Unfortunately, we cannot fully conclude the cause of E. Coli outbreaks in our local bathing waters. Despite research proving that the Cregganne agglomeration is a leading cause of local water pollution of bathing water (through environmental and beach reports as well as discharge licence), the readings of E. Coli from testing feeder streams contradict this.

Fortunately, we have proved that ‘beaches located at the mouth of an estuary show higher readings than beaches that are not,’ as the Warren has shown significantly higher results than Owenahincha in both the councils testing this summer and our own testing.

Despite not fully proving the cause of this issue, we have still brought change to public organisations’ testing of water as we have helped the motion for annual testing of beaches with more than two beach closures. We have however proved the effect rainfall has on E. Coli levels.

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