Served with a Side of Microplastics: An Analysis of Microplastics in Favourite Seafoods

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Introduction

Microplastics, plastic particles measuring less than five mm, are becoming a growing concern. Microplastics in seafood will eventually end up in humans as well! Plastic has helped many industries including packaging, building and construction, however people use plastics unmethodically in terms of overuse, unnecessary use and littering. To date, a limited number of studies have investigated microplastic quantities in Saint John, New Brunswick. This study analyzed microplastic quantities in the stomach of four top seafoods: lobster, shrimp, mussel and oyster, to understand seafood microplastic consumption. Mussel was in the lead with an average of 17 microplastics and shrimp had the least amount of microplastic consumption with an average of six microplastics. The primary reason is that mussels are filter feeders, so they filter their food from the contaminated water. The results from the study have real-world applications because microplastics are an important topic and studies from across the world continue to prove that. Microplastics not only affect the digestion, reproduction and growth of marine animals, but may affect humans as well.

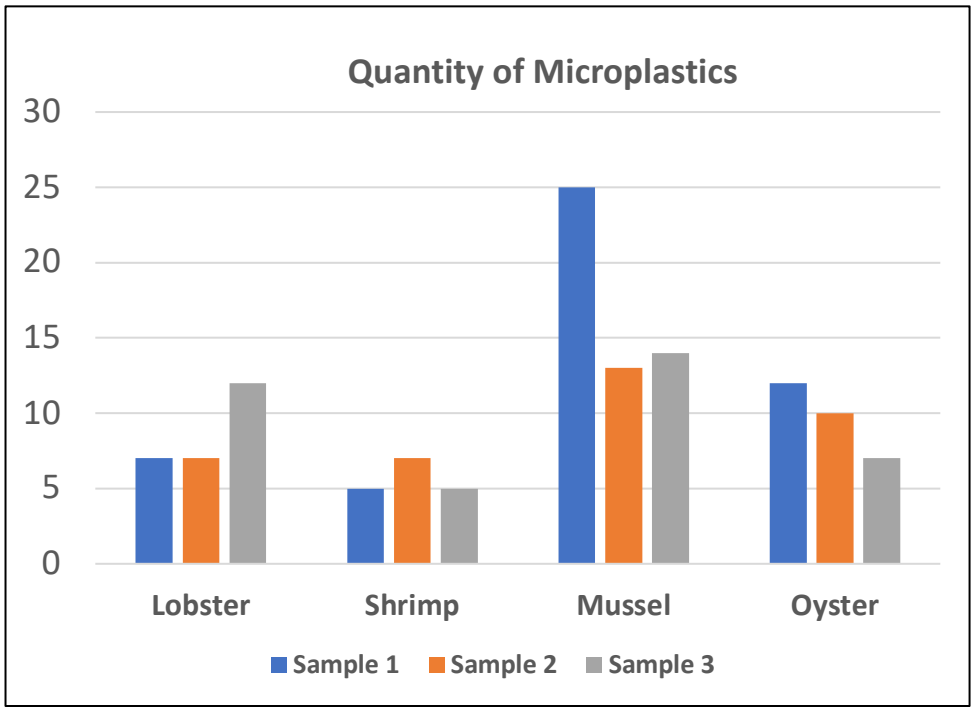
Methods and Procedure

1. First, an online survey was conducted in which 120 residents of Saint John, New Brunswick, who were diverse in terms of age and occupations, were asked to identify four of their favourite seafoods.
2. After the results were obtained, four of the top seafoods were selected to analyze based on availability. The seafoods were bought on the same day as the analysis. Different stores (local and chain) were used to ensure the study is not impacted by other factors and tests solely one factor: the type of seafood. Three of each type of seafood were bought.
3. The stomach of each organism was dissected using a scalpel, forceps, scissors and tweezers.
4. Next, each organ was placed in an airtight container which was labelled with the seafood's name and sample number (Ex. S1, S2, S3, for shrimp).
5. The organs were digested using a 10% potassium hydroxide (KOH) solution. The amount varied based on the organ size; the solution covered the entire organ. Each container was then incubated at 60 degrees Celsius for 24 hours (Dehaut et al., 2016). To avoid contamination, the triple rinse method was followed in which each equipment was rinsed thrice with tap water.
6. Then, each digested sample was poured upon a 100 μm filter to isolate the microplastics. The filter (dried for ten minutes to avoid light reflection based on) was placed between a petri dish under a dissection microscope for analysis. For particles in which distinguishing whether they are plastics was difficult, the hot needle test (De Witte et al., 2014) was used.
7. The colour, type and quantity of the microplastics were recorded in a lab notebook and later transferred to Excel.
8. This procedure was repeated for each organism.

Note: Samples were covered to limit airborne exposure to microplastics. Bright colored clothes were worn to ensure if contamination occurs, it is distinguishable. Microplastics of the colour clothes I was wearing were excluded. Several reliable resources including journal articles, websites, google books and videos were used to identify and understand what microplastics are. Also, Dr. Alli Murugesan, Senior Scientist, UNB; President of BioHuntress Therapeutics Inc., helped identify a protocol for the study.

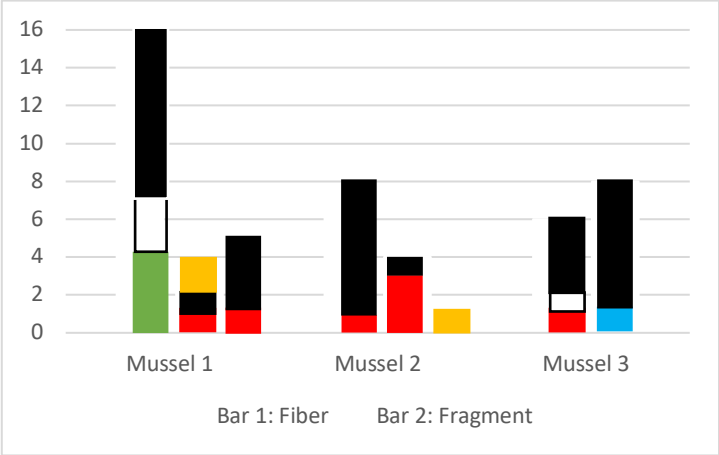
Results

Mussels had the most microplastics found in their stomach with an average of seventeen microplastics (standard deviation ±7). Shrimp had the least microplastics with an average of six microplastics (standard deviation ±1).



Graph 1

Graph 1 (above) displays the microplastic quantity found in the stomach of each of the seafoods analysed. A comparison can be made because of the parallel bars.



Graph 1

Graph 2 displays data from the analysis of mussel. The first bar in each group is a fiber, followed by fragment and pellet. The colours of each microplastic are shown in chunks of the bar.

There was a variety of microplastics found in the seafood; they were diverse in colour, size and type. The most microplastics were fibers. Fibers typically come from the washing of synthetic textiles. Microplastic fibers are small thread-like structures with a similar thickness throughout. Microplastic fragments are "chips" of plastic. Microplastic pellets are spherical plastic particles.

Discussion and Conclusion

I learnt that mussels have the highest microplastic contamination and shrimp has the lowest microplastic contamination. My results aligned with a study that analysed microplastic quantities in the stomach of seafoods conducted by Hull York Medical School which stated that mussels have the highest microplastic consumption. I believe the primary cause may be that mussels are filter feeders. They filter their food out of the water, this increases the chance of microplastic intake. Mussels ingest food as well as tiny particles of plastic. Also, the origin of the seafood and the individual store care practices can influence the microplastic quantity.
The washing of synthetic textiles had the largest contribution to the microplastic consumption of the seafoods analysed. Fibers, the most common microplastic in the samples, is caused by synthetic textiles.
This study could be described as a learning curve, there were many "firsts" including dissection, microscope analysis as well as microplastic identification and classification. During the microplastic identification and classification, there is a possibility of incorrect classification. For example, a fiber could have been classified as a fragment due to their similar properties such as their size, invisibility of cellular structures and homogenous colour. Despite the following of protocol, recounts are a possibility. Expanding this project by analyzing large sample size with relevant statistical analysis will help in the confirmation of my current results.

Methods of Awareness/Knowledge Translation

I decided to spread awareness about the topic of microplastics because of the shocking results. I created and manage a social media account (link attached: https://www.instagram.com/mighty_microplastics) in which I share infographics, facts, charts and methods to help the environment regularly. Instagram which is the location of the account is a revolving social media platform, especially popular amongst teenagers who are the account's target audience. Today, the account has over 780 followers, so over 780 people know what microplastics are!
Also, I had shared my findings with The ACAP (Atlantic Coastal Action Program) Saint John which is a community-based program to help the environment. Sharing my results at a high-level platform with a large reach allowed a strong sense of awareness to develop amongst people. Along with this, the business was enabled to grow with more reports and information which would in turn benefit the community and the environment.

Next Steps

I really enjoyed this project and hope to continue research about microplastics in the future. In a future investigation, I would sample and analyse a diverse number of water sites to gain a stronger understanding of microplastic consumption. Marine animals primarily consume microplastics through water bodies; developing a deeper understanding of the root of the problem allows a deeper understanding of the main. Multiple water sites including rivers, lakes and streams from across the Maritimes would be analyzed. Additionally, a future study that I would be interested in doing would identify a rate at which the microplastic problem is increasing. I would take samples of water biweekly from several water sites to see how much the microplastics contamination rates are rising. In conclusion, I hope to continue learning about microplastics and their effects on the environment!

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