



Microplastic in commercially exploited fish from Grenada, West Indies

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Introduction

Microplastics are defined as plastics less than 5mm in diameter or length (UNEP, 2013). Microplastics are either manufactured to carry out a range of functions, or come from materials that have broken down in the environment (Kershaw, 2015). Plastic debris and microplastics are now ubiquitous in the marine environment (UNEP, 2013).

Plastics have many impacts on marine life. Documented problems include damage to and accumulation in the digestive system, leading to malnutrition (Wright et al., 2013), deleterious effects of exposure to chemical additives in the plastics and compounds adsorbed from the environment (Kershaw, 2015). Research is needed to understand human hazards of microplastics in the environment.

Small island developing states import large quantities of consumer goods with their accompanying plastic packaging. Many small islands lack resources to adequately dispose of waste. Coastal development, natural disasters, and poor waste management practices result in plastic entering marine ecosystems. Grenada's fishing industry provides food locally, generates income through exports, and provides livelihoods.

The Gulf and Caribbean Fisheries Institute and UNEP's Regional Coordinating Unit for the Caribbean are co-hosting a Regional Node for the Global Partnership on Marine Litter in the Wider Caribbean Region and supported this first Caribbean study into the incidence of microplastics in fish harvested for human consumption in Grenada, West Indies.



Grenadian fishing boat
<https://www.redbubble.com/people/johndalvin/work/s/11009901-grenada-fishing-boat?pc=canvas-print>

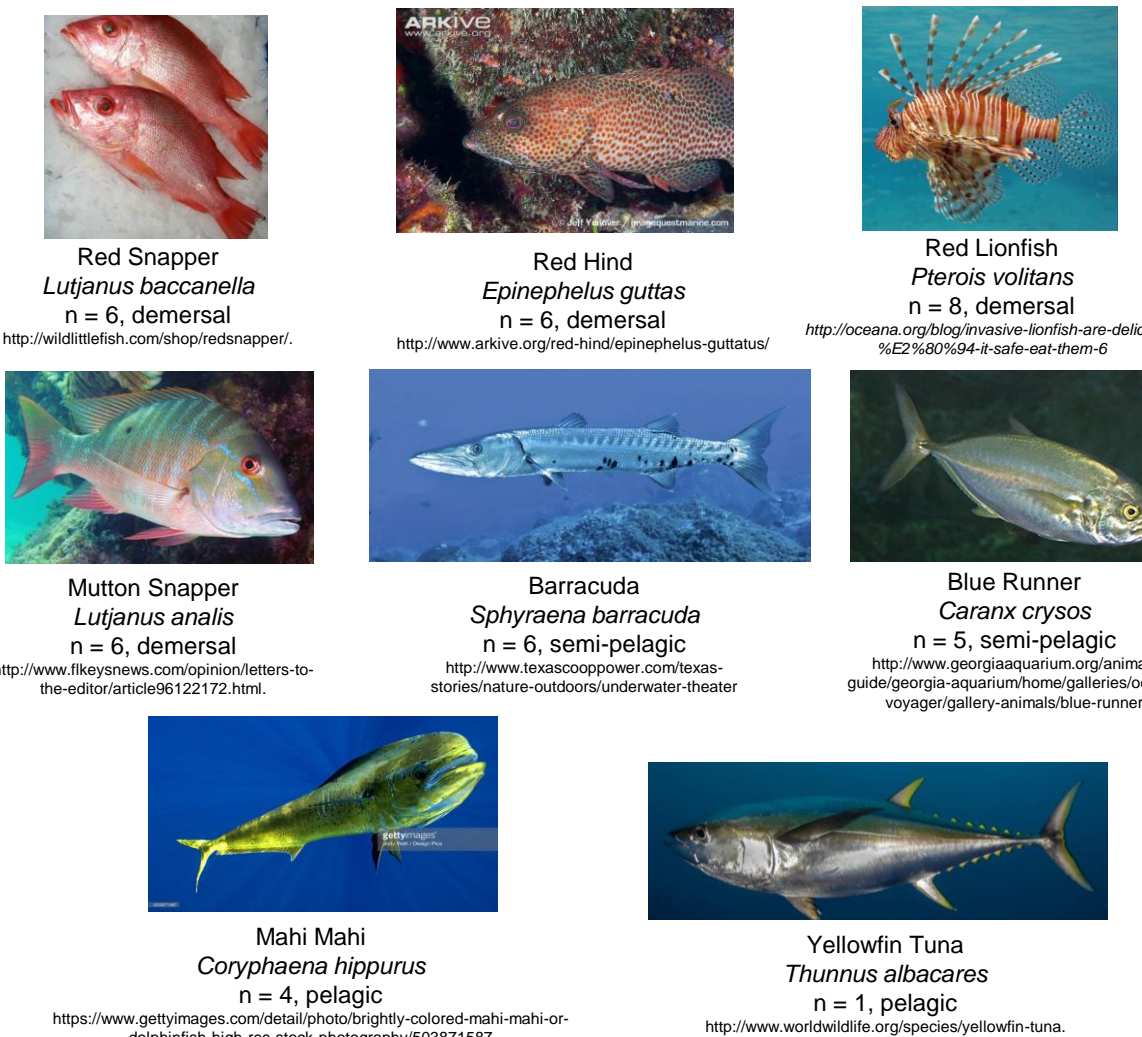


Map of the Caribbean showing location of Grenada.
<https://lizardpoint.com/geography/carib-quiz.php>



Methods

Seven fish species with three different life histories were investigated. Total weight and fork length were measured, digestive tracts were removed and weighed. A liver sample was taken from each fish for contaminant analysis.



Samples were digested in a 10% potassium hydroxide (KOH) solution at 60° C for 24 – 92 hours (Foekema et al., 2013). Three species of intertidal snails (*Littorina ziczac*, n=5; *Nodilittorina tuberculata*, n=4; *Nerita tessellate*, n=3) were examined after digestion of whole tissue.

Equipment was thoroughly rinsed with water prior to sample analysis. Blank samples of distilled water were analyzed. Samples were sieved through 180 µm mesh. Undigested material was examined using light microscopy. Microplastics were identified by careful visual examination by two investigators.



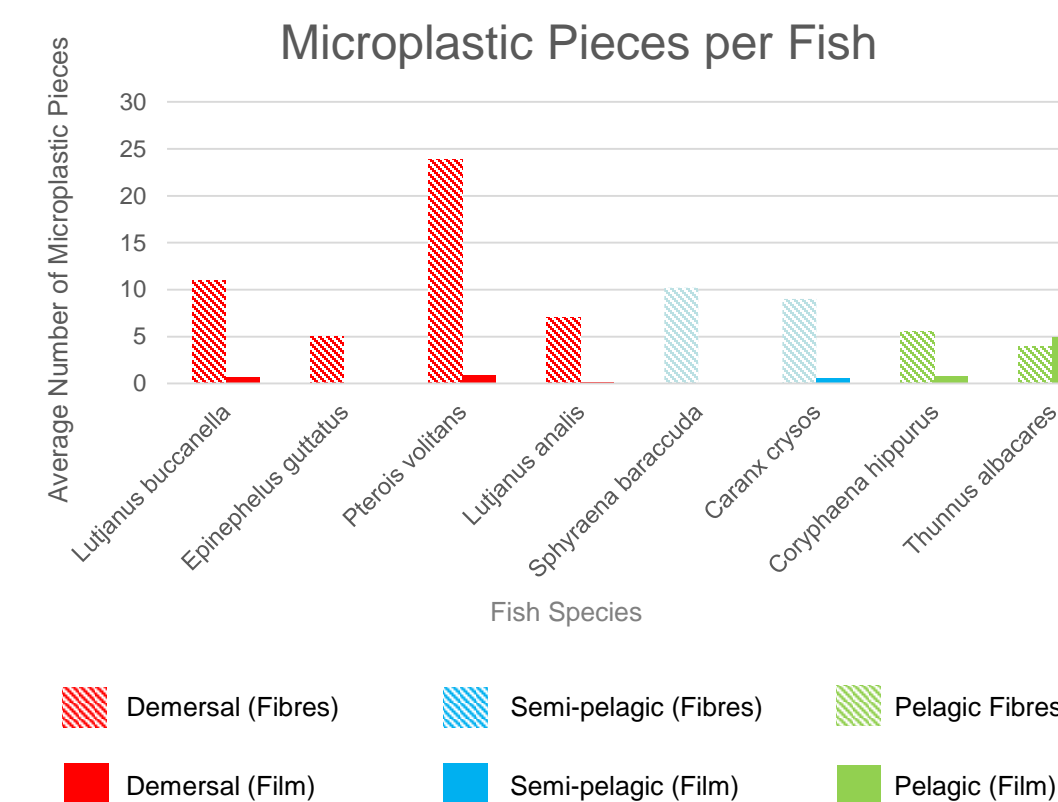
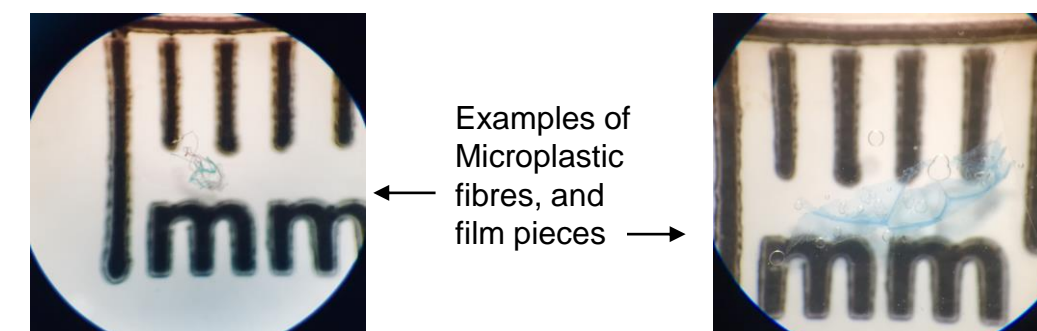
Undigested material on 180 µm mesh sieve



Sample at inspection stage

Results

A total of 42 fish guts were analysed; 41 of these samples contained microplastic particles (97.6%). 40 samples contained microplastic fibres (95.2%), and 12 samples contained microplastic film pieces (28.6%).



The greatest number of microplastics were found in a *Pterois volitans* (Lionfish) sample (79 fibres and 1 piece of film). Microplastics were found in fish of all life history types. No clear relationship was found to exist between number of microplastics and body weight.

Microplastic fibres were the most common type of microplastic found. One fish sample was microplastic free (*Sphyraena barracuda*). No microplastics were found in control samples. All intertidal snail samples contained microplastic (between 2 and 8 fibres per sample).

Conclusions

Finding microplastics in fish with varied life histories, and in intertidal snails, demonstrates that microplastics are present in coastal and marine environments in Grenada.

Plastics in the environment in Grenada likely come from both land-based and marine sources. Recent data shows that 33 million plastic bottles were imported into Grenada in 2013 (Zettl, 2015); equivalent to 312 plastic bottles per capita. Over 66% of the plastic bottles in Grenada ended up in landfill in 2013, while ~30% of the plastic bottles were unmanaged and as such are a potential source of environmental microplastics.

Plastic in the marine environment is of great concern. Action is needed to reduce the amount of plastic that gets into the environment. One solution is to reduce our reliance on plastics, especially single use plastic products. A number of countries in the Caribbean have already made progress with this: Jamaica, Guyana, and St. Vincent and the Grenadines implemented bans on importation of Styrofoam in 2017 (Jamaica Observer, 2015; GY Buzz, 2015; The Organisation of Eastern Caribbean States, 2017). While the Government of Grenada has yet to ban any plastic items, local private enterprises are reducing their utilization of single use plastics. We hope that individuals, communities and nations can reduce use of plastics. Future research plans include liver sample analysis for contaminants, and determination of the chemical composition of microplastics. Further investigation into the effects of microplastic in the food chain is warranted.

Acknowledgements

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References

Foekema, E.M., C. De Groot, M. T. Mergia, et al. 2013. Plastics in North Sea fish. *Environmental Science & Technology*. 47(15):8818-8824
GY Buzz. 2015 October 12. Jamaica Bans Styrofoam Containers. Retrieved from <http://gybuzz.com/business/jamaica-bans-styrofoam-containers/>
Jamaica Observer. 2015 October 18. Guyana to ban Styrofoam containers as of January 1. Retrieved from <http://www.jamaicaobserver.com/news/Guyana-to-ban-styrofoam-products-as-of-January-1>
Kershaw, P. 2016. Marine plastic debris and microplastics – global lessons and research to inspire action and guide policy change. *United Nations Environment Programme, Nairobi*. DOI: 10.13140/RG.2.2.30493.51687.
The Organisation of Eastern Caribbean States. 2017. St. Vincent and the Grenadines bans non-environmentally friendly materials: Styrofoams. Retrieved from <https://pressroom.oecs.org/st-vincent-and-the-grenadines-bans-non-environmentally-friendly-material--styrofoams>
UNEP. 2013. Microplastics. Retrieved from http://www.unep.org/yearbook/2013/pdf/Microplastic_english.pdf
Wright, S. L., R. C. Thompson, and T. S. Galloway. 2013. The physical impacts of microplastics on marine organisms: A review. *Environmental Pollution*. 178:483-192.
Zettl, E. 2015. Reducing the input of plastic litter into the ocean around Grenada. Giz (Deutsche Gesellschaft für Internationale Zusammenarbeit). Retrieved from <https://www.giz.de/en/downloads/giz2016-marine-litter-instruments-grenada.pdf>.