To: Vermont House Committee on Natural Resources, Fish and Wildlife
From: Rachel Obbard, PhD., Assistant Professor, Thayer School of Engineering at Dartmouth College
Date: February 26, 2017
Re: H.105

Thank you for this opportunity to testify on H.105, an act relating to the use of single-use carryout bags. My name is Rachel Obbard. I am a Materials Scientist and Engineer (BS, MS, PhD) and a Research Assistant Professor at Dartmouth College's Thayer School of Engineering. I have been part of the community of scientists who study microplastic pollution since 2009, when my team discovered microplastic particles in sea ice from the middle of the Arctic Ocean (Obbard et al., 2009), and I have recently been invited to write a review of the role of long-range transport in microplastic pollution there.

Vermont H.105 proposes to prohibit retail establishments from providing single use carryout bags to consumers at the point of sale. The bill would also establish standards for reusable bags and compostable bags provided by retail establishments in the state. Below I address the impact of single-use, compostable and reusable carryout bags on the environment. This information is based on an extensive body of literature on the subject. Some useful references are provided at the end of this document.

- The conventional engineered polymers in plastics are persistent materials that are not quickly mineralized. Polyethylene, for instance, can take more than 100 years to break down. Because of this, plastics accumulate in the environment: they have been found in air, soil, fresh water, seawater, deep-sea sediments, and sea ice. Plastics make up 60-80 percent of marine litter, with polyethylene, polypropylene, and polystyrene the major components of microplastic debris found in the ocean.

- Large plastic items fragment over time into smaller pieces, which are more readily transported. Microplastics are defined as plastic debris <5 millimeters in size. Microplastic particles come from the breakdown of larger plastic items, and first hand from abrasives, exfoliants and cosmetics, and pre-production plastic pellets.

- The amount of marine plastic debris and its persistence create physical hazards for wildlife that becomes entangled in or ingests it. Large and small pieces of plastic are ingested by freshwater and marine organisms. Microplastics have been found in many commercial species of fish, mollusks, and crustaceans. Chemicals used during plastics manufacture, or present in the marine environment – including phthalates, PCBs, and organochloride pesticides – are often sorbed by microplastics and may present an additional toxicological hazard to animals that ingest plastic fragments. The potential adverse effects of microplastics in seafood for human consumption is an area of growing concern and active research.

- Disposable packaging makes up 37% of all plastic produced. Single use carryout bags are most commonly made of polyethylene (PE). They are easily transported by air and water. Runoff has been shown to be a significant pathway of microplastics into bodies of water.

- Oxo-biodegradable plastic bags (sometimes called enhanced photodegradable polymers) contain additives intended to hasten their chemical degradation in the presence of UV light. However, biofilms form on the surface of bags in the environment within weeks, and may block as much as 90% of the transmitted UV light, drastically slowing degradation. In field tests, samples of single use bags of different types were deployed in the marine environment. Standard polyethylene and biodegradable bags lost only 2% of their surface area over 40 weeks (O'Brine and Thompson, 2010).

- It should be kept in mind that even faster degradation may not prevent a bag from reaching the marine environment, where colder temperatures and additional biofouling will slow further breakdown, and fragmentation will make small pieces available to marine organisms.

- Better biodegradability has been shown for bags made of cornstarch, vegetable oils and compostable esters. In the aforementioned study, a compostable polyester material lost 100% of its surface area between 16 and 24 weeks. However, as I'm sure you realize, there are behavioral aspects to mitigation efforts. For instance, some consumers will be more likely to dispose of a plastic carryout bag labeled as biodegradable after a single use, rather than recycling or reusing it. (O'Brine and Thompson, 2010).

- Freshwater lakes are increasingly being examined for microplastic pollution. This began when high levels of microplastics were found in a large, remote mountain lake in Mongolia. There, plastic bags were a major contributor (Free et al., 2014).

- To my knowledge, microplastic distribution has not been studied in Lake Champlain, however, microplastic abundance and types have been studied along the shores of the Great Lakes (e.g. Zhyszewski et al., 2014). Once entering the lake environment, low density floating polymers such as polyethylene and polypropylene were degraded by UV radiation at the water surface and on shorelines. Plastic fragments (as opposed to whole objects or pre-production beads) were found along multiple shorelines. The data has shown that plastics pollution is not only a marine issue, and research continues into the sources and effects of microplastics in the Great Lakes.

This testimony represents my own views, and does not represent an official position of my institution. As a member of the scientific community and a concerned citizen, I thank you for addressing the issue of plastic waste and urge you to make sure that Vermont joins the increasing number of states and municipalities passing legislation to control the use of plastic carryout bags. H.105 will benefit Vermont wildlife and reduce our contribution to global microplastics pollution.

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