

# Drifting Anthropogenic Fibers in the Indian River Lagoon, Florida

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## Abstract

Microplastics and anthropogenic particles serve as sources of pollution in the marine environment, and also as biofouling surfaces. The organic matter that accumulates on them can have an effect on the health of marine creatures. Alternatively, the particles themselves may be ingested and cause harm. Plankton tows were collected at five sites and examined for plastics, particles, and plankton. Densities of particles both relative to the water and to the plankton were computed and found to be high compared to the nearby Gulf Stream. The most common particle was determined to be a lignin related to cotton, a biodegradable substance that poses no obvious threat to the health Indian River Lagoon (IRL).

## Introduction

The effect of plastics and other anthropogenic particles in the marine environment has received much attention lately. Concerns focus on the effects on larger life forms displaying dramatic visible effects (e.g., birds, fish, or turtles choked by macroplastics). The majority of ocean creatures, however, cannot be seen and there are particles that may affect them as well, thereby impacting the entire food chain.

Microplastics and other anthropogenic particles can be so small the unaided eye cannot detect them. These particles may be ingested by fish (Lusher et al., 2013), crustaceans, birds, (Cole et al., 2011), zooplankton (Cole et al., 2013), cetaceans (Baulch and Perry, 2014), and filter-feeders (Wright et al., 2013). Bakir et al. found that the microplastics can serve as hosts of biofouling (2014). Setälä et al. showed that plastic passes through a zooplankton's digestive tract unimpeded in 12 hours (2014). The effects of ingesting plastics with biofouling on the health of organisms appears to be related to digestive rates (Andrady, 2011). No bioaccumulation studies have been done on microplastics like those that have been done on algae and other substances (Setälä et al., 2014). Murray and Cowie have shown that if a creature that has plastics in its digestive tract and gets eaten, the predator that eats the creature will get the indigestible plastic stuck in its own digestive tract (2011).

Microplastics occur around the world, but especially documented in Europe. It is a global issue and potentially affects food webs (Sul, 2014). Because the number of anthropogenic particles in the environment is going to increase (Browne, 2011) there is an urgency to understanding impacts. In some areas, microplastic densities exceed  $5 \times 10^5$  pieces  $m^{-3}$  (Sul, 2014). **The goal of this study is to quantify planktonic anthropogenic particles in the Indian River Lagoon.**

## Methods

Plankton tows were collected to determine the concentration of organisms as well as anthropogenic particles. Tows at four of the sites were done using a 363  $\mu m$  mesh net ( $n=3$ ); at the fifth site, the tow was done using a 165  $\mu m$  mesh net ( $n=2$ ).

The volume of every tow was 0.71  $m^3$ . Each of the samples was counted for total particles as well as differentiating between natural and anthropogenic particles. The former were tiny planktonic animals and sediment particles. The latter usually came in the form of fibers with a plastic-like appearance.

The fibers were analyzed via spectroscopy, compared to known spectrographic curves, and confirmed via microscope analysis.

## Results

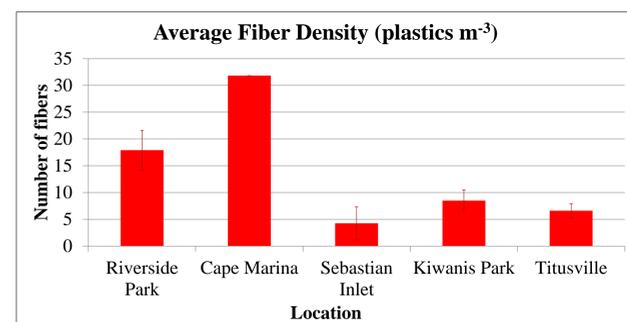


Figure 3: Fiber densities at the sample sites (above); ratio of plastics to 1000 plankton (below)

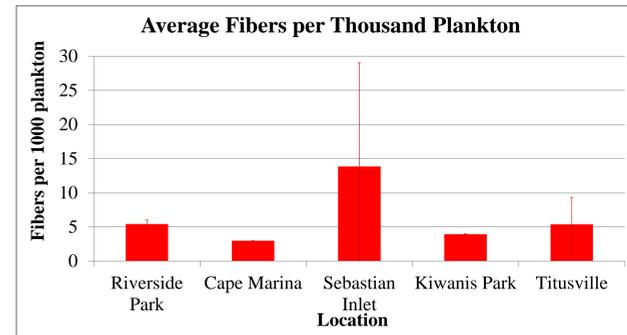


Figure 4: Microscopic image of an anthropogenic fiber found in the IRL (left); microscopic image of a cotton fiber (right); note the "crushed tube" appearance of the fibers in both images

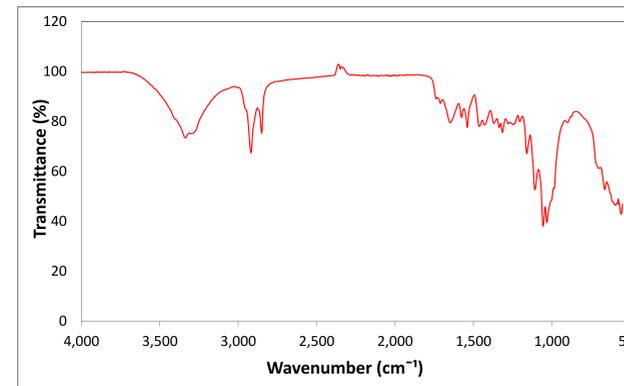
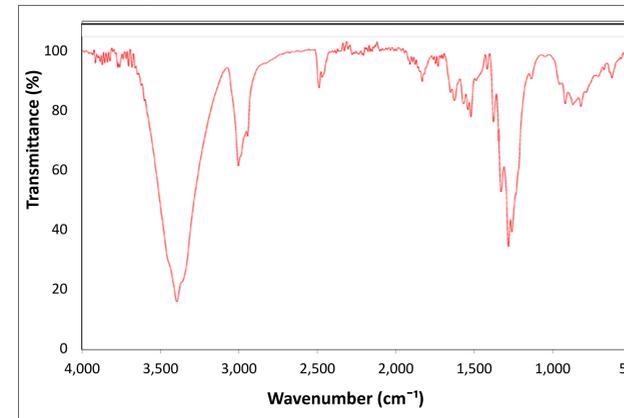


Figure 5: Spectroscopy graph of fiber found in the IRL (above); spectroscopy graph of cotton fibers (below, credit to University of Tartu)



## Discussion

The location with the greatest density of fibers was Riverside Park in Melbourne, FL, where there were 17.92 fibers  $m^{-3}$ . Although the density was 31.83 plastics  $m^{-3}$  at Cape Marina in Port Canaveral, FL, insufficient replicates were collected for proper statistical analysis. Sebastian Inlet had the greatest ratio of plastics to plankton at 13.9:1000. This is a much smaller amount of fibers than that found in the Mediterranean Sea near France, where the ratio was 500:1000 (Collignon et al., 2012). However, the number of fibers found is large compared to the nearby Gulf Stream, which has a density of 0.01-0.1 plastics/ $m^3$  (Sul, 2014), the South Pacific Gyre (Eriksen et al., 2013), and the English Channel (Cole et al., 2014).

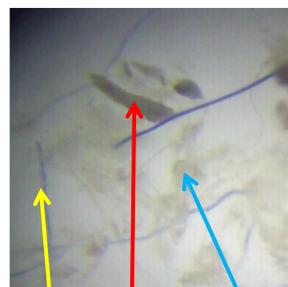
This study used similar methods for collecting plankton and anthropogenic particles to those used by Ng and Obbard (2006) in the waters of Singapore, although many more particles were found in this study. Most particles were fibers with the appearance of plastic or something anthropogenic. FTIR spectroscopy was employed to determine the nature of the captured material (Fig. 5). The fibers found were mostly cotton, or similar lignin-based plant material. There are no cotton plants near the IRL, so either this material is from cotton textiles or cloth, or the common local plants have a spectrographic curve similar to cotton lignin. It is recommended that cellulose and lignin of palms and common nearby plants be examined. If that is not a match, then it would seem that these fibers represent an anthropogenic pollution of the IRL. It should be noted that cotton, if that is indeed what it is, only remains in the water column for 3 to 5 weeks before decaying (Dorée, 1920).

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Fibers Plankton Algae  
Figure 1: Microscope image of fibers, algae, and plankton



Figure 2: Sampled sites, 6/2/14-6/30/14

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