

Monitoring Bermuda's inshore waters for Fecal indicators 2008-2009

In 2008, The Department of Health funded Rachel Parsons to monitor Bermuda's inshore waters for fecal indicators. In particular, this project was monitoring for the human strain of *Bacteroides* in water samples taken from "high-risk" sites around Bermuda. The Department of Health measured *E.coli* and *Enterococci*, fecal indicator bacteria species, in water samples from the sites using the membrane filtration (MF) method approved by the Environmental Protection Agency (EPA) and the World Health Organization (WHO).

The preliminary study showed that various sites were contaminated by human sewage, especially during the summer months. The EPA require less than 35 *Enterococci* cells per 100 millilitre of seawater and the WHO require less than 40 *Enterococci* cells per 100 millilitre of seawater to qualify as safe recreational waters (n=5). The EPA also has a standard for a single sampling of less than 104 *Enterococci* cells per 100 millilitres of seawater (n=1). Sites that exceeded this single standard are shown in bold in Table 1. Since *Enterococci* can be found in the feces of higher mammals, the PCR for the human strain of *Bacteroides* is required to determine if the sewage source is anthropogenic.

Human sewage was found at Controversy Lane (Mill's Creek), Crow Lane, Riddell's Bay, Snorkel Park and Dockyard Marina. These are all popular recreational boat harbors with relatively low flow rates. While *Enterococci* were found at Jennings's bay and Tobacco Bay, this fecal contamination was not anthropogenic in source and likely a result of nearby farm runoff. Sonesta Beach was closed to the public during 2008 while the adjoining hotel was knocked down for a new hotel complex. During September 2008, the seawater at this site was greenish in colour, resulting, in part, from a bloom of nanoflagellate known as *Pyramimonas* spp. (Photo 1). Human sewage was present at this site and may have been a result of damage done to the hotel. However, the contamination source has not been confirmed and has since dissipated.

	<u>Sept 8th</u>	<u>Sept 15th</u>	<u>Sept 22nd</u>	<u>March 9th</u>	<u>March 16th</u>	<u>Average</u>
Controversy Lane	12	22	92	36	2	32.8
Crow Lane	1	3	2	24	4	6.8
Dockyard Marina	45	1	1	1	1	9.8
Horseshoe Bay	39	6	2	1	1	9.8
Jenning's Bay	1	>240		31	1	11
Riddell's Bay	1	1		1	1	1
Shark Hole	1	2	1	2	1	1.4
Snorkel Park	3	8	1	10	1	4.6
Sonesta Beach	47	13	1	≥135	1	15.5
Tobacco Bay	44	1	1	1	1	9.6

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Table 1: Membrane Filtrations results for Enterococci/100ml from each of the ten sampling sites on September 8th, 15th and 22nd, 2008 and March 9th and 16th, 2009. The sites exceeding the EPA standard of 104 Enterococci per 100 millilires of seawater for one sampling are indicated in bold. The geometric mean (average) of sites needs to exceed the EPA standard of 35 Enterococci cells per 100 millilitre of water for multiple sampling (n = 5). No sites exceed this mean showing that no sites are consistently contaminated.

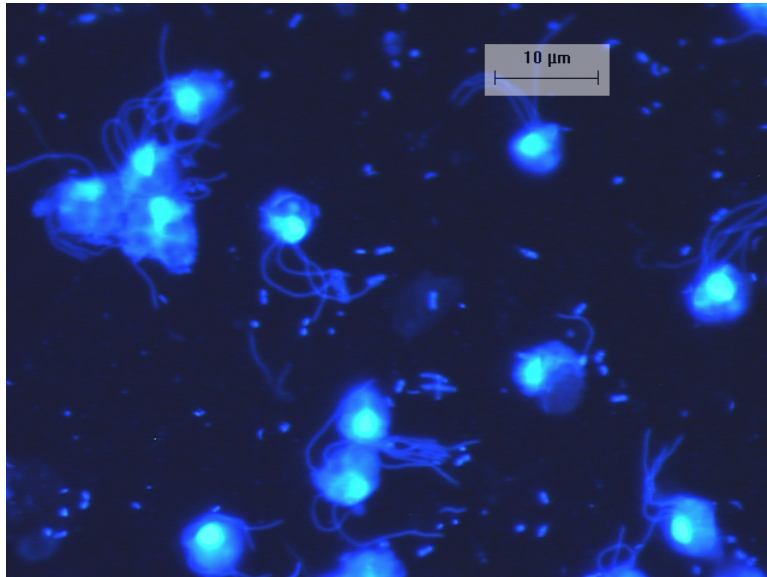


Photo 1: A bloom of nanoflagellate known as *Pyramimonas* spp. found in samples taken from Sonesta Beach in September 2008. The image was captured under x1000 magnification using epifluorescent microscopy (Olympus AX70 Microscope with Image Pro Plus software)

BIOS would like to continue working with the Bermuda Government on identifying sources of sewage contamination on the Bermuda platform. Funding for these projects were provided by the Department of Health, the Department of Environmental Protection, the BIOS-NSF funded REU Program and the BIOS Bermuda Program.