Massachusetts Water Resources Authority

Overview of beach water quality monitoring process

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Beaches SAC
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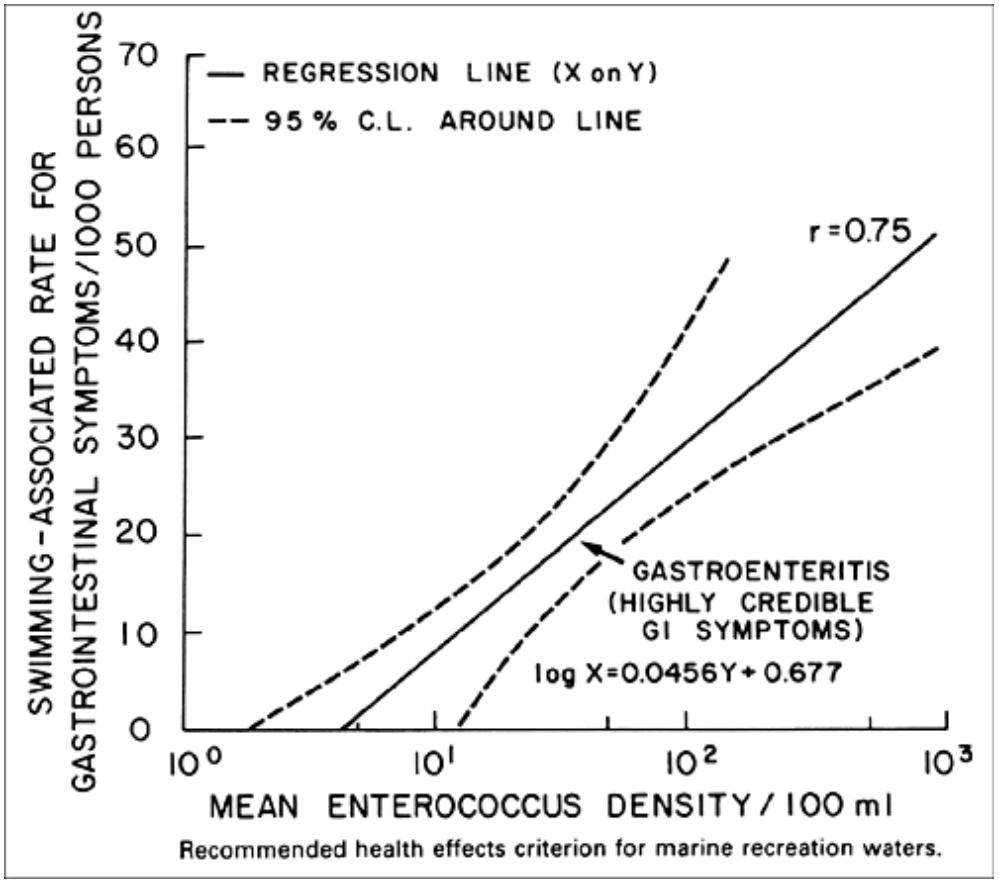
Purpose of microbial indicator monitoring regulations

- To minimize risk of waterborne GI disease from swimming by assessing whether water may be contaminated with feces, and therefore fecal pathogens (usually viruses).
- Main concern has historically been human waste (sewage)
- EPA has not determined that there is sufficient evidence yet to regard risk from animal-derived contamination differently
- Neither the federal nor Massachusetts indicators address non-enteric disease risk-such as eye, ear, skin, or respiratory infections.

In marine waters, current microbial indicator is *Enterococcus*

- Is one of many microbial indicators of fecal contamination
- Based on epidemiological studies carried out in late 1970's that showed reasonably good relationship between levels of *Enterococcus* in water and swimming-associated gastroenteritis
- Subsequent studies have provided reasonable support for this indicator



Recreational water quality criteria based on risk of GI illness

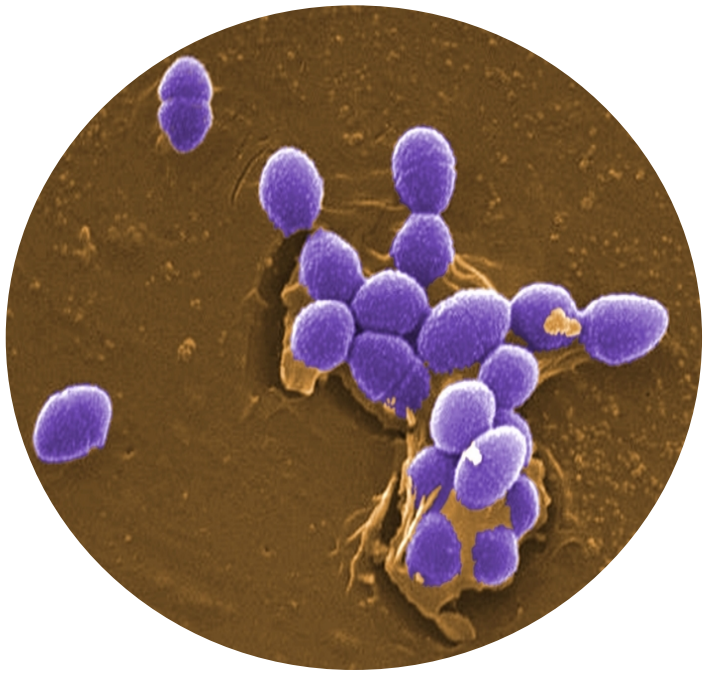
- USEPA 1986 established criteria (limit) for enterococci in marine waters at
  - **104** colony forming units (CFU) per 100 ml for a single sample and
  - **35** CFU per 100 ml for the geometric mean of at least five samples over a 30-day period.

- Expected incidence of gastrointestinal illness among swimmers was 19 illnesses per 1000 swimmers.

- Mass DPH adopted this standard by regulation beginning with the 2000 bathing season.

What is *Enterococcus*?

- Bacteria, part of normal gut (enteric) flora of warm-blooded animals, humans, birds
- Gram-positive cell wall = tough
- Highly resistant to salt, can grow in 6.5% NaCl
- Survives well in marine environment and during transport to lab
- 300,000 CFU/100 ml typical in raw sewage



Enterococcus isn't just in sewage

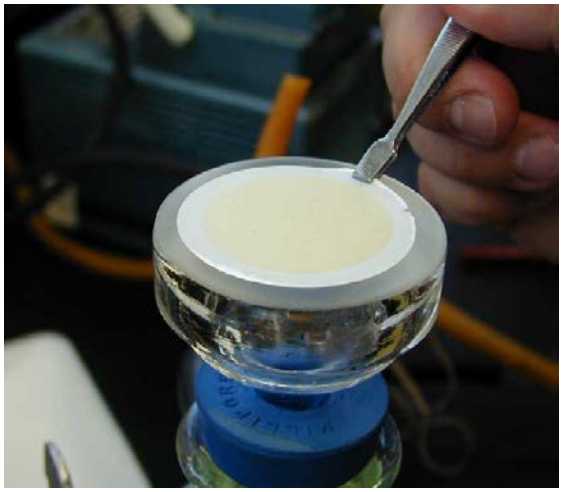
- Stormwater runoff
- Direct deposition from animals
  - "The highest enterococci concentrations… dog feces 740,000 /gram
  - the next highest…birds 33,000/gram
  - One dog fecal event was equivalent to 6,940 bird fecal events" -*Wright et al. Mar Pol Bul 2009*
- Other swimmers-shedding from skin
- Beach wrack, sediments, sand

Beach wrack

Not clear how risks from these sources compare to risks from sewage

Counting *Enterococcus* Day 1

- Collect and transport samples to lab-sampling areas often distant from each other
- Process sample at lab-intake, label, set up, database, chain of custody
- Use a measured amount of sample water to inoculate selective growth medium
- Filtration or dilution series
- Lab QA/QC
- Incubate 18-24 hours



Counting *Enterococcus* Day 2

- Count colonies, multiply by dilution factor
- QA/QC on calculations
- Prepare report
- Email or call report to beach manager
- Beach manager posts beach
- Time elapsed since sampling, ≥ 24hr or two tidal cycles
- Conditions may change in interim