Antibiotic Resistance in Massachusetts Bay

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Flow of Antibiotics into the Aquatic Environment


animal husbandry


agriculture


prescriptions


aquaculture


animal waste


general population


hospitals


landfills

leaching


surface run-off


sewage

aquatic environment

2 Conditions Ideal for Selecting for Resistance

1) Low concentration

2) Prolonged exposure

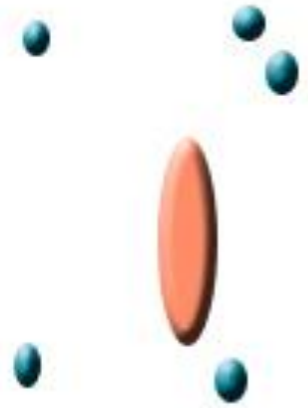
Clinical Strategy

Clinical Strategy

Clinical Strategy

Environmental Situation

Environmental Situation

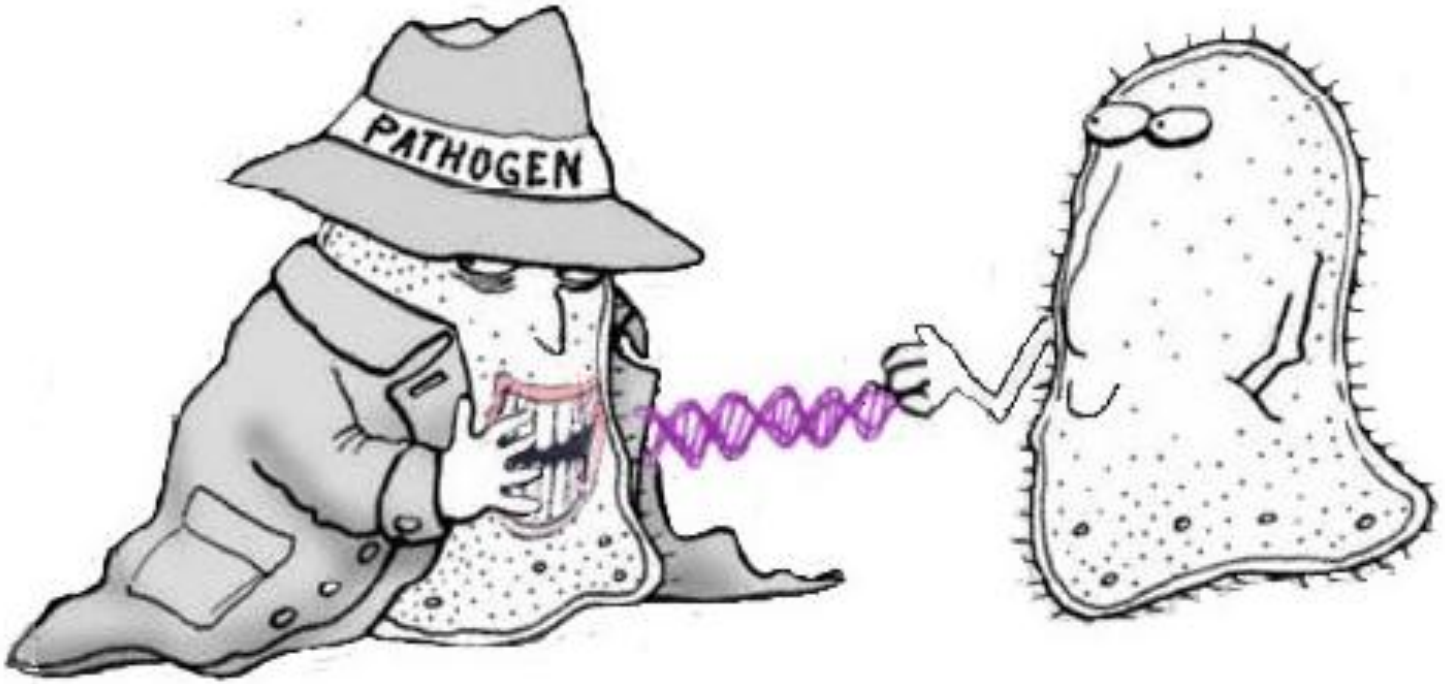


Environmental Situation

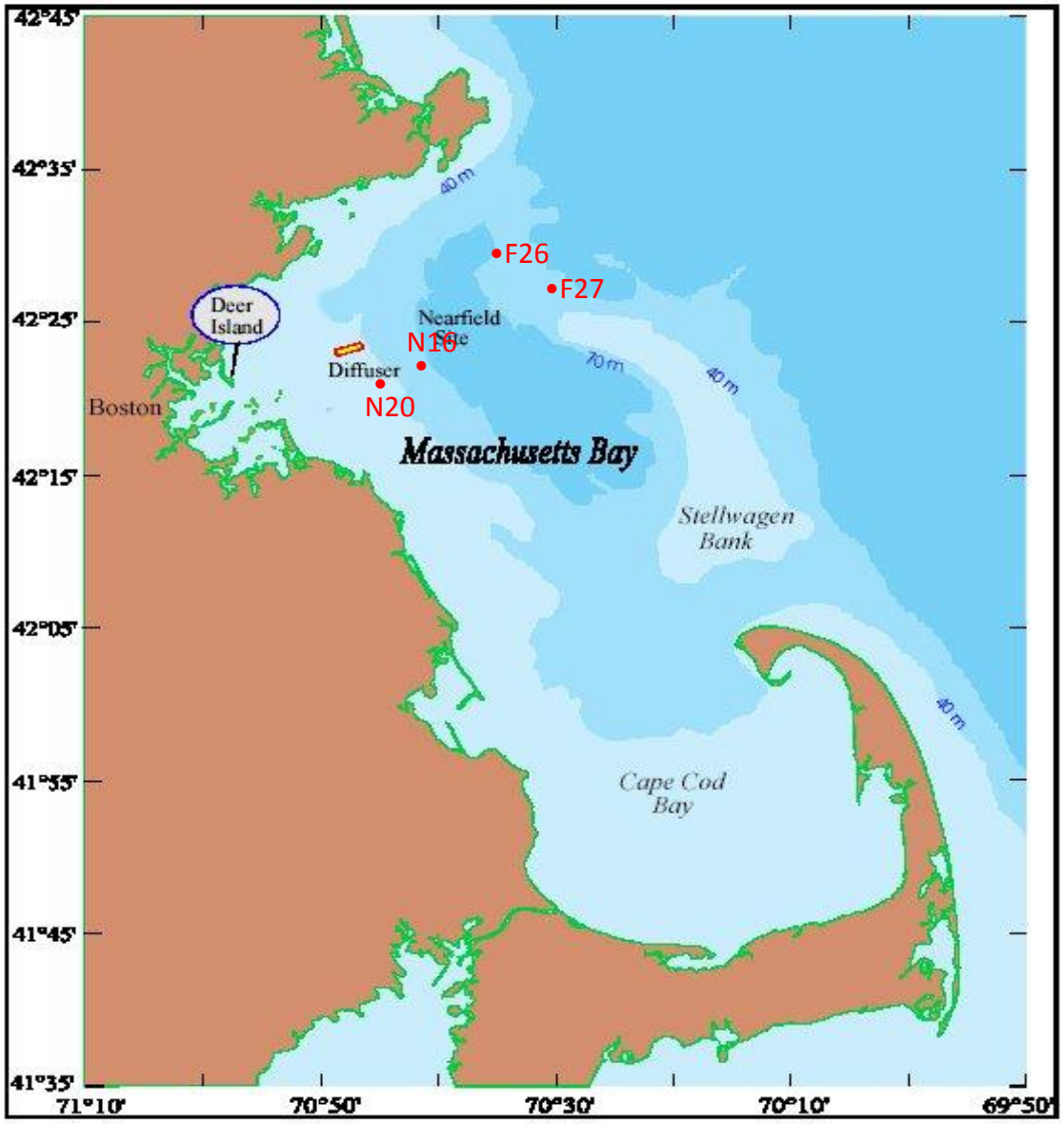
Environmental Situation

Why Should We Care if Nonpathogenic Environmental Microbes are Resistance to Antibiotics?

Horizontal Gene Transfer


PATHOGEN

Massachusetts Bay



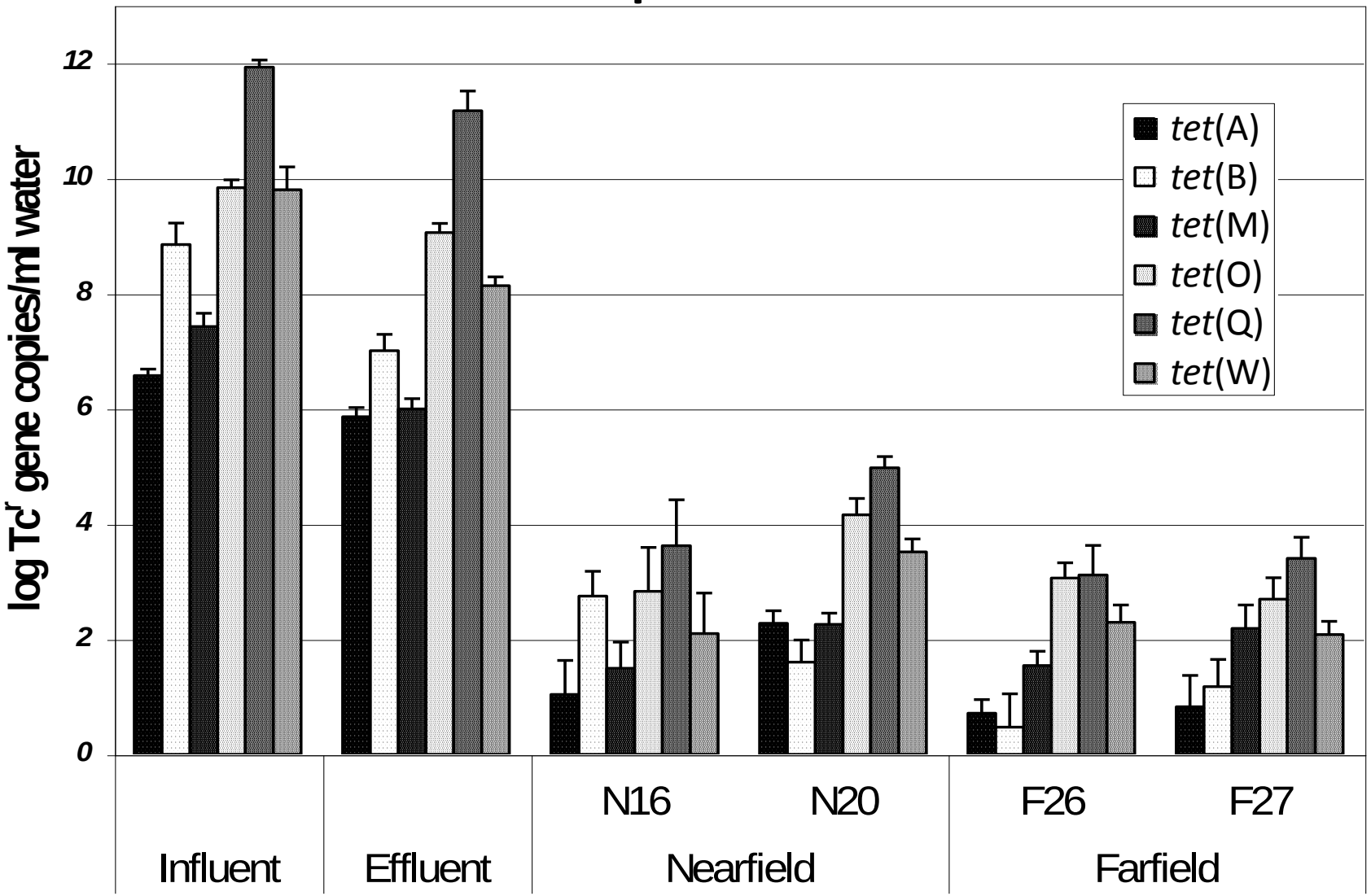
Biomass and Bacteria Estimates

	DNA_T-ng/ml water (biomass)	Copies 16S rRNA genes/ml water (bacteria)	Copies 16S rRNA genes/ng DNA_T (bacteria/biomass)
Influent	4750.9 1323.7	9.2×10^{10} 4.1×10^{10}	2.1×10^{7} 1.0×10^{7}
Effluent	1714.6 497.9	8.1×10^{9} 1.1×10^{10}	4.8×10^{6} 6.9×10^{6}
Nearfield	46.2 28.4	5.6×10^{7} 3.5×10^{7}	1.6×10^{6} 1.7×10^{6}
Farfield	35.7 23.1	8.5×10^{7} 4.8×10^{7}	3.0×10^{6} 2.1×10^{6}

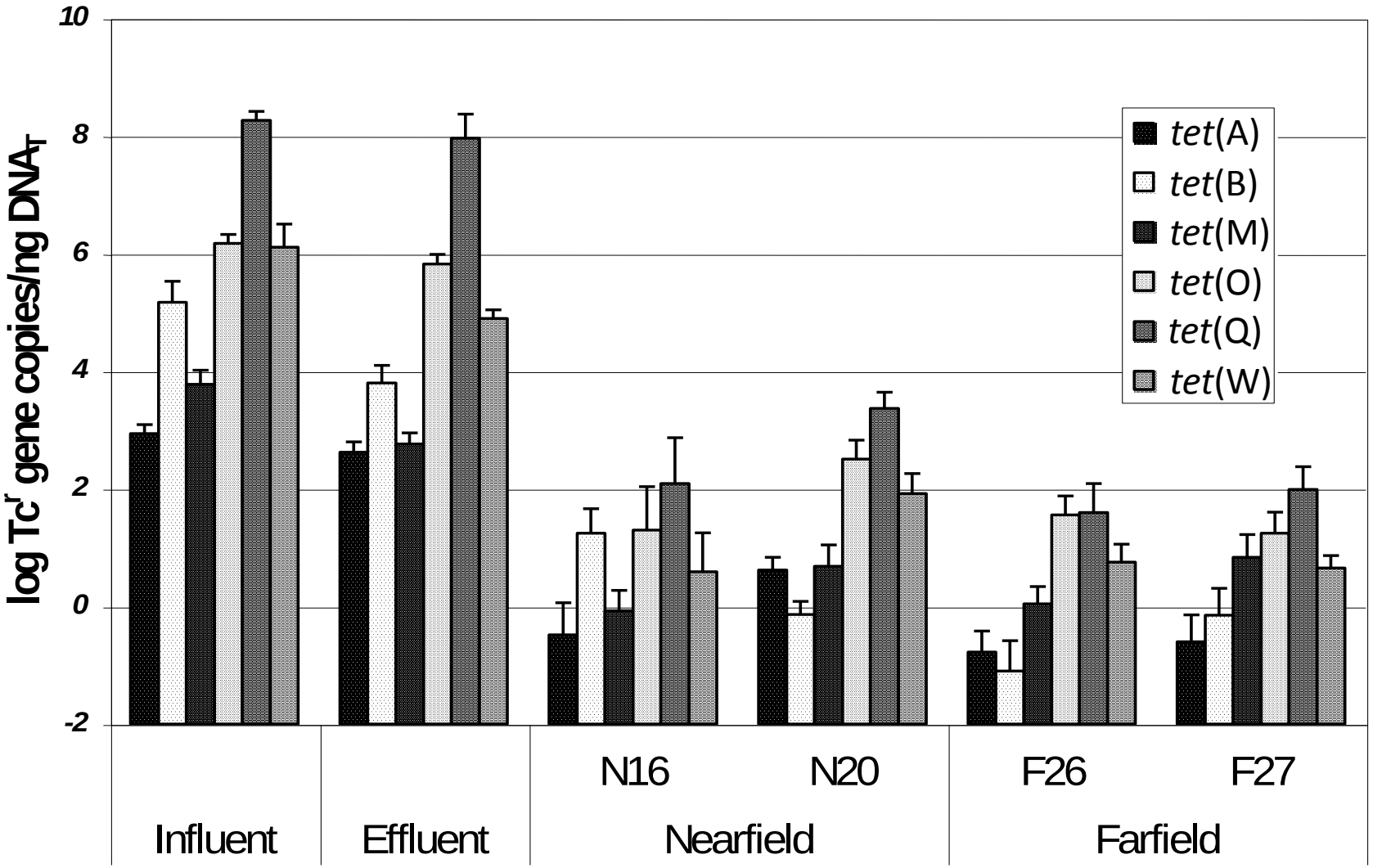
Sample Analysis

- DNA extracted
- Real Time PCR

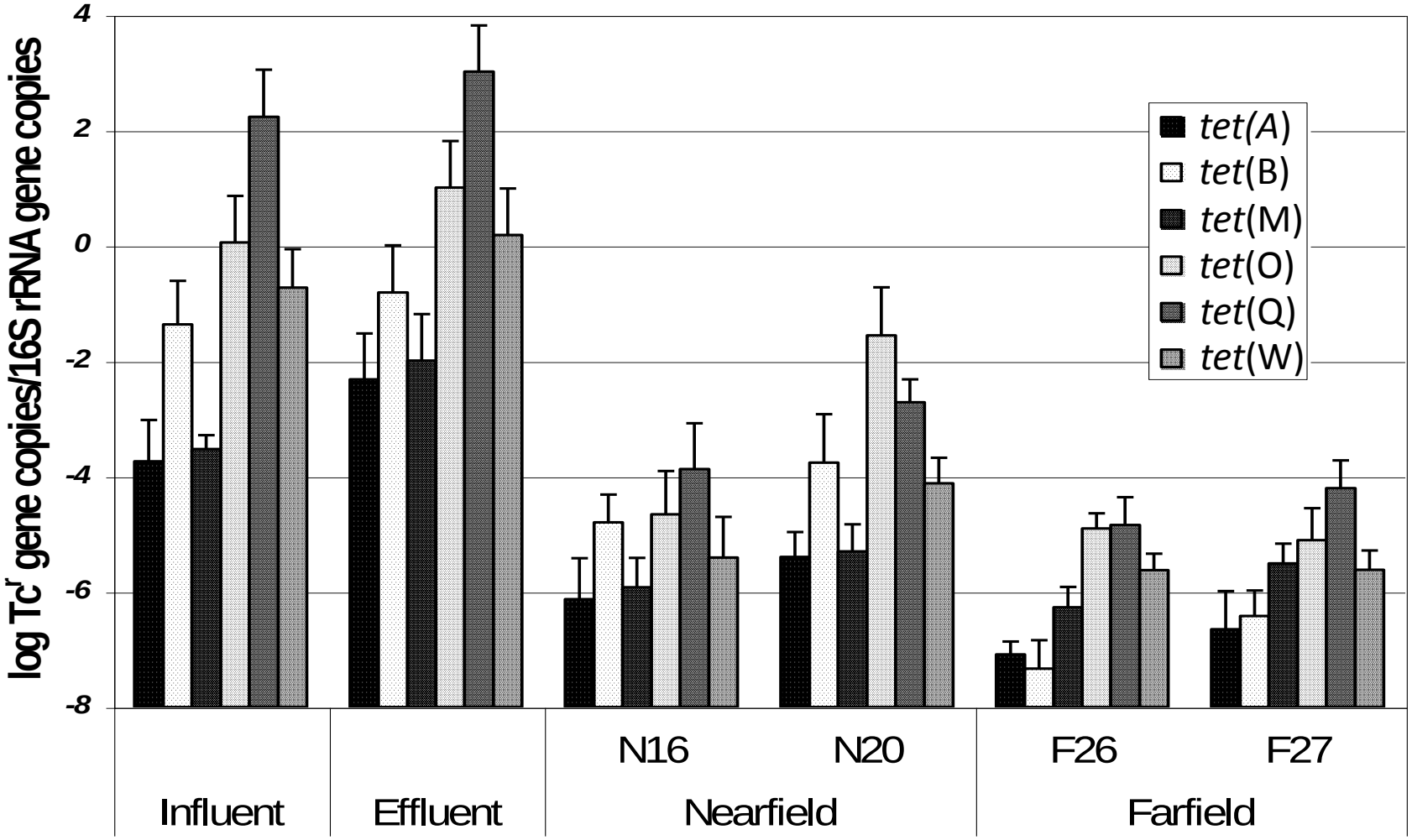
tet Genes per ml of Water



tet Genes Relative to Biomass



tet Genes Relative to Bacterial Count



Conclusions

- Sewage treatment decreases concentrations of antibiotic resistance genes
- Through sewage effluent, antibiotic resistance genes are introduced into the environment in substantially higher concentrations than occur naturally
- This creates reservoirs of increased resistance potential

Acknowledgements

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