

BIBLIOGRAPHY

The needs to augment current regulatory fecal indicator bacteria (FIB) standards

U.S. EPA (2007) Report of the expert scientific workshop on critical research needs for the development of new or revised recreational water quality criteria: EPA 823-R-07-006, U.S. EPA Offices of Water and Research and Development: Washington, D.C., United States. June 2007.

<http://www.epa.gov/waterscience/criteria/recreation/experts/index.html>

U.S. EPA (2007). Criteria development plan & schedule—recreational water quality criteria: U.S. EPA Offices of Water and Research and Development: Washington, D.C., United States. August 31, 2007.

U.S. EPA (2007). Critical path science plan for the development of new or revised recreational water quality criteria: EPA 823-R-08-002, U.S. EPA Office of Research and Development: Washington, D.C., United States. August 31, 2007.

Water Environment Research Foundation (WERF) (2008). Request for Proposals (RFP) : Informing the Risk-Based Framework for Recreational Waters: Quantification of Microbial Pathogens and Indicators from Various Sources RFP PATH1R08

Review of Microbial Source Tracking (MST)

Field, K. G. and Samadpour, M. (2007). Review: Fecal source tracking, the indicator paradigm, and managing water quality. Water Research **41**(16): 3517-3538.

Meays, C. L., Broersma, K., Nordin, R., and Mazumder, A. (2004). Source tracking fecal bacteria in water: a critical review of current methods. Journal of Environmental Management **73**(1): 71-79.

Santo Domingo, J. W., Bambic, D.G., Edge, T. A., and Wuertz, S. (2007). Quo vadis source tracking? Towards a strategic framework for environmental monitoring of fecal pollution. Water Research **41**(16): 3539-3552.

Bacteroidales as a fecal indicator in water monitoring campaigns

In estuarine application:

Bernhard, A. E., Goyard, T., Simonich, M. T., and Field, K. G. (2003). Application of a rapid method for identifying fecal pollution sources in a multi-use estuary. Water Research **37**(4): 913.

Shanks, O. C., Nietch, C, Simonich, M., Younger, M., Reynolds, D., and Field, K. G. (2006). Basin-wide analysis of the dynamics of fecal contamination and fecal source identification in Tillamook Bay, Oregon. Applied and Environmental Microbiology **72**(8): 5537-5546.

Our study

Sirikanchana, K., Bombardelli, F., Wang, D., and Wuertz, S. (2008). Monitoring and modeling non-point source contributions of host-specific fecal contamination in San Pablo Bay. Technical Completion Report Project No. WR1015. University of California Water Resources Center. December 2008.

http://www.lib.berkeley.edu/WRCA/WRC/pubs_tcrs.html

In sea water application:

Boehm, A. B., Fuhrman, J. A., Mrse, R. D., and Grant, S. B. (2003). Tiered approach for identification of a human fecal pollution source at a recreational beach: case study at Avalon bay, Catalina Island, California. Environmental Science and Technology **37**(4): 673-680.

In fresh water application:

Cleaner Rivers through Effective Stakeholder-led TMDLs (CREST) (2008). Los Angeles river bacteria source identification study final report, November 2008.

http://www.crestmdl.org/studies/bsi_final_docs.html

Jenkins, M.W., Tiwari, S., Lorente, M., Maina Gichaba, C., and Wuertz S. Identifying human and livestock sources of fecal contamination in Kenya with host-specific *Bacteroidales* assays developed in the United States and Europe. Submitted to Water Research

Kildare, B., Rajal, V., Tiwari, S., Thompson, D., McSwain, B., Bambic, D., Reide, G., and Wuertz, S. (2006). Calleguas Creek watershed microbial source tracking study. Report Prepared by UC Davis in Cooperation with Larry Walker Associates.

http://www.calleguascreek.org/ccwmp/DRAFT_CCW_MST_061406.pdf

Lee, Y.-J., Molina, M., Santo Domingo, J. W., Willis, J. D., Cyterski, M., Endale, D. M., Shanks, O. C. (2008). Temporal assessment of the impact of exposure to cow feces in two watersheds by multiple host-specific PCR assays. Applied and Environmental Microbiology **74**(22): 6839-6847.

McSwain, B., Kildare B., Bae, S., Lorente, M., and Wuertz, S. (2006). Management of pathogens associated with stormwater discharge and identification of sources of microbial contamination. Interim Report Prepared for the Environmental Division of California Department of Transportation, Task Order no.3.

Rajal, V., Thompson, D., Kildare, B., Tiwari, S., McSwain, B., and Wuertz, S. (2005). Management of pathogens associated with storm water discharge: methodology for quantitative molecular determination of viruses, bacteria, and protozoa. Interim Report Prepared for the Environmental Division of California Department of Transportation, Task Order no. 19.

Schriewer, A., Bae, S., Rizvi, A., Sirikanchana, K., Wang, D. and Wuertz, S. (2009). Completion of environmental toolkit for fecal source tracking and pathogen analysis in stormwater. Draft Report prepared for the environmental division of California Department of Transportation. Execution Date: Contract No. 43A0168. Task Order No.: 23. Submitted in January 2009

Walters, S. P., Gannon, V. P. J., and Field, K.G. (2007). Detection of *Bacteroidales* fecal indicators and the zoonotic pathogens *E. coli* O157:H7, *Salmonella*, and *Campylobacter* in River Water. Environmental Science & Technology. **41**(6): 1856-1862.

Wuertz, S. and Schriewer A.(2009). Santa Monica Bay microbial source tracking study, 2007-2008 Monitoring Season. Report prepared for the Environmental Division of California Department of Transportation. Technical Memorandum. January 2009.

The development of PCR or quantitative PCR assays for *Bacteroidales*

- Bae, S. and Wuertz, S. Discrimination of viable and dead fecal *Bacteroidales* with PMA-qPCR. Submitted to Applied and Environmental Microbiology
- Bernhard, A. E. and K. G. Field (2000). A PCR assay to discriminate human and ruminant feces on the basis of host differences in *Bacteroides-Prevotella* genes encoding 16S rRNA. Applied and Environmental Microbiology. **66**(10): 4571-4574.
- Kildare, B. J., Leutenegger, C. M., McSwain, B. S., Bambic, D. G., Rajal, V. B., and Wuertz, S. (2007). 16S rRNA-based assays for quantitative detection of universal, human-, cow-, and dog-specific fecal *Bacteroidales*: A Bayesian approach. Water Research **41**(16): 3701-3715.
- Shanks, O. C., J. W. Santo Domingo, et al. (2006). Competitive metagenomic DNA hybridization identifies host-specific microbial genetic markers in cow fecal Samples. Applied and Environmental Microbiology. **72**(6): 4054-4060.
- Shanks, O. C., Atikovic, E., Blackwood, A. D., Lu, J., Noble, R. T., Santo Domingo, J., Seifring, S., Sivaganesan, M., Haugland, R. A. (2008). Quantitative PCR for detection and enumeration of genetic markers of bovine fecal pollution." Applied and Environmental Microbiology. **74**(3): 745-752.

The assays used in this project

For *Bacteroidales* detection:

- Kildare, B. J., Leutenegger, C. M., McSwain, B. S., Bambic, D. G., Rajal, V. B., and Wuertz, S. (2007). 16S rRNA-based assays for quantitative detection of universal, human-, cow-, and dog-specific fecal *Bacteroidales*: A Bayesian approach. Water Research **41**(16): 3701-3715.

For fecal contamination from sea birds:

- Lu, J., Santo Domingo, J. W., Lamendella, R., Edge, T., and Hill, S. (2008). Phylogenetic diversity and molecular detection of bacteria in gull feces." Applied and Environmental Microbiology. **74**(13): 3969-3976.

For large and small system filtration and filtration recovery:

- Rajal, V. B., McSwain, B. S., Thompson, D. E., Leutenegger, C. M., Kildare, B. J., and Wuertz, S. (2007). Validation of hollow fiber ultrafiltration and real-time PCR using bacteriophage PP7 as surrogate for the quantification of viruses from water samples. Water Research **41**(7): 1411-1422.

For human virus detection:

- Rajal, V. B., McSwain, B.S., Thompson, D. E., Leutenegger, C. M., and Wuertz, S. (2007). Molecular quantitative analysis of human viruses in California stormwater. Water Research **41**: 4287-4298.

For *Cryptosporidium spp.* detection:

- Miller, W. A., Gardner, I. A., Atwill, E. R., Leutenegger, C. M., Miller, M. A., Hedrick, R. P., Melli, A. C., Barnes, N. M., and Conrad, P. A. (2006). Evaluation of methods for improved detection of *Cryptosporidium spp.* in mussels (*Mytilus californianus*). Journal of Microbiological Methods. **65**(3): 367-379.

For *Toxoplasma spp.* detection:

- Arkush, K. D., Miller, M. A., Leutenegger, C. M., Gardner, I. A., Packham, A. E., Heckerth, A. R., Tenter, A. M., Barr, B. C., and Conrad, P. A. (2003). Molecular

and bioassay-based detection of *Toxoplasma gondii* oocyst uptake by mussels (*Mytilus galloprovincialis*)." International Journal for Parasitology. **33**(10): 1087-1097.

The development of PCR or quantitative PCR assays for human viral pathogens and their application in environmental monitoring

Ahn, J. H., Grant, S. B., Surbeck, C. Q., DiGiacomo, P. M., Nezlin, N. P., and Jiang, S. (2005). Coastal water quality impact of stormwater runoff from an urban watershed in Southern California." Environmental Science & Technology **39**(16): 5940-5953.

He, J.-W. and S. Jiang (2005). Quantification of enterococci and human adenoviruses in environmental samples by real-time PCR." Applied and Environmental Microbiology. **71**(5): 2250-2255.

In coastal water, adenovirus:

Jiang, S., Noble, R., and Chu, W. (2001). Human adenoviruses and coliphages in urban runoff-impacted coastal waters of Southern California." Applied and Environmental Microbiology. **67**(1): 179-184.

In freshwater, adenovirus, enterovirus, hepatitis A:

Jiang, S. C. and Chu, W. (2004). PCR detection of pathogenic viruses in southern California urban rivers. Journal of Applied Microbiology **97**(1): 17-28.

In beach, enterovirus:

Boehm, A. B., Fuhrman, J. A., Mrse, R. D., and Grant, S. B. (2003). Tiered approach for identification of a human fecal pollution source at a recreational beach: case study at Avalon bay, Catalina Island, California. Environmental Science & Technology. **37**(4): 673-680.

qPCR, adenovirus, sewage, coastal water:

He, J.-W. and Jiang, S. (2005). Quantification of enterococci and human adenoviruses in environmental samples by real-time PCR." Applied and Environmental Microbiology. **71**(5): 2250-2255.

qPCR, adenovirus, enterovirus, storm water:

Rajal, V. B., McSwain, B.S., Thompson, D. E., Leutenegger, C. M., and Wuertz, S. (2007). Molecular quantitative analysis of human viruses in California stormwater. Water Research **41**: 4287-4298.

The correlation between Bacteroidales and pathogen detection

Walters, S. P., Gannon, V. P. J., Field, K. G. (2007). Detection of *Bacteroidales* fecal indicators and the zoonotic pathogens *E. coli* O157:H7, *Salmonella*, and *Campylobacter* in river water." Environmental Science & Technology. **41**(6): 1856-1862.

The (no) correlation between FIB and pathogen detection

Cryptosporidium spp.:

Mons, C., Dumètre, A., Gosselin, S., Galliot, C., Moulin, L. Monitoring of *Cryptosporidium* and *Giardia* river contamination in Paris area." Water Research
In Press, Corrected Proof.

Human viral pathogens:

Rajal, V. B., McSwain, B.S., Thompson, D. E., Leutenegger, C. M., and Wuertz, S. (2007). Molecular quantitative analysis of human viruses in California stormwater. Water Research **41**: 4287-4298.

Persistence of *Bacteroidales* in water

Microcosm study in freshwater:

Bell, A., Layton, A. C., McKay, L., Williams, D., Gentry, R., and Sayler, G. S. (2008). Factors influencing the persistence of fecal *Bacteroides* in stream water." Journal of Environmental Quality **In press**.

Freshwater:

Kreader, C. A. (1998). Persistence of PCR-detectable *Bacteroides distasonis* from human feces in river water." Applied and Environmental Microbiology. **64**(10): 4103-4105.

Bromodeoxyuridine Immunocapture:

Walters, S. P. and Field, K. G. (2006). Persistence and growth of fecal *Bacteroidales* assessed by bromodeoxyuridine immunocapture." Applied and Environmental Microbiology. **72**(7): 4532-4539.

Microcosm study in seawater:

Bae, S. and Wuertz, S. Persistence and survival of host-specific fecal *Bacteroidales* cells and their DNA in seawater. Submitted to Water Research

Survivability of microorganisms in water

Seawater, *Salmonella*, *Giardia*, *Cryptosporidium*, Poliovirus:

Johnson, D. C., Enriquez, C. E., Pepper, I.L., Davis, T.L., Gerba, C.P., and Rose, J.B. (1997). Survival of *Giardia*, *Cryptosporidium*, poliovirus and *Salmonella* in marine waters Water Science and Technology **35**(11-12): 261-268.

The application of hollow fiber ultrafiltration

Morales-Morales, H. A., Vidal, G., Olszewski, J., Rock, C. M., Dasgupta, D., Oshima, K. H., and Smith, G. B. (2003). Optimization of a reusable hollow-fiber ultrafilter for simultaneous concentration of enteric bacteria, protozoa, and viruses from water. Applied and Environmental Microbiology. **69**(7): 4098-4102.

Rajal, V. B., McSwain, B. S., Thompson, D. E., Leutenegger, C. M., Kildare, B. J., and Wuertz, S. (2007). Validation of hollow fiber ultrafiltration and real-time PCR using bacteriophage PP7 as surrogate for the quantification of viruses from water samples. Water Research **41**(7): 1411-1422.

Viability measurement of microorganisms

Legionella, EMA, PCR, qPCR:

Chang, B., Sugiyama, K., Taguri, T., Amemura-Maekawa, J., Kura, F., and Watanabe, H. (2008). Specific detection of viable *Legionella* cells by combined use of photoactivated ethidium monoazide and PCR/real-time PCR." Applied and Environmental Microbiology. **accepted**.

EMA vs PMA:

Nocker, A., Cheung, C.-Y., Camper, A. K. (2006). Comparison of propidium monoazide with ethidium monoazide for differentiation of live vs. dead bacteria by selective removal of DNA from dead cells. Journal of Microbiological Methods. **67**(2): 310-320.

Nondetect data analysis

Helsel, D. R. (2005). More than obvious: Better methods for interpreting nondetect data." Environmental Science & Technology. **39**(20): 419A-423A.

Helsel, D. R. (2005). Nondetects and data analysis: Statistics for censored environmental data. New York, Wiley.

Helsel, D. R. (2006). Fabricating data: How substituting values for nondetects can ruin results, and what can be done about it." Chemosphere. **65**(11): 2434-2439.

Lee, L. and Helsel, D. (2005). Statistical analysis of water-quality data containing multiple detection limits: S-language software for regression on order statistics. Computers & Geosciences **31**(10): 1241-1248.