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Distribution and loss rates of Faecal Indicator Bacteria (FIB) in the Red River, Viet Nam

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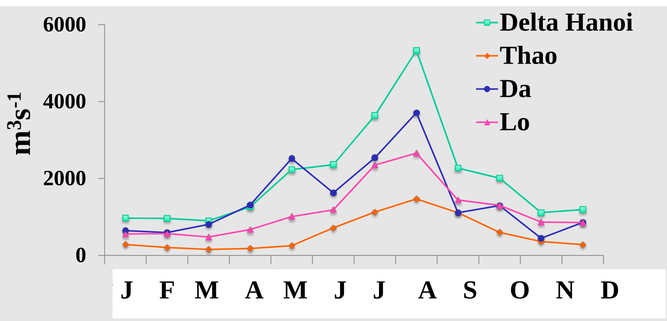
Objectives

i) To determine the distribution of faecal indicator bacteria (FIB) at 10 stations in the greater Hanoi area of the Red River over an annual cycle (July 2013-July 2014). ii) To determine the loss rates of FIB at 4 selected stations over the annual cycle.

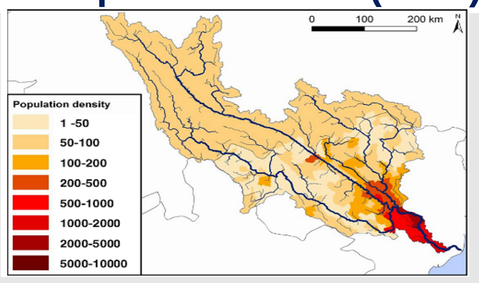
Study sites and methods

Red river System	Area (x 10^3 km^2)	Drainage density $km.km^{-2}$
Thao	51.8	0.55
Da	52.9	0.59
Lo	39	0.59
Delta Hanoi	1.5	-

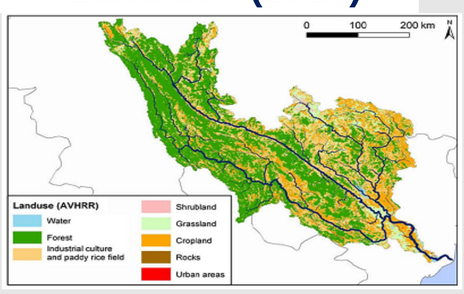
Monthly discharge (2012)



Population: 23 M (2010)



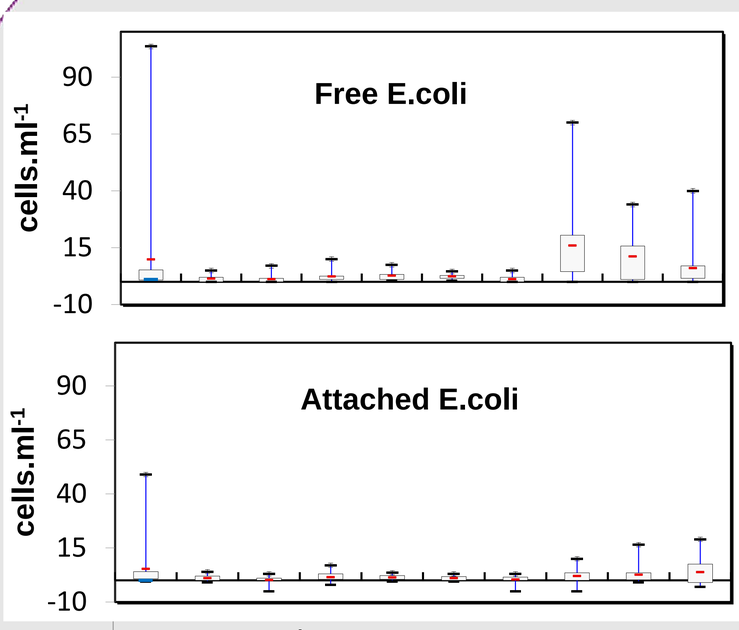
Land use (2010)



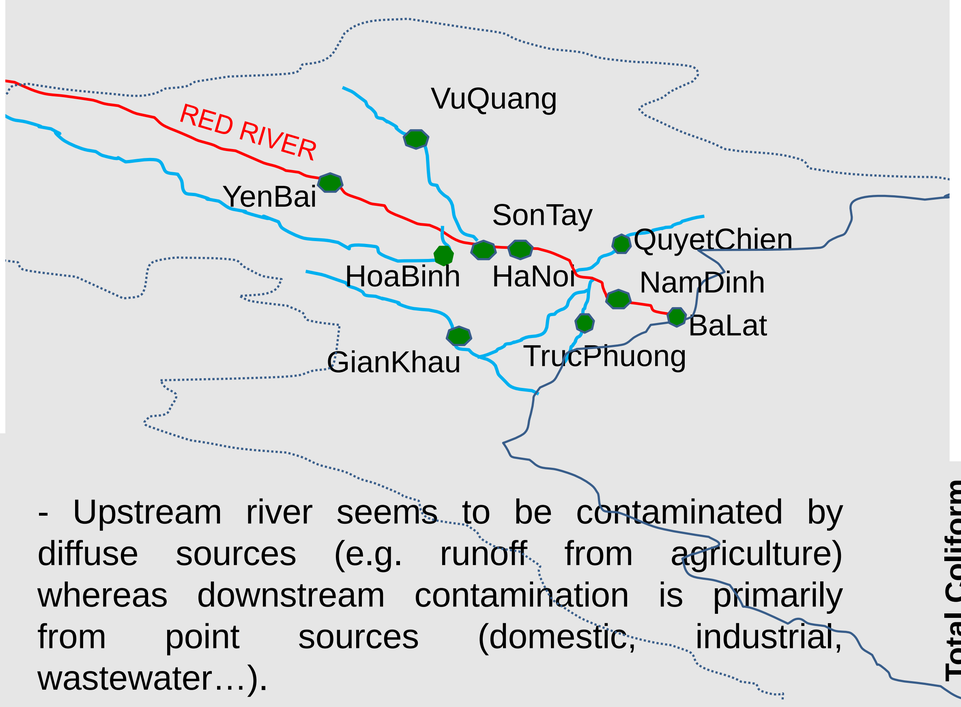
Methods: 1- *FIB abundance* (free and attached) was measured by a direct count method using Petrifilm E. coli/Coliform Count (EC) plates;
2- *FIB loss rates*: Samples from 4 sites (Hanoi, Truc Phuong, Gian Khau and Yen Bai) were incubated in duplicate during 5 days in the dark and at in situ temperature. Samples were collected daily for determination of FIB abundance.

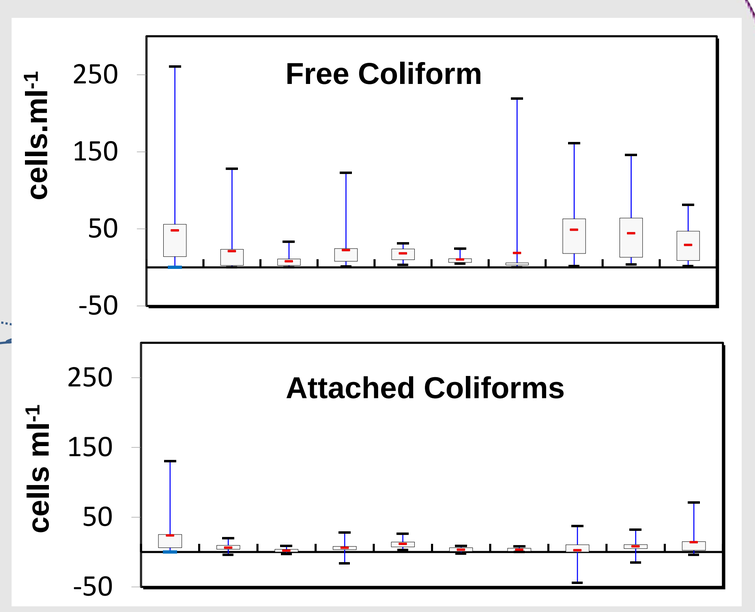
Results and discussion

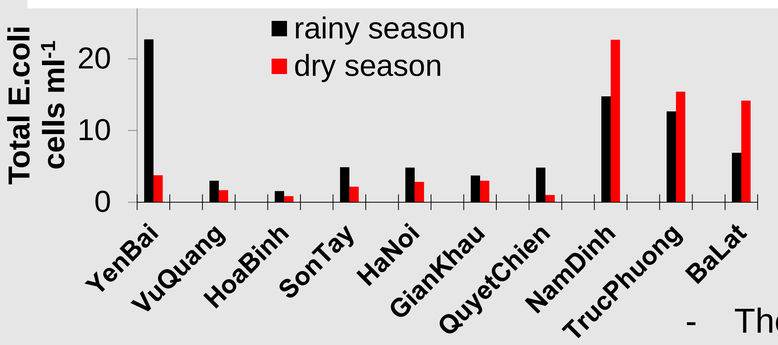
Distribution of indicator bacteria



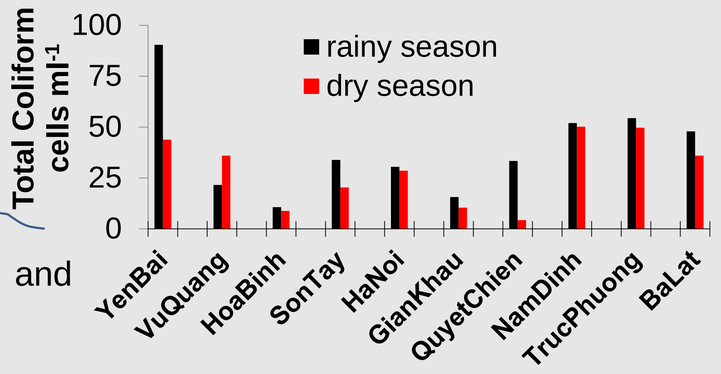
- Monthly observations at 10 gauging stations in July 2013 – July 2014 showed that Coliform density varied 0 – 391 cells ml^{-1} and E-coli density varied 0 – 153 cells ml^{-1}.





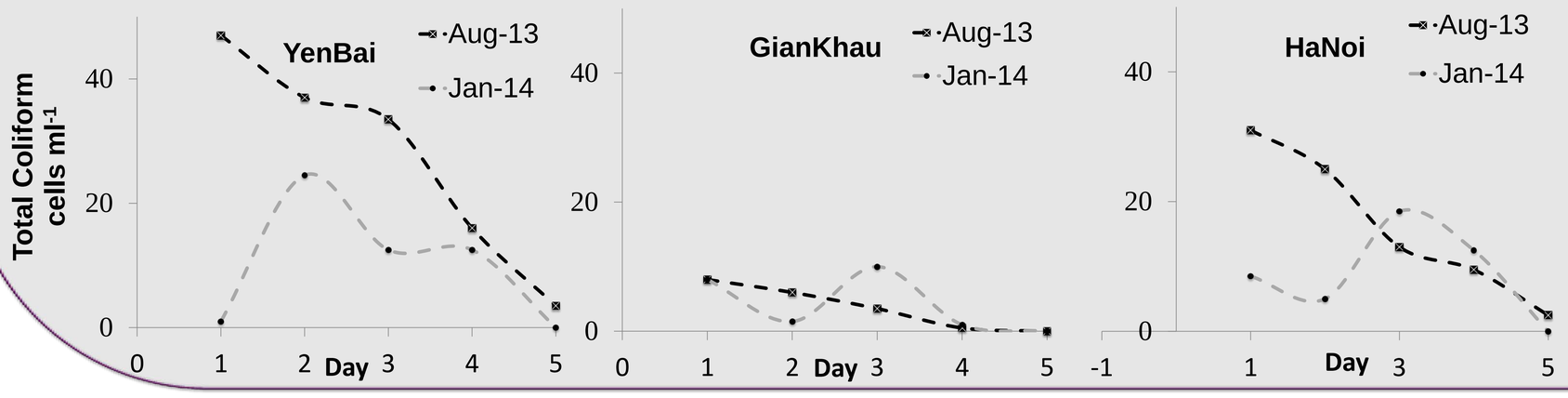


- Upstream river seems to be contaminated by diffuse sources (e.g. runoff from agriculture) whereas downstream contamination is primarily from point sources (domestic, industrial, wastewater…).



FIB die-off rates

- There are large differences in die off rates between station and month
- The decay rates for bacteria ranged from 0.04 to 0.72 d^{-1}



Conclusions

I. FIB numbers exceeded many fold the Viet Nam National technical regulations on domestic water quality for Coliforms (0.5 cells ml^{-1}) and E. coli (0 cells ml^{-1}).
II. The percentage of particle attached FIB varied between 8% and 95% for E.coli and between 17% and 79% for Coliforms. The % were generally highest in the rainy season.
III. FIB loss rates are were higher in the rainy season when temperatures were highest.
IV. Die-off was highest at Yen Bai (station) in July and lowest at Gian Khau in February (0.72 and 0.04 d^{-1}, respectively).

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