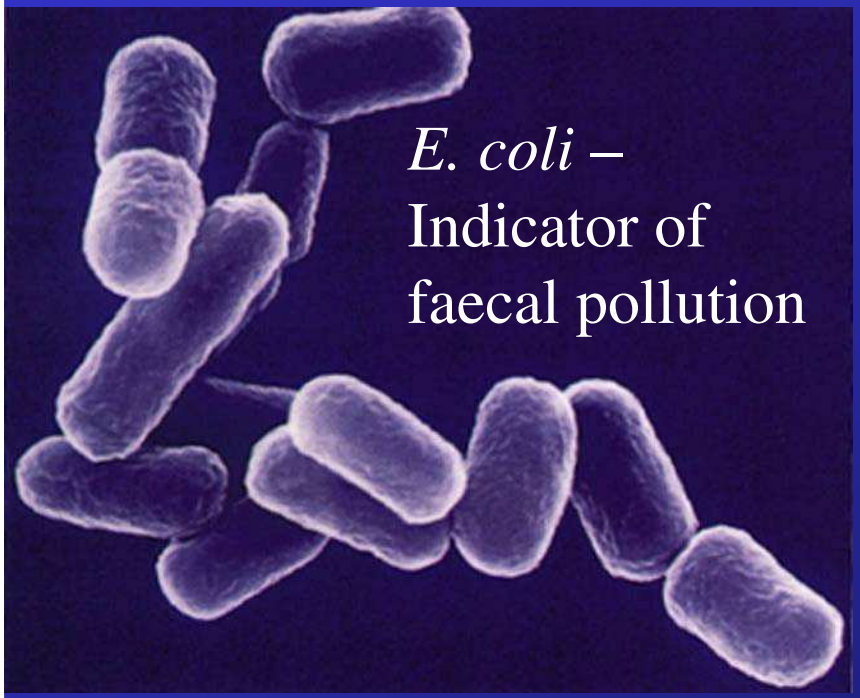
Faecal pollution from land sources flushed by storm flows

Recent research findings & current directions

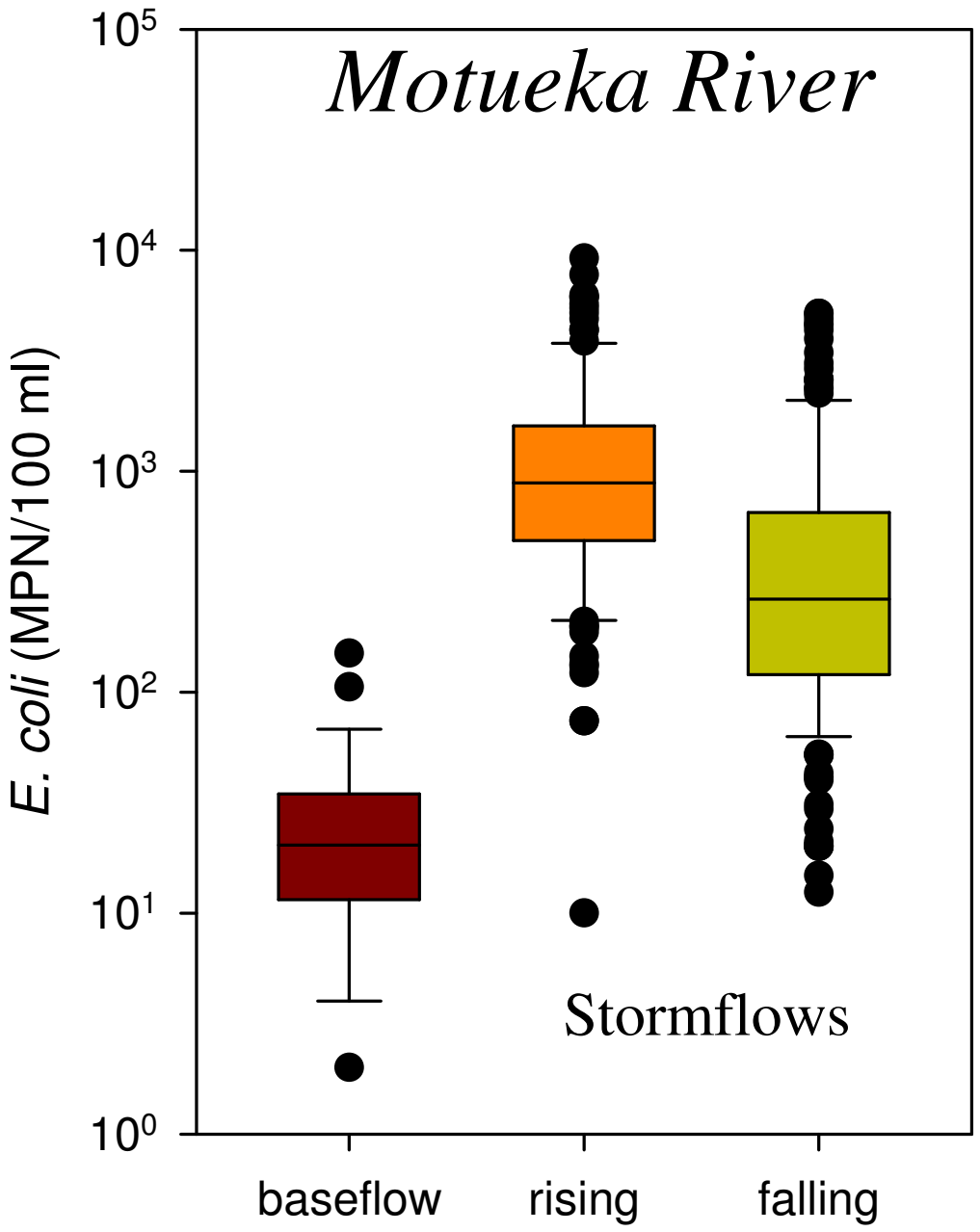


Rob Davies-Colley
NIWA, Hamilton
(and numerous colleagues from NIWA, ESR, AgRes, LCR,…)

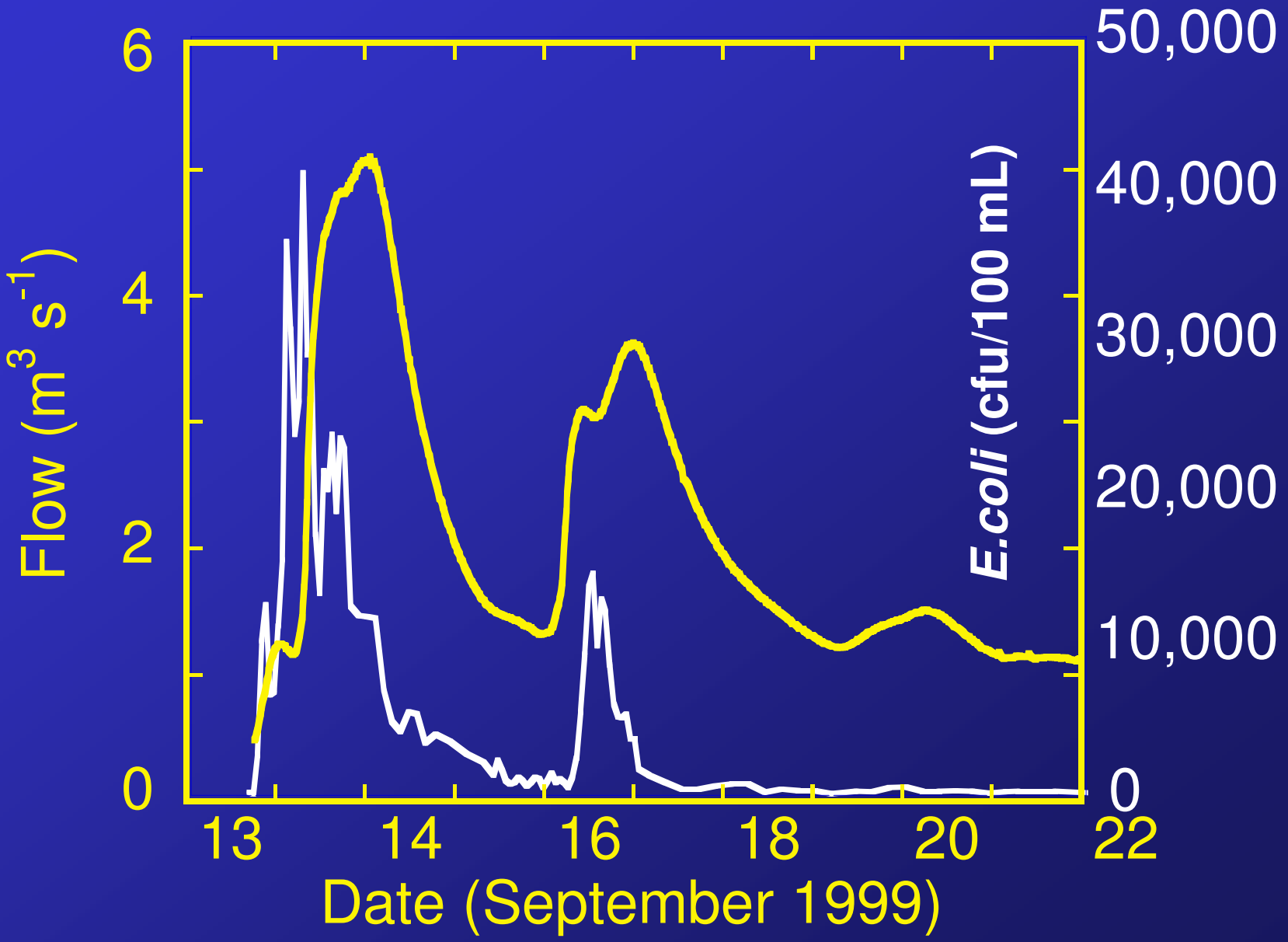
NIWA
Taihoro Nukurangi

Faecal pollution

Much higher on floods than at baseflow – esp. on rising limbs



Natural flood – flow and bacteria

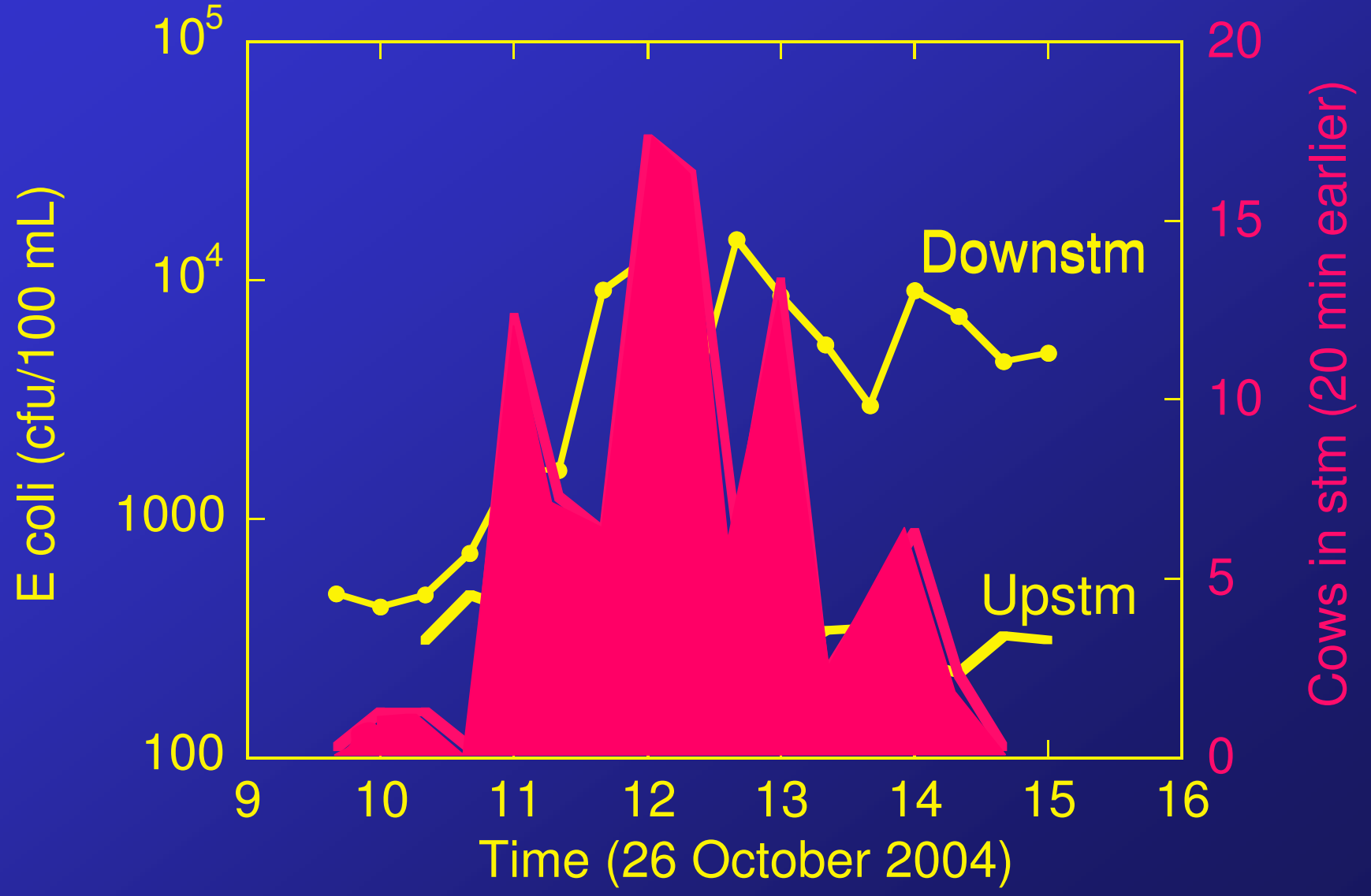


Overland flow – rainfall simulator

Direct deposition –
to unfenced streams

- **Dairy cow herd observed** - number in the stream and on the bank, recorded every minute.
- **Water Quality** (Turbidity *E. coli*) measured upstream and downstream.

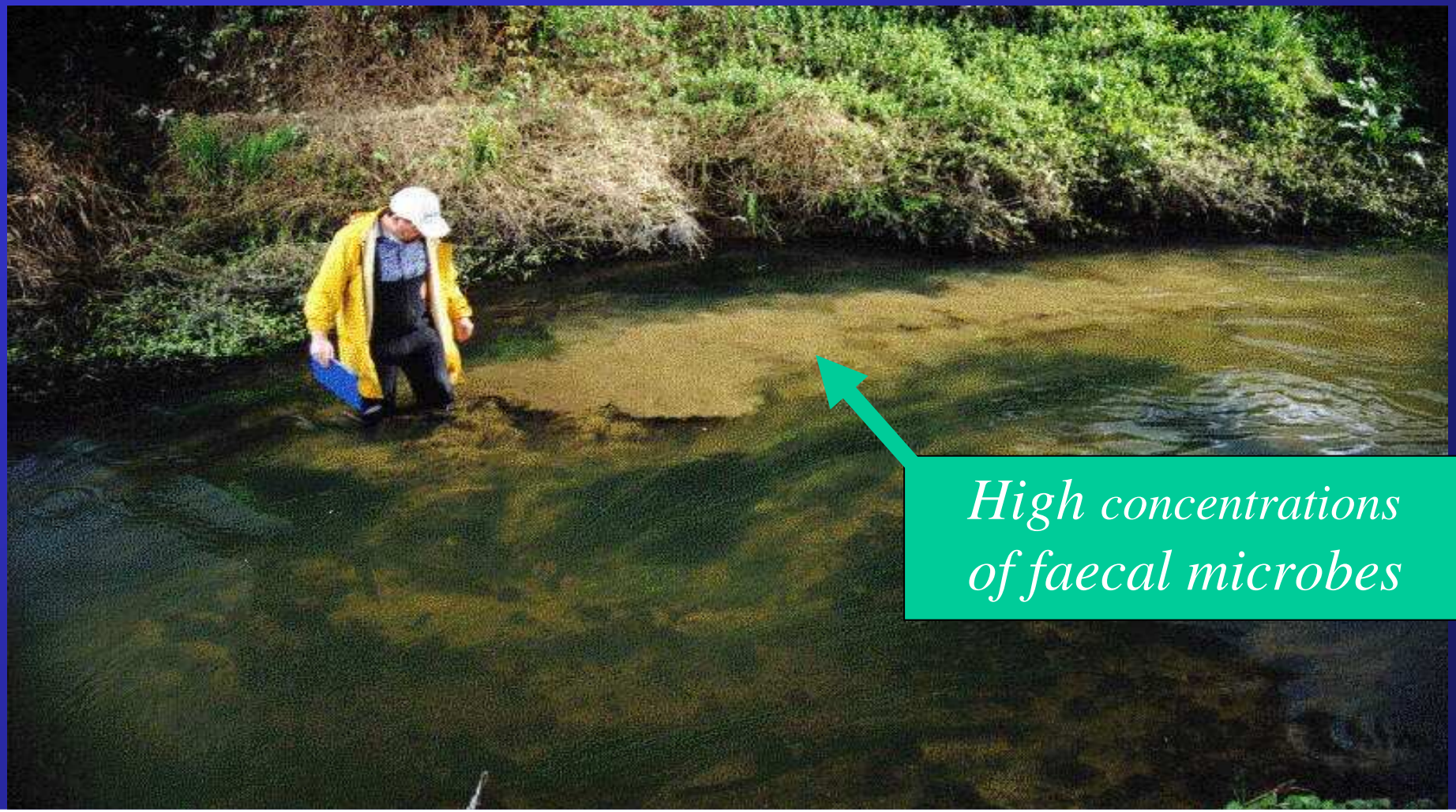
Direct deposition



Agricultural stream sediments –

contain much fine sediment…

and faecal microbes.



Artificial flood – Topehaehae Stm

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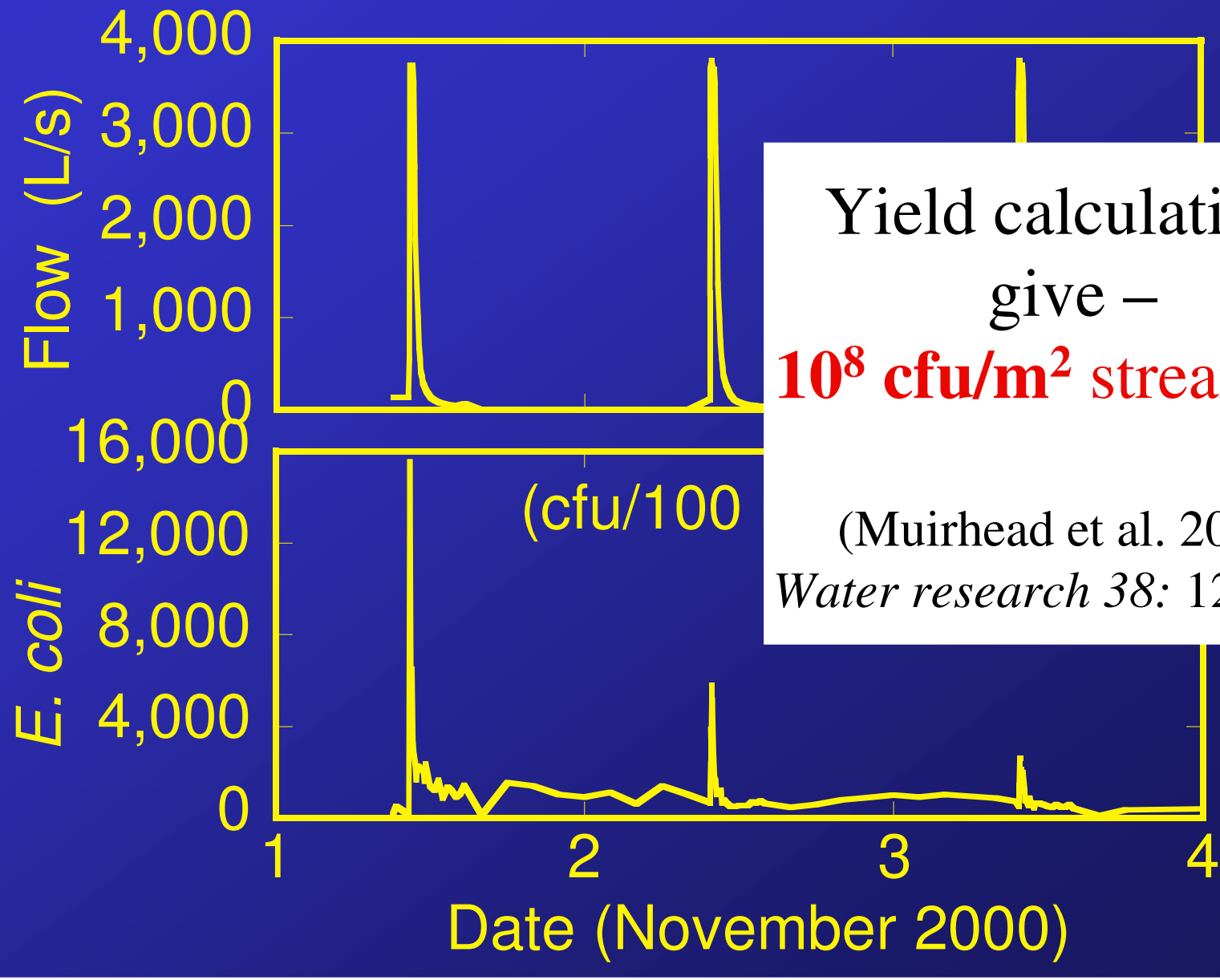


Yield calculations give –

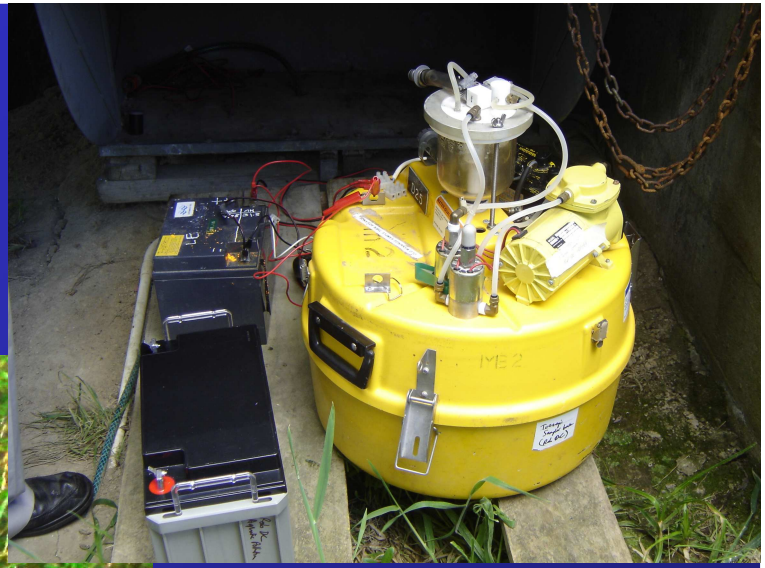
10^8 cfu/m^2 streambed

(Muirhead et al. 2004. *Water research 38:* 1215-24)

Sediment sampling
(Topehaehae Stm)

Areal concentration
1.5×10^8 cfu/m^2

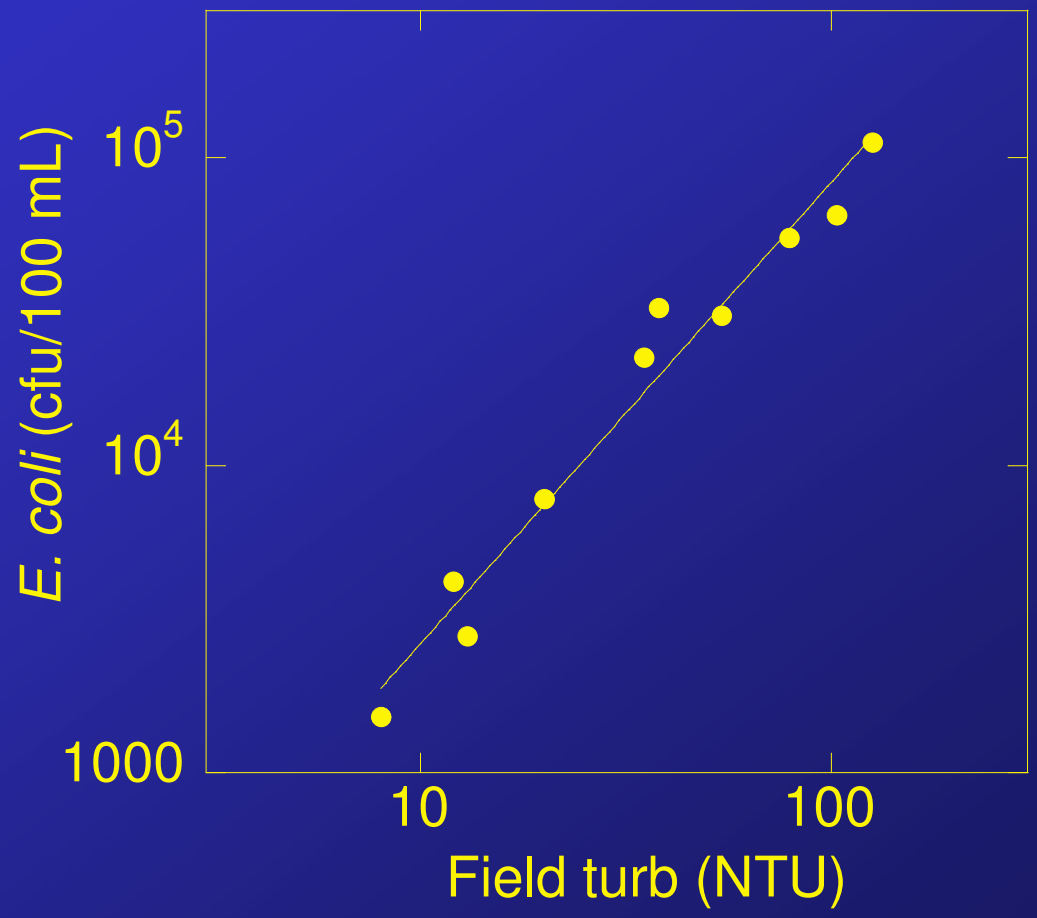
Toenepi Stm
(intensive dairying)



Stormflow faecal bacterial dynamics & yields

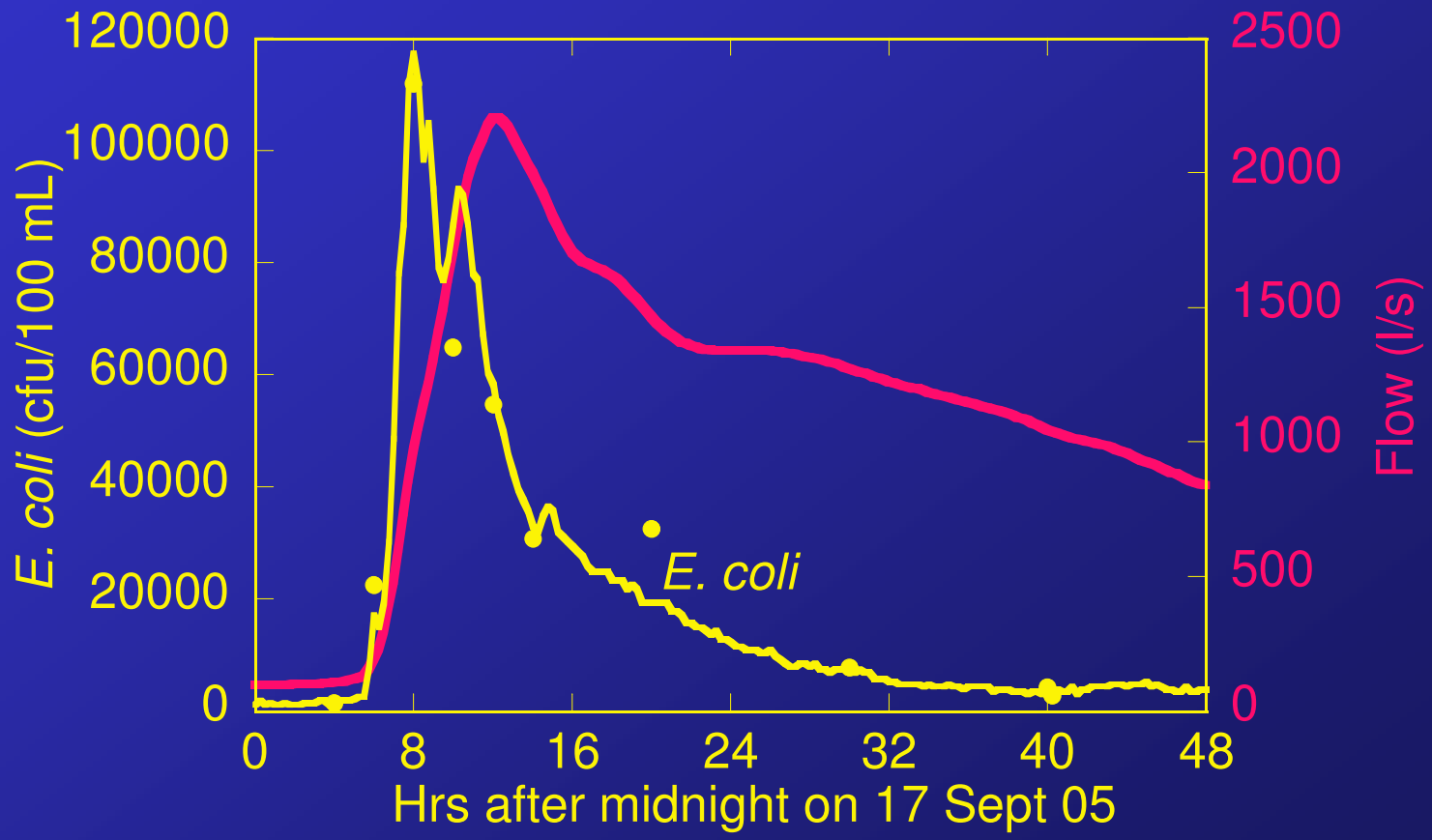
E. coli vs turbidity

Toenepi – 18 September 2005

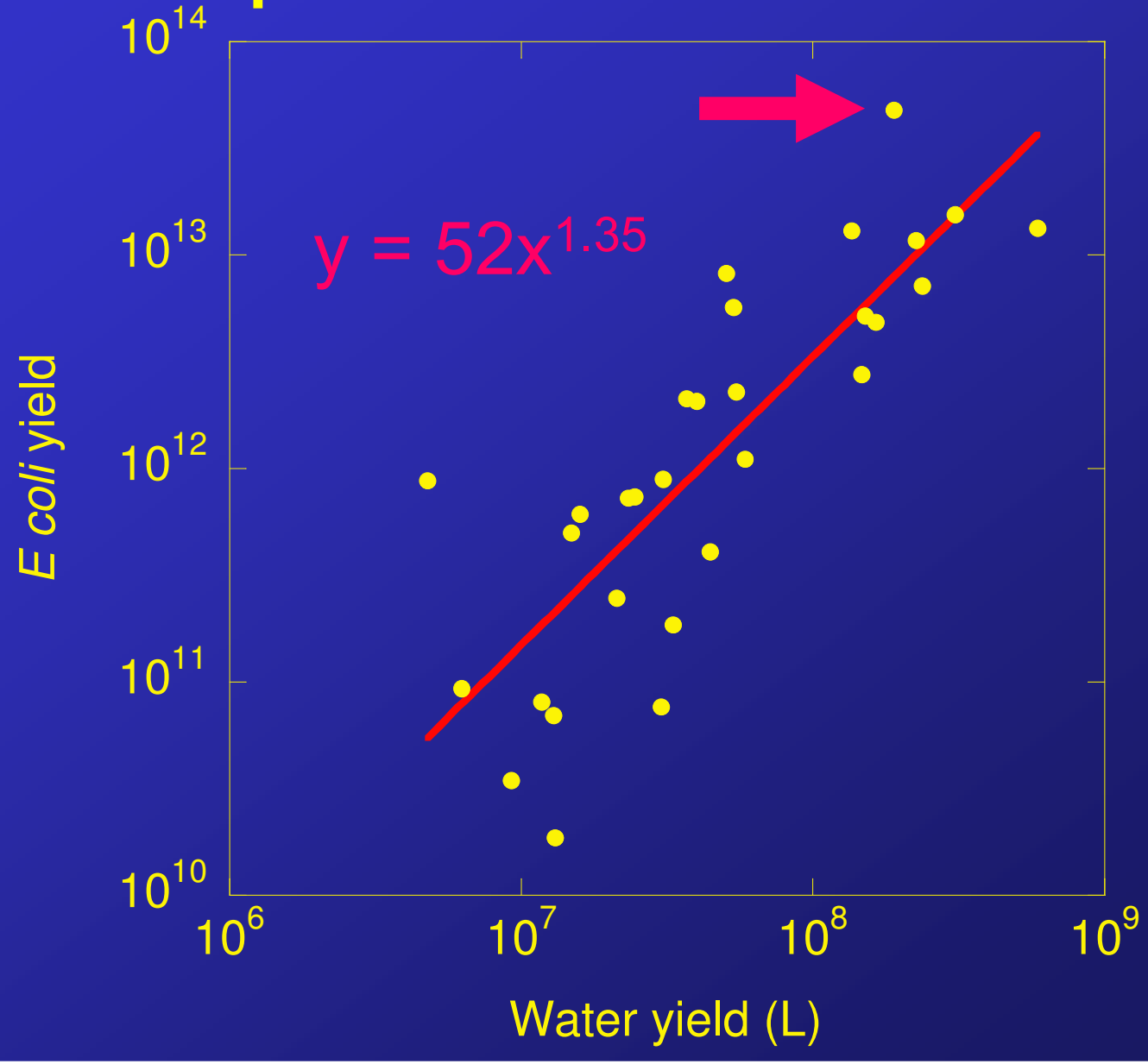


Faecal pollution over a storm hydrograph

(Toenepi, 18 Sept 2005)



Toenepi – 30 storm events

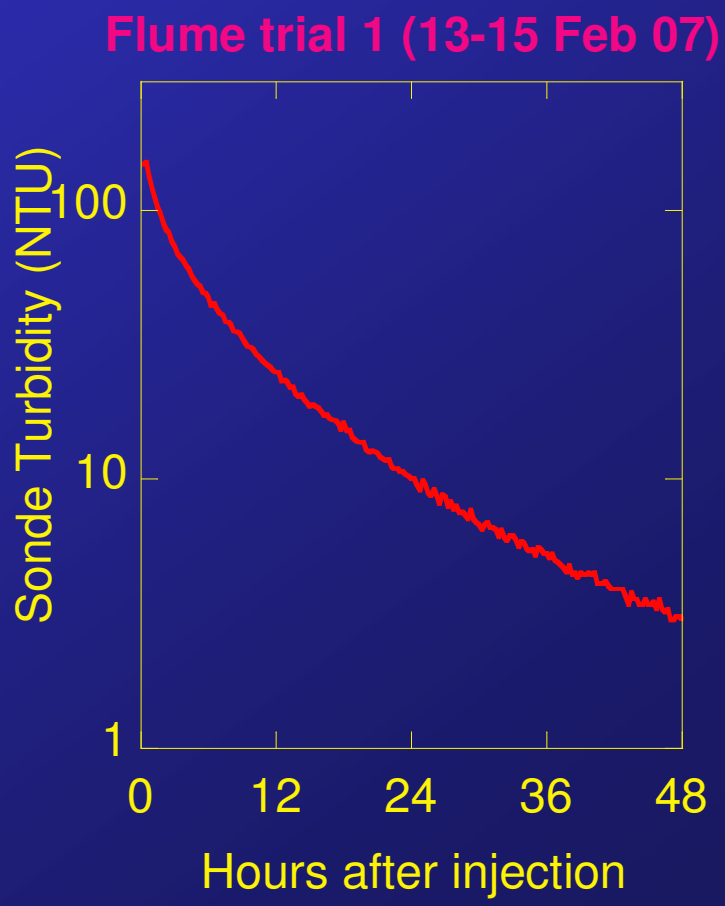


Toenepi – annual yields

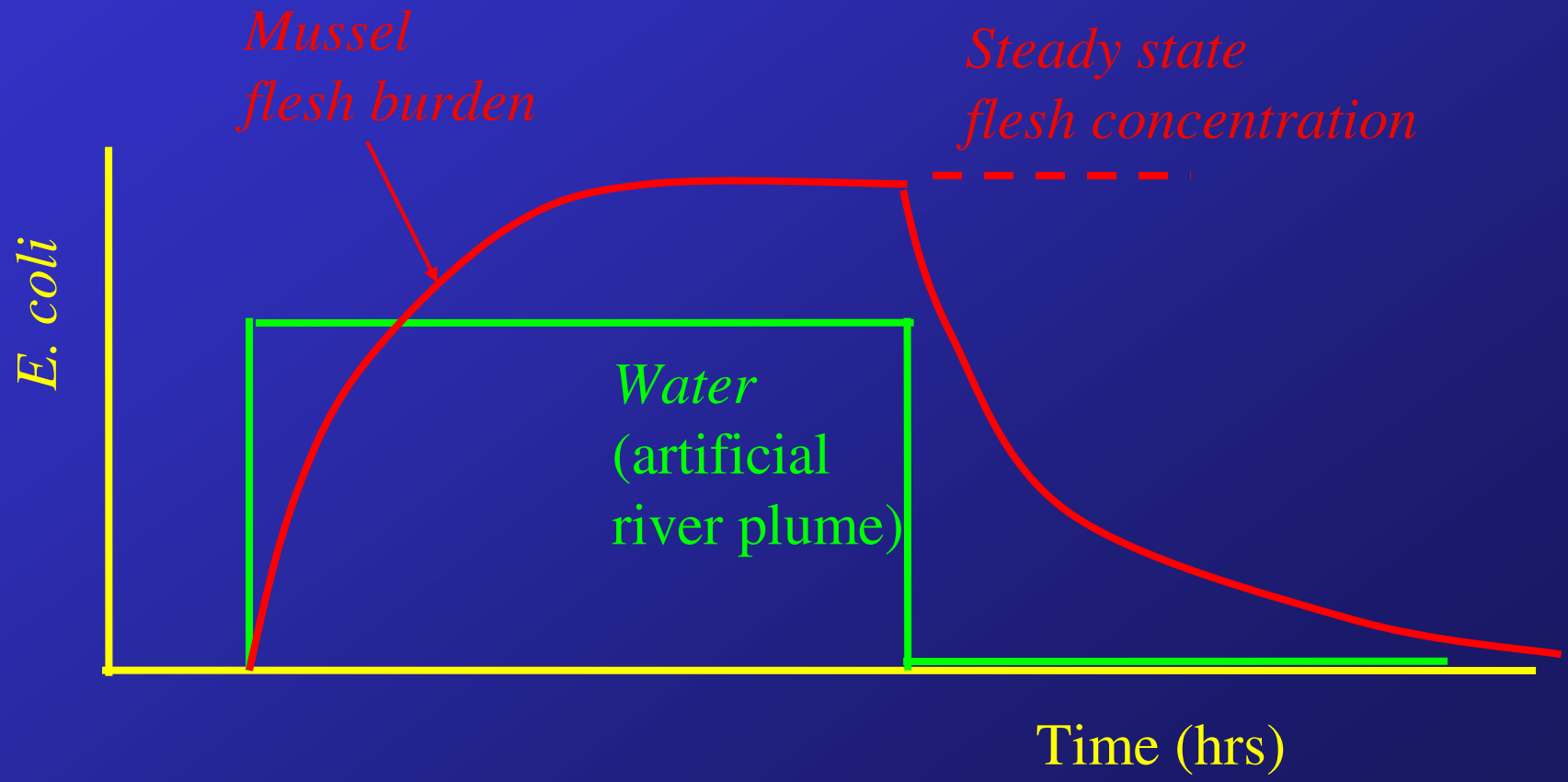
	Yield (cfu)	**%**
Storm events	1.5×10^{14}	95%
Base flow (76% of time)	8×10^{12}	5%
Total	1.6×10^{14}	100% *

* 6 % of production @ 1.3×10^{9} *E. coli*/cow/day

Studying sediment uptake of faecal pollution - Flume experiments



Shellfish contamination experiments – schematic



Shellfish contamination experiment – obtaining an artificial river plume

Conclusions – main take-home points

- Pathways of faecal contamination: overland flow and direct deposition
- Sediments: most stream contamination is in sediments – 1000X more than water
- Stormflows dominate faecal contamination yields – and contamination of downstream waters
- Turbidity is often a useful surrogate for faecal bacteria - exports of faecal pollution.
- Current research: flume studies of sediments stores, Experiments on shellfish contamination.