Observatoire pour la Recherche sur les Méga-Evènements

OLYMPIC GAMES: State of art
18th & 19th June 2018

Microbiological quality of the Seine River : is it compatible with Olympic competitions in open waters ?

F Lucas, B de Gouvello, JM Mouchel, L Moulin, P. Servais, S. Wurtzer

Photo: Le Figaro

Olympic competitions in open waters:

Lakes, rivers, reservoirs, ocean

1st Triathlon:
Sydney 2000

1st Marathon Swim:
Beijing 2008

Paris 2024: potential site

Seine River

Between Alma and Iéna Bridges

Pathogenic microorganisms

Point sources :
sewer systems, boats

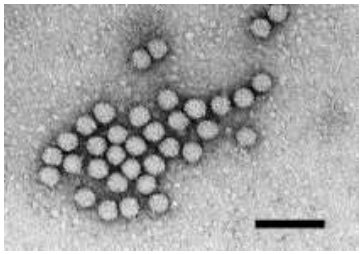
Diffuse sources :
runoff, animals

Bacteria

Enteric:
Campylobacter, Salmonella,…

Environmental, opportunists:
Aeromonas, Pseudomonas, Leptospira…

Human virus



Norovirus, Adenovirus, Rotavirus, ….

Enteric protozoa

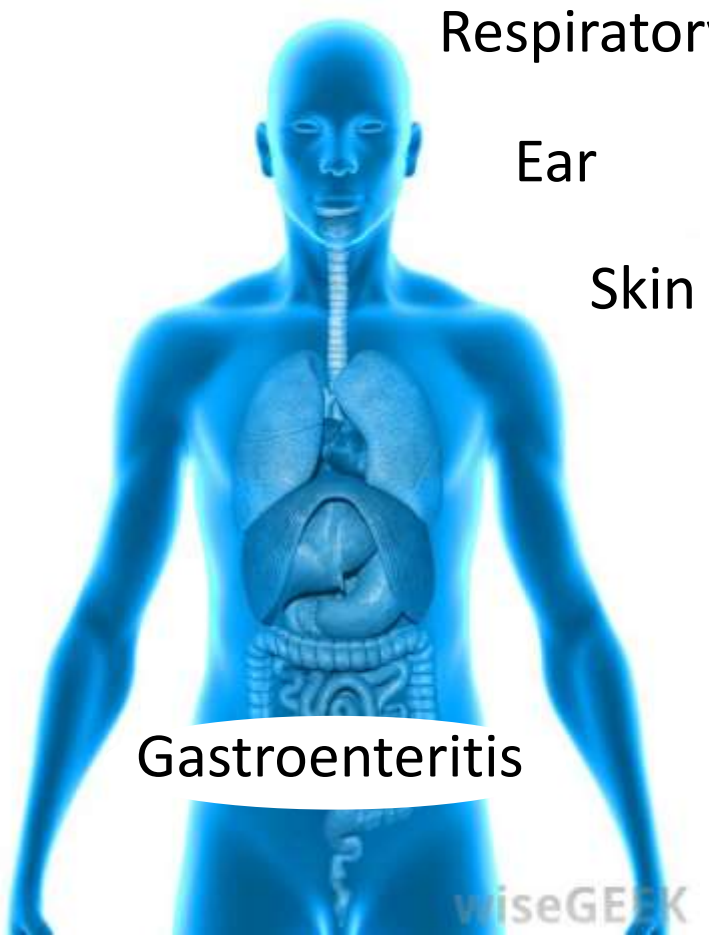
Giardia, Cryptosporidium

Phytoplankton: toxins

cyanobacteria, *Dinophyceae*

Sanitary risks:

Infections



Gastroenteritis contracted by triathletes/biathletes:

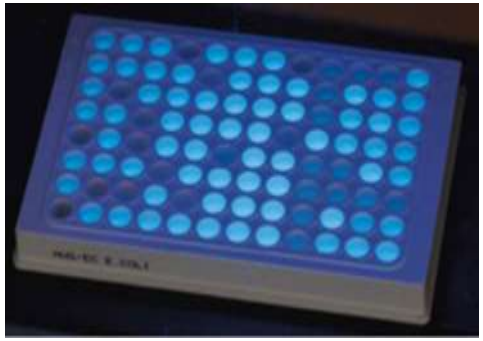
0.4-5.2% for swimmers (n=827)

0.1-2.1% for non-swimmers (n=773)

(7 olympic distance triathlons,
Water quality meeting the EU recommendations)

(van Asperen et al 1998)

Regulations: fecal indicator bacteria



Escherichia coli
Intestinal enterococci (IE)

international federations
FINA: swimming
ITU : triathlon
International Olympic Committee Medical commission

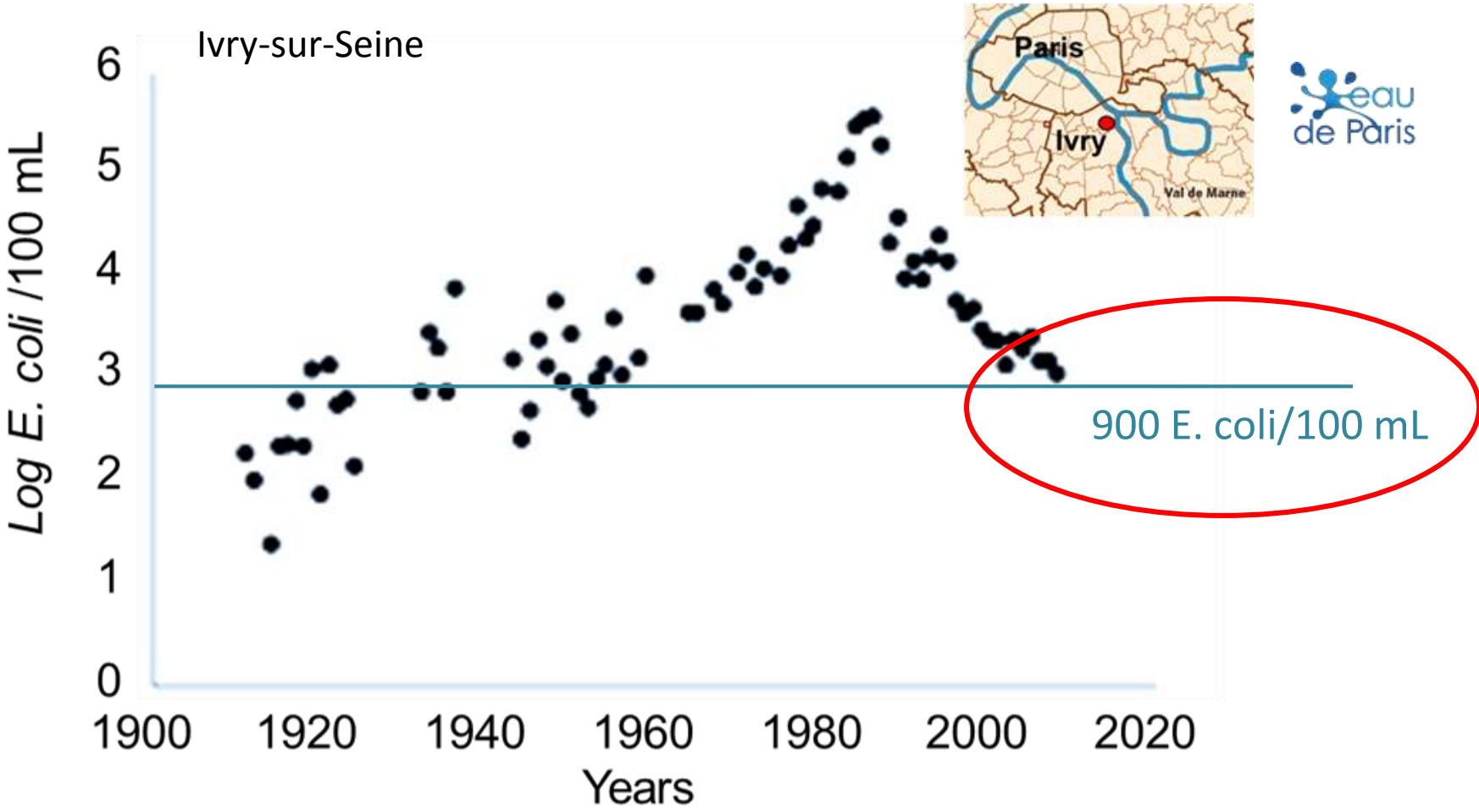
National and Local authorities

European bathing guidelines for inland waters (2006/7/CE)

Class of quality	**Excellent**	**Good**	**Sufficient**
Intestinal enterococci (N/100 mL)	200[a]	400[a]	330[b]
Escherichia coli (N/100 mL)	500[a]	1000[a]	900[b]

a: based on 95th percentile evaluation
b: based on 90th percentile evaluation

Improved quality of the Seine River



Past 30 years:

⇒Mitigation efforts (Wastewater Treatment, sewerage systems)

Microbial Quality of the Seine River in Paris

Summer 2016 & 2017

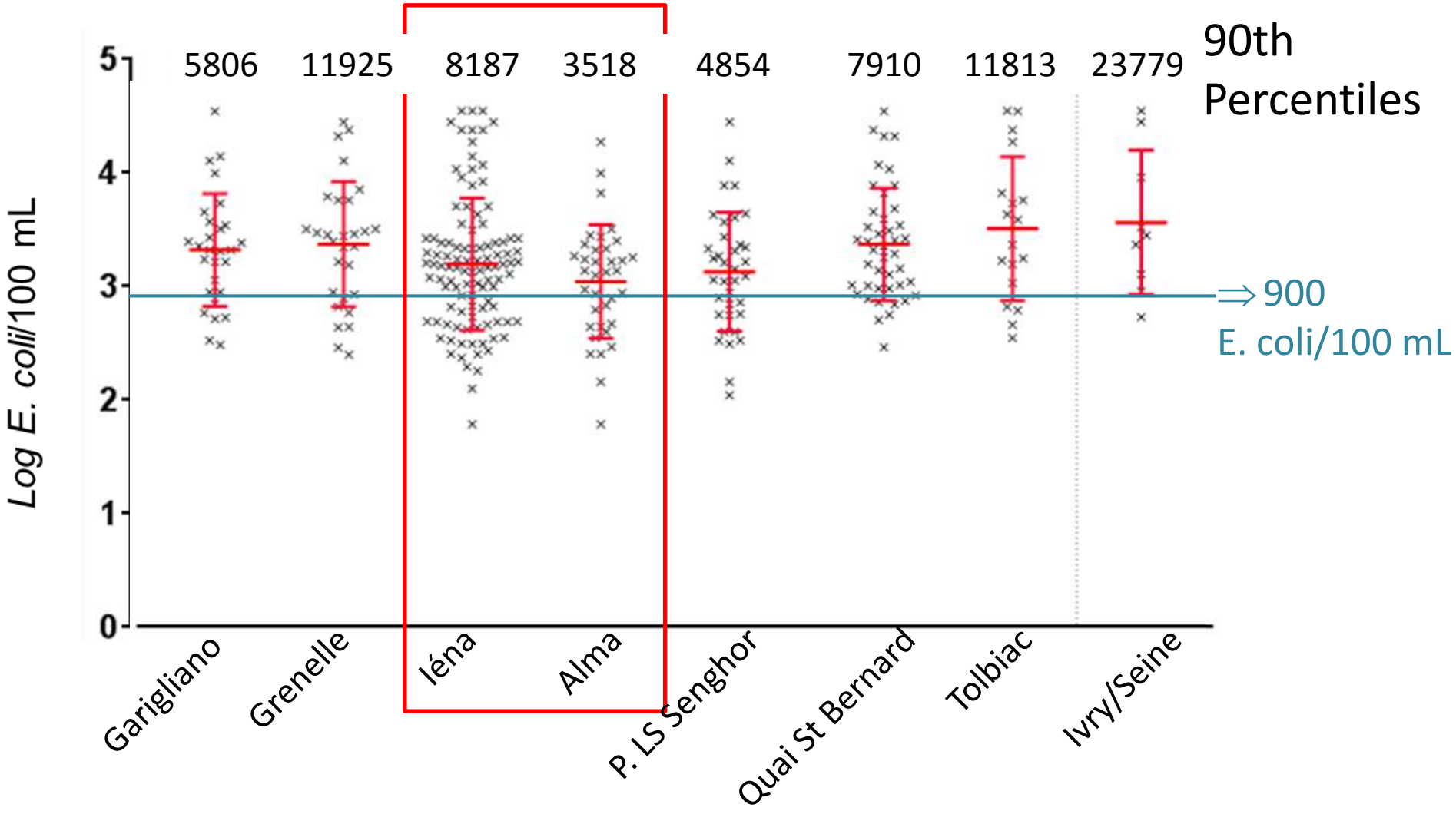
n= 30 to 101 samples/station

Data

MAIRIE DE PARIS

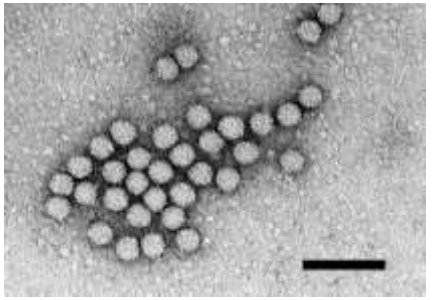
eau de Paris

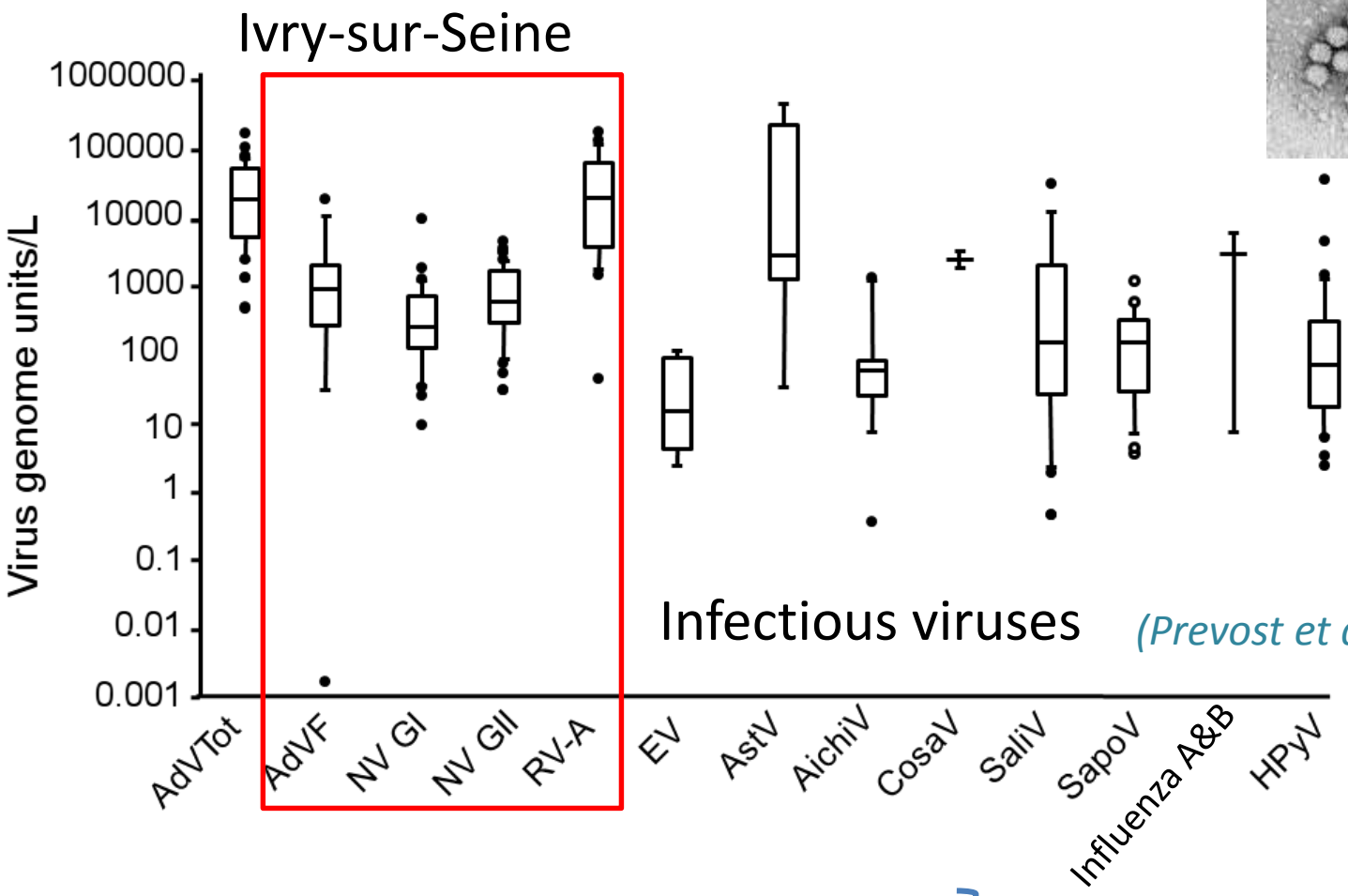
Fecal indicator bacteria in the Seine River



- Insufficient quality at the Alma and Iena bridges
- 34-44% of data < 900 *E.coli*/100 mL and <330 enterococci/100 mL

Pathogens in the Seine River





(Prevost et al. 2015)

- 60 cystes of *Giardia*/10 L
- 5 oocystes of *Cryptosporidium*/10 L

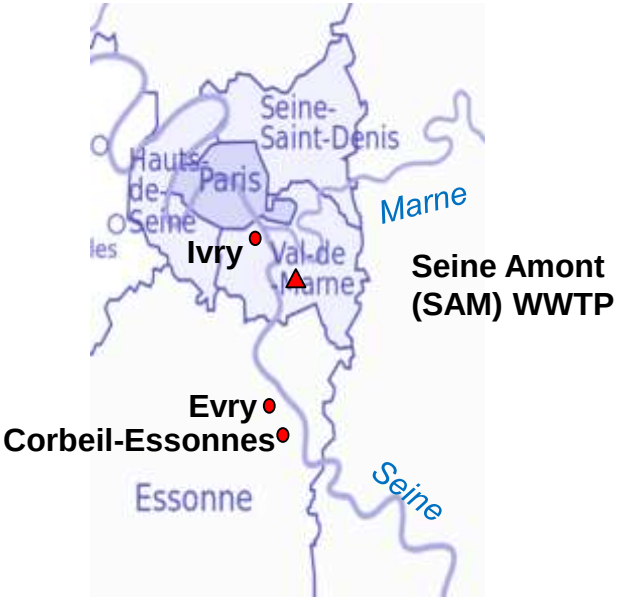
(Mons et al. 2009)

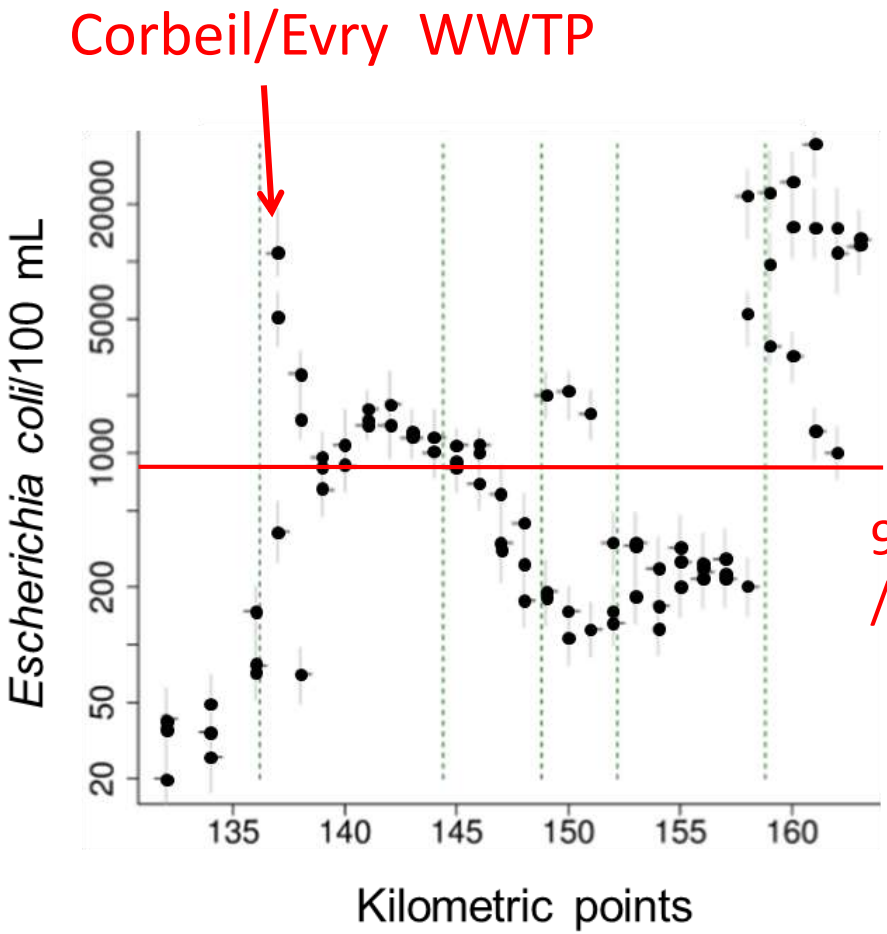
- ~ 1000 genome units/L of Adenovirus, Norovirus GI & GII, Rotavirus

⇒ 2016 Olympics: 10^3-10^9 viral genome units/L *(Staggemeier et al. 2017)*

Quality upstream Paris

Dry weather, summer 2017

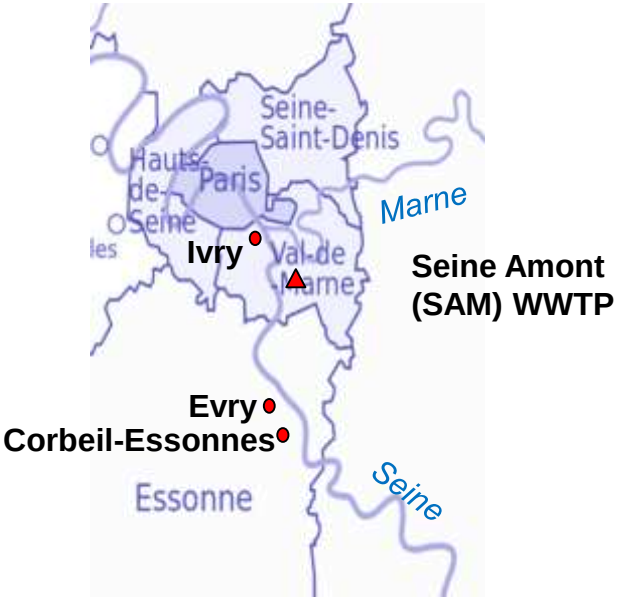




(Mouchel et al 2018)

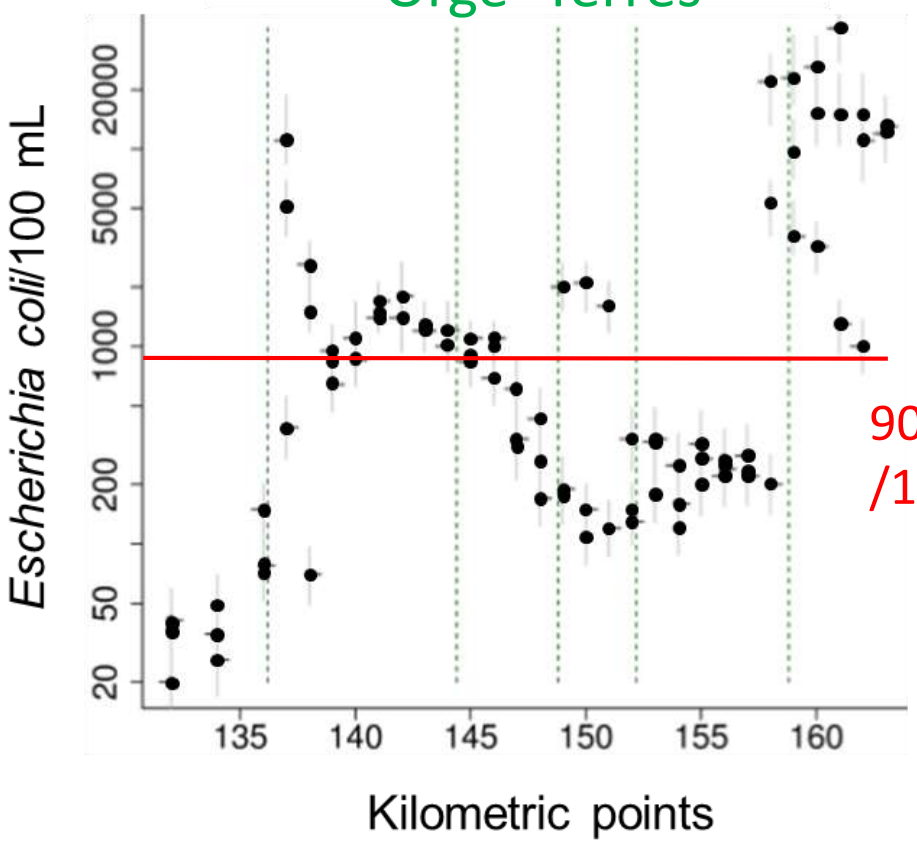
Quality upstream Paris

Dry weather, summer 2017



Tributaries

Orge Yerres

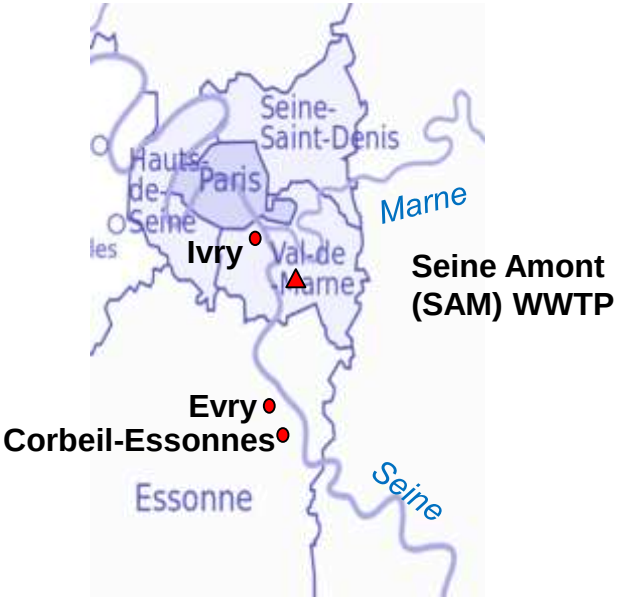


900 *E.coli* /100 mL

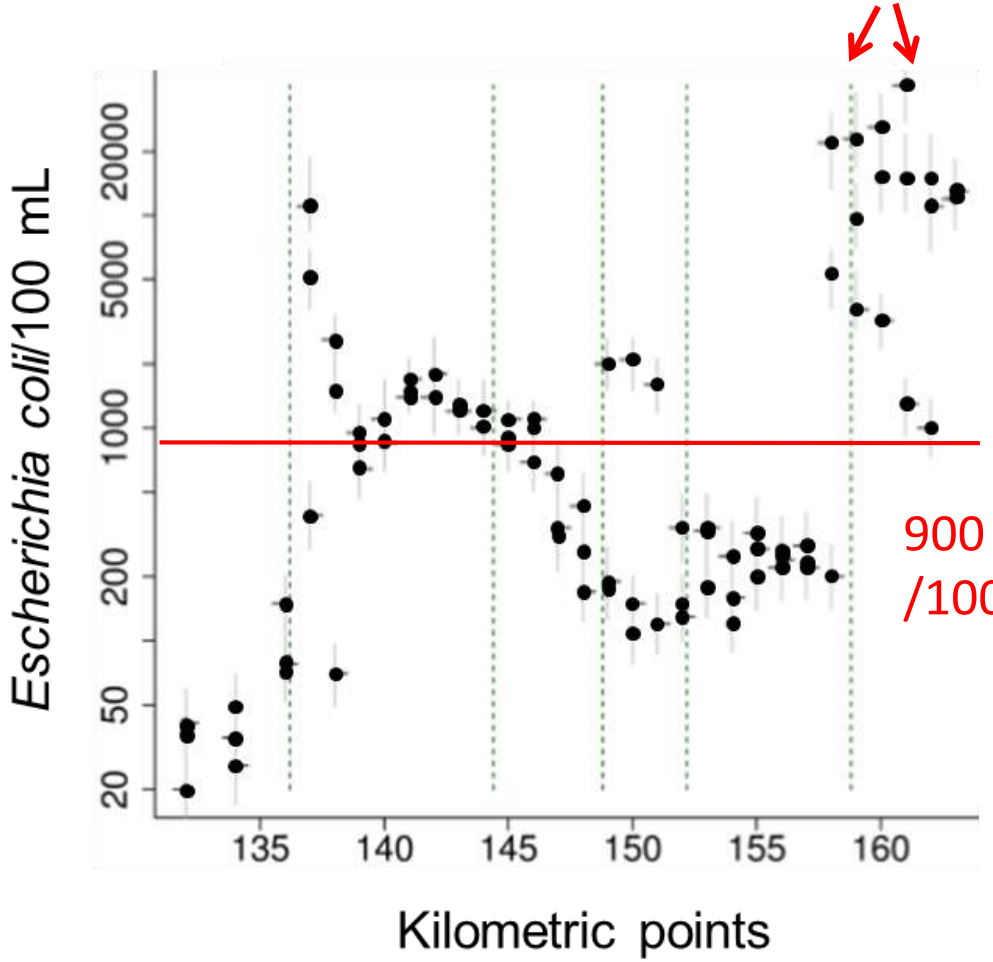
(Mouchel et al 2018)

Quality upstream Paris

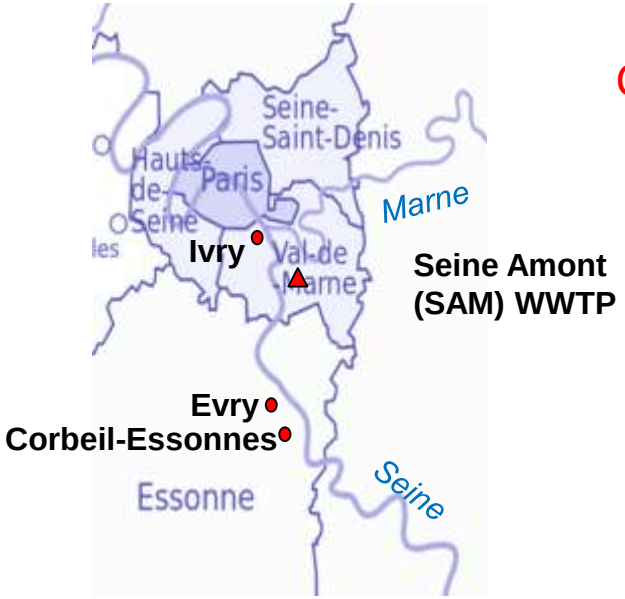
Dry weather, summer 2017

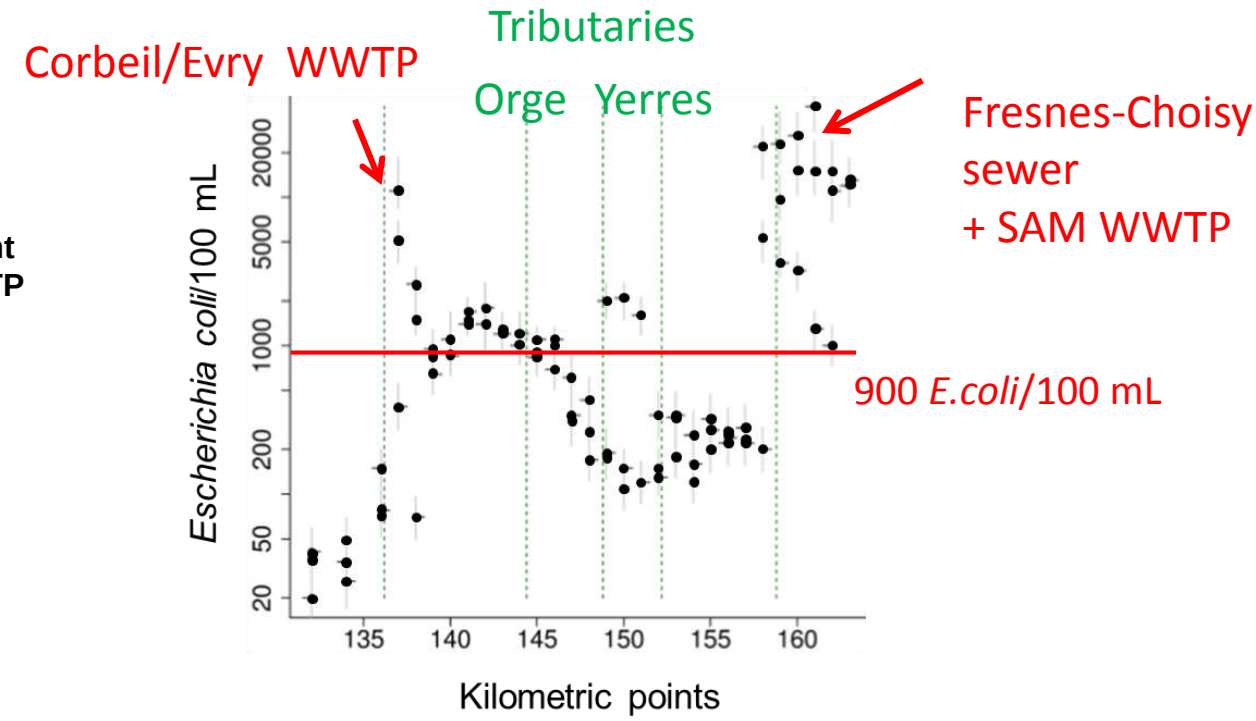


Fresnes-Choisy sewer
+ SAM WWTP



(Mouchel et al 2018)





Mitigation strategies at the watershed level
=> coordination of stakeholders and local authorities

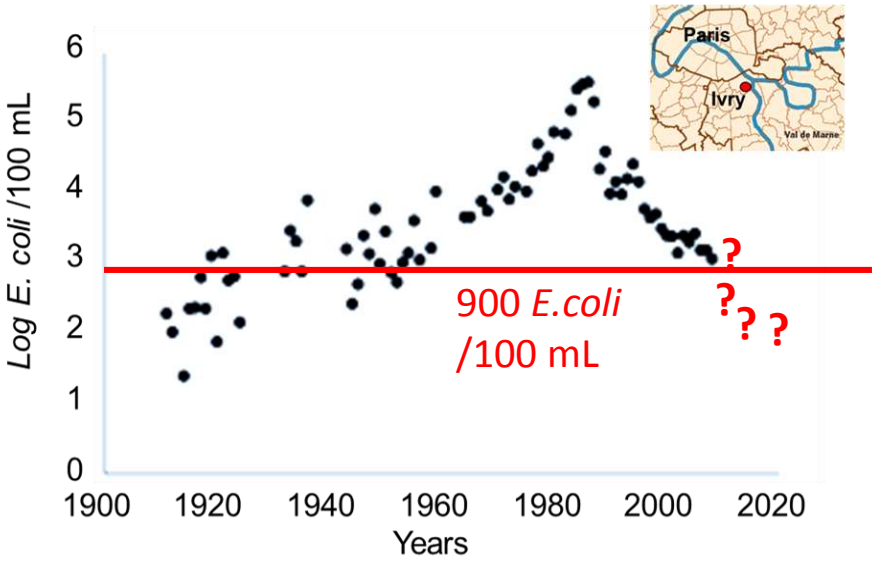
- **Source points:**
  - Fix ~ 35000 inappropriate sewer connections
  - WWTPs=> Addition of a disinfection treatment
- **Runoff** : remove 600 ha of impervious surfaces, build 3 water storages
- **Boat sewage**: obligation to connect to the sewers

Conclusions : water quality of the Seine River in Paris

- today not suitable for swimming according to the EU regulation

Fecal indicators, enteric viruses, gastrointestinal protozoa
> 10 % of risk to declare gastroenteritis *(WHO, 2013)*

- Improving the quality?
  - Mitigation strategies deployed all over Ile de France



Monitoring of water quality
- In the Seine River:
=> in Paris and upstream Paris
- In the Marne river

Support of research studies

THANKS FOR YOUR ATTENTION

Triathlon de Paris 2010 (https://www.nageurs.com)

We thank :

Marne Vive
Syndicat mixte

MAIRIE DE PARIS

all the members of the Working Group
“Qualité de l’eau et baignade”