



Veterinary pharmaceutical and fecal contamination in mixed-land use watersheds: from agricultural headwater watersheds to watermonitoring watersheds

Anne Jaffrezic, Lise Charuaud, Marine Liotaud, Q. Goyat, Fabien Mercier,
Barbara Le Bot, Emilie Jardé

► To cite this version:

Anne Jaffrezic, Lise Charuaud, Marine Liotaud, Q. Goyat, Fabien Mercier, et al.. Veterinary pharmaceutical and fecal contamination in mixed-land use watersheds: from agricultural headwater watersheds to watermonitoring watersheds. XIth Scientific Assembly of the International Association of Hydrological Sciences (IAHS 2022), May 2022, Montepplier, France. hal-03619909

HAL Id: hal-03619909

<https://hal.science/hal-03619909>

Submitted on 4 Oct 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

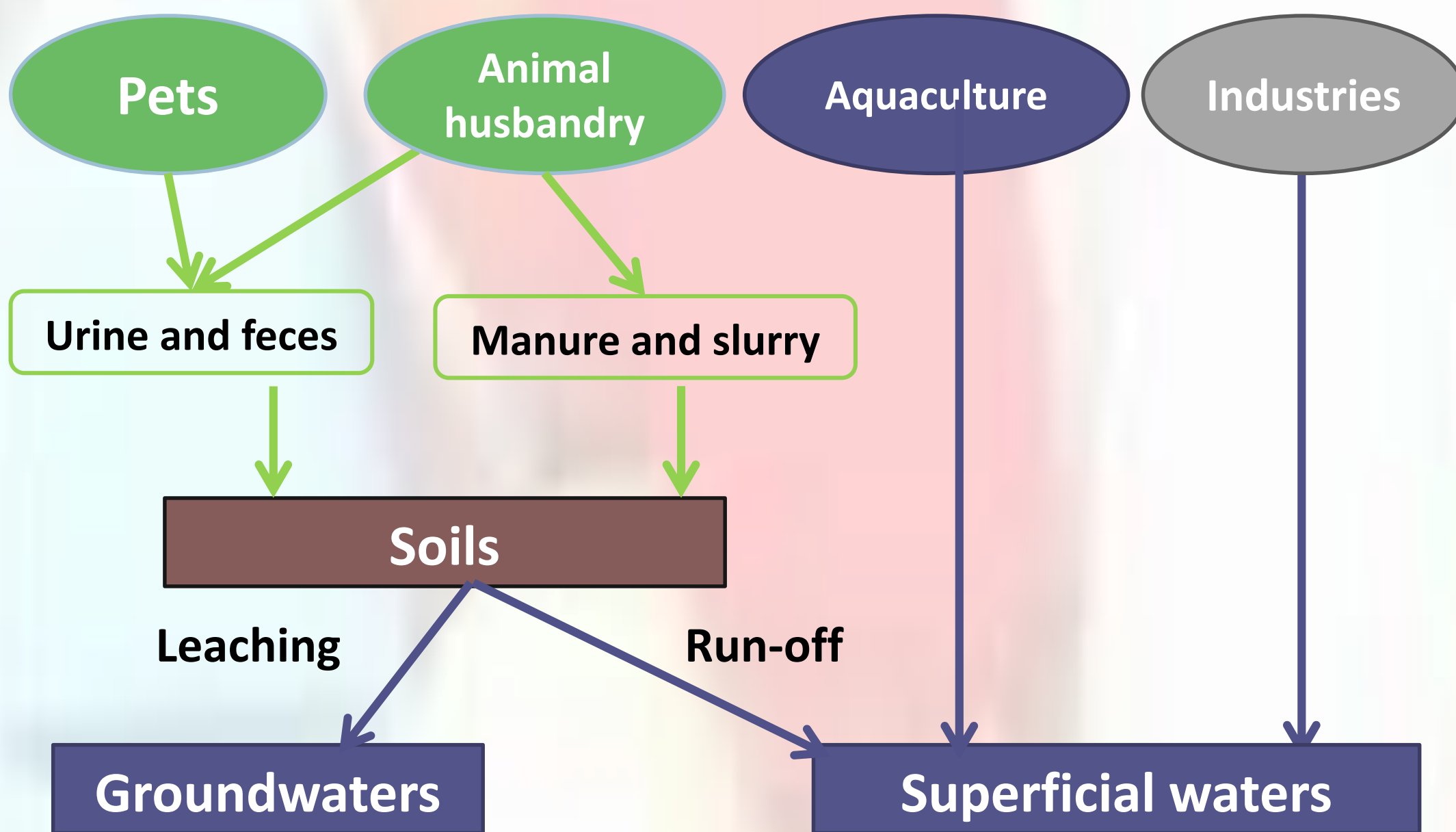
Veterinary pharmaceutical contamination and fecal contamination in mixed-land use watersheds: from agricultural headwater watersheds to water-monitoring watersheds



A. Jaffrézic, L. Charuaud, M. Liotaud, Q. Goyat, F. Mercier, B. Le bot and E. Jardé
Institut Agro Rennes Angers, Inserm-EHESP, Géosciences Rennes-CNRS

Background & Objectives

Transfer of veterinary pharmaceuticals from sources to water



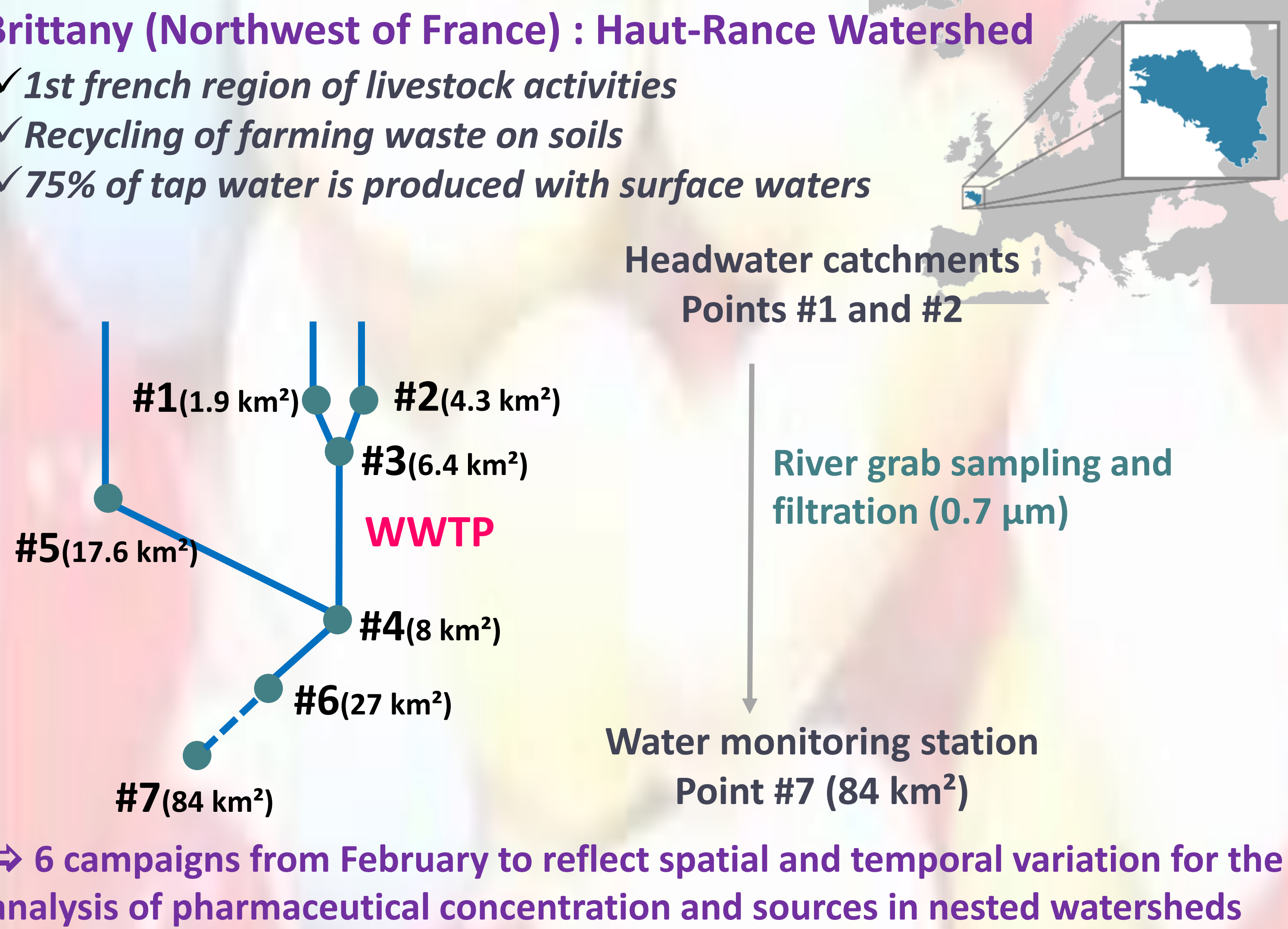
- ✓ Intensive livestock : curative and prophylactic use of pharmaceuticals
- ✓ 30 to 90% of (VP) excreted in feces and urine as parents molecules
- ✓ Degradation of the chemical quality of water is controlled by the presence of organic contaminants such as veterinary pharmaceuticals residues (VPR)
 - ⇒ Vulnerability of water resources

GOALS of the study

- 1/ Spatiotemporal occurrence of VPR in nested agricultural catchments,
- 2/ Spatiotemporal variability of VPR fluxes upstream and downstream from a WWTP.
- 3/ Fecal contamination and origin of the contamination (human, porcine, bovine).
- 4/ Contribution of livestock vs human fluxes in agricultural watersheds.

Samples & Methods

Study site and sampling



Analytical methods

Twenty pharmaceuticals

SPE → RRLC reversed phase → Tandem MS

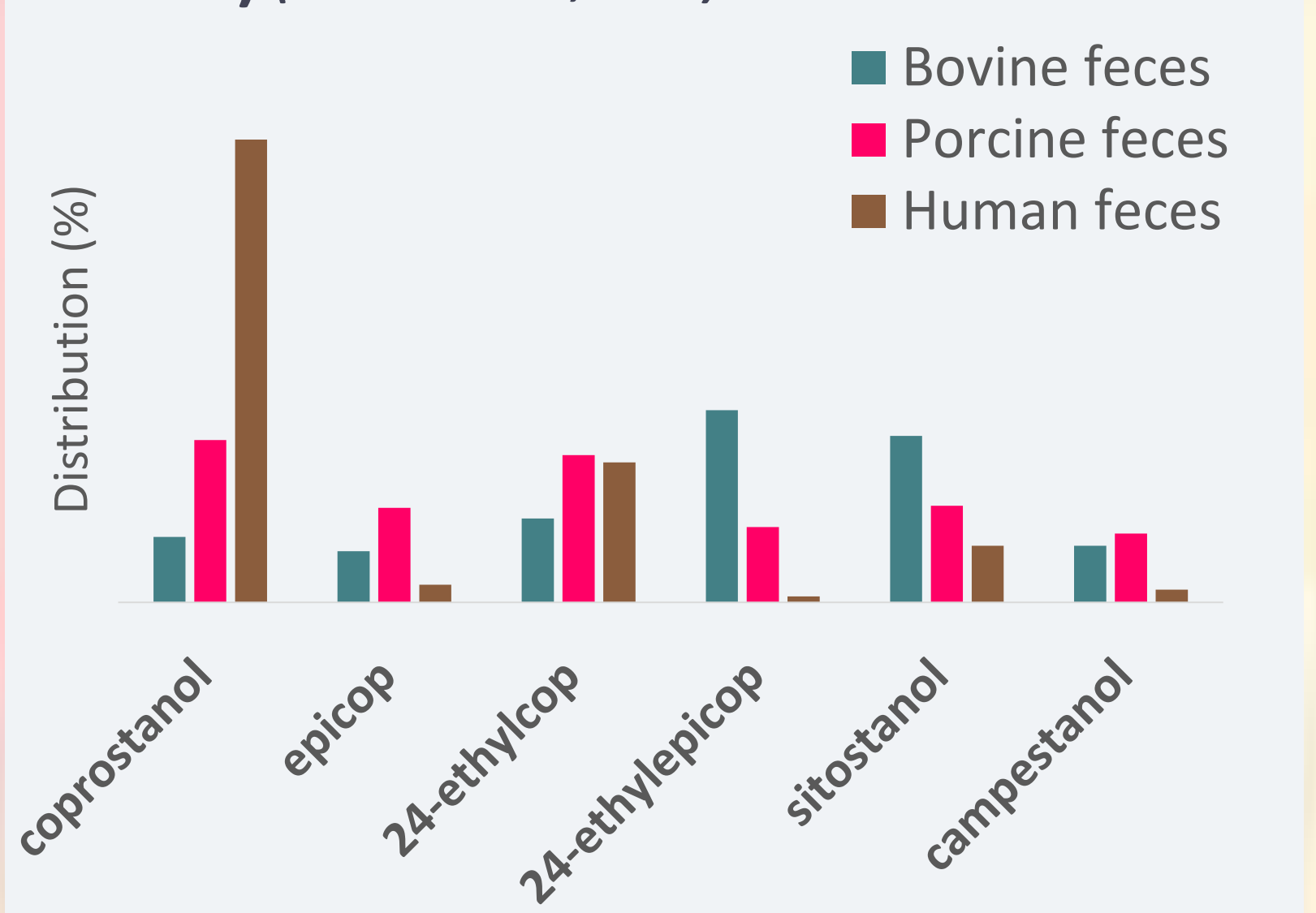
16 antibiotics :
amoxicillin, ampicillin, benzylpenicillin, ceftiofur, danofloxacin, doxycycline, enrofloxacin, flumequine, lincomycin, marbofloxacin, oxytetracycline, spiramycin, sulfadiazine, sulfamethazine, tetracycline, and trimethoprim,

3 non-steroidal anti-inflammatory drugs:
diclofenac, flunixin, ketoprofen,

1 anticonvulsive drug :
carbamazepine.

Faecal indicator and markers:

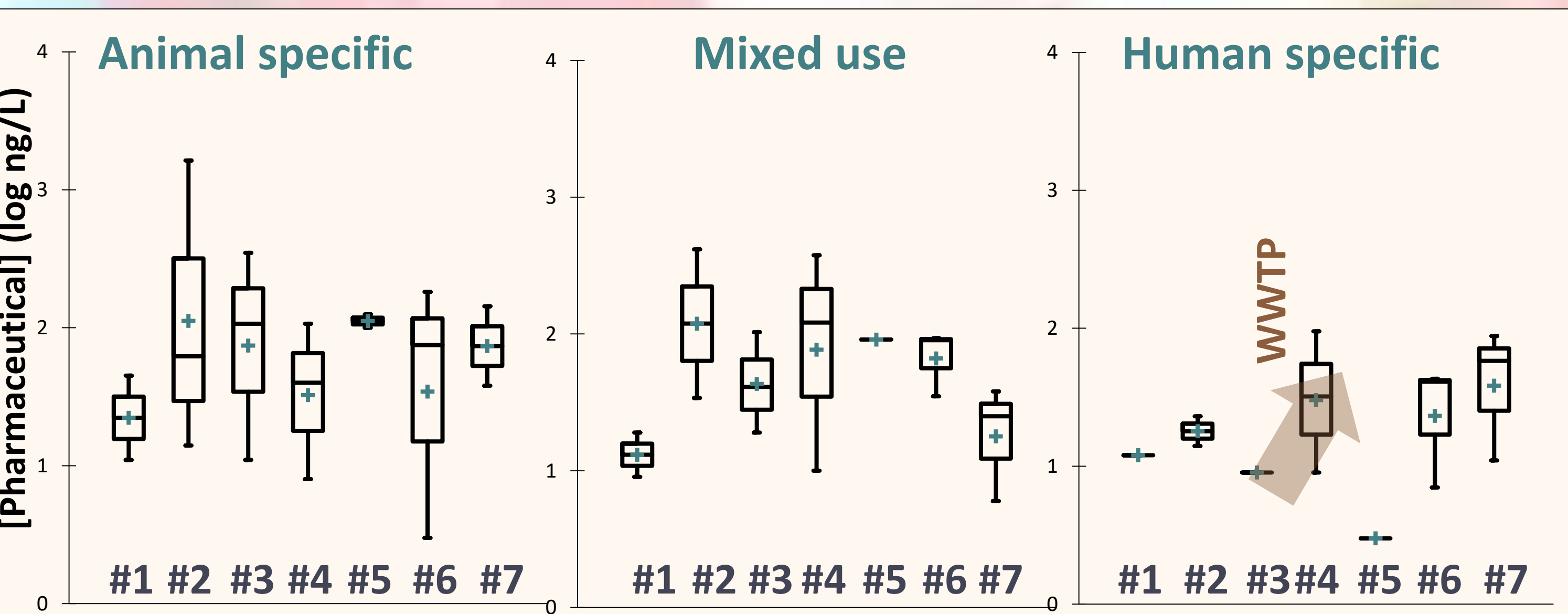
E. Coli and fecal markers to discriminate the origin of the contamination (human, porcine or bovine) (Derrien et al., 2011)



1 animal species = 1 stanol fingerprint
⇒ Stanol fingerprint specific of animal feces

Results & Discussion

Occurrence of pharmaceuticals

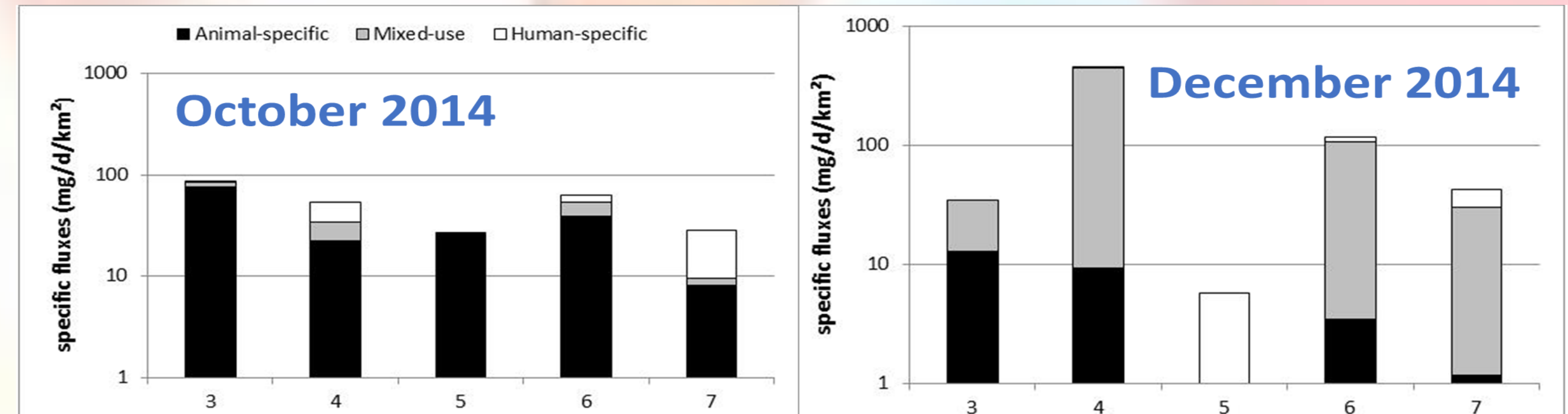


- ⇒ Spatial occurrence of pharmaceutical according to their medical use:
- ✓ Animal-specific and mixed-use pharmaceuticals were detected at all 7 points, upstream and downstream WWTP.
- ✓ Human-specific pharmaceuticals concentration significantly increased from point #3 (upstream WWTP) to point #4 (downstream WWTP).
- ✓ Need to perform risk assessment studies of pharmaceuticals mixtures

Fecal contamination and origin

- ⇒ Spatial origin of pharmaceutical according to co-markers of sources:
- ✓ Fecal stanols as co-tracers of pharmaceuticals (mixed-use) origin.
- ✓ Predominance of bovine faecal contamination, except after the WWTP at point #4

Livestock and human fluxes in watershed



- ⇒ Spatio temporal variations of fluxes of pharmaceuticals:
- ✓ October: Predominance of animal specific pharmaceuticals (in black) from headwater to water monitoring station after rainfall events and when runoff events connected agricultural soils to the river.
- ✓ December: Increase of mixed-use and human pharmaceuticals contributions with decrease of runoff, suggesting a dilution of agricultural sources.

Conclusion

Veterinary pharmaceutical quantification (more than 100 ng/L) from headwater catchment to water monitoring station
Headwater agricultural catchment are important sources of veterinary pharmaceuticals
Veterinary pharmaceuticals, *E coli* are transferred during rain events
Mitigation of diffuse pollutions : priority on headwater catchments.

