Are we swimming in Pharmaceuticals?

What effects does the release of pharmaceuticals have on the environment?

Tim Kristian Lefdal & Sumeth Bhasin
Department of Biological Sciences, BIO316

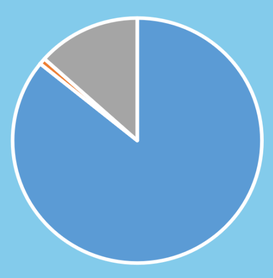
Challenges

Studies show that active pharmaceutical ingredients enter the environment by effluent from wastewater treatment plants which can be toxic to both animals and plants in the ecosystem.
Wastewater and sewage contain many pharmaceuticals and chemicals such as caffeine, nonsteroidal anti-inflammatory drugs (NSAIDs), antibiotics, and psychiatric drugs.
The NSAIDs ibuprofen including its metabolites and diclofenac have been found to be readily available in wastewater in Tromsø as well as the antimicrobial agent triclosan.

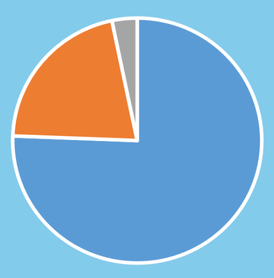
Longyearbyen

Breivika mixed sewer

Tromsø STP



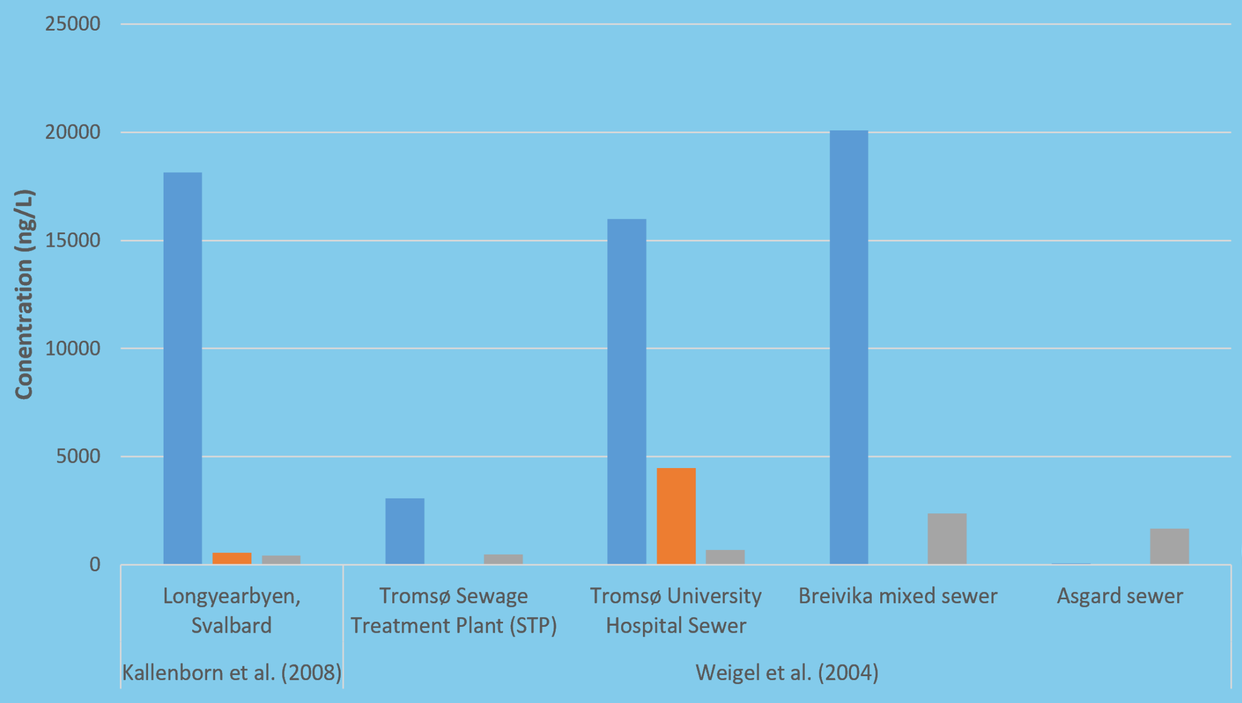
Tromsø Hospital



Asgard

Ibuprofen
Diclofenac
Triclosan

Concentrations of selected pharmaceuticals in sewage effluents

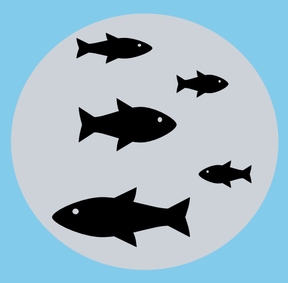


Consequences

Biomagnification

Ibuprofen residues were found in the white-tailed eagle which is an apex predator.

Toxicity to the wildlife



Ibuprofen and diclofenac were seen to cause inflammation and gut microbiota changes in rainbow trout.

Antibiotic resistance

888 relevant antibiotic-resistant genes were found in Adventfjorden sediments in Svalbard. This is due to the wastewater discharge.

Solutions

Photolytic Breakdown | **Improved management** | **Increased Monitoring**

- Developing pharmaceuticals which can be degraded by photolysis may reduce active pharmaceuticals in nature.
- Improving effectiveness of wastewater treatment and limiting release from hospitals and pharmaceutical factories.
- Development of monitoring systems to observe how pharmaceuticals get transported in the environment and which metabolites to look for.

References

Dube, N. *et al*. (2024). Human pharmaceuticals in the arctic – A review. In: *Chemosphere*. 364. https://doi.org/10.1016/j.chemosphere.2024.143172
Weigel, S. *et al*. (2004). Determination of selected pharmaceuticals and caffeine in sewage and seawater from Tromsø/Norway with emphasis on ibuprofen and its metabolites. In: *Chemosphere*. 56, 6, 583-592. https://doi.org/10.1016/j.chemosphere.2004.04.015
Kallenborn, R. *et al*. (2008). Pharmaceutical Residues in Northern European Environments: Consequences and Perspectives. In: Kümmerer, K. (eds) *Pharmaceuticals in the Environment*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-74664-5_5
Hodkovicova, N. *et.al*. (2022) Non-steroidal anti-inflammatory drugs caused an outbreak of inflammation and oxidative stress with changes in the gut microbiota in rainbow trout (*Oncorhynchus mykiss*). In: *Science of The Total Environment*. 849. https://doi.org/10.1016/j.scitotenv.2022.157921
Image of Tromsø was collected from openstreetmap.org
This poster was made in PowerPoint

316.3