

FRÅN TOAN TILL HAVET

Förekomst och effekter av läkemedel ute i miljön



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Läkemedel



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- Läkemedel är ämnen som kan användas för att förebygga, lindra eller bota sjukdomar
- Ca 1200 på svenska marknaden
- >1000 ton per år i Sverige

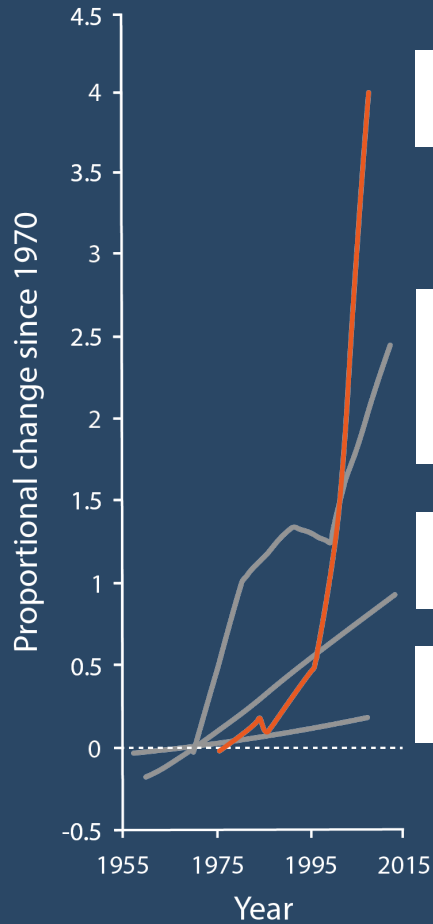


- Ca 3000-6000 läkemedel
- >600 läkemedel detekterade i miljön
- Uppmätta halter i 132 länder
- Alla kontinenter



Människor





Läkemedel

Kemisk
industri

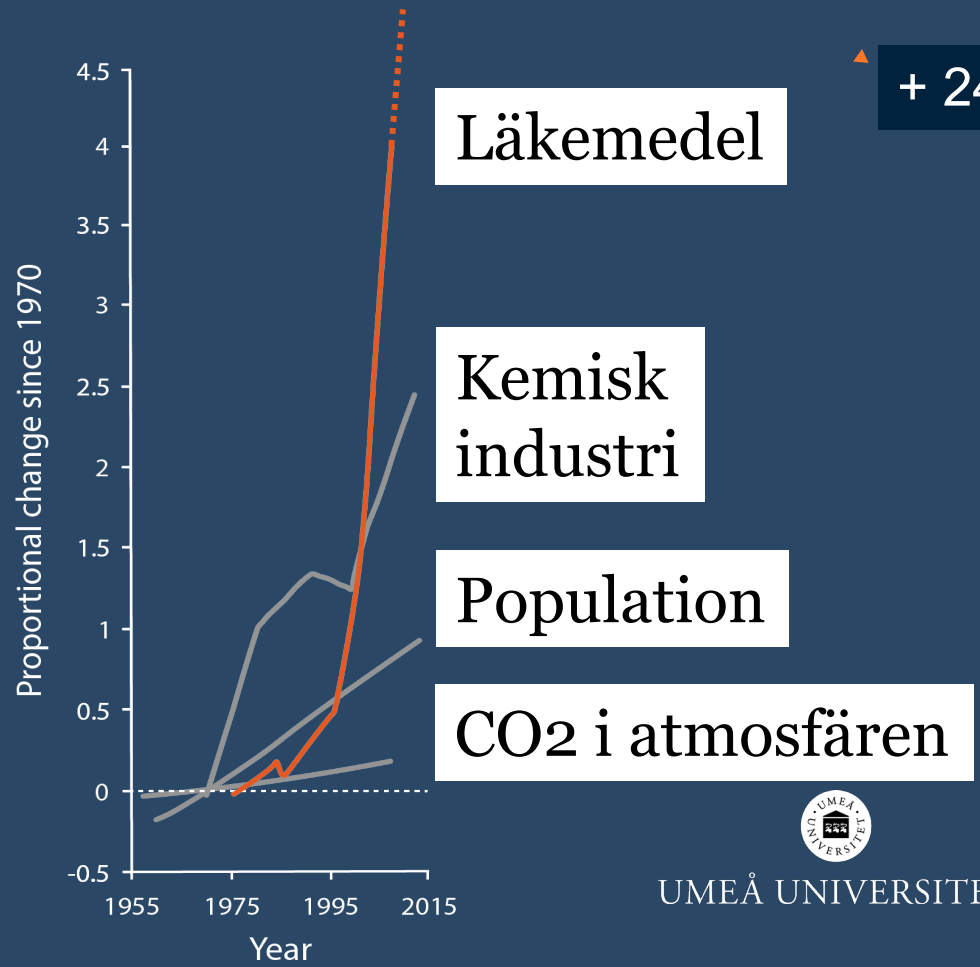
Population

CO₂ i atmosfären



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Adapted from Bernhardt et al.
Front. Ecol. Environ. 2017

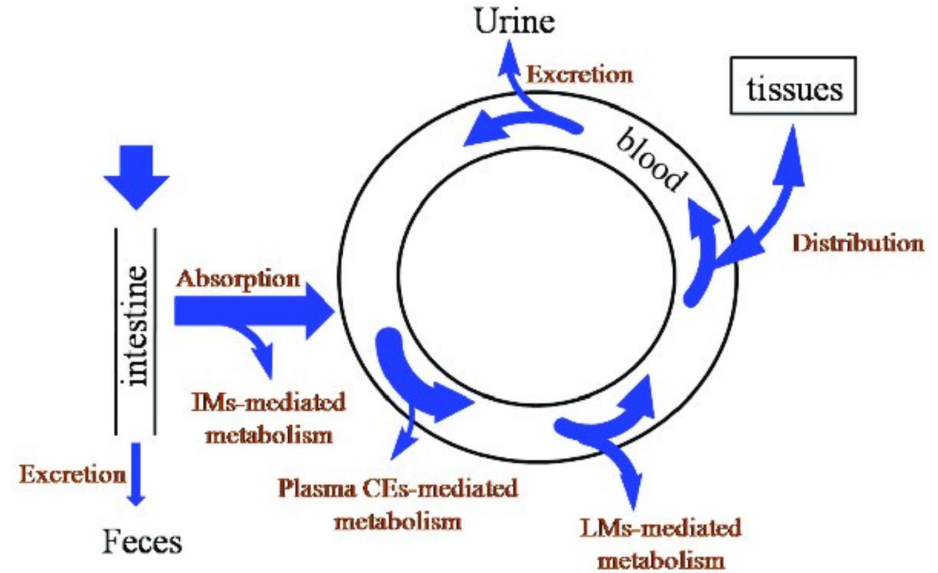
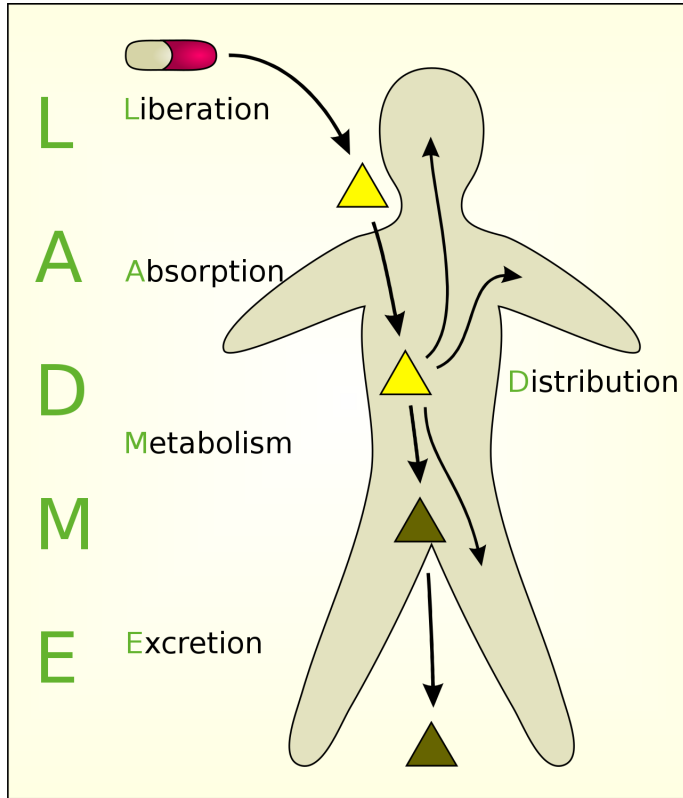


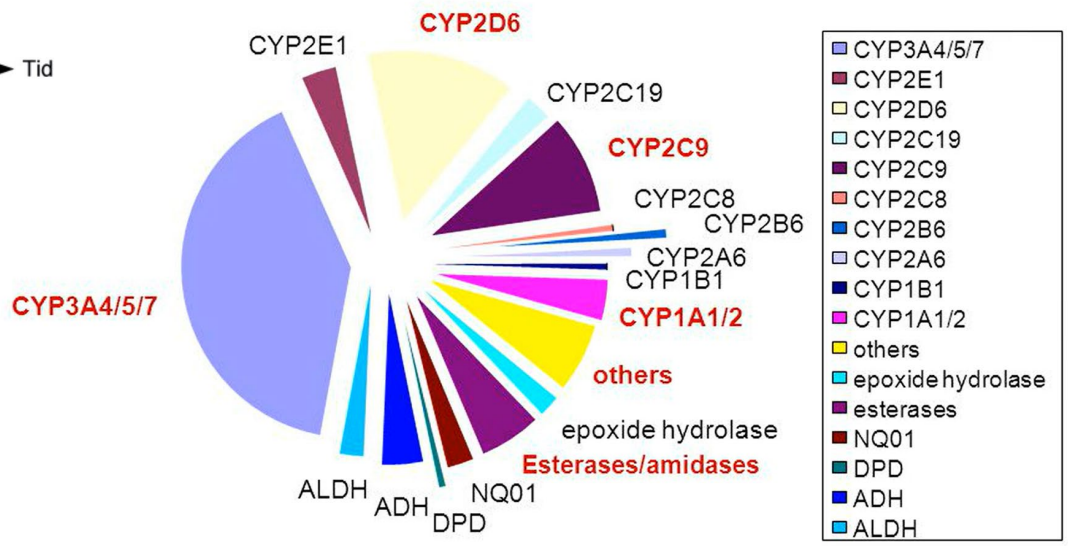
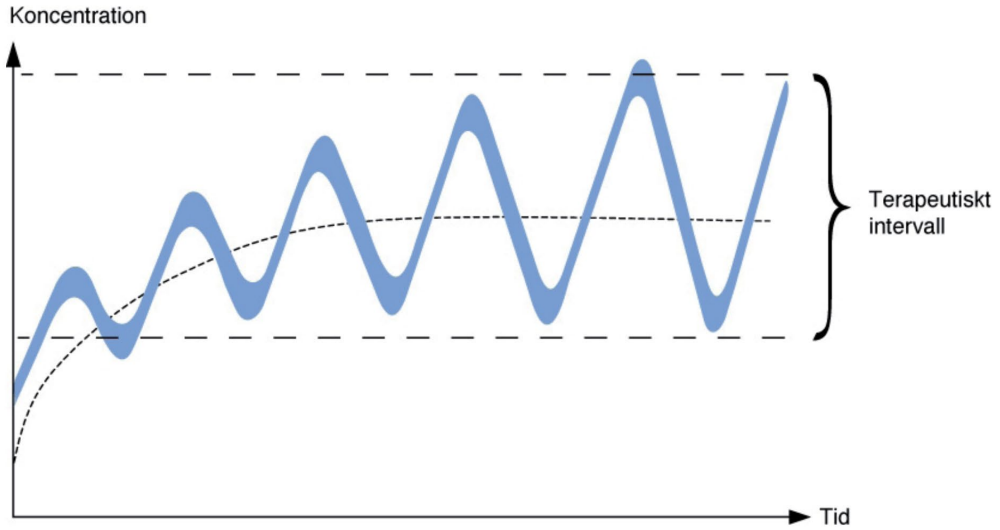
+ 24% from 2015



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Adapted from Bernhardt et al.
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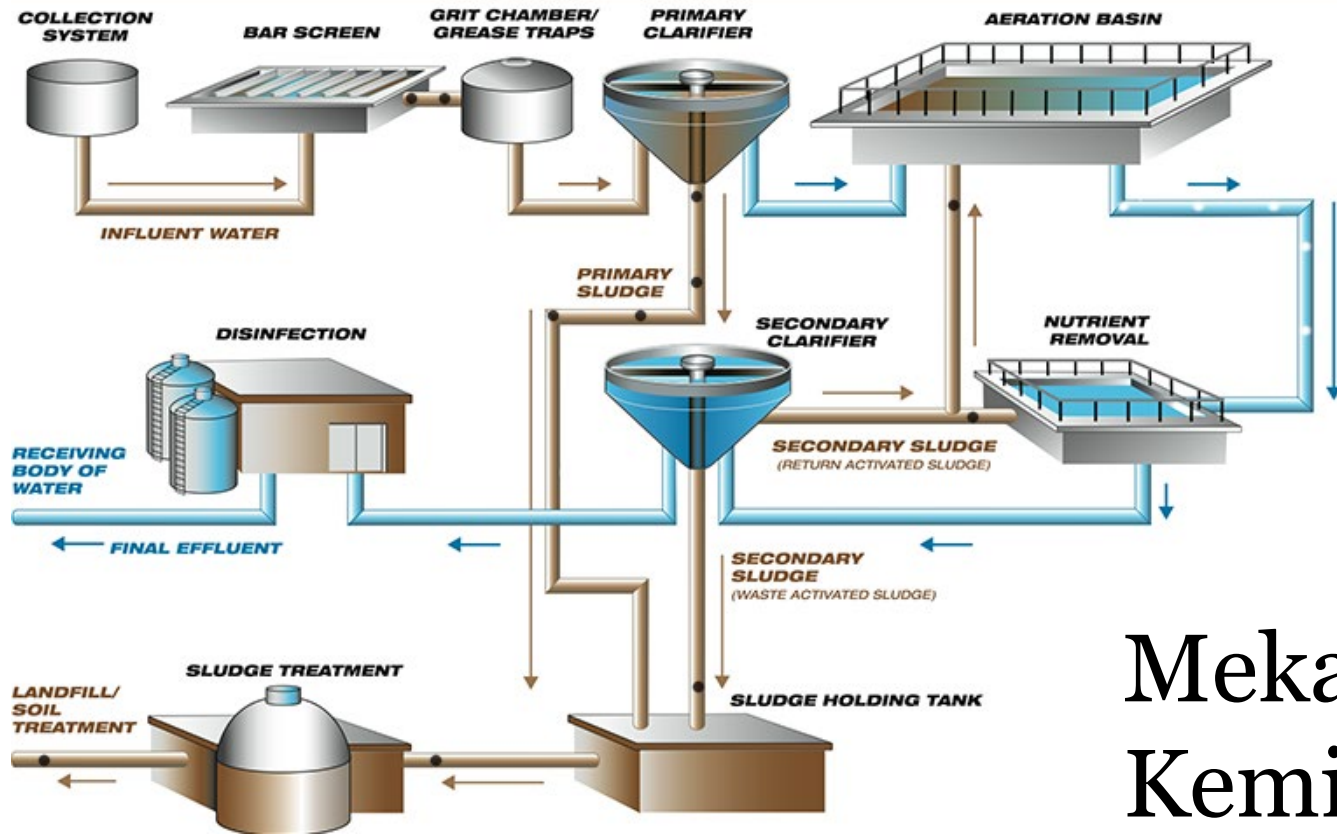






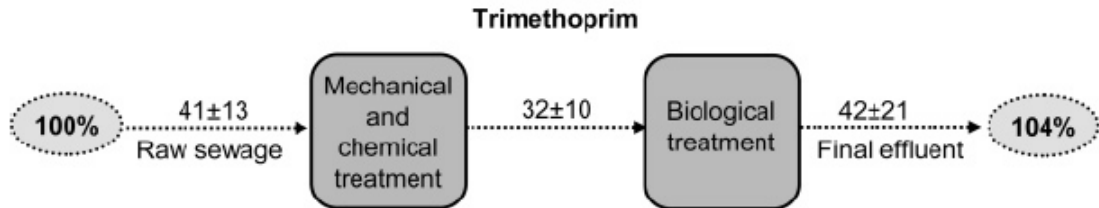
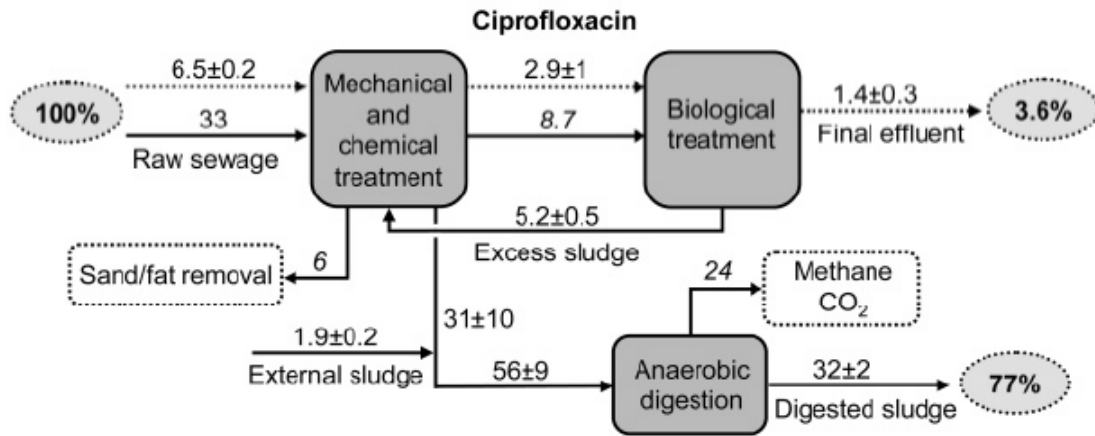
Reningsverk





Mekanisk
 Kemisk
 Biologisk





$x \pm y$ g/d → Aqueous phase
 $x \pm y$ g/d → Solid phase



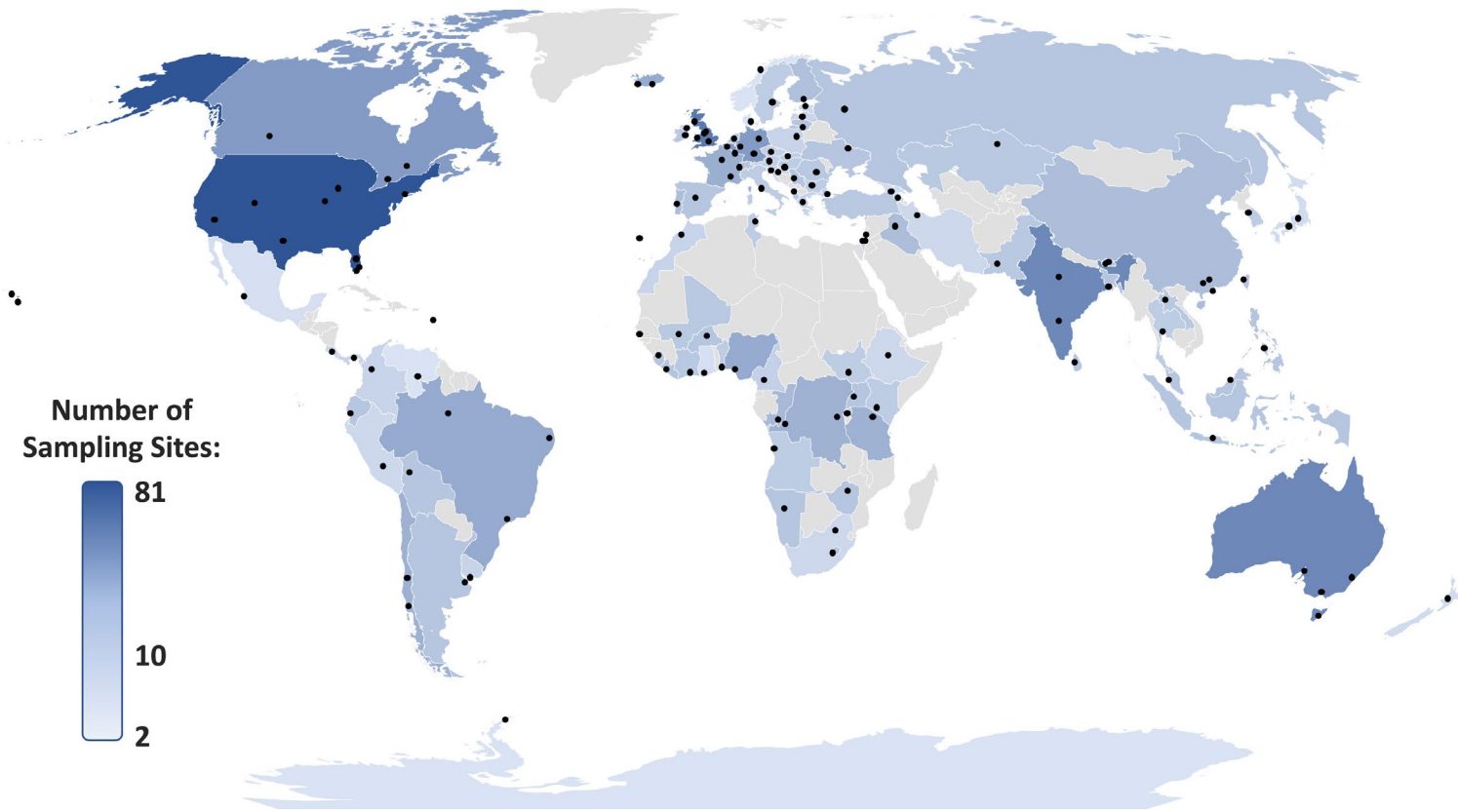
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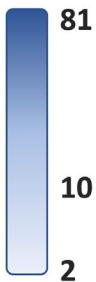
Ca 50% av avloppsvatten släpps ut helt orenat
20-50% av de renade avloppsvattnet får bara enklaste möjliga rening



Floder



Number of
Sampling Sites:

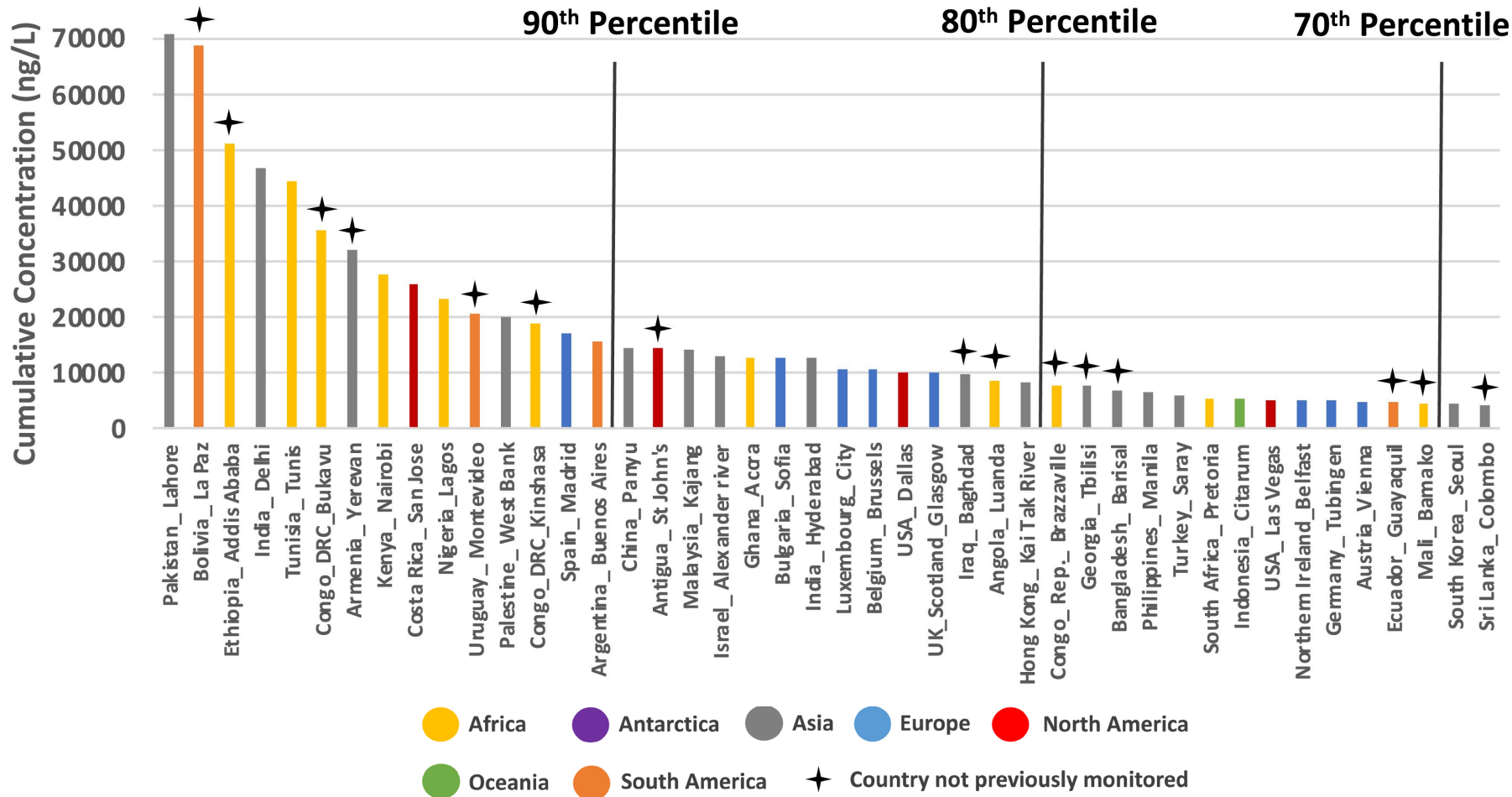


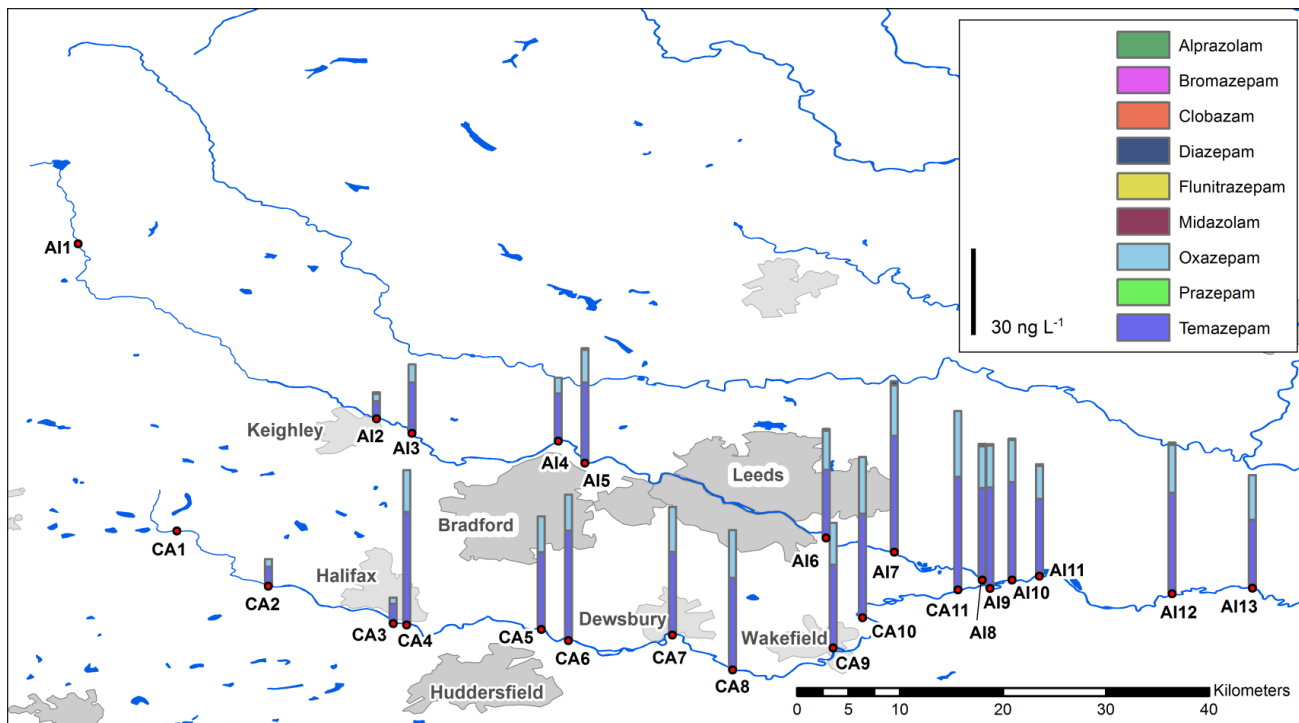
1052 prover
258 floder
104 länder

61 läkemedel



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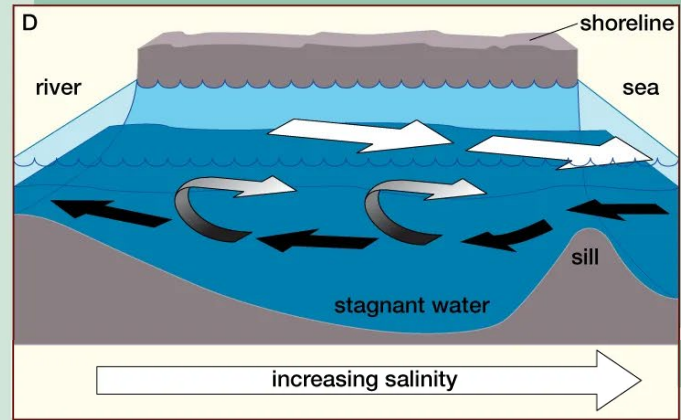
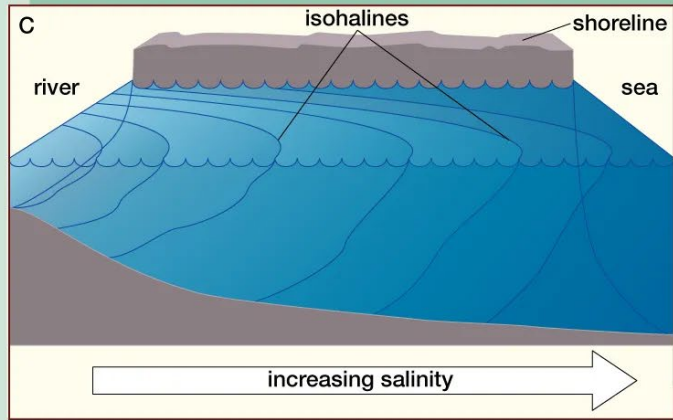
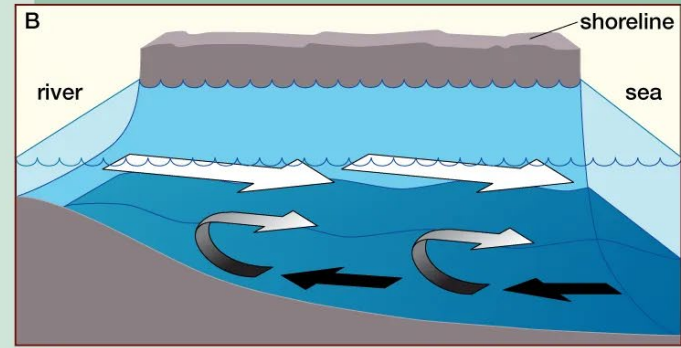
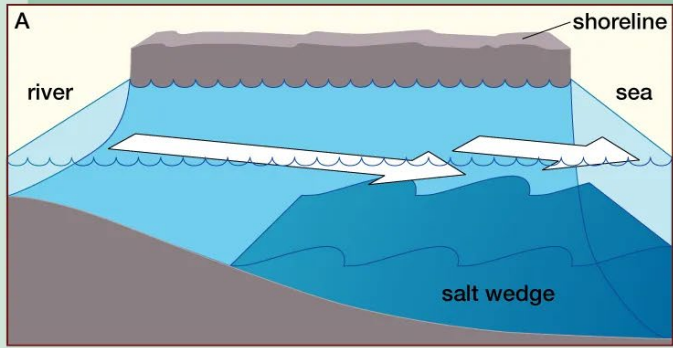


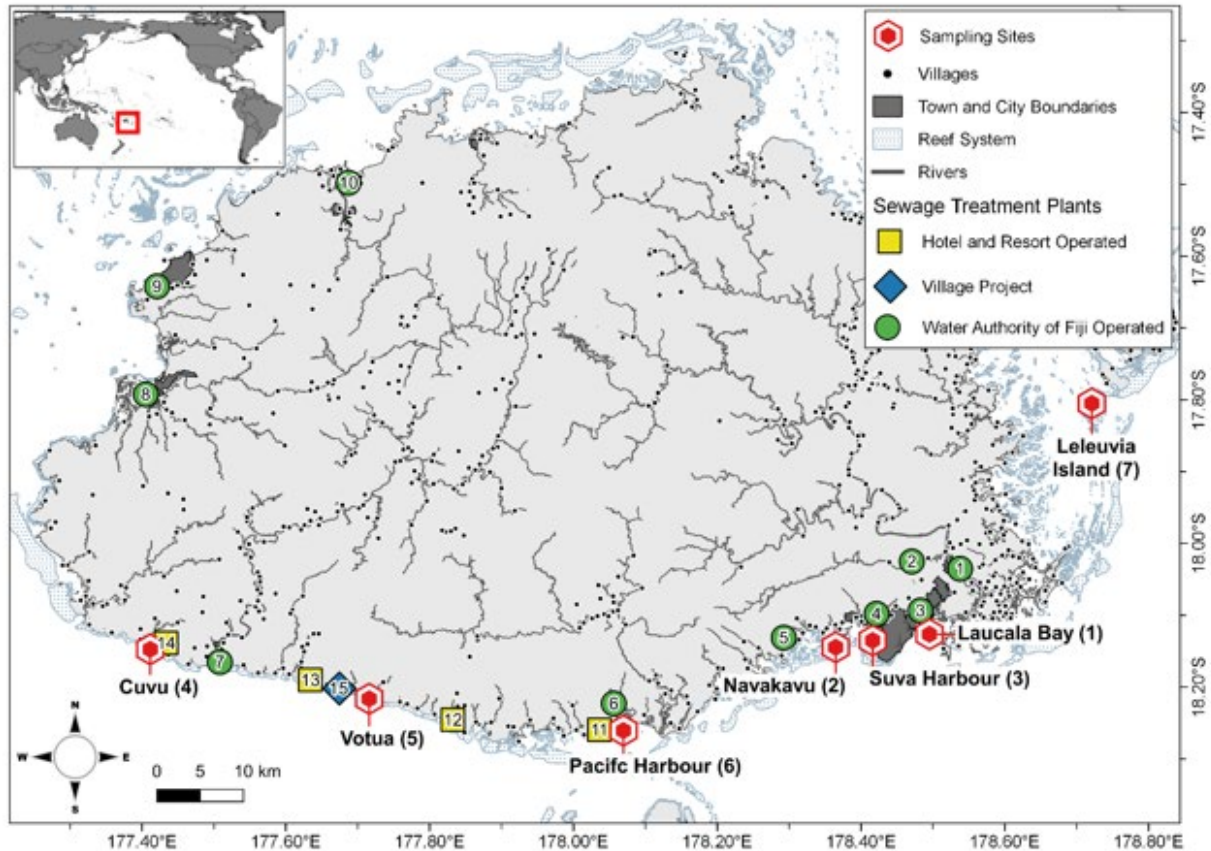


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Hav





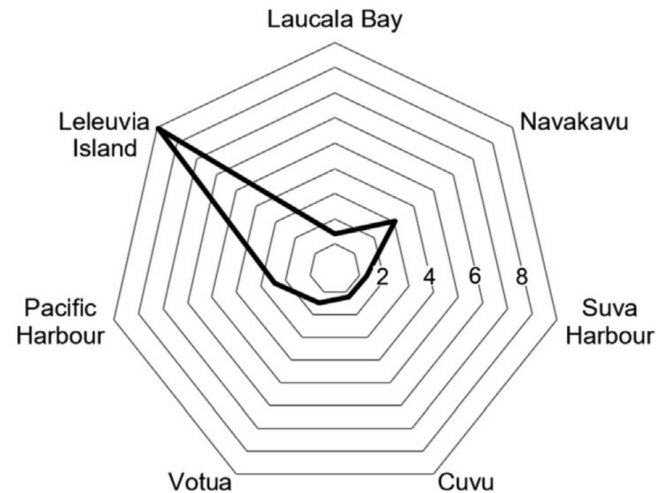
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Pharmaceutical	Freq. (%)	Min. (ng/L)	Max. (ng/L)	Average (ng/L)
Trimethoprim	71	0.13	230	7.45
Biperiden	56	0.11	29	0.91
Codeine	46	0.50	130	7.56
Clomipramine	40	0.54	480	5.62
Irbesartan	35	0.52	62	1.75
Orphenadrine	35	0.10	16	0.53
Carbamazepin	35	1.00	190	2.84

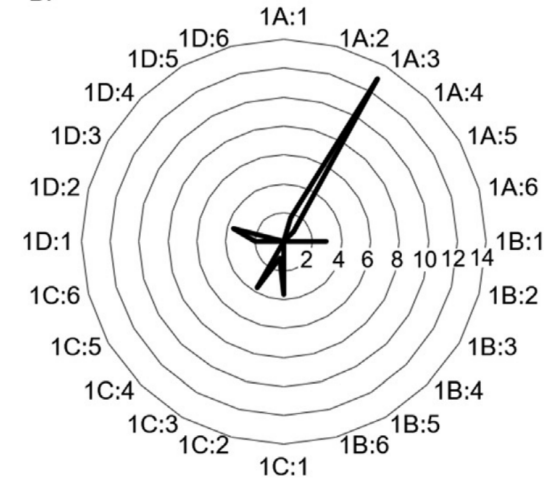
168 prover
7 platser
2 säsonger

80 läkemedel

A.

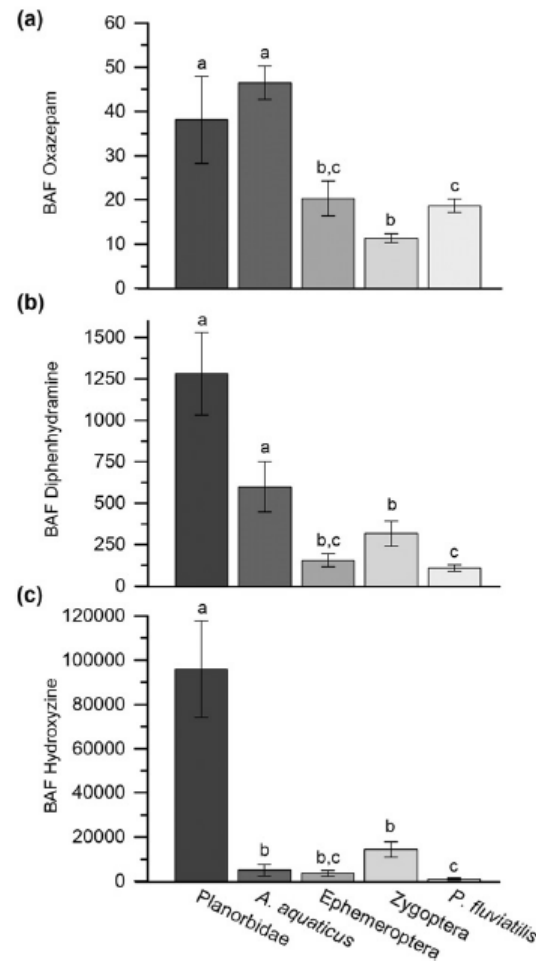
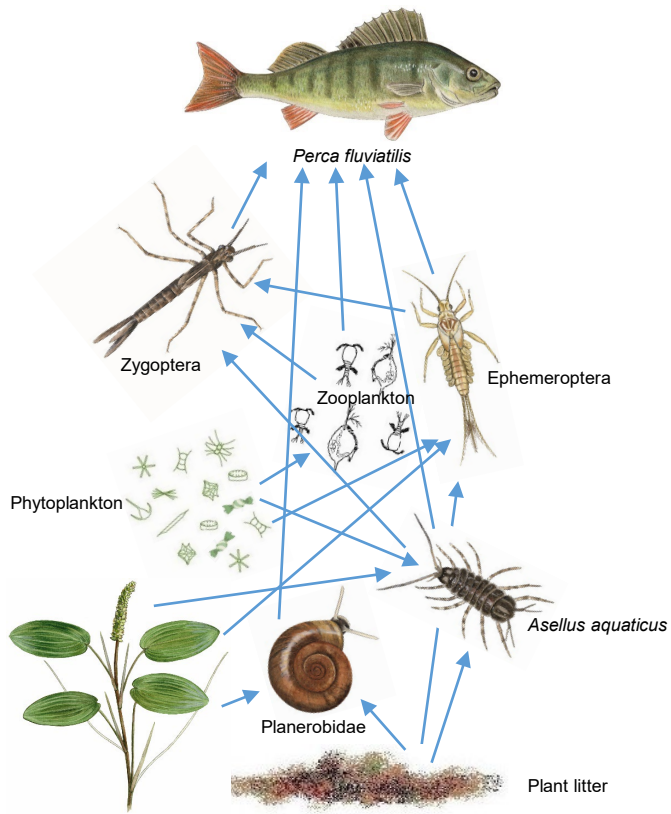


B.

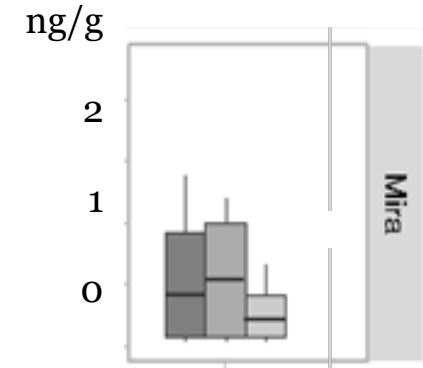
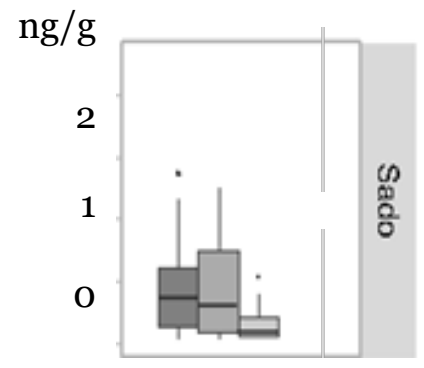
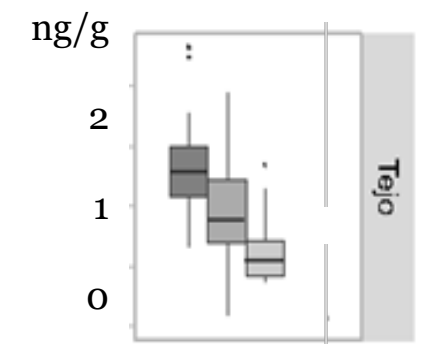
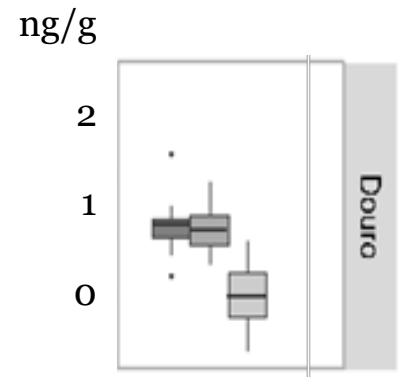
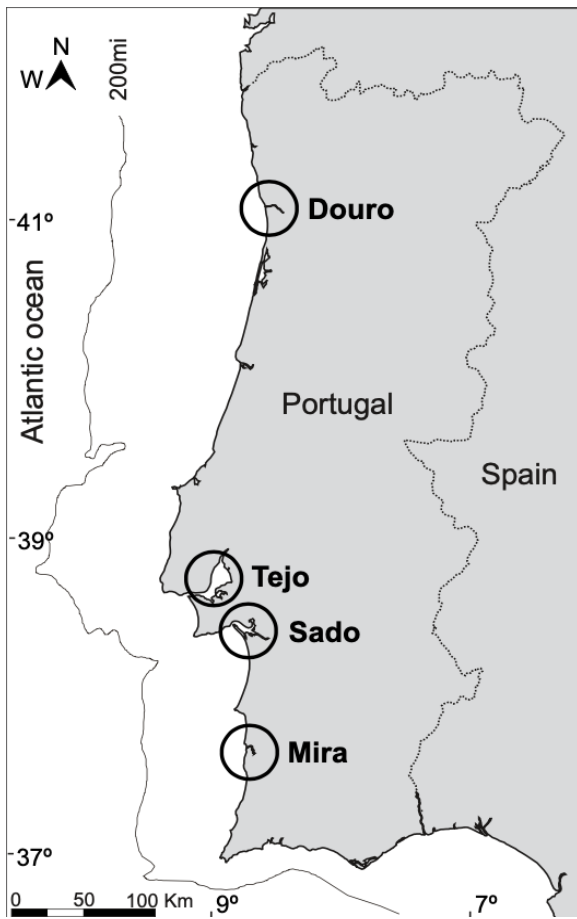


Djurliv






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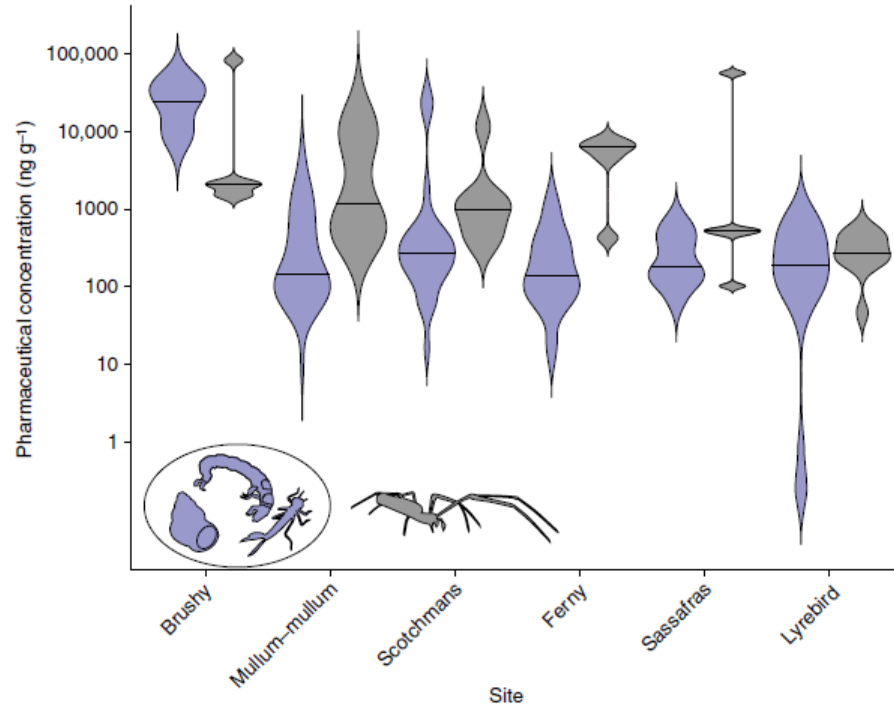


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- 
- 6 streams in and around Melbourne
 - 247 biota samples
 - 33 different species of insects & spiders



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Increasing Ecological Relevance

Number of Influencing Factors



Laboratory Exposure

Field Exposure

Single Substance Testing

Ambient Samples

In Situ

Resident Organisms

In Vitro

In Vivo

Biomarkers

Pathology

Single
Species

Multiple
Species

Community
Indices

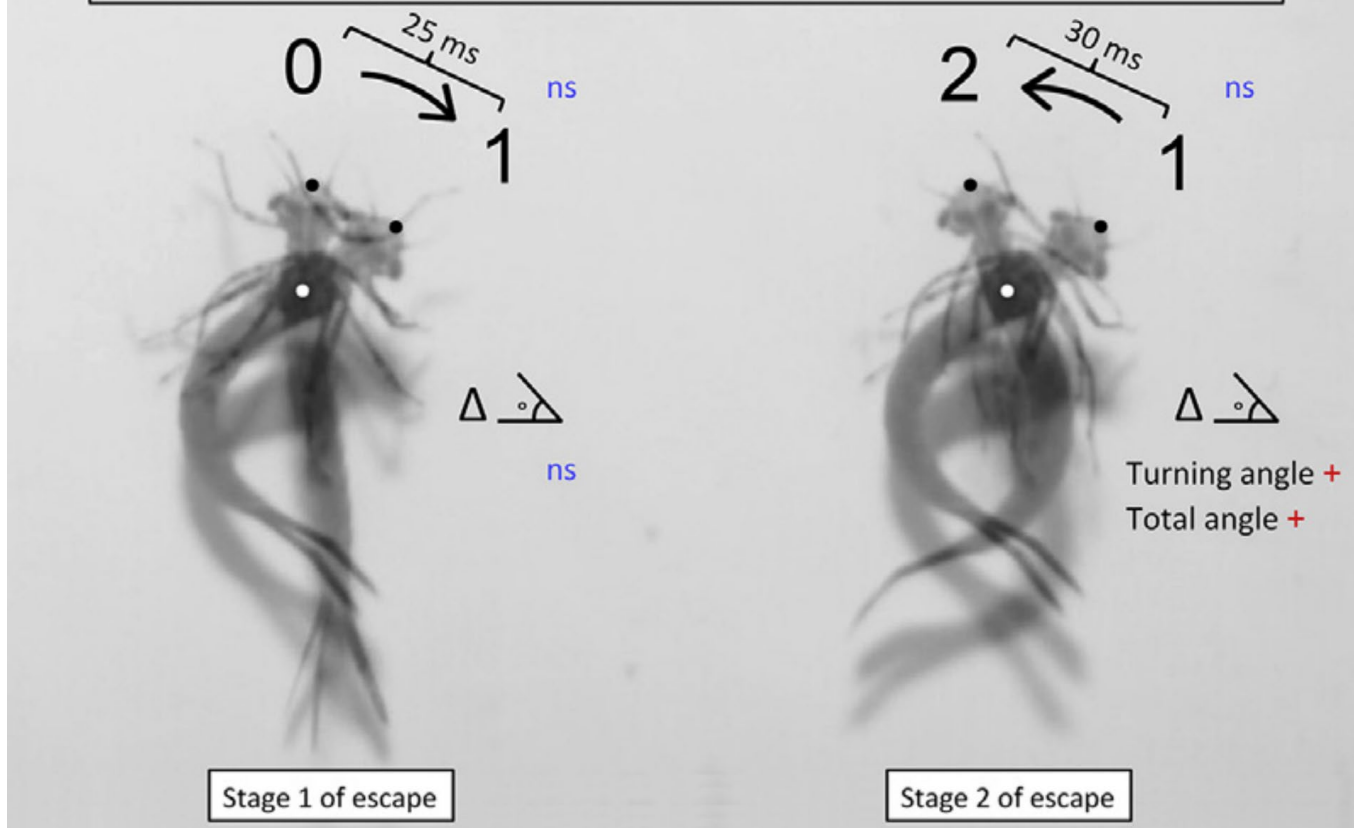


Reproducibility and Specificity

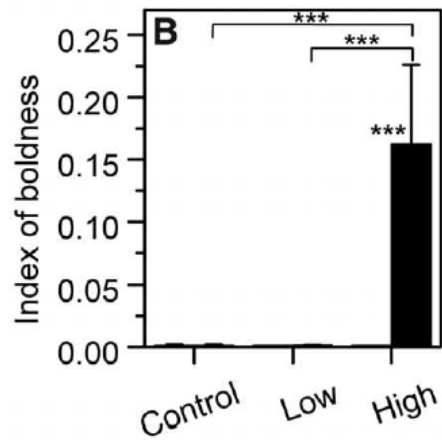
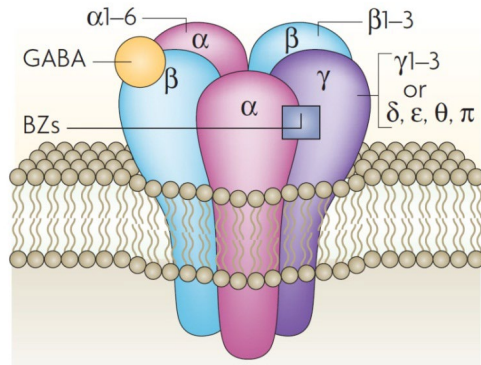
A detailed view of a Daphnia magna water flea. The organism is transparent, revealing its internal anatomy. A prominent red organ, likely the heart or gut, is visible in the upper central region. Below it, several bright green, spherical eggs are clustered together. The head features two large, dark eyes and several long, thin, branching appendages extending upwards. The entire organism is set against a solid, vibrant blue background.

Daphnia EC50, 48h

Effects of antihistamine exposure on insect prey speed and angle of escape



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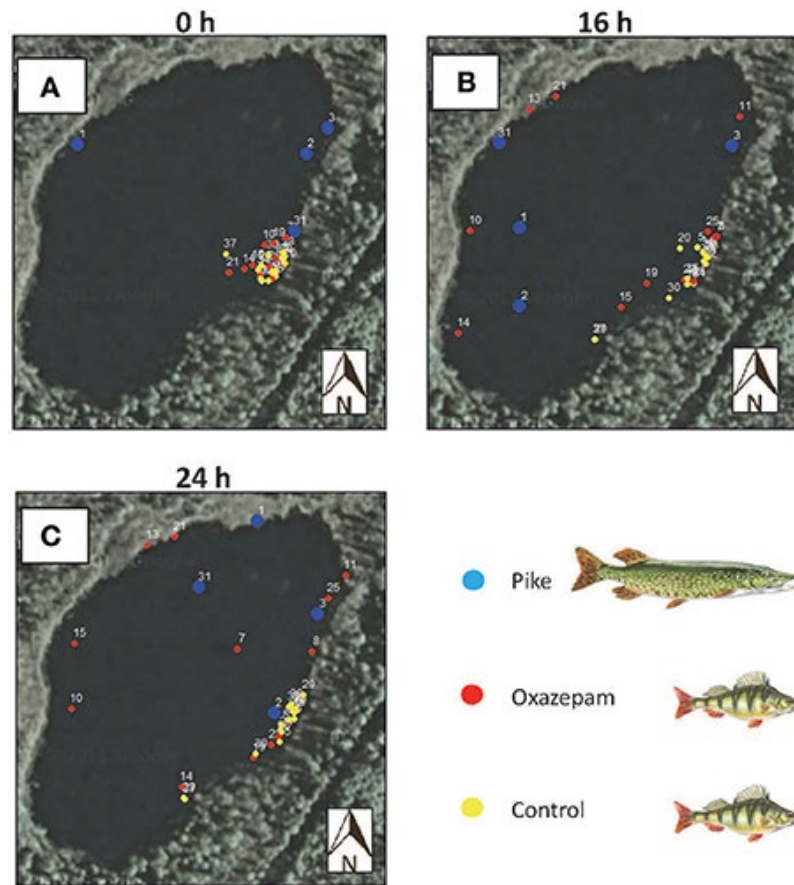
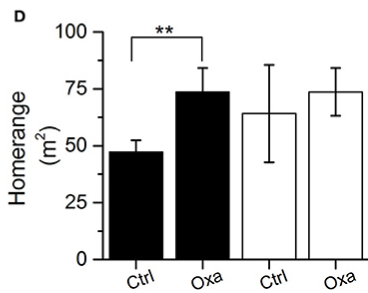
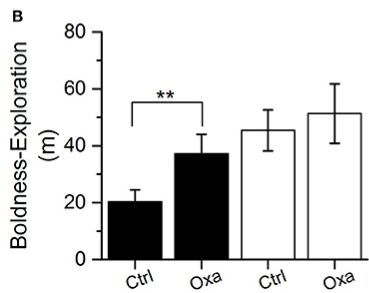
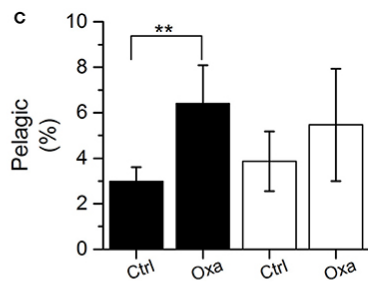
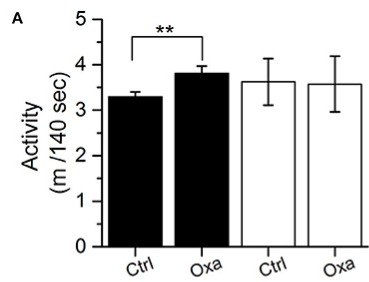
□ Pre-treatment ■ Post-treatment



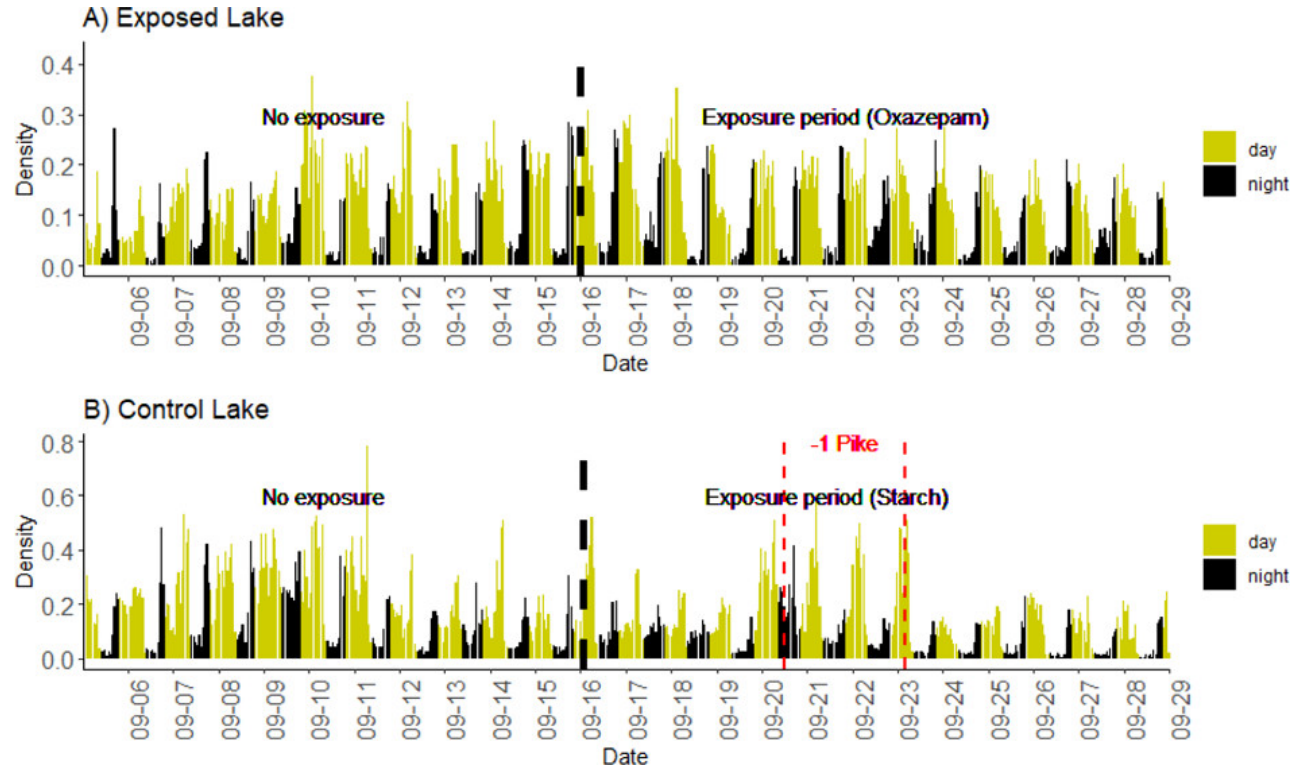
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Brodin et al Science 2013





Ingen effekt vid helsjö-experiment



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Increasing Ecological Relevance

Number of Influencing Factors



Laboratory Exposure

Field Exposure

Single Substance Testing

Ambient Samples

In Situ

Resident Organisms

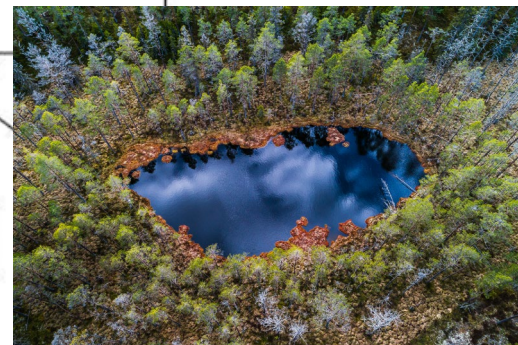


In Vivo

Biomarkers

Single Species

Multiple Species



Community Indices



Reproducibility and Specificity

