

Environmental Impact Assessment matters

EMA Veterinary Awareness Day
September 12th, 2023 – Ivo Roessink



Environmental impact

- Active substances such as pesticides, biocides, pharmaceuticals, veterinary medicines have a targeted use...
- However, these substances can easily end-up in the environment, potentially impacting non-target organisms



Environmental Impact – Exposure examples

- Sometimes excess exposure rather is obvious...

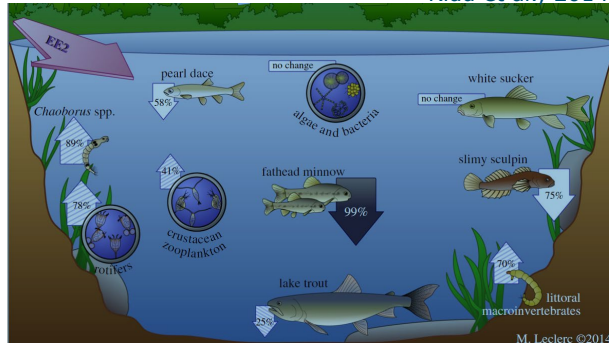


Environmental Impact – Exposure examples

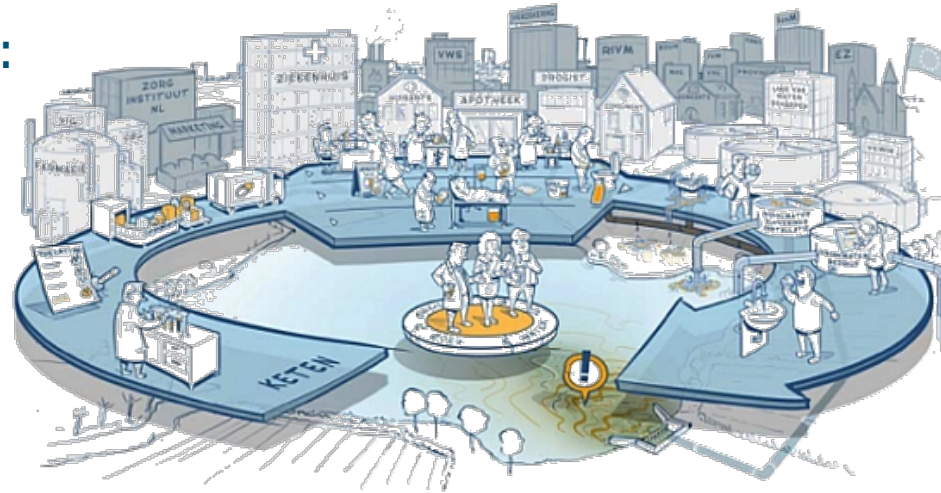
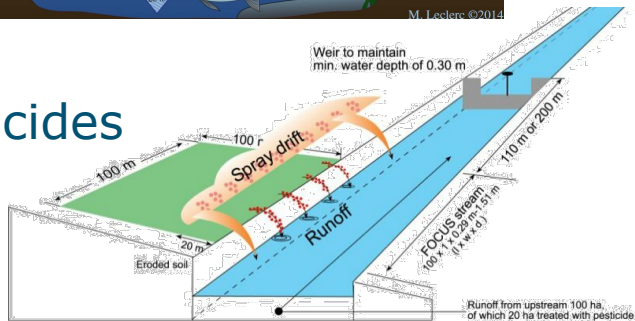
But more recent examples contain:

Medicines

Kidd et al., 2014



Pesticides



Exposure scenarios for whole of EU available

...but also less logic routes of exposure occur.

Environmental Impact – Exposure examples

- Case study 'sheep dipping' from UK
- Sheep are dipped in insecticide bath as anti-lice and -tick treatment
- UK = rain → sheep run-off → overspill in brooks
- Dead endangered native crayfish



Environmental Impact – Exposure examples

Other less obvious substances and routes:

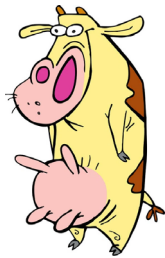
- Veterinary medicines
- Biocides
- Livestock route

Feed

Feed from within EU

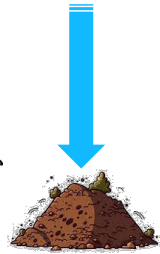


Feed from outside EU

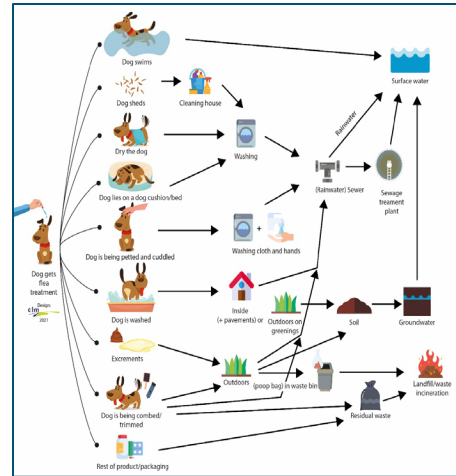


**Biocides -
desinfecting
stable**

**Bedding
stable floor**



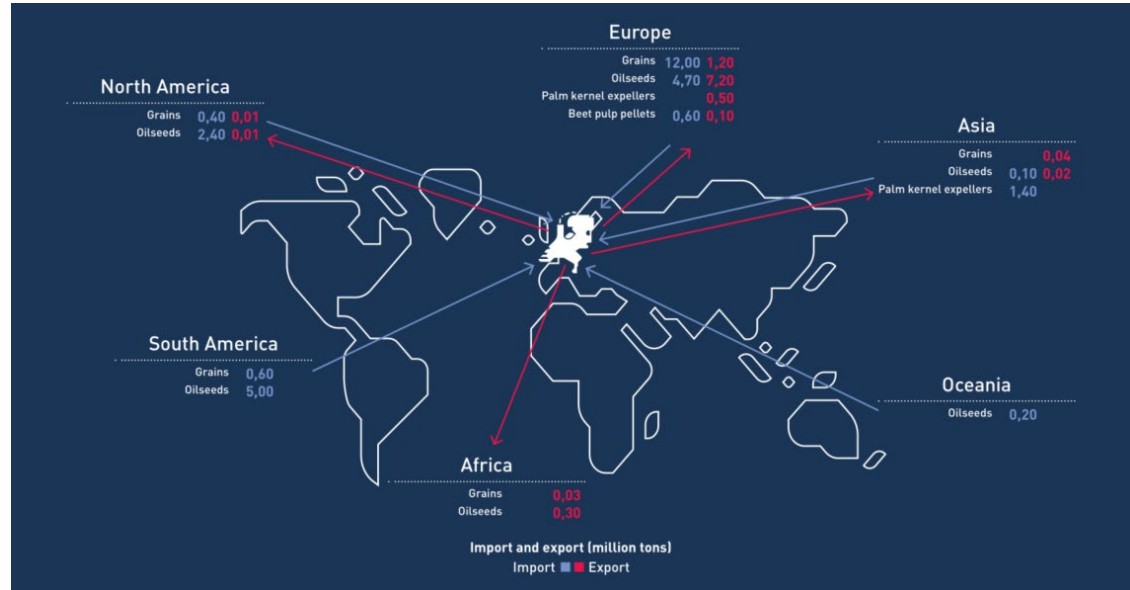
Manure



Environmental Impact – Exposure examples

Livestock route - feed

- With different regulations different residues are present in foreign feed
- Impact of residues is only checked for livestock health...or when a human health issue occurs. No ERA!

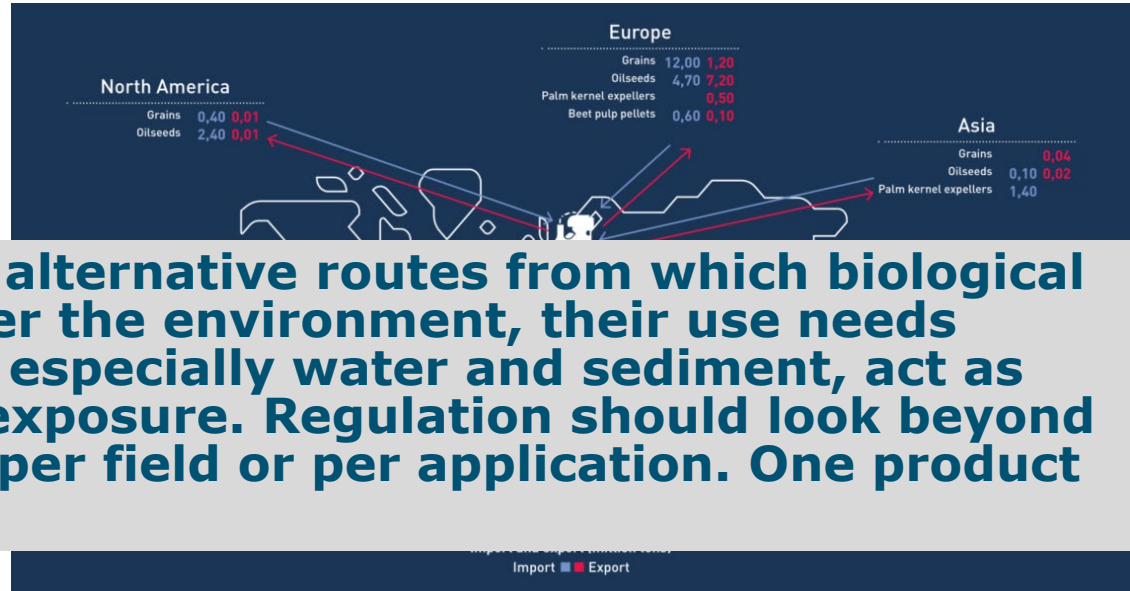


Import and export (in mln tonnes) for use in feed

Environmental Impact – Exposure examples

Livestock route - feed

- With different regulations different



Conclusion: Due to all alternative routes from which biological active substances enter the environment, their use needs attention. As soil, and especially water and sediment, act as sinks we accumulate exposure. Regulation should look beyond authorisation per use per field or per application. One product one assessment?

LIVESTOCK HEALTH...

when a human health issue occurs. No ERA!

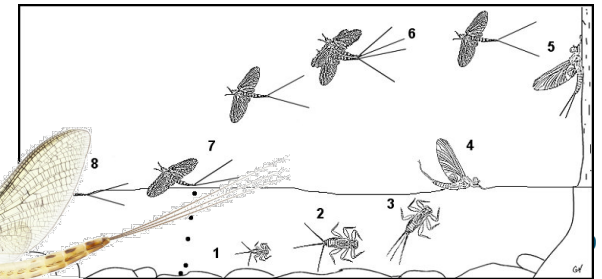
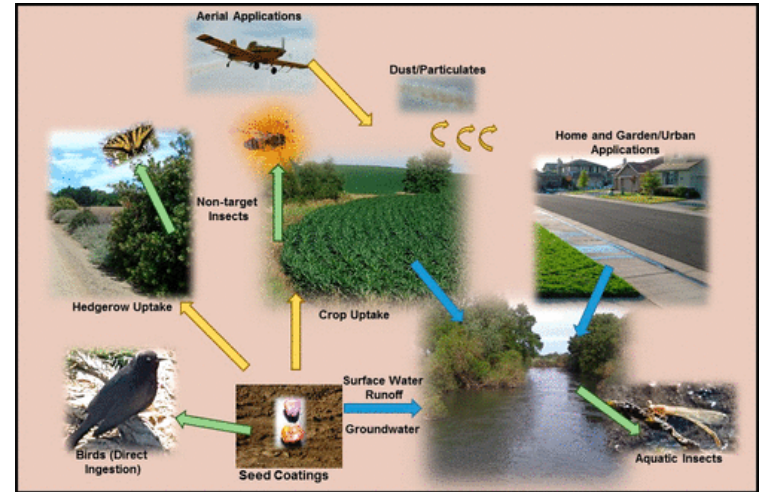
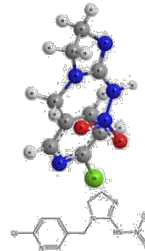
Import and export (in mln tonnes) for use in feed

Environmental Impact – Effects

Pesticides/biocides/veterinary medicine - Why one compound, one assessment?

Example: Imidacloprid

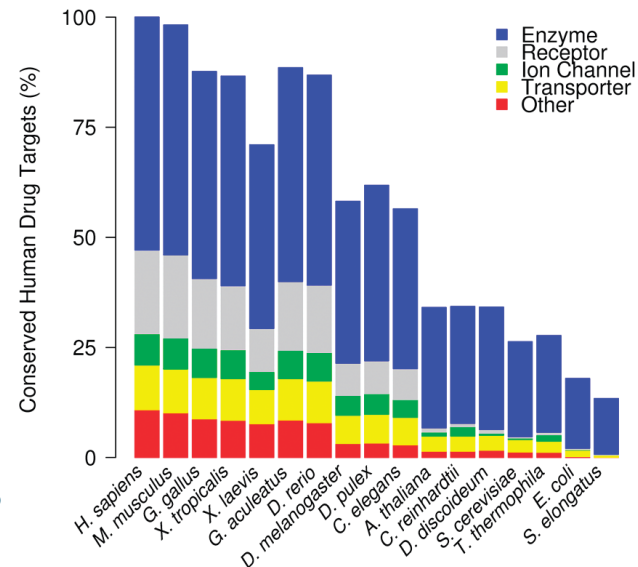
After ban of agricultural use, still exceedances of water quality standards. Especially after sewage treatment plants ...additional route from domestic use very important → environmental problem has not been solved yet.



Current IMI concentrations in the water have detrimental effects on especially mayflies.

Environmental Impact – Effects

- Impact of especially modern non-pesticides and –biocides is much more subtle ...
- ‘Old fashioned’ knock-down effects are no more....
 - Either because actives are not meant to kill (i.e., pharmaceuticals and medicines)
 - Either alternative exposure routes result in environmental concentrations too low for direct mortality



Categories for the drug targets in human and in all the investigated species. Gunnarsson et al., 2007.

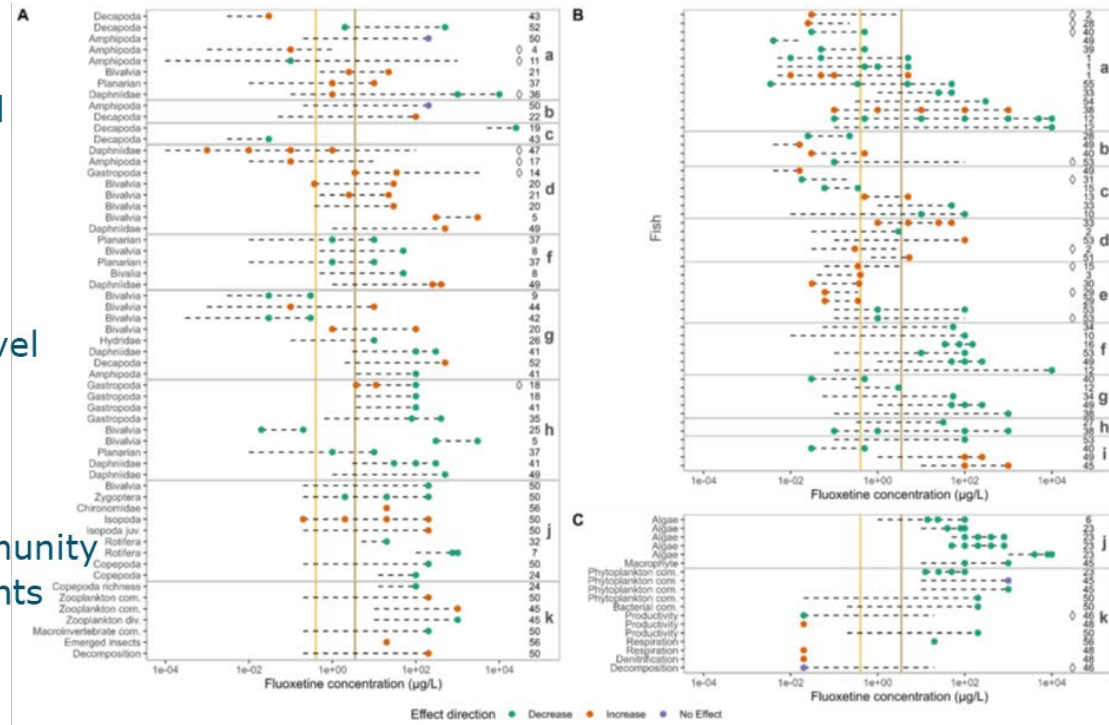
Environmental Impact – Effects

■ Aquatic impact of Fluoxetine - antidepressant

Behavioural endpoints

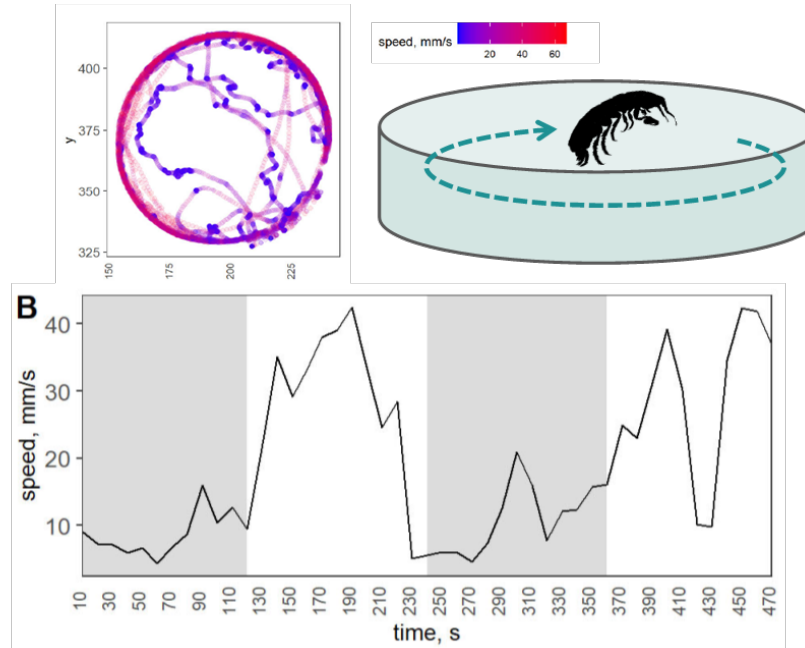
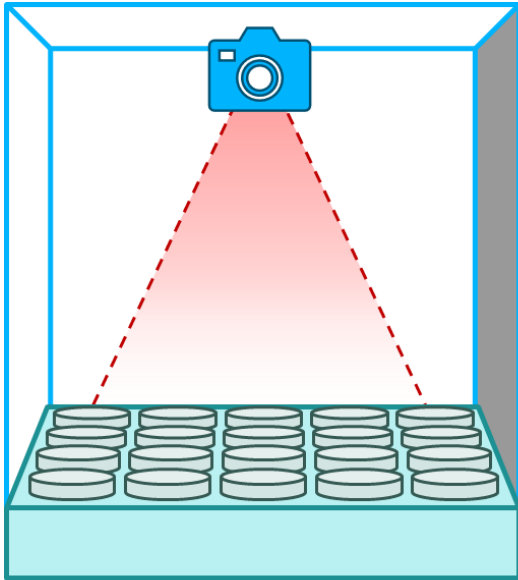
Individual-level endpoints

Population/community-level endpoints



- Endpoint
- a. Activity
 - b. Startle response
 - c. Anxiety
 - d. Other behaviour
 - e. Mating
 - f. Feeding
 - g. Growth
 - h. Reproduction
 - i. Mortality
 - j. Population growth
 - k. Community/ecosystem

Environmental Impact – Effects



Schuijt, 2023



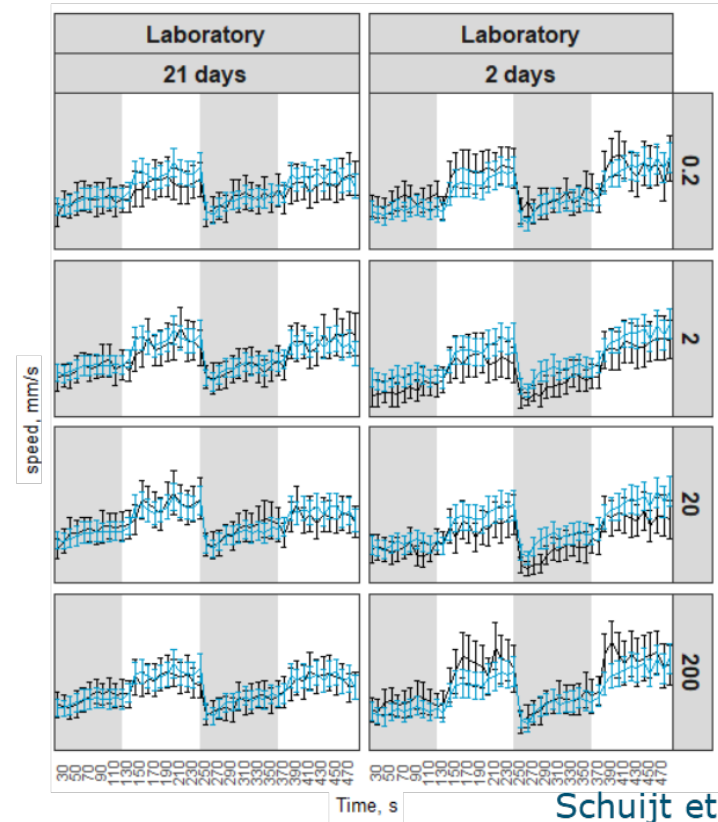
Crustacean
amphipod:
Gammarus pulex

Function:

- Processing organic material
- food

Environmental Impact – Effects

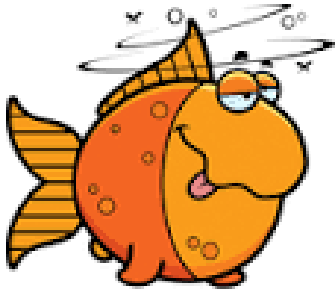
- Laboratory behavioural tests with *Gammarus pulex* and fluoxetine
- Average swimming speed of treated (black line) and untreated (blue line) individuals
- Only few significant differences for 2 and 20 µg/L after 2 days of exposure, no systematic ones



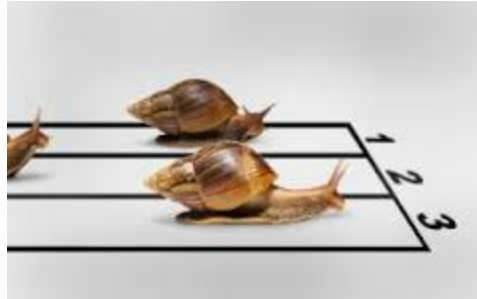
Schuijt et al., 2023

Environmental Impact – Effects

- But at other specimen impact on behaviour/locomotion/cognition (Brodin et al, 2013; Fong and Ford, 2014)



Oxazepam:
Mellow fish
getting eaten...



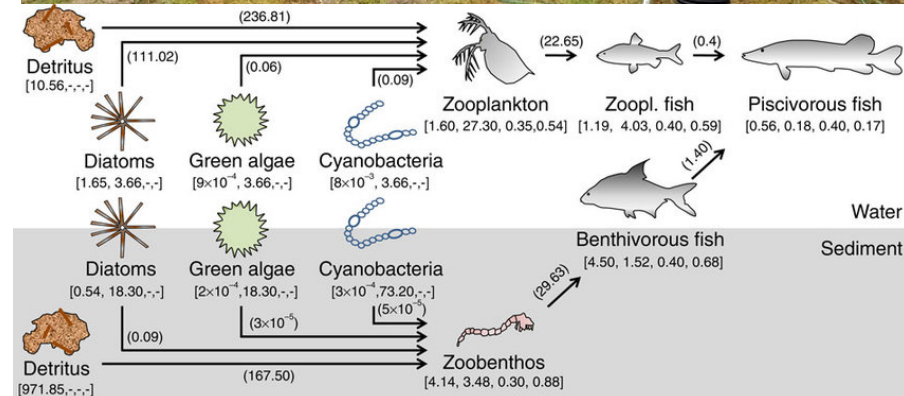
Venlafaxine:
Snails losing
footing...



Octopus cannot
remember...

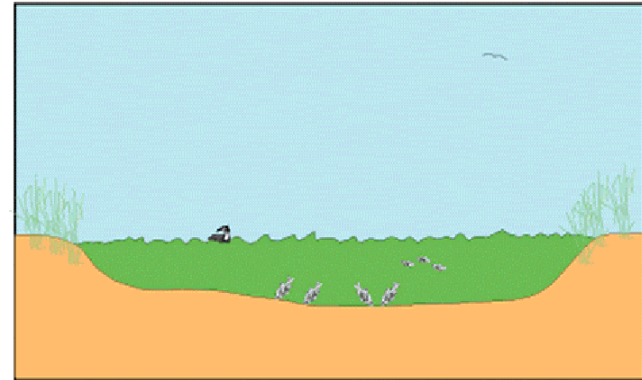
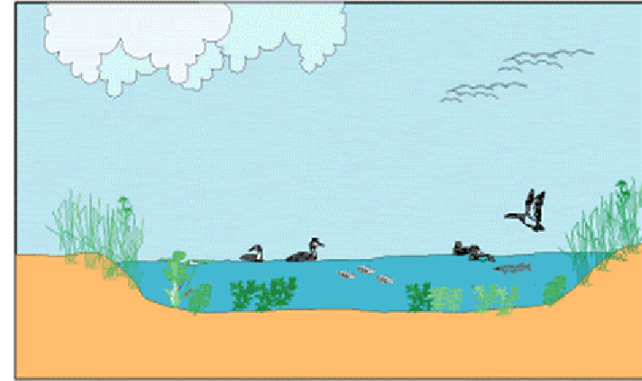
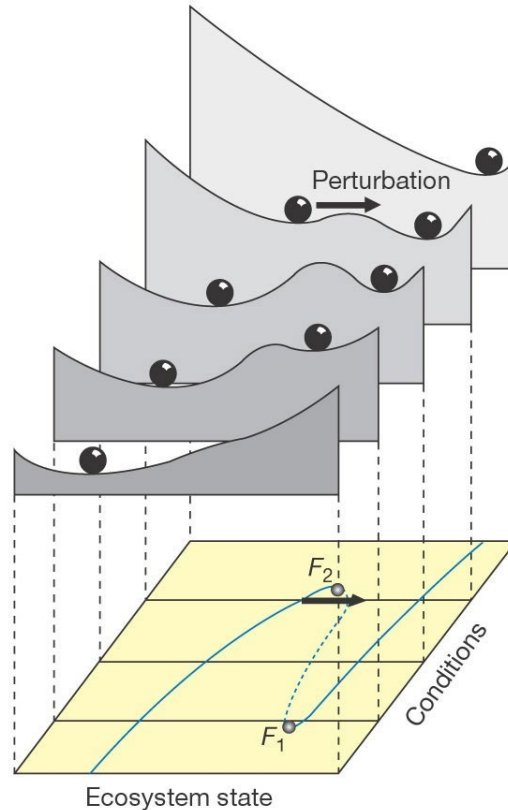
Environmental Impact – Effects

- Studying impact in aquatic model ecosystems to see how different communities react
- But if effect is behaviour and not mortality; one usually needs more levels of the trophic chain (i.e. predators present) to see impact.



Environmental Impact – Effects

- Healthy ecosystems and the populations therein are resilient and robust; they can handle a lot of stress
- But when the 'tipping point' is reached, a system can collapse and make a critical transition...



Environmental Impact – final remarks (1/2)

- 
- A pair of hands is shown from the bottom, cupping a glowing, translucent globe of the Earth. The globe is bright blue and white, with a soft glow emanating from its base. The background is dark and out of focus.
- Health is not found in a pill or shot, it is a way of managing life/systems
 - In line with the One Health concept; if our environment is under stress, so are we...
 - Think scenario: Which exposure can be expected from which use and where does it accumulate?
 - Impact can indeed be measured or quantified...but not with traditional methods

Environmental Impact – final remarks (2/2)

- Do not wait for action from regulators... then you are usually too late.
- Bottom-up approaches from committed stakeholders are better...



Thank you for your attention

...and be most welcome to contact me.

E: ivo.roessink@wur.nl

