Biological effects of waste water effluents and what we should do with them?

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Specific features of the Baltic Sea in relation to waste water burden

Local contamination, local effects

- A mixture of marine and freshwater species
  - Living on the edge
- Limited number of published WWTP related studies
- Buffer zone of coastal area
  - Dilution is the solution approach

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Known effects of waste water effluents

- Hormonal effects (endocrine disruption)
  - Feminization of fishes and mussels
  - Female reproduction related protein expression in male fishes
- Biomarkers of stress in mussels and fishes
  - Different proteins, enzymes, gene expression
- Immunosystem down -> serious infections in mussels
- Population level effects
  - Decrease in number of species/individuals, change in structure

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Baltic Sea specific studies on effects

Examples on mussel cagings at the pipe ends

- Helsinki WWTP
  - Biomarker responses (oxidative stress, genotoxicity, cytotoxicity)
  - Better energy reserves; more nutrients => food
- Tallinn WWTP
  - Heart rate increases
- Swedish WWTPs
  - Genetic differentiation; evolutionary effects on populations

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CHEMPACT data and effect assessment

Cocktail of thousand substances

Information needed:

- Environmental significance of the most frequently released chemicals in effluents
  - By calculating hazard quotients (HQs) for single chemicals
    - Observed concentration/effect concentration; > 1 is a risk
  - By grouping chemicals with certain mode of toxic action
    - (estrogenicity, neurotoxicity etc.)
  - By summing up the HQs
    - Assuming additivity in toxicity
  - Applying different dilution scenarios

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What we should do with the waste water effluents?

- Consider them as potentially harmful mixtures
  - Paracelsus statement by Thomas Backhaus: It's the dose *and the number of components* that make the poison
  - Sum up risks of single chemicals
  - Use effect-based methods (biotests)
- Consider setting limits for chemicals AND effects in effluents
- Consider upgrading treatment plants