

Introduction to Bioindication

- summary -



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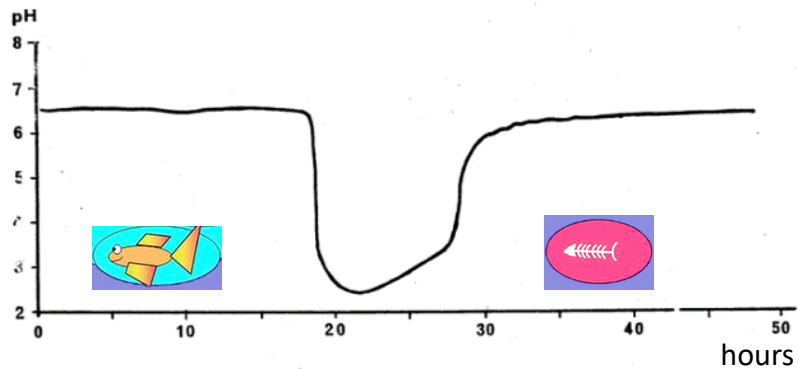
Note:

This presentation is part of a course that has been given in April/May 2023 in Belgrade. To avoid any potential issues with respect to copyright, however, the version which is publicly available has been modified. Specifically, some illustrations were removed.

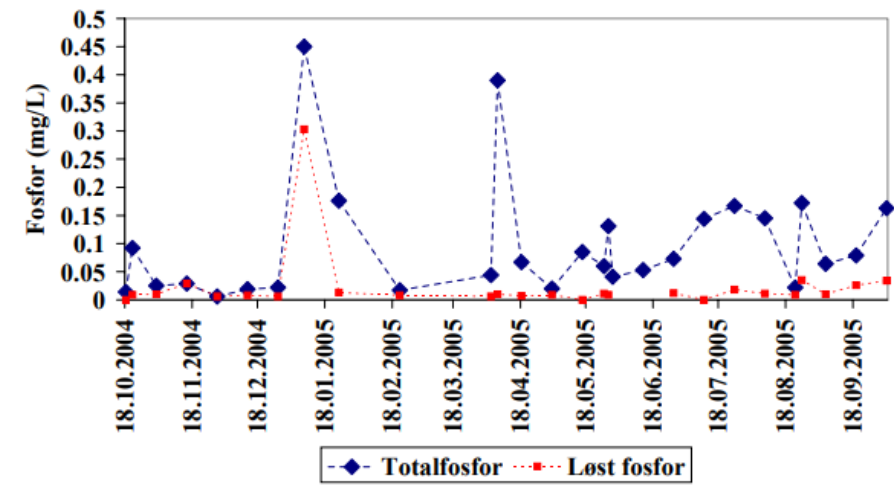
For this reason, layout and design may appear somewhat “empty”.
The course content has not been changed, however.

Why is bioindication important?

- Detect short-term releases and earlier events
- Show less “random” variation; integrate over time
- Water quality has **biological aspects** (ecosystem)
- Register a wide variety of pollutants
- multiple stressors: synergistic and antagonistic effects

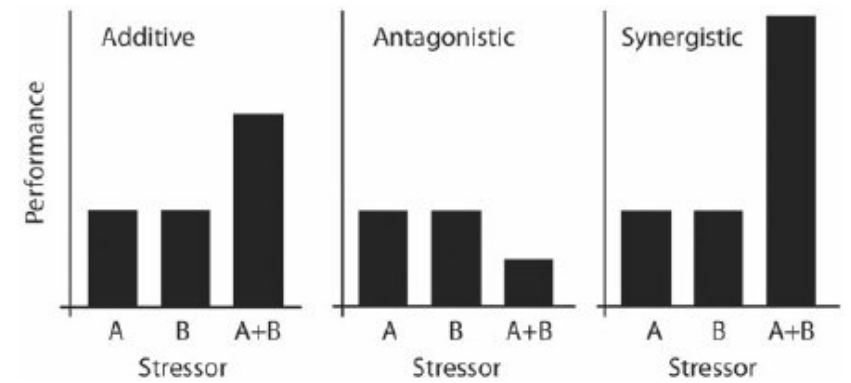


pH in a stream in Oslo, before, during and after a spill of sulfuric acid



TotP and DRP in the Årvoldbekken stream (Norway)

Picture of a fish kill



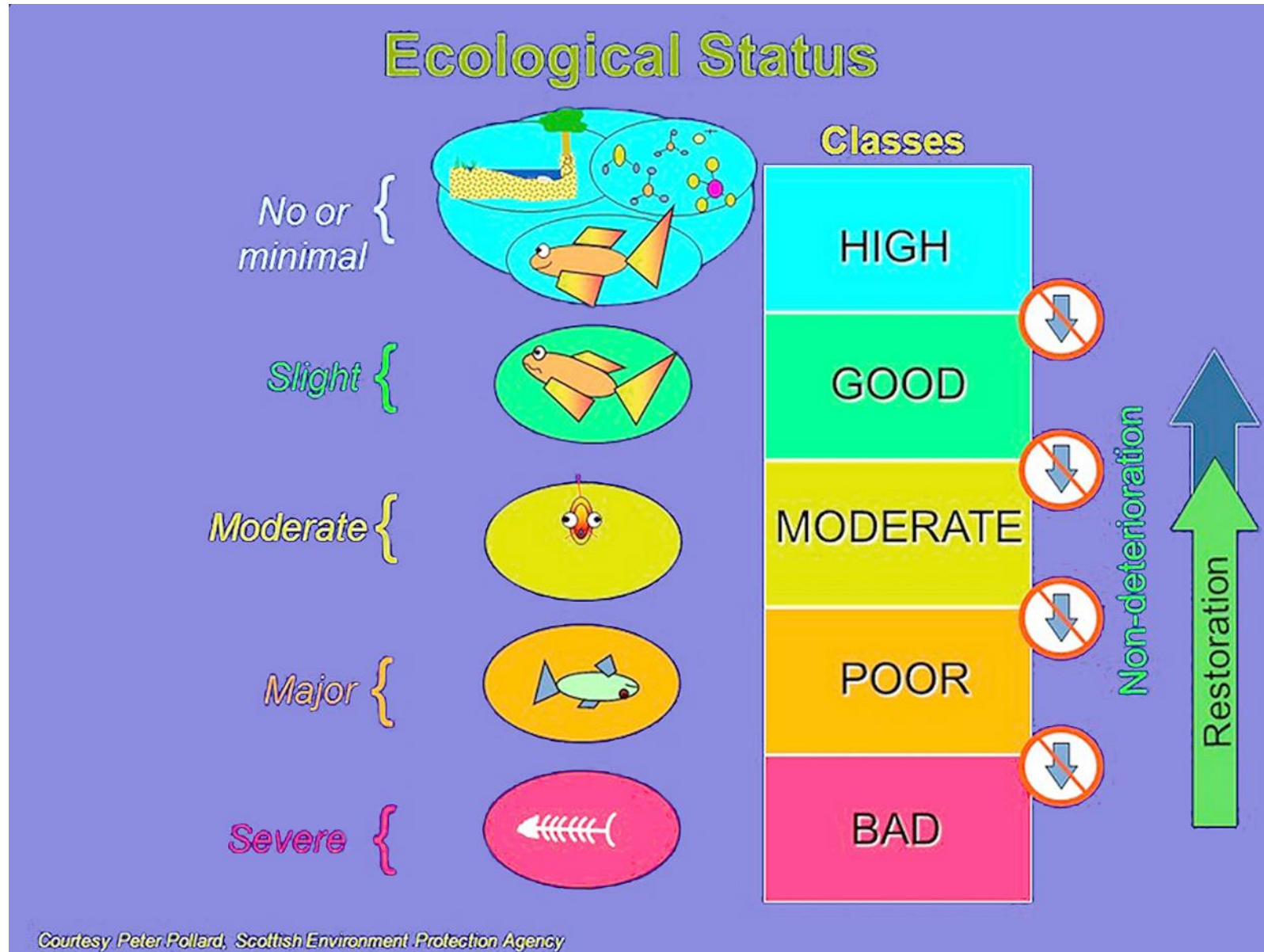
What is a «good bioindicator»?

Good indicator ability	Provide measurable response (sensitive to the stressor)
	Response reflects the whole population/community/ecosystem
	Responds in proportion to the degree of contamination/degradation
Abundant and common	Adequate local population density (rare species are not optimal)
	Common, including distribution within area of question
	Relatively stable despite moderate climatic and environmental variability
Well-studied	Ecology and life-history well understood
	Taxonomically well documented and stable
	Easy and cheap to survey

Water Framework Directive:



Ecological status in brief



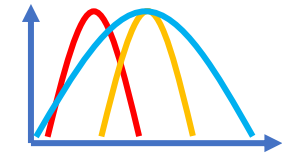
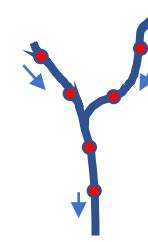
Summary stressor:

- must be relevant
- high quality data needed
- make sure sites are («sufficiently») independent
- make sure you have a sufficient gradient length
- take care of multiple stressors
- take care of outliers
- transform data where necessary

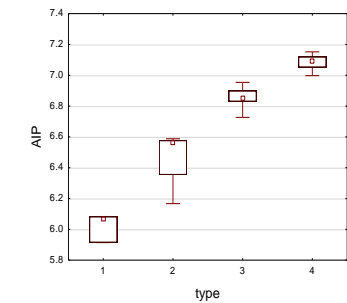
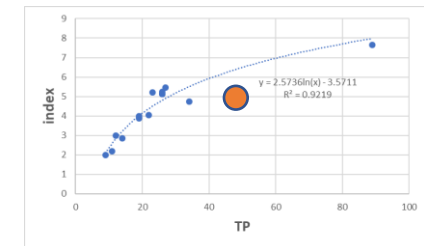
Summary indicator:

- must be relevant
- have a hypothesis
- monotonic relationship to the stressor
- high quality data needed
- make sure sites are («sufficiently») independent (time and space)
- make sure you have a sufficient gradient length
- take care of multiple stressors
- take care of outliers
- transform data where necessary

Summary index development



- Make sure data for stressor and response are from the same sites, and from the same time!
- Check ecological amplitudes of potential indicator species, consider weighing the indicator values
- Try to have a least some **independent sites for index validation** (i.e. sites that have not been used for calculating species indicator values)
- Invest some time into finding good reference sites
- Use reference sites to describe water body types
- Do not use more water body types than necessary to describe the natural variation
- Do not publish preliminary indices, but rather show current data to authorities and ask for money for collecting the necessary data. At the same time, be pragmatic where necessary.
- Use reference sites to define high/good boundary
- Make sure to have scientific arguments for the other status class boundaries
- Make sure the class boundaries are consistent with the results of the intercalibration exercise



What next?

Drones for bioindication?

eDNA?

For which organism groups?



Develop an index: good luck!

Did this course meet your expectations?

Do you have suggestions for improvements?

Acknowledgement



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