Introduction to Ecological Assessment of Marine Environments

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Presentation 1

Water pollution has accompanied all human civilisations…

It is a result of most human activities and landuse practices

Can you list sources of water pollution?

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Sadly, the list is very long:

Industrial waste	effluent outfalls from e.g. factories and refineries, but also air pollution which finally ends up in seas (mainly toxic chemicals but fertilisers and waters of higher temperature as well)
Sewage and waste water	produced by households which although treated still can carry harmful bacteria and chemicals
Chemical fertilizers and pesticides	these chemicals when mixed up with water can be harmful for plants and animals. When washed out with rainwaters, flow down into rivers and canals where pose serious damages for aquatic animals
Burning of fossil fuels	in the process of coal and oil burning substantial amounts of ash are released in the atmosphere. The particles which contain toxic chemicals when mixed with water vapour result in acid rains

Can you list sources of water pollution?

Sadly, the list is very long:

Mining activities	emit e.g. metal waste and sulphides which enter surface and ground waters
Marine dumping	some countries deposit the garbage produced by each household into the sea
Accidental oil leakage	during transportation via ships or pipes. The oil spill pose a huge concern as does not dissolve with water
Leakage from sewer lines	leakage from the sewer lines can contaminate the underground

Can you list sources of water pollution?

Sadly, the list is very long:

Animal waste	during rains the waste produced by animals is washed away into the rivers (e.g. manure)
Radioactive waste	nuclear industry still has no solution to the nuclear waste problem. The nuclear waste is either disposed in near-surface repositories or reprocessed
Leakage from the landfills	during rains the landfills may leak and pollute the underground water with large variety of contaminants
Global warming	increases the water temperature and can result in death of aquatic organisms which later results in water pollution with organic matter and substances accumulated in them

Water pollution has accompanied all human civilisations...

Three strategies to combat the problem of accumulated waste

- Centralised rubbish piles (middens)

- Nomad lifestyle

- Settlements in the vicinity of waterways

All work well but only when populations are small and scattered

Problem grows with extending human needs…

First symptoms of water pollution were observed in antiquity…

e.g. in the Bible, Book of Joshua, instruction on fumigation and purification of drinking watere were included

e.g. Aristotle described polluted waters and changes in aquatic communities during their self-purification 300 B.C.

e.g. Romans built aqueducts to supply fresh water and remove among others domestic waste

But when concepts of ecological assessment were defined?

And when aquatic pollution was recognised as a problem requiring regulation?

The first effective improvements in water pollution were brought in Britain after pollution crises which coincided with increased awareness of the modes of disease transmission

The severity of degradation in the Thames in the early industrial age were captured in a cartoon from 1858…

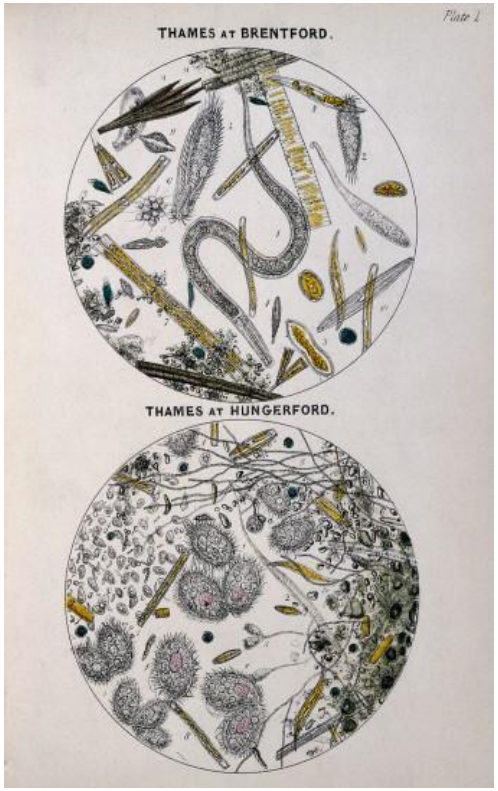
When it was generally agreeded that pollution caused biological problems a series of laws and commissions were established

e.g. Gas Works Clauses Act of 1847 which banned industry from discharging industrial wastes to sewers

e.g. Salmon Fisheries Acts of 1861 and 1865 to halt pollution

These acts declared illegal any practise that resulted in fish kill

The first scientific observations linking organisms existing in water with its quality were published in 1850 by Arthur Hill Hassal, a pioneer of algal studies searching for the cause for the cholera epidemics that were sweeping through Europe at the time



Hassal drawings presenting organisms typical for river Thames and waters supplied by several companies (from *A microscopic examination of the water supplied to the inhabitants of London and the suburban districts…, 1850)*

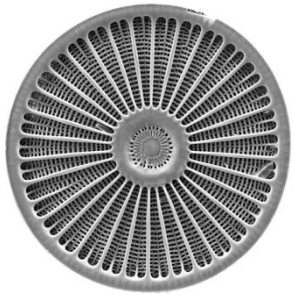
In 1870 Fryderyk Cohn professor of botanics from Wroclaw developed a first system of water classification

Between 1902 and 1909 two German scientists, Kolkwitz and Marsson traced the process of decomposition in a river below sources of sewage and described zones of recovery following high pollution zone

What were objectives of first classification systems?

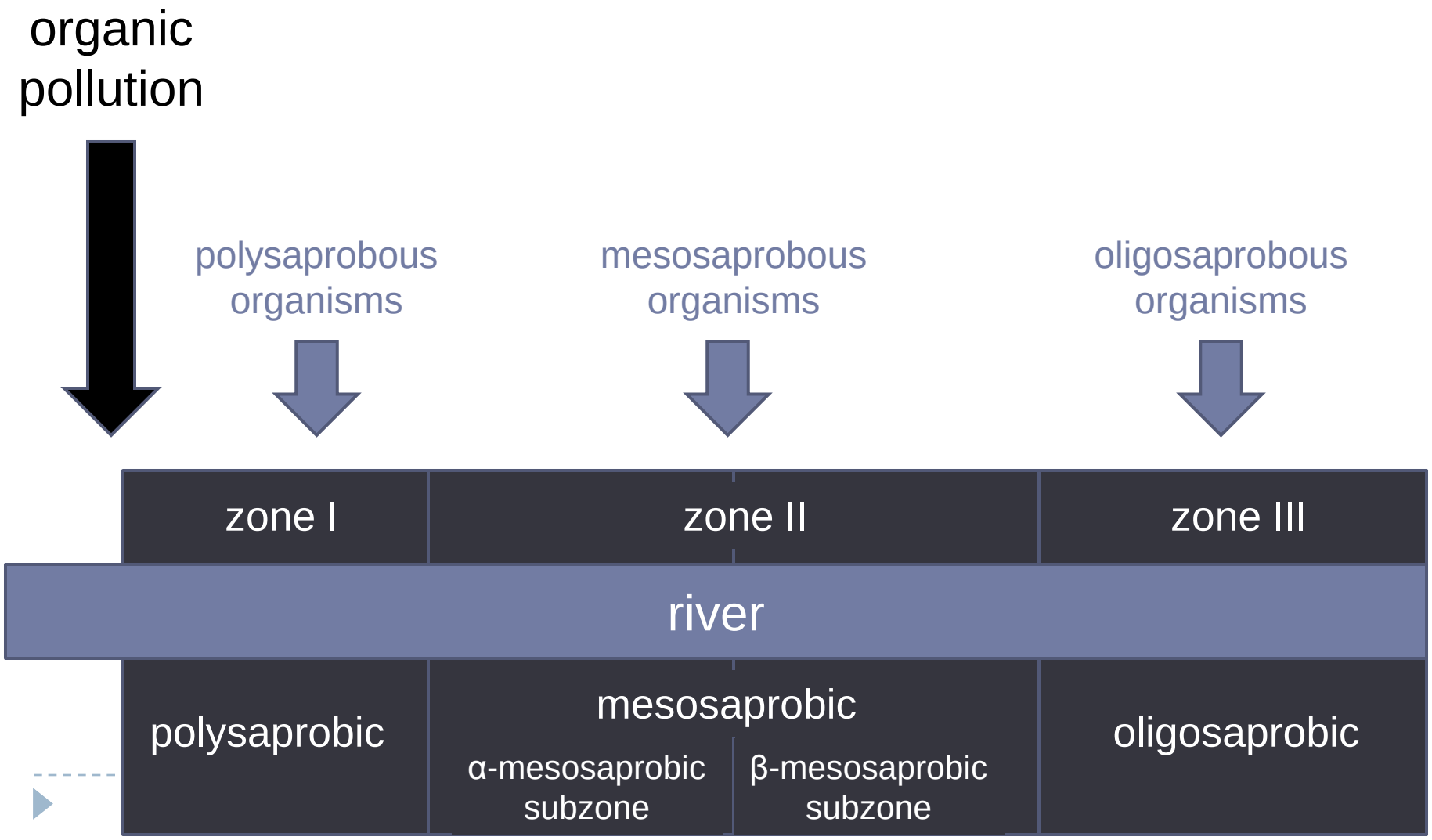
And how they were constructed?

First classification systems assumed that specific species of plants and animals were typical for each zone and river quality could be classified by examining their communities

e.g.  clean water

e.g.  polluted water

The diagram below presents the idea behind Kolkwitz and Marsson system called „saprobic system”



At the begining it was assumed that the more sensitive organism towards pollution, the better indicator was. In other words, high indicator values had organisms which were first eliminated under pollution pressure.

Of course such organisms were of great importance for biological analysis of water

Those days pollution with organic matter was the major problem so systems was focused on relations between organisms and organic pollution

But about 1935 scientists began to recognise and quantify impacts of other kinds of pollution…

e.g. chemical pollution, radioactive pollution

Kolkwitz and Marsson model was later developed into an indicator organism approach, which is widely used in water quality and other fields of environmental assessment

But to understand better the indicator idea, first the ecological tolerance concept should be introduced

And this is the main subject of the next presentation

Resources used:

Creative Commons

Perry J., Vanderklein E. 2002. Water quality. Management of a natural resource. Blackwell Science

Slide 3-5: http://www.conserve-energy-future.com/sources-and-causes-of-water-pollution.php, http://www.gdrc.org/uem/water/water-pollution.html

Slide 13: picture of rotifer by Diego Fontaneto https://en.wikipedia.org/wiki/Bdelloidea#/media/File:Bdelloid.JPG