

5. Usage and Valuation of Waters



Nied at Niedaltdorf

5. Usage and Valuation of Waters

Why should waters be evaluated ?

What is supposed to be evaluated ?

**What is a „good“ waterbody,
what is a „bad“ waterbody ?**

5. Usage and Valuation of Waters

Views of waters



Saar at Saarbrücken

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Floating Algae (hypertrophy indicators) (Brünn, Thuringia)



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Visible wastewater (grey, smelly) (Nesse, Thuringia)



5. Usage and Valuation of Waters



Lake Constance - Bodensee

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Wastewater treating pond III - Heerte (Salzgitter, Gebhardshagen)

5. Usage and Valuation of Waters

Guiding principles for the target state of a water body

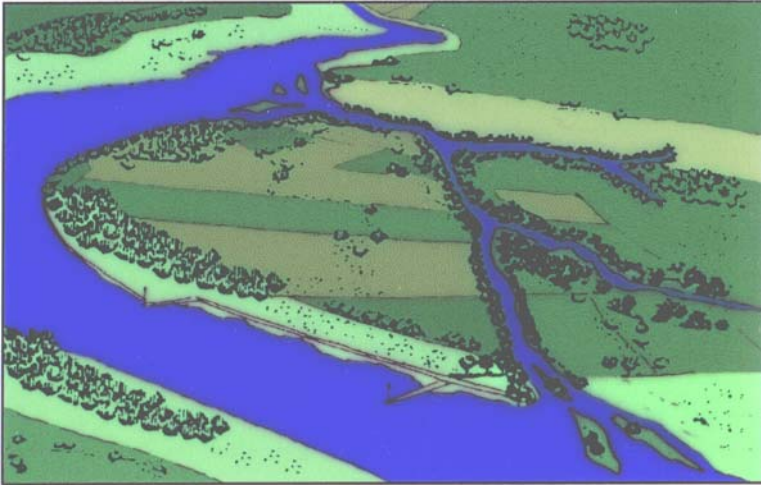
How should the ecological quality look like ?

What are the criteria to determine a target state ?

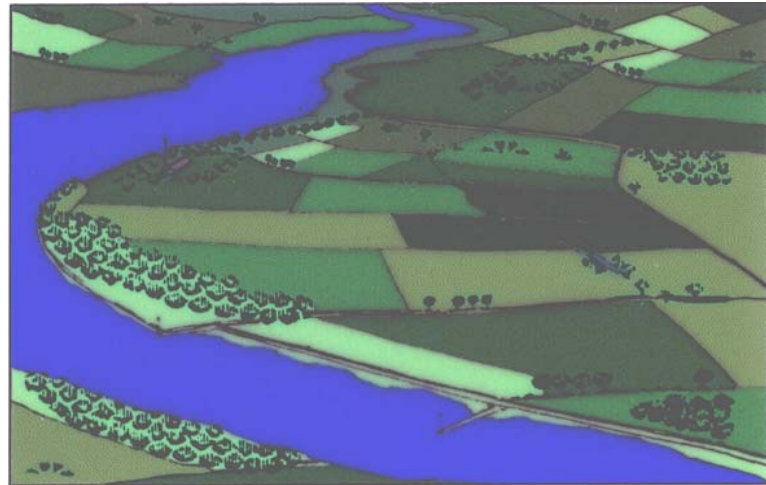
Is it possible to determine identical criteria for all types of waters ?

5. Usage and Valuation of Waters

Overall concepts for the renaturation of a river



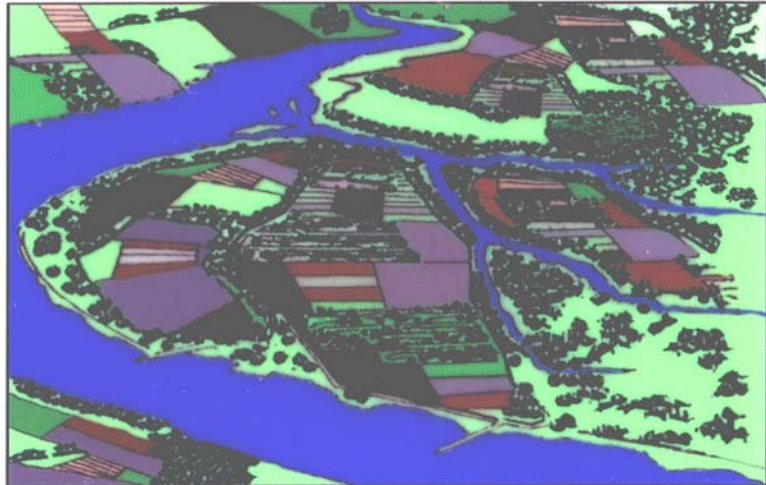
Common otter (*Lutra lutra*)



Montagu's Harrier (*Circus pygargus*)



Elk (*Alces alces*)

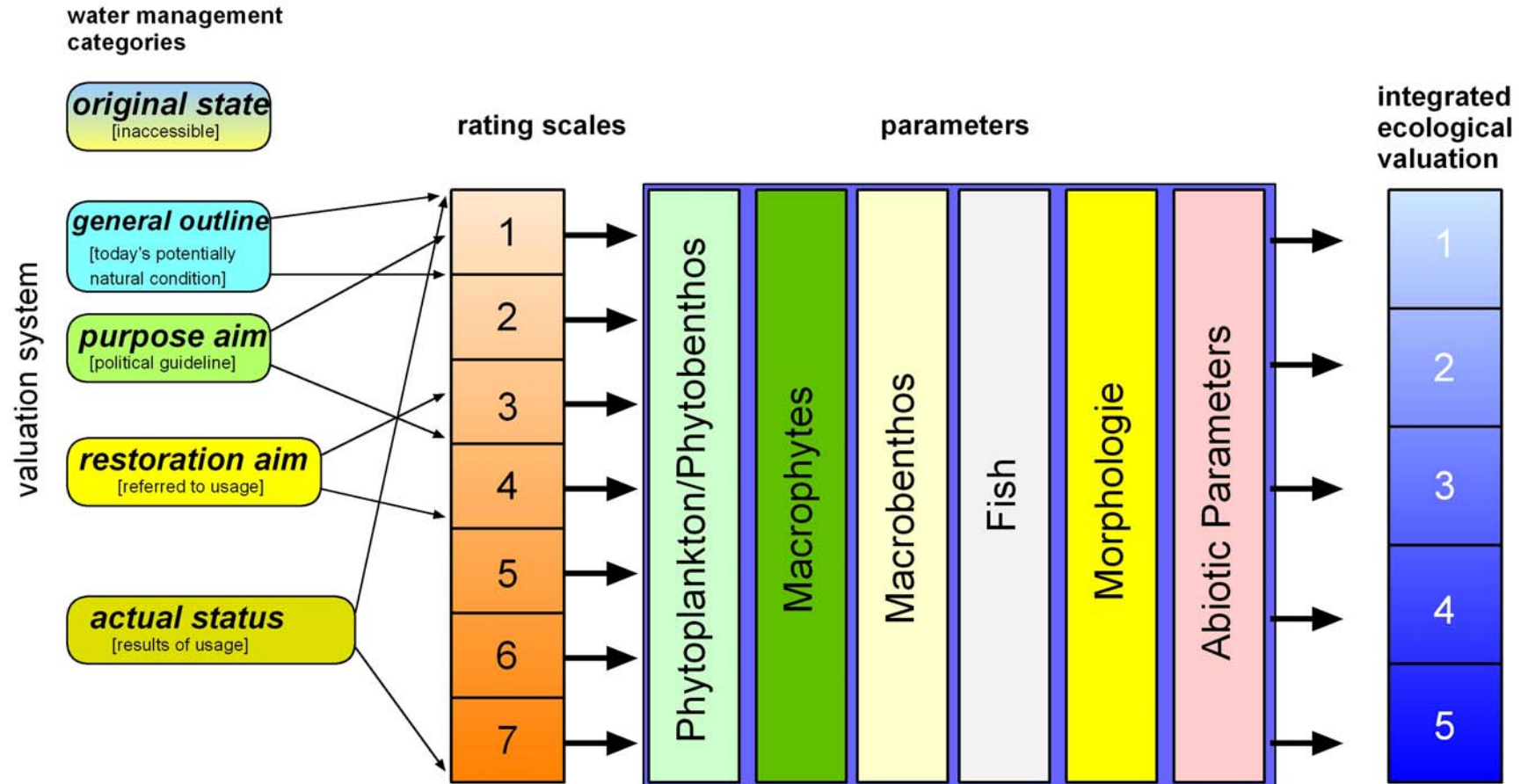


Common quail (*Coturnix coturnix*)

5. Usage of Waters

Presentation of Investigation Results

Integrated scientific valuation system for water pollution control



5. Usage of Waters

Ecological valuation of Waters

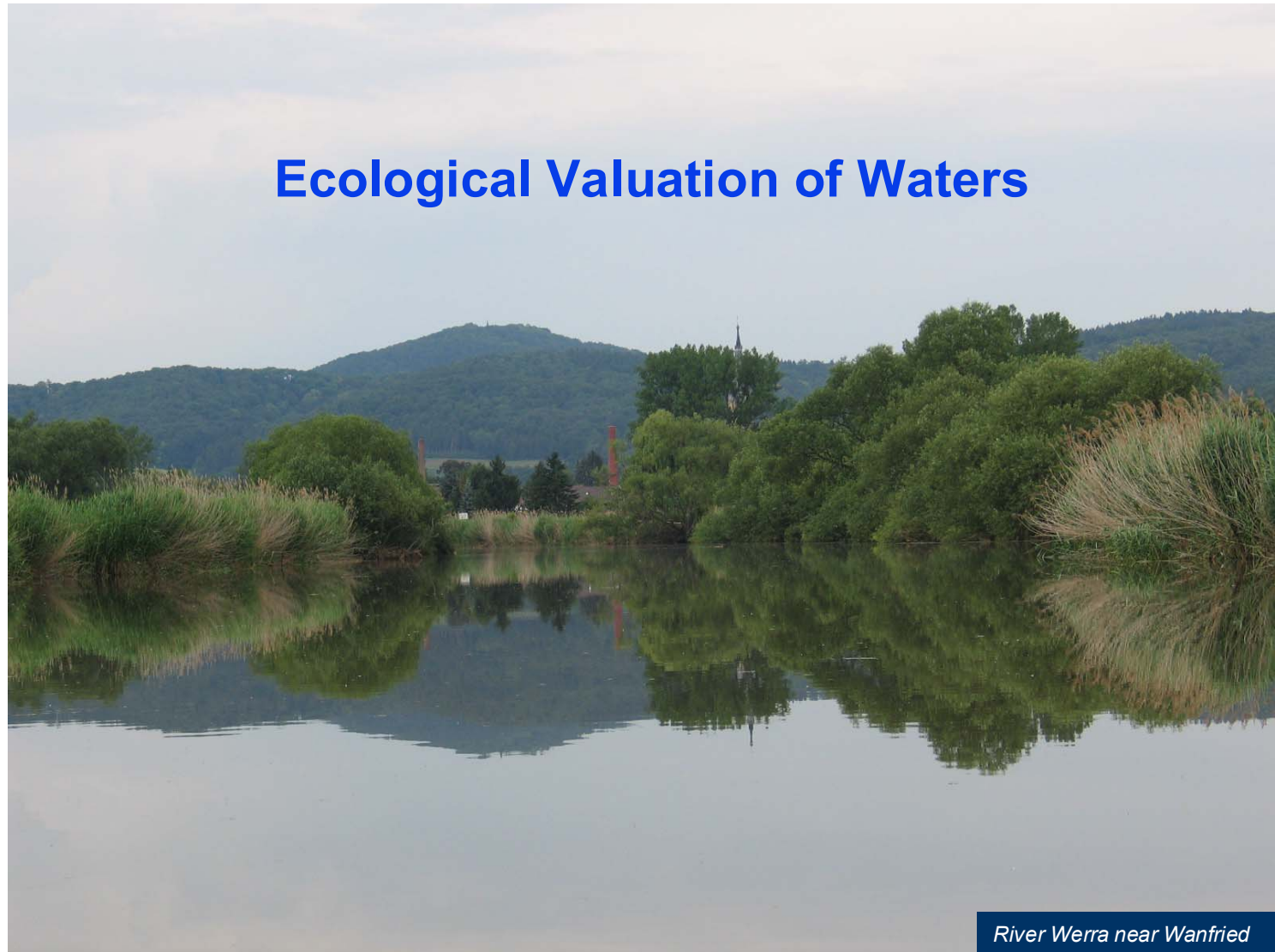
Investigations and measurements have to be based on scientific methods.

Evaluation of waters, ecosystems or any part of nature is a social and political decision.

Social and political decisions should be based on scientific findings.

5. Usage of Waters / Ecological valuation of Waters

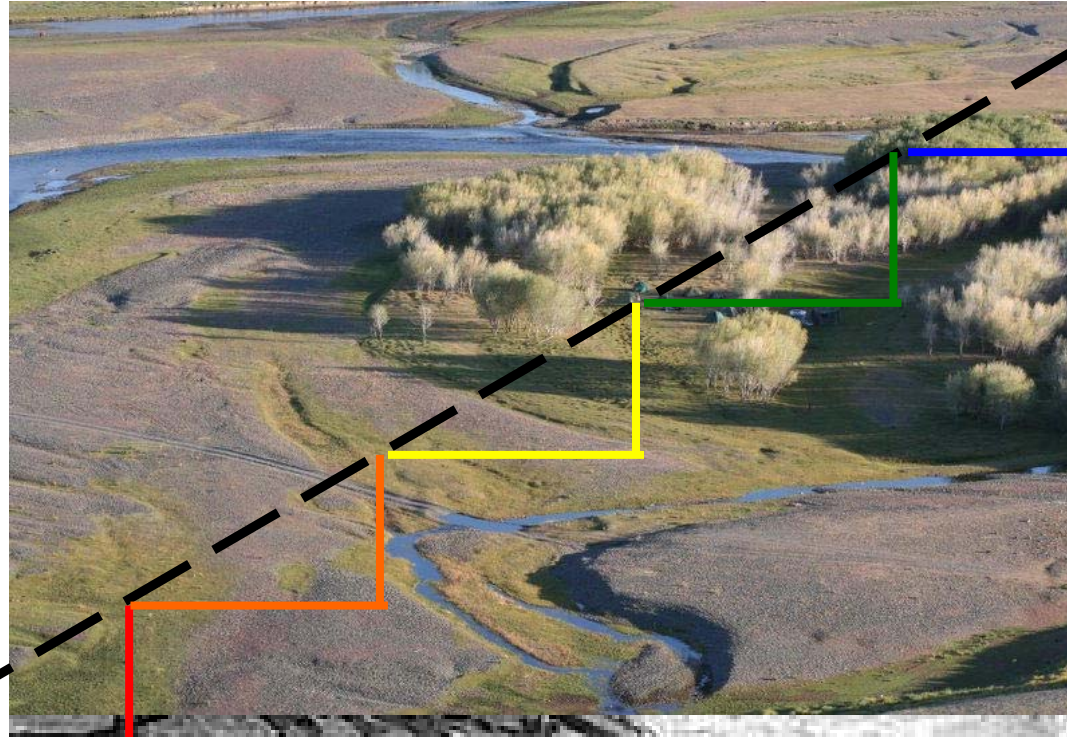
Ecological Valuation of Waters



River Werra near Wanfried

5. Usage of Waters / Ecological valuation of Waters

- Valuation is subjective and characterised by social conventions
- Consensus is: **bad = anthropogenous**; **very good = no anthropogene influence**



Quality gradients are basically continuous

Class-/Stepsystems present the continuum incomplete

5. Usage of Waters / Ecological valuation of Waters

- Classes only seem to be equal in valuation systems



- in practice they are not equidistant: e.g. Chloride (LAWA-classification)
[chloride in mg/l]



- **organisms react on threshold values:**
- e.g.: phosphor: decrease in River Ruhr from 1.2 mg/l auf 0.1 mg/l between 1980 and 1998

Ernst A. Nusch (Head of Laboratory, Ruhrverband, 1998):

"When do algae finally take notice of our studies about eutrophication?"

5. Usage of Waters / Ecological valuation of Waters

German Valuation Systems are traditionally divided into 7 steps
(I-IV, with 3 intermediate stages)



Political objective in Germany always was Quality Class II

Water Quality Atlas was planned including the following (developed) Systems:

- Saprobie/organic pollution (DIN-procedure)
- Trophie / Nutrient Load
- Acidification
- Quality of wetland and waters structure
- Quality Classes referred to chemical parameters

All Systems referred to ecological effectiveness of specific stressors and could be used for analysing deficits and preservation of evidence.

5. Usage of Waters

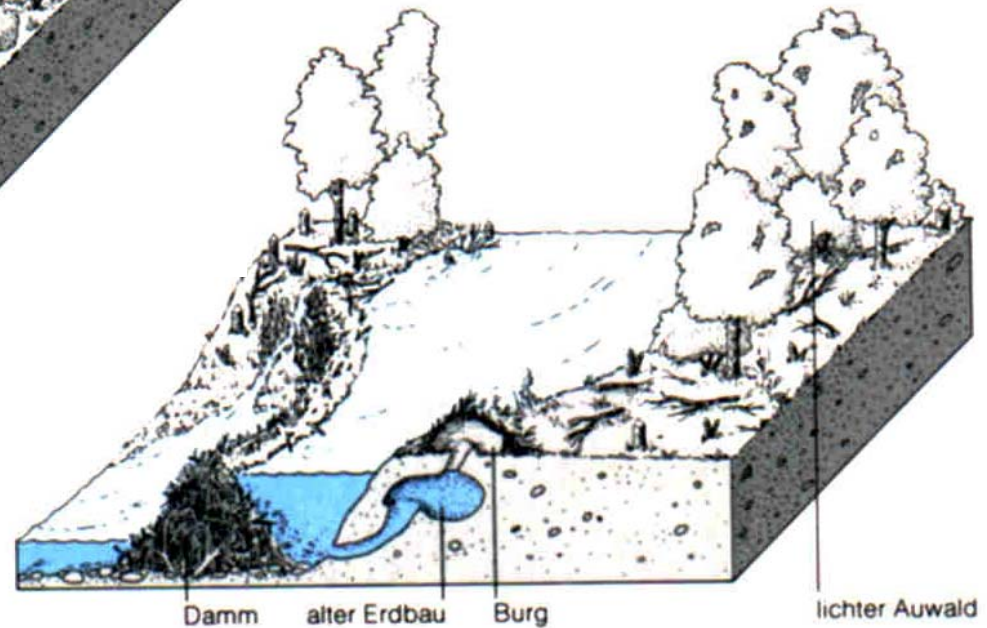
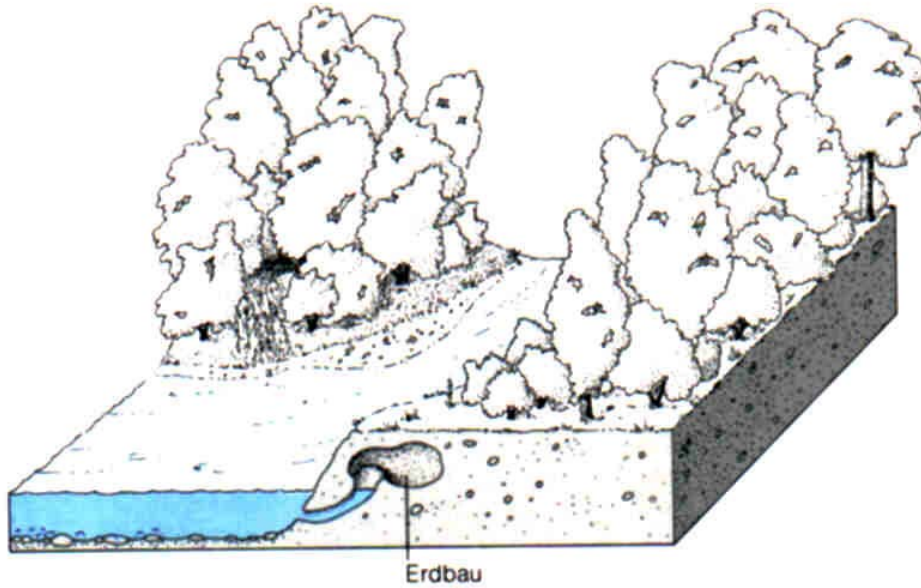
Effects of different usages on waters

Waters and their wetlands are:

- areas of settlement
- agricultural areas
- drinking water donor
- process water donor
- energy source
- waterways
- areas of wood production
- fishing grounds
- hunting grounds
- collectors of wastewater
- ...

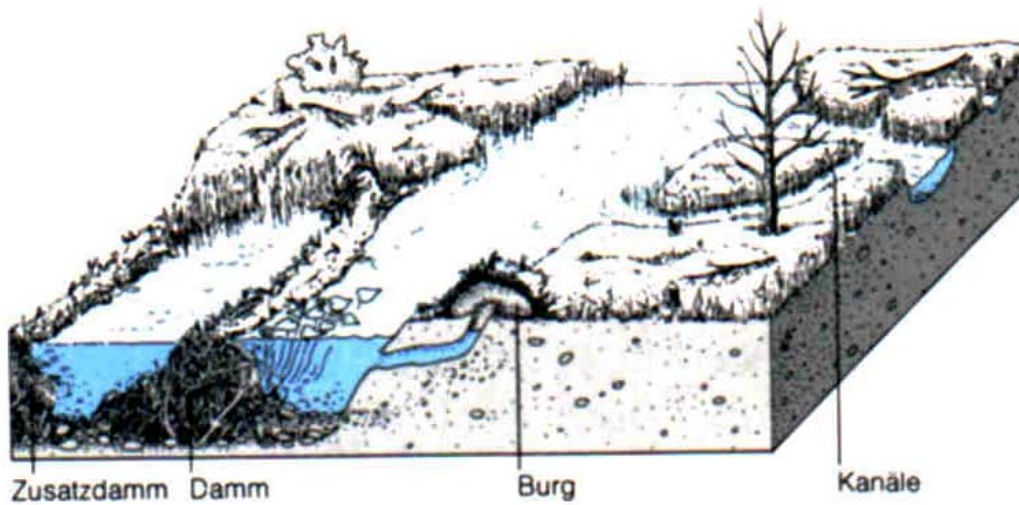


5. Usage of Waters / Waters as settlement areas

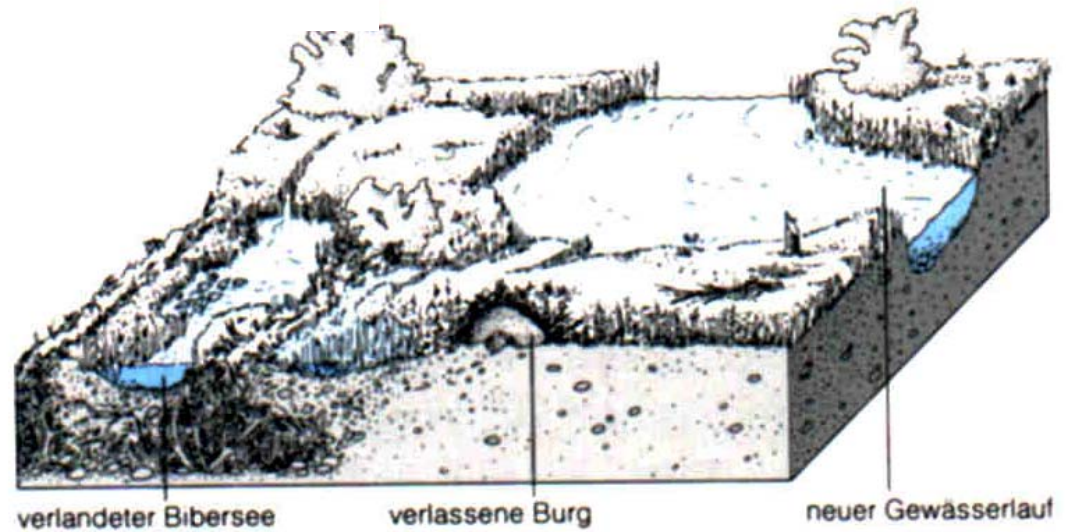


The beaver dam

5. Usage of Waters / Waters as settlement areas



The beaver creates landscape and hydrologic balance



5. Usage of Waters / Waters as settlement areas

Allocation of woodlands and fields in Europe

7th Century
13th Century

woodlands

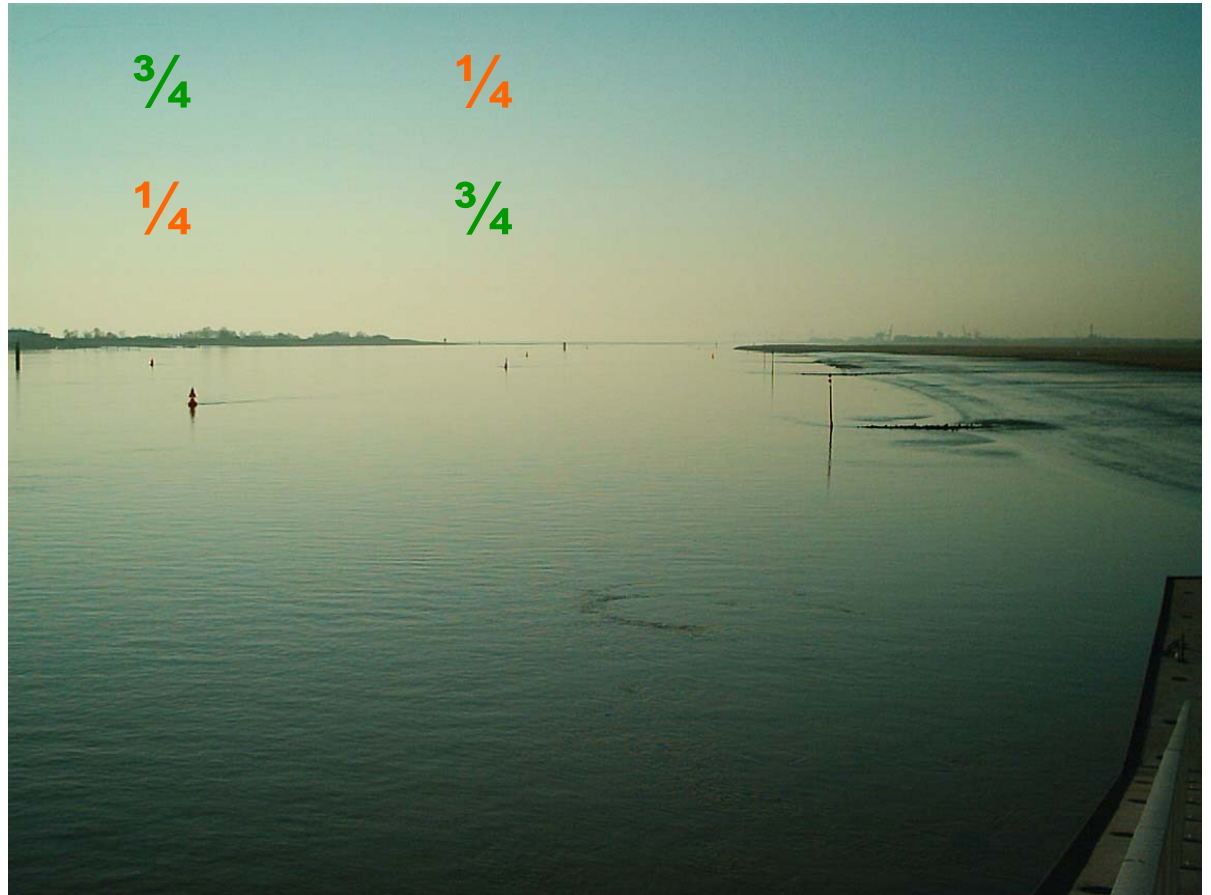
fields

$\frac{3}{4}$

$\frac{1}{4}$

$\frac{1}{4}$

$\frac{3}{4}$



5. Usage of Waters / Waters as waterways



Shape of the Oberrhein

before rectification by Tulla (left),

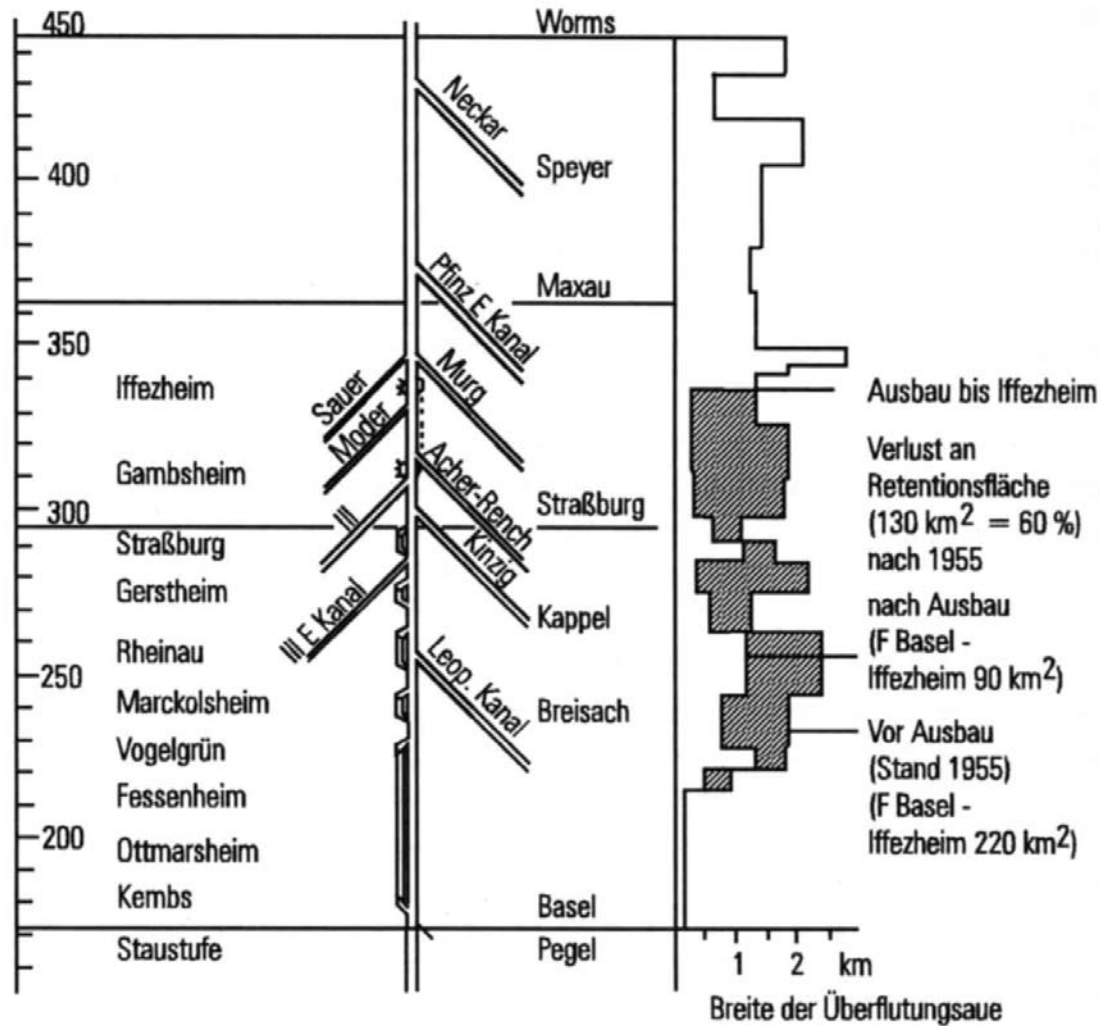
after the rectification (center) and

after modern river training (right)

(acc. to CARBIENER et al. 1986)

5. Usage of Waters / Waters as waterways

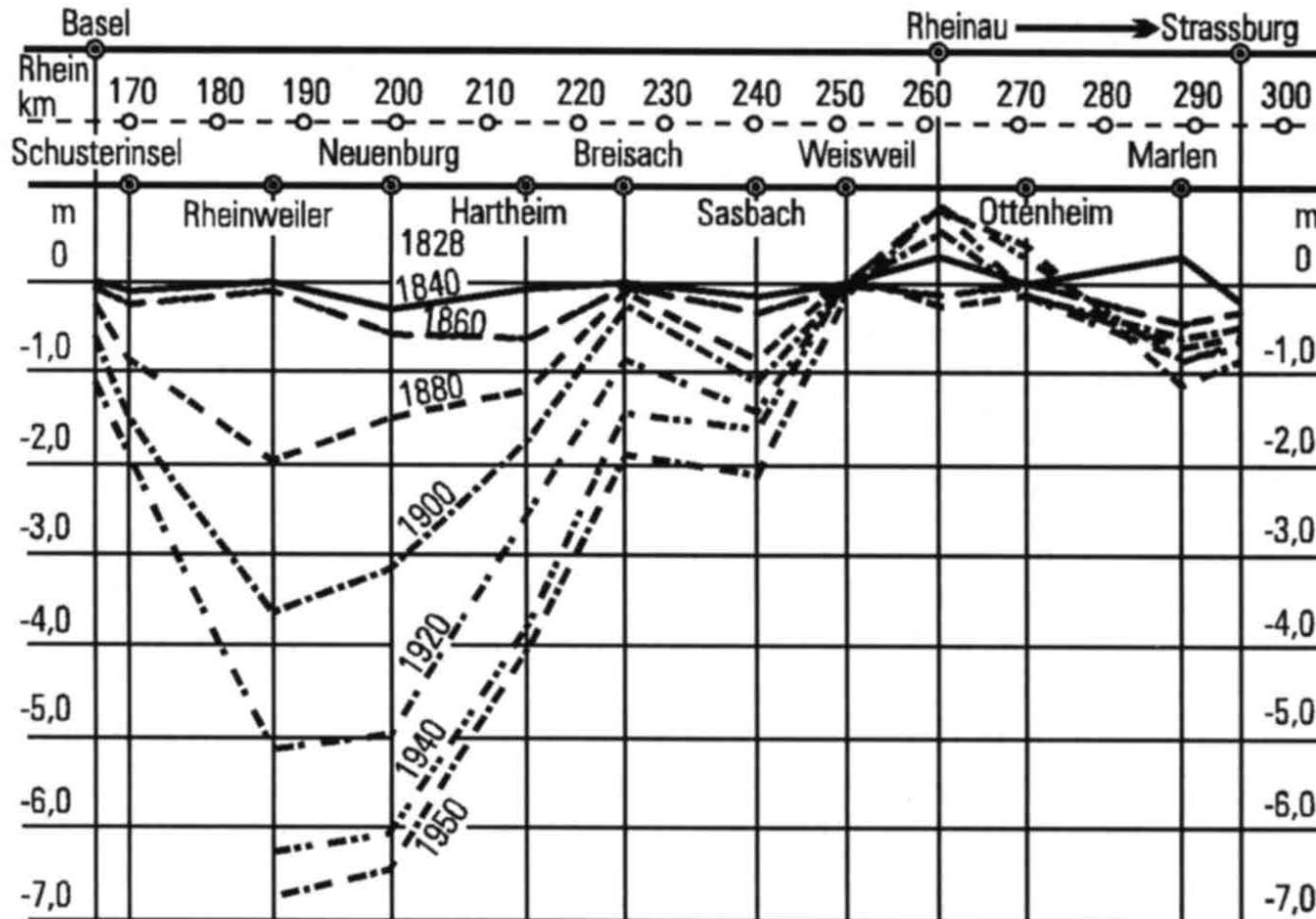
Implications of Rectification of the River Rhine by Tulla



Loss of wetland areas on Oberrhein
(HLU et al. 1988)

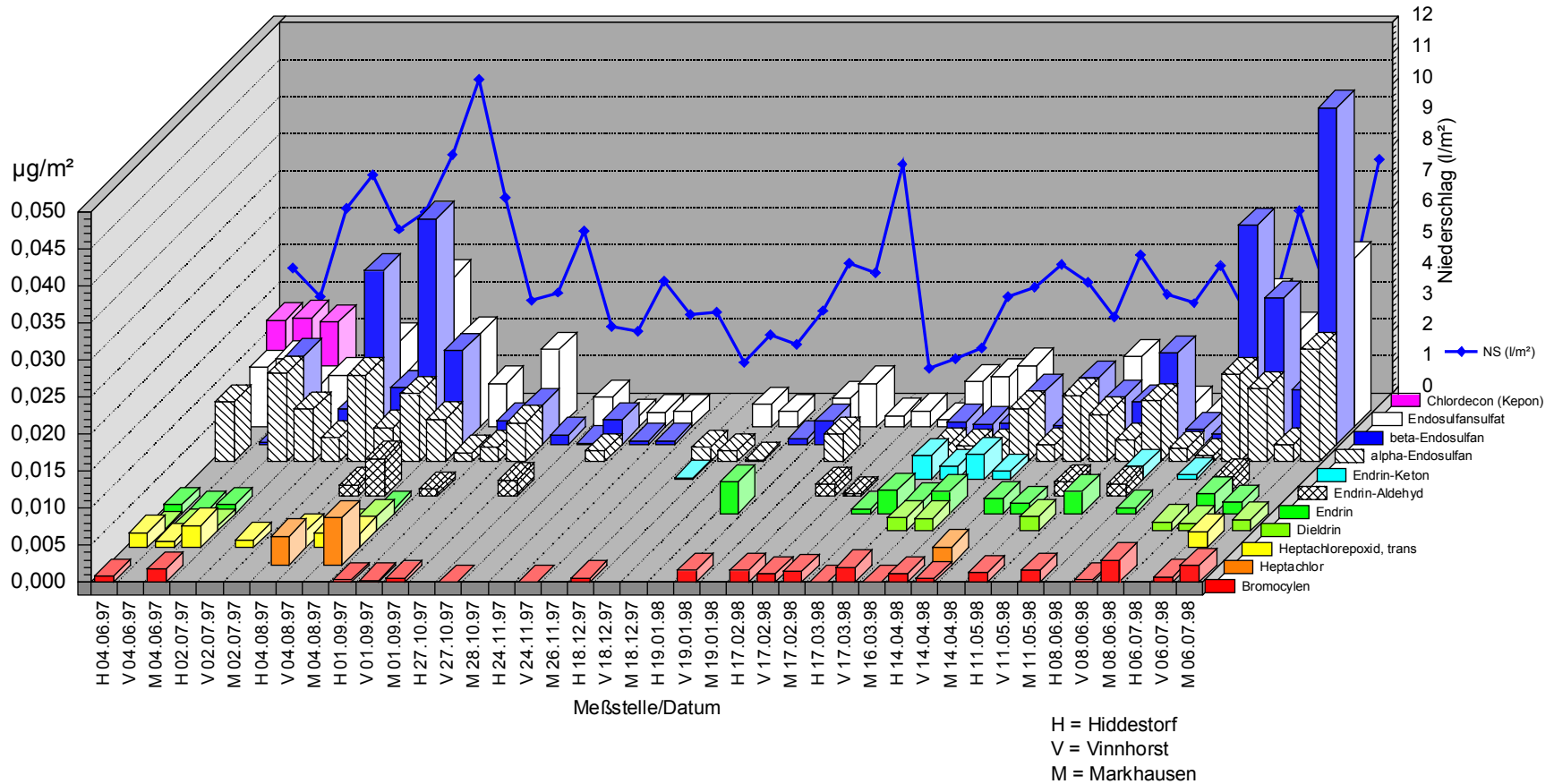
5. Usage of Waters / Waters as waterways

Implications of Rectification of the River Rhine by Tulla



Deepening of the River Rhine and depression of water level in the River Rhine between 1828 und 1950 (from: RAABE 1968)

5. Usage of Waters / chemical loads



Nonvolatile alkyl halides in rainwater (1997-1998)

5. Usage of Waters / nutrient loads



floating algae (indicators of hypertrophy)

5. Usage of Waters / nutrient loads



Weedage; lowland stream (Lower Saxony)

5. Usage of Waters / nutrient loads



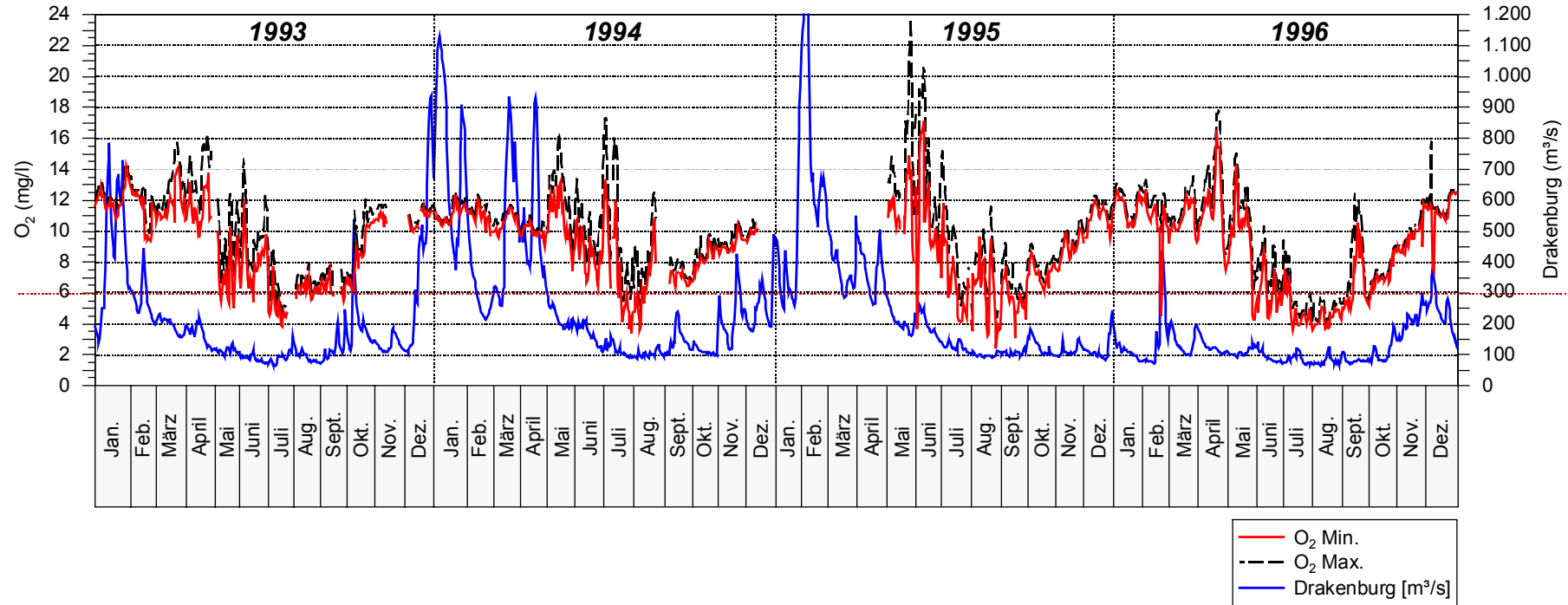
Weedage; Gräfte (Emsland)

5. Usage of Waters / nutrient loads



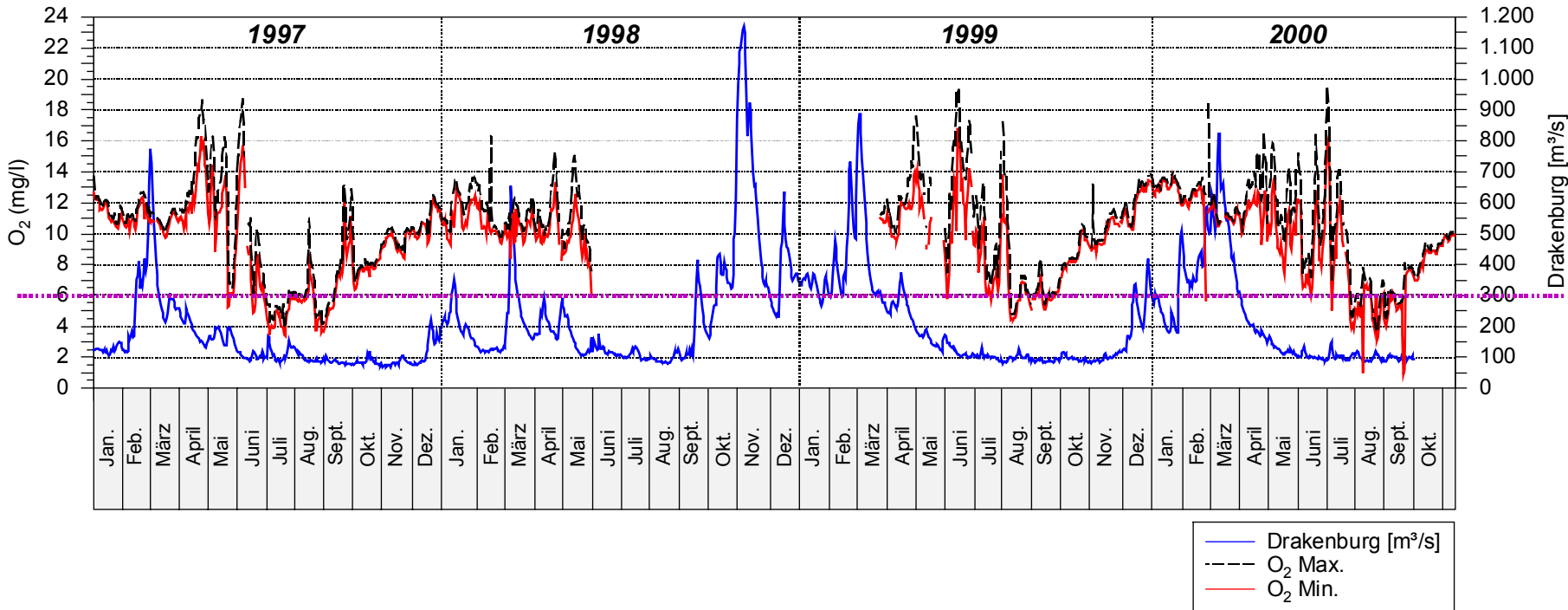
Secondary Pollution: sudsing by mechanically destroyed algae after power plant passage

5. Usage of Waters / nutrient loads



Oxygen concentrations (mg/l) und discharge (m³/s) of the Mittelweser (Drakenburg, Weser-km 277,750) 1993-1996

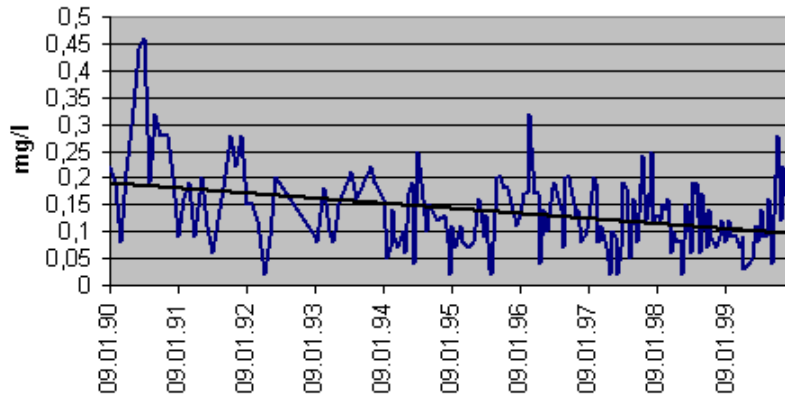
5. Usage of Waters / nutrient loads



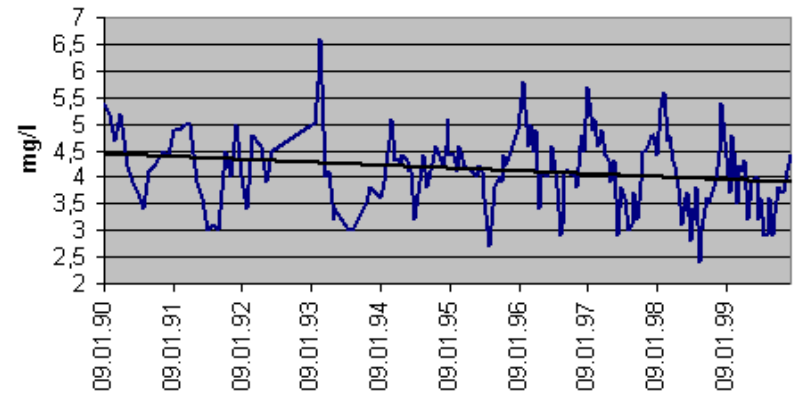
Oxygen concentrations (mg/l) und discharge (m^3/s) of the Mittelweser (Drakenburg, Weser-km 277,750) 1997-2000

5. Usage of Waters / nutrient loads

Hemeln, Weser,
Station: 43352010, oPO4-P



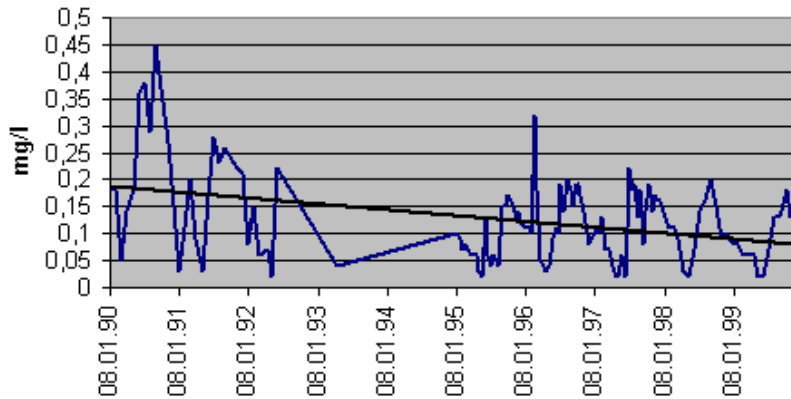
Hemeln, Weser,
Station: 43352010, NO3N



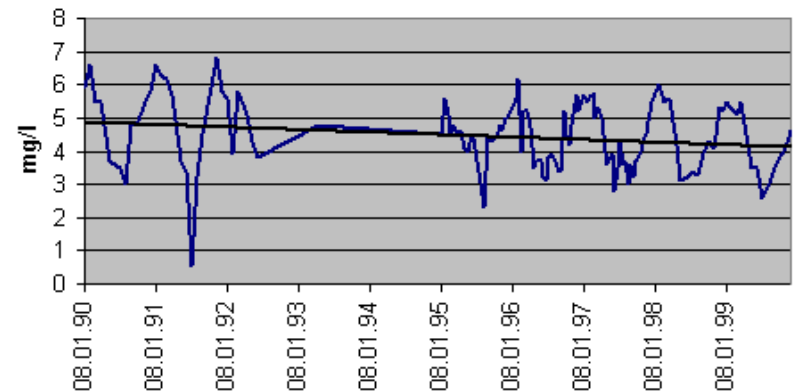
Concentrations (mg/l) of nutrients **orthophosphate** and **nitrate** at monitoring station **Hemeln** (Weser-km 11,7)

5. Usage of Waters / nutrient loads

Drakenburg, Weser,
Station: 47912026, oP04-P



Drakenburg, Weser,
Station: 47912026, NO3N



Concentrations (mg/l) of nutrients **orthophosphate** and **nitrate** at monitoring station **Drakenburg** (Weser-km 277,750)

5. Usage of Waters / nutrient loads and ecological effects



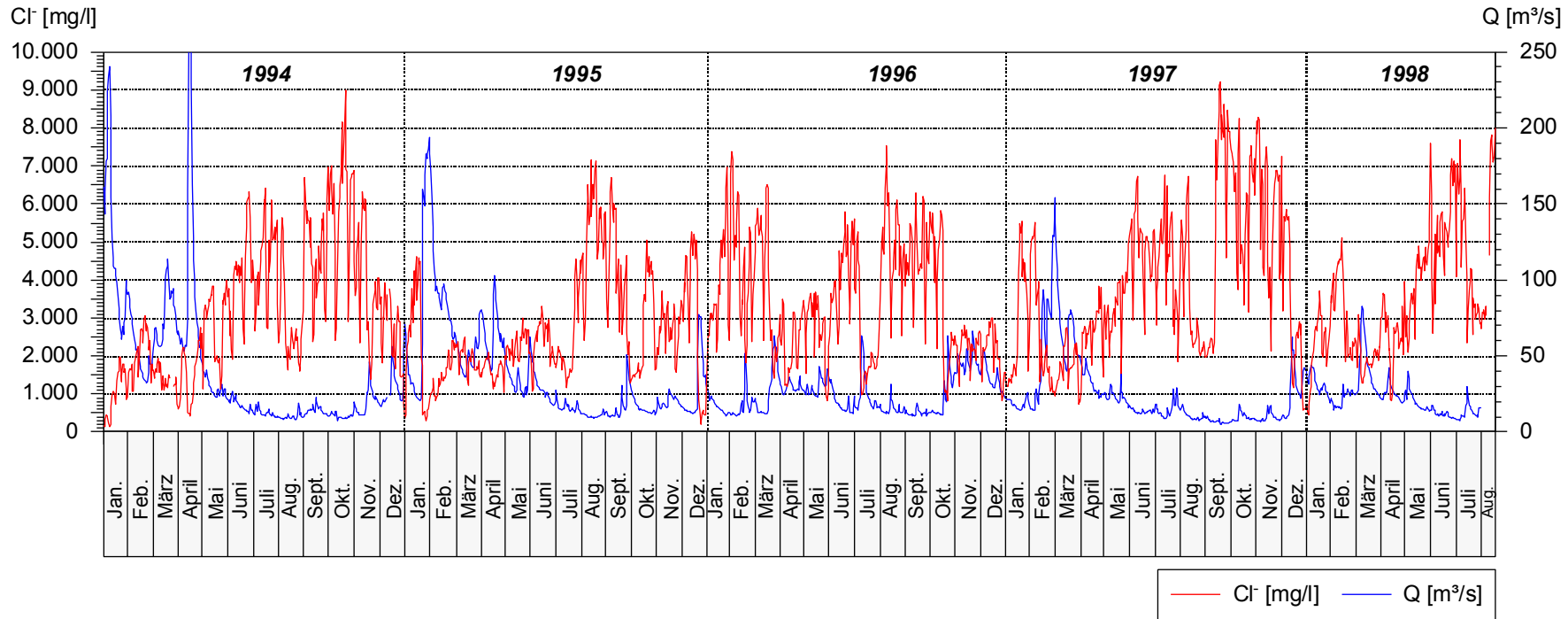
Sediment sample with dying mussels (*Corbicula fluminalis*) (Juli 2001)

5. Usage of Waters / heavy metal loads

Heavy metals in sediment of Söse-Barrage (from: MATSCHULLAT et al. 1994)

	min./max.	geog. background
Cd ($\mu\text{g/g}$)	2,1-7,9	0,13
Pb ($\mu\text{g/g}$)	350-830	14
Zn ($\mu\text{g/g}$)	580-1380	77

5. Usage of Waters / salt loads



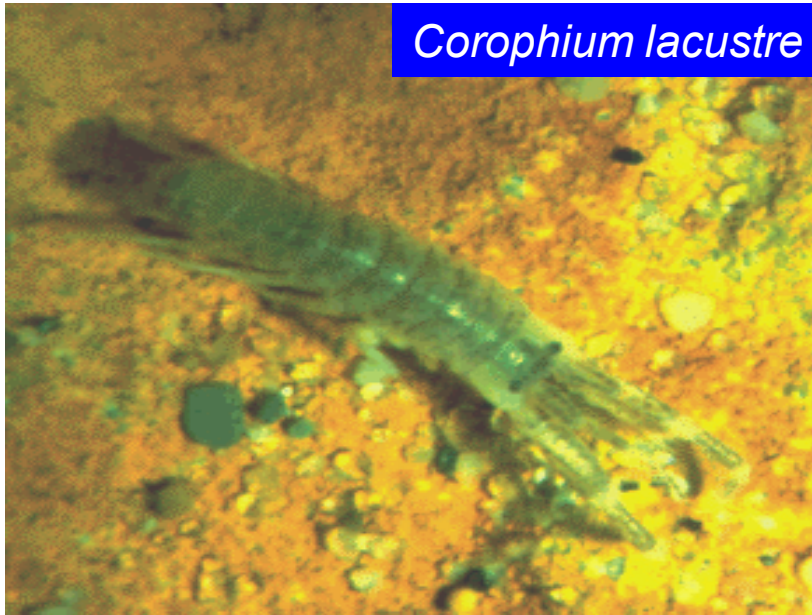
Chloride concentrations [mg/l] and discharge [m³/s] of River Werra (Gerstungen) Jan. 1994 - Aug. 1998

5. Usage of Waters / salt loads



Gammarus tigrinus (striped amphipod)

5. Usage of Waters / salt loads



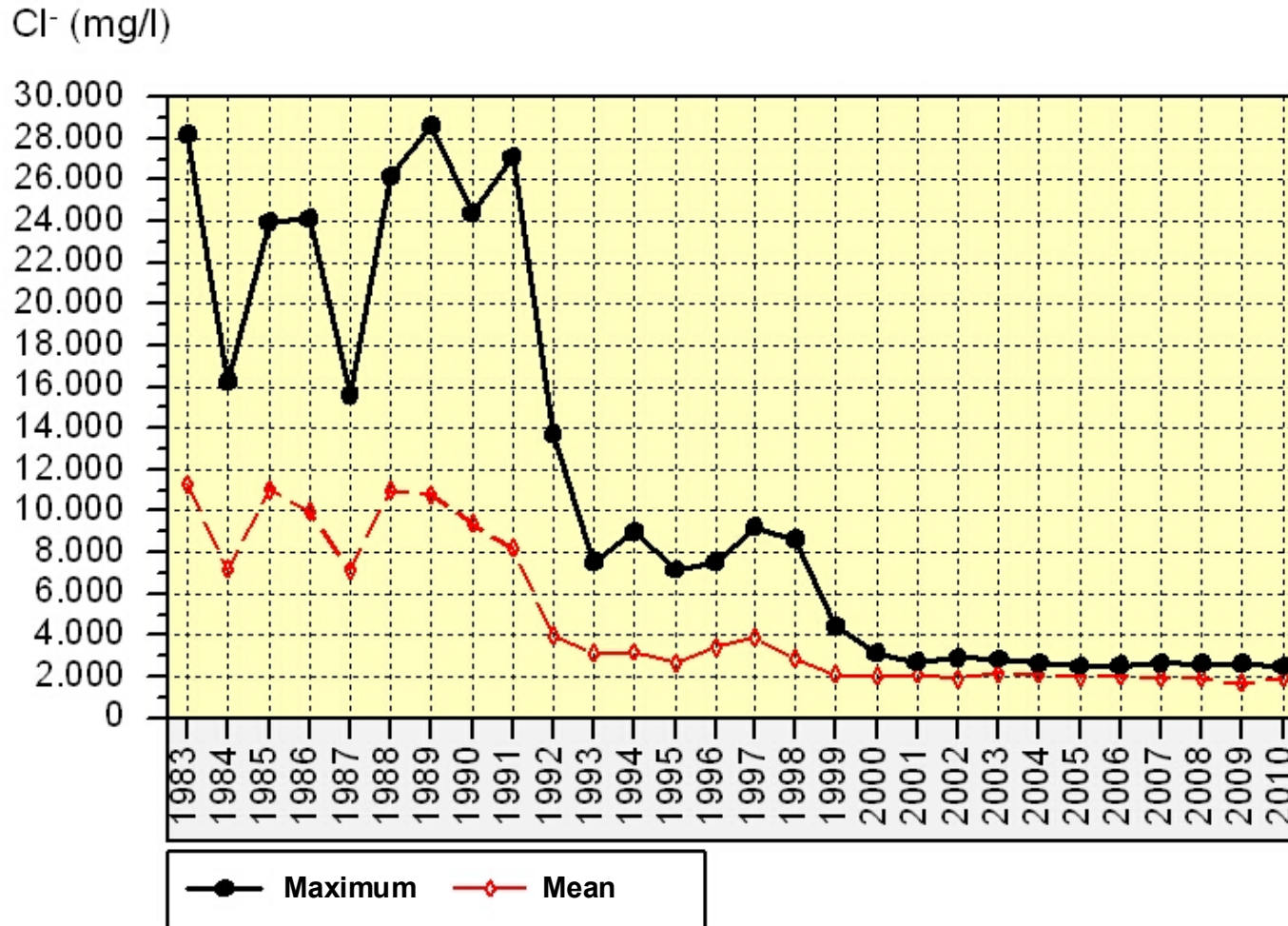
Corophium lacustre



Balanus improvisus

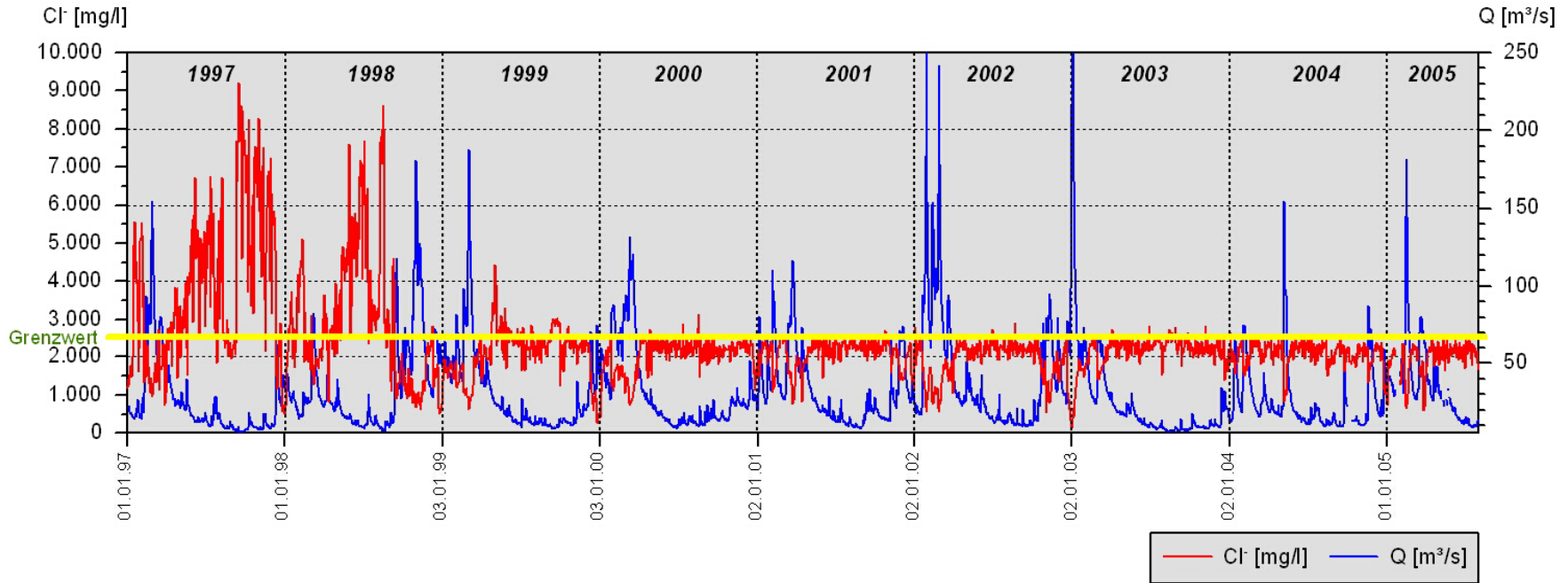
Brackish water organisms: *Corophium lacustre* (mud shrimp), *Balanus improvisus*. Both taxa originate from estuary and the North Sea

5. Usage of Waters / salt loads



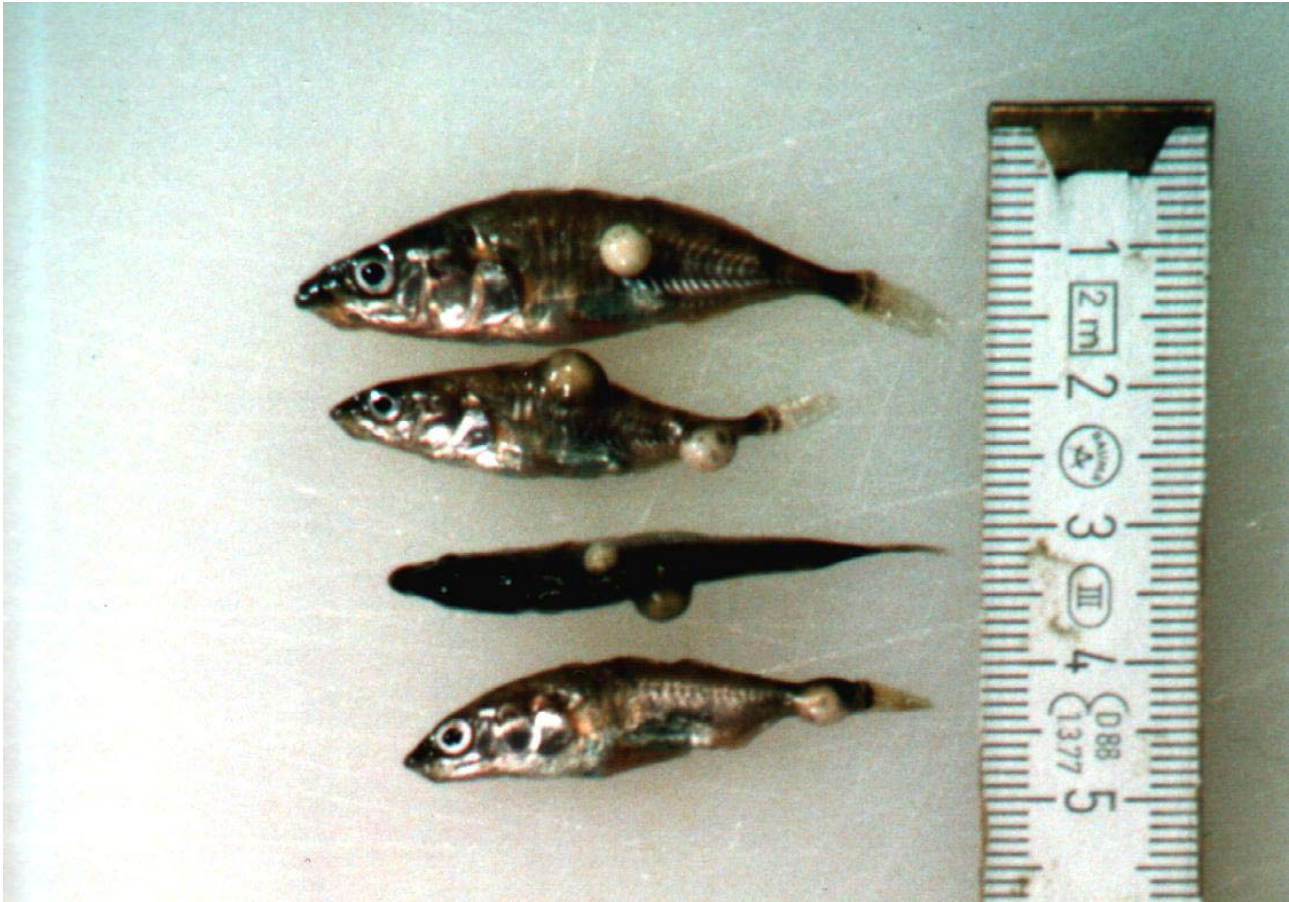
Chloride concentrations of the River Werra (monitoring station: Gerstungen) (annual data [mg/l] 1982-2010)

5. Usage of Waters / salt loads



Chloride concentrations (daily data [mg/l]) und discharge (daily data [m³/s]) of the Werra, (monitoring station: Gerstungen) 1997 – 2005

5. Usage of Waters / salt loads



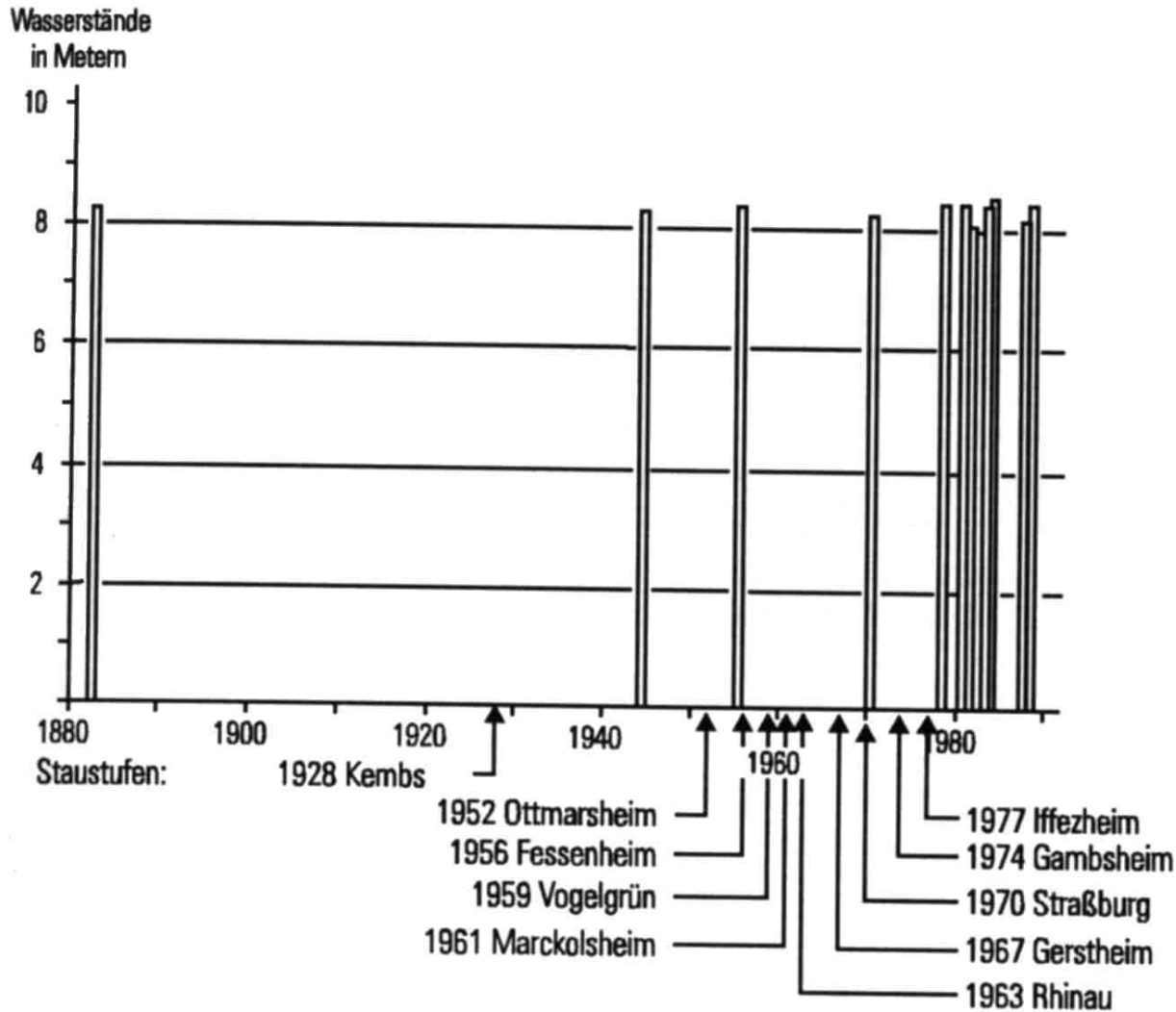
Deseased sticklebacks (necrosis) by high salt (potash-) concentrations

5. Usage of Waters / technical construction of waters



Stream in trapezium river training (Welle, Emsland)

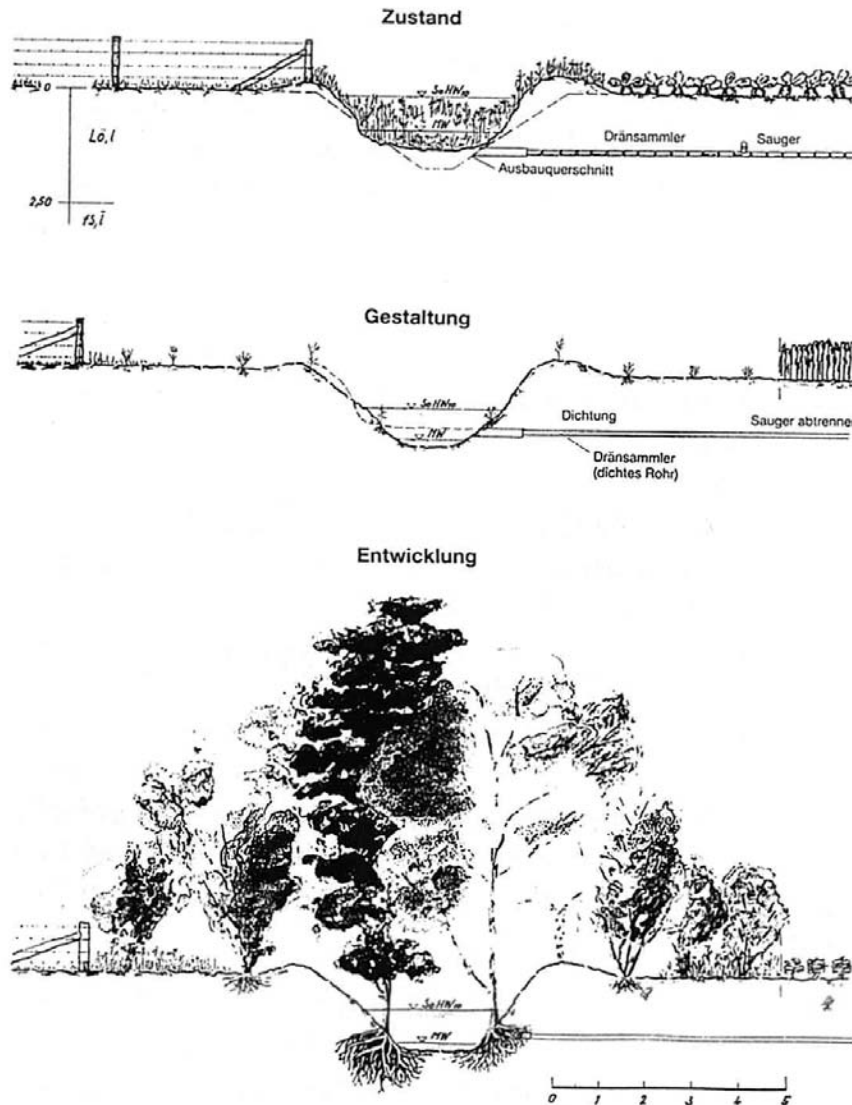
5. Usage of Waters / technical construction of waters



Increase of flood events

(HLU et al. 1988)

5. Usage of Waters / technical construction of waters



Development potential by renaturation of brooks and streams

Top: actual state;

Centre: future state;

Bottom: state after 10 years of vegetation development

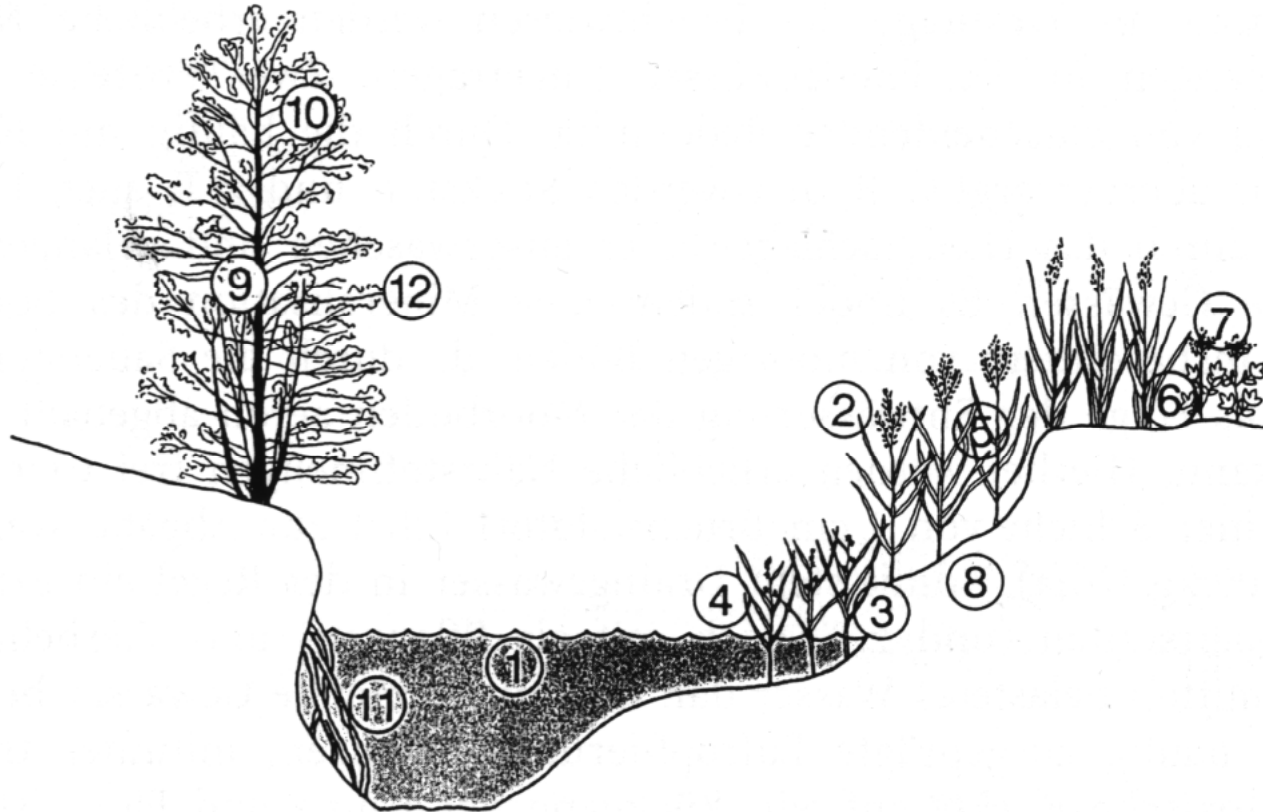
(from: LWA 1989)

5. Usage of Waters / melioration



Weir with deduction building (Lohner Bach; Emsland)

5. Usage of Waters / technical construction of waters



Importance of river bank vegetation for quality of waters: **1** = shadowing minimises warming of water, **2** = development of insects as food for fish, **3** = habitat of insect larvae for pupation, **4** = oviposition of insects, **5** = habitat and refuge of insects, **6** = breeding place for birds, **7** = habitat of butterflies and beetles, **8** = riparian stabilisation by plant roots, **9** = alder as habitat for birds, **10** = habitat of insects, **11** = alder roots give shelter to fish, **12** = leaves and dead wood are nutrition to aquatic invertebrates (nach MADSEN 1995)

5. Usage of Waters / technical construction of waters



Drainage influent to agricultural stream. Iron oxide and algae (eutrophication) are visible

5. Usage of Waters / technical fixation of waters



Fixation of embankment with cement and steelwall (artificial cataract)

5. Usage of Waters / technical fixation of waters



Fixation of embankment by quarrystone rubble and geotextile (Aller)

5. Usage of Waters / technical fixation of waters



Fixation of the riverbed by cement basins (Lengericher Dorfbach/Emsland)

5. Usage of Waters / waterway construction



Cargo ship on River Weser. Banks with levee, moulded quarrystone rubble and paved ferryboat ramp

5. Usage of Waters / waterway construction



Banks with quarrystone rubble(River Weser)

5. Usage of Waters / effects of extreme weather effects



Floods at Deutsches Eck/Koblenz (2000)

5. Usage of Waters / effects of extreme weather effects



Floods at River Weser (Photo: FlussGebietsGemeinschaft Weser 2002)

Historic view on River Rhine



The natural River Rhine at Isteiner Klotz,
Painting by Peter Birmann (1758-1844), from: Hölzinger 1987

Present-day view on River Rhine

Der Rhein bei Istein heute, Blick nach Süden



The River Rhine at Istein today (2000)
(Photo by Guido Haas)