Restoration of Lowland Rivers in North Germany – a few thoughts about habitats to be improved[i]

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Preliminary remark

The following text collects the views of a limnologist, being angler for more than 40 years. These views are heavily influenced by local observation, the knowledge of organisms as indicators and the perception of the organisms` absence, illness or health. Only the latter, seen on a population scale with all the species typical for the locality, can be accepted as the goal for everybodys ways and doings – just as the german laws on the basis of the EU Water Framework Directive ask for. The examples focus on the River Elbe catchment in the surroundings of the Metropolitan Region of Hamburg, but are representative for most of „Das Norddeutsche Tiefland".

1. Introduction

The North German Lowland („Das Norddeutsche Tiefland", fig. 1), as indicated by it`s name, in the imagination of many people appears as a flat, marshy area, in which sluggish, muddy waters with bream and other species of the carp family might flow. In fact, reaching from the south, e.g. the vicinity of the city of Dresden, north to the Baltic Sea and the North Sea, much of it`s territory is characterised by moranes and dunes – remnants of different glacial ages, which ruled the landscape for a long time. Water erosion created in most areas brook and river beds dominated by boulders, cobbles and gravel, thus giving gravel spawners optimal conditions to thrive – and among them the long distance migrators as salmon. This has been documented by catch statistics over centuries and is to be found in the literature, as well (example for the river Elbe: Riedel-Lorjé & Gaumert 1982).

Fig. 1: The North German Lowland with parts of South Denmark.

Altitudes ranging from 40-60-80 m above sea level predominate the morane areas with „hills“ up to 100 m. This is just the same situation as is to be found in Denmark, with the remarkable discrepancy that the landscape`s name instead of „Lowland“ is called „Søhøjlandet“ (The Lake Highlands) there. With this definition everybody is able to imagine without problems, that ground water fed, summer cold, murmuring trout brooks flow downstream the hills to the sea . . .

We learn: „Das Norddeutsche Tiefland“ is not (totally) flat. It has been home for the inhabitants of summer cold watercourses in the past – and this is to what we have to restore the present day sand deserts.

2. History of river restoration in Germany

The improvement of the hygienic situation in urban areas by the invention of the flushing toilet and the increasing industrialisation in the 19th century resulted in fast and heavy deterioration of german rivers – as in many other places of the world. Combined with the construction of big reservoirs for electricity or flood prevention purposes and heavy exploitation of sensitive fish populations like sturgeon a rapid decline of the natural production potential of river systems occurred. Drainage systems and the straightening of watercourses for intensified agriculture up to the headwaters minimised the colonization even of tiny brooks – with next to no natural systems being left.

Although there had been complaints from the beginning, it was not until the 1970s that consequent action was taken at the places of the problems` origin. With a strong water law from about 1977 on the wastewater situation was improved within two decades.

The goal, however, water quality class II, was not achieved to the requested extent (fig. 2), although chemical data seem to indicate better conditions. The lacking time scale from the middle of the 1990s up to now does not matter: There have been no changes to be reported.

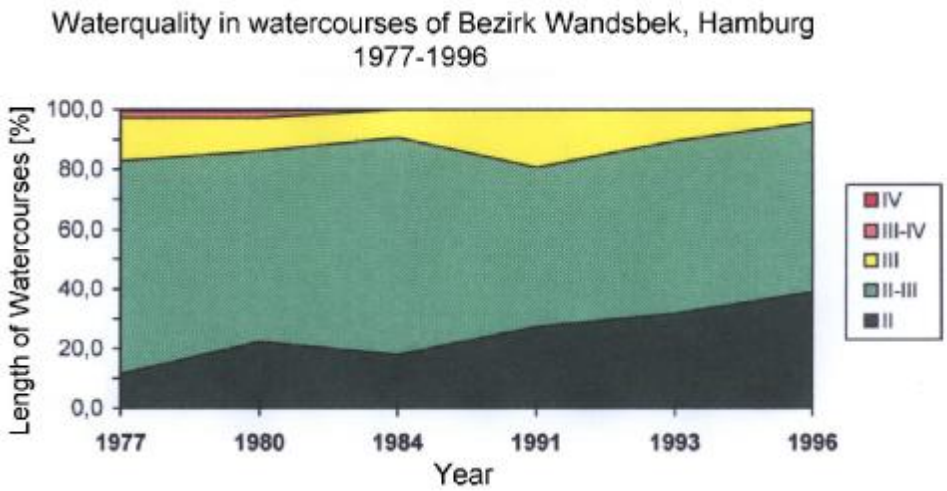

Fig. 2: Example for the development of water quality (cf. Tent, 1999).

Aquatic ecologists interpret this situation as the lacking of a rich structured habitat quality, being able to give more vulnerable species a chance to reproduce to a higher extent and thus being represented in the statistical samples. Main cause of this low level habitat quality is the continuing hard watercourse maintenance, in rural areas accompanied by chronic effects of excessive land use, in urban areas by road runoff etc.

Another cause for lacking improvements of habitats over decennia has been the loss and lack of knowledge about local ecological potentials in Germany, as given by the (disturbed) natural geomorphological structures. Although local names like Fischbek (Fish Beck / Creek), Steinbek (Stone Beck) and Perlbach (Pearl Brook – *by Margaritifera margaritifera L.*) indicate those high potentials it took a long time to accept examples of best practice in north Germany. – This stands in contrast to activities in the USA, Canada and Scandinavia, where first restoration attempts were continued after World War II and intensified from the 1970s on. The famous Danish experience was presented by Madsen (1995), showing results of shifting hard river maintenance to more gentle methods and of active restoration work.

3. Habitat improvements – first steps

There have always been engaged persons longing for support and restoration of „their" watercourses. Among these were many anglers, members of nature conservation clubs and persons generally interested in a healthy state of their surroundings (Janssen & Gäbler 1984, Janssen 1985, Tent 1988). A situation to be successful, however, for many decades did not exist. Up into the 1980s watercourse maintenance organisations, often supported by the former water authority engineers, who managed the former drainage and straightening works up to the streams` headwaters, fought hard to keep others out of „their" rivers. While for the general public this only was a sad fact, anglers in many cases lost the lease / rent of the beloved rivers.

Where ideas for improvements were accepted, however, pilot stretches with in-stream boulder and gravel placement (fig. 3) showed that no adverse reaction for neighbourhood landuse was to be awaited. In some regions the alder (climate factor for the aquatic habitats, food supply, shelter for the aquatic organisms) and other plants of the shoreline were no longer mowed and over time were able to present the natural view of our watercourses. Plant succession led from simple grass structures to the direction of alderwood-species. Biological indicators, e.g. the black stork, in addition to trout year class improvement and the (re-)appearance of specific invertebrates, have proven those pilot activities successful (Janssen et al. 2004).

Fig. 3: The first re-introduced boulder riffle, inducing turbulence and presenting spawning possibilities, River Este, 1983.

Another means in many federal states of Germany – by private or official initiatives – was the installation of „Bachpatenschaften" (adopt-a-stream). Especially where watercourses are

public spaces, e.g. in cities, this is a chance to integrate the vast number of engaged people being willing to lend a hand to the „brooks at the doorstep“ (Tent 1998 b). Investigations have proven that these efforts are successful even in metropolitan cities as Hamburg – there is no problem to alter canalised brooks, geomorphologically characterised by morane area, into the former trout stream (Tent 2003).

On the other hand, in many places authorities carried out first restoration work, learning step by step (Tent 1998 a). The keener managers realised to get into river restoration whereever some kind of construction work came ahead, e.g. with the construction or restoration of bridges and weirs. Administrative organizations like the „Arbeitsgemeinschaft für die Reinhaltung [name of the River]“ were such stakeholders, too. An internet recherche with „ARGE [+ name of the river]“ or „Internationale Kommission [+ name of the river]“should bring good results for Rhein, Weser, Elbe etc. It has to be mentioned, however, that the rivers of north Germany (un)fortunately lacked such an awakening event as the heavy poisoning of the river Rhine, emanating 1986 from Sandoz, a chemical plant in Switzerland: As soon as 1987 the International Rhine-Commission lanced the first big ecological program, part of which is known in Germany as „Lachs 2000“. Main topics were further improvements in wastewater technology and the construction of big fish ladders in the Rhine itself. After re-thinking the goals later the program included the improvement of the important spawning and nursery sites in the tributaries, as well.
(Special emphasis has been laid to the „Wanderfischprogramm Nordrhein-Westfalen“(MUNLV 2001). Today, with increasing numbers of migratory fish, one realises a problem – heavily discussed in the first half of the 20th century by fishery biologists, already: For downstream migrators the power plants with an intake of most of the water discharge result in 20-100 % fish kills, each. So another adaption of the program is on it`s way – politics, natural and technical sciences etc. in co-operation!)

4. River Restoration with the Water Framework Directive (WFD)

4.1 Pre-period with foundations

In the 1990s in several parts of north Germany new chances arose from co-operations with new partners. Many institutions were installed, e.g. foundations, to spend their money for best practice projects in environmental protection. Thus a lot of river restoration projects could be initiated. Having the money for the start, in most cases it was no problem to raise other funding opportunities. In Lower Saxony, for instance, a proposed „Gewässerentwicklungsplan“ (GEPl) was the means to transport necessary alterations in and around the watercourses including the surrounding land use. The measures concern not only the main stream but the tributaries, former important spawning and nursery streams, as well.

Examples for necessary measures are

- Reducing and altering watercourse maintenance
- Re-establishment of stream continuity, altering weirs and other obstructions
- Re-introduction of gravel, boulders, stones and dead wood to narrow cross sections and induce turbulence, in the long term: induce the streams` own dynamics
- Buffer strips with natural succession, sometimes with initial alder planting
- Reduction of sand transport by lowering the pressure of adjacent land use; for aquatic organisms passable sand traps to be constructed, where necessary for a transitional period
- Felling of coniferous trees and development of wet deciduous woods

This brought river restoration in most GEPl-catchments from the situation of confrontation to co-operation (Tent 2000 a). The lack of money, as had been discussed before, was no longer a theme, because it is easy to find funding for specific measures being described in the GEPls.

Not only a variety of in-stream improvements has been set into reality but huge organism passages, too. But one example is the passage for the Elbe River at the weir Geesthacht, managed by the ARGE Elbe with important initial funding by the „Umweltstiftung der Hamburgischen Electricitäts-Werke“ (fig.4).

Fig. 4: Passage at Geesthacht weir, Elbe River *(photo from: ARGE Elbe and limnobios, 2004: Kontrolluntersuchungen im Fischaufstieg am Elbewehr bei Geesthacht, availabel as pdf-file under www.arge-elbe.de)*

4.2 The current process

The WFD is in force since the year 2000. Up until 2015 every waterbody shall reach a good ecological and chemical status. In Germany this is co-ordinated by the „Länderarbeitsgemeinschaft Wasser“ (LAWA) – to reach the goals is a task of the federal states. However, inspite the activities of the LAWA, there is no general activity to be seen to reach the clear goal. One main problem is that in many states` view the intermedium steps are perceived as points, not as flow in a schedule. By this up to now one third of the given timescale is lost, as parallel to different planning and administrating nearly no activities took place in the field – not to forget a few states with pilot measures . . .

With this clearly to be seen quite early there are publications, indicating that federalism runs itself to death by misdealing clear goals – it becomes obvious that the government of the Federal Republic of Germany has to take a lead in global settings to avoid multiplied failure (e.g. Berendes, K. 2002, Frenz 2002, Seidel & Rechenberg 2004, SRU 2004). But this misperception is not only a german phenomenon – the EU commission started to warn other countries, too. It seems as if there will be a lot of fines to be paid (cf. chapter 5.1.2, too) . . .

5. Outlook – bad signs, good prospects?

5.1 Bad signs

5.1.1 Sea Trout Catch as Indicator of recent River Elbe Deterioration

Although river restoration in international terms continues to be a field of intensive learning from each other there seem to exist parts of the society where natural science and nature`s

reality is neglected. To point it out with an example of the Elbe catchment: The importance of a healthy migration route for successful migration of sea trout through the limnic part of the Elbe Estuary, represented in catch statistics of the heath river Seeve flowing into the Elbe upstream Hamburg, has been clearly outlined. If the River Elbe discharge is low the seasonal activity of self purification and the tidal flow result in such a massive oxygen depletion within the canalised area of Hamburg Harbour that over tens of kilometers there is a total migration barrier for adult fish on their upstream migration (Tent 1984, 1994).

In this part of the Elbe the river was altered from a 2-5 m deep river for inland navigation to a 15 m deep canal for seagoing vessels. With this hard shift in the surface-depth ratio the reaeration is stressed heavily – with even higher stress by each following excavation dredging.

The catch statistics over decades show how biological indicators can be used to prove reality. They are a historic example for the water quality improvements, both during the years of effective wastewater treatment and after the GDR vanished. This reanimation led to salmon programs for the Elbe, too, with the federal state of Saxony taking the lead.

From the year 2000 on, however, dramatic changes occurred (fig. 5). While the improvements of the 1990s resulted in an about sixfold increase of sea trout numbers, which – compared to river systems like the Kolding Å in Denmark – is up to about half of the potential (the other half to be gained by catchment improvements of the Seeve, hopefully) the sudden drop directs towards „the bad old days`“ situation during heavy pollution. This stands in accordance to recent heavier seasonal collaps of the Elbe oxygen content in the Hamburg Harbour region since the year 2000, which is documented by internet presentations of the measuring stations of that area. In this case, as much of the wastewater burdon is gone, and the chronic exposure to heavy nutrient load (causing „secondary pollution“) did not alter much compared to the 1990s, only morphological changes can be the cause of the present day deterioration. Two big investigations have to be mentioned for the time ahead the deterioration: investment dredgings of the Elbe and landfilling for commercial purposes in the last huge shallow water and freshwater wadden area directly aside the critical stretch – the last powerful lung of the sick Elbe lost it`s function, is gone!

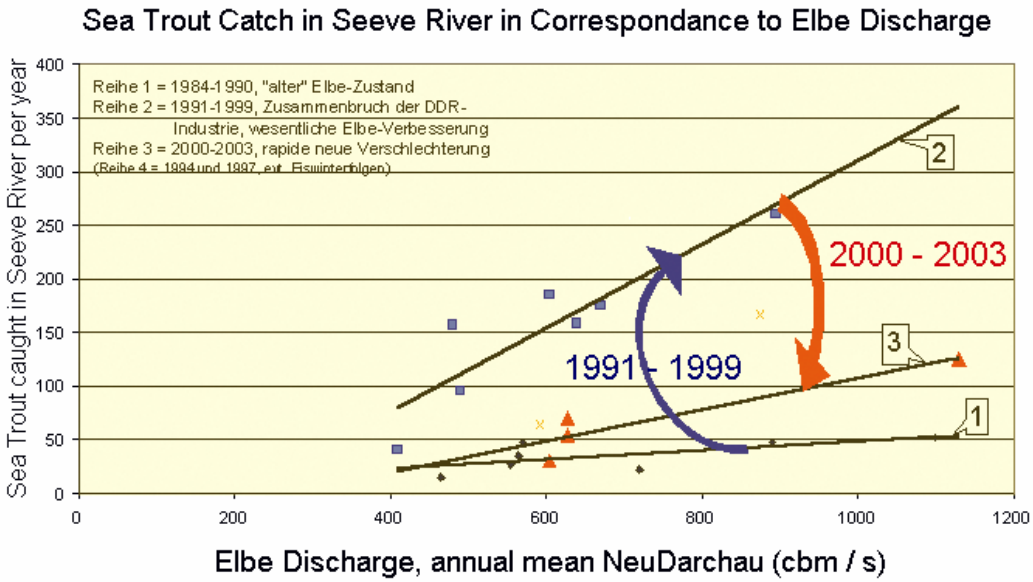

Fig. 5: Sea Trout of the Seeve River indicate improvements and recent deterioration of the Elbe.

With the next investment dredgings ahead, digging the tidal Elbe even deeper, it has to be quoted, that the compensation measures of the two mentioned investigations of the recent past failed – or: had the most important role been forgotten, the shallow water areas play for the survival of this river? There are hydrobiological and hydraulic investigations of the 1980s clearly revealing this crucial aspect. May there be hope for use of best knowledge to stabilise the Elbe – the WFD asks for a good status or a good potential, as well.

5.1.2 Information Pollution, counter-definitions of goals and reality

The following examples resemble what Petersen (2004) described. After citing the Danish Minister of Finance with a statement concerning the environment – with a political, totally wrong content, he concludes: „Statements like the just mentioned clearly demonstrate that apart from the real environmental problems, we all to a smaller or larger extent have severe problems of communicating the fact of things – to the media as well as to the elected politicians." and he continues „In this perspective good genuine, independent research and optimal monitoring programmes, and frequent assessments, are particularly useful tools – and maybe the only efficient ones – to wipe out untrue statements and perceptions." – Here but a few similarities from Germany:

„Die Elbe ist der fischartenreichste Fluss Europas" was to be read in august 2004 in a Hamburg newspaper, and there was more of that stuff. Imagining the various European streams it becomes clear quite soon that this declaration is of no worth: comparison of apples and pears has often mislead human thinking (in fact: the species lists of the Elbe and e.g. the Rhine are next to the same. Only by using different statistics – add marine species to the Elbe sum, leave them with the Rhine, leads to such headlines). The texts were printed just in the same period that the Elbe oxygen around Hamburg for the first time for years fell as low as 1 mg/l! No one reported about that. The following fish kills, represented for the public mostly by young smelt – millions of them died in a stretch of about 15 km – found a tiny space in a newspaper, so what?

The crucial role of land use for the state of watercourses and seas for Denmark has been perfectly summarised by Hansen (2003). As the mentioned problems of erosion, eutrophication and poisoning are steered by European subsidy definitions, the same holds true for Germany (Tent 2000 b). And again it is the task of the federal states of Germany to define e.g. „good practice" in agriculture – part of tasks of the young soil law, which tries to improve the present day situation. Fulfilling this (??), the federal state of Hessia recently defined buffer zones at river edges down to zero (which had been 10 m e.g. for pesticide use) . . .

A re-defining of reality recently was to be found in the federal state of Lower Saxony. One stated „the 98%-problem" – the vast majority of our rivers has a desert like structure. International practicioners would state „Let`s improve it – we know how to do it!" (cf. CFB 2002). The federal government of Lower Saxony, however, gave out order to the administration to eliminate such ugly components like river structure or specific biological analyses and rely on the saprobic system (which indicates water quality and not habitat quality as asked for in the WFD). Furthermore, for lowland rivers the re-definition of „good status" now defines, that watercourses of water quality class II-III – what never meant „good" (= II) – fit to the goal. – We find us in chapter 2, again: the circulus vitiosus is closed . . .

All this shows a tendency similar to the description of Lanz (2004), who quoted for waterworks „Seit einigen Jahren ist die Verantwortung ... mehr und mehr auf fachfremde

Manager und Finanzexperten übergegangen.“ (free translation: Since several years responsibility . . . shifted more and more to managers from outside the original profession of the company and experts of finance). He concludes that the engineers and technicians feel helpless to retort the neoliberal ideology.

5.2 Good prospects?!

1. There is no choice. There have to be good prospects. Otherwise the EU-commission will raise heavy questionnaires and possibly ask for a lot of money to pay if the goals will not be achieved in time. First signals have been sent out to Germany among others.

2. There is enough knowledge, there is enough money! Ending nonsense activities, stopping destructive subsidies, to name only two examples, sets the necessary amounts free (Tent 1998 a, Goebel et al. 2003). Best environment (fig. 6) for the spent money has to be the headline.

Fig. 6: An optimal habitat like this alder dominated stretch with high depth variance and lots of shelter for aquatic organisms needs no maintenance, River Seeve, North Germany.

3. Education, to be started and continued: The importance and success of continued information and education for personnel of watercourse maintenance organizations as well as advanced training for local and regional administrations is known e.g. from Denmarks „Ferskvandscentret“ for many years. Best practice information of this kind has been translated into German to lower the „start-hurdles“. The experience of the Danish local and regional administrations (Madsen & Tent 2000), the information about plants and their maintenance by Århus Amt (Tent 2001) and the publication of Vejle and Sønderjyllands Amt on practical recommendations / tips how to improve watercourses to a good extent with relatively low expenditure (Tent 2002, fig. 7) are presented as guiding information.
Thus there is a basis for north Germany to start continuing education programs, which went into reality, already, by several watercourse maintenance organizations, pilot counties and associations. By this one can hope to reach the situation of south Germany, where education aspects and watercourse neighbourhood opportunities are reality for many years now.

Aside the official attempts to approach the set goal of good habitat quality engaged people, among them a lot of anglers, will continue to do the best for their beloved watercourses. Hopefully this mixture of active groups will lead to a faster speed in improving the home of our aquatic organisms.

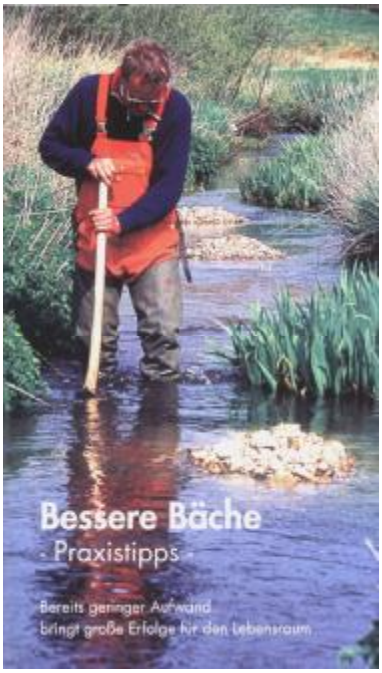

Fig. 7: Better Brooks – practical advice. Low effort results in high gains for the habitats.

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[i] Danmarks Sportsfiskerforbundets Restaureringsseminar, 13. November 2004