Fondation
Hëllef fir d'Natur

LIFE05 NAT/L/000116

« Restauration des populations de moules perlières en Ardennes »

Technical Report: Action D4 Control and survey of the water quality

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Heinerscheid, July 2007

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Environnement

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DU GRAND-DUCHÉ DE LUXEMBOURG
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1 Introduction

Throughout Europe a dramatic decline in freshwater mussel is observed (Young et al., 2001). In most countries population are overaged and are, without conservation measures, no longer viable (reproducing). The major threats discussed are industrial and agricultural pollution, habitat degradation due to river engineering as well as low densities of fish hosts.

Despite many studies concerning the ecology of the Fresh Water Pearl Mussel very little is known about the physical and chemical water quality requirements (Young, 2005). Table 1 lists the water quality objectives for *Margaritifera margaritifera* that have become apparent during different studies in the past.

Table 1: Water quality objectives for *M. margaritifera*

	Target (Bauer, 1988)	Target (Moog et al., 1993)	Target (Oliver, 2000)
Nitrate [mg/l]	< 0.5	< 2.0	< 1.0
Phosphate [mg/l]	< 0.03	< 0.035	< 0.03
pH	N/A	N/A	6.5 – 7.2
Conductivity [µS/cm]	< 70	< 150	< 100
Calcium	2mg/l	N/A	< 10 mg/l Ca CO_3
BOD [mg/l]	1.4	N/A	< 1.3
Dissolved oxygen [%]	N/A	N/A	90-110%

Especially the post parasitic phase of the mussel living buried in the interstitial is highly vulnerable to environmental changes. But only a few investigations (see for instance Buddensiek, 1991 or Geist & Auerswald, 2007) analyzed the water parameters in the interstitial in different depths.

The intent of the following report is to present physical and chemical water parameters of the river Our and of eleven tributaries. Some of the data was collected between 2002 and 2007 by the national laboratory of the water management department. The other data, mainly physical parameters were measured by the life group in 2006 and 2007.

2 Material and Method

Previous date on chemical and physical water parameters of the river Our were obtained by the laboratory of the national water management department. Figure 1 shows the sampling sites of the national laboratory located in the river Our as well as the sampling sites in the Our and the different tributaries that were analyzed by the life group in 2006 and 2007.
The following parameters were measured on every occasion by the national laboratory:

Temperature [˚C]	Oxygen concentration O_2 [mg/l]
pH	Oxygen saturation Sat O_2 [%]
Carbonate hardness [˚fH] (French degree)	Biological oxygen demand BOD5 [mg/l]
Total hardness [˚fH] (French degree)	Sulfate SO_4^{2-} [mg/l]
Conductivity [µS/cm]	Sodium Na^+ [mg/l]
Ammonium NH_4^+[mg/l]	Potassium K^+ [mg/l]
Nitrite NO_2^- [mg/l]	Magnesium Mg [mg/l]
Nitrate NO_3^- [mg/l]	Phosphate total [mg/l]
Chloride Cl^- [mg/l]	Ortho-Phosphate [mg/l]

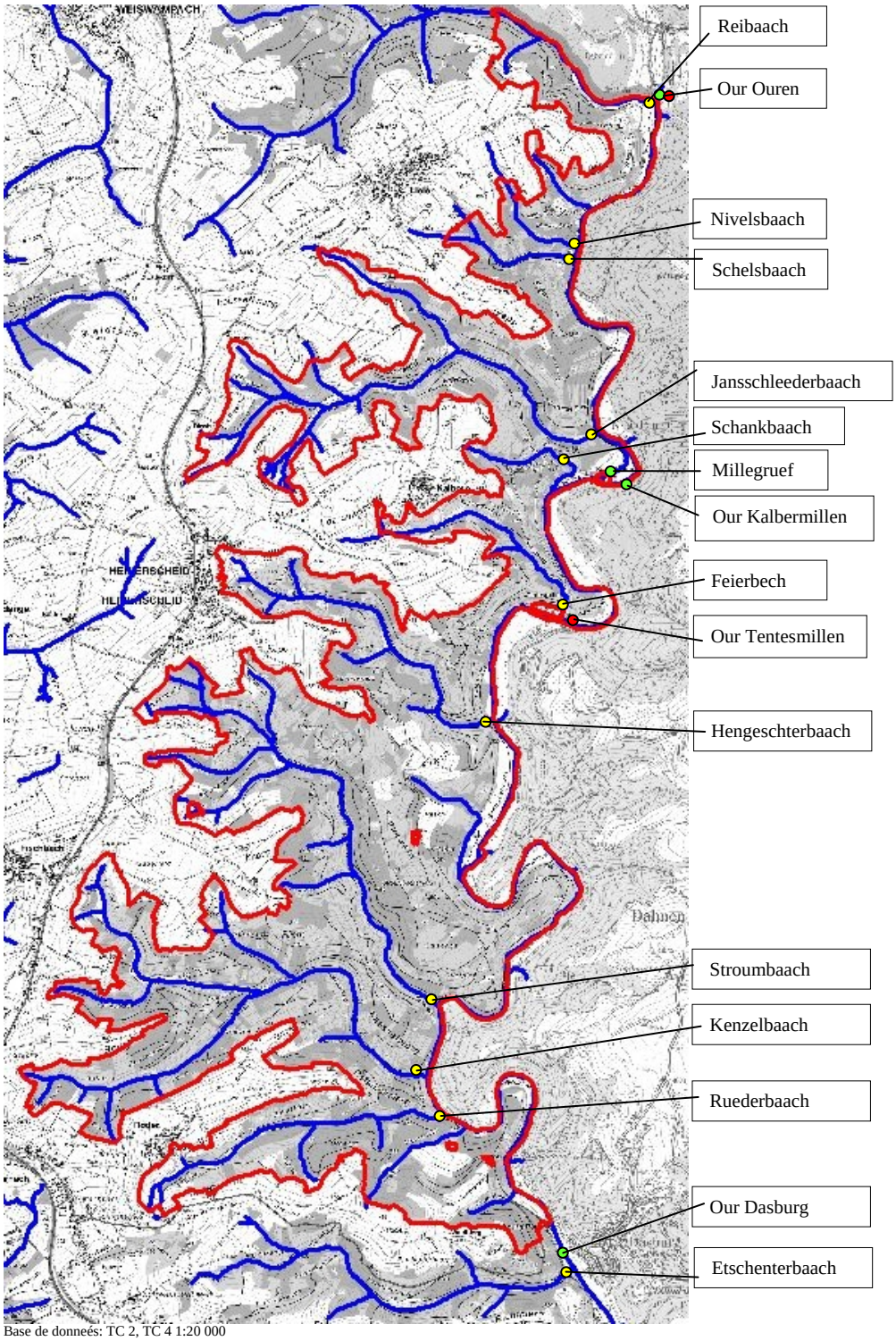
For further details about the methods used see:
http://www.eau.public.lu/publications/rapports_activite/rapport_2006.pdf

From the Our at Kalbermillen and the mill channel (Millegruef), which will later supply the mussel rearing channel with water, samples were measured weekly whereas the water parameters in the tributaries were measured every second week.
On every location and every sampling date the following parameters were measured with a WTW Multi 350i (Weilheim, Germany) handheld device.

- pH
- Conductivity [µS/cm]
- Oxygen concentration [mg/l]
- Oxygen saturation [%]
- Temperature [˚C]

With visible color tests (Merck Microquant, Aquamerck, Darmstadt, Germany) the following parameters were measured on different occasions in the Our and the tributaries:

- Ammonium NH_4^+[mg/l]
- Nitrite NO_2^- [mg/l]
- Nitrate NO_3^- [mg/l
- Total hardness [˚dH] (German degree)



Base de donnees: TC 2, TC 4 1:20 000

Figure 1 Water parameter sampling sites

- Tributaries
- Our and Millegruef
- Our (measured by the national laboratory of the water management department)

3 Results and Discussion

3.1 Our Ouren

3.1.1 Results

Table 3 presents the water parameter measured by the national laboratory of the water management department from 2002 to 2007. The samples were always taken between May and August and measured the same day.

3.1.2 Discussion

Regarding the target values for *M. margaritifera* rivers (see introduction) Table 3 shows, that many values in the river Our at the sampling site Ouren are too elevated. Especially the nutrients concentrations are much too high. For instance Moog et al., 2003 give a target value for nitrate being below 2 mg/l. In the Our at the sampling site Ouren however maximum values of 24 mg/l are reached (see Table 3). The average year value for nitrate even increased from 10.3 mg/l in 2002 to 17.2 mg/l in 2006. The same development is also visible for the total phosphate concentration. In optimal Fresh Water Pearl Mussel Rivers the concentration of the total phosphate should not exceed 0.03 mg/l. In the Our values of up to 0.27 mg/l were measured and the average year value increased from 0.08 in 2002 to 0.15 in 2007. The source of the elevated nutrient concentrations at this sampling site is on the one hand the missing of sewage treatment plants in many villages in the Belgian catchment area and on the other hand the diffuse input of nutrients from intensive used agricultural land.

3.2 Reibaach

3.2.1 Results

Figure 2 and Table 2 present the water parameters of the Reibaach

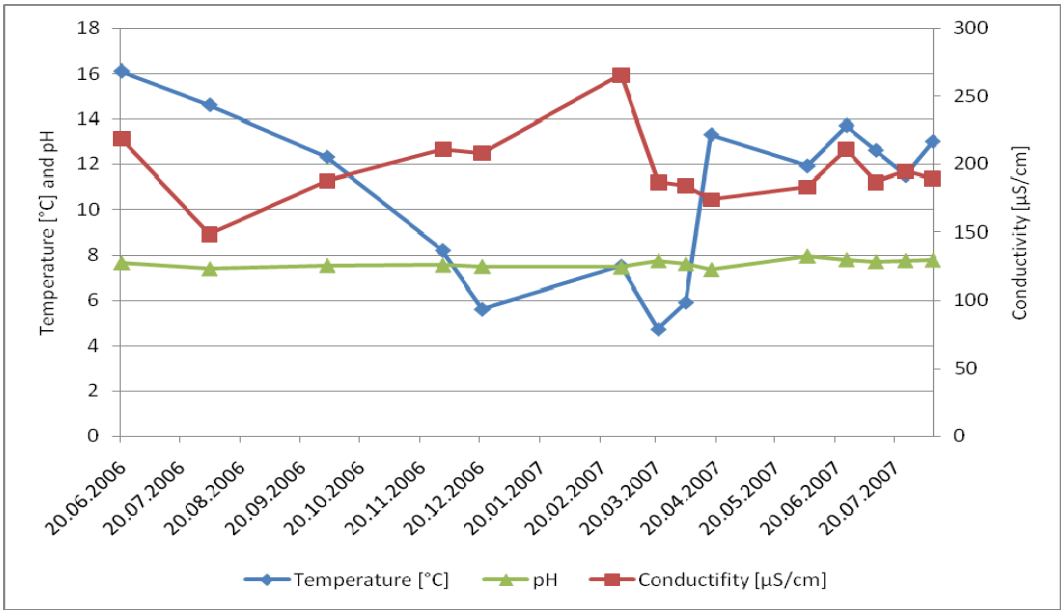


Figure 2: Water parameters Reibaach

Table 2: Water parameters Reibaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
02.03.2007	10,59					
21.03.2007	9,81					
04.04.2007	12,18	101,7				
17.04.2007	9,68	96,1				
05.06.2007	11,82	112,2	25	0	0	6
25.06.2007	11,69	120				
10.07.2007	11,52	113				
25.07.2007	11,6	110,4	35	0	0	5
08.08.2007	12,03	120,5	25	0	0	5

3.2.2 Discussion

As seen in Figure 2, the conductivity in the Reibbach is with around 200 µS/cm rather high and reached at the beginning of February even more then 250 µS/cm. It is however not known what caused this higher conductivity at one occasion. Also the pH is with nearly 8 higher than in the Our itself. The oxygen concentration and saturation were with more or less 10 mg/l and 105 %, high enough for a trout river throughout the measuring period. However the nitrate input from the Reibaach into the Our is with 25-35 mg/l to high for a pearl mussel river.

Table 3: Water parameter in the river Our at the sampling site Ouren as measured by the national laboratory between 2002 and 2007

Year	Date	Temperature [°C]	pH	Carbonate hardness [°fH]	total hardness [°fH]	Conductivity [µS/cm]	NH_4^+ [mg/l]	NO_2^- [mg/l]	NO_3^- [mg/l]	Cl^- [mg/l]	O_2 [mg/l]	Sat O_2 [%]	BOD5 [mg/l]	SO_4^{2-} [mg/l]	Na^+ [mg/l]	K^+ [mg/l]	Mg [mg/l]	Phosphate total [mg/l]	Ortho-Phosphate [mg/l]
2002	15.05.2002	11,9	7,7	3,3	3,9	134	<0,10	0,1	13	13	12,5	119	3,6	9	7,7	2,1		0,034	0,015
	12.06.2002	14,3	7,4	3,6	4,7	149	<0,10	0,18	12	14	9,9	100	3,2	9	9	2,4		0,070	0,037
	17.07.2002	16,9	7,9	4,2	4,9	158	<0,10	0,09	9	15	9,3	99	1,7	9	9,8	3		0,112	0,088
	21.08.2002	17	7,7	4,1	4,4	151	0,15	0,09	7	13	8,4	89	1	9	8,4	4,8		0,095	0,061
2003	12.05.2003	13,9	8	2,6	4,1	136	<0,10	0,09	13	13	11,2	113	1,1	9	8,1	2,1		0,033	0,020
	08.07.2003	16,3	7,5	3,4	4,4	148	<0,10	0,06	10	14	10,3	108	0,8	8,9	9,8	2,8		0,080	0,050
	06.08.2003	21	7,7	4,8	5,4	180	<0,05	0,25	7,1	17	8,6	96	1	7,7				0,140	0,100
2004	11.05.2004	9,6	8,1	2,1	4,1	116	<0,05	<0,05	19	16	11,1	100	<0,5	9,7	7,2	4,4		0,030	0,020
	09.06.2004	17,8	7,7	4,1	5,5	142	0,13	0,14	14	20	9,2	98	2,2	9	10,5	8,9		0,090	0,060
	06.07.2004	14,8	7,8	4,6	5,5	172	<0,05	0,09	10	20	10,4	105	1,7	8,6	13,2	6,5		0,180	0,050
	29.07.2004	15,6	7,6	4,6	5,5	163	0,06	0,08	8,9	17	10,9	113	1,5	8,9	12	3,3		0,170	0,120
	16.08.2004	16,1	7,3	4,2	6,5	153	<0,05	0,06	11	19	9,2	99	2,4	9,7	11,7	8,5		0,090	0,060
2005	27.04.2005	10,5	7,5	2,3	4,4	135	0,06	0,06	19	18	10,9	102	2,1	9	9,7	5		0,060	0,050
	02.06.2005	13,5	7,8	3,4	5	162	<0,05	0,07	16	16	10,7	108	1,7	10	9,5	2,4		0,100	0,070
	29.06.2005	20,4	7,4	4,6	5,9	166	0,11	0,16	12	15	7,8	92	2,2	8	11	4		0,170	0,130
	27.07.2005	16,7	7,7	4,4	6	151	<0,05	0,07	9,9	21	9,5	101	1,7	7,3	11	7,4		0,110	0,080
	25.08.2005	14,3	7,5	3,7	4,7	122	0,06	<0,05	9,5	16	9,3	78	1,4	7,8	10	2,9		0,090	0,050
2006	26.04.2006	12,4	7,7	2,8	6	120	<0,05	0,07	20	17	10,6	103	1,9	8,9	9,4	3,6		0,03	0,016
	01.06.2006	8,7	8,1	2,5	4,8	134	<0,05	<0,05	24	13	10,8	105	1,6	9,1	7,8	2,4		0,030	0,010
	28.06.2006	16,1	7,8	3,5	4,9	135	0,12	0,16	13	15	9,1	97	2,6	7,7	8,9	3,8		0,270	0,150
	26.07.2006	22,1	7,8	5,4	5,8	172	0,13	0,14	9,9	18	8,6	102	1,7	8,1	14	3,6		0,200	0,130
	24.08.2006	13,6	7,8	2,7	4,8	107	<0,05	<0,05	19	12	10,3	103	1,1	9,1	7,9	2,4	4,7	0,080	0,016
2007	25.04.2007	14,2	7,9	3,8	4,9	151	<0,05	0,11	16	17	10	102	2,4	8,3	10	6,5	5,8	0,090	0,064
	27.06.2007	12,3	7,7	3,8	5	129	0,06	0,08	14	10	9,8	97	2	8,3	7,5	3	5,1	0,210	0,074

3.3 Nivelsbaach

3.3.1 Results

Figure 3 and Table 4 present the water parameters of the Nivelsbaach

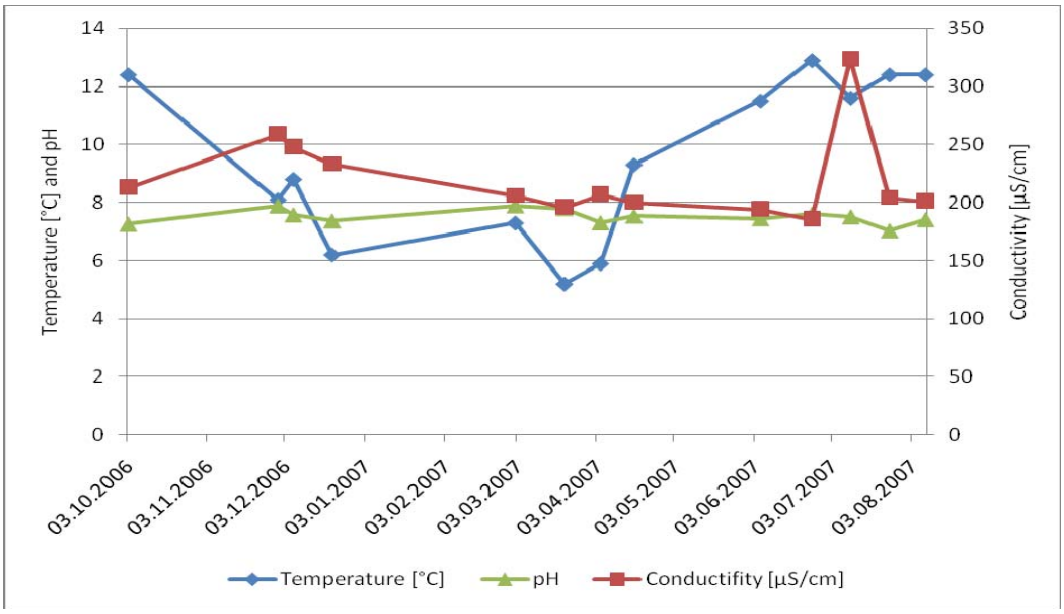


Figure 3: Water parameters Nivelsbaach

Table 4: Water parameters Nivelsbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
02.03.2007	10,68					
21.03.2007	9,71	80,4				
04.04.2007	11,59	96,2				
17.04.2007	10,3	92,9				
05.06.2007	11,06	105,6	50	0	0	6
25.06.2007	10,59	105,9				
10.07.2007	11,62	111,2				
25.07.2007	10,17	98,9	20	0	0	6
08.08.2007	10,61	103,2	55	0	0	5

3.3.2 Discussion

As for the Reibaach also the conductivity in the Nivelsbaach is mostly above 200 µS/cm. In the middle of July on one occasion a value above 300 was reached, which is unusual. It is not known what caused this peak. The oxygen concentration and saturation are with 10 mg/l respectively 100 % good, although a little bit lower than in the Reibaach. The nitrate concentration was however on all three occasion where it was measured too high.

3.4 Schelsbaach

3.4.1 Results

Figure 4 and Table 5 present the water parameters of the Schelsbaach

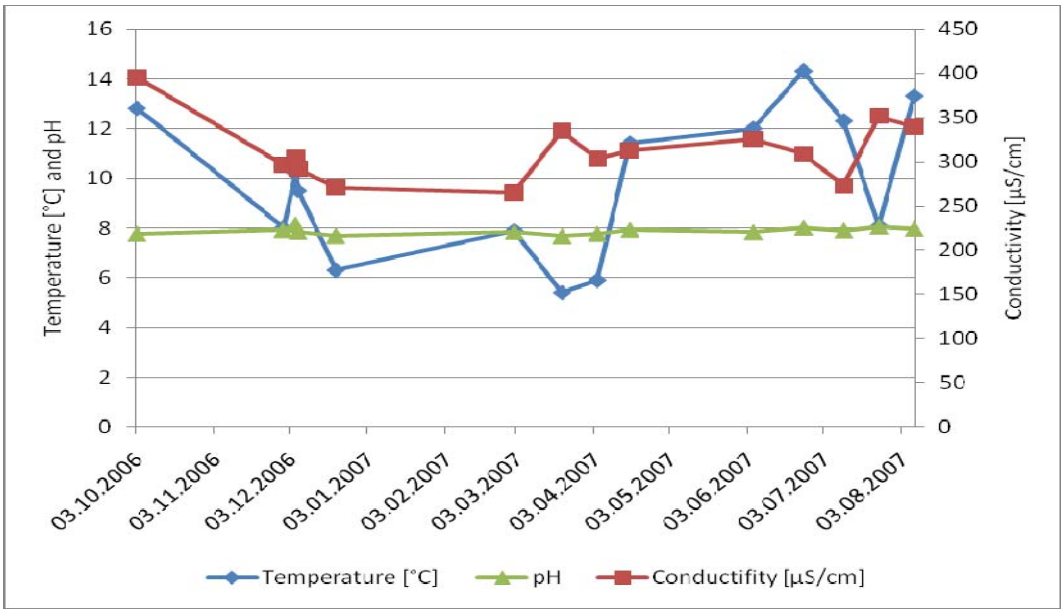


Figure 4: Water parameters Schelsbaach

Table 5: Water parameters Schelsbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
02.03.2007	10,56					
21.03.2007	10,09	83,7				
04.04.2007	11,72	96,9				
17.04.2007	10,39	98,4				
05.06.2007	12,19	117,3	50	0	0	7
25.06.2007	10,96	112,5				
11.07.2007	11,73	114,2				
25.07.2007	11,24	110	75	0,05	0	8
08.08.2007	12,07	120,2	60	0	0	7

3.4.2 Discussion

The waste water from the village Lieler used to be discharged in the Schelsbaach. Although a sewage treatment station is operating meanwhile some water parameters are still elevated. The conductivity and the nitrate concentrations are among the highest observed for a brook in the project area. The oxygen parameters are nevertheless good. The water parameters in this brook should carefully be observed in order to control the functioning the sewage treatment station and to see if any improvement takes place.

3.5 Jansschleederbaach

3.5.1 Results

Figure 5 and Table 6 present the water parameters of the Jansschleederbaach

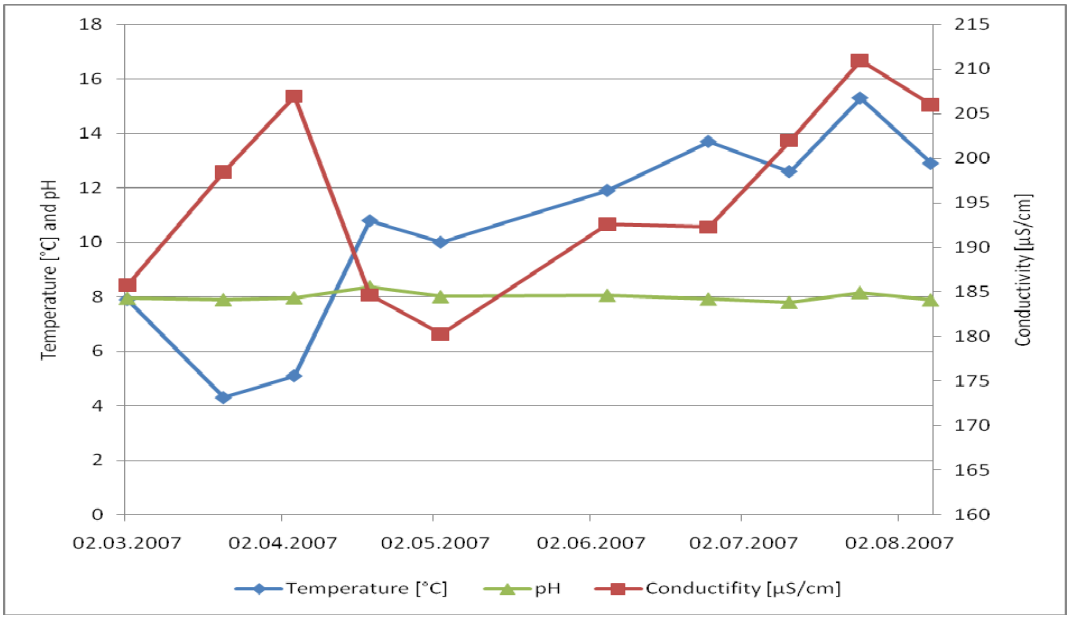


Figure 5: Water parameters Jansschleederbaach

Table 6: Water parameters Jansschleederbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
21.03.2007	9,64					
04.04.2007	12,2	101				
19.04.2007	10,2	98,8				
03.05.2007	11,9	110,1				
05.06.2007	11,81	113,2	25	0	0	6
25.06.2007	10,57	106,7				
11.07.2007	11,37	112,7				
25.07.2007	10,84	113,2	35	0	0	5
08.08.2007	12,5	123,1	25	0	0	5

3.5.2 Discussion

Again like for the other brooks the nitrate concentration in the Jansschleederbaach is too elevated. The conductivity increased from May to August. The lower discharge during the summer months explains this development. The pH is with around 8 also higher compared to the other brooks. The oxygen parameters show that this stream is suitable for trout also during the summer months.

3.6 Schankbaach

3.6.1 Results

Figure 6 and Table 7 present the water parameters of the Schankbaach

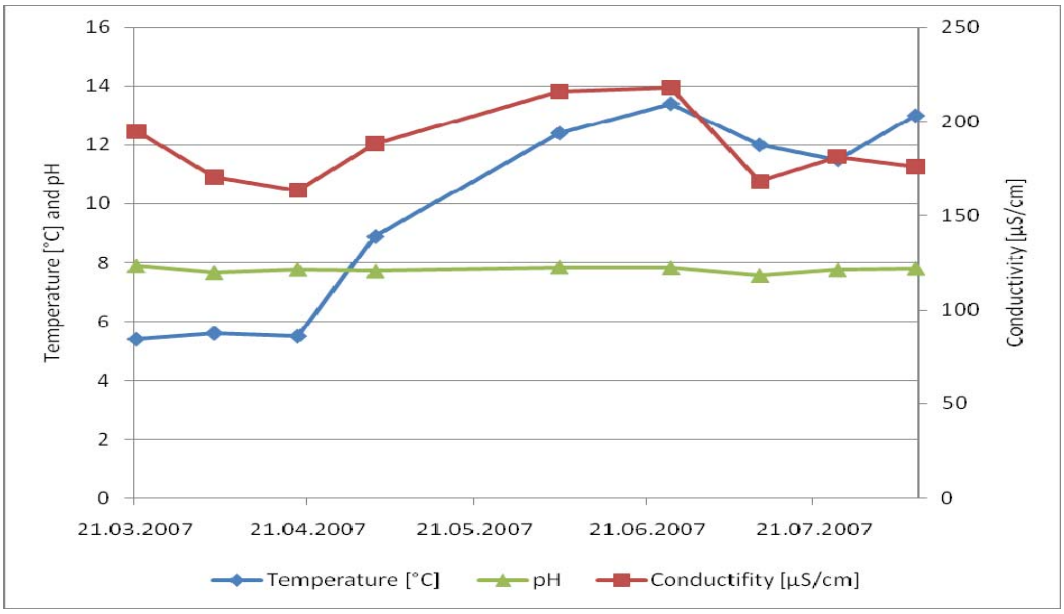


Figure 6: Water parameters Schankbaach

Table 7: Water parameters Schankbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
21.03.2007	9,84	81,6				
04.04.2007	12,02	99,3				
19.04.2007	11,76	96,7				
03.05.2007	11,78	106,4				
05.06.2007	12,01	117,2	25	0	0	5
25.06.2007	10,95	111,3				
11.07.2007	11,77	111,7				
25.07.2007	10,49	102,2	35	0	0	6
08.08.2007	10,18	101,3	25	0	0	4

3.6.2 Discussion

The Schankbaach is a very small brook which often nearly runs dry during the summer. For this reason it harbors no trout but larvae of fire salamander are present. The oxygen concentration and saturation are good but the nitrate concentration is again elevated.

3.7 Our Kalbermillen

3.7.1 Results

Figure 7 and Table 8 present the water parameters of the Our at the sampling site Kalbermillen

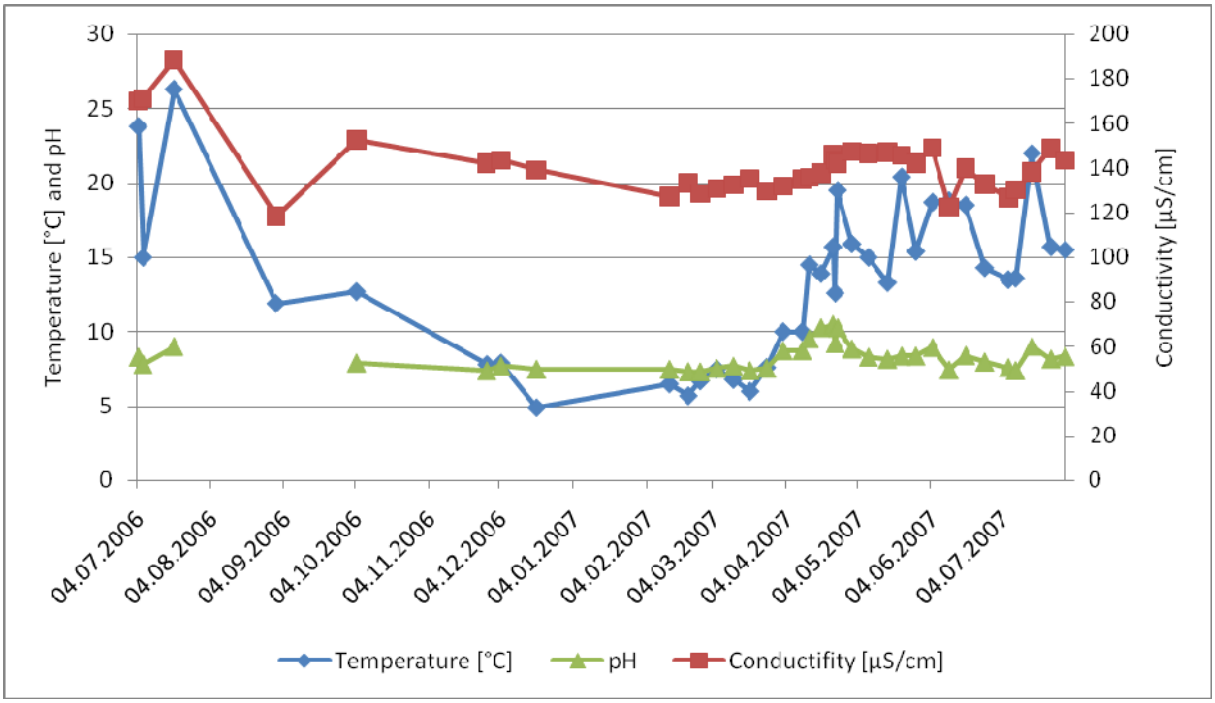


Figure 7: Water parameters Our Kalbermillen

Table 8: Water parameters Our Kalbermillen

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^- [mg/l]	NO_2^- [mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
05.03.2007	11,28	97,6				
12.03.2007	11,35	95,8				
19.03.2007	10,58	90,0				
26.03.2007	7,33	64,0				
02.04.2007	12,26	112,0				
10.04.2007	12,93	118,2				
13.04.2007	12,01	122,8				
18.04.2007	11,23	112,0	10	0,05	0	5
23.04.2007	13,51	141,1				
24.04.2007	13,29	143,5				
25.04.2007	13,9	157,3				
01.05.2007	12,78	133,9				
08.05.2007	11	113,7				
16.05.2007						
22.05.2007						
28.05.2007						
04.06.2007	12,28	135,9	15	0,05	0	5
11.06.2007	7,85	87,7				
18.06.2007	11,15	123,4				
26.06.2007	11,63	119,6				

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
06.07.2007	9,67	99				
09.07.2007	10,65	112,8				
16.07.2007	11,15	140,1				
24.07.2007	10,51	110,4	20	0,05	0	5
30.07.2007	12,47	129,4				

3.7.2 Discussion

The Millegruef is directly supplied with water from the river Our. Therefore both sampling points, Our Kalbermillen and Millegruef (see 3.8), are discussed together. Measurements took place every week on Monday in the afternoon between 15:00 and 17:00 o'clock.
In July 2006 the conductivity reached values above 180 µS/cm which was related to the low discharge of the river Our at that time. In 2007 the conductivity did not fluctuate a lot and was always around 150 µS/cm. Until now 2007 was a year with a lot of rain and the water level in the Our was never low which explains the constant level of the conductivity. Nevertheless for pearl mussel rivers the target value of the conductivity, as seen by the authors mentioned in the introduction, should be below 150 µS/cm.
As can also be seen the water temperature fluctuated a lot in summer 2007. Values above 20˚C were seldom reached whereas values around and below 15˚C were frequent. Such cold summers are problematic for the reproduction of Fresh Water Pearl mussels as fewer mussels become mature. Furthermore in 2007 a low glochidia load of the few mature mussels was observed.
At the Our at Kalbermillen as well as in the Millegruef the pH increased up to 9-10 in April 2007. The April was unusual sunny and warm and the shading by deciduous trees was still low. This caused probably good grow conditions for algae, which needed during the day a lot of carbon dioxide. As a result the pH increased during the day. The highest values were normally reached around 8-9 pm. This phenomenon was already observed the years before (personnel communication Gerhard Weidmann). It is however not known if and to which extent these high pH values in the evening are harmful to the Fresh Water Pearl Mussel population. This point needs further observations in the future.
The oxygen saturation and concentration were at both sampling points always good, whereas the nitrate concentrations were again with 10-20mg/l too high, although lower than in the brooks. Only on one occasion (24.07.2007) a higher nitrate concentration (60 mg/l) was measured in the Millegruef.

3.8 Millegruef

3.8.1 Results

Figure 8 and Table 9 present the water parameters of the Millegruef

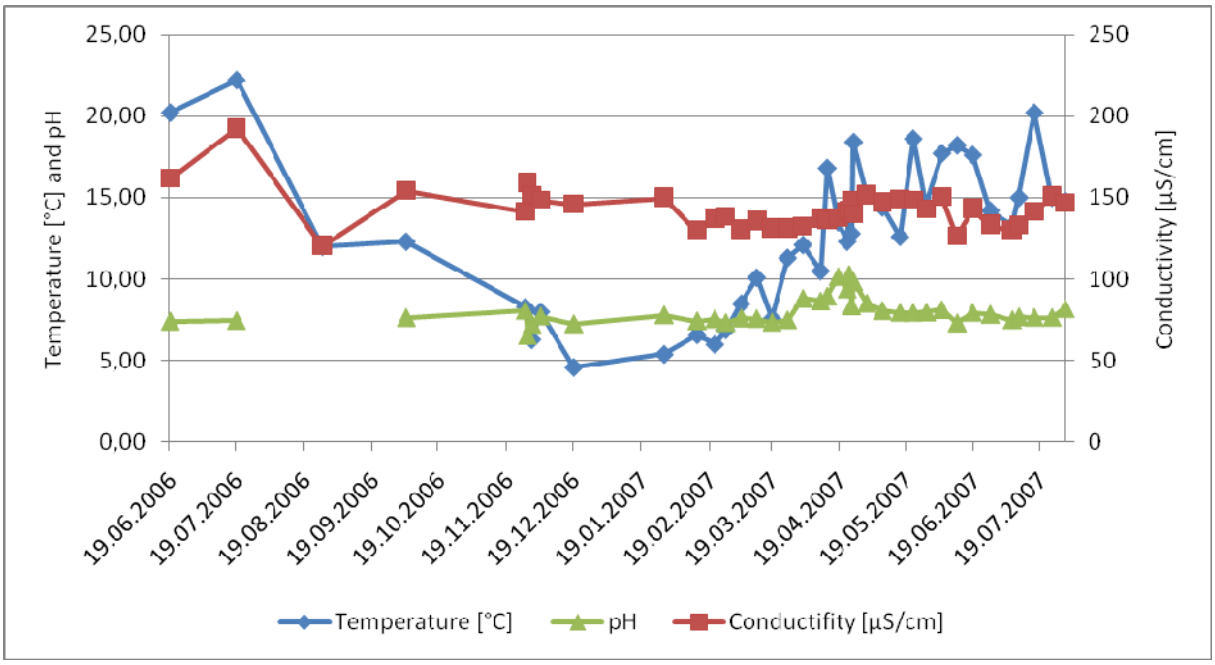


Figure 8: Water parameters Millegruef

Table 9: Water parameters Millegruef

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
05.03.2007	10,61	94,40				
12.03.2007	12,10	110,60				
19.03.2007	11,44	101,90				
26.03.2007	9,74	93,10				
02.04.2007	12,22	117,10				
10.04.2007	12,56	119,00				
13.04.2007	11,53	123,10				
18.04.2007	11,01	108,40	10	0,05	0	4,50
22.04.2007	13,37	129,00				
23.04.2007	12,99	131,4				
24.04.2007	12,77	126				
25.04.2007	12,53	138,1				
01.05.2007	12,31	127				
08.05.2007	10,85	110,9				
16.05.2007						
22.05.2007						
28.05.2007						
04.06.2007	11,27	122	15	0,05	0	4
11.06.2007	7,68	84,5				
18.06.2007	10,31	113				
26.06.2007	11,43	116				
06.07.2007	10,93	109,1				
09.07.2007	10,97	113,3				
16.07.2007	10,67	122,9				
24.07.2007	9,83	102	60	0,05	0	6
30.07.2007	11,75	120,1				

3.9 Feierbech

3.9.1 Results

Figure 9 and Table 10 present the water parameters of the Millegruef

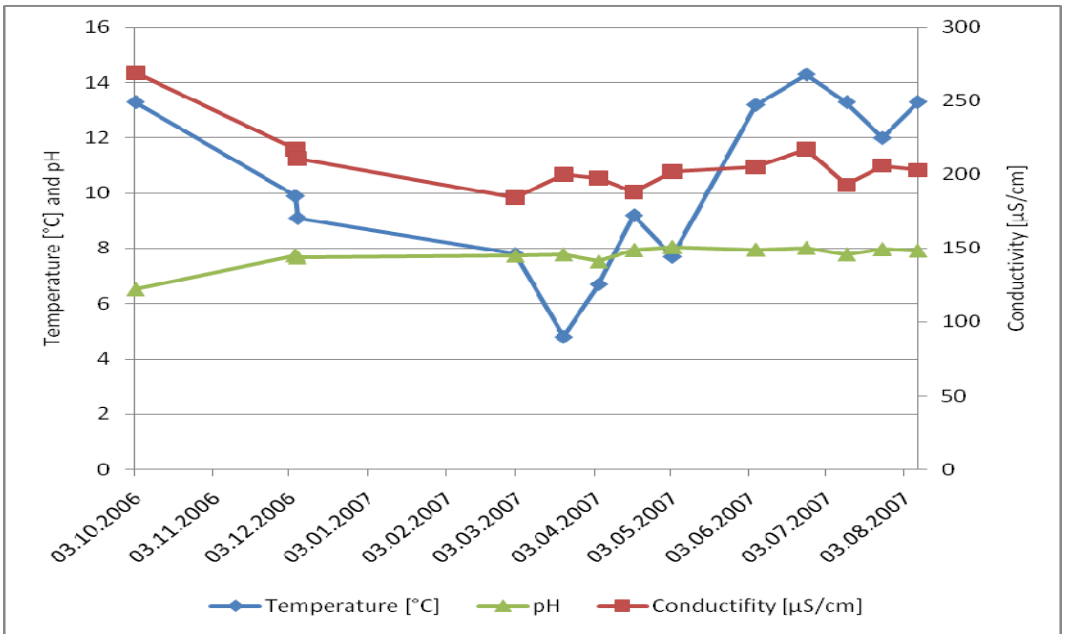


Figure 9: Water parameters Feierbech

Table 10: Water parameters Feierbech

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
21.03.2007	10,08	82,1				
04.04.2007	12,0	101,9				
18.04.2007	11,12	99,4				
03.05.2007	12,16	105,7				
05.06.2007	12,32	121	50	0	0	6
25.06.2007	10,96	111,8				
11.07.2007	11,89	117,5				
25.07.2007	11,46	109,8	35	0	0	6
08.08.2007	11,81	117,4	35	0	0	5

3.9.1 Discussion

The Feierbech used to discharge the waste water from the village Kalborn. This water is now treated in the sewage station at the Tintesmühle. The conductivity is with above 200 µS/cm still elevated compared to the Our, but lower than in the Schelsbaach which discharges the treated water from the village Lieler. Also the nitrate concentrations are lower than in the Schelsbaach but with 35-50 mg/l still elevated. Again the oxygen concentration and saturation are good.

3.10 Our Tintesmillen

3.10.1 Results

Table 12 presents the water parameter measured by the national laboratory of the water management department from 2002 to 2007. The samples were always taken between May and August and measured the same day.

3.10.2 Discussion

Like for the sampling site Our Ouren, also many values in the river Our at the sampling site Tintesmillen are too elevated. Again the nutrients concentrations are much too high. In the Our at the sampling site Tintesmillen maximum values of 24 mg/l for nitrate are reached (see Table 12). Like at the sampling site Ouren also at Tintesmillen the average year value for nitrate increased from 10.5 mg/l in 2002 to 17.5 mg/l in 2006. The total phosphate concentration doubled from 0,08 mg/l in 2002 to 0,16 mg/l in 2007. All tributaries between Ouren and Tintesmühle show at least for nitrate elevated values. Thus it is not surprising that also at the sampling site Tintesmillen the nutrient values are too high. As most of the waste water from the villages is treated in this section the main source for these important values is surely diffuse input from intensive used agricultural land.

3.11 Hengeschterbaach

3.11.1 Results

Figure 10 and Table 11 present the water parameters of the Hengeschterbaach

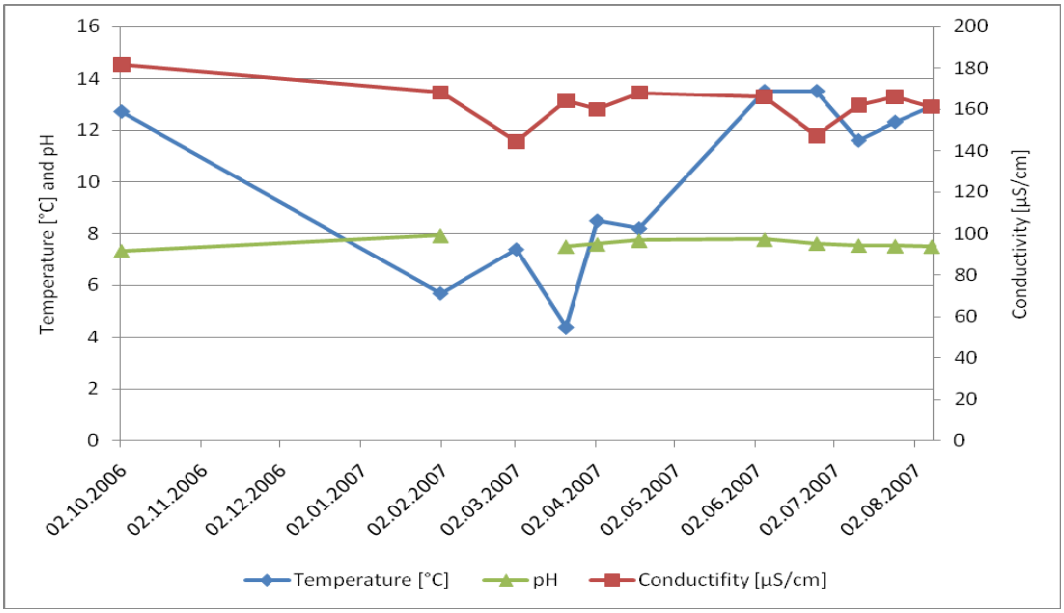


Figure 10: Water parameters Hengeschterbaach

Table 11: Water parameters Hengeschterbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
21.03.2007	10,35	83,4				
02.04.2007	11,31	98,9				
18.04.2007	10,93	95,9				
05.06.2007	12	118	35	0	0	5
25.06.2007	11,26	113				
11.07.2007	11,8	113,3				
25.07.2007	11,39	110,2	35	0	0	4
08.08.2007	11,57	113,5	30	0	0	4

3.11.2 Discussion

The conductivity values in the Hengeschterbaach are slightly decreasing since 2006. As this brook is no longer used to discharge the waster water from the village Heinerscheid this observation expected. Oxygen parameters are good for brooks in the epirithral and thus this brook might also recover as trout habitat. The nitrate concentrations are elevated.

Table 12: Water parameter in the river Our at the sampling site Tintesmillen as measured by the national laboratory between 2002 and 2007

Year	Date	Temperature [°C]	pH	Carbonate hardness [°fH]	total hardness [°fH]	Conductivity [µS/cm]	NH_4^+ [mg/l]	NO_2^- [mg/l]	NO_3^- [mg/l]	Cl^- [mg/l]	O_2 [mg/l]	Sat O_2 [%]	BOD5 [mg/l]	SO_4^{2-} [mg/l]	Na^+ [mg/l]	K^+ [mg/l]	Mg [mg/l]	Phosphate total [mg/l]	Ortho-Phosphate [mg/l]
2002	15.05.2002	13,3	7,7	3,2	4,2	131	<0,10	0,08	13	11	10,8	107	1,7	10	7,1	2		0,03	0,013
	12.06.2002	14,8	7,4	3,8	4,8	154	<0,10	0,2	12	14	10,1	103	3,2	9	9,2	2,5		0,076	0,044
	17.07.2002	17	8	4,2	4,8	157	<0,10	0,05	9	15	9,8	105	1,6	9	9,5	2,9		0,099	0,08
	21.08.2002	17,2	7,7	4	4,6	154	0,16	0,09	8	14	8,5	91	2	9	9	4,2		0,107	0,081
2003	12.05.2003	13	8	2,8	4,1	142	<0,10	0,08	12	14	11,4	113	1,2	9	8,5	3,9		0,03	0,014
	08.07.2003	16,8	7,8	3,6	4,6	150	<0,10	0,04	9,3	14	10,5	110	0,8	9,1	10	2,9		0,08	0,05
	06.08.2003	21	7,6	5,1	5,7	182	<0,05	<0,01	5,7	17	9	100	1,4	7,2				0,09	0,06
2004	11.05.2004	10,2	8,1	2	4,1	120	<0,05	<0,05	20	16	11	100	0,7	10	7,6	4,7		0,04	0,02
	09.06.2004	18,3	7,8	3,6	5,1	141	0,09	0,11	13	18	9,4	102	1,9	9,3	10,2	7,2		0,08	0,06
	06.07.2004	14,8	8	4,6	5,3	160	<0,05	0,05	9,2	18	10,5	107	1,4	8,6	13	4,8		0,09	0,06
	29.07.2004	15,6	7,8	4,5	5,9	160	<0,05	<0,05	8,7	17	11	114	1,4	8,8	11,6	3,1		0,12	0,08
	16.08.2004	16	7,4	3,8	6,1	154	<0,05	0,07	12	22	9,9	107	2,2	10	10,7	11,9		0,09	0,07
2005	27.04.2005	10,4	7,6	2,4	4,5	135	0,06	0,06	19	17	10,7	98	2,5	9,2	9,6	5		0,06	0,05
	02.06.2005	13,6	7,9	3,3	5	163	<0,05	0,05	17	16	10,7	105	1,4	8,2	9,3	2,6		0,04	0,02
	29.06.2005	20,7	7,5	4,4	6	163	0,07	0,1	11	17	8,2	95	1,6	9,5	11	4,1		0,16	0,12
	27.07.2005	17,3	7,8	4,2	5,2	144	<0,05	<0,05	9,7	19	9,6	105	1,4	8,4	11	5,2		0,1	0,06
	25.08.2005	14,7	7,4	3,9	6,4	128	0,05	<0,05	9,5	17	9,3	97	1,4	8	10	3,2		0,06	0,05
2006	26.04.2006	12,5	7,8	2,7	5,7	121	<0,05	0,06	20	17	10,6	103	1,6	9,2	9,7	2,9		0,05	0,03
	01.06.2006	8,8	8,1	2,4	6,2	138	<0,05	<0,05	24	13	10,8	105	1,6	9,3	8	2,3		0,05	0,02
	28.06.2006	16,3	7,9	3,7	4,7	144	0,08	0,16	15	17	9,2	98	2,9	8,2	10	3,7		0,22	0,08
	26.07.2006	21,9	7,8	5,5	6,4	175	<0,05	0,05	9,3	18	8,6	101	1,5	8,6	15	4,1		0,17	0,1
	24.08.2006	13,8	7,7	2,8	4,2	110	<0,05	<0,05	19	12	10,1	102	1,2	9,1	8,1	2,7	4,8	0,1	0,016
2007	25.04.2007	14,6	8	4,2	5	152	<0,05	0,09	16	15	10,1	102	2,3	8,6	10	4,3	6,1	0,07	0,052
	27.06.2007	12,3	7,6	3,8	4,5	128	0,05	0,08	14	10	9,8	98	2,2	8,3	7,5	3	5,1	0,25	0,109

3.12 Stroumbaach

3.12.1 Results

Figure 11 and Table 13 present the water parameters of the Stroumbaach

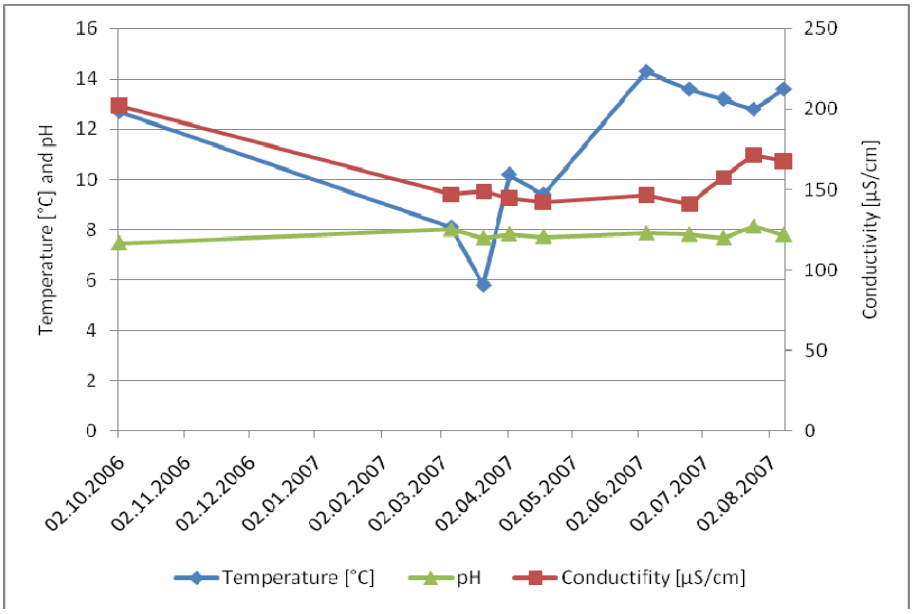


Figure 11: Water parameters Stroumbaach

Table 13: Water parameters Stroumbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
06.03.2007	10,29	91,3				
21.03.2007	9,42	79				
02.04.2007	10,79	100,1				
18.04.2007	10,89	97,6				
05.06.2007	11,47	115,8	25	0	0	5
25.06.2007	11,28	113,5				
11.07.2007	11,92	118,2				
25.07.2007	11,33	110,5	35	0	0	5
08.08.2007	12,15	121,3	20	0	0	4

3.12.2 Discussion

The conductivity values in the Stroumbaach are with values around 150 µS/cm in 2007 comparable to those of the river Our. The higher values in October 2006 were due to a low discharge at that time. The Stroumbaach is a good habitat for Brown Trout (*Salmo trutta fario*) as was seen by an electric fishing action in 2006 (Technical Report Action D5). This is also supported by the good oxygen conditions. However the nitrate concentrations are although lower than in some other tributaries too high.

3.13 Kenzelbaach

3.13.1 Results

Figure 12 and Table 14 present the water parameters of the Kenzelbaach

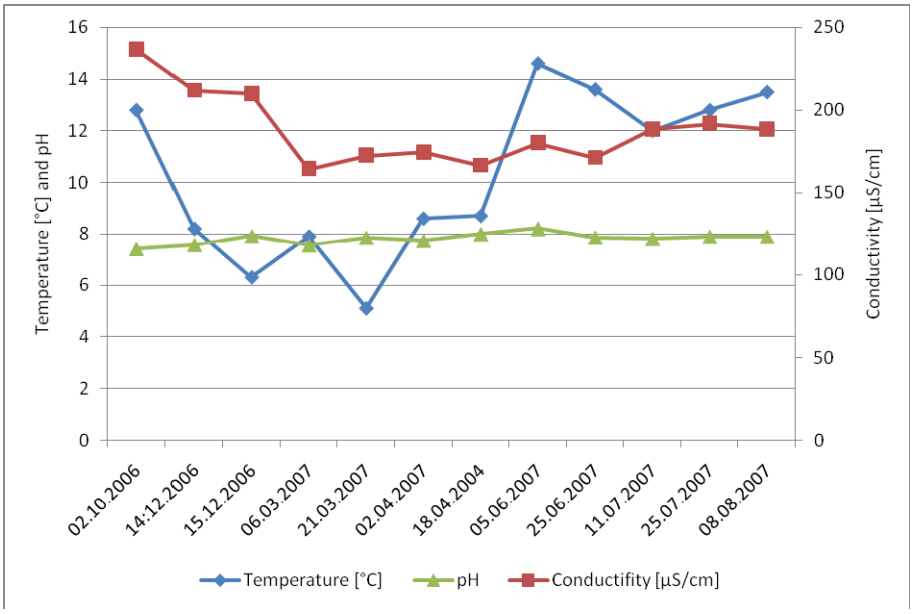


Figure 12: Water parameters Kenzelbaach

Table 14: Water parameters Kenzelbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
06.03.2006	11,37	99,8				
21.03.2007	9,98	81,4				
02.04.2007	11,5	101,3				
18.04.2004	11,13	97,9				
05.06.2007	11,85	120,4	35	0	0	5
25.06.2007	11,23	113				
11.07.2007	11,32	114,5				
25.07.2007	11,59	112,2	35	0	0	5
08.08.2007	12,56	124,4	35	0	0	5

3.13.2 Discussion

The Kenzelbaach is comparable to most of the other brooks located in the project area. The oxygen conditions are good and the conductivity is fluctuating between 150 – 200 µS/cm. Nitrate concentration are again above the target values demanded by Fresh Water Pearl Mussel habitats.

3.14 Ruederbaach

3.14.1 Results

Figure 13 and Table 15 present the water parameters of the Ruederbaach

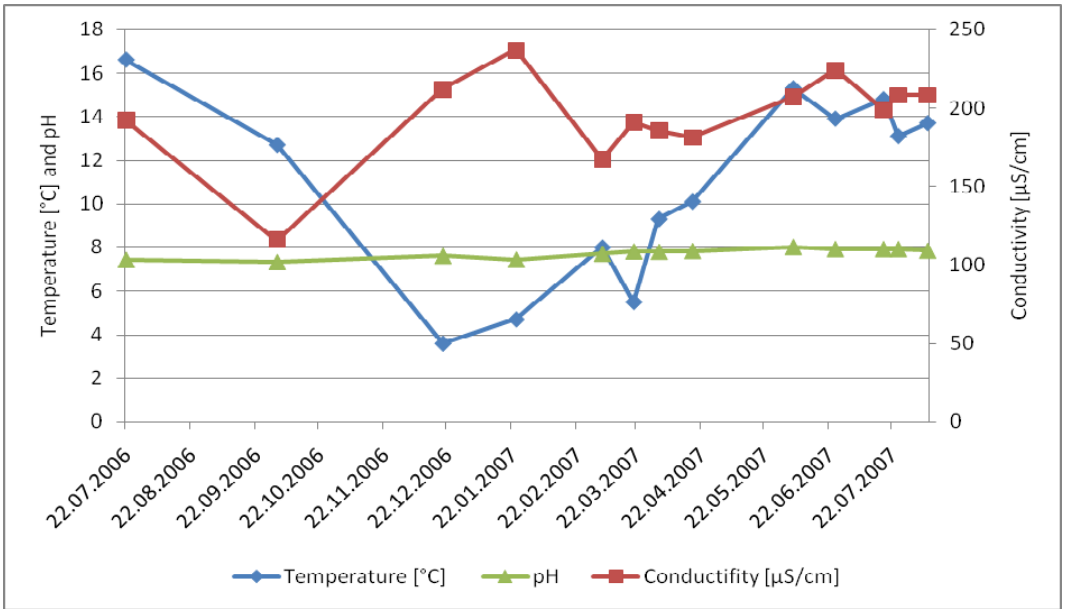


Figure 13: Water parameters Ruederbaach

Table 15: Water parameters Ruederbaach

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+[mg/l]	total hardness [°dH.]
06.03.2007	11,59	102,9				
21.03.2007	10,12	83,9				
02.04.2007	11,19	99,9				
18.04.2007	10,66	97,1				
05.06.2007	11,7	120,4	25	0	0	5
25.06.2007	10,91	110,9				
18.07.2007	10,61	106,9				
25.07.2007	10,99	109	35	0	0	5
08.08.2007	11,87	117	25	0	0	4

3.14.2 Discussion

The conductivity in the Ruederbaach fluctuated highly in 2006 and 2007. The waste water from the village Roder is still discharged in this brook. The waste water is collected in a sedimentation tank and the runoff directly discharges in the brook. During high precipitation periods a lot of organic material from the sedimentation tank is rinsed out and thus causing an elevated conductivity in the brook. Like in all brooks the nitrate concentrations are too high whereas the oxygen parameters are good.

3.15 Etschenderbaach

3.15.1 Results

Figure 14 and Table 16 present the water parameters of the Etschenderbaach

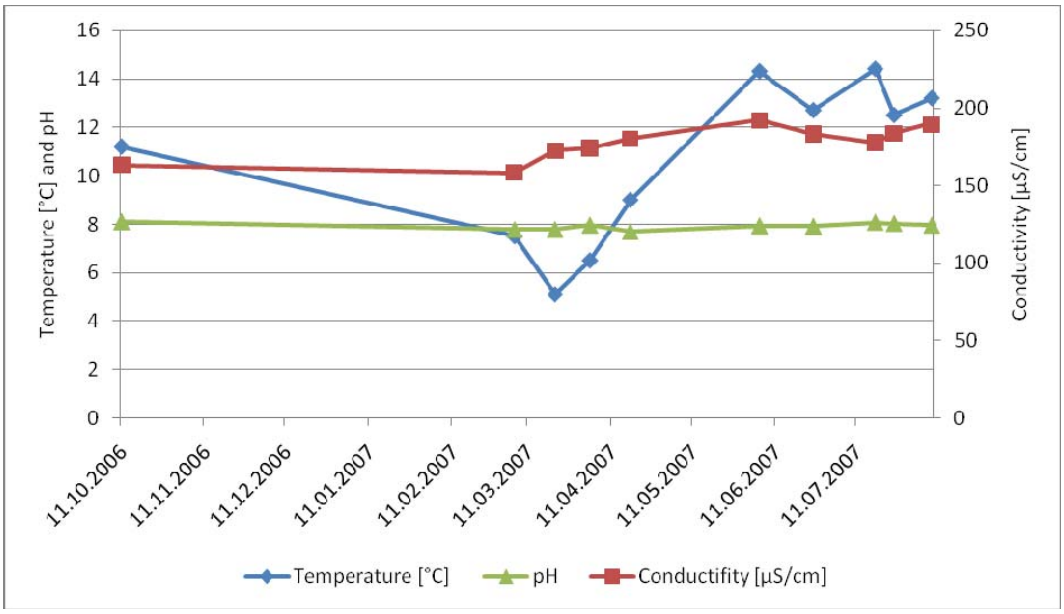


Figure 14: Water parameters Etschenderbacch

Table 16: Water parameters Etschenderbacch

Date	O_2 [mg/l]	Sat O_2 [%]	NO_3^-[mg/l]	NO_2^-[mg/l]	NH_4^+ [mg/l]	total hardness [°dH.]
06.03.2007	11,82	103,2				
21.03.2007	10,19	82,9				
03.04.2007	12,1	101,8				
18.04.2007	10,21	90,5				
05.06.2007	12,17	122,4	25	0	0	6
25.06.2007	11,3	112,1				
18.07.2007	11,26	113,1				
25.07.2007	11,13	107,8	30	0	0	6
08.08.2007	11,89	117	20	0	0	5

3.15.2 Discussion

Like in all brooks of the project area the oxygen saturation and concentration are good in the Etschenderbaach and the conductivity ranges between 150 and 200 µS/cm. Nitrate concentrations are too high.

3.16 Overall view

This Report presents the first measurements of different water parameter in the river Our and its tributaries. One parameter not discussed above is the water hardness. The total hardness describes mainly the presence and concentration of the Ca^{2+} and Mg^{2+} cations. The water hardness of a river is to a great part depending on the geology of the catchment area. Freshwater Pearl Mussels occur in waters with low water hardness. Unfortunately many different measurements were used in the past in different countries which make a comparison often difficult. The national laboratory expressed the water hardness in French degree [˚fH], whereas we measured with our fast tests German degrees [˚dH]. The conversion factor is the following: 1˚dH=1,79˚fH=17,9 ppm(mg/l) $CaCO_3$. The values for the total hardness measured by the national laboratory range around 5 ˚fH which is equivalent to 2.8˚dH. The values measured with the fast test in the Our and the tributaries ranged between 4 and 6 ˚dH. Thus we are always in the region of soft water. Nevertheless the target value for *M. margaritifera* is exceeded.
A high ammonium concentration is a sign of water which is heavily polluted with sewage water. None of the samples analyzed showed high ammonium concentrations. Under natural conditions ammonium is transformed by bacteria over nitrite to nitrate. The low nitrite concentrations detected in the river Our by the national laboratory and us are nevertheless a sign of a slightly pollution with sewage water of the main river. In the tributaries nitrite was not detectable with the fast tests.
The factor summarizing the charge of water with organic material is the BOD5 (Biological Oxygen Demand in five days). For Fresh Water Pearl Mussel Rivers the BOD5 should be below 1.4 mg/l. In the Our measured in Ouren and Tintesmillen the value ranged between 1-2.3 respectively 1.1-2.3 and being thus also often above the target value demanded.

A major problem in the Our and the tributaries are the important concentrations of nitrate and phosphate which increased during the last years. These parameters should be carefully observed in the future in order to locate the main sources especially in the tributaries.

4 Literature

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