Juvenile densities in the Norwegian tributaries of the River Teno in 2006-2007

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1. Introduction

The River Teno (Tana in Norwegian) watercourse (drainage area 16386 km^2) is one of the most important Atlantic salmon, *Salmo salar* L., rivers in the world, with annual river catches of 70-250 t. More than 1200 km of river are accessible to migrating adult salmon, including c. 30 first and second order tributaries. Based on recent genetic studies, genetically distinct salmon populations exist in the main stem and in several tributaries.

The valuable salmon stocks of the River Teno are monitored on annual basis. The yearly monitoring programmes includes catch enquiries for estimation of the salmon catch, electrofishing of salmon nursery habitats for assessment of parr densities in permanent experimental sites and collection of adult salmon scale samples to determine the sea-age distribution and growth of ascending salmon and to estimate the origin of the fish (wild/reared).

The spatial coverage of the annual monitoring programmes includes the mainstem of the River Teno and two large tributaries, the rivers Inarijoki and Utsjoki. However, in the headwaters of the River Teno two important salmon production areas, the river Karasjoki (Karasjok, Kárašjohka) (drainage area 5019 km^2) and its tributary, the River Jiesjoki (Iešjok, Iešjohka), are poorly monitored. These rivers constitute about one third of the whole River Teno watershed and are historically known to be important spawning areas for multi-sea-winter salmon (MSW, 2-4 sea-winters, large salmon). In addition to the headwater streams very limited information is available from one of the lowermost tributaries of the River Teno, the Maskejoki, which also supports a large salmon population with a considerable fraction of MSW salmon.

In 2006, Fylkesmannen I Finnmark and Finnish Game and Fisheries Research Institute agreed to start collection of information from Karasjoki, Jiesjoki and Maskejoki (Fig. 1) with an aim to update the knowledge about the status of salmon stocks in the rivers by examining the juvenile salmon densities by electrofishing. This preliminary report presents information on electrofishing surveys in these rivers conducted in 2006 and 2007. Electrofishing results from other tributaries of the River Teno (Fig. 1) and from the River Näätämöjoki (Neidenelva) are also presented for comparison.

2. Materials and methods

The electrofishing surveys were conducted by a three-person group with generator-powered equipment (Hans Grassl GmbH, ELT 60II GI) using pulsed direct current (700-900 V, 0.2 A). In each study area one member of the fishing crew used the anode and two persons collected the stunned fish with dipnets. Except some few areas in Jiesjoki, all other areas were electrofished by one removal sampling to enable larger number and wider coverage of sampling sites for this preliminary survey. The densities are therefore expressed as catches of juveniles on one pass/100m^2.

Electrofishing sites were selected to represent running water habitats, different types of riffles and flats, in an approximately same proportion as they are found in the river systems. The electrofishing surveys of all study areas were conducted during August-September in 2006-2007.

In the River Karasjoki the electrofishing sites (n=29) were distributed between Vuoddasluoppal (upstream) and Suolggasavu (downstream) in 2006 and between Bavtajoki rivermouth and Suolggasavu in 2007 (n=18) (Appendices 3 and 11). In 2007, 14 sites were also sampled in the River Bavtajokka, a major tributary to the River Karasjoki (Appendices 6 and 11). In the River Jiesjoki 13, and 16 electrofishing sites were sampled between Lake Suosjavri (upstream) and

rivermouth (downstream) in 2006 and 2007, respectively (Appendices 4 and 12). In 2007, additional 15 sites were sampled above the Suosjavri in 2007 (Appendices 5 and 12). Most of the sites below Suosjavri and those right above the lake were the same sites that have been fished in earlier studies conducted in the mid 1990-s. In the River Maskejoki 14 electrofishing sites were covered in 2007 (Appendices 7 and 13). The monitoring sites were distributed between 34 and 15 km upstream from the rivermouth. To our knowledge, no electrofishing surveys have been conducted in Maskejoki before 2007.

The juvenile densities observed in the rivers Karasjoki, Jiesjoki and Maskejoki are compared to the densities observed in the other parts of the River Teno, including the mainstem Teno, Gorzejoki (Appendices 9 and 15), Inarijoki, Utsjoki, Ylä-Pulmankijoki and Akujoki (Fig. 1), as well as those in the River Näätämöjoki.

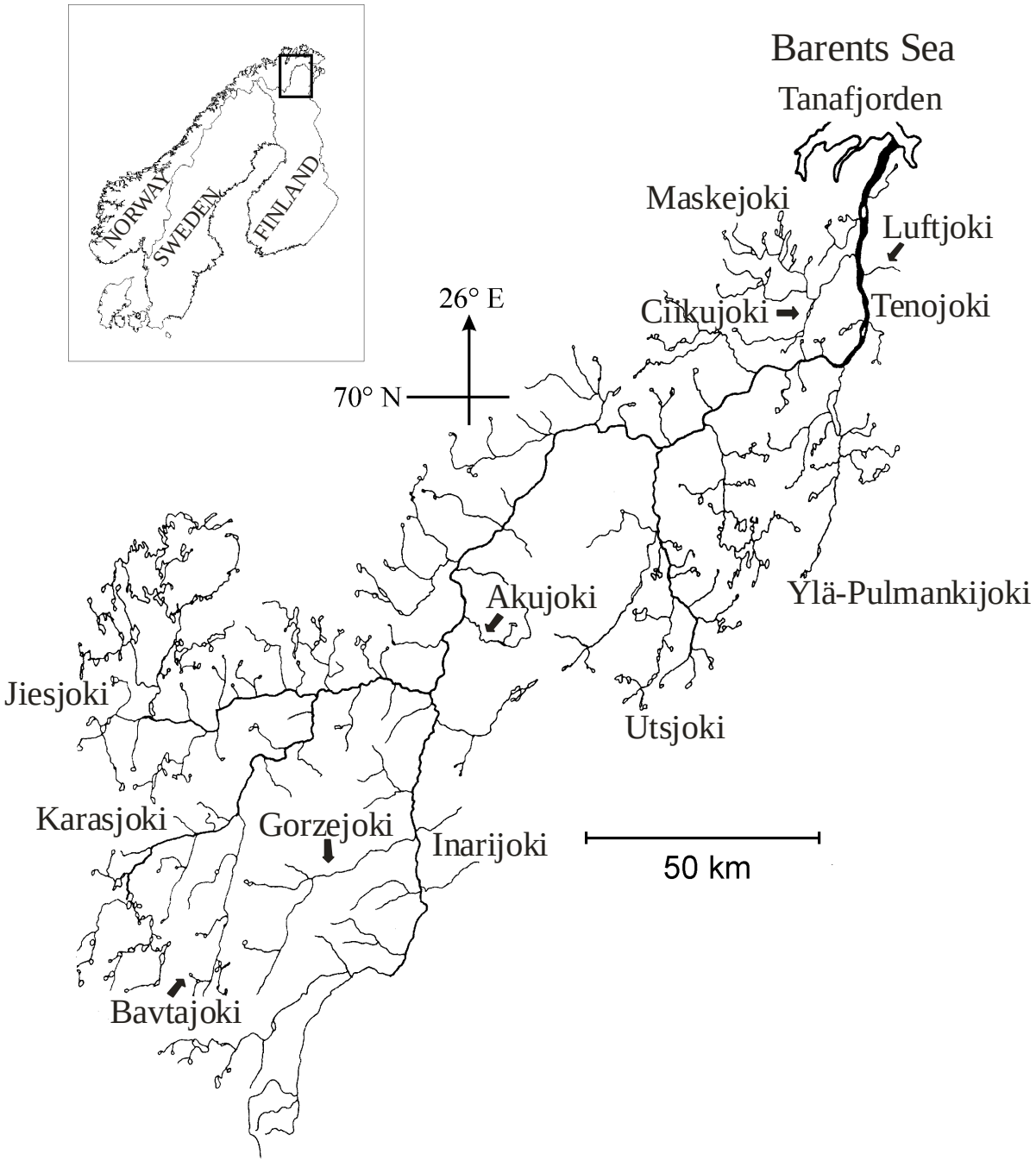


Figure 1. Map of the River Teno watershed including the names and locations of the rivers where electrofishing studies were carried out in 2006-2007.

3. Results

3.1. Karasjoki

In 2006, salmon fry (0+) were found throughout the study section between Vuottasluoppal and Suolggasavu: out of the 29 electrofishing areas fry were present in 26 areas (Fig. 2). The fry densities were considerably high above the great waterfall Suorbmugorzi (areas 1-7), which has sometimes been considered as a migration hindrance to ascending salmon. The highest 0+ density, close 60 fry/100 m^2, was observed in area 2 above the Lailagorzi waterfall. The mean density of salmon fry was 15.1 individuals/100 m^2 (Fig. 2).

Salmon parr (≥1+) were found from all the electrofishing areas in 2006. Parr densities varied between 1.4-41.9 individuals/100 m^2 (Fig. 2). The mean density of salmon parr was 18.8 individuals/100 m^2. In the uppermost electrofishing areas (areas 1-8) parr densities were moderately low, but they increased substantially in downstream study areas (Fig. 2).

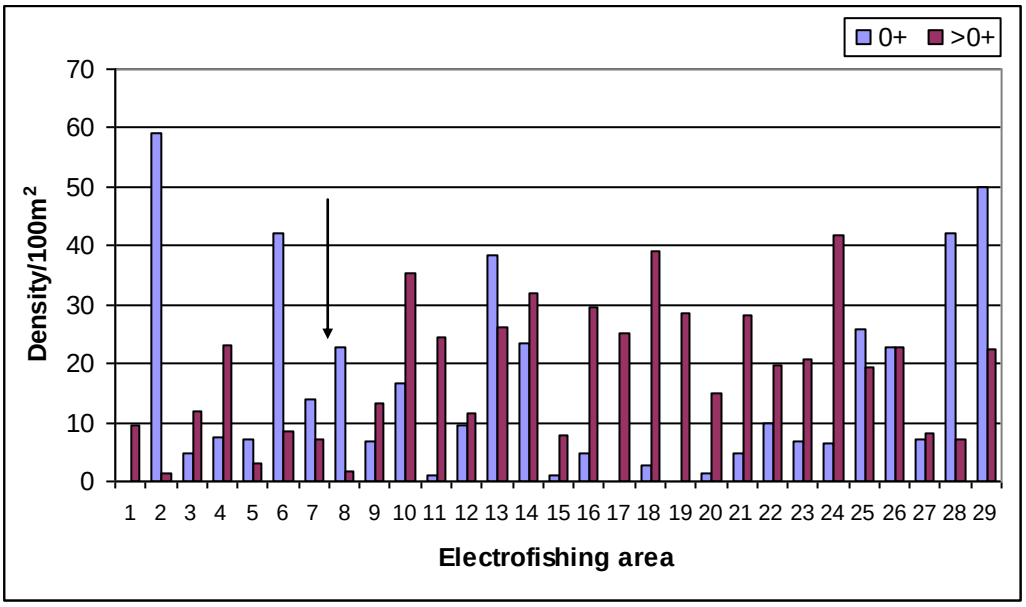


Figure 2. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Karasjoki electrofishing areas (n=29) in 2006. Arrow indicates the location of the Suorbmugorzi waterfall. The density is expressed as individuals/100 m^2 from one pass electrofishing. The numbering of the electrofishing areas starts from the upstream end of the study section.

In 2007, the electrofishing survey included the sites 12-29 below the Bavtajoki outlet (Fig. 3). The fry densities varied between 1.2 and 57.1 individuals/100 m^2 (Fig. 3). The mean fry (0+) density was 13.5 individuals/100 m^2, which was at same level compared to 2006 (14.3 fry/100 m^2, sites 12-29).

Salmon parr (≥1+) densities varied between 5.3 and 29.3 individuals/100 m^2 in 2007 (Fig. 3). The mean parr density in sites 12-29 was 15.9 individuals/100 m^2, which was slightly less than in 2006 (22.5 parr/100 m^2, sites 12-29).

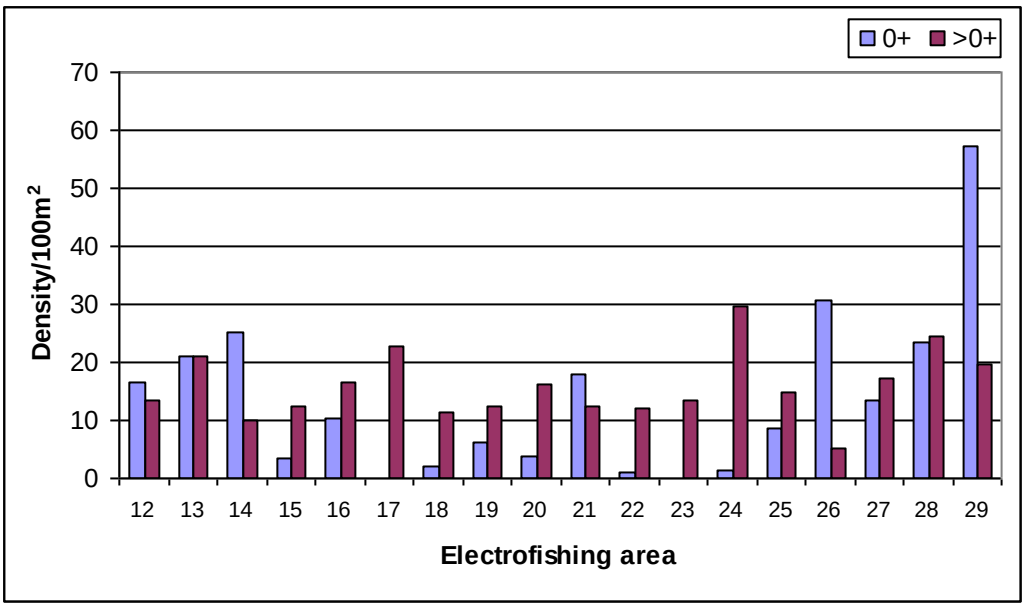


Figure 3. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Karasjoki electrofishing areas (n=18) in 2007. The density is expressed as individuals/100 m^2 from one pass electrofishing. The numbering of the electrofishing areas starts from the upstream end of the study section.

In the River Batvajoki (a tributary of Karasjoki) fourteen electrofishing sites were monitored in 2007. The salmon fry were found from 11 out of 14 sites (Fig. 4). The fry densities varied between 1.2 and 173.3 individuals/100 m^2. The mean fry density was 36.4 individuals/100 m^2, which was considerably higher compared to the mean densities observed in the River Karasjoki mainstem in 2006-2007. However, one monitoring site (area 10) with a high catch strongly affects the mean density of fry in the River Bavtajoki (Fig. 4).

Salmon parr (≥1+) densities of Bavtajoki varied between 2.2 and 45.3 individuals/100 m^2 (Fig. 4). The mean parr density was 17.5 individuals/100 m^2, which is approximately at the same level observed in the River Karasjoki mainstem in 2006-2007.

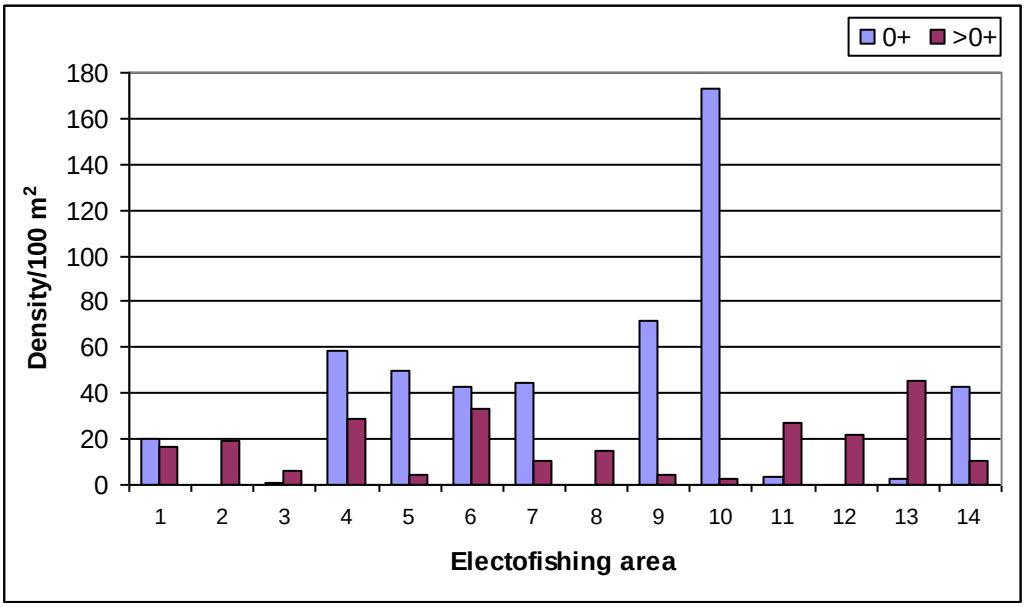


Figure 4. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Bavtajoki electrofishing areas (n=14) in 2007. The density is expressed as individuals/100 m^2 from one pass electrofishing. The numbering of the electrofishing areas starts from the upstream end of the study section.

3.2. Jiesjoki

In 2006 salmon fry were found from seven out of 14 electrofishing sites in the River Jiesjoki (Fig. 5). Fry densities varied between 2.8-33.0 individuals/100 m^2. The mean density of 0+ salmon was 7.7 individuals/100 m^2.

Salmon parr were distributed throughout the study section, except the electrofishing area 13, which were situated just below the Lake Suosjavri (Fig. 5). Parr densities varied between 9.3-43.1 individuals/100 m^2. The mean density of parr was 19.6 individuals/100 m^2. No salmon fry or parr were found at the two electrofishing sites of the tributary river Vuoddasjokka, which flows from west to the Lake Suosjavri (Appendix 12).

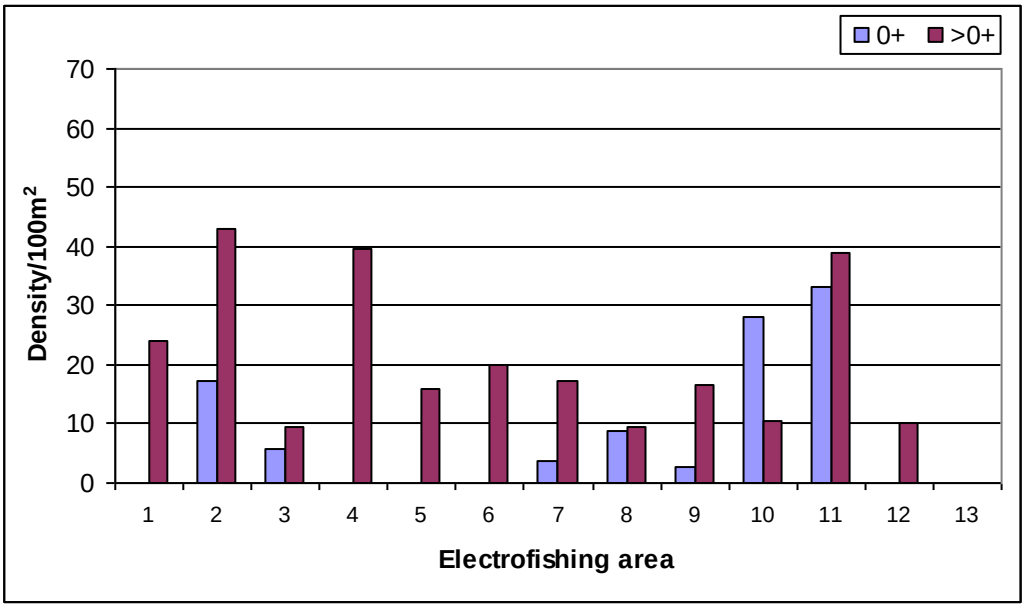


Figure 5. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Jiesjoki electrofishing areas (n=13, below Suosjavri) in 2006. The numbering of the electrofishing areas starts from the downstream end of the study section.

In 2007 salmon fry were present in nine out of 16 electrofishing sites (Fig. 6). The mean fry density (5.6 fry/100 m^2) was, however, lower that in 2006 (7.7 fry/100 m^2). Salmon parr were found from all the monitored sites except the site 13.The mean parr density was 18.7 individuals/100 m^2, which was comparable to the densities observed year before (19.6 parr/100 m^2).

In the upper part (above the Lake Suosjavri) of the River Jiesjoki 15 electrofishing sites were monitored in 2007. Salmon fry were not found from the monitoring sites. However, salmon parr were present in six monitoring sites (Fig. 7). The mean parr density was low, 1.8 individuals/100 m^2.

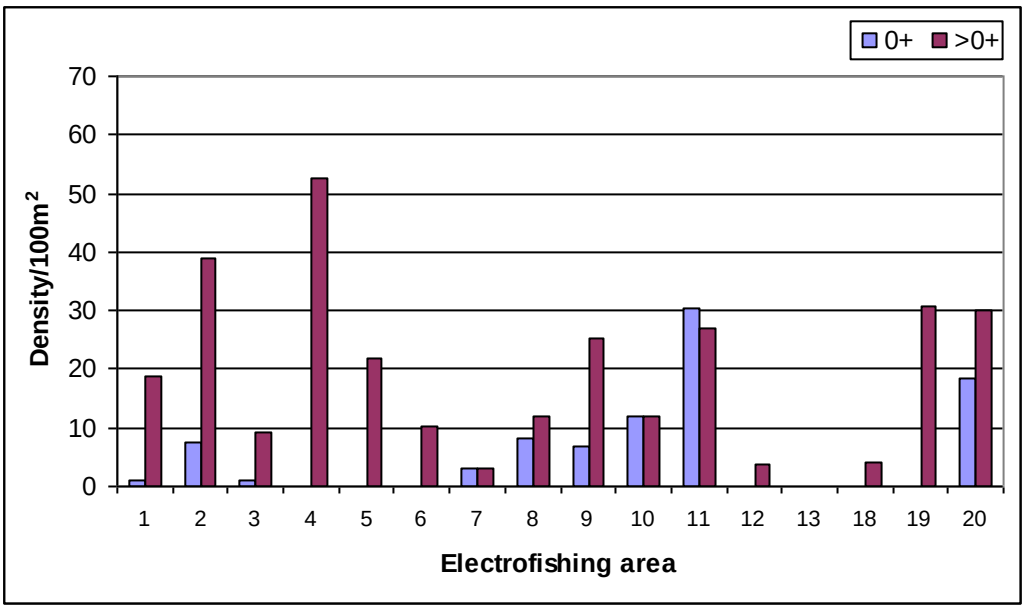


Figure 6. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Jiesjoki electrofishing areas (n=16, below Suosjavri) in 2007. The numbering of the electrofishing areas starts from the downstream end of the study section.

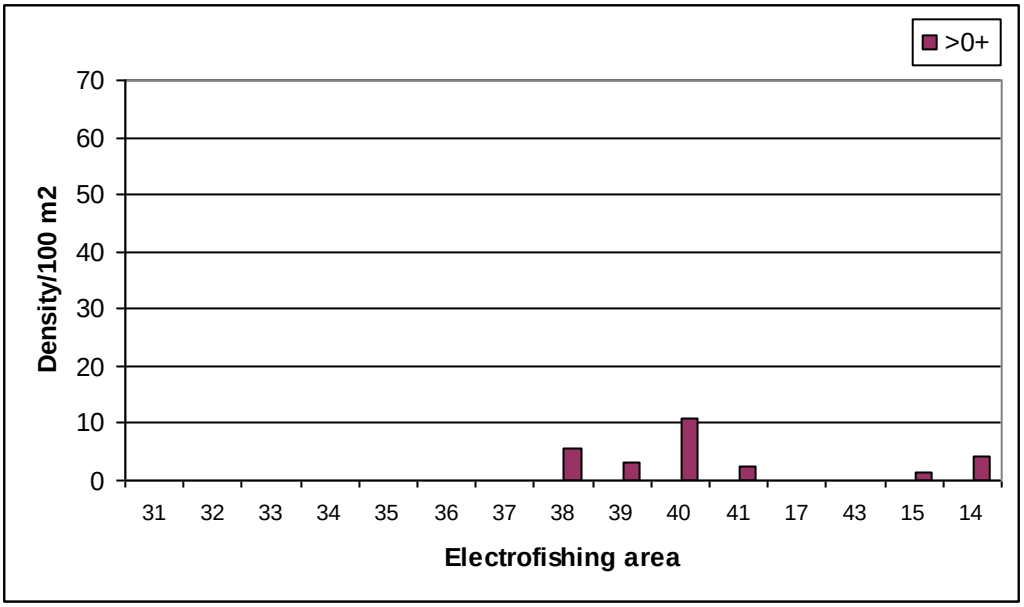


Figure 7. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Jiesjoki electrofishing areas (n=15, above Suosjavri) in 2007. Electrofishing area 31 is the uppermost study area.

3.3. Maskejoki

Salmon fry were present in eight electrofishing sites out of 12 in the River Maskejoki (Fig. 8). The fry density varied heavily (2.2-118.9 fry/100 m^2) between monitoring sites, and the fry densities were considerably lower in the upper stretches of the river system (Fig. 8). Mean fry density in 2007 was 29.8 individuals/100 m^2. Parr were found from all the electrofishing sites and densities varied between 8.8 and 83.5 individuals/100 m^2 (Fig. 8). The mean parr density was 36.2 parr/100 m^2.

In the river Ciikujoki (a tributary of Maskejoki) nine electrofishing sites were monitored in 2007 (Appendices 8, 14). The electrofishing areas were concentrated to the lower reaches of the river. Salmon fry were found in two sites (sites 8-9) and parr in three sites (sites 9, 10 and 15) (see appendix 14). Both the fry (0.9 fry /100 m^2) and parr (1.7 parr/100 m^2) mean densities were very low, indicating that the river is not a major salmon production area at the moment.

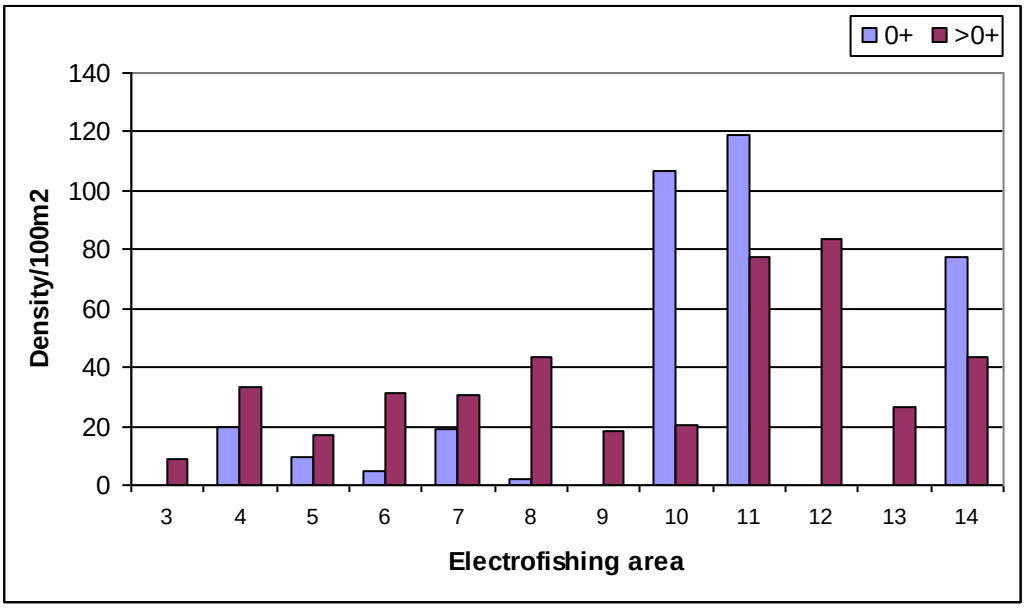


Figure 8. The densities (individuals/100 m^2) of salmon fry (0+) and parr (>0+) in the River Maskejoki electrofishing areas (n=12) in 2007. Electrofishing areas 1-2 were above waterfalls and no salmon juveniles were observed. The numbering of the electrofishing areas starts from the upstream end of the study section.

3.3. Other tributaries

Six electrofishing sites were monitored in the lower reaches of the River Gorzejoki in 2007 (Appendices 9 and 15). Fry densities varied between 0.0-10.3 individuals/100 m^2 and parr densities varied between 4.0-40.0 individuals/100 m^2. Mean fry and parr densities were 5.8 and 16.0 individuals/100 m^2, respectively. For more information see figures 10-13 and appendix 2.

In the River Luftjoki 11 electrofishing sites were monitored in 2007 (Appendices 10 and 16). Salmon fry were not found from the electrofishing areas. Salmon parr densities varied between 0.0-54.5 individuals/100 m^2 (Fig. 9). Mean parr density was 14.3 individuals/100 m^2.

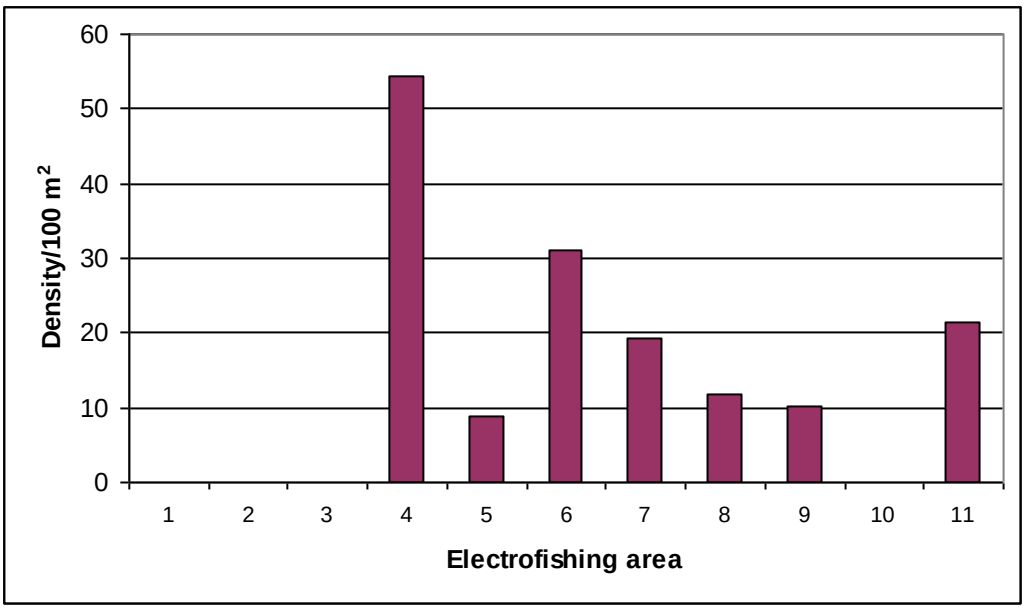


Figure 9. The densities (individuals/100 m^2) of salmon parr (>0+) in the River Luftjoki electrofishing areas (n=11) in 2007. The numbering of the electrofishing areas starts from the upstream end of the study section.

4. Density levels – comparing to other rivers

The mean salmon fry (0+) densities in 2006-2007 in the River Teno area and in the River Näätämöjoki are presented in figure 10 and in Appendices 1-2. The fry densities in the river Bavtajoki and Maskejoki were higher than observed in other areas of the River Teno (except the River Inarijoki) or in the River Neiden. In the Karasjoki mainstem mean fry densities were approximately at same level observed in most parts of the River Teno or Näätämöjoki. Fry densities in Jiesjoki and Gorzejoki were relatively low and no fry were found in the River Jiesjoki above the Lake Suosjavri.

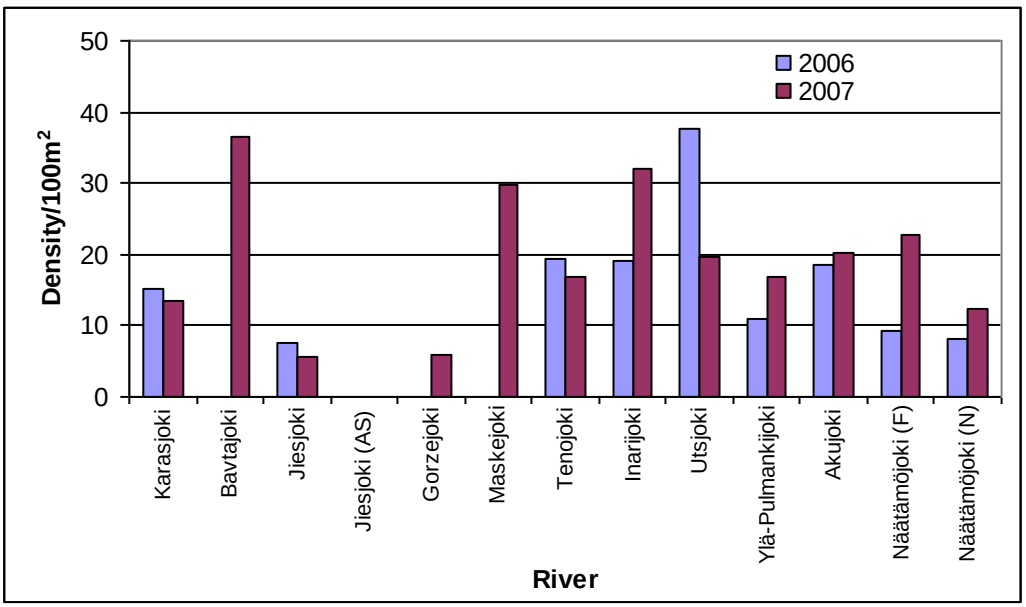


Figure 10. The mean densities of salmon fry (0+) in the rivers Karasjoki, Bavtajoki, Jiesjoki (Jiesjoki (AS)= Jiesjoki above Suosjavri), Gorzejoki, Maskejoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki and Akujoki in 2006-2007. As a reference, results from the river Näätämöjoki (F= Finnish side and N= Norwegian side) are also included. The density is expressed as individuals/100 m^2 from one pass electrofishing.

The mean salmon parr 1+ densities in 2006-2007 in the River Teno area and in the River Näätämöjoki are presented in figure 11. Salmon 1+ densities were relatively low in the Rivers Jiesjoki (especially above Lake Suosjavri) and Gorzejoki. In Karasjoki mainstem, Bavtajoki and Maskejoki 1+ densities were well within the density range observed in other parts of the River Teno or Näätämöjoki.

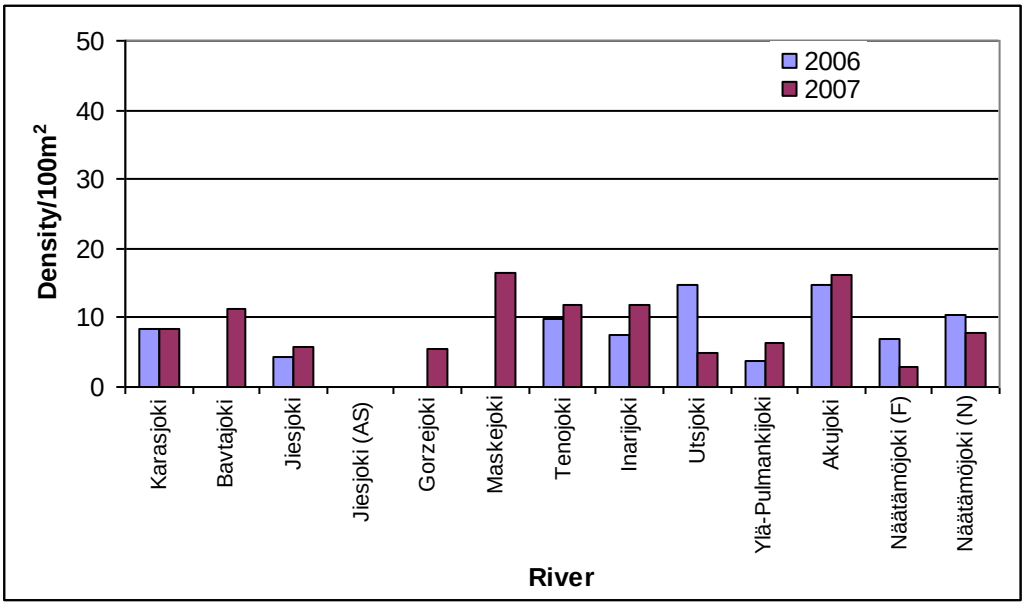


Figure 11. The mean densities of 1+ salmon parr in the rivers Karasjoki, Bavtajoki, Jiesjoki (Jiesjoki (AS)= Jiesjoki above Suosjavri), Gorzejoki, Maskejoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki and Akujoki in 2006-2007. As a reference, results from the river Näätämöjoki (F= Finnish side and N= Norwegian side) are also included. The density is expressed as individuals/100 m^2 from one pass electrofishing.

The mean densities of salmon parr ≥2+ in 2006-2007 in the River Teno area and in the River Näätämöjoki are presented in figure 12. Compared to 2006 the densities of ≥2+ salmon parr were lower in most of the studied rivers in 2007. The densities observed in the rivers Karasjoki, Bavtajoki, Jiesjoki and Gorzejoki were at the same level observed in other parts of the River Teno. In the river Maskejoki ≥2+ parr density were highest that were observed in 2006-2007 in the River Teno watershed and comparable to the results observed in the Norwegian side of the River Näätämöjoki.

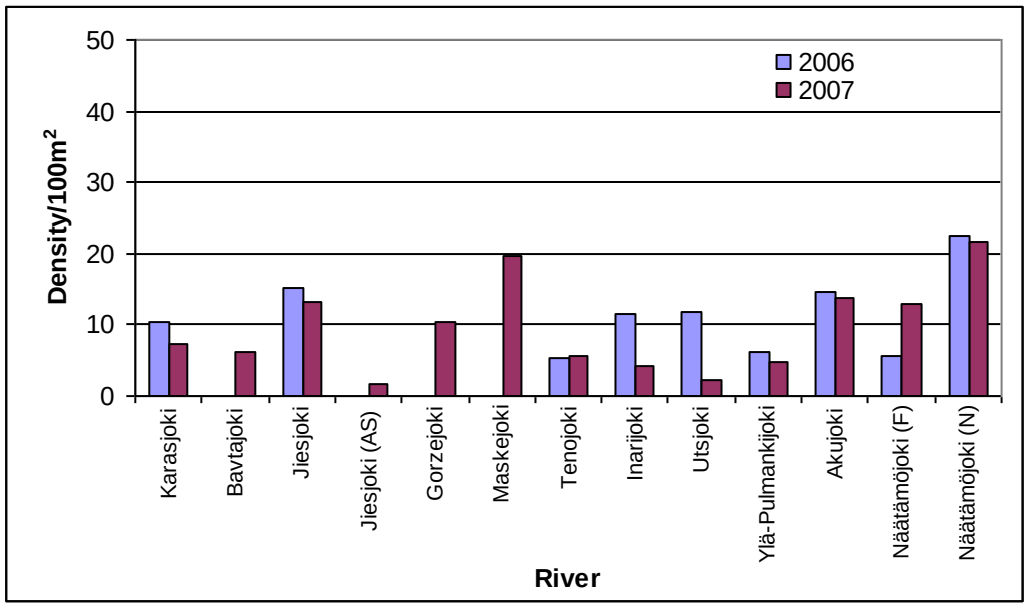


Figure 12. The mean densities of ≥2+ salmon parr in the rivers Karasjoki, Bavtajoki, Jiesjoki (Jiesjoki (AS)= Jiesjoki above Suosjavri), Gorzejoki, Maskejoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki and Akujoki in 2006-2007. As a reference, results from the river Näätämöjoki (F= Finnish side and N= Norwegian side) are also included. The density is expressed as individuals/100 m^2 from one pass electrofishing.

The total salmon juvenile densities in 2006-2007 in the River Teno area and in the River Näätämöjoki are presented in figure 13 and in Appendices 1-2. The densities observed in different parts of the River Teno system seem to be mostly between 20 and 60 fish/100m^2. The only clear exception is the River Jiesjoki above the Suosjavri lake, where the juvenile density was extremely low. Fairly high juvenile densities were found both in one of the lowermost tributaries (Maskejoki) and one of the uppermost tributaries (Bavtajoki) of the River Teno system.

Overall, the salmon juvenile densities in the rivers Teno, Inarijoki and Utsjoki in 2006-2007 were within the long-term variation interval observed in 1979-2005 (Figs. 14-16), when at least no negative trend has been discovered in the juvenile densities.

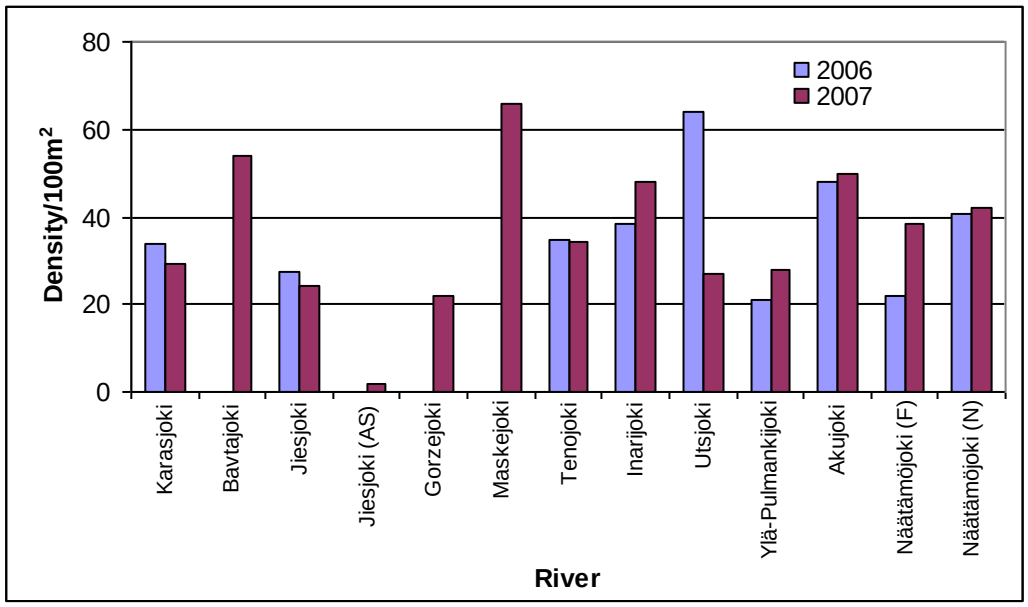


Figure 13. The mean densities of salmon fry and parr (total) in the rivers Karasjoki, Bavtajoki, Jiesjoki (Jiesjoki (AS)= Jiesjoki above Suosjavri), Gorzejoki, Maskejoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki and Akujoki in 2006-2007. As a reference, results from the river Näätämöjoki (F= Finnish side and N= Norwegian side) are also included. The density is expressed as individuals/100 m^2 from one pass electrofishing.

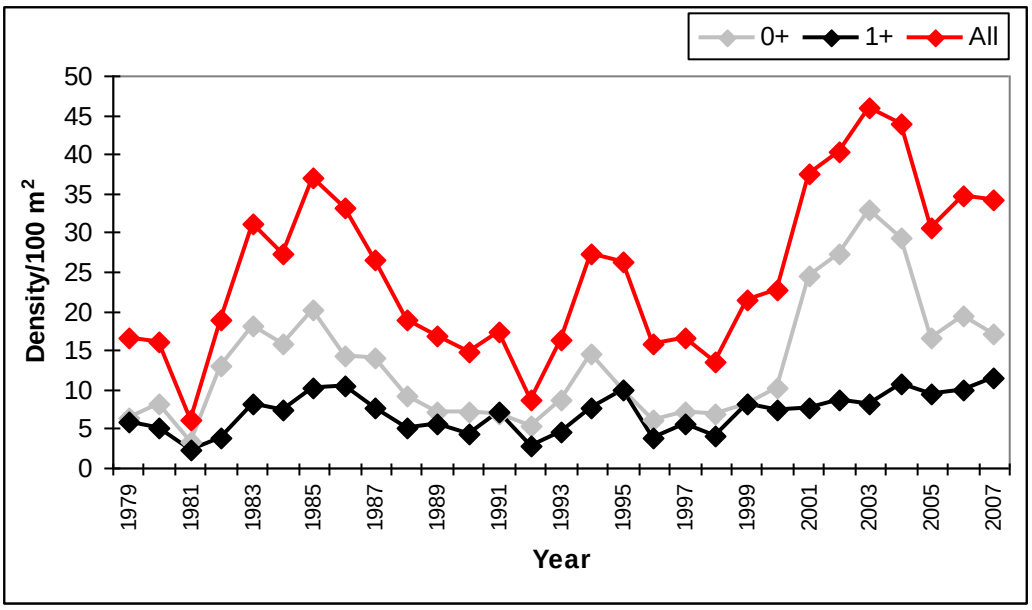


Figure 14. The mean densities of 0+ (fry), 1+ and all salmon juveniles in the River Teno electrofishing sites in 1979-2007. The densities are expressed as individuals/100 m^2 from one pass electrofishing.

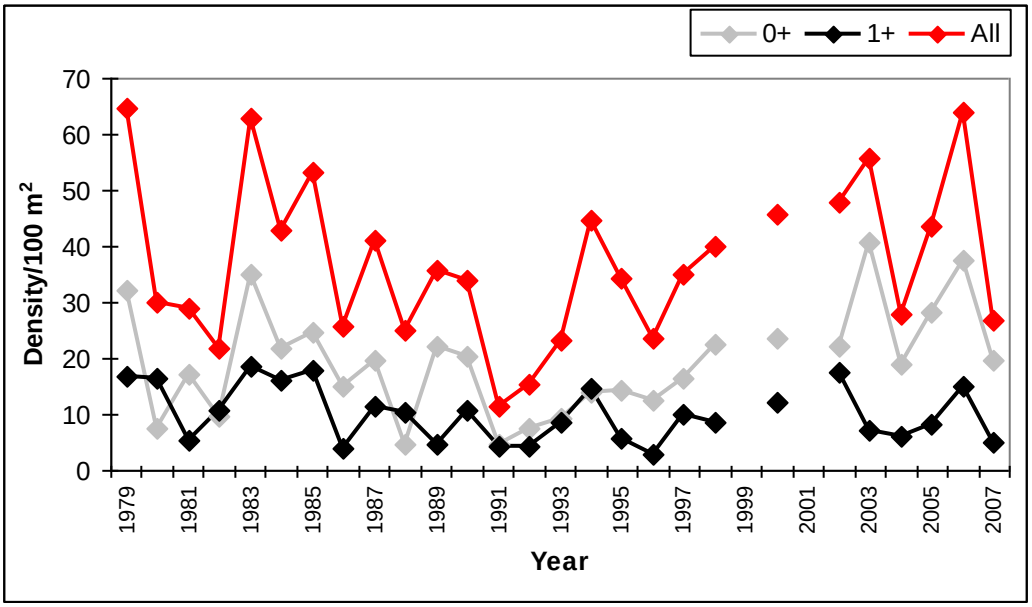


Figure 15. The mean densities of 0+ (fry), 1+ and all salmon juveniles in the River Utsjoki electrofishing sites in 1979-2007. The densities are expressed as individuals/100 m^2 from one pass electrofishing.

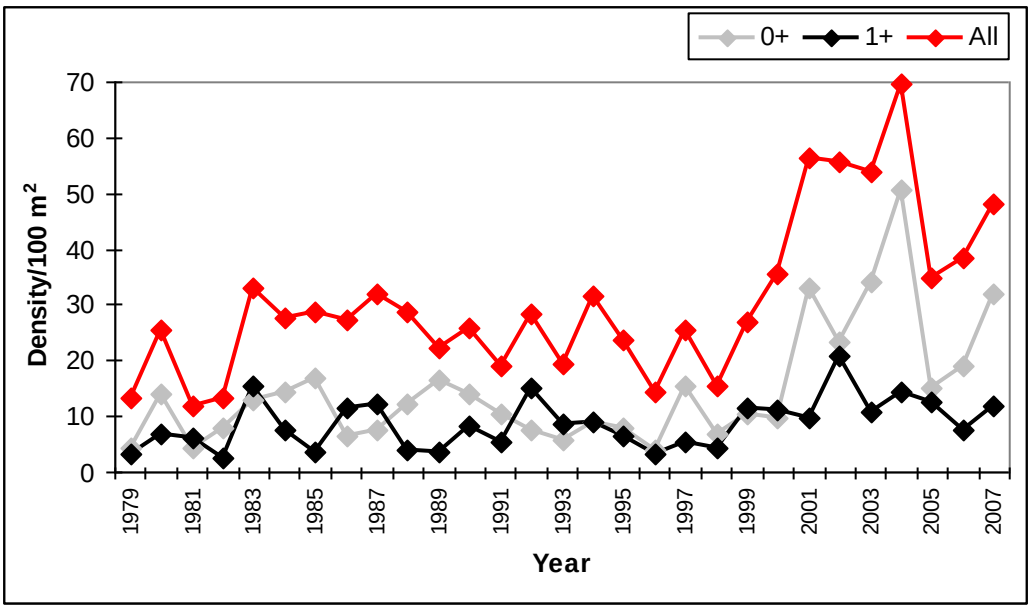


Figure 16. The mean densities of 0+ (fry), 1+ and all salmon juveniles in the River Inarijoki electrofishing sites in 1979-2007. The densities are expressed as individuals/100 m^2 from one pass electrofishing.

5. Conclusions and recommendations

Spawning salmon use extensively the production areas in the rivers Karasjoki and Bavtajoki as indicated by the high incidence of 0+ juveniles within the studied electrofishing areas. It seems evident that the many waterfalls in the River Karasjoki mainstem, including Suorbmugorzi, are not migration barriers to adult salmon as both fry and parr were widely and abundantly observed above the waterfalls.

In the River Jiesjoki salmon fry densities were low, but parr densities were at a level observed in other parts of the River Teno watershed. The electrofishing sites in Jiesjoki were chosen already in 1990-s and it seems that low fry densities in Jiesjoki are at least partly explained by the fact that suitable 0+ habitats were under-represented in the electrofishing programme. If long-term juvenile monitoring will be initiated in Jiesjoki more 0+ salmon habitats should be included in the monitoring programme.

In the River Maskejoki, the mean juvenile salmon density was the highest observed in the River Teno or Näätämöjoki watersheds in 2007, indicating that spawning has been successful at least during the last years. In the mainstem the salmon distribution area is constrained by two waterfalls, which prevent the migration of spawners. Above the waterfalls the fish fauna is dominated by resident brown trout.

Abundances of juvenile salmon in Maskejoki and Bavtajoki appeared to be at a good level compared to other areas in the Teno and Näätämöjoki systems in 2006 and 2007. In Karasjoki mainstem and in Jiesjoki (below Suosjavri) juvenile abundances were slightly lower compared to most other areas in Teno and Näätämöjoki systems. In contrast, in the upper reaches of the River Jiesjoki (above Suosjavri) salmon spawning is either infrequent or rely only on few individuals. In the uppermost part of the Jiesjoki, the area between the Iešjohkgorži waterfall and the Iesjavri lake, no juvenile salmon were observed. It seems likely that this area is sparsely and infrequently used by spawning salmon, but according to the interviews of local people in the area, e.g. the late Klemet Eriksen at the Mollisjok fjellstue, this area has probably never been within a preliminary salmon distribution area, at least not for decades. There was information about some salmon catches,

mostly large fish, taken from that area some decades ago, but the salmon abundance appears to have always been very low. Thus, the present situation may not reflect a major, recent change in the salmon stock status in the uppermost stretches of the Jiesjoki.

In recent years, concerns have been raised whether the salmon spawning populations of Karasjoki, Jiesjoki and Maskejoki river systems are still dominated by multi-sea-winter (MSW) salmon or if there has been a change towards an increase in one-sea-winter salmon component. Therefore, a well-organized scale sampling programme and/or counting of ascending salmon (e.g. DIDSON counter) should be considered in future monitoring of the River Karasjoki and/or Maskejoki watersheds. In addition, the preliminary information on the salmon returns to the Teno system in 2008 indicate a relatively good run of MSW salmon, and the water level stayed rather high throughout the summer. Therefore, a thorough juvenile survey especially in the large headwater systems, Karasjoki and Jiesjoki, could be interesting and important to carry out in 2009 in order to assess the (MSW) salmon spawning stock in 2008 in these areas.

6. Appendices

Appendix 1.

Number of electrofishing sites, mean densities and standard deviations of 0+, >+0 and total salmon juveniles in the rivers Karasjoki, Jiesjoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki Akujoki, Näätämöjoki Finnish side and Näätämöjoki Norwegian side in 2006. The densities are catches of salmon juveniles on one electrofishing removal/100 m^2.

River	n-sites	0+	Std.	>0+	Std.	Total	Std.
Karasjoki	29	15,1	16,6	18,8	11,3	33,9	17,5
Jiesjoki (below Suos)	14	7,7	11,4	19,6	13,3	27,3	20,3
Tenojoki	32	19,4	15,0	15,3	10,7	34,6	19,6
Inarijoki	10	19,2	25,7	19,1	7,7	38,3	25,9
Utsjoki	12	37,7	60,2	26,5	16,3	64,0	71,1
Ylä-Pulmankijoki	20	11,0	7,9	9,9	7,9	20,9	9,8
Akujoki	21	18,5	14,5	29,5	22,1	47,9	25,9
Näätämöjoki (F)	20	9,2	9,5	12,7	11,3	21,9	16,8
Näätämöjoki (N)	13	8,0	11,0	32,7	17,3	40,7	21,3

Appendix 2.

Number of electrofishing sites, mean densities and standard deviations of 0+, >+0 and total salmon juveniles in the rivers Karasjoki, Bavtajoki, Jiesjoki, Gorzejoki, Maskejoki, Teno, Inarijoki, Utsjoki, Ylä-Pulmankijoki Akujoki, Näätämöjoki Finnish side and Näätämöjoki Norwegian side in 2007. The densities are catches of salmon juveniles on one electrofishing removal/100 m^2.

River	n-sites	0+	Std.	>0+	Std.	Total	Std.
Karasjoki	18	13,5	14,5	15,9	5,8	29,3	15,5
Bavtajoki	14	36,4	46,8	17,5	12,7	53,9	42,8
Jiesjoki (below Suos)	16	5,6	8,6	18,7	14,7	24,3	18,7
Jiesjoki (above Suos)	15	0,0	0,0	1,8	3,1	1,8	3,1
Gorzejoki	6	5,8	4,1	16,0	12,7	21,8	11,1
Maskejoki	14	29,8	44,4	36,2	23,1	66,0	56,0
Tenojoki	32	16,8	21,2	17,5	11,8	34,2	28,3
Inarijoki	10	32,2	34,6	15,8	9,0	48,0	35,1
Utsjoki	12	19,7	23,4	7,2	6,0	26,9	27,3
Ylä-Pulmankijoki	20	16,8	15,1	11,1	7,9	27,9	14,7
Akujoki	21	20,3	19,4	29,7	20,1	50,0	25,6
Näätämöjoki (F)	20	22,7	25,0	15,9	14,7	38,4	36,2
Näätämöjoki (N)	13	12,3	11,3	29,6	11,9	41,9	14,1

Appendix 3.

Location (WGS 84) of electrofishing areas (n=29) in the River Karasjoki mainstem.

Area nro.	Location (WGS 84)		
1	35 W	392852	7669462
2	35 W	394797	7671440
3	35 W	394835	7671454
4	35 W	395261	7671678
5	35 W	396622	7671952
6	35 W	399592	7673133
7	35 W	401115	7673208
8	35 W	402083	7672846
9	35 W	406751	7674440
10	35 W	410104	7677086
11	35 W	410676	7677414
12	35 W	411386	7678577
13	35 W	411439	7679041
14	35 W	411071	7680201
15	35 W	411524	7681036
16	35 W	411879	7681437
17	35 W	412255	7681777
18	35 W	412501	7682853
19	35 W	412825	7684136
20	35 W	415341	7690452
21	35 W	416355	7690859
22	35 W	417329	7689919
23	35 W	418207	7689803
24	35 W	420375	7689636
25	35 W	421720	7690270
26	35 W	421186	7690755
27	35 W	421456	7691756
28	35 W	422943	7692429
29	35 W	424142	7693175

Appendix 4.

Location (WGS 84) of electrofishing areas in the River Jiesjoki below the Lake Suosjavri and in the tributary river Vuoddasjokka (V1-V2).

Area nro.	Location (WGS 84)		
1	35 W	424101	7704415
2	35 W	421834	7704507
3	35 W	419419	7703316
4	35 W	417564	7703740
5	35 W	414675	7702914
6	35 W	411163	7702700
7	35 W	407306	7700466
8	35 W	407277	7699425
9	35 W	407513	7698051
10	35 W	402791	7697377
11	35 W	400106	7697842
12	35 W	397223	7698198
13	35 W	394110	7698226
18	35 W	399127	7697404
19	35 W	401472	7698087
20	35 W	404433	7696106
V1	35 W	389946	7698870
V2	35 W	385417	7699626

Appendix 5.

Location (WGS 84) of electrofishing areas in the River Jiesjoki above the Lake Suosjavri.

Area nro.	Location (WGS 84)		
31	35 W	394343	7725554
32	35 W	394320	7725100
33	35 W	394667	7724278
34	35 W	398261	7719606
35	35 W	398149	7719665
36	35 W	397301	7714019
37	35 W	397313	7714020
38	35 W	394131	7708385
39	35 W	394107	7708406
40	35 W	393892	7708174
41	35 W	393780	7707761
17	35 W	393612	7707171
43	35 W	394214	7704258
15	35 W	393862	7704272
14	35 W	393375	7703028

Appendix 6.

Location (WGS 84) of electrofishing areas in the River Bavtajoki. Location data from site 8 is missing.

Area nro.	Location (WGS 84)		
1	35 W	409426	7662799
2	35 W	409520	7663415
3	35 W	409536	7663777
4	35 W	409889	7664915
5	35 W	409874	7665571
6	35 W	409871	7665791
7	35 W	410349	7666870
8	35 W	?	?
9	35 W	411031	7669460
10	35 W	412220	7673163
11	35 W	412529	7674431
12	35 W	412684	7675784
13	35 W	411866	7676424
14	35 W	411657	7676984

Appendix 7.

Location (WGS 84) of electrofishing areas in the River Maskejoki.

Area nro.	Location (WGS 84)		
1	35 W	531048	7794425
2	35 W	531062	7794438
3	35 W	531414	7794425
4	35 W	532045	7793912
5	35 W	532688	7792997
6	35 W	532850	7792384
7	35 W	532972	7790984
8	35 W	531940	7790215
9	35 W	534064	7788425
10	35 W	535084	7788560
11	35 W	535496	7789962
12	35 W	536785	7791705
13	35 W	537842	7792599
14	35 W	539381	7794650

Appendix 8.

Location (WGS 84) of electrofishing areas in the River Ciikujoki.

Area nro.	Location (WGS 84)		
11	35 W	532341	7782939
12	35 W	531214	7782095
13	35 W	530945	7781943
14	35 W	530635	7781916
15	35 W	530261	7781430
1	35 W	531797	7782111
10	35 W	532337	7782943
8	35 W	532304	7783524
9	35 W	532338	7782979

Appendix 9.

Location (WGS 84) of electrofishing areas in the River Gorzejoki.

Area nro.	Location (WGS 84)		
1	35 W	432699	7664713
2	35 W	433116	7664692
3	35 W	434319	7664511
4	35 W	438008	7668134
5	35 W	438668	7669082
6	35 W	443842	7669308

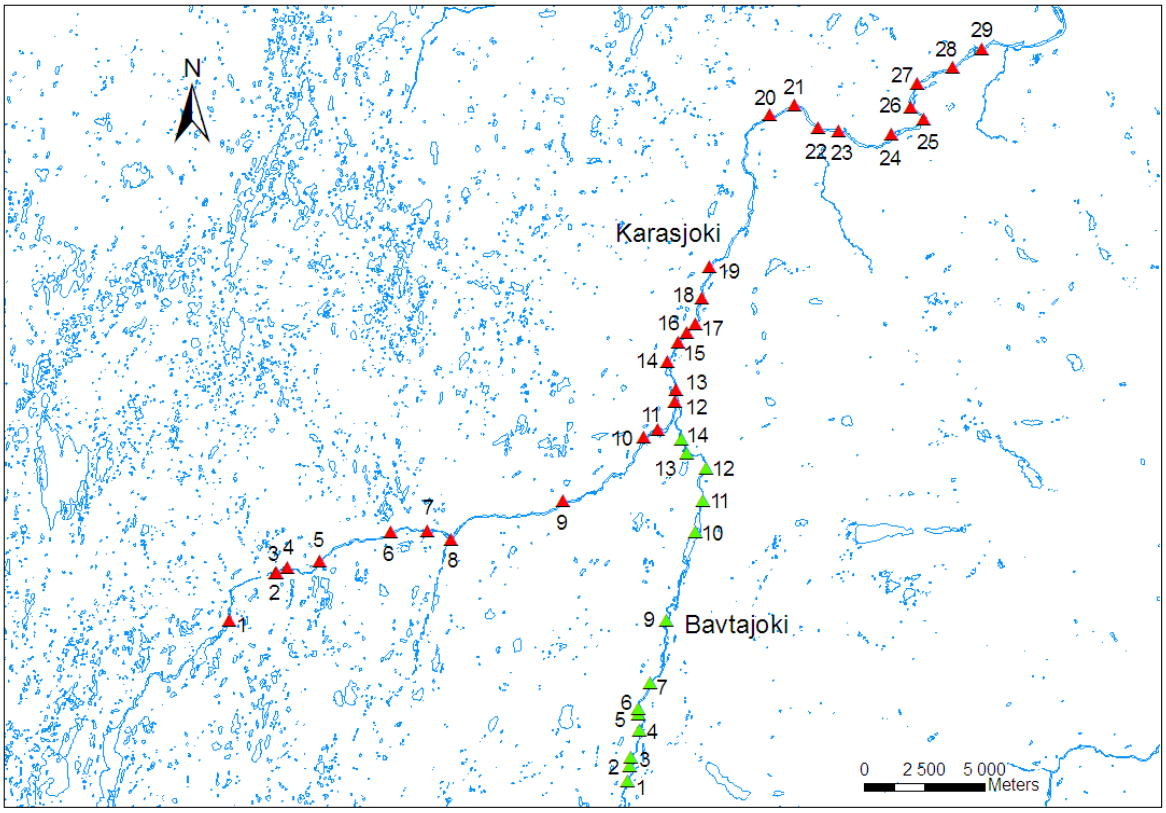
Appendix 10.

Location (WGS 84) of electrofishing areas in the River Luftjoki.

Area nro.	Location (WGS 84)		
1	35 W	552352	7794471
2	35 W	549395	7794557
3	35 W	548829	7794589
4	35 W	548497	7794913
5	35 W	548402	7794945
6	35 W	548305	7794922
7	35 W	548306	7794813
8	35 W	548275	7794679
9	35 W	547747	7794361
10	35 W	547363	7794045
11	35 W	546132	7793151

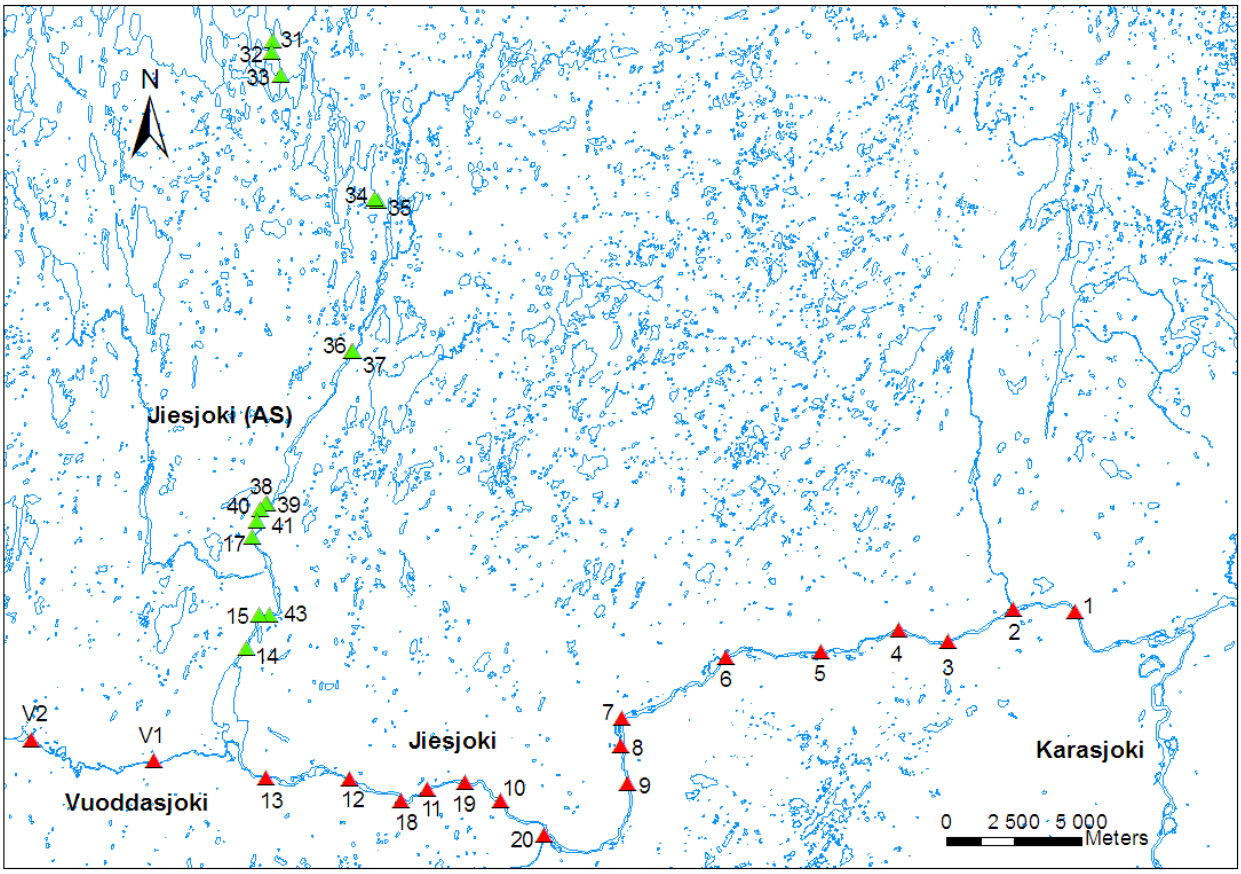
Appendix 11.

Map of the electrofishing sites in the rivers Karasjoki (red triangles) and Bavtajoki (green triangles). In Bavtajoki the electrofishing site 8 is missing as no coordinates for the site are available, but the site is located between sites 7 and 9.



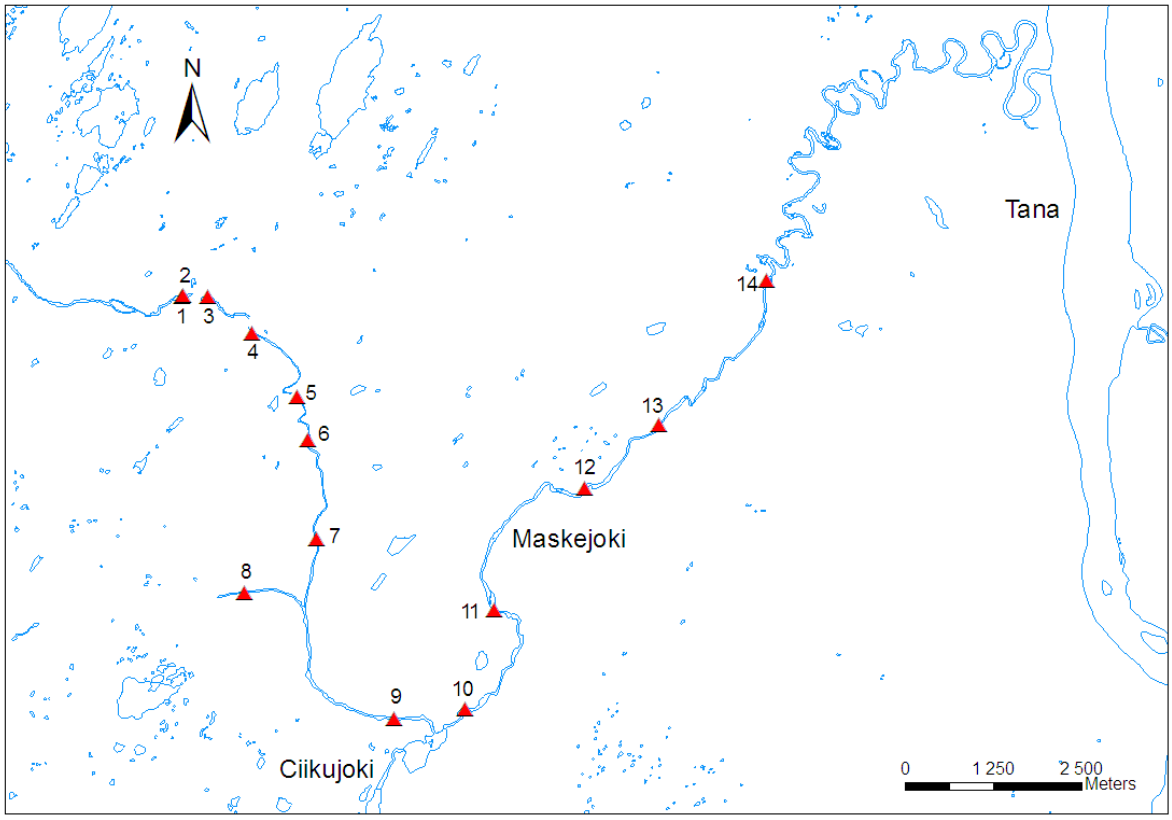
Appendix 12.

Map of the electrofishing sites in the river Vuoddasjoki (V1-V2), Jiesjoki below Suosjavri (red triangles) and Jiesjoki above Suosjavri (green triangles, Jiesjoki (AS)).



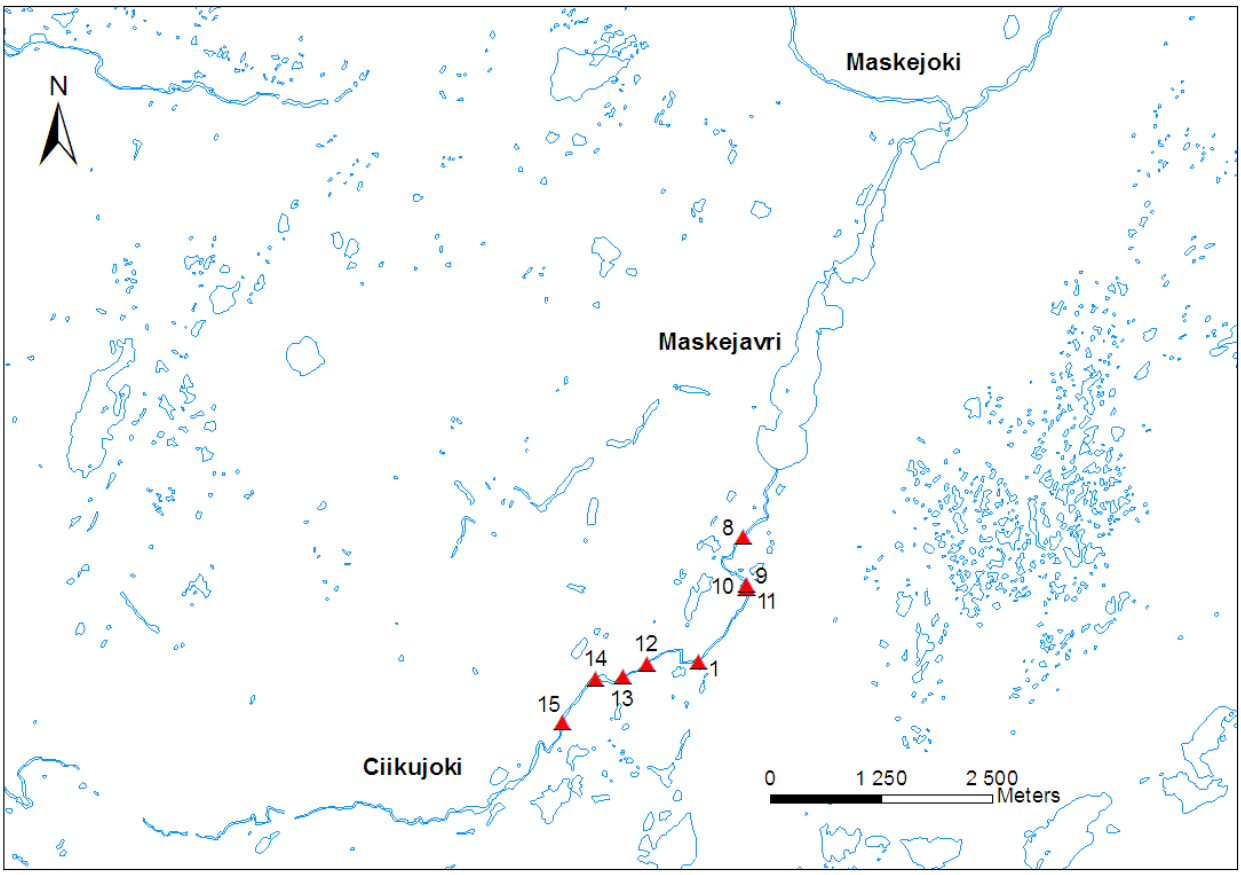
Appendix 13.

Map of the electrofishing sites in the River Maskejoki.



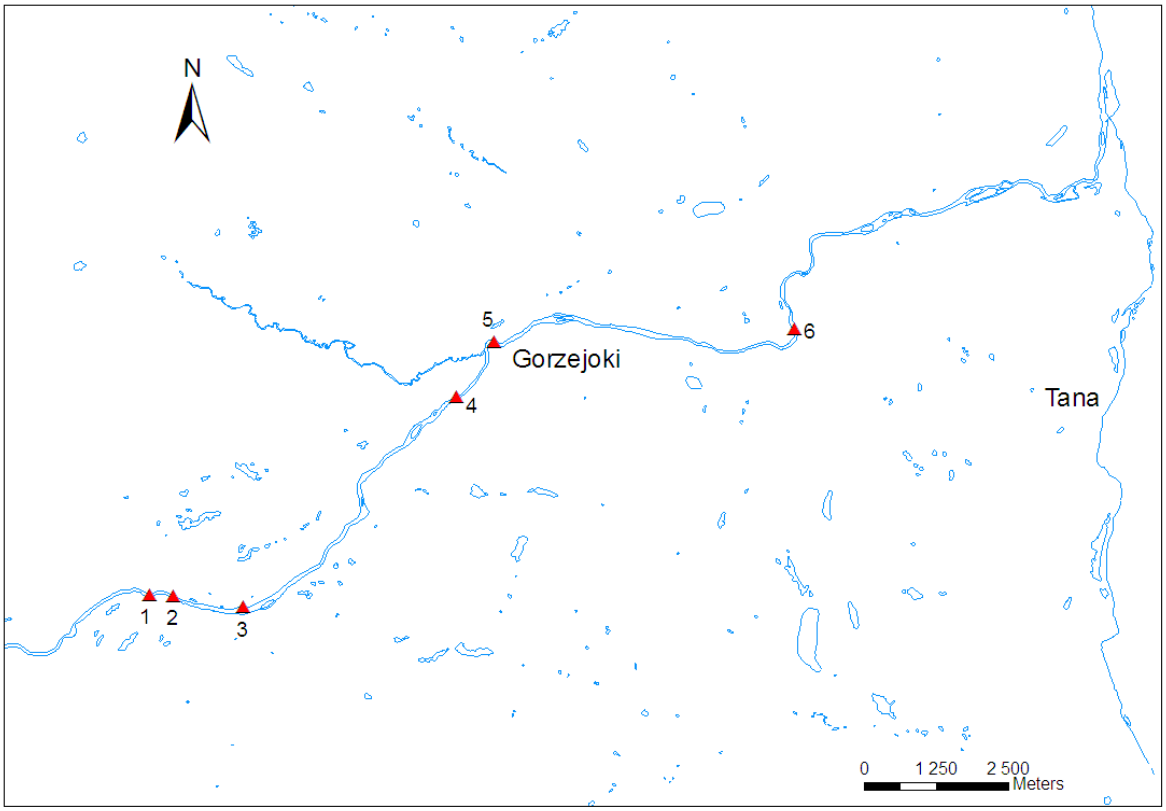
Appendix 14.

Map of the electrofishing sites in the River Ciikujoki, a tributary of Maskejoki.



Appendix 15.

Map of the electrofishing sites in the River Gorzejoki.



Appendix 16.

Map of the electrofishing sites in the River Luftjoki. The site 1 is located in a small tributary not shown in the map.