Aquatic assessment in river Tana

NATURTJENESTER I NORD

Water chemistry, invertebrates and fish in 6 tributaries

Report 3 – 2019

Naturtjenester i Nord
Holtveien 66
9016 Tromsø
Org 983 342 663
Tlf 41423272
www.ninord.no

Project

Aquatic assessment in river Tana

Project lead

Rune Muladal

Contact

[Kontaktperson]

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Summary

We have carried out surveys in 6 tributaries to river Tana. The result provides a snapshot of the water chemistry, and only hints for the overall water chemistry throughout the year. According to the classification guides Vuottasjohka, Tsulleveäijohka, Keädgejohka, Vuobmaveäijohka and Kuktsejohka can be classified as river type R206 (calcareous, humid) and Gossjohka as river type R207 (moderately calcareous, humid). The invertebrate fauna in six sites was investigated. The density of bottom animals varied widely with 24 to 257 individuals per sample, but despite the variation in density, the overall ecological condition was not effected. Gossjohka had the lowest bottom animal densities, but when Norwegian and Finnish samples were merged, the condition became very good. Electrofishing was carried out in 4 tributaries of a total of 1850 m2 distributed over 11 stations. The catch was dominated by salmon and trout juveniles .A total of 7 species were registered and the highest densities of salmon were in Gossjohka.

Project leader	Quality control
Rune Muladal	Helge Huru

1. Preface

Naturtjenester i Nord (NINORD) were commissioned by Lapland Centre for Economic Development, Transport and the Environment (Lapland ELY-centre) to conduct aquatic survey in 6 tributaries of Tana river system. Responsible for the surveys (planning, sampling and reporting) have been Rune Muladal who, together with Grzegorz Wierbinski, also carried out the field work (NINORD). Analysis of invertebrates have been carried out by Helge Huru (NINORD) and Gaute Kjærstad (NTNU). Contact person at the client has been Jukka Ylikörkkö, who has also contributed with relevant information according sampling and infrastruture. We thank ELY for the cooperation and the assignment of the project.

Tromsø, Mars 2019

2. Content

3. Introduction

The River Teno (Tana in Norwegian) is located in northern Norway and northern Finland and it runs via Tanafjord into the Barents Sea. The river system (drainage area 16386 km2) is one of the most important Atlantic salmon, Salmo salar L., rivers in the world with annual in-river catches of 60-250 t and more than 1200 km of rivers accessible to migrating adult salmon. The river Tana system supports at least 20 genetically differentiated salmon populations in the main stem and in its tributaries (Vähä et al., 2007, 2008). Naturtjenester I Nord was commissioned to carry out surveys in 6 tributaries to Tana in autumn 2018.

The rivers Vuottasjohka / Iesjohka and Gossjohka / Anarjohka (Norway) and Tsulleveäijohka / Tana, Keädgejohka / Tana, Vuobmaveäijohka / Inarijohki and Kuktsejohka / Utsjoki (Finland) has been assessed for water chemistry, invertebreates and juvenile atlantic salmon. The survey is a part of Joint Environmental Management of the River Tana Interreg project, which is coordinated by Lapland ELY-centre in cooperation with the County Governor of Finnmark and the Tana municipalities. Due to challenging situation with high water flow no registrations were carried out in Bavvtajohka.

The purpose in this project is to fill data gaps in the regional aquatic monitoring, map suitable long-term monitoring stations and to compare different national benthic sampling methods. The survey include three parts:

1. Macroinvertebrate sampling and analysis

2. Electrofishing

3. Water quality sampling and analysis

4. Methodology

The fieldwork was done 23-25th September under descending water levels after a period of rain. According to the water framework directive, the results from water chemistry or fish communities measured after only one collection are not sufficient to assess the ecological status of the quality elements of chemistry and fish. On the other hand, the methodology satisfies the assessment of ecological status based on the quality element "bottom fauna" (invertebrates). To measure the deviation from the reference state, the ratio of observed values to water-type-specific reference values for the relevant parameter or index is calculated. This ratio is called ecological quality ratio (EQR), and normalized EQR (n-EQR) varies from 0 to 1, where 1 is best (reference state). The class limits are given in the norwegian supervisor (Veileder 02: 2018)[1].

4.1. Water quality sampling and analysis

Water in each station is sampled one time during the biological survey at an undisturbed site. Samples are collected from depth about 25 cm in appropriate containers and cooled before analyzes. The samples are processed in the laboratory (Eurofins) (see table 1).

Table 1. Parameters analysed from water samples in the project.

Analysis	Unit	Method
Alkalinity	mmol/l or meq/l	Gran titration
Turbidity		Turbidimetric FTU or FNU
Colour	mg Pt/l	Comparative
Total Nitrogen	µg/l	Digestion K2S2O8/ K2S2O8+H3BO3, automatic analysis
Total Phosphorus	µg/l	Spectrophotometric
pH		Electronic or ionselective
Suspended solids	µg/l	Filtering 0,4 µm Nuclepore, gravimetric 105 °C
Chemical oxygen demand CODMn	mg/l	Titrimetric
Total calcium	mg/l	

[1] http://www.vannportalen.no/globalassets/nasjonalt/dokumenter/veiledere-direktoratsgruppa/Klassifisering-av-miljotilstand-i-vann-02-2018.pdf

4.2. Macroinvertebrate sampling and analysis

Sampling is conducted according to national standards A and B, were given in the tender background and explained in principle below.

The subscriber provides field sheets to be filled at site. At stations 1 and 4 both methods are applied. From these sides the total number of samples includes the 4x30 second samples by method A) and the 3-minute sample by the method B). The identification of invertebrate fauna are given in the taxa resolution applied . Reporting includes summary of the findings using relevant indices and expertise, comparison of the two method's results from stations 1 and 4, the raw data in taxa **densities per sample** and copies of the field sheets (attachement to this report).

A) Finland (SFS5077, adjusted by Meissner et al. 2016 [in Finnish]) - Kick-net has the mesh size of 0.5 mm and sieve is max. the same size. 1. Each station is sampled at one riffle section, where two separate sites are identified according to flow velocity and substrate grain size. Sampling proceeds from downstream to upstream. 2. When different substrates are available the sites are 1) small rock/gravel ~1-6 cm, 2) big rock ~6-20 cm. Mossy rocks are included in the same proportion they are represented in the riffle. Turf nor sandy substrates are not sampled. Field sheet is filled for each site separately. 3. At a site two separate 30 second/1 meter kick-net samples taken. Therefore each station comprises 2x2=4 separately sieved and preserved 30 second samples. Samples are named after the station and the site. Samples are stored in ethanol with final concentration c. 70 %. 4. Benthic indices are calculated for the total 2 minute catch, but the raw data has to be delivered as densities per sample.

As an example station Keädgejohka includes samples Keädgejohka pKi1 (small rocks), Keädgejohka pKi2, Keädgejohka iKi1 (big rocks), Keädgejohdk iKi2.

B) Norway (NS-EN 16150 [in Norwegian]) - Both kick-net and sieve have the mesh size of 0.25 mm. 1. Each station is sampled at one riffle section 9 times 20 second / 1 meter. The total of 3 minutes sampling effort comprises one sample for the station. 2. Sampling should be located in three habitat-types/bottom substrates so that each minute represents one type. The catch collected after each minute (3 rounds of kicking) to avoid the net from clogging. 3. Samples are named after the station and preserved in ethanol with final concentration c. 70 %. 4. Benthos density is calculated referring to an effort of 3 min per station, representing approx. 2,25 m^2 of the river bottom.

4.3. Electrofishing

Electrofishing is conducted following standard EN 14011.

1. An area of 300 m^2 (minimum of 100 m), is surveyed one time. 2. The catch is recorded on species level and in addition salmonids in age classes 0+ and 1+ and a subsample is measured (mm). 3. The habitat of each station is classified as either 1) suitable for salmonids or 2) highly suitable for salmonids, to enable evaluation of the data according to the Norwegian classification guidelines 02:2018. 4. The subscriber provides standard field sheets.

5. Results are reported by shortly summarizing the findings. The raw data including all the field measurements is returned with the report.

4.4. Indexing

Fish index

According to EUs framework there is still no good method for indexing fish as quality element in rivers in northern Norway. Criteria for the use of habitat classes in the classification are specified in guidelines (Veileder 2:2018, Table 6.15). Habitat class 1 is "poorly suited", habitat class 2 is "suitable", habitat class 3 is "Suitable".

It's probably dominance of sympathetic fish communities in large parts of the Tana watercourse, include all the tributories in this survey. There is also a significant proportion of trout. Whether this is resident or potentially anadromous trout or a combination is uncertain. The criteria for using salmon as quality element for evaluation of ecological status is then not applicable.

Invertebrate index

To assess the ecological status of the river, the ASPT index (Average Score Per Taxon) can be used. For practical reasons, it is not the occurrence of species used, but the presence of a selection of higher taxa, substantial families, which can be identified of taxa at family level. The index is based on a ranking of the families according to their tolerance to the load of organic substances and nutrients. The tolerance values vary from 1 to 10, where 1 indicates the highest tolerance (Table 5).

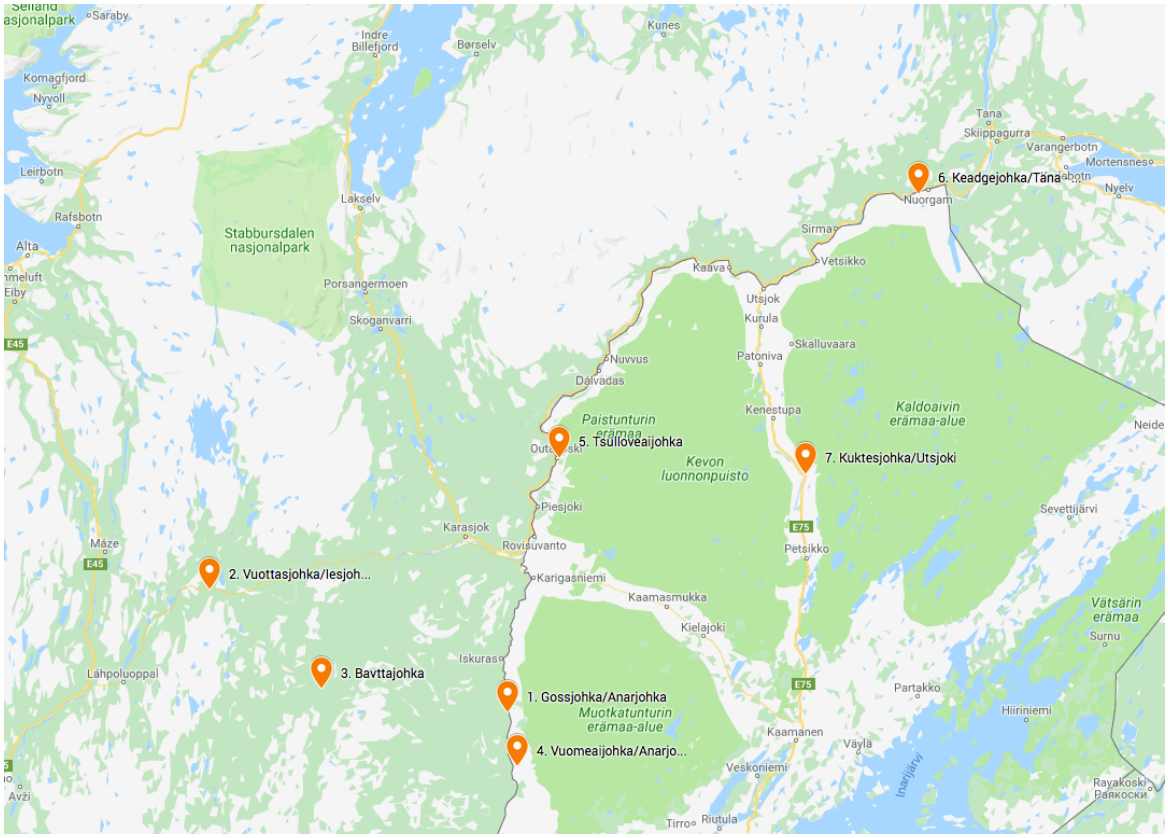
The taxonomic requirement for calculating the ASPT index is at the family level. The tolerance values for all relevant families (plus the class of Oligochaeta) are summed and the sum is divided by the number of families registered: ASPT = ∑tolerance values of all families / number of families.

Class limits for ASPT in rivers are given in in the Norwegian classification system guidelines (Veileder 02: 2018). The benthic community is intended for genus and species for mayflies (Ephemeroptera) and stone flies (Plecoptera, and for family of caddisflies (Trichoptera).

EQR - Ecological Quality Range and n-EQR are calculated according to the eference values in the Norwegian classification system. The EQR for bottom animals is calculated according to the formula EQR = observed value / reference value. This gives EQR = obs / 6.9, since the reference value is set to 6.9 and n-EQR is calculated according to the formula given in the guidelines (kap. 3.5.5)

4.5. Survey locations

The River Teno (Tana in Norwegian) is located in northern Norway and northern Finland and it runs via Tanafjord into the Barents Sea (Fig. 1). The river system (drainage area 16386 km^2) is one of the most important Atlantic salmon, *Salmo salar* L., rivers in the world with annual in-river catches of 60-250 t and more than 1200 km of rivers accessible to migrating adult salmon. The river Teno system supports at least 20 genetically differentiated salmon populations in the main stem and in its tributaries (Vähä et al., 2007, 2008).



Figur 1. Examination area with stations for sampling indicated.

Tabell 2. Overview of rivers with geographical location, methods for collecting bottom animals (Norwegian=B or Finnish=A) for the surveys.

	Name	Tributary	WGS84N	WGS84E	Macroinvertebrate method		Electrof. station
1	Gossjohka	Anárjohka/Inarijoki	69,15461	25,71631	A+B	4+1	5
2	Vuottasjohka	Iesjohka	69.37852	24.22133	B	1	4
3	Bávttajohka	Karasjohka			B	1	
4	Vuobmeveäijohka	Anárjohka/Inarijoki	69,05663	25,76901	A*	4	1
5	Tsulloveäijokha	Tana/Teno	69,61191	25,98405	A+B*	4+1	
6	Keädgejohka	Tana/Teno	70,07563	27,8193	A	4	
7	Kuktsejohka	Utsjohki	69,58332	27,24198	A	4	1

* Tsulloveäijokha were replaced with A+B samples on the basis of poor conditions (high waterlevel) in Vuobmeveäijohka.

5. Results

5.1. Water chemistry

One water sample was taken at each of the 6 rivers 24-25 september 2018. The result provides a snapshot of the water chemistry, and only hints for the overall water chemistry throughout the year. According to the classification guides Vuottasjohka, Tsulleveäijohka, Keädgejohka, Vuobmaveäijohka and Kuktsejohka can be classified as river type R206 (calcareous, humid) and Gossjohka as river type R207 (moderately calcareous, humid).

Both alkalinity, calcium concentrations and pH show satisfactory values concerning acidification. Vuottasjohka: One tot-P sample shows very good condition, but is the highest measured in this study, 11 µg / l. The other measurements of total phosphorus and all total nitrogen showed very good condition.

Table 3. Results from water analyse in Tana river tributaries September 2018.River type refer to the Norwegian guidelines table 3.6 (see reference).

	Alk mmol/l	Color mg Pt/l	Ca mg/l	KOF mgO2/l	pH	Susp stoff mg/l	Tot-P ug/l	Tot-N ug/l	Turb FNU	River-type[2]
Gossjohka	0.48	75	4.5	9.5	7.2	9.6	6.0	170	1.0	R207
Vuottasjohka	0.15	40	2.0	6.0	6.9	7.6	11	150	3.8	R206
Voubmeatjohka	0.25	46	3.3	6.2	7.2	6.0	5.6	120	0.69	R206
Tsulluvajohka	0.17	30	2.5	3.0	7.1	< 2	3.3	62	0.52	R206
Kadjejohka	0.14	43	2.5	6.1	7.0	< 2	4.5	170	1.6	R206
Kuktsejohka	0.37	42	3.0	6.2	7.2	3.9	6.9	190	2.1	R206

Invertebrate – ecological status

The invertebrate fauna in six sites was investigated. The density of bottom animals varied widely with 24 to 257 individuals per sample, but despite the variation in density, the overall ecological condition was not effected. Gossjohka had the lowest bottom animal densities, but when Norwegian and Finnish samples were merged, the condition became very good.

Overall the ecological status showed very good condition in all tributaries studied. Only one locality had a moderate condition (Vuottasjohka). Three rivers (Gossjohka, Tsulleveäijohka and Keädgejohka) had a natural state, with nEQR> 0.99, while Vuobmaveäijohka and Kuktsejohka had very good condition, nEQR better than 0.8.

Vuottasjohka had low animal fauna in moderate state, nEQR = 0.47. However, the density of bottom

[2] http://www.vannportalen.no/globalassets/nasjonalt/dokumenter/veiledere-direktoratsgruppa/Klassifisering-av-miljotilstand-i-vann-02-2018.pdf

animals (206/sample) and number of families of bottom animals (17) was high, Moderate condition can be explained by the fact that the river is characterized by large, calm parties with lake areas that could affect the index, while the locality in Vuottasjohka is downstream of the small settlement. There is also a reindeer slaughter nearby, without us saying that there are any influences from this infrastructure.

Invertebrate diversity

The benthic fauna in the tributaries were rich in species and taxa diversity. Totally 56 taxa of bottom fauna were recorded. Compared to our 5 streama, Falkegård et al 2016 found 87 taxa in 39 sampling sites in 13 streams. we recorded at least 34 species of EPT (Ephemeroptera, Plecoptera and Trichoptera), compared to 48 species in Falkegård et al 2016. Some species within other bottom fauna groups were recorded. Up to 19 species of EPT were registered at one station. Vuottasjohka and Vuobmaveäijohka had the lowest diversity with 10-11 species. Here, only one sample was taken according to Norwegian or Finnish sampling method. Where both methods or Finnish method were used, the number of species was high.

No rare species were recorded, but several species are less common. All species except two were also found in Tana river system by Falkegård et al 2016, ***Xanthoperla apicalis*** and ***Oulimnius tuberculatus. X.apicalis,*** is found on two sites, Tsulleveäijohka and Keädgejohka. Most previous findings are old (Jalve in Tanariver from 1908). This is near Keädgejohka.
Nemoura viki and ***Nemoura sahlbergi*** have been found sometimes earlier, scattered in Finnmark, and are not rare. ***Paraleptophlebia submarginata*** has previously been found on several sites in the Lakselv watercourse, Porsanger, so it is not unexpected that it is found in the Tana river system.
Micrasema gelidum has previously been found relatively few times in Finnmark.
The beetle ***O. tuberculatus*** has only three finds earlier in Finnmark. Now registered in Vuottasjohka and Kuktsejohka.

Methodological differences

Two different sampling methods have been used (see the method chapter). The study does not provide an answer to which method provides the best "image" of the bottom animal fauna, nor was it the goal of the study. Where the Norwegian and Finnish method was used, the number of species for EPT increased, this is probably a result of the effort being greater when both methods are used. Nevertheless, the amount of animals was greatest when only the Finnish method was used on the Finnish side. But this can also be explained by natural conditions. Attempts to convert to densities per m^2 evened out the differences, yet the densities were highest in the Finnish tributaries.

When we try to compare the results from the two methods, similar registrations (Norwegian and Finnish samples) have been carried out in Gossjohka and Tsulloveäijokha. As the results indicate, there are differences in the number of animals and groups, but both methods capture the groups that are required to give an indication of ecological status by using ASPT. As the table shows, the

condition is good ecological status (blue color). And the ASPT values and EQR values indicate natural state, ie no impact. In other words, both methods in this study are suitable for the purpose of assessing the ecological status according to the Norwegian classification system guidelines (table 4).

When it comes to density and number of species, there are also differences between the methods. This can be owed to site-specific differences rather than methodical differences. It is difficult to conclude on this limited study. In Gossjohka the highest density and number of species was using the Norwegian method while the opposite was the case in Tsulleveäjohka (table 5).

Table 4. ASPT and EQR values in each group based on Norwegian guidelines in Gossjohka and Tsulleveäjohka.

	1 Gossjohka			5 Tsulleveäjohka		
	Norwegian	**Finnish**	**N+F**	**Norwegian**	**Finnish**	**N+F**
Number famiies with ASPT value	13	11	17	9	17	18
Sum ASPT-value	92	67	111	56	124	131
ASPT	7,08	6,09	6,53	6,22	7,29	7,28
EQR	1,03	0,88	0,95	0,90	1,06	1,05
nEQR	1,06	0,82	0,93	0,85	1,11	1,11

Table 5. Numbers of individuals in each group based on densities and number of species in Gossjohka and Tsulleveäjohka.

	1 Gossjohka			5 Tsulleveäjohka		
	Norwegian	**Finnish**	**N+F**	**Norwegian**	**Finnish**	**N+F**
Ephemeroptera	48	12	60	62	160	222
Plecoptera	35	6	41	22	60	82
Trichoptera	4	3	7	1	8	9
Mollusca	0	1	1	0	0	0
Nematoda	0	0	0	0	0	0
Oligochaeta	0	4	4	2	3	5
Ostracoda	0	0	0	0	0	0
Hydrachnidae	0	0	0	1	19	20
Corixidae	3	2	5	0	0	0
Diptera	15	2	17	9	41	50
SUM all individs	**105**	**30**	**135**	**97**	**293**	**390**
SUM EPT	**87**	**21**	**108**	**85**	**230**	**315**
n species EPT	**14**	**7**		**7**	**16**	
Species sum N+F			**16**			**18**
Sum species all group	**20**	**11**	**24**	**12**	**26**	**27**

5.2. Fish

Electrofishing was carried out in 4 tributaries of a total of 1850 m^2 distributed over 11 stations. The catch was dominated by salmon and trout juveniles (table 3). A total of 7 species were registered and the highest densities of salmon were in Gossjohka (16/100 m2). Density can be compared to "medium" good salmon rivers in Finnmark County. In the other tributaries, density was very low (1-2.8 / 100m^2). It must be said that these tributaries are at the outer edge of the anadromous part of Tana river with distance to the sea of> 250 km. In addition, there is a sympathetic fish community which problematizes indexing the river based on fish as parameter for the assessment of ecological status. There are also limited references to the natural state of Atlantic salmon on the outer edge of the Tana river system. A discussion about ecological status based on Atlantic salmon would have given *poor condition* in all the rivers with the exception of Gossjohka. Probable cause its lack of spawners in this part of the Tana river system. At the same time, water chemistry and bottom animals (invertebrates) indicate good conditions (corresponding to natural state). One can also question out: what is (natural) enough amount of juvenile salmon in these parts of the Tana river system to give "good status".

Table 6. Catch from electrofishing in Tana tributaries 2018

	n stations	m^2	Atl. salmon	trout	minnows	burbot	greyling	pike	3sp*
Goššjohka	4	550	88	3	0	1	0	0	0
Vuottašjohka	5	600	6	21	16	3	3	2	
Vuobmeveäjohka	1	400	11	5		2	2	1	
Kuktsejohka	1	300	7	2					1
Total		1850	112	31	16	6	5	3	1

*3sp=three spined stickleback.

Table 7. Number stations and total m^2 electrofished in the 4 rivers with catch of juvenile atlantic salmon (Salm) in different age groups.

	n stations	tot. m^2	0+	1+	2+	≥3+	total atl.salm	Atl.sal >0+ /100m*
Goššjohka	4	550	16	45	17	10	88	16,0
Vuottašjohka	5	600				6	6	1,0
Vuobmeveäjohka	1	400		4	2	5	11	2,8
Kuktsejohka	1	300		2	1	4	7	2,3

* mean all stations

5.2.1. Vuottašjohka (234-590-R)

Vuottašjohka one of the largest tributaries in Ieshjohka and is in the water network (vann-nett.no) registered as the waterbody 234-590-R. The river is at the outer edge of the anadromous salmon distribution of Iesjohka. Due to low densities of fish we desided to fish several stations instead of only one. Electric fishing has been carried out on 5 stations each with a total of 600 m^2 on 17.9 (station VU1) and 23.9.2018 (station VU2-5). Water levels were increasing on the last round after a rainfall, but conditions are considered to be good. Only 6 salmon were caught. In addition, 21 trout, 16 minnows, 3 grayling, 3 burbot and 2 pike, total 51 fish were registered. This gives very low density of 1.2 salmon

juveniles / 100 m^2 . In general, the fish density was somewhat low (a total of 8.5 fish / 100m^2). All salmon juveniles were 3 years of age and older with a length of 14-17 cm. Very low density of salmon juveniles indicates the absence of spawning salmon in this part of the Tana river system.

Few results have been found from previous registrations in Vuottašjohka. In 2016, surveys were conducted from Sousjavre and down Iesjohka (Johansen, 2016). Very low densities of salmon of all sizes were found at the nearest 4 stations downstream of Sousjavre. The same situation was found in in surveys in the 1990s and 2000s with consistently very low densities of salmon juveniles in areas near Sousjavre. The same situation was already pointed out in the 1970s by Bjerknes (1978). This underlines the situation in this part of the Tana river where ecological condition is very poor due to lack of salmon spawners.

5.2.2. Goššjohka (234-83-R)

Goššjohka is in the water net registered with the water body 234-590-R. The watercourse is a large watercourse to Anarjohka and is located on the outer edge of the salmon-carrying part of the Tana river. One-time electric fishing has been carried out on 4 stations each of a total of 550 m2. Only registrations have been made in the lower part of the river.

Total catch was 88 salmon. In addition, 3 trout, 3 grayling, 3 lake and 2 pike total 96 fish were registered (Table 4). This gives very moderate density of 16 salmon juveniles / 100 m^2. Although salmon was a dominant species, the density is considered to be moderate compared to other similar watercourses and sites where the density of salmon species is often> 30-50 salmon when ecological status in relation to salmon is good. There were salmon eggs in all age groups indicating spawning of salmon in recent years (Table 5).

Electrofishing has previously been carried out in the river. In 2013, the density of salmon juveniles varied from 10 - 60 salmon juveniles spread over 21 stations surveyed on the whole anadromous stretch (average approx. 20-30 salmon / 100 m2) (Finnish note, 2013).

5.2.3. Vuobmeveäjohka and Kuktsejohka

In Vuobmeveäjohka and Kuktsejohka respectively 400 and 300 m^2 was electrofished. In Vuobmeveäjohka there were generally good habitat for salmon parr. But the low density of juveniles (2,8 / 100 m^2) indicate few spawners. Fish, invertebrates and watersamples are sampled on the same location (se map).

In Kuktsejohka the station was between the bridges. The river is characterized by stony areas with high velocity waters running with medium-sized growth areas for salmon. The low density of juveniles (2,3 / 100 m^2) indicate few spawners. Fish, invertebrates and watersamples are sampled on the same location (se map).

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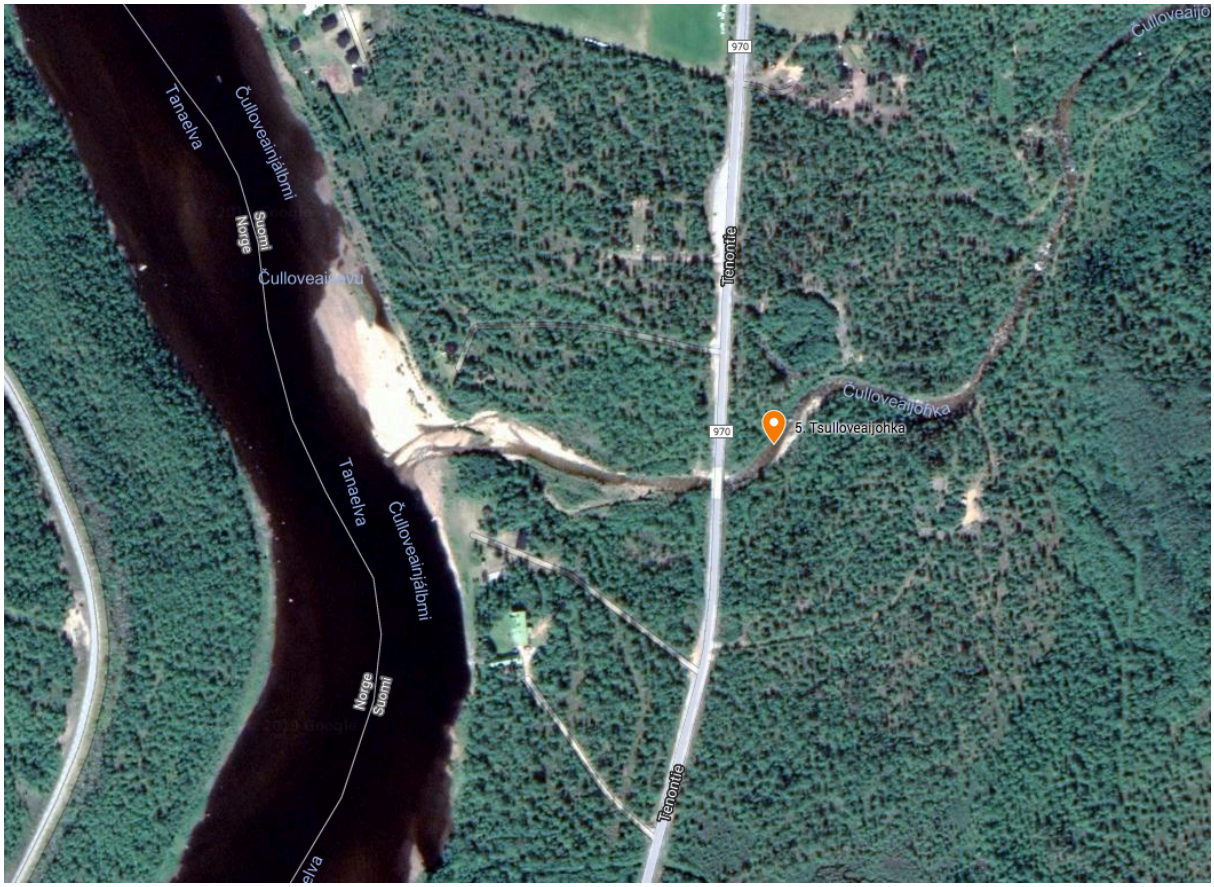
6.1. Appendix 1 Sampling stations

6.1.1. Vuobmaveäijohka (Anarjohka)

- 1 station : fish, invertebrate, water sample

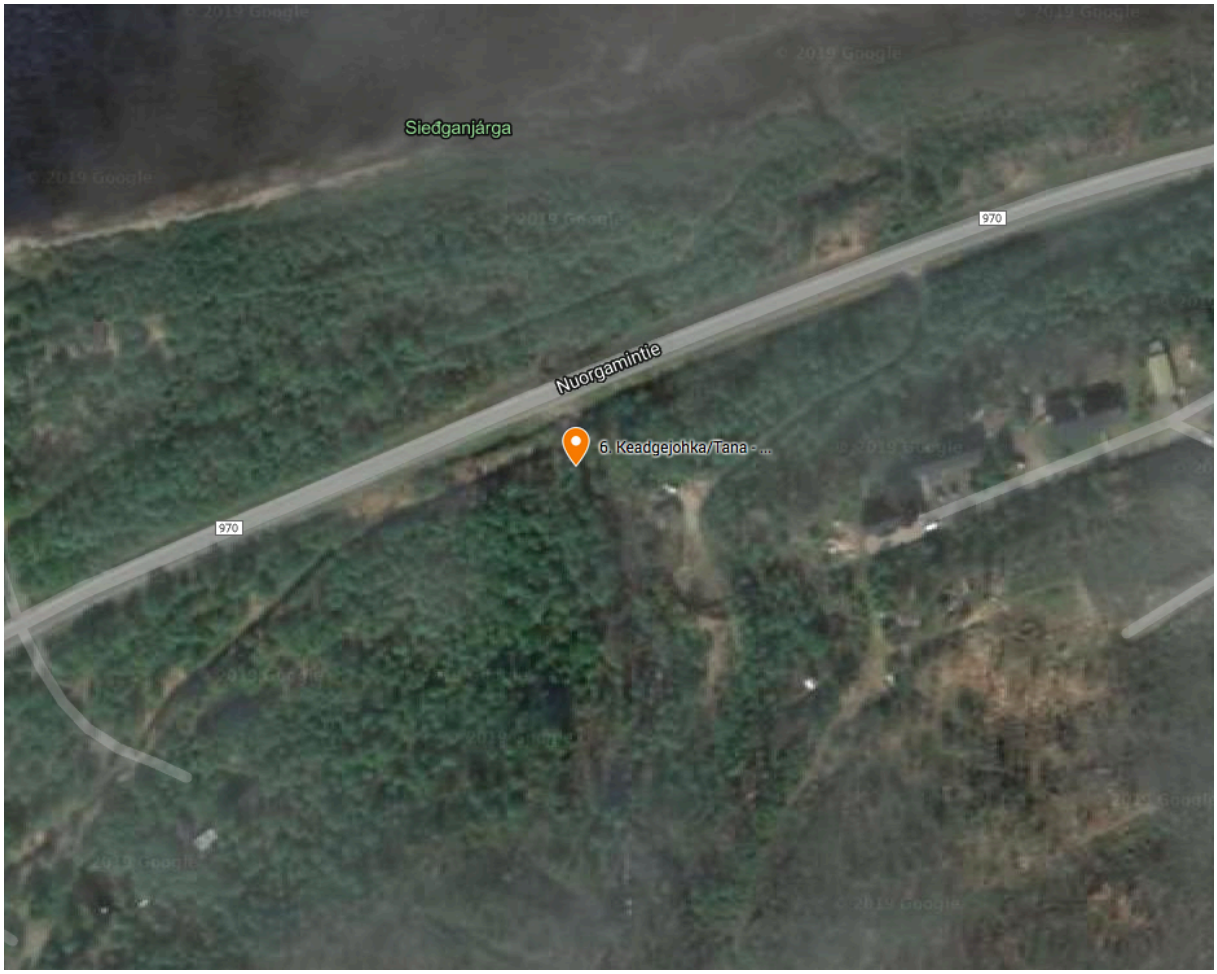
6.1.2. Tsulloveäijohka (Tana)

1 station: invertebrate, water sample



6.1.3. Keädgejohka (Tana)

1 station : invertebrate, water sample



6.1.4. Kuktsejohka (Utsjohki)

1 station : fish, invertebrate, water sample

6.1.5. Vuottasjohka

- 5 station fish, + invertebrate, water sample

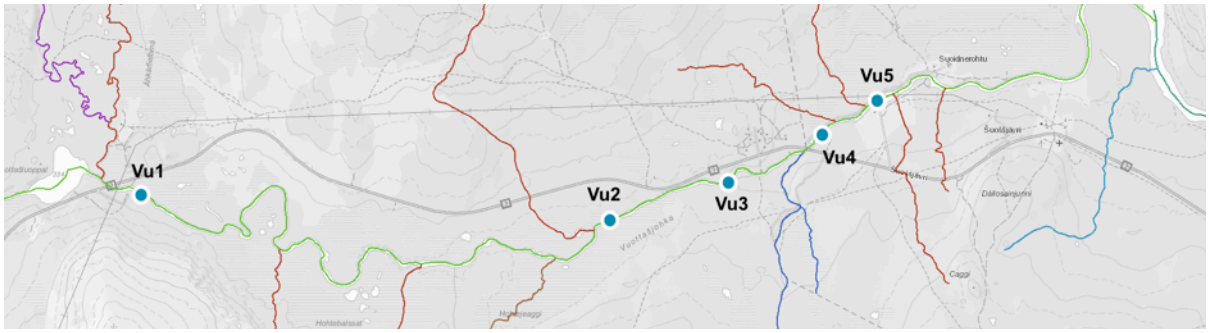


Figure 2. El-fishing sample points (Vu1-Vu5) in Vuottašjohka (234-590-R). VU5 include invertebrate and water sample.

Table 8. Overview of fished area, and number of fish of the different species in Vuottašjohka.

Lokalitet	m^2	Atl.salmon	trout	minnows	burbot	grayling	pike	Sum
VU1	200	0	3	5	1	2	1	12
VU2	100	2	6					8
VU3	100	2	3					5
VU4	100	0	5	8	1	1	1	16
VU5	100	2	4	3	1			10
Total	**600**	**6,0**	**21,0**	**16,0**	**3,0**	**3,0**	**2,0**	**51**
n/100 m2		**1,0**	**3,5**	**2,7**	**0,5**	**0,5**	**0,3**	**8,5**

Table9. Fished area and catch of different age groups of Atlantic salmon (S.salar) in Vuottašjohka in autumn 2018.

	m2	0+	1+	2+	≥3+	total	Atl.salmon >0+/100m
VU1	200	0	0	0	0	0	0,0
VU2	100	0	0	0	2	2	2,0
VU3	100	0	0	0	2	2	2,0
VU4	100	0	0	0	0	0	0,0
VU5	100	0	0	0	2	2	2,0
Total	**600**	**0**	**0**	**0**	**6**	**6**	**1,0**

6.1.6. Gossjohka

- 4 station fish, + invertebrate, water sample

Figur 3. El-fishing sample points (GO1-GO4) in Goššjohka (234-83-R). GO2 include invertebrate and water sample.

Table 10. Overview of fished area, and number of fish of the different species in Gossjohka

Lokalitet	m²	Laks	Ørret	Lake	Gjedde	Sum
GO1	200	20	2	1		23
GO2	150	29		2	1	32
GO3	100	23	0			23
GO4	100	16	1		1	18
Totalt	**550**	**88**	**3**	**3**	**2**	**96**
n/100 m2		**16,0**	**0,0**	**0,2**	**0,0**	**16,2**

Table 11. Fished area and catch of different age groups of Atlantic salmon (*S.salar*) in Goššjohka autumn 2018.

	m2	Laks 0+	laks 1+	laks 2+	laks ≥3+	total laks	laks >0+/100m
GO1	200	3	13	3	1	20	8,5
GO2	150	10	15	2	2	29	12,7
GO3	100	3	8	8	4	23	20,0
GO4	100	0	9	4	3	16	16,0
Total	**550**	**16**	**45**	**17**	**10**	**88**	**16,0**

6.2. Appendix 2. Invertebrate

Table 12. Composition of zoobenthos in tributory sites of the River Tana with number of individuals collected.

	1 Goss-johka	2 Vuottas-johka	4 Vuobmeveäjohka	5 Tsulleveä johka	6 Keädge-johka	7 Kuktse-johka
Method	**N+F**	**N**	**F**	**N+F**	**F**	**F**
EPHEMEROPTERA:	0			0	0	0
Ameletus inopinatus	8	1		4	2	9
Baetis sp.	8		2	7	5	0
Baetis muticus	9		6	10	4	7
Baetis rhodani	30	20	32	196	161	99
Heptagenia sp.	0		1	1	1	2
Heptagenia dalecarlica	2		2	3	1	9
Ephemerella sp.	0	1		0	0	0
Ephemerella aurivilli	3		1	0	0	11
Parareptophlebia sp.	0			1	0	1
Paraleptophlebia submarginata	0			0	0	1
PLECOPTERA:	0			0	0	0
Isoperla (difformis)	0			0	0	1
Xanthoperla apicalis	0			1	2	0
Arcynopteryx compacta	0			1	0	0
Diura nanseni	1	1		0	0	3
Amphinemura sp.	0		5	0	0	0
Taeniopteryx nebulosa	0			3	0	0
Protonemura meyeri	0			0	1	2
Amphinemura borealis	6			0	0	0
Nemoura sp.	5	19		2	3	0
Nemoura cinerea	0	4	3	10	7	18
Nemoura avicularis	4			0	0	5
Nemoura ?sahlbergi	0			0	5	
Nemoura viki	0			0	10	0
Capnia	4			11	0	0
Capnia atra	0			4	0	0
Leuctra	0			0	7	4
Leuctra fusca	0			0	0	0
Leuctra hippopus	21	2	7	38	3	59
Leuctra nigra	0			12	1	0
TRICHOPTERA:	0		1	2	0	3
Rhyacophila nubila	4			4	2	0
Glossosoma intermedium	0			0	6	0
Hydroptila sp.	0	3		0	1	5
Oxyethira sp. (Hydroptilidae)	0		1	1	2	2
Plectrocnemia conspersa (Polycentropodidae.)	0			3	0	0
Polycentropus flavomaculatus	0	12		0	0	5
Arctopsyche ladogensis	1			0	0	1
Hydropsyche nevae	0			0	0	4
Hydropsyche sp. (angustipennis?)	0		1	0	0	10
Micrasema gelidum (Brachycentridae)	0			0	1	0
Apatania wallengreni (Limnephilidae)	0	2		0	0	0
Potamophylax latipennis (Limnephilidae)	1			0	0	0

Limnephilidae	1	1	1	1	1	0
Mollusca				0		
Lymnea peregra	0			0	0	1
Planorbis	1	5		0	0	1
Pisidium (Ertemusling)	0	14		0	0	1
Nematoda	0	3		0	0	0
Oligochaeta	4	3	7	5	0	4
Ostracoda	0	5		0	0	3
Hydrachnidae	0	2		20	1	0
CORIXIDAE	0	1		0	0	0
Elmis aenea	5	2	2	0	0	1
Oulimnius tuberculatus	0	7		0	0	1
DIPTERA:	0			0		
Sialidae	0	2		0	0	0
Tipulidae	2		1	1	2	0
Chironomidae	8	91	8	37	9	32
Ceratopogonidae	4	10	4	0	2	9
Simuliidae	1		3	11	12	1
Psychodidae	2		1	1	4	0

Table 13. Presentation of results from the different methods in Gossjohka and Tsulleveäjohka where Norwegian and Finnish methods have been used.

	1 Goss-johka	1 Goss-johka	1 Goss-johka	5 Tsulle veäjohka	5 Tsulle veäjohka	5 Tsulle veäjohka
	Norwegian	Finnish	N+F	Norwegian	Finnish	N+F
EPHEMEROPTERA:						
Ameletus inopinatus	1	7	8		4	4
Baetis sp.	8		8		7	7
Baetis muticus	8	1	9	1	9	10
Baetis rhodani	30		30	59	137	196
Heptagenia sp.					1	1
Heptagenia dalecarlica	1	1	2	2	1	3
Ephemerella sp.						
Ephemerella aurivilli		3	3			
Parareptophlebia sp.					1	1
Paraleptophlebia submarginata						
PLECOPTERA:						
Isoperla (difformis)						
Xanthoperla apicalis					1	1
Arcynopteryx compacta					1	1
Diura nanseni	1		1			
Amphinemura sp.						
Taeniopteryx nebulosa					3	3
Protonemura meyeri						
Amphinemura borealis	6		6			
Nemoura sp.	5		5		2	2
Nemoura cinerea				3	7	10
Nemoura avicularis	4		4			
Nemoura sahlbergi						
Nemoura viki						
Capnia	4		4	5	6	11
Capnia atra					4	4
Leuctra						
Leuctra fusca						
Leuctra hippopus	15	6	21	13	25	38
Leuctra nigra				1	11	12
TRICHOPTERA:					2	2
Rhyacophila nubila	2	2	4		4	4
Glossosoma intermedium						
Hydroptila sp.						
Oxyethira sp. (Hydroptilidae)					1	1
Plectrocnemia conspersa (Polycentropodidae.)					3	3
Polycentropus flavomaculatus						
Arctopsyche ladogensis		1	1			
Hydropsyche nevae						
Hydropsyche sp.						

(angustipennis?)						
Micrasema gelidum (Brachycentridae)						
Apatania wallengreni (Limnephilidae)						
Potamophylax latipennis (Limnephilidae)	1		1			
Limnephilidae	1		1	1		1
Mollusca						
Lymnea peregra						
Planorbis		1	1			
Pisidium (Ertemusling)						
Nematoda						
Oligochaeta		4	4	2	3	5
Ostracoda						
Hydrachnidae				1	19	20
CORIXIDAE						
Elmis aenea	3	2	5			
Oulimnius tuberculatus						
DIPTERA:						
Sialidae						
Tipulidae	2		2		1	1
Chironomidae	6	2	8	4	33	37
Ceratopogonidae	4		4			
Simuliidae	1		1	5	6	11
Psychodidae	2		2		1	1
SUM all individs	**105**	**30**	**135**	**97**	**293**	**390**
SUM EPT	**87**	**21**	**108**	**85**	**230**	**315**
n species EPT	**14**	**7**		**7**	**16**	
Species sum N+F			**16**			**18**
Sum species all group	**20**	**11**	**24**	**12**	**26**	**27**