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Summary

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Salmon populations should be managed in a population-specific and target-based manner, and therefore biological reference points and consequent management targets should be established for each salmon population. In Norway, first-generation management targets in the form of spawning targets were established in 2007. In the case of the transboundary River Näätämöjoki/Neidenelva spawning targets were then set only for the Norwegian side of the river system.

In this report we present the estimated spawning targets for the whole Näätämöjoki/Neidenelva system including the Finnish side. The spawning targets are presented separately for the Näätämöjoki/Neidenelva mainstem, for tributaries Silisjoki and Harrijoki and for the whole system. Spawning target of the Norwegian side was also updated by using more accurate habitat knowledge.

The total spawning target of the River Näätämöjoki/Neidenelva system was estimated at slightly over 10 000 000 salmon eggs. This converts to 5634 kg of female salmon when using fecundity of 1800 eggs/female salmon kg and 4558 kg when using the fecundity level of 2225 eggs/female salmon kg. Based on the production area size and their value to salmon production 66% of the spawning target is situated in Finland and 34% in Norway. In practise depending on the chosen fecundity level, c. 650–800 female salmon averaging a weight of 4.65 kg are annually needed on the Finnish side and c. 330–410 females on the Norwegian side of the Näätämöjoki/Neidenelva to fulfil the spawning targets.

Although the spawning targets are expressed in female salmon biomass and numbers, male salmon are also needed for successful spawning and recruitment.

Keywords: Atlantic salmon, *Salmo salar*, spawning target, production area, egg-density, spawning population, management target, conservation limit

Tiivistelmä

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Lohikantoja tulisi hoitaa populaatiokohtaisesti ja ennalta asetettuihin tavoitetasoihin perustuen. Sitä varten jokaisella lohikannalle tulisi asettaa biologiset tavoitetasot sekä kantojen hoitotavoitteet (kutukantatavoite). Norjassa ensimmäisen sukupolven hoitotavoitteet asetettiin useimmille lohikannoille vuonna 2007 kutukantavoitteiden muodossa. Yhteisen rajajokemme Näätämöjoen osalta kutukantatavoitteet asetettiin tuolloin vain vesistön Norjan puoleiselle osalle.

Tässä raportissa esitellään kutukantatavoitteet koko Näätämöjoelle mukaan lukien vesistön Suomen puoleiset osat. Kutukantatavoitteet on arvioitu erikseen Näätämöjoen pääuomalle, Silisjoelle ja Harrijoelle sekä lopulta koko jokisysteemille. Aiempi vesistön Norjan puoleiselle osalle vuonna 2007 asetettu kutukantatavoite päivitettiin tarkempien elinympäristötietojen perusteella.

Näätämöjoen vesistön kokonaiskutukantatavoitteeksi arvioitiin hieman yli 10 000 000 lohen mätimunaa. Se tarkoittaa 5634 kg naaraslohibiomassaa käytettäessä hedelmällisyysarvona 1800 mätimunaa per naaraslohikilo ja 4558 kg naaraslohibiomassaa käytettäessä 2225 mätimunaa per naaraslohikilo. Lohen tuotantoalueiden määrän ja laadun perusteella Näätämöjoen kutukantatavoitteesta 66% sijoittuu vesistön Suomen puoleiselle osalle ja 34% Norjan puoleiselle osalle. Riippuen käytetystä hedelmällisyysarvosta noin 650–800 keskimäärin 4.65 kiloa painavaa naaraslohta tarvitaan vuosittain vesistön Suomen puoleisella osalla kutukantatavoitteen täyttämiseksi ja noin 330–410 saman kokoista naarasta Norjan puolella kutukantatavoitteen täyttämiseksi.

Vaikka kutukantatavoitteet määritellään naaraslohien biomassana ja määrinä, myös riittävä määrä koiraslohia tarvitaan lisääntymisen ja poikastuotannon onnistumiseksi.

Asiasanat: Lohi, *Salmo salar*, kutukantatavoite, tuotantoalue, mätimäärä, kutukanta, hoitotavoite, suojeluraja

Sammendrag

Panu Orell[1], Jorma Kuusela[2], Matti Kylmäaho[2], Anders Foldvik[3], Kjetil Hindar[3] og Jaakko Erkinaro[1]

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Forvaltning av laks skjer på en bestandsbasert og målbasert måte, der biologiske referansepunkter og forvaltningsmål blir etablert for hver laksebestand. I Norge ble det utarbeidet førstegenerasjons gytebestandsmål for 80 laksebestander i 2007. I den norsk-finske grenseelva Näätämöjoki/Neidenelva ble det da utarbeidet et gytebestandsmål som kun var basert på kartgrunnlag fra den norske siden av vassdraget.

I denne rapporten presenterer vi gytebestandsmål for hele Neidenelva, inkludert hovedelva og sideelver på finsk side. Separate gytebestandsmål er beregnet for hovedelva og sideelvene Silisjoki og Harrijoki. Gytebestandsmålet for den norske delen av elva har også blitt oppdatert basert på mer detaljerte habitatkartlegginger.

Gytebestandsmålet for hele Neidenelva ligger like i overkant av 10 000 000 lakseegg. Dette tilsvarer 5634 kg hunnlaks om en antar 1800 egg pr kg hunnlaks, og 4558 kg hunnlaks om en antar 2225 egg pr kg hunnlaks. Basert på produksjonsområdenes størrelse og deres verdi for lakseproduksjon, er 66% av gytebestandsmålet i Finland og 34% i Norge. Avhengig av antagelser om eggantall pr kg hunnlaks, betyr dette at det trengs 650–800 hunnlaks med gjennomsnittsvekt 4.65 kg på finsk side og 330–410 hunnlaks på norsk side av Näätämöjoki/Neidenelva for å nå gytebestandsmålet for vassdraget.

Selv om gytebestandsmålene er oppgitt i biomasse og antall hunnlaks, er det også behov for hannlaks for vellykket gyting og rekruttering.

Nøkkelord: Laks, *Salmo salar*, gytebestandsmål, produksjonsareal, egg-tetthet, gytebestand, forvaltningsmål, bevaringsgrense

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1. Introduction

The North Atlantic Salmon Conservation Organization (NASCO), established by an intergovernmental convention, has recommended a precautionary approach to salmon fisheries management for the Atlantic salmon (*Salmo salar* L.) populations, which should be safeguarded and maintained above their defined biological reference points, often defined as conservation limits (NASCO 1998). Salmon populations should be managed in a population-specific and target-based manner, and therefore such biological reference points and consequent management targets should be established for each salmon population. Conservation Limits (CL) have been defined as demarcating the undesirable spawning stock level at which recruitment would begin to decline significantly (cf. Hindar et al. 2011). Currently, NASCO and International Council for the Exploration of the Sea (ICES) define the CL as the spawning stock level that produces maximum sustainable yield (NASCO 2009). CLs or corresponding targets have been defined and implemented, or are currently being implemented, by most North Atlantic countries for their salmon fisheries management (ICES 2020).

In Norway, the biomass of females necessary to attain the freshwater carrying capacity has been established as conservation limits (later referred to as spawning targets) for each of the >400 Atlantic salmon populations in Norway (Hindar et al. 2007; Forseth et al. 2013). The method for establishing the spawning targets is based on stock-recruitment relationships during the freshwater phase and annual estimates of spawning escapement are then compared with the set targets when assessing attainment and stock status (Hindar et al. 2007; Forseth et al. 2013).

The original spawning targets for Norwegian rivers, including the Finnish-Norwegian transboundary rivers Teno/Tana and Näätämöjoki/Neidenelva, have been established and published by Hindar et al. (2007). Refined, revised population-specific spawning targets were later defined for 25 different tributaries or areas of the large River Teno/Tana system (Falkegård et al. 2014). Accounting for the vast diversity in both life histories (Erkinaro et al. 2019) and genetic differentiation (Vähä et al. 2017) of multiple salmon populations in the Teno/Tana system, the population-/tributary-specific, target-based management system for this large and diverse river system is following the guidelines of the North Atlantic Salmon Conservation Organization (NASCO), where both abundance and diversity criteria must be considered in a precautionary approach to salmon management (NASCO 2009).

For the other transboundary river, the River Näätämöjoki/Neidenelva, spawning target has earlier been defined for the Norwegian side of the river system only (Hindar et al. 2007), although a habitat survey from the Finnish part of the main stem exists as well (Erkinaro et al. 2000). In this report, we used the newly collected information from multiple field surveys and assessments for establishing the spawning target for Atlantic salmon populations in the entire catchment of Näätämöjoki/Neidenelva. In the background work, the different salmon producing stretches of the system have been surveyed in the field and using expert knowledge, and their habitat quality assessed. As a result, spawning target for the whole Näätämöjoki/Neidenelva system has been estimated and established with detailed assessment of production potential for different parts of the catchment.

2. Methods

The first-generation spawning targets of the Näätämöjoki/Neidenelva river are based on the methods developed in Norway. These spawning targets are similar to those used in the Teno/Tana system (Falkegård et al. 2014) and the methods are fully explained in Hindar et al. (2007). Therefore, only a brief summary of the methods is presented here.

Generally, the spawning targets of the Näätämöjoki/Neidenelva system are based on:

1. Total salmon producing wetted river area
2. Assignment of river stretches to different egg-density categories

The wetted salmon producing river area (m^2) was calculated from digital geographic maps from Finland and Norway by using QGIS-software. Estimation of the upper borders of the salmon production area was based on recent monitoring data, especially electrofishing surveys that were conducted during 2019-2021 (Figure 1).

Four egg-density categories corresponding to the stock-recruitment (S/R) variation observed in nine Norwegian index rivers were established (Hindar et al. 2007). The four egg-density categories were defined as follows (see Falkegård et al. 2014):

- 1 egg/m^2(lower and upper limits: 0.5-1.5 eggs/m^2). These are unproductive rivers with a low catch of salmon per area unit. A large proportion of the area has a poor habitat quality for juvenile production and/or spawning.
- 2 eggs/m^2 (lower and upper limits: 1.5-3 eggs/m^2). These are medium productive rivers with a varied habitat quality for juvenile production and spawning.
- 4 eggs/m^2 (lower and upper limits: 3-5 eggs/m^2). A large proportion of the area in these rivers is good habitat for juvenile production and spawning. The catch per unit river area is relatively high.
- 6 eggs/m^2(>5 eggs/m^2). These are highly productive rivers with very good habitat quality.

In addition to these four egg-density categories, a 0 egg/m^2 category was used in river areas and lakes that were estimated to be of no or very limited value to salmon production.

The assignment of a certain river stretch to a particular egg-density category is a subjective process relying heavily on local knowledge about river characteristics (extent and quality of spawning and juvenile production areas) and river history (e.g., catch data). This local knowledge was based on Luke's personnel (Panu Orell, Jaakko Erkinaro, Matti Kylmäaho and Ari Savikko) that have been studying the Näätämöjoki/Neidenelva system the last 20-30 years.

The spawning target obtained with the above approach is the total number of spawned eggs needed to fulfil the production potential of the Näätämöjoki/Neidenelva river. For management-practical reasons this egg deposition level was converted to female salmon biomass needed at spawning to produce the target number of eggs. As the fecundity of Näätämöjoki/Neidenelva salmon is not fully known we used two different fecundity options in this report. The first option was based on Hindar et al. (2007) with a fixed relative fecundity of 1800 eggs/female salmon kg. The second option (2225 eggs/female salmon kg) was derived from the Teno/Tana system by using the relative fecundity of the River Inarijoki/Anarjohka system which have rather similar salmon sea-age structure as the Näätämöjoki/Neidenelva system. The mean weight of female spawner used in calculations (4.65 kg for the whole river system) was obtained from Näätämöjoki/Neidenelva catch sample collections from 2011-2020.

This mean female weight was used both in the Näätämöjoki/Neidenelva main stem and in the tributaries as tributary specific mean weight data was not available.

Although the spawning targets are expressed in female salmon biomass and numbers, male salmon are also needed for successful spawning and recruitment. This should be noted in interpreting the results of this report.

2.1. Study area/salmon distribution area

The River Näätämöjoki/Neidenelva drains a catchment area of 2962 km^2, situated mostly in northern Finland, and flows into the Barents Sea on the Norwegian coast in the bottom of the Neidenfjorden (Figure 1). The system supports a substantial Atlantic salmon population which forms the basis for important recreational and subsistence fisheries (Niemelä et al. 2018a). Recently, a genetic population structure has been revealed in the salmon population complex of the Näätämöjoki system with populations in the main stem and some tributaries showing genetic differentiation (Sinclair-Waters & Primmer 2021).

The spawning targets were estimated separately for the Näätämöjoki/Neidenelva mainstem, for the tributaries Silisjoki and Harrijoki and for the whole system (Figure 1). Adult salmon is also known to ascend to the River Kallojoki. It was not, however, included in the spawning target estimation process as the status of the stock and salmon distribution area are not known.

Detailed information on the characteristics and environment of the River Näätämöjoki/Neidenelva together with the fish species and distribution of Atlantic salmon in the system can be found in Niemelä et al. (2001, 2018b).

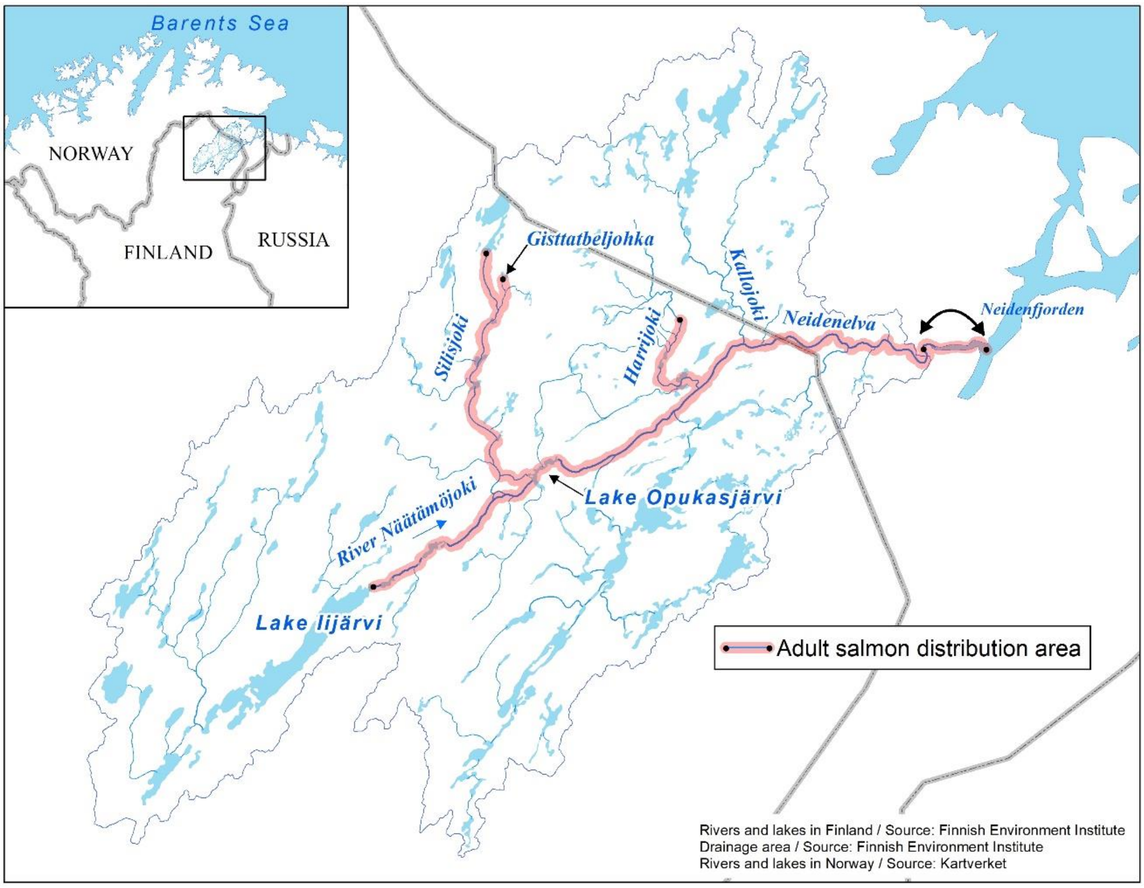

Figure 1. The map of the Näätämöjoki/Neidenelva river showing the salmon distribution area used in the spawning target analysis. The lowermost tidal river area (double-headed arrow) was not included in the spawning target estimation. The River Kallojoki was excluded from the analysis as its salmon distribution area and stock status are unknown.

3. Spawning targets

3.1. Näätämöjoki/Neidenelva mainstem

The salmon production area of the River Näätämöjoki/Neidenelva main stem starts from the outlet of the Lake Iijärvi, c. 80 km upstream from the river mouth (UTM35: 598835, 7734078). The lower endpoint of the production area was set to the upper limit of the tidal area (UTM35: 592851, 7734112), c. 7 km from the river mouth (Figure 2). Based on recent genetic studies the Näätämöjoki/Neidenelva main stem sustains only a single salmon population (Sinclair-Waters & Primmer 2021).

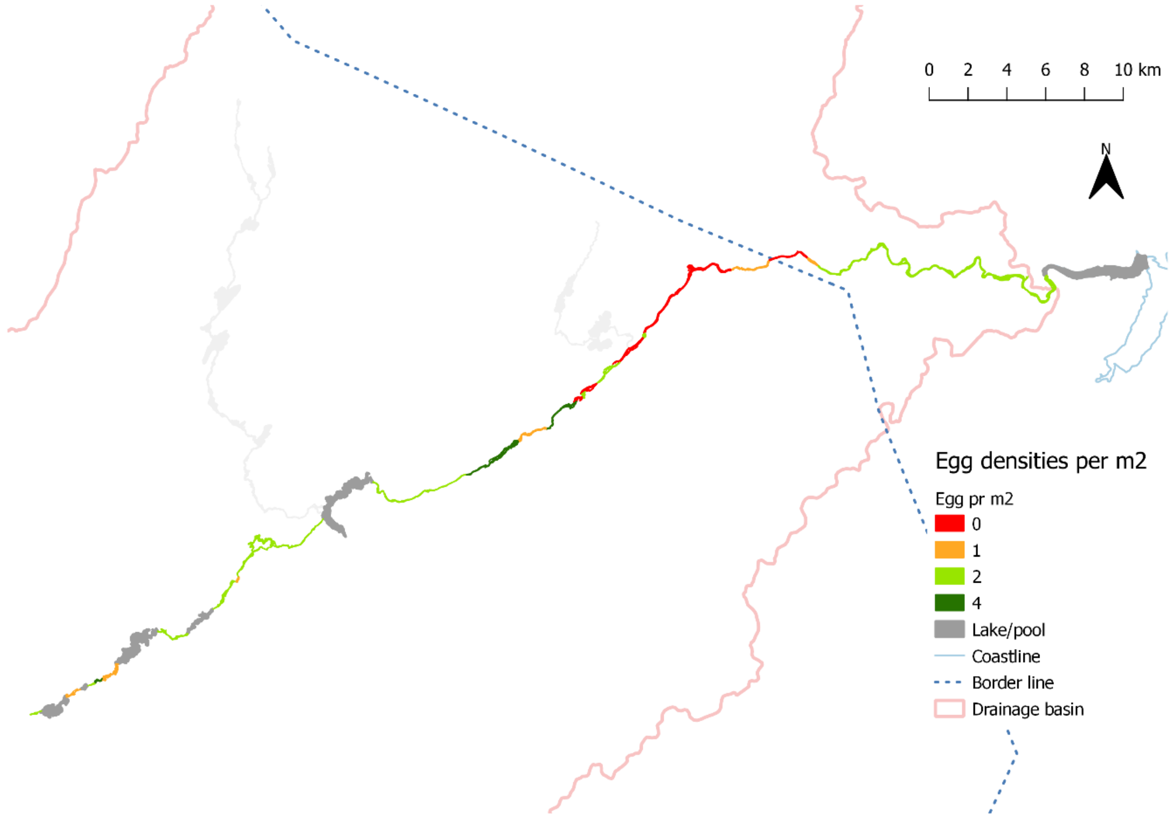

Figure 2. Map of the River Näätämöjoki/Neidenelva mainstem including the river areas with different defined egg density classes (eggs/m^2). Lakes (grey colour) were not included in the spawning targets. The lowermost grey area just before the sea represent the tidal river zone and is considered non-significant for salmon production.

Most of the upper Näätämöjoki/Neidenelva main stem above the Lake Opukasjärvi was estimated to represent either unproductive (1 egg/m^2) or medium productive (2 eggs/m^2) river area (Figure 2). The main limiting factor for salmon production in these areas are irregularly distributed suitable spawning grounds and limited supply of nursery areas for 0+ juvenile salmon. This river area is characterized by rather steep rapids and large stone/bedrock dominated substrate.

Below the Lake Opukasjärvi, the quality of the Näätämöjoki/Neidenelva mainstem for salmon production is very diverse. There are large areas of medium and good (4 eggs/m^2) salmon habitats (Figure 3) with readily available spawning grounds and high-quality juvenile production areas, but also long stretches of non-productive (0 eggs/m^2) slow flowing pools with sandy or muddy bottoms (Figure 2).

Figure 3. Lower middle reaches of the River Näätämöjoki/Neidenelva main stem at Niloskoski, on Finnish side. Good spawning and juvenile production areas are readily available. Photo: Ari Savikko.

The estimated spawning target of the River Näätämöjoki/Neidenelva main stem is 8 451 180 eggs. In female salmon biomass (kg) this becomes 4695 kg when using a fecundity of 1800 eggs/female salmon kg and 3798 kg when using fecundity of 2225 eggs/female salmon kg (Table 1). In numbers of female salmon (mean weight 4.65 kg) these biomasses convert to 1010 and 817 individuals, respectively (Table 1).

Table 1. Summary table of the Näätämöjoki/Neidenelva main stem production area (m^2) and spawning target calculations. Two different fecundity options (1800 vs. 2225 eggs/female salmon kg) were used in the calculations (see Methods). Mean female salmon weight of 4.65 kg was used in converting needed female salmon biomass (kg) to female salmon numbers.

Area with 0 eggs/m^2	1 104 976
Area with 1 eggs/m^2	583 591
Area with 2 eggs/m^2	2 909 032
Area with 4 eggs/m^2	512381
Spawning target (number of eggs)	**8 451 180**
Lower limit (eggs)	6 192 487
Upper limit (eggs)	12 164 389
Spawning target (female biomass kg, 1800 eggs/kg)	**4 695**
Lower limit (kg)	3 440
Upper limit (kg)	6 758
Spawning target (number of female salmon)	**1 010**
Spawning target (female biomass kg, 2225 eggs/kg)	**3 798**
Lower limit (kg)	2 783
Upper limit (kg)	5 467
Spawning target (number of female salmon)	**817**

3.2. Silisjoki

The River Silisjoki is flowing to the Lake Opukasjärvi c. 60 km from the river mouth. The catchment area of the system is 457 km^2. Based on recent (2019) electrofishing surveys, salmon distribution area continues far upstream including the tributary River Gisttahbealhjohka (Figure 1). The upper limit of salmon distribution area was set to the coordinates (UTM35: 551248, 7743214). Recent genetic studies have documented a genetically distinct salmon population in the Silisjoki system compared to the Näätämöjoki/Neidenelva main stem population (Sinclair-Waters & Primmer, 2021).

The upper part of the Silisjoki system including the Gisttahbealhjohka was assessed as a relatively unproductive stretch for salmon production (1 egg/m^2; Figure 4). The main limiting factors include the small water volume in very shallow riffle areas with only few small pools for adult salmon holding and possible juvenile overwintering, and shortage of spawning areas (Figure 5).

The quality of salmon production area is increasing downstream from the Keskimmäinen Silislompolo (a lake or a large pool) at the middle reaches of the system. From there downstream the river is dominated by long riffle-pool sections. Suitable spawning grounds and juvenile production areas for salmon are readily available (Figure 6). Most of this area was estimated as a medium productive (2 eggs/m^2) river with some long slow flowing non-productive pools (Figure 4).

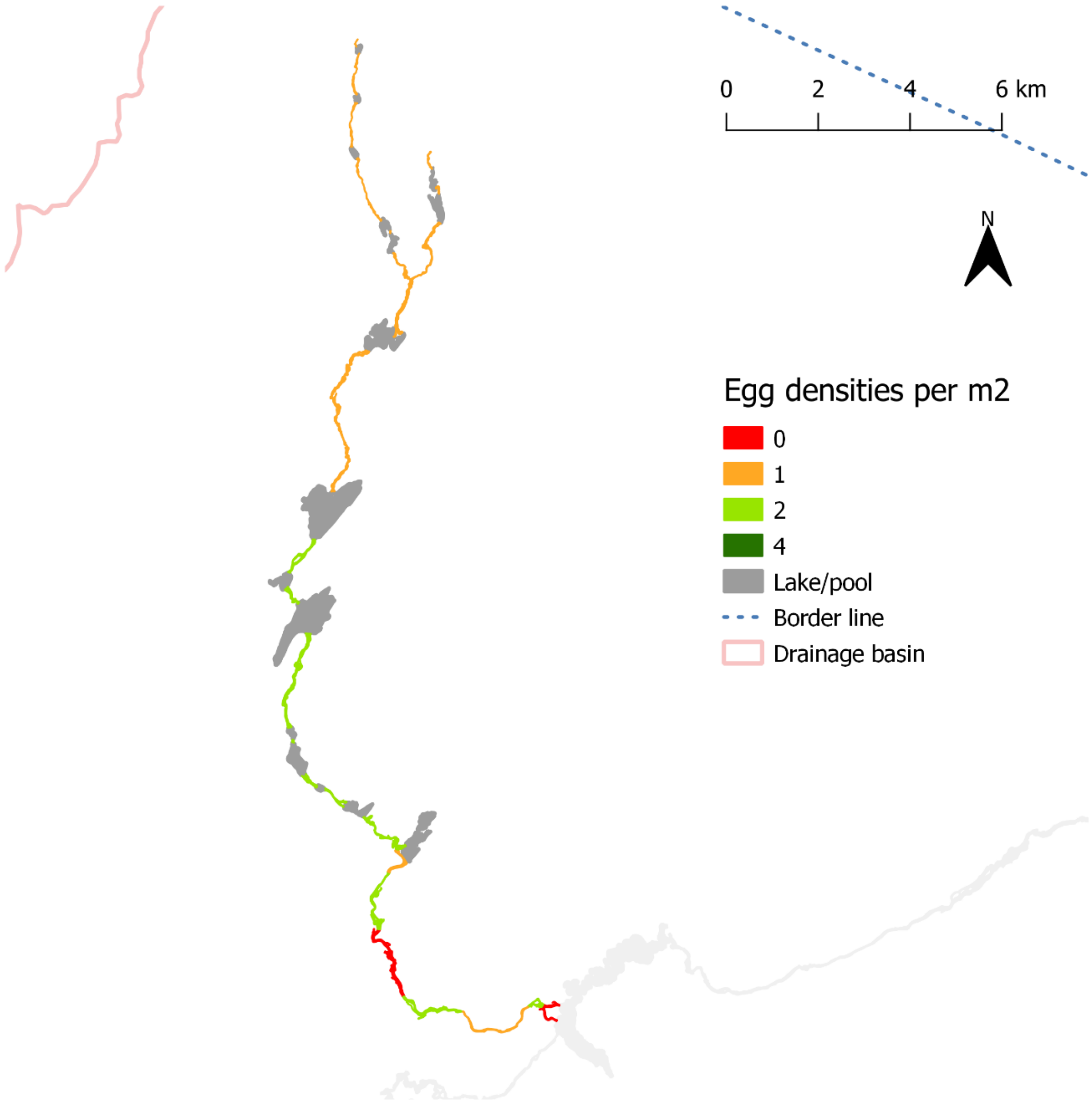

Figure 4. Map of the River Silisjoki (including Gisttahbealhjohka) system including the river areas with different egg density (eggs/m^2) classes set. Lakes (grey colour) were not included in the spawning targets.

Figure 5. Upper reaches of the River Silisjoki. In these reaches salmon production is limited by the small water volume in riffle areas and shortage of spawning areas and holding pools for adult salmon. Photo: Jaakko Erkinaro.

The estimated spawning target of the River Silisjoki is 1 525 332 eggs. In female salmon biomass (kg) this becomes 847 kg when using fecundity of 1800 eggs/female salmon kg and 686 kg when using fecundity of 2225 eggs/female salmon kg (Table 2). In numbers of female salmon (mean weight 4.65 kg) these biomasses convert to 182 and 147 individuals, respectively (Table 2).

Figure 6. Lower reaches of the River Silisjoki. There are good holding pools for adult salmon and large amount of suitable juvenile production areas. Photo: Jaakko Erkinaro.

Table 2. Summary table of the River Silisjoki (including Gisttahbealhjohka) production area (m^2) and spawning target calculations. Two different fecundity options (1800 vs. 2225 eggs/female salmon kg) were used in the calculations. Mean female salmon weight of 4.65 kg was used in converting needed female salmon biomass (kg) to female salmon numbers.

Area with 0 eggs/m^2	414 878
Area with 1 eggs/m^2	491 577
Area with 2 eggs/m^2	516 878
Area with 4 eggs/m^2	0
Spawning target (number of eggs)	**1 525 332**
Lower limit (eggs)	1 021 105
Upper limit (eggs)	2 287 997
Spawning target (female biomass kg, 1800 eggs/kg)	**847**
Lower limit (kg)	567
Upper limit (kg)	1 271
Spawning target (number of female salmon)	**182**
Spawning target (female biomass kg, 2225 eggs/kg)	**686**
Lower limit (kg)	459
Upper limit (kg)	1 028
Spawning target (number of female salmon)	**147**

3.3. Harrijoki

The River Harrijoki (catchment area 216 km^2) is flowing from north to the River Näätämöjoki/Neidenelva c. 38 km from river mouth. The river system is dominated by lakes and rather slowly flowing pools. The salmon distribution area of the system is not perfectly known and may continue somewhat upstream from the point (UTM35: 569665, 7736897) used in this report. Recent genetic studies suggest that Harrijoki supports a genetically distinct salmon population (Sinclair-Waters & Primmer 2021).

Overall, the River Harrijoki is not a very prominent salmon river, and it was mostly considered as an unproductive (1 egg/m^2) river with long sections of non-productive slowly flowing pools of sandy/mud substrate (Figures 7-8). One of the most important limiting factors of salmon production is the low occurrence of suitable spawning areas and related 0+ nursery areas.

Figure 7. The upper parts of the River Harrijoki with potential juvenile production area. Photo: Matti Kylmäaho.

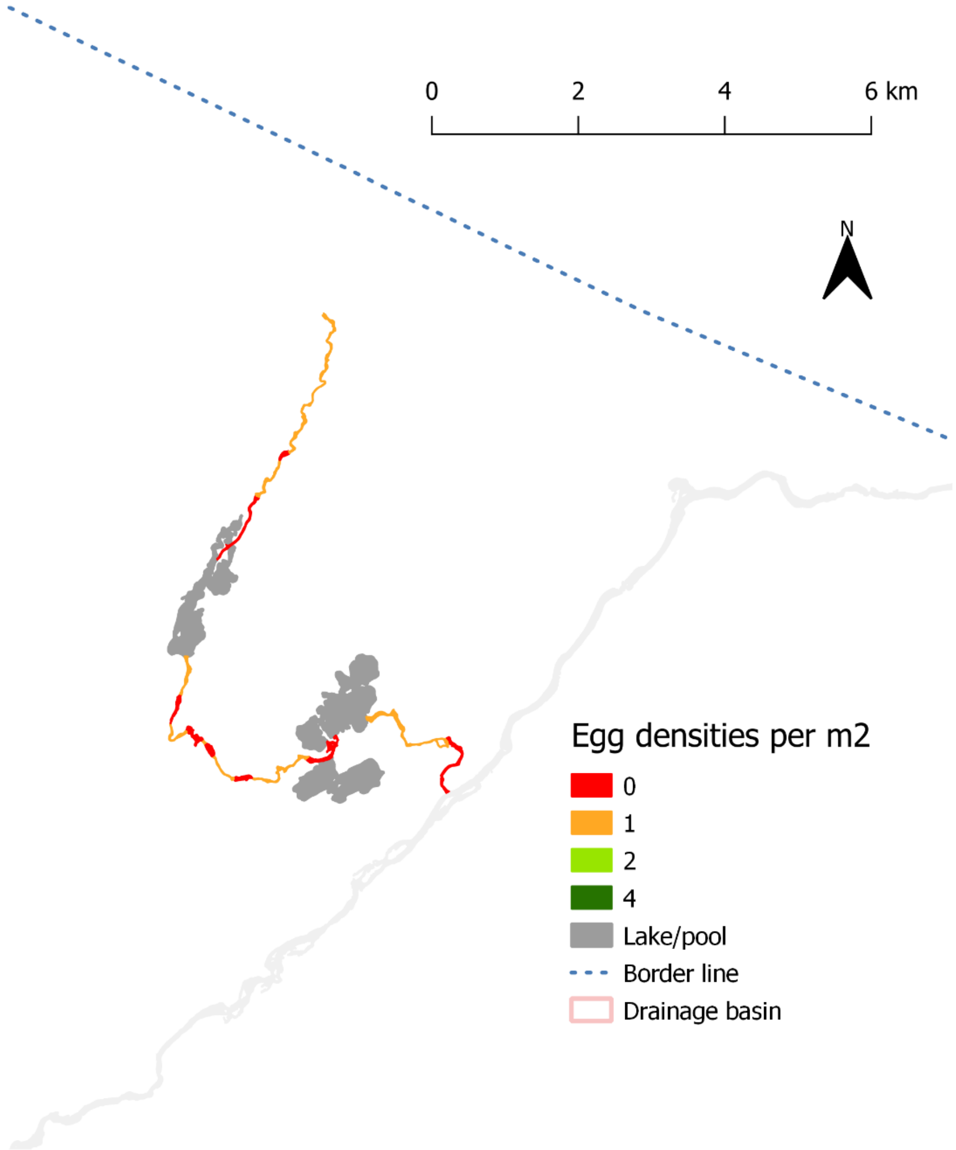

Figure 8. Map of the River Harrijoki system including the river areas with different egg density (eggs/m^2) classes set. Lakes (grey colour) were not included in the spawning targets.

The estimated spawning target of the River Harrijoki is 164 310 eggs. In female salmon biomass (kg) this becomes 91 kg when using fecundity of 1800 eggs/female salmon kg and 74 kg when using fecundity of 2225 eggs/female salmon kg (Table 3). In numbers of female salmon (mean weight 4.65 kg) these biomasses convert to 20 and 16 individuals, respectively (Table 3).

Table 3. Summary table of the River Harrijoki production area (m^2) and spawning target calculations. Two different fecundity options (1800 vs. 2225 eggs/female salmon kg) were used in the calculations. Mean female salmon weight of 4.65 kg was used in converting needed female salmon biomass (kg) to female salmon numbers.

Area with 0 eggs/m^2	0
Area with 1 eggs/m^2	164 310
Area with 2 eggs/m^2	0
Area with 4 eggs/m^2	0
Spawning target (number of eggs)	**164 310**
Lower limit (eggs)	82 155
Upper limit (eggs)	246 464
Spawning target (female biomass kg, 1800 eggs/kg)	**91**
Lower limit (kg)	46
Upper limit (kg)	137
Spawning target (number of female salmon)	**20**
Spawning target (female biomass kg, 2225 eggs/kg)	**74**
Lower limit (kg)	37
Upper limit (kg)	111
Spawning target (number of female salmon)	**16**

3.4. Total spawning target of the River Näätämöjoki/ Neidenelva system

The total spawning target of the River Näätämöjoki/Neidenelva system is slightly over 10 000 000 salmon eggs (Table 4). This converts to 5634 kg of female salmon when using fecundity of 1800 eggs/female salmon kg and 4558 kg when using the fecundity level of 2225 eggs/female salmon kg (Table 4). Based on the production area size and their value to salmon production 66% of the spawning target is situated in Finland and 34% in Norway (Table 4). In practise depending on the chosen fecundity level, c. 650-800 female salmon averaging a weight of 4.65 kg are annually needed on the Finnish side and c. 330-410 females on the Norwegian side to fulfil the spawning targets.

Table 4. Summary table the Näätämöjoki/Neidenelva total production area (m^2) and spawning target calculations and the same variables divided to countries (FIN=Finland, NOR=Norway). Two different fecundity options (1800 vs. 2225 eggs/female salmon kg) were used in the calculations. Mean female salmon weight of 4.65 kg was used in converting needed female salmon biomass (kg) to female salmon numbers.

	Total	FIN	NOR
Area with 0 eggs/m^2	16 67 047	1 537 047	130 000
Area with 1 eggs/m^2	1 239 477	1 173 477	66 000
Area with 2 eggs/m^2	3 425 910	1 734 910	1 691 000
Area with 4 eggs/m^2	512 381	512 381	0
Spawning target (number of eggs)	**10 140 821**	**6 692 821**	**3 448 000**
Lower limit (eggs)	7 295 747	4 726 247	2 569 500
Upper limit (eggs)	14 698 851	9 526 851	5 172 000
Spawning target (female biomass kg, 1800 eggs/kg)	**5 634**	**3 718**	**1 916**
Lower limit (kg)	4 053	2 514	1 428
Upper limit (kg)	8 166	5 293	2 873
Spawning target (number of females)	**1 212**	**800**	**412**
Spawning target (female biomass kg, 2225 eggs/kg)	**4 558**	**3 008**	**1 550**
Lower limit (kg)	3 279	2 124	1 155
Upper limit (kg)	6 606	4 282	2 324
Spawning target (number of female salmon)	**980**	**647**	**333**

4. Implications for monitoring and research

The setting of spawning targets gives a meaningful biological background to the management of the Näätämöjoki/Neidenelva river salmon populations. The numbers of female salmon needed to be present at spawning grounds after the fishing season are now known. The next step is to monitor if these spawning targets are actually met or not.

To do this, information on numbers of ascending salmon and their size and sex distribution together with salmon caught are needed on an annual basis. Counting ascending fish is rather resource demanding and may not be feasible in all different parts of the Näätämöjoki/Neiden system. There are, however, cost-effective possibilities in counting ascending salmon (partial count) annually at the Skoltefossen fishway by using a fish counter. That counting series can be supported by conducting occasionally full-scale salmon counting at the Näätämöjoki/Neidenelva river mouth with sonar monitoring. From these counts a model can be built to get a salmon ascendance estimate that is based on fishway data only. It would also be beneficial to conduct occasional salmon counting e.g., in Silisjoki to increase the reliability of its spawning target attainment estimation.

It is also very important to produce reliable salmon catch data in both countries as the spawning stock size is estimated by subtracting the numbers of caught salmon from the numbers of ascending salmon. Currently catch reporting is mandatory on Norwegian side and voluntary on Finnish side. Mandatory catch reporting also on Finnish side would be advantageous for the spawning target evaluations. Additionally collecting salmon catch samples (scales) is needed to estimate the sex and size distributions of both the ascending salmon population and the catch.

Some new, additional information on salmon distribution is also needed in near future, most importantly from the River Kallojoki. It is known that some adult salmon ascend the tributary but its stock status and salmon distribution area are currently unknown.

Overall, co-operation between researchers from Finland and Norway is needed to produce the annually needed datasets, to develop the monitoring and spawning target attainment estimation processes and to update the spawning targets when new knowledge is available.

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