

3 River data on salmon populations

3.1 Current wild and potential salmon rivers

In 1997 former IBSFC adopted the IBSFC Salmon Action Plan 1997–2010. In the plan were given several definitions and objectives. For the purpose of the Salmon Action Plan 1997–2010, the following rivers are intended to have self-sustaining populations by 2010:

- Finland
 - Simojoki
- Finland/Sweden
 - Tornionjoki/Torneälven
- Sweden
 - Kalixälven, Råneälven, Piteälven, Åbyälven, Byskeälven, Rickleån, Sävarån, Ume/Vindelälven, Öreälven, Lögdeälven, Emån, Mörrumsån
- Estonia
 - Kunda, Keila, Vasalemma
- Latvia
 - Salaca, Vitrupe, Peterupe, Irbe, Uzava, Saka
- Latvia/Lithuania
 - Barta/Bartuva
- Lithuania
 - Zeimena
- Russian Federation
 - Gladyshevka

Former IBSFC decided that management decisions for salmon in the Baltic should be based on the status of wild salmon populations and ICES advice to IBSFC has been based on this principle for the last few years. The Working Group has divided the Baltic salmon and sea trout rivers into four categories: **wild**, **mixed**, **reared** and **potential** rivers. The categorization is defined and discussed in the earlier working group reports, e.g., ICES 2002.

In 1999, in its 25th session, the former IBSFC adopted a list of index rivers to be established as a part of the IBSFC Salmon Action Plan. The status of wild salmon in these rivers would according to IBSFC be considered the basis for monitoring the status of wild Salmon populations. In total 12 index rivers were appointed, 4 in Gulf of Bothnia, 5 in the Main Basin and 3 in the Gulf of Bothnia. The monitoring in these rivers should consist of electrofishing, smolttrapping and counting of spawners. Other monitoring activities have also been established in some of these index rivers (Table 5.3.2.1).

However, in spite of several attempts, only one river (Simojoki) with both smolt trapping and counting of spawners have so far been possible to establish. The Working Group has repeatedly stressed the importance of both these elements to occur in index rivers in all parts (assessment areas), of the Baltic as it otherwise is difficult to monitor the actual importance of the fishery for the future development of populations in these areas as well as create stock/recruitment functions and thereby calculate the actual potential smolt production capacity of the rivers.

In regard of the objective that wild salmon populations shall be re-established in potential salmon rivers, there was no actual list of potential rivers adopted by the former IBSFC to be included in the objective that the production of wild salmon should gradually increase to attain by 2010 at least 50% of the estimated potential. However, potential rivers have been officially selected by several countries to be considered within the implementation of national Salmon Action Plans.

3.2 Wild salmon populations in Main Basin and Gulf of Bothnia

Monitoring of parr densities are carried out by standardized electrofishing surveys. The method is carried out in the similar way in all assessment units. By using removal fishing the fish densities are estimated. The performance of the electrofishing is the same today as in the beginning of the monitoring surveys. The choice of electrofishing sites in almost all rivers was done in the beginning of the monitoring surveys when the density of parr was very low. To have some kind of possibility to detect salmon parr, rapids and sites was selected by the "expert knowledge" of possibility to catch parr. When number of sites has extended to cover the whole river system the selection has been made the same way as earlier.

3.2.1 Rivers in the assessment unit 1 (Gulf of Bothnia, Subdivision 31)

During the past centuries and even during the early 1900s, river catches were generally on a much higher level than during the late 1900s, as illustrated by the catch statistics from the **Tornionjoki** (Figure 3.2.1.1). During the 1980s, the river catches were the lowest ever recorded: only 50–200 kg/year in the **Simojoki**, and some tonnes/year in the **Tornionjoki** and the **Kalixälven**, indicating that the escapement to the spawning grounds was very low (Table 3.2.1.1, Figure 3.2.1.2). In 1994–1996, a clear increase in the river catches was observed. Salmon catches peaked in 1997, when the catches were 4, 74 and 10 tonnes in the **Simojoki**, **Tornionjoki** and **Kalixälven**, respectively. Catches decreased thereafter to 25%–60% of that of 1997, until there was a new prominent rise in 2008. Exceptionally warm and low river water prevailed in these rivers during the summers of 2002, 2003 and 2006, which might have affected fishing success. Anyhow, exceptional circumstances cannot fully explain the reduced catches, but instead it is likely that the abundance of spawners was generally lower until 2008 (but see development in fish ladder data of the **Kalixälven**). In both **Tornionjoki** and **Kalixälven** the catch in 2008 was about double the catch in 2007 and 3–5 times higher than the catch in 2005.

A special kind of fishing from boat (rod fishing by rowing) dominates in salmon fishing in the **Tornionjoki**. Also in **Kalixälven** this fishing occurs but is not as dominating as in the **Tornionjoki**. The cpue of this kind of fishery in the **Tornionjoki** has increased ten to twenty-fold since the late 1980s (Table 3.2.1.1), apparently reflecting the parallel drastic increase in the abundance of spawners in the river. The cpue peaked in 1997 and 2008, when the total river catch was also peaking. Between these years the cpue was 30–50% lower than the peak values. In 2008 the cpue was 1215 grams/day, which is the record of the whole time series and which indicates a rapid increase of abundance within the last 1–2 years.

Spawning runs and their composition

In **Kalixälven** fish passage has been controlled in the fishladder since 1980. Until 1997 the control of fish passage was carried out by manual control and from 1998 the control has been carried out by an electronic, infrared fish counter, "Riverwatcher" (Vaki Aquaculture System Ltd, Iceland). After some improvement of the underwater video camera during 2006, registration of species was carried out during the whole migra-

tion season 2007 and 2008. Every species passing upstream is distinguished with video recording. Totally six species (salmon, trout, whitefish, grayling, bream, and ide) were registered in 2007 and 2008. From the registration 1999–2006 totally 100 fishes were every year reduced from the total counted number of salmon and classified as trout. The level of reduction is based on earlier number from the manual control and recorded catches of trout in the area closest to the fishladder.

The run of total number of salmon has decreased from 2001 to 2008. In 2001 the total numbers of salmon that passed the ladder was the highest (9367). The total counted number increased slightly 2008 compared to 2007 and the proportion of MSW was 90%, the highest recorded (Table 3.2.1.2, Figure 3.2.1.3).

There have been trials to count the spawning run into the **Simojoki**. A hydroacoustic split-beam technique was employed in 2003–2007. It seems evident that these counts cover an unknown fraction of the total run, as there are irregularities in the river bottom of the counting site, allowing salmon to pass the site without being recorded. There are also problems connected to differentiation of species and size categories of salmon. Yet, preliminary results indicated 940, 680, 900, 885 and 1248 MSW spawners for the years 2003, 2004, 2005, 2006 and 2007 respectively. In 2008, the split-beam technique was replaced by a new echo sounder called DIDSON (Dual frequency IDentification SONar). This technique gives much more reliable run size estimates than the older techniques. In 2008, a total of 1160 fish longer than 60 cm (i.e., deemed to be salmon) were counted by DIDSON in the **Simojoki**. A lot of back-and-forth movement of salmon was detected by DIDSON, which further erodes the reliability of the previous years' split-beam counts, because the old technique was not capable of identifying downstream movement of fish.

About 7300 catch samples have been collected mainly from the Finnish **Tornionjoki** fishery of salmon since the mid-1970s. Table 3.2.1.3 shows number of samples, sea-age composition, sex composition and proportion of reared fish (identified either by the absence of adipose fin or by scale reading) of the data for the given time periods. During the past few years caught fish became gradually older until 2008, when the average sea age decreased and 2-sea-winter fish accounted for a great majority of spawners. This together with the parallel jump in the river catch (Table 3.2.1.1, Figure 3.2.1.1) indicate that salmon which smolted in 2006 constitute a very abundant cohort in the **Tornionjoki**. The proportion of spawners of reared origin has declined to about 1 percent, which is a natural consequence of decreased stocking and increased wild reproduction.

Parr densities and smolt trapping

The lowest parr densities in the longest time series of electrofishing were observed in the mid-1980s (Table 3.2.1.4, Figures 3.2.1.4 and 3.2.1.5). Since then, densities have increased in a cyclic pattern with two jumps. The second, higher jump started in 1996–1997. Between the jumps there was a few years' collapse in the densities around the mid-1990s, when the highest M74 mortality was observed. Average parr densities are nowadays 5–40 times higher than in the mid-1980s. Annual parr densities have varied 2–5 fold during this decade, but without any clear trend.

In some years of this decade, especially in 2003, high densities of parr hatched in spite of relatively low preceding river catches (indicating low spawner abundance) in the **Simojoki**, **Tornionjoki** and **Kalixälven**. Among the reasons for this inconsistency may be exceptionally warm and low summer-time river water, which might have affected fishing success in river and even the measurements of parr densities. Also the decline in M74 mortality (see Section 3.5) can partly explain the phenomenon. In

the summer 2006, circumstances for electrofishing were extraordinarily favourable because of the very low river water level, i.e. the circumstances were opposite to those prevailing in 2004–2005. Therefore, one must be cautious when considering the results of these years.

In summer 2008, conditions for electrofishing were rather normal. The mean density of wild one-summer old parr increased from 2007 to 2008 in every AU1 river (Table 3.2.1.4). The density was the highest ever recorded in the **Tornionjoki** and it was among the top three years in the **Kalixälven** and **Råneälven**. In the **Simojoki** the mean density of one-summer old parr was not a record but anyhow above average level of the current decade. The mean density of wild older parr (ages >0+; Table 3.2.1.4) in 2008 was a new record in **Tornionjoki**, among top three years in **Kalixälven** and **Råneälven**, but quite low in **Simojoki**.

The parr cohort hatched in 2007 (spawning in 2006) seems to be weak both in the **Simojoki** and the **Råneälven**. Perhaps the extraordinary low water level prevailing in the summer of 2006 and also in the following winter might have negatively affected natural reproduction in these smallest rivers of AU1.

Smolt production has been monitored by a partial smolt trapping and mark-recapture experiments (see Section 5.3.4 for methodology) in the **Simojoki** and **Tornionjoki**. A hierarchical linear regression analysis (see Section 5.3.5) has been applied to combine the information of electrofishing and smolt trapping results, to obtain updated estimates of the wild smolt production (see Section 5.3.9) (Table 3.2.1.5).

In the late 1980s, the annual estimated wild smolt run was only some thousands in the **Simojoki** and less than 100 000 in the **Tornionjoki** (Table 3.2.1.5). There was an increase in the production in the early 1990s, and a second, higher jump in the turn of the century. Thus, run of wild smolt has followed the changes in the wild parr densities with the 1–3 years time lag needed for parr to transform to smolts. Since the year 2000, annual estimated run of wild smolt has exceeded the level of 30 000 and 500 000 smolts with high certainty in the **Simojoki** and **Tornionjoki**, respectively. In 2008, the estimated smolt runs increased from the previous year in the both rivers, in **Tornionjoki** by about 140% and in **Simojoki** by about 80%. Trapping apparently missed the earliest part of the **Tornionjoki** smolt run in 2007 due to postponing of the start of trapping in high flood, but this was not the case in 2008. Thus, the real difference in the smolt abundance between 2007 and 2008 is not as large as indicated by these results. The smolt trapping in **Tornionjoki** in 2008 indicated an abundance of about 1 490 000 (mode of the posterior distribution, 95% PI 960 000–3 620 000) wild smolts, which is the highest abundance ever estimated in **Tornionjoki**. The estimate derived by trapping was about 30% than that predicted by the hierarchical linear regression analysis (river model) a year before. The river model with 2008 data as input indicates, that the wild smolt production in **Tornionjoki** was about 1 100 000 in 2008. The model predicts notable increase of smolt runs in **Tornionjoki** for the next two years, apparently because of the observed high recent parr densities (Table 3.2.1.5). However, smolt runs in **Simojoki** are expected to decrease at least in 2009.

All salmon stocking except for research purposes was terminated in 2002 in the **Tornionjoki** and in 2005 in the **Simojoki**. Lately, only a few thousand smolts have annually been reared-origin. Number of smolts of reared origin has been radically declining since the peak in the late 1990s both in the **Simojoki** and **Tornionjoki** when the estimated numbers was about 200 000 (Table 3.2.1.5).

3.2.2 Rivers in the assessment unit 2 (Gulf of Bothnia, Sub-division 31)

River catches and fishery

In summer 2008, conditions for electrofishing were rather normal. Exceptionally warm and low river water prevailed in rivers in assessment unit 2 during the summer 2006 could have influenced the decreased catches. The catches 2005 and 2004 in the rivers, especially in the northern part of assessment unit 2, could have been influenced by very high water level in the late summer and autumn. During 2002 and 2003 exceptionally low and warm river water, might also have affected fishing success these years. The catch (45) in **Piteälven** 2008 was at the same low level as in 2007. The catch of salmon in **Åbyälven** 2008 was 30 salmon almost the same (20) as in previous years. The catches in **Byskeälven** has varied during the 1980s between 251–687 kg and in the beginning of 1990s the catches increased noticeably (Table 3.2.1.1). The highest catches occurred in 1996 when it was 4788 kg and afterwards the catch shows a decreasing trend. The catch 2008 increased with the double compared to 2007. In **Sävarån** the catches decreased to only 5 salmon compared to 49 salmon in 2007. The catches in **Ume/Vindelälven** doubled in 2008 compared to 2007, from 250 to 450 salmon. In **Öreälven** the catch increased to 50 salmon in 2008 compared to 2007 when 20 salmon were caught. In **Lögdeälven** the catches was 50 salmon the same level as in the two previous years.

Spawning runs and their composition

In almost all rivers the upstream migration is counted by electronic, infrared fish counter, "Riverwatcher" (Vaki Aquaculture System Ltd, Iceland) or by an underwater camera (Poro AB, Sweden). In **Piteälven** a power plant station (the only one in **Piteälven**) with a fishladder was built in the end of 1960s about 40 km from the river mouth. In 1992 the company built a new ladder and in 1998 they installed an electronic fish counter (Riverwatcher) and in 2001 a camera were installed for detection of species. The run in the fish ladder is the entire run. The total run 2008 increased to 723 salmon compared to 518 in 2007. (Table 3.2.1.2, Figure 3.2.1.3). Low water level have no affected on the possibility for salmon and trout to entering the ladder but very high water can temporary stop and delay migration.

In the river **Åbyälven** a powerplant station (the only one in **Åbyälven**) with a fishladder is located 30 km from the river mouth. The power plant company installed an electronic fish counter (Riverwatcher) in 2000. The run in the fish ladder is only a small part of the entire run. The total run increased to 210 salmon which is nearly the double of the highest number 2001 when 112 salmon passed (Table 3.2.1.2, Figure 3.2.1.3). Very low water level can cause shut down of the powerplant which make it almost impossible for fish to enter the fishladder. In 2006 the powerplant station was stopped for one month causing no fish passage during that time. The water level 2008 was at mean level during the migrations season causing no problem for fish to entering the ladder.

In **Byskeälven** a new fishladder was built in 2000 on the opposite side to the old ladder. The waterfall is a partial obstacle for the salmon. In 2000 an electronic fishcounter (Riverwatcher) was installed in the new ladder and a Poro counter (camera) was installed in the old ladder. The run in the fish ladder is part of the entire run. Low water level can increase the possibility for salmon to pass the natural waterfall while high water level decreases the possibility to force the waterfall. The total run has decreased yearly from 2004 to 2006, but in 2008 the number of salmon increased to 3409 which is the highest level since 1996 (Table 3.2.1.2, Figure 3.2.1.3).

In **Rickleån** the powerplant company built four ladders in 2002, fishpassage is controlled with an electronic counter (Poro) in the uppermost ladder. Before construction of ladders, salmon passage has been closed for over 100 years since building the first powerplant station in the beginning of the 1900s. The run in the fish ladder is part of the entire run. The water level does not affect the migration of salmon in the four ladders except when the level are extremely low then the migration can decline or even stopped. Only 5 salmon passed the ladders 2008 compared to 7, 2 and 1 salmon 2007, 2006 and 2005 respectively.

The ladder in **Ume/Vindelälven** was built in 1960. In the river **Ume/Vindelälven** the salmon run is affected by the yearly differences in the amount of water in the old riverbed leading to the fish ladder, and therefore the possibilities for salmon and trout to find their way. The run in the fish ladder is the entire run. The results in 1999–2002 might in part be the result of an unusually large amount of water spilled to the riverbed at the dam in Norrfors. From the beginning of 1970s when the total run was divided into reared and wild salmon by finclipping, the highest number of wild salmon occurred in 2002 when 6052 passed the ladder (6832 including reared). In 2008 the run of wild salmon increased to 5157 compared to 4023 in 2007. Additional to the wild salmon 1847 of reared original was caught in the ladder (Table 3.2.1.2 and Figure 3.2.1.3).

In **Öreälven** the control of passage of fish ended in 2000. The reason was that high water level 2000 destroyed part of the dam with the fishtrap (Table 3.2.1.2).

Parr densities and smolt trapping

Electrofishing surveys have been done with the same kind of equipment (Lugab), portable motor and a transformer. During the time series same group of people have made most of the electrofishing in Swedish rivers in assessment unit 1–4. In the beginning of monitoring surveys the average size of the sites was around 500–1000 m² especially in assessment unit 1 and 2. The reason of the larger size of the sites was to have some possibility to catch parr. In 2003 and onward changes has been made in assessment unit 1 and 2 by reducing the size of the sites to about 300–500 m² due to the higher parr densities. In the summer 2006, circumstances for electrofishing were extraordinary because of the very low river water level, i.e. the circumstances were opposite to those prevailing in 2004–2005. For the electrofishing carried out in 2008 the water level was normal. The densities of salmon parr in electrofishing surveys in rivers in assessment unit 2 in the Gulf of Bothnia, Sub-divisions 31, are shown in Table 3.2.2.1 and Figures 3.2.2.1 and 3.2.2.2.

Electrofishing during 2008 was made in 83 sites in 8 rivers. The densities of 0+ parr increased in all rivers compared to 2007 except in Vindelälven where the densities decreased and in Öreälven where the densities was at the same level as in 2007.

In **Piteälven** no consistent electro fishing surveys has been made during the 1990s. In 2002, 2006, 2007 and 2008 surveys were carried out. The density of 0+ parr were low for 2002 and 2006 and in 2007 no 0+ parr where caught. In 2008 the density of 0+ was the highest observed together with the densities in 2002 (Table 3.2.2.1) and (Figure 3.2.2.1).

In **Åbyälven**, the mean densities of 0+ parr in 1989–1996 were about 3.1 parr/100 m². In 1999 the densities of 0+parr were 16.5 parr/100m² that's about five times higher than the earlier. In 2005 the densities of 0+ parr was 6.4/100 m² which is almost the same as the year before .In 2006 the densities reached the highest observed density 27.2 parr/100m². In 2008 the densities increased to 12.5/100 m² compared to 2007.

One-summer old parr were observed in about 80% of the study sites (Table 3.2.2.1), which is close to the average of the last few years.

In **Byskeälven**, the mean densities of 0+parr in 1989-1995 were about 4.7 parr/100 m². In 1996-1997 the densities increased to about 10.9 parr/100m². In 1999 and 2000 the densities of 0+ parr were about 70% higher than in 1996-1997. In 2006 the densities of 0+ parr decreased by half compared to 2005 when the densities was 26.2 parr/100m². In 2007 the densities decreased to 6.8 parr/100 m² which is the lowest number since 1995. In 2008 the densities increased to 20.5 parr/100m². In 2008 one-summer old parr were observed in 93% of all the study sites (Table 3.2.2.1), which is close to the average of the last ten years.

In **Rickleån**, the mean densities of 0+parr in 1988-1997 were about 0.6 parr/100 m² and in 1998 the mean densities increased to 2.5 parr/100 m². The densities in 2006 were almost the same as in 2005 3.9 parr/100 m². In 2007 no 0+ parr were caught and the densities of older parr were also very low. In 2008 the densities increased to 4.2 parr/100m² which is at the same level as in earlier years (Table 3.2.2.1).

In **Sävarån**, the mean densities of 0+-parr in 1989-1995 were about 1.4 parr/100 m². In 1996 the densities increased to 10.3 parr/100 m² and in 2000 the highest densities occurred, 12.8 parr/100 m². Difficulties in the electro fishing with only some of the sites examined in 2000 might in part explain the very high number. No electrofishing was made in 2001 and 2004. The density in 2006 increased to 12.5 parr/100 m² which is the same level as in 2000. The mean of older parr (>0+) for the latest 10 years is 5.3 parr/100 m². In 2008 the density doubled to 7.3 parr/100 m² compared to 2007. One-summer old parr were observed in about 80% of the study sites (Table 3.2.2.1), which is slightly above the average of the last years.

In **Ume/Vindelälven**, the mean densities of 0+-parr in 1989-1999 were about 0.8 parr/100 m². In 1997 the densities increased to 17.2 parr/100 m². The highest densities occurred in 1998 and 2003 when they were 21.6 and 24.0 parr/100 m², respectively. The densities in 2008 decreased with half, 8.5 parr/100m², compared to 2007 (Table 3.2.2.1).

In **Öreälven**, the mean densities of 0+-parr in 1986-2000 have been very low: about 0.5 parr/100 m². In 2002 the densities increased to 6.7 parr/100 m². The densities of 0+ parr in 2008 were the same as in 2007, i.e. 1.2 parr/100 m² (Table 3.2.2.1).

In **Lögdeälven**, the mean densities of 0+-parr in 1986-1997 were about 1.4 parr/100 m². In 1998 the densities increased to 13.7 parr/100m², which is the highest recorded density. For the three latest years the densities have increased and in 2005 it were 11.2, which is almost the same level as in previous years. The density 2007 decreased to 2.9 parr/100 m² which is the lowest densities since 1997. In 2008 the densities increased to 10 parr/100 m². One-summer old parr were observed in every study site (Table 3.2.2.1).

In **Sävarån** 2005-2008 smolts of salmon and sea trouts were caught on their downstream migration using "Rotary-Screw-traps", positioned 15 km upstream the mouth of the river (Table 3.2.1.5). Totally 583, 812, 823 and 829, wild salmon smolts were caught 2005-2008 respectively. Fish were caught from mid May to mid June. The smolts were measured for length- and weight, scale samples were taken for age determination and genetics. The dominating age group among caught smolts of was 3 years. The number of recaptured tagged fish in the trap has yearly varied between 15-31%. (Lundqvist *et al.*, 2009).

3.2.3 Rivers in the assessment unit 3 (Gulf of Bothnia, Sub-division 30)

River catches and fishery

In **Ljungan**, the salmon angling catch was 35 in 2008 compared to 21 and 40 in 2007 and 2006. The catches has increased the three latest years compared to the years 2000–2002 when 18, 2, and 1 salmon were caught by angling, respectively.

Parr densities

The densities in **Ljungan** of 0+ parr/100 m² in 1990–2005 varied between 3.1 and 45.3, and the mean density was 15.1 0+parr/100 m². In 2005 the densities of 0+ parr/100 m² increased to 45.3 compared to 3.0 in 2004. One-summer old parr were observed in all of the study sites in 2005. No electrofishing was carried out in 2006 because of high water level in late autumn. The decrease in 2007 of the densities of 0+ parr could have caused by the high water level during the surveys. In 2008 the density of 0+ parr increased to 19 parr/100 m² compared to 2007. Only three sites were possible to sample due to high water level (Table 3.2.3.1 and Figure 3.2.3.1).

3.2.4 Rivers in the assessment unit 4 (Western Main Basin, Subdivisions 25 and 27)

River catches and fishery

In **Emån**, only 15 salmon was reported as caught and retained in 2008. The retained catches in 2007, 2006 and 2005 were even lower 1, 9 and 12 salmon respectively. In 2004, 2003 and 2002 the catch was 89, 83 and 143 salmon respectively. In **Emån** fisherman has applied catch and release for the latest 10–15 years and the trend is that the rate of utilizing catch and release has increased the latest years. The sportfishing in **Emån** is nowadays basically a catch and release fishing. This could be a reason for the decreasing catches.

In **Mörrumsån**, the retained salmon catches have varied during the latest five years between 171 and 536. In 2008 the catch increased to 302 salmon compared to 242 in 2007. In **Mörrumsån** fisherman has applied catch and release for the latest 10–15 years and the trend is that the rate of utilizing catch and release has increased the latest years. This could be a reason for the decreasing catches the latest years.

Parr densities and smolt trapping

In **Emån**, the densities of parr in electrofishing surveys below the first partial obstacle in the river are shown in Table 3.2.4.1 and Figures 3.2.4.1 and 3.2.4.2. The densities of 0+ have varied from 1992–2007 between 13–71 parr/100 m² and the mean density during this time is 43 parr/100 m². The highest densities of 0+ parr occurred in 1997. The density of 0+ parr in 2008 was 35 parr/100 m² the same as in 2007. The densities of older parr have varied from 1–10 parr/100 m² in 1992–2008 with mean value of 5 parr/100 m².

The production estimates in River **Emån** have been a problem in the current assessment model used by WGBAST. According to the model the current production would be very low compared to the production capacity. The estimated production is based on electrofishing surveys in a few sites (about six) every year. In 2007 an overview of the conditions in the river concluded that probably the difficulties for particularly salmon spawners and to a minor extent also sea trout to ascend fish ladders may give rise to low production of juveniles above the ladder. Electrofishing sites in these areas do therefore normally have low juvenile abundance. On the other hand there is a highly successful sea trout and salmon fishery in the lower part of the river (at **Emån**).

and this fishery have not shown signs of a lower abundance of either species. On the contrary salmon seems to have increased in abundance, probably as a result of lower exploitation at sea.

In contrast to other Swedish rivers, the smolt production in Emån river has not shown any positive signs after the regulations that were initiated in the 1990s (Michelsens *et al.*, 2007, Section 5). An analysis in order to understand why the number of smolts has not increased suggests that it is migration problems that have caused this lack of effects. Earlier work in WGBAST has estimated the spawning areas available for salmon in Emån but it is argued that very few salmon can migrate to these areas. Monitoring of salmon migration in one fish ladder during 2001–2004 suggests that very few salmon could reach some of the upstream potential spawning areas.

In order to get a quantitative estimate of the smolt run in the river, smolt traps have been operating in the river Emån in 2007 and 2008. The primary purpose was to get an overview of the smolt production in the river. Two smolt wheels were installed within 200 m of the river mouth. In 2008 the smolt traps were operating through most of the smolt migration period. Almost the entire catch of salmon and sea trout smolts in the traps were utilized for mark-recapture estimation. The estimate salmon smolt run in 2008 was 3473 smolts (95% confidence interval 1536–5409 smolts). The efficiency was estimated to 6.1%.

A considerable emigration of *Salmo* sp. fry (the species was not identified more accurately) in the length interval of 30 mm and some in 50 mm interval occurred in 2007 and 2008, indicating that this migration can be a common phenomenon. It was not possible to estimate the catch efficiency for small fry, but it is certainly much lower than for smolts. If assumed that the trap efficiency for the fry is half that of the salmon smolts, or 3%, the estimated number of fry emigrating from the river would be in the order of 97 500. On the other hand the efficiency could be much lower with resulting higher numbers emigrating. This kind of mass emigration has not been observed in any of the other Swedish rivers where smolt wheels have been operating (Testeboån Subdiv 30, Sävarån Subdiv 31). It is normal that high densities of fry in the early phase of the life may lead to displacement and emigration of fry, but as the parr densities in Emån are normally quite moderate it ought to be possible for a majority of the fish to find suitable places to establish territories.

In **Mörrumsån**, the densities of parr in electrofishing surveys are shown in Table 3.2.4.1 and Figures 3.2.4.1 and 3.2.4.2. The densities of 0+ have varied from 1973–2008 between 12–307 parr/100 m². The highest densities occurred in 1989. The densities decreased during 2006 and 2007, but in 2008 the densities of 0 + parr increased to 102 parr/100 m². The probably the reason for the lower density in 2007 was the high water level, only 4 of 9 sites were possible to electrofishing. In the river Mörrumsån, hybrids between salmon and trout have been found during the electrofishing. In 1993–1994 the numbers were high, up to over 50% in some sampling sites. The number of hybrids has varied and was in 1995 and 1996 only some percent of the total catch. In 2005 the density of 0+ hybrids was 14 parr/100 m² which is higher than in the three years before. The amount of hybrids has decreased in 2006–2008: only 0.9 0+ hybrid parr/100 m² was caught in 2008. In 2004 two new fish ladders was built at the power plant station about 20 km from the river mouth which opens about 9 km of suitable habitat for salmon including about 16–21 ha of production area.

3.2.5 Rivers in the assessment unit 5 (Eastern Main Basin, Subdivisions 26 and 28)

Estonian rivers

The River **Pärnu** is the only Estonian salmon river in the Main Basin, and it flows into the Gulf of Riga. The first obstacle for migrating salmon in the river is the Sindi dam, located 14 km from the river mouth. The dam has a fish ladder, which is not effective due to the location of the entrance. The electrofishing surveys are carried out on the spawning and nursery ground below the dam in 1996–2008. The number of parr/100m² was low during all period (Table 3.2.5.1 and Figure 3.2.5.1). No parr were found in 2003, 2004, 2007 and 2008. In 2008 flood reduced the catchability. A part of potential spawning area was cleaned from excessive vegetation and loosened in autumn 2004 and 2005 but parr density has not increased.

Latvian rivers

There are 10 wild salmon rivers in the Latvia, mainly in the Gulf of Riga. Some rivers have been stocked by hatchery reared parr and smolt every year with the result that salmon populations in these rivers are a mixture of wild and reared fish.

In 2006 the river fish monitoring programme was revised. All monitoring activities were divided in:

- 1) Salmon monitoring carried out in 11 rivers (2 river basin districts) 48 electrofishing stations, smolt trapping in the river Salaca;
- 2) Fish background monitoring carried out in 28 rivers (4 river basin districts) 56 electrofishing stations.

In 2008 monitoring was carried out in rivers in Natura 2000 area. Salmon occurred in 10 of these sites. Also in background monitoring stations salmon parr were caught. The salmon parr densities are presented in Table 3.2.5.1 and in Figure 3.5.2.2.

The wild salmon population in the river **Salaca** has been monitored by smolt trapping since 1964 and by parr electrofishing since 1993. From 2000 all stockings of artificial reared salmon in the river **Salaca** were stopped.

In 2008, 16 sites were sampled in **Salaca** and their tributaries, divided in 10 sites in the rapid and 6 in the pool biotopes. All sites in the lower part of the main river hold 0+ age salmon parr. The 0+ salmon parr occurred in the Salaca tributaries, **Jaunupe** and **Svētupe**, too. Average density of 0+ salmon parr was 92.5 per/100 m². Density of 1+ and older salmon parr was 4.9 per/100 m². Density of 0+ and older wild salmon parr in the river Salaca tributaries (5 sampling sites in 3 rivers) was 43.4 and 1.1 accordingly.

In total 3470 salmon and 2202 sea trout smolts were caught in the smolt trap in the river **Salaca**, 2234 of them were marked using streamer tags for total smolt run estimation. The rate of catch efficiency was at the same level as in previous years and fluctuated from 4–23% (14% in average). As estimated, in total 24 900 salmon and 15 900 sea trout smolts migrated from the river **Salaca** in 2008.

It is almost certain that the river **Salaca** monitoring data demonstrated that number of adult salmon probably is sufficient. It seems that fisheries management and effective fisheries control to illegal fisheries on-site are determinative factors in Latvia to reach a higher wild salmon production values in the rivers.

In the river **Venta** wild salmon parr was found below the Rumba waterfall. The number of parr increased in comparison with the two previous years.

In the river **Gauja** wild salmon parr production was lower in comparison with parr production in the tributary **Amata**.

Wild salmon were found in the river **Vitrupe**. Age structures testify that salmon reproduction occurred in the river at least in 2005 and 2007. The average 0+ parr density in 2008 was 20.4 per/100m².

Wild salmon parr was found in the rivers **Rīva** and **Saka**. Age structure of parr shows that salmon reproduction occurred in these rivers at least in 2005–2007.

Salmon parr were not found in the small rivers **Peterupe** (Saka system), **Tebra**, **Durbe** and in **Barta**.

Lithuanian rivers

Lithuanian rivers are typical lowland ones and many of them are tributaries in Nemunas system. These are mainly the sandy, gravelly rivers flowing in the heights of upper and lower Lithuania. Nevertheless, salmonids inhabit more than 180 rivers in Lithuania. In totally 76 rivers inhabits trout and Baltic salmon spawned in 14–16 rivers. Leaning on historical data and today's situation, salmon rivers can be divided into following groups: 1-inhabited by wild salmon; 2-inhabited by artificially reared salmon; 3-inhabited by mixed salmon population; 4-“potential” rivers, i.e. where salmon occurs occasionally; 5-rivers, where salmon got extinct (Kesminas *et al.*, 2003).

Estimated salmon smolt production in Lithuania increased to 32 808 in 2008 which is 2.4 times higher than 2007. The increase was highest in **Neris**, **Žeimena**, **Šventoji** and **Siesartis** rivers, 92% of the total smolt production originated from these rivers. Smolt production in other salmon rivers is significantly lower and ranges from 0 to 1000 individuals.

Electrofishing is the main monitoring method for evaluation of 0+ and older salmon abundance. In 2008 monitoring of salmonids covered 101 sites in 50 rivers in Lithuania. Monitoring covers all main salmon rivers (including all potential rivers). In 2008 salmon parr were found in 13 rivers in the south-eastern part **Zeimena**, **Neris**, **Šventoji**, **Vilnia**, **Vokė**, **Mera**, **Siesartis** and **Sirvinta**. In the western part salmon parr were found in river **Šventoji** (Baltic Sea) and river **Minija**. In the central part salmon parr were found in river **Dubysa** and in some other small tributaries.

The mean density of salmon juveniles in Lithuanian rivers 2008 was 3.6 parr/100 m² and ranged within 0.25–22.5 parr/100 m² (Table 3.2.5.2 and Figures 3.2.5.3 and 3.2.5.4).

In river **Neris** wild salmon parr were caught in all 9 sites in 2008. The mean density was relatively high in comparison to the previous year 7.6 parr/100m² and ranged within 1.7–22.5 parr/100 m².

In river **Zeimena**, the index river, in 2008 the average density of wild salmon parr 0+ was 2.8 parr/100 m² and for >0+ parr it was 0.08 per/100 m². The highest recorded density was 13.3 parr/100 m² in the middle river course. Following few years of low productivity, salmon juveniles reappeared in the **Mera** river (tributary of Žeimena) in 2008 with mean density of parr of 0.5 parr/100 m².

Salmon restocking program in Lithuania started in 1998 and there are lots of measures implemented every year to increase salmon population, including artificial rearing, construction of fish ladders, protection of spawning ground, stock monitoring, and scientific projects. Despite the measures taken, according to the data of salmon

monitoring smolt production in Nemunas basin increased very slowly. High increase in production was observed during the recent years. Smolt production increased substantially during the last 3 years from 5700 in 2006 to 32 800 in 2008. This could be influenced by good hydrological conditions and means directed towards protection of spawning grounds which were carried out for three subsequent years. Implementation of these measures helped to stabilize salmon population in Lithuania and prevented possibility for salmon extinction in Lithuania. All artificially reared smolts were not included in statistics. Also salmon smolt production is affected by other factors as well. Water temperature in the Lithuanian rivers has been well above average during the last years and water levels were below normal. Also one of main concerns in salmon rivers remains of pollution. Another important factor is the fact that Lithuanian rivers are lowland type and there is a lack of habitats for salmon, only some river stretches are suitable for parr production. Quite high mortality rate caused by predators is another problem. The densities of predators are significantly higher in Lithuanian rivers compared with typical salmon rivers in the northern Baltic.

3.3 Potential salmon rivers

3.3.1 General

Several countries have officially appointed potential salmon rivers as suggested in the former IBSFC Salmon Action Plan. Mostly, these rivers are old salmon rivers that have lost their salmon population. Restoration in potential salmon rivers was started in some countries in different ways and with varying efforts. The goal of the restoration is to re-establish natural reproduction of salmon.

The current status of the restoration programs in Baltic Sea potential salmon rivers is presented in Table 3.3.1. Releases of salmon fry, parr and smolt have resulted in natural reproduction in some rivers (Table 3.3.2).

3.3.2 Potential rivers by country

Finland

The rivers **Kuivajoki**, **Kiiminkijoki** and **Pyhäjoki** were selected to the Finnish Salmon Action Plan programme. All these rivers are located on the assessment unit 1 (Sub-division 31). Hatchery reared parr and smolts have been annually stocked in the rivers since the 1990s. Due to poor success of stock rebuilding to date, especially in the Pyhäjoki and Kuivajoki, the monitoring activities and stocking volumes have been decreased. Current activities include only salmon releases in the Kiiminkijoki and Kuivajoki, and monitoring of parr densities in the Kiiminkijoki. The poor success of stock rebuilding is probably due to a combination of high exploitation in mixed-stock fisheries, insufficient quality of water and physical habitat in rivers and their temporally low flow, which may hinder the spawning migration of adult salmon.

In 2008, 73 990 smolts and 41 200 one-year old parr of the Simojoki origin were stocked in the **Kuivajoki**. In the **Kiiminkijoki**, 3838 smolts and 236 228 parr of the river Iijoki origin were stocked. In 2008, the average density of wild (one-summer old) parr in the river **Kiiminkijoki** increased back to the 2006 value (2.3 ind./100m²) from the lowest level (0.7 ind./100m²) observed in 2007 (Table 3.3.2).

Small-scale natural reproduction was observed also in the **Merikarvianjoki** at the Bothnian Sea (Sub-division 30), and in the **Vantaanjoki** at the Gulf of Finland (Sub-division 32). The density of wild salmon parr in the lower reaches of the **Kymijoki** (Sub-division 32) has been in recent years rather high, about 60 parr/100m² in 2005 and 29 parr/100m² in 2006. In these rivers, salmon smolts are released annually, and

there is angling of salmon and sea trout. The potential and current salmon production in the Kymijoki has been re-examined (Table 3.3.2), and the results are described in more details under the Section 6.

Lately, plans have emerged for building up fish ladders and rebuilding migratory fish stocks in the large, former Finnish salmon rivers. Projects have been funded for studying in 2008 the preconditions for these activities in the rivers Kemijoki, Iijoki, Oulujoki and Kymijoki.

The goal of SAP (a production of at least half of the potential capacity) seems to be impossible to be reached in the Finnish potential rivers with the present efficiency of sea fishing.

Lithuania

Since 1998, artificially reared salmon juveniles are constantly being released into the following potential rivers: **Shventoji, Siesartis, Virinta, Vilnia, Voke, Dubysa, Baltic Shventoji and Minija**. Salmon juveniles are being released into rivers in spring (fry) and in autumn (0+ parr). In 2008 totally 3000 individuals of salmon smolts, 50 000 one-summer old parr and 15 000 fry were released into the rivers: **Neris, Šventoji** (Neris basin), **Dubysa, Jura** and **Minija**. The results of stocking were monitored by electrofishing showing that restocking efficiency varies in between years. Salmon juveniles stocking efficiency were relatively high, in **Neris** river 65.1%, **Vilnia** river 28.8% and **Šventoji** river 21.4%. Stocking strategy was the key to high efficiency as in spring time salmon of different ontogenetic stages (fry, parr, smolt) were released in salmonidae rivers. The survey indicates that in the larger rivers mortality of juveniles is higher. Data on releases of reared salmon are presented in Table 3.3.2.

Salmon density was higher in some larger tributaries of **Neris** and **Šventoji** River. Salmon parr were recorded at 13.3 parr/100 m² density in one stretch of **Šventoji**, average densities in this river were 4.9 (0+–4.8; >0+–0.1) parr/100 m². In **Siesartis, Širvinta** and **Vokė** tributaries salmon parr densities were estimated at 7.7 (0+–6.3, >0+–1.2), 6.35 and 4.1 parr/100 m² respectively. In other potential salmon rivers parr density was low (average 0–0.58 parr/100 m²) (Table 3.3.2).

Estonia

The rivers **Valgejõgi, Jägala** and **Vääna** were selected as potential rivers for Salmon Action Plan. Enhancement releases are carried out in river **Valgejõgi** and **Jägala**. In river **Vääna** recent stocking occurred in 2005 (10 000 one yr. old smolts), stocking was quit due to the high risk of returning adults straying in to the neighbouring river **Keila**, which is considered to be wild stock. In 2007 the totally 11 000 one year and 16 000 two years old salmon smolt were released. In 2008 releases consisted of 15 600 two-year old smolts.

In the River **Valgejõgi** salmon 0+ parr have occurred since 1999 (Table 3.3.2). There are 3 monitoring sites, but in 2007 0+ salmon parr were found only on the lowermost monitoring site at the density of 17.4 per/100 m². In 2008 high flow conditions disturbed fishing, however 0+ parr at low densities were found in all sites, average 0+ parr density was 4.9 parr/100²m.

In the River **Vääna** low numbers of wild salmon parr have been found only in 1998, 2000 and in 2002. Higher 0+ parr densities occurred in 2006 (13.9 parr/100²m) and in 2008 (9.5 parr/100²m) (Table 3.3.2).

In the River **Jägala** wild parr at low numbers was found in 1999, 2001, 2004, 2005 and 2007. In 2008 0+ parr abundance increased to 6.6 parr/100 m². On the river, **Linnamäe**

power plant (about 1.5 km from river mouth) was restored in 2002. Soft sediments were released from water reservoir and spawning area below the dam was covered by silt. Some spawning grounds after improvement recovered in 2003 and wild parr were found again in the next years (Table 3.3.2).

Poland

There are no officially stated potential rivers in Poland included in the former IBSFC Salmon Action Plan. However, restoration programme for salmon in Polish rivers started in 1994, based on Daugava salmon. This programme has been carried out in 7 rivers but till now there is no good evidence for successful re-establishment of self-sustaining salmon population (Table 3.3.1).

In 2008, spawners were observed in **Vistula** river system but there are no data on wild progeny. Totally 220 839 smolts and 593 450 fry and alevins were released into the river system (Sub-division 26).

Natural spawning was observed in the **Drawa** river (the Odra R. system) but numbers of salmon nests were lower than in previous years and not higher than 5. There is still no evidence of wild progeny resulting from this spawning. Total of 75 392 of smolts and 186 500 younger fish were released in the Odra river system (Sub-division 24).

No nests, assumed to be salmon nests, stated in **Wieprza** river. In almost all Pomeranian rivers, stocked with salmon, ascending and spent salmon were observed and caught by anglers but only in **Slupia** river wild parr were found. In 2008 totally 102 093 smolts and 100 000 alevins were released into Pomeranian rivers (Sub-division 25).

Russia

The River **Gladyshevka** has been selected as Potential River for the Russian Salmon Action Plan. The salmon stocking with hatchery reared (Narova origin) parr and smolts are going on in this river. About 3000 of one-year old salmon parr were released here in 2008. Wild parr have occurred in Gladyshevka in previous years: in 2004 salmon parr densities were on the level about 6 parr/100 m², in 2005–2006 about 10 parr/100 m². In 2007 one-summer old and two-summer old wild salmon parr were detected in rapids in Gladyshevka. The densities were on the level 2–12 parr/100 m² with the mean, about 7 parr/100 m² (Table 3.3.2).

In 2008 only one site was sampled by electrofishing, due to abnormal high waters. Two-summer old and three-summer old wild salmon parr were caught and the densities were 2 parr/100 m².

Sweden

In Sweden, five rivers are considered to be potential salmon rivers. Two of them, rivers **Kågeälven** and **Testeboån**, are selected nationally as potential rivers. The others, rivers **Moälven**, **Alsterån** and **Helgeån**, have restoration efforts on regional-local levels. Densities of salmon parr in rivers **Testeboån** and **Kågeälven** have improved but in recent two years the density decreased in Kågeälven. Restocking program ended in Testeboån in 2006 when the last fry were released and in Kågeälven stocking ended in 2004 (Table 3.3.2).

There is a trap for ascending fish in river **Testeboån**. High water levels in the autumn 2008 resulted in record high numbers of fish 31 salmon and 32 sea trout ascended the river. In **Kågeälven** on the other hand there is no trap for counting ascending spawn-

ers, but there is a successful angling in the river except for the latest years when only a few fish have been caught in the river.

The absence of 0+ parr in river **Testeboån** in 2008 was clearly the result of the very poor spawning run in 2007. It is obvious that in low flow years special actions such as artificial freshets are needed to maintain spawning runs in the river.

3.4 Reared salmon populations

The reared stocks in Sweden were severely affected by the M74-syndrome from the spring of 1992 onwards. As a result of the high level of M74 in the early 1990s, the Swedish compensatory releases of salmon smolts in 1995 were 60–70% of the normal, but already in 1996 the releases once again increased to the level prescribed in water court decisions. From 1996 and onwards to 2008 the releases have been kept on the intended level (Table 3.4.1).

The broodstock traps in three of the Swedish rivers having reared stocks are operated with equal intensity throughout the entire fishing season. This means that the catch in these traps can be considered as relative indexes of escapement. In these rivers (Umeälven, Ljusnan and Dalälven) the catches in the five-year period 1995–1999 were considerably above the long term average. This is to be expected because of the lower TAC and consequently a higher abundance of fish escaped from the sea to the rivers. The catches in 2000 in river Umeälven increased to the highest level since 1974. In 2001–2003 the catches decreased but in 2004 increased again almost to the level of year 2000 catches. In river Ljusnan the catches has been decreasing since 2001 and it was particularly low in 2003 when only eight salmon spawners were caught. The reason was uncertain but it is believed that seal predation may be a contributing factor to the low catch. In river Dalälven the catch in 2000 was about two times higher than the five-year-mean but decreased again in 2001 and has been since then at the average rates. In the river Skellefteälven the low numbers of salmon is at least partly due to inefficient function of both the catch gear in broodstock fishery and the fishladder in the weir in the lower part of the river. Catches in the coastal area and river mouth of this river indicate a similar abundance of salmon as in the other rivers.

In total, the catches of spawners of the populations in Swedish rivers discharging into Sub-division 30 and 31 decreased in 2004, but as discussed above the catch rates are often not a good indicator of the abundance of fish in the rivers. The prediction for 2009 indicates that the Swedish releases of salmon will be at the level of the water court decisions, approximately 1.8 million smolts.

In Finland, the production of smolts is based on broodstocks reared from eggs and kept in hatcheries. The number of spawners kept in the hatcheries is high enough to secure the whole smolt production. A renewal of the brood stocks has been regarded necessary, and are consequently partly enforced occasionally by broodstock fishing in order to avoid inbreeding. The annual smolt releases in Finland has been about 2 million salmon since all compensatory release programs were enforced in the early 1980s.

In Latvia the artificial reproduction is based on sea-run wild and hatchery origin salmon broodstock. The broodstock fishery is carried out in the coastal waters of the Gulf of Riga in October–November, as well in the rivers Daugava and Venta. The mortality of yolk sac fry has been low indicating that M74 is absent in this region. The annual smolt production in Latvian hatcheries has been about 0.85 million.

In Poland the last salmon population became extinct in the mid 1980s. A restoration programme was started in 1984 when eyed eggs of Daugava salmon were imported.

Import of eggs from Latvia went on until 1990. In 1988–1995 eggs for rearing purposes were collected from salmon broodstock kept in sea cages located in Puck Bay. Since then eggs has been collected from spawners caught in Polish rivers and from spawners reared in the Miastko hatchery. Spawners are caught mainly in the Wieprza river and in the mouth of Wisla river, but also from the rivers Drweca, Parseta, Rega and Slupia. They yearly produce 2.5 to 3.0 million eggs. Stocking material, smolt, one-year old parr and one-summer old parr are reared in 5 hatcheries. The total annual production of smolts has been about 0.35 million. In the two latest years (2007 and 2008) the smolt releases has increased to 0.4 million.

In Estonia a rearing programme using the Neva salmon stock was started in 1994. Eggs were collected from the reared Narva stock, mixed Selja stock and in late 1990s also imported from Finland. Captive stock from river Kunda was established in 2007. One hatchery is at present engaged in salmon rearing. The annual smolt production has been about 0.04 million two year old fish and about 0.1 million one year old fish.

In Denmark a rearing programme has been run in a hatchery in Bornholm. The river Mörrumsåns stock has been used. In 2004 a total of 13 100 salmon smolts were released in an experiment on artificial imprinting and establishment of a Terminal Fishery. In 2005 16 000 tagged salmon were released. No more releases have been planned.

According to tagging results the yield from the salmon smolt releases has decreased in all Baltic Sea countries during the last 15 years (Figures 2.9.2.1–2.9.2.4) Lower catches have been explained by decreased offshore fishing and strong regulations in coastal fishery. However, no substantial surplus of fish has been observed in the rivers where compensatory releases have been carried out. Decrease in catches is considered to be based on reduced survival of salmon in post smolt phase. The tag return rate from year-classes 1996 onwards has been substantially lower than rates on average in long-term. Return rates fluctuate in a same pace in the other countries, which indicates that long-term variation is partly caused by the variation in the Baltic Sea ecosystem. Wild smolt production has increased during the last five years and they contribute significantly to the catches. Catch samples from years 2003–2007 indicate that the proportion of reared salmon has been less than 50% in the most Baltic Sea fisheries (Tables 2.7.3 and 2.7.5). On the basis on the ratio in the smolt phase, the expected proportion was about 25%. When proportions are extrapolated to the total catches, the results suggest a significantly lowered initial survival for the reared smolts; also lower than the survival of the wild catch.

Releases

The total number of released smolts in assessment units 1–5 (Sub-divisions 22–31) was about 4.9 million and 0.8 million in assessment unit 6 (Sub-division 32) making a grand total of 5.6 million smolts in 2008 (Table 3.4.1).

Releases of younger life stages are presented in the Table 3.4.2. These releases have consisted in many areas of hatchery surplus and releases have been carried out at poor rearing habitats. In such cases mortality among parr is high and releases gain only to small amounts of smolts. Instead when releases have taken place at the potential or wild salmon rivers with good rearing habitats they have had a true contribution to a smolt production. The magnitude of these releases has been decreasing in the last few years in the most of the assessment units. Roughly estimated these releases will produce less 0.1 million smolts in the next few years. The data available to the Group, however, were not distinguishable between river and release categories

and therefore the exact smolt estimates coming from the releases of younger stages were not computed.

3.5 M74

The proportion of females whose offspring suffered from M74 in 2008 in the Gulf of Bothnia rivers was in most cases below 20%, i.e., somewhat lower than in the years 2006 and 2007 but, however, higher than in the years 2003–2005 (Table 3.5.1). On the basis of prognostic hatching in Swedish hatcheries the level in the spring 2009 is estimated to be in the range of 20%.

The M74 frequency in Table 3.5.1 has predominantly been given as the percentage of females whose offspring were affected by M74. In the Rivers Simojoki and Tornionjoki as well as in the River Kymijoki (Sub-division 32), the estimates of the mortality since the years 1992, 1994 and 1995, respectively, and in the River Kemijoki, have been made in Finland using both the proportion of females affected and the mean percentage yolk-sac fry mortality (Table 3.5.2). In Finnish estimates annual M74 figures are based on the laboratory incubations, in which M74 symptom-related mortality is ascertained, and are presented as three numbers: (1) the average yolk-sac fry mortality, (2) the proportion of females with offspring affected by M74 and (3) the proportion of those females whose all offspring have died (Keinänen *et al.*, 2000; 2008). Usually, the M74 frequency has been higher than the offspring M74 mortality, especially that is the case in years when many offspring groups with mild M74 occur, i.e., so that only a part of yolk-sac fry die. The mean annual yolk-sac fry mortalities and proportions of M74 females correlate significantly. However, in the years when the M74 syndrome is moderate in most offspring groups, the difference between the proportion of M74 females and mean yolk-sac fry mortality can exceed 20 percentage units (Keinänen *et al.*, 2008). Details regarding the number of offspring groups for the different rivers can be found in the Finnish National Report, Working paper No 6. Swedish data are based only on the proportion of the number of females whose offspring suffer from M74 (Table 3.5.3).

The M74 syndrome resulted in a high mortality of salmon yolk-sac fry with over 50% of M74 frequency (i.e. the proportion of the females whose offspring were affected by M74) in most Swedish and Finnish rivers in hatching years 1992–1996 (Table 3.5.1). Since 1997 the M74 frequency, as a mean of monitored populations, has been in most cases below 40% and in recent years lower than that. There was earlier a tendency that the estimate of M74-mortality was higher in Finland than in Sweden but this difference seems to have disappeared in the years when the M74 mortality has been low (Figure 3.5.1). The difference may be due to the fact that in Finland all females caught for M74 monitoring have been included in it but in Sweden females that have displayed uncoordinated swimming have been excluded from incubation. Such wiggling females are inevitably known to produce offspring that would all die of M74. The proportion of wiggling females has been high in the early and middle of the 1990s (Fiskhälsan, 2007). Nonetheless, the annual variation is very similar in the average data from Swedish and Finnish rivers but there appear to be considerable variation between rivers.

Apart from the observations in the hatcheries and experimental incubations, effects of the syndrome was also observed as decreased parr densities in some of the wild salmon populations in 1992–94 and also in the years 1995 and 1996 despite a high number of spawners (Karlström, 1999; Romakkaniemi *et al.*, 2003). In the Swedish river Ume/Vindelälven in the Gulf of Bothnia an estimate of the egg deposition is available together with an estimate of the parr densities derived from these brood-year-classes. It shows that the densities of 0+ parr were low in years 1993–1995 when

the incidence of M74 was high, while parr densities were better correlated to the egg deposition in years when the incidence of M74 was low (1986–1991 and 1996–2004).

The estimates of M74 have normally been lower in areas outside of the Gulf of Bothnia. In Estonia M74 has been observed in hatcheries in some years during the period 1997–2006, but the mortality has not exceeded 15%. There is no evidence to suggest that M74 occur in Latvian salmon populations. In the Latvian main hatchery Tome, the mortality from hatching until feeding starts varied in the range 2–10% in the years 1993–1999. Parr densities in the Latvian river Salaca have not decreased during the period in the 1990s when salmon reproduction in the Gulf of Bothnia was negatively influenced by M74 (Table 3.2.5.1).

In the River Kymijoki in Gulf of Finland the incidence of M74 has in many years been lower than in the Rivers Simojoki and Tornionjoki (Table 3.5.1 and Keinänen, 2008) but this may be due primarily to that fish from the Gulf of Finland suffer from this syndrome to a lower degree than populations from the Gulf of Bothnia.

The egg thiamine (vitamine B1) concentration is low in eggs that produce yolk-sac fry suffering from the M74 syndrome (Lundström *et al.*, 1999; Vuorinen and Keinänen, 1999). The thiamine concentration was at quite a high level in eggs especially in hatching years 2003–2004, when no total mortalities among offspring of any female were observed but have decreased since then (Vuorinen *et al.*, unpublished data).

It seems highly likely that M74 is linked to the diet of salmon in the Baltic and changes in the ecosystem (Ikonen, 2006). The incidence of M74 is statistically well correlated with parameters describing the sprat stock (Karlsson *et al.*, 1999). The occurrence of M74 has been linked to low levels of thiamine, and yolk-sac fry suffering from M74 can be restored in hatchery to a healthy condition by treatment with thiamine (Koski *et al.*, 1999). The thiamine content in both herring and sprat that were of the size (13.5–15.9 cm) preferred by salmon as prey, appeared to be above the nutritional guidelines as regards the growth of salmon, but was nonetheless lower in sprat than in herring (Vuorinen *et al.*, 2002). The concentrations of dioxins and PCBs were higher in sprat (2–10 years old) than in herring (1–3 years old) and in particular contents of polychlorinated dibenzofurans and coplanar biphenyls were high in all age groups of sprat. The concentrations of the same organochlorines in salmon spawners ascending the River Simojoki increased coincidentally with the outbreak of the M74 syndrome indicating that sprat might have been the principal source of organochlorines for salmon (Vuorinen *et al.*, 2002).

In Section 5.3.6, a Bayesian hierarchical model is applied to the Gulf of Bothnian (GoB) monitoring data (Tables 3.5.2 and 3.5.3) of M74 occurrence from Finland and Sweden to obtain annual estimates of the M74-derived yolk-sac fry mortality. This information is needed to fully assess the effects of M74 on the reproductive success of spawners. Besides annual estimates of the M74-mortality in the rivers, where mortality has been recorded, the model provides annual estimates of the mortality for any GoB river, in which no monitoring has been carried out (Table 5.3.6.1, Figure 5.3.6.1). Most of the wild stocks and all small stocks in the GoB belong to this group. The results demonstrate the substantial uncertainty in our knowledge about the M74 mortality in unmonitored stocks, but also that in the last few years the actual M74 mortality among offspring has been lower than the proportion of M74-females indicated, which apparently is related (see above) to mildness of the syndrome, i.e. to partial mortalities of offspring groups.

3.6 Summary of the information on wild and potential salmon rivers

Wild smolt production versus the smolt production capacity is one of the ultimate measures of management success. Of the rivers with wild populations flowing into the Gulf of Bothnia and the Main Basin (assessment units 1–5), wild smolt abundance is however measured directly only in the index rivers **Simojoki** and **Tornionjoki/Torneälven** (au 1), **Sävarån** (au 2) and in the Latvian river **Salaca** (au 5) (Table 5.3.2.1). The smolt abundance model (Section 5.3.5), which utilises all available juvenile abundance data, is a rigorous tool for formal assessment of current smolt production.

Differences in the status of the wild stocks have become more apparent in recent years than before, not only in terms of the smolt production target, but also in terms of the trends in various indices of abundance. This applies especially on regional basis: most Gulf of Bothnia (au 1–3) rivers have shown increase in abundance while, many of the Main Basin (au 4–5) rivers have shown either decreasing or steady abundance.

Regarding potential salmon rivers, apparent increase in wild reproduction has been documented in at least one of the rivers in Gulf of Bothnia, but most of the potential rivers show only low and irregular wild reproduction in spite of even massive stocking programmes and other rebuilding efforts. Several problems in various phases of salmon's life cycle may adversely affect restoration measures, but their relative importance is difficult to assess. A more thorough analysis, e.g., comparing more and less successful cases of restoration is needed. The rivers Kågeälven and Gladyshevka show positive development in increasing densities of parr indicating of natural spawning.

Rivers in the Gulf of Bothnia (assessment units 1–3)

The parr production in the hatching years of 1992–1996 was as low as in the 1980s (Tables 3.2.1.4, 3.2.2.1 and 3.2.3.1, and Figures 3.2.1.4, 3.2.1.5, 3.2.2.1, 3.2.2.2 and 3.2.3.1), although the spawning runs were apparently larger (Tables 3.2.1.1, 3.2.1.2, and Figures 3.2.1.2, 3.2.1.3). In those years the M74 syndrome caused a high mortality (Table 3.5.1 and Figure 3.5.1), which decreased parr production considerably. In the hatching years 1997–1999, parr densities increased to higher levels, or about five to ten times higher than in the earlier years and in fact the highest levels ever recorded in some rivers. These strong parr year classes resulted from large spawning runs in 1996–1997 and a simultaneous decrease in the general level of M74. The large parr year-classes hatching in 1997–1998 resulted in higher smolt runs in 2000 and 2001 (Table 3.2.1.5). In spite of some reduction on the general level of parr production during the years 1999–2002, parr densities and subsequent smolt runs stayed on elevated level compared to the situation prevailing before the late 1990s. In 2003, densities of one-summer old parr increased in some rivers back to the peak level observed around 1998, while no similar increase was observed in other rivers. From 2004–2006, densities of one-summer old parr show a yearly increase in most of the rivers but in 2007 the densities of one summer old parr decreased. In all rivers except two the densities of one summer old parr increased again in 2008, densities being at least two times higher than in 2007.

Catch statistics and fish ladder counts indicate some differences in the development of the number of spawning migrants among rivers since the late 1990s. There has been large variation in the indices of wild reproduction of salmon both between and within the rivers. Differences in the indices of abundance might be partly connected to extreme summer conditions in the rivers, e.g. in 2002–2003 and 2006, which might

have affected river catches and the fish migration in some ladders. Counted number in 2007 of salmon in ladders increased with about 50% overall compared to 2006. The further increase in fish ladder counts in 2008 is in coherence with the increased river catches; the catches in some rivers more than doubled compared to 2007 and were almost as high as in the highest recorded years 1996 and 1997.

Most data from the Gulf of Bothnia rivers indicate an increasing trend in the juvenile production. The rivers in the assessment unit 1 have been showing the most positive development, while stocks in the small rivers of the assessment units 2 and 3 are showing the worst development. These small rivers are located on the Swedish coast close to the Quark area (northern Bothnian Sea, southern Bothnian Bay). The recent overall low level in M74 mortality has probably supported the positive trend in the juvenile production. Preliminary data for 2009 show a slight increase in M74 mortality stays on the same level of magnitude as in two previous years (Table 3.5.1).

Rivers in the Main Basin (assessment units 4–5)

The status of the Swedish salmon populations in the rivers **Mörrumsån** and **Emån** in the Main Basin differs, but they both show similar trends in time (Table 3.2.4.1 and Figures 3.2.4.1 and 3.2.4.2). The outbreak of M74 mortality in early 1990s might have decreased smolt production in mid-1990s, after reaching the historical highest densities parr densities in the turn of the 1980s and 1990s. The juvenile production was estimated to slightly increase till the turn of the century. However, parr and smolt production has turned to decrease in both rivers. In the river **Emån** the smolt production has been long below the required level which is highly likely dependent on insufficient numbers of spawners entering a fish ladder to reproduction area above the ladder.

Among the rivers of the assessment unit 5, the **Pärnu** river exhibit the most precarious state of the wild population: no parr at all were found in the river in 2003–2004, in 2005–2006 the densities increased slightly, but in 2007 and 2008 again no parr were found (Table 3.2.5.1, Figure 3.2.5.1). Since 1997, parr densities in the river **Salaca** in Latvia have been high (Table 3.2.5.1, Figure 3.2.5.2). There has been remarkable variation in the annual parr densities, as well as between different rivers. In the river **Salaca** wild salmon parr production stays at the high level of about 100 parr/100 m². In the river **Gauja** parr production level has been decreasing since 2004–2005. It seems that in some of the small salmon rivers **Barta**, **Saka**, **Peterupe**, **Vitrupe** salmon reproduction occurs only occasionally.

Although only a short time series of parr and smolt abundance is available from Lithuanian rivers, the latest monitoring results indicate somewhat similar variation in juvenile production as the Latvian stocks (Table 3.2.5.2). The observed parr densities are very low in relation to the observed parr densities in most other Baltic rivers. This illustrates the poor state of several wild salmon stocks in the assessment unit 5. These stocks might be in a higher risk of extinction than any of the stocks in the assessment units 1–3 (Gulf of Bothnia). In Lithuania measures has carried out to since 1998 to increase salmon population. Implementation of measures has stabilized salmon population in Lithuanian rivers and the salmon production is increasing very slowly. Pollution also affects the salmon rivers. Another important factor in Lithuanian rivers, which are lowland type, is a lack of suitable habitat for salmon parr.

Besides regulation of fisheries, many of the salmon rivers of the Main Basin may need different kinds of restoration and enhancement measures, which aim at stabilizing and improving natural reproduction possibilities. For instance, in the **Pärnu** river cleaning of spawning grounds from extra vegetation and silt was carried out in 2004.

In the rivers **Mörrumsån** and **Rickleån** opening of new fish ladders in 2002 and 2004, respectively, has increased the reproduction area accessible to salmon.

Table 3.2.1.1 Salmon catches (in kilos) in four rivers of the sub-division 31, and the catch per unit effort (CPUE) of the Finnish salmon rod fishing in the river Tomionjoki/Tomeälven.

	Simojoki	Kalixälven	Byskeälven	Tomionjoki/ Tomeälven (au 1)			CPUE grams/day
	(au1) catch, kilo	(au1) catch, kilo	(au2) catch, kilo	Finnish catch, kilo	Swedish catch, kilo	Total catch, kilo	
1970	1330						
1971							
1972	700						
1973							
1974				7950			
1975				3750			
1976				3300			
1977				4800			
1978				4050			
1979	400			5850			
1980				11250	7500	18750	
1981	200	4175	531	3630	2500	6130	
1982		1710	575	2900	1600	4500	
1983	50	3753	390	4400	4300	8700	9
1984	100	2583	687	3700	5000	8700	8
1985		3775	637	1500	4000	5500	14
1986	200	2608	251	2100	3000	5100	65
1987		2155	415	2000	2200	4200	33
1988		3033	267	1800	2200	4000	42
1989		4153	546	6200	3700	9900	65
1990	50	9460	2370	8800	8800	17600	113
1991		5710	1857	12500	4900	17400	106
1992		7198	1003	20100	6500	26600	117
1993		7423	2420	12400	5400	17800	100
1994 ¹⁾	400	0	109	9000	5200	14200	97
1995	1300	3555	1107	6100	2900	9000	115
1996	2600	8712	4788	39800	12800	57600 ⁴⁾	561 ^{2)/736³⁾}
1997	3900	10162	3045	64000	10300	74300	1094
1998	2800	5750	1784	39000	10500	49500	508
1999	1850	4610	720	16200	7760	27760	350
2000	1730	5008	1200	24740	7285	32025	485
2001	2700	6738	1505	21280	5795	27075	327
2002	700	10478	892	15040	4738	19778	300
2003	1000	5600	816	11520	3427	14947	320
2004	560	5480	1656	19730	4090	23820	520
2005	830	8727	2700	25560	12840	38400	541
2006	179	3187	555	11640	4336	15976	311
2007	424	5728	877	22010	13013	35023	553
2008	952	9585	2126	56950	18036	74986	1215

1) Ban of salmon fishing 1994 in Kalixälven and Byskeälven and the Swedish tributaries of Tomeälven.

2) Calculated on the basis of a fishing questionnaire similar to years before 1996.

3) Calculated on the basis of a new kind of fishing questionnaire, which is addressed to fishermen, who have bought a salmon rod fishing license.

4) 5 tonnes of illegal/unreported catch has included in total estimate.

Table 3.2.1.2 Numbers of wild salmon in fish ladders in the rivers of the assessment units 1 and 2 (sub-divisions 30-31, Gulf of Bothnia).

Year	Number of salmon												
	Kalixälven (au 1)		Piteälven (au 2)			Åbyälven (au 2)		Byskeälven (au 2)		Ume/Vindelälven (au 2)			Öreälven (au 2)
	MSW fish	Total	MSW fish	Females	Total	MSW fish	Total	MSW fish	Total	MSW fish	Females	Total	Total
1973					45								
1974					15						716	1583	
1975											193	610	
1976											319	808	
1977											456	1221	
1978											700	1634	
1979											643	2119	11
1980	62	80								842	449	1254	1
1981	79	161								293	196	638	8
1982	11	45								216	139	424	3
1983	132	890								199	141	401	7
1984	no control									222	177	443	14
1985	no control				30					569	330	904	10
1986	no control				28					175	128	227	2
1987	no control				18					193	87	246	13
1988	no control				28					367	256	446	23
1989	no control				19					296	191	597	13
1990	139	639			130					767	491	1572	65
1991	122	437			59					228	189	356	51
1992	288	656	57	52	115					317	258	354	63
1993	158	567	14	14	27				227	921	573	1663	54
1994	144	806	14	18	30				258	984	719	1309	39
1995	736	1282	23	17	66			157	786	619	249	1164	18
1996	2736	3781	89	66	146	1	1	2421	2691	1743	1271	1939	24
1997	5184	5961	614	324	658	38	39	1025	1386	1602	1064	1780	51
1998	1525	2459	147	34	338	12	15	707	786	447	233	1154	30
1999	1515	2013	185	116	220	10	14	447	721	1614	802	2208	52
2000	1398	2459	204	119	534	11	36	908	1157	946	601	3367	
2001	4239	8890	668		863	44	112	1435	2085	1373	951	5476	
2002	6190	8479	1243		1378	52	95	1079	1316	3182	2123	6052	
2003	3792	4607	1305		1418	15	21	706	1086	1914	1136	2337	
2004	3206	3891	1269		1628	25	51	1331	1707	1717	663	3292	
2005	4450	6561	897		1012	19	94	900	1285	2464	1480	3537	
2006	2125	3163	496		544	22	32	528	665	1733	1093	2362	
2007	4295	6489	450		518	66	109	1208	2098	2636	1304	4023	
2008	6165	6838	471		723	163	210	2714	3409	3217	2167	5157	

Kalixälven: Fishcounting in the fishladder is a part of the run. No control during 1984 - 1989.

Piteälven: New fishladder built 1992. Fishcounting in the ladder is the entire run.

Åbyälven: New fishladder built in 1995. Fishcounting in the ladder is the entire run above the fishladder but only part of the total run.

Byskeälven: New fishladder built 2000. Fishcounting in the the fishladders is part of the run.

Umeälven/Vindelälven: Fishcounting in the fishladder is the entire run.

Öreälven: Fishcounting in the trap is part of the run. The trap was destroyed by high water levels in 2000.

Table 3.2.1.3 The age and sex composition of ascending salmon caught by the Finnish river fishery in the River Tornionjoki since the mid-1970s.

	Year(s)											
	1974-85	1986-90	1991-95	1996-2000	2001	2002	2003	2004	2005	2006	2007	2008
N:o of samples	728	283	734	2114	505	355	244	438	628	210	349	733
A1 (Grilse)	9%	53%	35%	7%	33%	21%	18%	21%	8%	6%	12%	8%
A2	60%	31%	38%	59%	51%	64%	34%	48%	49%	45%	34%	77%
A3	29%	13%	24%	28%	12%	13%	40%	25%	38%	40%	45%	10%
A4	2%	2%	3%	4%	2%	1%	7%	4%	2%	6%	7%	3%
>A4	0%	1%	<1 %	2%	2%	2%	2%	2%	2%	3%	2%	2%
Females, proportion of biomass	About 45 %	49%	75%	71%	64%	67%	77%	64%	62%	63%	70%	67%
Proportion of reared origin	7%	46 %*	18%	15%	21%	7%	9%	3%	3%	1%	2%	0,5%

* An unusually large part of these salmon were not fin-clipped but analysed as reared on the basis of scales (probably strayers). A bulk of these was caught in 1989 as grilse.

Table 3.2.1.4 Densities and occurrence of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 1 (sub-division 31).

River year	Number of parr/100 m2 by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Simojoki							
1982	4.31			1.65	50%	14	No age data of older parr available
1983	0.83			2.86	57%	14	No age data of older parr available
1984	0.59			2.73	44%	16	No age data of older parr available
1985	0.11			1.08	8%	16	No age data of older parr available
1986	0.21			0.58	19%	16	No age data of older parr available
1987	0.82			0.81	27%	22	No age data of older parr available
1988	2.23	2.55	0.27	2.82	36%	22	
1989	2.57	1.27	0.38	1.65	41%	22	
1990	1.90	1.93	0.62	2.55	36%	25	
1991	4.05	1.92	0.71	2.63	32%	28	
1992						0	No sampling because of flood.
1993	0.09	0.38	0.95	1.33	19%	27	
1994	0.43	0.53	0.58	1.11	16%	32	
1995	0.73	0.35	0.14	0.49	31%	29	
1996	2.31			0.76	28%	29	No age data of older parr available
1997	12.12	1.53	0.32	1.85	72%	29	
1998	11.32	3.83	0.51	4.34	100%	17	Flood; only a part of sites were fished.
1999	23.11	11.5	2.66	14.16	93%	28	
2000	17.36	13.4	3.25	16.65	93%	27	
2001	9.74	7.9	3.58	11.48	72%	29	
2002	16.07	9.1	3.59	12.69	80%	30	
2003	21.89	5.85	1.56	7.41	90%	29	
2004	14.02	8.39	1.41	9.80	78%	18	Flood; only a part of sites were fished.
2005	20.35	8.22	2.08	10.30	82%	23	Flood; only a part of sites were fished.
2006	39.30	13.69	6.78	20.47	87%	31	
2007	4.95	2.88	1.34	4.22	43%	30	
2008	19.82	3.56	1.56	5.12	84%	31	
Tornionjoki							
1986	0.52	0.89	0.23	1.12		30	
1987	0.38	0.31	0.48	0.79		26	
1988	0.73	0.60	0.46	1.06	46%	44	
1989	0.58	0.68	0.64	1.32	47%	32	
1990	0.52	0.82	0.36	1.18	40%	68	
1991	2.35	0.63	0.48	1.12	69%	70	
1992	0.24	1.80	0.36	2.16	16%	37	Flood; only a part of sites were fished.
1993	0.52	0.44	2.49	2.94	44%	64	
1994	1.02	0.49	1.35	1.84	43%	92	
1995	0.49	1.45	0.65	2.10	48%	72	
1996	0.89	0.33	0.82	1.15	39%	73	
1997	8.05	1.35	0.74	2.09	78%	100	
1998	12.95	4.43	0.53	4.96	92%	84	
1999	8.37	8.83	4.23	13.06	85%	98	
2000	5.90	4.70	6.81	11.51	83%	100	
2001	5.91	3.13	3.82	6.94	78%	101	
2002	7.23	6.03	3.92	9.94	78%	101	
2003	16.09	4.19	2.93	7.12	81%	100	
2004	5.81	4.99	1.27	6.25	80%	60	Flood; only a part of sites were fished.
2005	8.57	2.86	4.28	7.15	81%	87	
2006	13.31	10.57	5.44	16.01	83%	80	
2007	10.24	8.61	5.60	14.21	75%	81	
2008	26.16	10.66	8.70	19.36	94%	81	

table continues on next page

Table 3.2.1.4 continues...

River year	Number of parr/100 m ² by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Kalixälven							
1986	0.55	1.59	4.10	5.69	50%	6	
1987	0.40	1.11	1.64	2.75	33%	9	
1988	0.00	0.87	2.08	2.95	0%	1	
1989	2.82	0.99	1.86	2.85	75%	24	
1990	4.96	5.67	2.1	7.77	91%	11	
1991	6.19	1.37	1.09	2.46	79%	19	
1992	1.08	3.54	1.87	5.41	54%	11	Flood; only a part of sites were fished.
1993	0.59	0.66	3.05	3.69	42%	19	
1994	2.84	1.16	3.08	4.24	69%	26	
1995	1.10	3.16	0.94	4.10	67%	27	
1996	2.16	0.77	1.15	1.92	71%	28	
1997	10.16	2.98	1	3.98	86%	28	
1998	31.62	9.81	2.6	12.41	78%	9	Flood; only a part of sites were fished.
1999	4.41	7.66	6.36	14.02	87%	30	
2000	10.76	4.99	8.31	13.30	93%	29	
2001	5.60	5.48	6.3	11.78	79%	14	
2002	6.21	6.22	3.77	9.99	93%	30	
2003	46.94	12.51	5.2	17.71	87%	30	
2004	13.58	14.65	3.25	17.90	88%	24	
2005	15.34	5.53	8.63	14.16	87%	30	
2006	15.96	19.33	8.32	27.65	90%	30	
2007	11.63	7.65	6.53	14.18	80%	30	
2008	25.74	15.91	8.40	24.31	97%	30	
Råneälven							
1993	0.00	0.08	0.83	0.91	0%	9	
1994	0.17	0	0.27	0.27	22%	9	
1995	0.06	0.13	0.21	0.34	18%	11	
1996	0.52	0.38	0.33	0.71	25%	12	
1997	3.38	1.00	1.14	2.14	90%	10	
1998	2.22	0.35	0.35	0.70	100%	1	Flood; only a part of sites were fished.
1999	1.05	2.22	1.66	3.88	50%	12	
2000	0.98	1.67	1.99	3.66	69%	13	
2001	0.23	0.53	2.39	2.92	40%	10	
2002	1.65	0.92	1.32	2.24	43%	14	
2003	4.71	3.34	1.11	4.45	57%	14	
2004						0	No sampling because of flood.
2005	2.83	1.14	2.10	3.24	64%	14	
2006	6.75	4.06	5.12	9.18	50%	14	
2007	2.74	2.36	2.83	5.19	57%	14	
2008	6.25	1.83	3.64	5.47	64%	14	

Table 3.2.1.5 Estimated number of smolt by smolt trapping in the rivers Simojoki and Tornionjoki (assessment unit 1) and Sävarån (assessment unit 2). The coefficient of variation (CV) of the trapping estimates has been derived from the mark-recapture model (Mäntyniemi and Romakkaniemi 2002) for the last years of the time series. The ratio of smolts stocked as parr/wild smolts in trap catch is available in some years even though total run estimate can not be provided (e.g., in the cases of too low trap catches). The number of stocked smolts is based on stocking statistics.

	Tornionjoki (AU 1)				Simojoki (AU 1)				Sävarån (AU 2)	
	Smolt trapping, original estimate	CV of estimate	Ratio of smolts stocked as parr/wild smolts in catch	Number of stocked reared smolts (point estimate)	Smolt trapping, original estimate	CV of estimate	Ratio of smolts stocked as parr/wild smolts in catch	Number of stocked reared smolts (point estimate)	Smolt trapping, original estimate	CV of estimate
1977					29,000					
1978					67,000					
1979					12,000					
1980					14,000					
1981					15,000					
1982										
1983										
1984					19,000					
1985					13,000					
1986					2,200					
1987	50,000 *)		1.11	32,129	1,800		1.78	14,800		
1988	66,000		0.37	11,300	1,500		3.73	14,700		
1989			1.22	1,829	12,000		0.66	52,841		
1990	63,000		0.20	85,545	12,000		1.41	26,100		
1991	87,000		0.54	40,344	7,000		1.69	60,916		
1992			0.47	15,000	17,000		0.86	4,389		
1993	123,000		0.27	29,342	9,000		1.22	5,087		
1994	199,000		0.16	17,317	12,400		1.09	14,862		
1995			0.38	61,986	1,400		7.79	68,580		
1996	71,000		0.60	39,858	1,300		28.5	140,153		
1997	50,000 **)			20,004	2,450		6.95	144,939		
1998	144,000		0.57	60,033	9,400		2.28	75,942		
1999	175,000	17%	0.67	60,771	8,960		0.75	66,815		
2000	500,000	39%	0.17	60,339	57,300		0.48	50,100		
2001	625,000	33%	0.09	4,000	47,300		0.15	49,111		
2002	550,000	12%	0.08	3,998	53,700		0.29	51,300		
2003	750,000	43%	0.06	4,032	63,700		0.26	18,912		
2004	900,000	33%	0.02	4,000	29,100		0.30	1,900		
2005	660,000	25%	0.00	4,000	17,500	28%	0.10	4,800	3,800	15%
2006	1,250,000	35%	0.00	3,814	29,400	35%	0.11	809	3,000	12%
2007	610,000	48%	0.00	8,458	23,200	20%	0.01	8,000	3,100	18%
2008	1,490,000	37%	0.00	6,442	42,800	29%	0.00	4,000	4,570	18%

*) trap was not in use the whole period; value has been adjusted according to assumed proportion of run outside trapping period

**) Most of the reared parr released in 1995 were non-adipose fin clipped and they left the river mainly in 1997. Because the wild and reared production has been distinguished on the basis of adipose fin, the wild production in 1997 is overestimated. This was considered when the production number used by WG was estimated.

Table 3.2.2.1 Densities and occurrence of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 2 (sub-divisions 30-31). Detailed information on the age structure of older parr (>0+) is available only from the Åbyälven and Byskeälven.

River year	Number of parr/100 m2 by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Piteälven							
1990	0			0		1	
1991							No sampling
1992							No sampling
1993	0			0		1	
1994	0			0		4	
1995							No sampling
1996							No sampling
1997	0.31			0.2		2	
1998							No sampling because of flood.
1999							No sampling
2000							No sampling
2001							No sampling
2002	5.37			1.24		5	
2003							No sampling
2004							No sampling
2005							No sampling
2006	3.92	1.39	0.30	1.69	71%	7	
2007	0.00	2.08	0.42	2.50	0%	5	
2008	5.06	0.81	1.04	2.50	100%	6	
Åbyälven							
1986	1.11	1.15	0.00	1.15	100%	2	
1987	1.69	0.75	0.79	1.54	100%	4	
1988	0.28	0.11	0.69	0.80	67%	3	
1989	2.62	0.17	2.26	2.43	100%	4	
1990	0.9	2.13	0.25	2.38	50%	4	
1991	5.36	0	4.47	4.47	100%	2	
1992	2.96	3.65	0.17	3.82	100%	1	
1993	1.01	0.56	4.62	5.18	75%	4	
1994	1.53	0.67	1.95	2.62	67%	6	
1995	3.88	1.53	1.42	2.95	86%	7	
1996	3.77	3.89	1.10	4.99	71%	7	
1997	3.09	1.99	3.06	5.05	67%	7	
1998						0	No sampling because of flood.
1999	16.51	6.57	1.74	8.31	71%	7	
2000	5.85	4.43	3.62	8.05	71%	10	
2001	6.31	1.58	3.76	5.34	100%	4	
2002	8.16	1.63	2.10	3.73	100%	10	
2003	2.93	3.73	0.83	4.56	80%	10	
2004	5.40	0.49	0.83	1.32	70%	10	
2005	6.36	1.40	0.62	2.02	90%	10	
2006	27.18	10.37	2.77	13.14	90%	10	
2007	5.26	6.30	4.76	11.06	80%	10	
2008	12.48	2.19	3.95	6.14	80%	10	

table continues on next page

Table 3.2.2.1 continues...

River year	Number of parr/100 m2 by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Byskeälven							
1986	0.10	0.85	0.54	1.39	29%	7	
1987							No sampling
1988							No sampling
1989	2.39	0.48	1.15	1.63	75%	8	
1990	1.45	1.14	0.39	1.53	80%	5	
1991	5.14	1.25	0.83	2.08	73%	11	
1992	1.46	5.85	2.65	8.50	50%	10	
1993	0.43	0.21	1.35	1.56	57%	7	
1994	2.76	0.97	2.5	3.47	80%	10	
1995	3.42	2.15	1.42	3.57	91%	11	
1996	8.64	2.53	1.26	3.79	83%	12	
1997	10.68	4.98	1.18	6.16	100%	12	
1998						0	No sampling because of flood.
1999	16.28	7.45	4.55	12.00	100%	15	
2000	8.72	8.38	3.72	12.10	100%	12	
2001						0	No sampling because of flood.
2002	15.84	4.3	2.25	6.55	93%	14	
2003	33.83	4.89	1.7	6.59	93%	15	
2004	12.32	6.83	2.33	9.16	93%	15	
2005	26.18	8.78	7.02	15.80	100%	15	
2006	13.20	14.39	4.01	18.40	87%	15	
2007	6.76	5.49	6.09	11.58	93%	15	
2008	20.49	6.80	5.61	12,23	93%	15	
Rickleån							
1988	0.00			0.23	0%	2	
1989	0.34			0	33%	6	
1990	0.69			0.24	29%	7	
1991	0.30			0.09	29%	7	
1992	0.22			0.05	43%	7	
1993	1.63			0.18	50%	8	
1994	0.63			1.18	38%	8	
1995	0.64			0.23	50%	8	
1996	0.00			0.10	0%	7	
1997	0.17			0.90	29%	7	
1998	2.56			0.99	86%	7	
1999	2.32			0.49	86%	7	
2000	3.41			4.04	100%	7	
2001						0	No sampling because of flood.
2002	2.42			2.58	43%	7	
2003	1.05			0.39	43%	7	
2004	1.13			3.24	43%	7	
2005	4.88			0.34	43%	7	
2006	3.88			5.70	86%	7	
2007	0.00			0.19	0%	7	
2008	4.16			2.16	43%	7	

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Table 3.2.2.1 continues...

River year	Number of parr/100 m ² by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Sävarån							
1989	0.60			0.90	25%	4	
1990	1.50			3.10	56%	9	
1991	0.70			4.50	29%	7	
1992	0.20			3.00	43%	7	
1993	1.80			1.90	29%	7	
1994	1.50			2.90	33%	6	
1995	0.40			1.00	33%	9	
1996	10.30			2.50	44%	9	
1997	0.40			3.50	33%	9	
1998	2.70			2.70	63%	8	
1999	0.80			5.00	44%	9	
2000	12.80			7.40	100%	4	
2001						0	No sampling because of flood.
2002	4.60			5.20	63%	8	
2003	2,30			4.40	56%	9	
2004						0	No sampling because of flood.
2005	3.30			3.80	56%	9	
2006	12.49			16.89	67%	9	
2007	4.70			9.20	67%	9	
2008	7.30			8.10	78%	9	
Ume/Vindelälven							
1989	1.57			1.97	67%	3	
1990	0.57			2.91	50%	12	
1991	2.28			1.11	50%	6	
1992							
1993	0.29			0.99	33%	6	
1994	0.51			1.10	24%	25	
1995	0.39			0.23	37%	19	
1996	0.30			0.95	14%	21	
1997	17.23			1.82	79%	19	
1998	21.59			11.12	100%	6	Flood; only a part of sites were fished.
1999	3.29			16.88	28%	18	
2000	4.53			3.99	75%	12	
2001	3.54			8.10	72%	18	
2002	21.95			18.21	89%	18	
2003	24.00			3.84	89%	18	
2004	12.09			10.36	83%	18	
2005	3.71			4.32	79%	19	
2006	16.44			9.52	63%	19	
2007	15.30			8.43	79%	19	
2008	8.46			5.55	79%	19	
Öreälven							
1989	0			0.01	0%	14	
1990	0			0.00	0%	8	
1991	0			0.25	0%	8	
1992	0			0.25	0%	6	
1993	0			0.03	0%	13	
1994	0			0.00	0%	8	
1995	0.21			0.04	30%	10	
1996	0.44			0.00	30%	10	
1997	0.23			0.70	50%	10	
1998	1.02			0.34	75%	8	
1999	0.44			0.47	40%	10	
2000	0.60			0.80	67%	9	
2001						0	No sampling because of flood.
2002	6.73			1.35	60%	10	
2003	3.39			2.62	60%	10	
2004	2.12			0.16	56%	9	
2005	8.02			1.41	44%	9	
2006	5.91			4.84	60%	10	
2007	1.36			0.39	30%	10	
2008	1.16			1.09	40%	10	

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Table 3.2.2.1 continues...

River year	Number of parr/100 m2 by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+ (sum of two previous columns)			
Ligdeälven							
1989	0.69			0.53	50%	8	
1990	2.76			0.46	44%	9	
1991	3.16			0.37	88%	8	
1992	0.14			0.79	38%	8	
1993	0.53			0.79	38%	8	
1994	0.42			0.66	38%	8	
1995	2.17			1.71	88%	8	
1996	2.64			0.87	89%	9	
1997	2.59			2.79	88%	8	
1998	13.7			3.69	100%	6	
1999	5.67			0.48	100%	8	
2000	4.80			4.10	86%	7	
2001						0	No sampling because of flood.
2002	5.01			1.54	100%	7	
2003	11.14			3.47	100%	8	
2004	13.26			3.64	100%	8	
2005	11.19			5.06	100%	8	
2006	6.73			3.91	88%	8	
2007	2.86			2.70	63%	8	
2008	9.68			3.76	100%	8	

Table 3.2.3.1 Densities and occurrence of wild salmon parr in electrofishing surveys in the River Ljungan, assessment unit 3 (sub-divisions 30). Detailed information on the age structure of older parr (>0+) is not available.

River year	Number of parr/100 m ² by age group				Sites with 0+ parr (%)	Number of sampling sites	Notes
	0+	1+	2+ & older	>0+			
Ljungan							
1990	5.50			4.80	67%	3	
1991	16.50			0.60	100%	3	
1992							
1993							
1994	6.90			0.20	100%	3	
1995	11.90			0.90	100%	3	
1996	8.60			6.50	100%	3	
1997	19.60			2.10	100%	6	
1998						0	No sampling because of flood
1999	17.40			7.90	80%	5	
2000	10.60			6.50	86%	7	
2001						0	No sampling because of flood
2002	23.90			2.60	100%	8	
2003	11.60			0.20	100%	8	
2004	3.10			1.40	56%	9	
2005	45.31			2.30	100%	9	
2006						0	No sampling because of flood
2007	7.70			2.00	89%	9	
2008	18.93			0.30	100%	3	Flood; only a part of sites were fished.

Table 3.2.4.1 Densities of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 4 (sub-divisions 25-26, Baltic Main Basin).

River year	Number of parr/100 m ² by age group		Number of sampling sites	River year	Number of parr/100 m ² by age group		Number of sampling sites
	0+	>0+			0+	>0+	
Mörrumsån				Emån			
1973	32	33		1967	52	4	
1974	12	21		1980-85	52	8	
1975	77	13		1992	49	10	
1976	124	29		1993	37	9	2
1977	78	57		1994	24	7	2
1978	145	49		1995	32	4	4
1979	97	65		1996	34	8	4
1980	115	60		1997	71	6	4
1981	56	50		1998	51	6	2
1982	117	31		1999	59	7	4
1983	111	74		2000	51	3	4
1984	70	67		2001	37	3	4
1985	96	42		2002	57	4	4
1986	132	39		2003	46	4	7
1987				2004	45	4	6
1988				2005	60	4	7
1989	307	42	11	2006	13	1,3	7
1990	114	60	11	2007	36	1,7	5
1991	192	55	11	2008	35	2,9	6
1992	36	78	11				
1993	28	21	11				
1994	34	8	11				
1995	61	5	11				
1996	53	50	11				
1997	74	15	14				
1998	120	29	9				
1999	107	35	9				
2000	108	21	9				
2001	92	22	9				
2002	95	14	9				
2003	92	28	9				
2004	80	21	7				
2005	98	29	9				
2006	61	34	9				
2007*	54	10	4				
2008	102	16	9				

* Flood, only a part of sites were fished.

Table 3.2.5.1 Densities of wild salmon parr in electrofishing surveys in the Latvian and Estonian wild salmon rivers of the assessment unit 5 (Gulf of Riga, sub-divisions 28).

River year	Number of parr/100 m ² by age group		Number of sampling sites
	0+	>0+	
Pärnu			
1996	3.8	1.0	1
1997	1.0	0.1	1
1998	0.0	0.0	1
1999	0.2	0.4	1
2000	0.8	0.4	1
2001	3.1	0.0	1
2002	4.9	0.0	1
2003	0.0	0.0	1
2004	0.0	0.0	1
2005	9.8	0	1
2006	4.2	0	1
2007	0	0	1
2008	0	0	1
Salaca			
1993	16.7	4.9	5
1994	15.2	2.6	5
1995	12.8	2.8	5
1996	25.3	0.9	6
1997	74.4	3.1	5
1998	60	2.8	5
1999	68.7	4	5
2000	46.3	0.8	5
2001	65.1	4.4	5
2002	40.2	10.3	6
2003	31.5	1.3	5
2004	91.3	2.7	5
2005	115	3.8	7
2006	77.3	17.9	6
2007	69.4	6.9	10
2008	92.5	4.9	5
Gauja			
2003	<1	<1	5
2004	7.9	<1	7
2005 ²	2.7	1.3	5
2006	<1	0	7
2007	<1	0	5
2008	0.1	0.1	5
Venta			
2003	0.5	0.2	7
2004	20.8	0.7	7
2005	29.9	1.1	6
2006	2.6	2.9	5
2007	10.1	0.1	5
2008	18	1.5	5
Amata			
2003	0.0	<1	3
2004	7.9	3,4*	3
2005	2.7	1.3	3
2006	16.7	3.4	3
2007	0.0	5.8	3
2008	6.2	1.8	3

²⁾ tributaries to Gauja

*) reard fish

Table 3.2.5.2 Densities of salmon parr in electrofishing surveys in rivers in Lithuanian of the assessment unit 5 (Baltic Main Basin).

River year	Number of parr/100 m ² by age group		Number of sampling sites
	0+	>0+	
Neris			
2000	0.19	0.06	10
2001	2.51	0.00	10
2002	0.90	0.00	11
2003	0.27	0.00	11
2004	0.41	0.05	10
2005	0.10	0.03	9
2006	0.06	0.02	9
2007	1.68	0.36	9
2008	7.44	0.32	9
Žeimena			
2000	4.10	0.46	7
2001	1.40	0.10	7
2002	0.66	0.00	6
2003	0.72	0.00	6
2004	3.10	0.30	6
2005	1.33	0.47	5
2006	2.52	0.06	5
2007	4.20	0.80	5
2008	2.80	0.10	7
Mera			
2000	0.13	0.00	3
2001	0.27	0.00	3
2002	0.08	0.00	4
2003	0.00	0.00	4
2004	0.00	0.00	3
2005	0.00	0.00	2
2006	0.00	0.05	2
2007	0.22	0.22	2
2008	0.00	0.50	2
Saria			
2000	2.50	0.00	1
2001	0.70	0.00	1
2002	0.00	0.00	1
2003	0.40	0.00	1
2004	3.00	0.00	1
2005	0.00	0.40	1
2006	n/a	n/a	
2007	0.00	0.00	1
2008	0.40	0.00	1

Table 3.3.1 Current status of reintroduction programme in Baltic Sea potential salmon rivers. Potential production estimates are uncertain and currently being re-evaluated.

River	Description of river					Restoration programme					Results of restoration				
	Country	ICES sub-division	Old salmon river	Cause of salmon population extinction	Potential production areas (ha)	Potential smolt production (num.)	Officially selected for reintroduction	Programme initiated	Measures	Releases	Origin of population	Pair and smolt production from releases	Spawners in the river	Wild pan production	Wild smolt production
Kåge älv	SE	31	yes	3,4	39	700-11600	yes	yes	c,f,j,n	1	Byske älv	yes	yes	>0	>0
Moälven	SE	31	yes	3,4	7	2000	no	yes	c,l	2	Byske älv	yes	yes	0	0
Testeboån	SE	30	yes	1,3	8	2100-4200	yes	yes	a,e,i	1	Dalälven	yes	yes	>0	>0
Alsterån	SE	27	yes	2,3	4	4000	no	no	c,g,l	4	**	**	yes	>0	>0
Helgeån	SE	25	yes	2,3	7	3200	no	yes	c,e,m	2	Mörrumsån	yes	yes	>0	>0
Kuivajoki	FI	31	yes	1,2	58	17000	yes	yes	b,c,f	2	Simojoki	yes	yes	yes	0
Kiiminkijoki	FI	31	yes	1,2	110	40000	yes	yes	b,c,d,f	2	Iijoki	yes	yes	yes	>0
Siikajoki	FI	31	yes	1,2,3	32	15000	no	yes	b,g,m	1,4	mixed	yes	*	0	0
Pyhäjoki	FI	31	yes	1,2,3	98	35000	yes	yes	b,c,d,f,m	2	Tornionjoki/Montt	yes	yes	yes	0
Kalajoki	FI	31	yes	1,2,3	33	13000	no	yes	b,e,m	1,4		no	*	0	0
Perhonjoki	FI	31	yes	1,2,3	5	2000	no	yes	b,f	2	Tornionjoki/Montt	yes	*	0	0
Merikarvianjoki	FI	30	yes	1,2,3	8	2000	no	yes	b,c,e	2	Neva	yes	yes	>0	*
Vantaanjoki	FI	32	no?	2	16	8000	no	yes	b,c,f,m	2	Neva	yes	yes	0	0
Kymijoki	FI	32	yes	2,3,4	75	100000	no	yes	b,c,m	2	Neva	yes	yes	yes	25000
Valgejõgi	EE	32	yes	4	15	16000	yes	yes	c,l	2	Neva, Narva	yes	yes	yes	200
Jägala	EE	32	yes	2,4	2	1500	yes	yes	c,g	2	Neva, Narva	yes	yes	yes	>0
Vääna	EE	32	yes	4	4	5000	yes	yes	c,k	2	Neva, Narva	yes	yes	yes	>0
Venta	LI	28	yes	2,3	*	10000	no	no	m,c	4	Venta	no	no	0	0
Sventoji	LI	26	yes	2,3	7	12000	yes	yes	m,c	2	Nemunas	yes	yes	4300	1750
Minija/Veivirzas	LI	26	yes	*	*	15000	yes	yes	c	2	Nemunas	no	no	0	0
Wisla/Drweca	PL	26	yes	1,2,3,4	*	*	yes	yes	b,l,m	2	Daugava	*	yes	*	*
Slupia	PL	25	yes	1,2,3,4	*	*	yes	yes	b,l,m	2	Daugava	yes	yes	yes	*
Wieprza	PL	25	yes	1,2,3,4	*	*	yes	yes	b,m	2	Daugava	yes	yes	*	*
Parseta	PL	25	yes	1,2,4	*	*	yes	yes	b,n	2	Daugava	*	yes	*	*
Rega	PL	25	yes	1,2,3,4	*	*	yes	yes	b	2	Daugava	*	yes	*	*
Odra/Notec/Drawa	PL	24	yes	1,2,4	*	*	yes	yes	b	2	Daugava	yes	yes	*	*
Reda	PL	24	yes	1,2,3,4	*	*	yes	yes	b	2	Daugava	yes	yes	*	*
Gladyshevka	RU	32	yes	1,2,4	1,5	3000	no	yes	a,g,k,n	2	Narva	yes	yes	yes	>0

Cause of extinction

- 1 Overexploitation
- 2 Habitat degradation
- 3 Dam building
- 4 Pollution

* No data

** Not applicable

Measures

Fisheries

- a Total ban of salmon fishery in the river and river mouth
- b Seasonal or areal regulation of salmon fishery
- c Limited recreational salmon fishery in river mouth or river
- d Professional salmon fishery allowed in river mouth or/and river

Habitat restoration

- e partial
- f completed
- g planned
- h not needed

Dam removal

- i planned
- j completed
- k not needed

Fish ladder

- l planned
- m completed
- n not needed

Releases

- 1 Has been carried out, now finished
- 2 Going on
- 3 Planned
- 4 Not planned

Table 3.3.2 Densities of wild salmon parr in electrofishing surveys in the potentials rivers.

Contry	Assess- ment unit	Sub-div	River and year	Number of parr /100 m ²		Number of sampling sites
				0+	>0+	
Sweden	2	31	Kågeälven *			
			1987	0	0	5
			1988	0	0	1
			1989	0	0	3
			1990	0	0	1
			1991	0.5	0	4
			1992	1.6	n/a	2
			1993	0	n/a	5
			1994	0	n/a	5
			1995	n/a	n/a	
			1996	n/a	n/a	
			1997	n/a	n/a	
			1998	n/a	n/a	
			1999	19.7	n/a	26
			2000	1.5	n/a	10
			2001	9.5	n/a	9
			2002	8.7	n/a	26
			2003	8.3	n/a	26
			2004	7.0	n/a	25
			2005	14.0	n/a	26
2006	30.7	n/a	17			
2007	4.1	6.2	25			
2008	2.5	7.1	14			
Sweden	3	30	Testeboån			
			2000	17.6	n/a	10
			2001	32.7	n/a	10
			2002	40.0	n/a	10
			2003	16.7	n/a	10
			2004	17.8	n/a	10
			2005	12.3	n/a	5
			2006	8.2	n/a	5
			2007	10.8	17.8	10
			2008	0.0	4.9	11
Sweden	4	27	Alsterån			
			1997	13.3	0	1
			1998	23.8	5.4	1
			1999	6.8	7.0	1
			2000	8.0	3.4	1
			2001	1.5	1.3	1
			2002	36.2	0.4	1
			2003	0	4.4	1
			2004	0	0	1
			2005	13.2	0	1
			2006	0	3.6	1
			2007	0	0	1
			2008			no sampling
Finland	1	31	Kuivajoki *			
			1999	0	n/a	
			2000	0	n/a	8
			2001	0	n/a	16
			2002	0.2	n/a	15
			2003	0.4	n/a	15
			2004	0.5	n/a	15
			2005	0.6	n/a	14
			2006	3.2	n/a	14
			2007	0.2	n/a	14
2008			no sampling			

table continues next page

* n/a = reared parr, which are stocked, are not marked;
 natural parr densities can be monitored only from 0+ parr

Table 3.3.1.2 continues...

Contry	Assess- ment unit	Sub-div	River and year	Number of parr /100 m ²		Number of sampling sites
				0+	>0+	
Finland	1	31	Kiiminkijoki *			
			1999	1.8	n/a	
			2000	0.8	n/a	31
			2001	1.9	n/a	26
			2002	1.5	n/a	47
			2003	0.7	n/a	42
			2004	3.9	n/a	46
			2005	8.2	n/a	45
			2006	2.3	n/a	41
			2007	0.7	n/a	17
Finland	1	30	Pyhäjoki *			
			1999	0.3	n/a	
			2000	0.2	n/a	23
			2001	0.9	n/a	18
			2002	1.9	n/a	20
			2003	0	n/a	22
			2004	0.2	n/a	13
			2005	0.7	n/a	16
			2006	0.2	n/a	17
			2007	0.0	n/a	13
Estonia	6	32	Valgejõgi			no sampling
			1999	2.2	0	3
			2000	0.4	1	3
			2001	4.4	1.6	4
			2002	7.1	1.6	1
			2003	0.2	0.8	3
			2004	0.5	3.7	2
			2005	0.5	2.8	3
			2006	8.2	2.6	3
			2007	6.7	5	3
Estonia	6	32	Jägala			
			1999	0.5	0	1
			2000	0	0	1
			2001	16.2	0	1
			2002	0	0	1
			2003	0	0	1
			2004	0.5	0	1
			2005	1.9	0	1
			2006	0	0.1	1
			2007	0.1	0	1
Estonia	6	32	Vääna			
			1999	0	0	4
			2000	0.1	0	4
			2001	0	0	2
			2002	0	0	4
			2003	0	0	4
			2004	0	0	2
			2005	0	0	4
			2006	13.9	0	3
			2007	0	0.6	3
Russia	6	32	Gladyshevka			
			1999	9.5	0	3
			2001	0	0	2
			2002	0	0	2
			2003	0	0	3
			2004	6	0	2
			2005	15.6	4.1	3
			2006	7.7	6.2	2
			2007	3.1	3.7	4
			2008	0	2	1

table continues next page

* n/a = reared parr, which are stocked, are not marked;
 natural parr densities can be monitored only from 0+ parr

Table 3.3.1.2 continues...

Contry	Assess- ment unit	Sub-div	River year	Number of parr/100 m ² by age group		Number of sampling sites
				0+	>0+	
Lithuani	5	26	Šventoji			
			2000	1.90	0.00	6
			2001	0.25	0.00	6
			2002	2.00	0.10	6
			2003	0.10	0.00	6
			2004	0.62	0.28	6
			2005	0.50	0.46	4
			2006	3.15	1.35	4
			2007	4.80	0.10	4
			2008	5.80	0.30	5
Lithuani	5	26	Siesartis			
			2000	1.84	0.00	2
			2001	3.35	0.35	2
			2002	2.50	0.00	2
			2003	0.45	0.00	2
			2004	3.40	0.00	3
			2005	7.30	3.00	2
			2006	0.27	0.94	2
			2007	6.30	1.20	2
			2008	18.90	17.50	2
Lithuani	5	26	Virinta			
			2003	0.95	0.00	2
			2004	0.17	0.00	2
			2005	0.55	0.49	2
			2006	0.14	0.00	2
			2007	0.00	0.00	2
			2008	0.00	0.00	2
Lithuani	5	26	Širvinta			
			2004	1.00	0.00	2
			2005	1.00	0.00	2
			2006	0.00	0.00	2
			2007	6.35	0.35	2
			2008	10.90	0.00	2
Lithuani	5	26	Vilnia			
			2000	0.00	0.00	3
			2001	0.70	0.00	3
			2002	1.30	0.00	4
			2003	0.00	0.00	3
			2004	0.36	0.15	3
			2005	4.48	0.13	3
			2006	0.49	2.63	3
			2007	0.58	0.00	3
			2008	1.53	0.28	3
Lithuani	5	26	Vokė			
			2001	4.30	0.00	2
			2002	0.16	0.00	2
			2003	0.00	0.00	2
			2004	9.50	0.00	2
			2005	0.77	0.00	2
			2006	0.00	0.80	2
			2007	4.10	0.00	2
			2008	4.50	0.00	2
Lithuani	5	26	B. Šventoji			
			2003	1.12	0.00	8
			2004	2.52	0.00	8
			2005	0.00	0.22	9
			2006			no sampling
			2007	0.02	0.00	5
			2008	0.02	0.00	3
Lithuani	5	26	Dubysa			
			2003	2.12	0.00	9
			2004	0.75	0.00	9
			2005	1.47	0.00	8
			2006	0.00	0.06	9
			2007	0.02	0.00	8
			2008	0.53	0.09	10

Table 3.4.1 Salmon smolt releases by country and assessment units in the Baltic sea (x1000) in 1987-2008.

Assessment unit	Country	Age	year																						
			1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
1	Finland	2yr	1301	1703	1377	1106	1163	1273	1222	1120	1440	1394	1433	1528	1542	1679	1630	1541	1361	1541	1205	1439	1406	1340	
		3yr			21	5			0			1	1	1		1						1	1		
1 Total			1301	1703	1398	1111	1163	1273	1223	1120	1440	1395	1434	1529	1542	1679	1630	1541	1361	1541	1205	1439	1407	1340	
2	Sweden	1yr	292			8					22					5							84		
		2yr	976	901	771	813	809	816	901	804	675	711	786	803	784	693	795	802	758	748	779	685	780	784	
2 Total			1267	901	771	821	809	816	901	804	698	711	786	803	784	693	800	802	758	748	779	685	780	867	
3	Finland	1yr	3							73													0		
		2yr	435	454	313	277	175	178	135	201	235	257	125	188	202	189	235	211	155	163	252	239	237	250	
		3yr	19																		0				
	Sweden	1yr			10	12	11	41	10		103	43	69	43	38	35	47	84	162	96	273	268	391	564	
		2yr	1026	983	1170	973	962	1024	1041	808	457	1011	1063	1072	864	1060	933	867	902	808	888	719	494	461	
3 Total			1484	1437	1492	1261	1148	1242	1185	1083	794	1311	1257	1303	1104	1284	1215	1161	1218	1067	1414	1227	1122	1275	
4	Denmark	1yr	62	60	46	60	13	64	80		70								14	13	16				
		2yr	8	10	10	12	11																		
	EU	1yr		25	107	60	109	40			7														
		2yr		26	192	149	164	124	332	165	2	28													
	Sweden	1yr	117	89	136	96	41	84	103	14	12	37	55	3		11		1				20			
		2yr	129	113	18	58	69	25	33	68	3	4	9	2		1	9	5	5	6	7	8	31	8	
4 Total			317	323	509	435	407	337	548	246	87	76	167	35	35	84	9	7	19	19	23	28	31	8	
5	Estonia	1yr			17	18	15	18	15																
	Poland	1yr		1						22	129	40	280	458	194	309	230	186	262	207	161	385	310	374	
		2yr								2	107	77	30	80	175	60	24	86	53	58	69	79	98	30	
	Latvia	1yr	686	1015	1145	668	479	580	634	616	793	699	932	902	1100	1060	1069	867	961	777	566	814	868	944	
		2yr	224	49	39	36	31	34	86	58	33	60	8	49	41	46		64	34	38	175	61	5	23	
	Lithuania	1yr													11			9	4	11	30			3	
5 Total			910	1065	1201	722	525	632	735	698	1062	876	1250	1489	1521	1475	1324	1203	1317	1084	983	1371	1281	1374	
Assessment units 1-5 Total			5278	5429	5371	4350	4052	4300	4592	3950	4081	4369	4893	5158	4986	5215	4977	4713	4673	4460	4403	4750	4621	4865	
6	Estonia	1yr								22	33		30	18	52	36	69	129	101	86	82	96	125	80	122
		2yr		1										29	90	58	34	40	35	46	46	48	0	49	
	Finland	1yr	156	26	23	30	67	26	120	66	63	45		15				65	80	58	84	13			
		2yr	429	415	372	363	349	315	190	198	284	346	222	253	326	362	400	338	266	275	325	276	222	337	
		3yr	12																						
	Russia	1yr	85	113	81	100	102	13	128	78	124	102	174	85	165	77	103	136	70	271	233	247	278	270	
		2yr	3	2	2	30			9	22	18	18	6	12	12	41	135	1	107	85	81	33	55	1	
6 Total			686	556	478	524	518	354	470	398	489	542	449	507	597	584	801	681	644	817	865	742	635	778	
Grand Total			6505	5986	5849	4874	4569	4654	5061	4347	4571	4911	5342	5665	5583	5799	5778	5394	5317	5277	5268	5492	5256	5642	

Table 3.4.2. Releases of salmon eggs, alevin , fry and parr to the Baltic Sea rivers by assessment unit in 1995-2008.

Assessment unit	year	age						
		eyed egg	alevin	fry	1s parr	1yr parr	2s parr	2yr parr
1	1997	1033	459	321	834	14		
	1998	687	198	690	582			
	1999	1054	25	532	923	15		
	2000	835	27	402	935			
	2001			98	1079			
	2002		19	145	775	5		
	2003				395	10		
	2004			63	266			
	2005		98	96	451	15	21	
	2006		330	11	14	896		
2	1997		825	395	87			
	1998		969	394	190	3		
	1999		370	518	67	4		
	2000		489	477	71			
	2001		821	343	83			
	2002		259	334	127			
	2003		443	242	45			
	2004		200	155				
	2005		712	60				
	2006			80	36			
3	1997	482	2	596	390	60	93	
	1998	691		468	359	99	184	
	1999	391		16	443	4	29	
	2000	516		158	239	30	34	
	2001	177		736	263		16	
	2002	74		810	161		17	
	2003			655	56	0	31	
	2004			503	6		7	
	2005			151	2	48	27	
	2006			295		18	4	
4	1997		159					
	1998			7		4		
	1999				3	1		
	2001		40			2		
	2002		88					
	2003		42					
	2005		70					
	2006		45					
	2007		69					
	2008		145					
5	2001		100	96	14			
	2002		160	106	33			
	2003		109	515				
	2004		120	52	11	10		
	2005		420	199	224			
	2006		30	376	236	1		
	2007		200	418	125			
	2008		364	322	508	17		
6	1997		8	6	236			
	1998	514		50	166			
	1999		277		267			
	2000	267	51		233			
	2001		74		250			
	2002	20	102	640	272	13	5	
	2003	21	120	120	240	248	35	
	2004		294		229	208	3	
	2005	80	26		263	110		
	2006				197			
	2007		98		90	148	28	
	2008		6		355	50	40	

Table 3.5.1 The M74 frequency (in %) as a proportion of M74 females (partial or total offspring M74 mortality) or the mean offspring M74-mortality (see annotation 2) of searun female spawners, belonging to reared populations of Baltic salmon, in hatching years 1985-2008 with projections for 2009. The data originate from hatcheries or from laboratory monitoring.

River	Sub-div.	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Simojoki (2)	31		6	2	6	3	14	4	53	74	53	92	86	91	31	60	44	42	42	6	7	3	18	29	10	
Tornionjoki(2)	31				5	6	1	29	70	76	89	76	NA	NA	25	61	34	41	62	0	0	NA	27	9	20	
Kemijoki	31																						38	54	25	
Luleälven	31								58	66	62	50	52	38	6	34	21	29	37	4	4	1	18	21	10	
Skellefteälven	31								40	49	69	49	77	16	5	42	12	17	19	7	0	2	3	13	0	
Ume/Vindelälven	30	40	20	25	19	16	31	45	77	88	90	69	78	37	16	53	45	39	38	15	4	0	5	14	4	
Angermanälven	30								50	77	66	46	63	21	4	28	21	25	46	13	4	3	28	30	16	
Indalsälven	30	4	7	8	7	3	8	7	45	72	68	41	64	22	1	20	22	6	20	4	0	3	18	16	18	
Ljungan	30								64	96	50	56	28	29	10	25	10	0	55	0						
Ljusnan	30							17	33	75	64	56	72	22	9	41	25	46	32	17	0	0	25	15	9	
Dalälven	30	28	8	9	20	11	9	21	79	85	56	55	57	38	17	33	20	33	37	13	4	7	15	18	7	21
Mörrumsån	25	47	49	65	46	58	72	65	55	90	80	63	56	23												
Neva/Åland (2)	29									70	50															
Neva/Kymijoki (2)	32								45	60-70		57	40	79	42	42	23		43	11	6	6	0	26		
Mean River Simojoki and Tornionjoki			6	2	5.5	4.5	7.5	16.5	61.5	75	71	84	86	91	28	60.5	39	41.5	52.0	3.0	3.5	3.0	22.5	19.0	15.0	
Mean River Luleälven, Indalsälven, Dalälven		16.0	7.5	8.5	13.5	7.0	8.5	14.0	60.7	74.3	62.0	48.7	57.7	32.7	8.0	29.0	21.0	22.7	31.3	7.0	2.7	3.7	17.0	18.3	11.7	
Mean total		29.8	18.0	21.8	17.2	16.2	22.5	26.9	55.8	76.5	66.4	59.2	61.2	37.8	15.1	39.9	25.2	27.8	39.2	8.1	2.9	2.8	17.7	22.3	11.9	

1) All estimates known to be based on material from less than 20 females in bold.

2) The estimates in the rivers Simojoki, Tornionjoki/Torne älv and Kymijoki are since 1992, 1994 and 1995, respectively, given as the proportion of females (%) with offspring affected by M74 and before that as the mean yolk-sac-fry mortality (%).

Table 3.5.2 Summary of M74 data for Atlantic salmon (*Salmo salar*) stocks of the rivers Simojoki, Tornionjoki and Kemijoki (hatching years 1986-2008), indicating the percentage of sampled females with offspring that display M74 symptoms (%), the total average yolk-sac-fry mortality among offspring of sampled females (%) and the percentage of sampled females with 100% mortality among offspring (%). Data from less than 20 females in bold.

	Total average yolk-sac fry mortality among offspring (%)			Proportion of females with offspring affected by M74 (%)			Proportion of females without surviving offspring (%)		
	Simojoki	Tornionjoki	Kemijoki	Simojoki	Tornionjoki	Kemijoki	Simojoki	Tornionjoki	Kemijoki
1986	7	NA		0	NA		0	NA	
1987	3	NA		0	NA		0	NA	
1988	7	5		0	NA		0	NA	
1989	1	6		0	NA		0	NA	
1990	14	1		0	NA		0	NA	
1991	4	29		0	NA		0	NA	
1992	52	70		53	NA		47	NA	
1993	75	76		74	NA		74	NA	
1994	55	84		53	89		53	52	
1995	76	66		92	76		58	49	
1996	67	NA		86	NA		50	NA	
1997	71	NA		91	NA		50	NA	
1998	19	26		31	25		6	19	
1999	55	62		60	61		39	56	
2000	38	34		44	34		22	24	
2001	41	35		42	41		27	21	
2002	32	61		42	62		25	38	
2003	2	4		6	0		0	0	
2004	4	2		7	0		0	0	
2005	5	NA		3	NA		3	NA	
2006	11	9	25	18	27	38	6	0	19
2007	26	8	40	29	9	54	16	5	31
2008	15	25	18	10	20	25	3	10	6

Table 3.5.3 Summary of M74 data for nine different Atlantic salmon stocks (1985-2008), in terms of the number of females sampled with offspring affected by the M74 syndrome in comparison to the total number of females of stock sampled

	Luleälven		Skellefteälven		Ume/Vindelälven		Angermanälven		Indalsälven		Ljungan		Ljusnan		Dalälven		Mörrumsån	
	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total
1985	NA	NA	NA	NA	14	35	NA	NA	9	219	NA	NA	0	78	19	69	23	50
1986	NA	NA	NA	NA	16	82	NA	NA	18	251	NA	NA	0	49	4	49	24	50
1987	NA	NA	NA	NA	16	64	NA	NA	20	245	NA	NA	0	84	8	88	32	50
1988	NA	NA	NA	NA	12	64	NA	NA	15	202	NA	NA	0	75	16	79	23	50
1989	NA	NA	NA	NA	6	38	NA	NA	6	192	NA	NA	0	78	7	65	29	50
1990	NA	NA	NA	NA	18	59	NA	NA	15	198	NA	NA	0	86	4	45	39	55
1991	NA	NA	NA	NA	32	71	NA	NA	14	196	NA	NA	14	88	16	78	35	55
1992	161	279	16	40	55	71	78	157	85	190	14	22	29	89	50	63	33	60
1993	232	352	44	89	60	68	98	128	149	206	5	5	89	119	69	81	54	60
1994	269	435	54	78	146	164	52	79	148	208	6	12	105	163	70	126	4	5
1995	209	418	38	77	148	215	58	126	97	237	15	27	79	142	22	40	17	27
1996	202	392	54	70	68	87	36	57	107	167	6	22	92	128	102	178	10	18
1997	156	409	8	50	26	71	38	183	39	178	5	17	28	130	360	159	5	22
1998	22	389	2	48	6	37	3	81	2	155	2	20	7	82	14	83	NA	NA
1999	108	316	22	53	27	51	30	108	25	126	5	20	19	46	27	82	NA	NA
2000	67	320	7	57	27	60	29	136	27	125	1	10	29	114	36	131	NA	NA
2001	96	322	9	51	24	62	31	122	7	100	0	10	47	102	27	82	NA	NA
2002	119	300	8	42	20	53	56	122	25	123	6	11	23	60	56	150	NA	NA
2003	12	270	4	60	8	53	15	120	5	128	0	2	17	100	22	164	NA	NA
2004	10	270	0	59	2	56	4	114	0	125	NA	NA	0	47	5	112	NA	NA
2005	3	250	1	58	0	55	4	114	4	128	NA	NA	0	7	11	151	NA	NA
2006	40	228	1	40	2	39	19	67	18	98	NA	NA	15	60	25	132	NA	NA
2007	45	219	5	40	5	37	24	79	17	105	NA	NA	8	55	17	93	NA	NA
2008	22	212	0	40	2	50	13	80	19	106	NA	NA	7	81	8	108	NA	NA

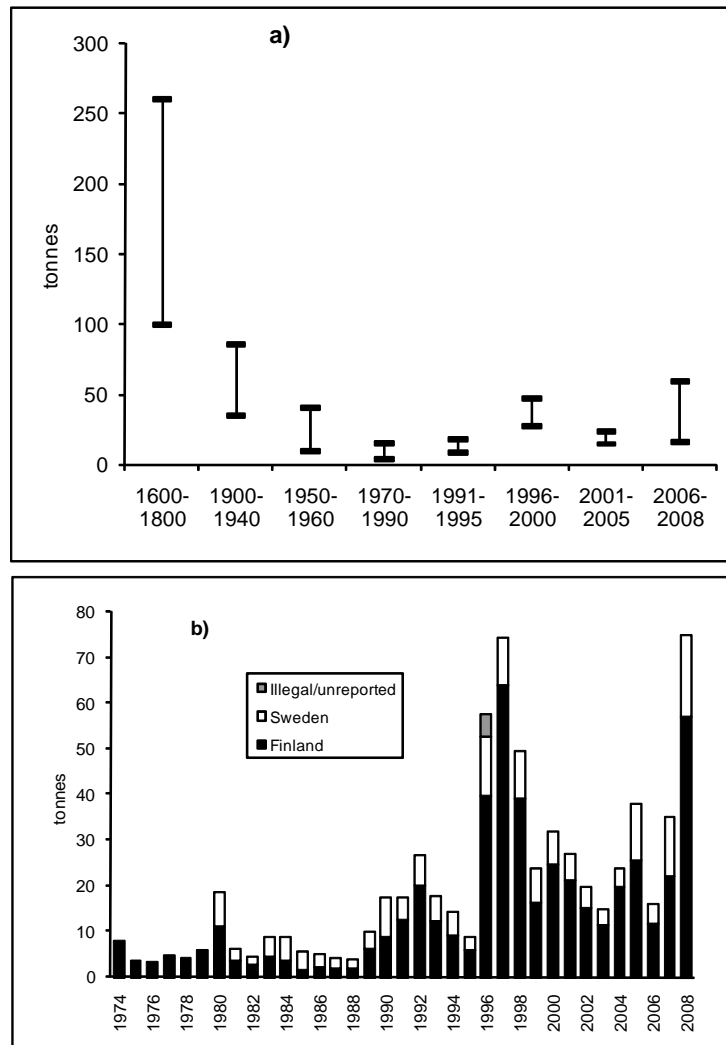


Figure 3.2.1.1. Total river catches in the River Tornionjoki (assessment unit 1). a) Comparison of the periods from 1600 to present (range of annual catches). b) from 1974 to present. Swedish catch estimates are provided from 1980 onward

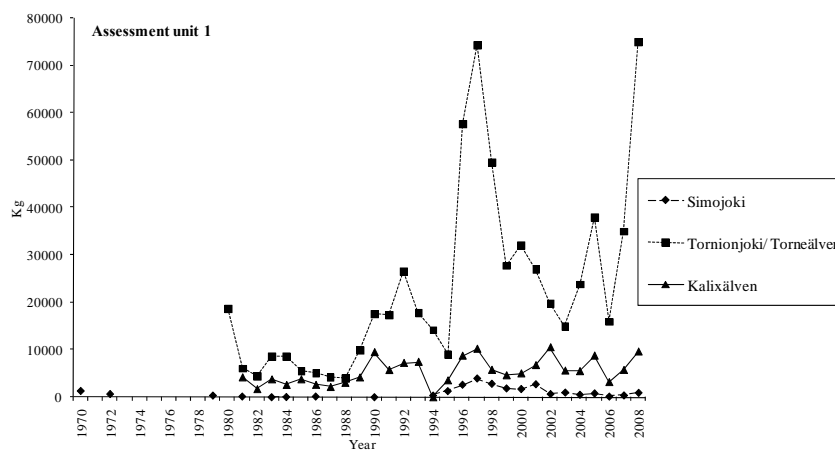


Figure 3.2.1.2 Salmon catch in the rivers Simojoki, Tornionjoki/Torneälven(finnish and swedish combined) and Kalixälven, Gulf of Bothnia, assessment unit 1.1970-2008. Ban of salmon fishing 1994 in the rivers Kalixälven.

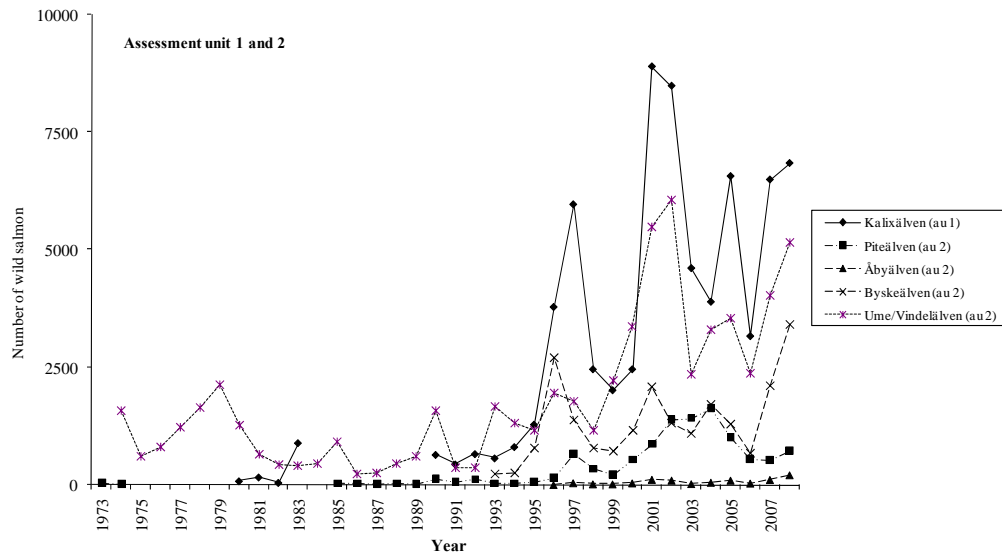


Figure 3.2.1.3 Total wild salmon run in fish ladders in rivers in assessment unit 1 and 2, in 1973-2008.

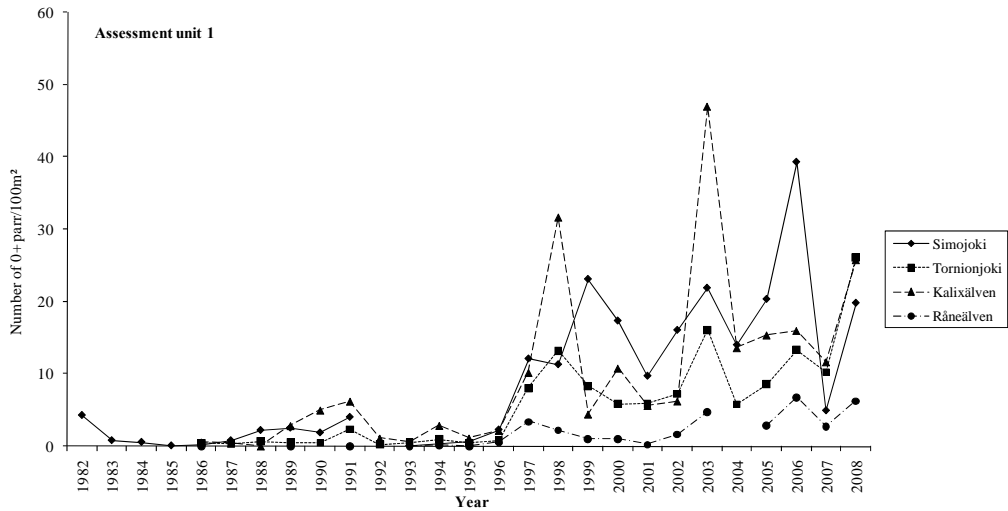


Figure 3.2.1.4 Densities of 0+ parr in rivers in the Gulf of Bothnia (Sub-division 31) assessment unit 1, in 1982-2008.

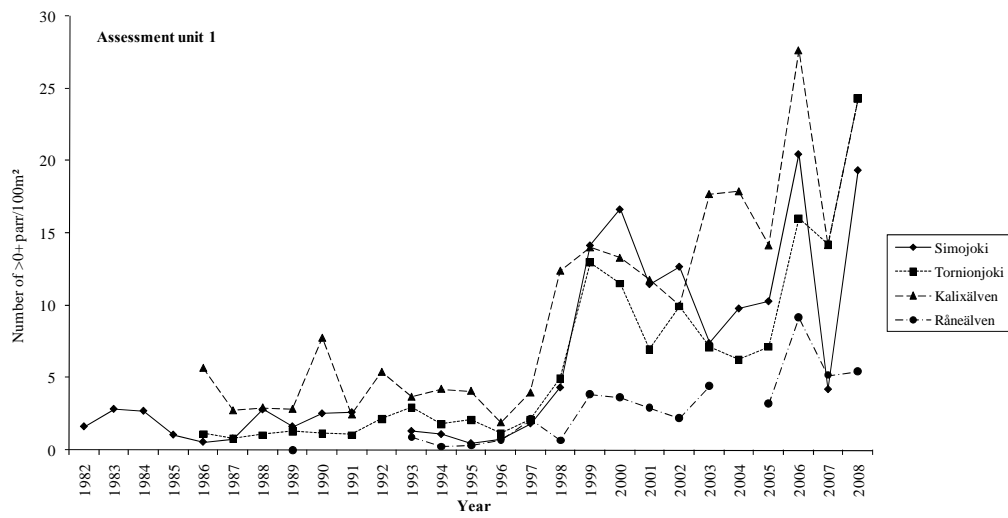


Figure 3.2.1.5 Densities of >0+ parr in rivers in the Gulf of Bothnia (Sub-division 31) assessment unit 1, in 1982-2008.

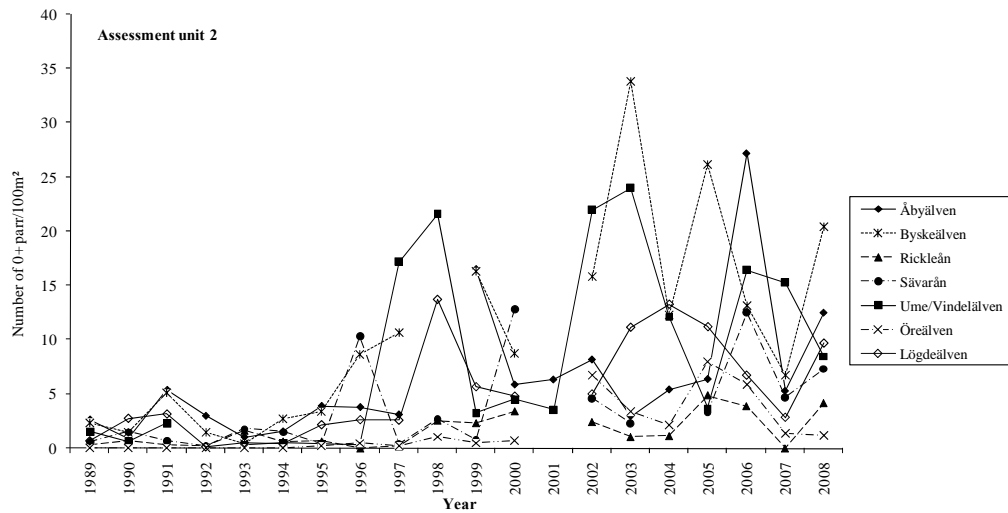


Figure 3.2.2.1 Densities of 0+ parr in rivers in the Gulf of Bothnia (Sub-division 31) assessment unit 2, in 1989-2008.

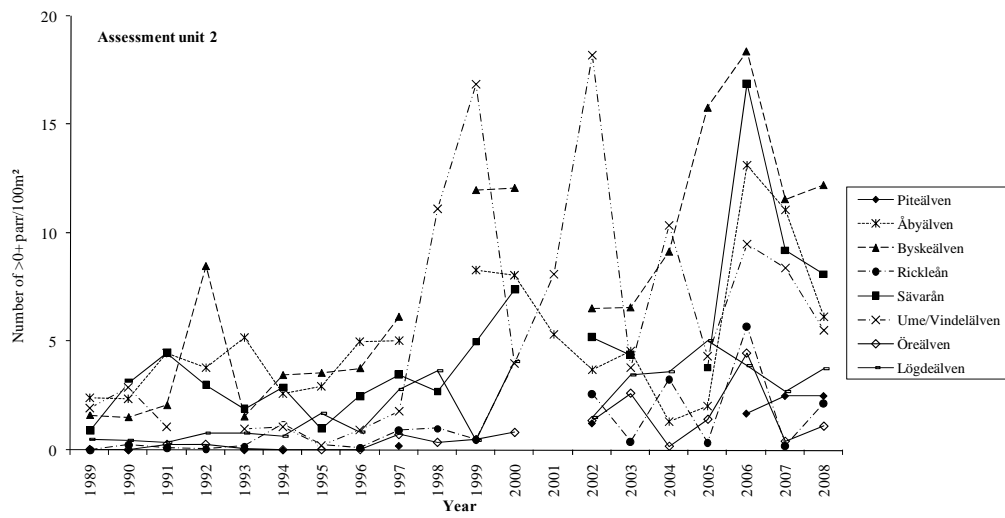


Figure 3.2.2.2 Densities of >0+ parr in rivers in the Gulf of Bothnia (Sub-division 31) assessment unit 2, in 1989-2008.

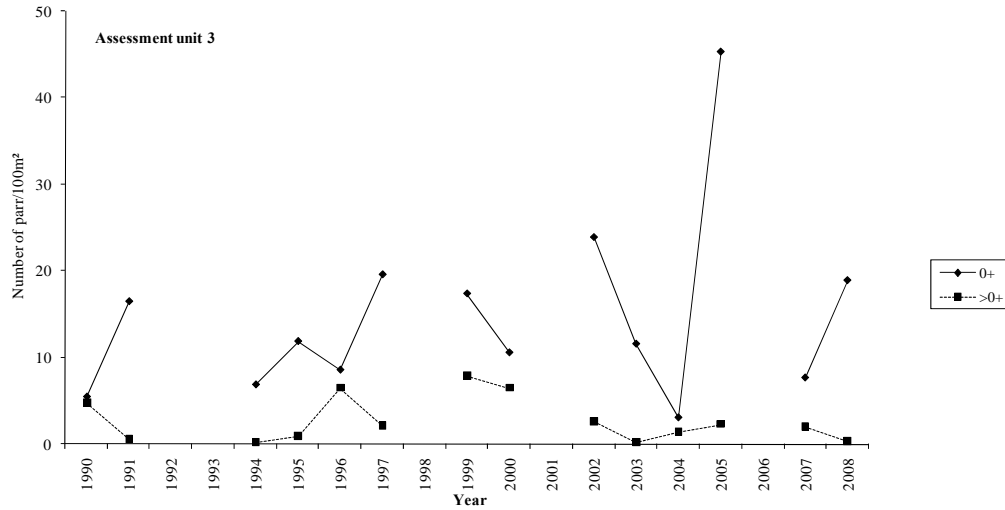


Figure 3.2.3.1 Densities of parr in Ljungan in the Gulf of Bothnia (Sub-division 30) assessment unit 3, in 1990-2008.

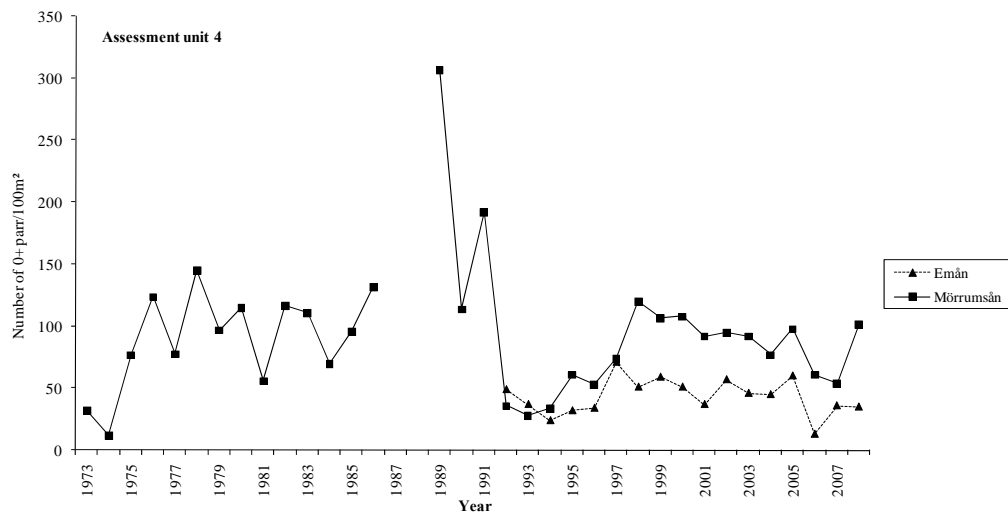


Figure 3.2.4.1 Densities of 0+ parr in rivers in the Main Basin (Sub-division 25-27) assessment unit 4, in 1973-2008.

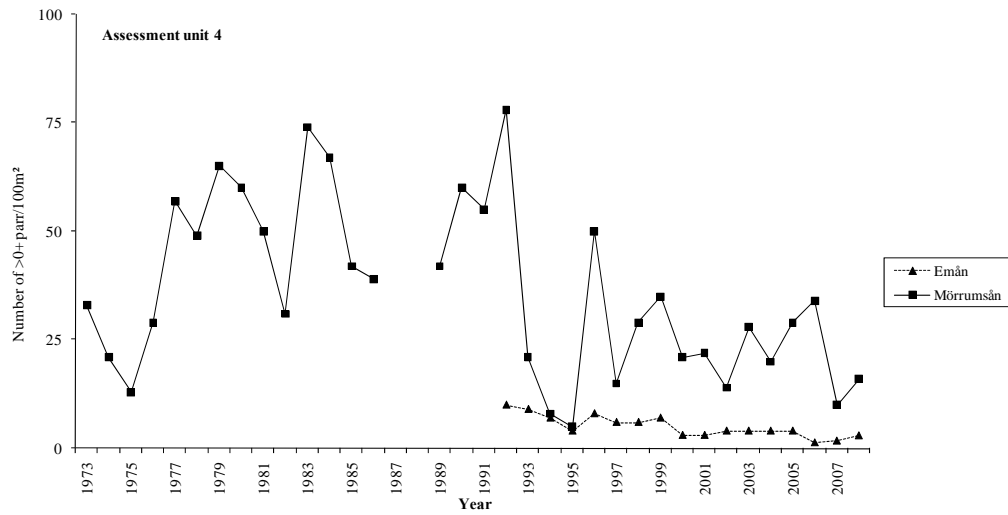


Figure 3.2.4.2 Densities of >0+ parr in rivers in the Main Basin (Sub-division 25-27) assessment unit 4, in 1973-2008.

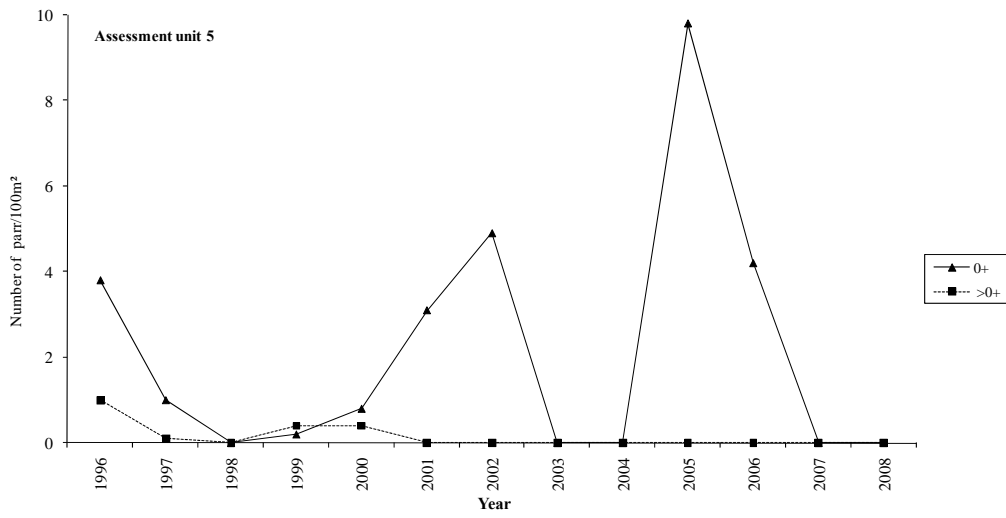


Figure 3.2.5.1 Densities of parr in the river Pärnu Main Basin (Sub-division 22-29) assessment unit 5, in 1996-2008.

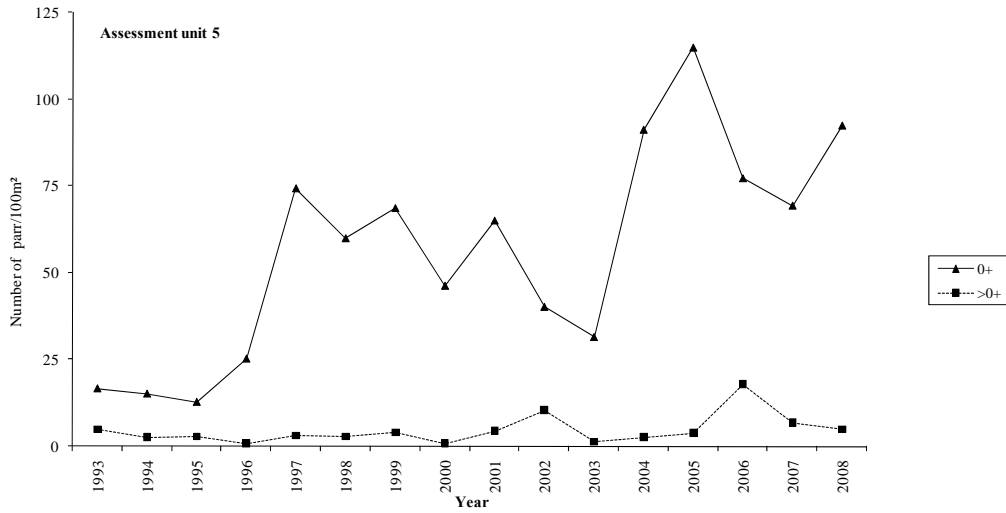


Figure 3.2.5.2 Densities of parr in the river Salaca Main Basin (Sub-division 22-29) assessment unit 5, in 1993-2008.

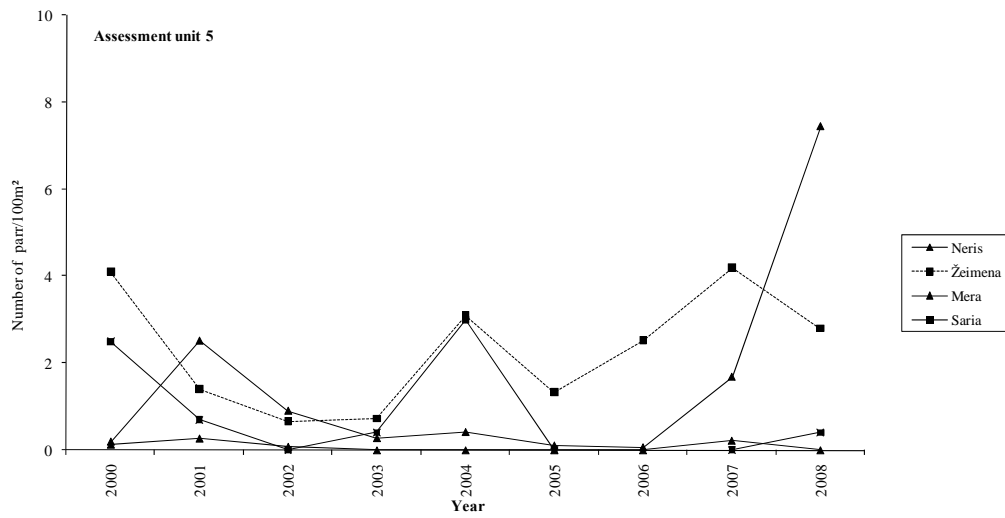


Figure 3.2.5.3 Densities of 0+ parr in the Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2008.

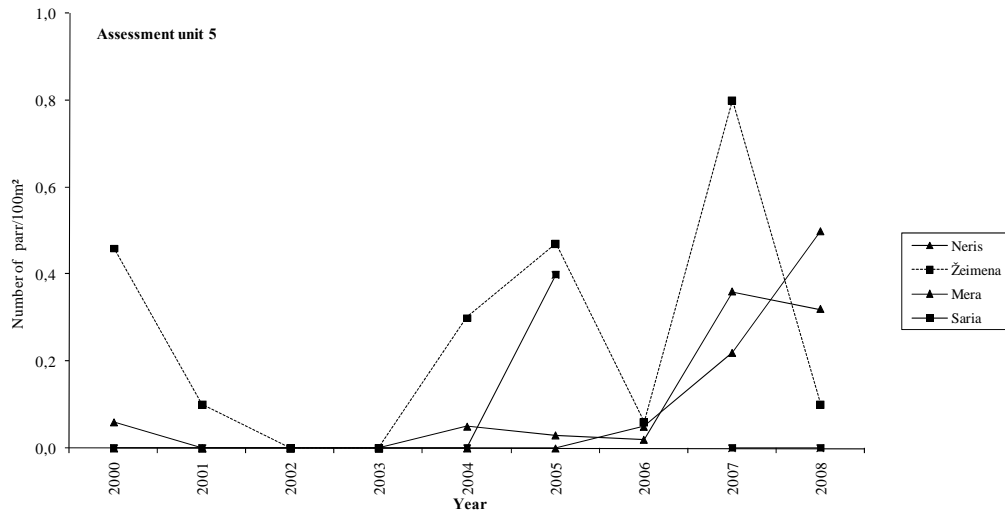


Figure 3.2.5.4 Densities of >0+ parr in the Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2008.

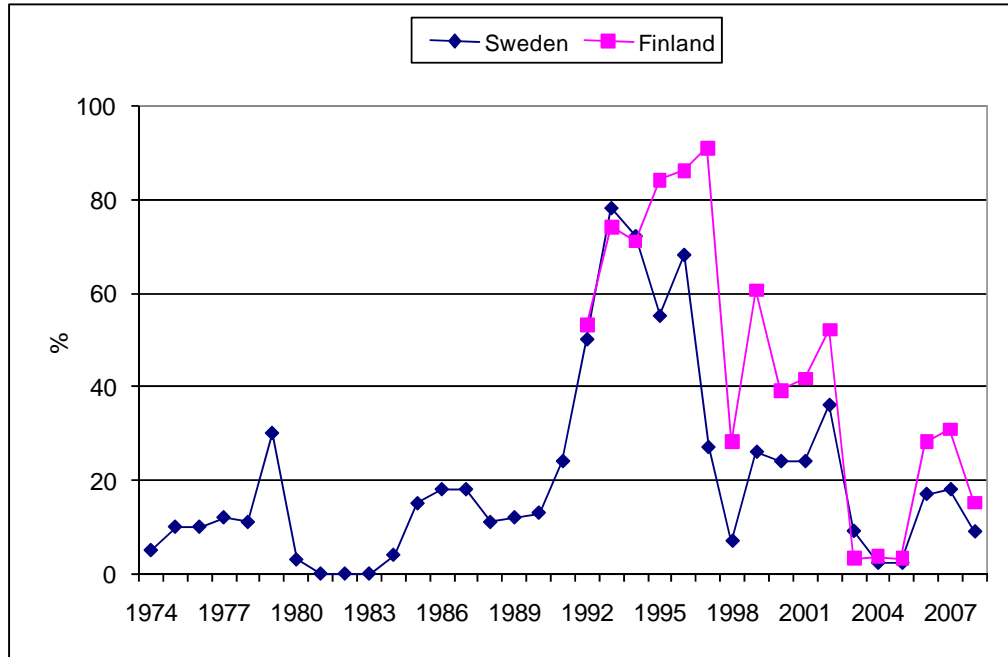


Figure 3.5.1 Proportion of M74 positive females in Swedish and Finnish hatcheries.