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

Loobu, 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 have 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., Anon. 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 was 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, no river 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 tonnes, 74 tonnes and 10 tonnes the **Simojoki**, **Tornionjoki** and **Kalixälven**, respectively. Since then, catches have decreased to 25%-60% of that of 1997. 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 has generally decreased during the last five years (see development in fish ladder data of the **Kalixälven**). In **Tornionjoki** and **Kalixälven** the catches dropped to less than half from 2005 to 2006.

A special kind of fishing from boat (rod fishing by rowing) dominates in salmon fishing in the **Tornionjoki**. The CPUE of this kind of fishery has increased by about ten-fold since the late 1980s (Table 3.2.1.1), apparently reflecting the parallel drastic increase in the abundance of spawning migrants in the river. The CPUE peaked in 1997, when the total river catch was also peaking. After that, the CPUE has dropped to 30-50% of the peak value and in 2006 the CPUE was one of the lowest within last ten years.

Spawning runs and their composition

In **Kalixälven**, about 110 km above the sea just above the artic circle, there is a 9 meter high waterfall which has been a partial obstacle for the salmon until 1980, when a fishway (pool and weir) was build. Fish passage has been controlled since 1980. Until 1997 the control of fishpassage was carried out by manual control and from 1998 the control was carried out by an electronic, infrared fishcounter, "Riverwatcher", constructed by the Icelandic company Vaki Aquaculture System Ltd. The electronic fishcounter register time for passage, both up- and downstreams and fishlength. Between 1984-1989 no control of migrating fish occurred because of security matter working in the ladder. The ladder was improved in 1989, 1994 and in 1997 an extra pool was built in the entrance to better attract fish to the entrance of the ladder. Low water level don't influence fish migration in the ladder. When the water level reaches about 600 m³ no registration of fish passage has occurred. A underwater camera was installed in late autumn 2005 for distinguish species. Some enhancement will be needed coming years to get better quality of the pictures

The run of total number of salmon has decreased from 2001 to 2006. In 2001 the total numbers of salmon that passed the ladder was the highest (9367). The total number of salmon in 2006 was 3302 which is a decrease with 45% compared to 2005 and the amount of multi-sea winter (MSW) fish decreased with about 2 500 fish. (Table 3.2.1.2, Figure 3.2.1.3).

There have been trials to count the spawning run into the **Simojoki** since 2003. A hydroacoustic split-beam technique has been employed. By now it seems evident that counts from the last four summers cover only 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 indicate minimum of 940, 680, 900 and 885 MSW spawners for the years 2003, 2004, 2005 and 2006 respectively.

About 6,000 catch samples have been collected mainly from the Finnish **Tornionjoki** fishery of salmon since the mid-1970s. Table 3.2.1.3 shows numbers 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 current decade, caught fish have gradually become older and now the average sea-age is about as high as in the late 1990s. Both in 2005 and 2006 grilse accounted for less than 10% of the catch, which may indicate relatively low abundance of the fish smolted in 2004 and 2005. The proportion of spawners of reared origin has declined to about one 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 5-20 times higher than in the mid-1980s. Annual parr densities have varied 2-4 fold during this decade, but without any clear trend. In some of the recent years, 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 phenomen.

In the summer 2006, circumstances for electrofishing were extraordinary favourable because of the very low river water level, i.e. the circumstance were opposite to those prevailing in 2004-2005. Therefore, one must be cautious when comparing the last year's results with the preceding years' results. In 2006, the mean density of wild one-summer old parr increased from the previous year by about 100% in the **Simojoki,** by 55% in the **Tornionjoki** and in **Kalixälven** the one-summer old parr was the same as in 2005 (Table 3.2.1.4). One-summer old parr were observed in a slightly higher proportion of sites than in last few years in **Simojoki, Tornionjoki** and **Kalixälven**.

The mean density of wild older parr in 2006 rose remarkably (1.5-2.5 fold) compared to the densities of 2005. 3-year old parr were relatively abundant among the older parr in the

Tornionjoki and **Kalixälven** which is coherent with the high densities of one-summer old parr observed three years before.

In **Råneälven** the time series of parr density has been shorter than that of the other rivers (Table 3.2.1.4, Figures 3.2.1.4 and 3.2.1.5). Anyhow, parr densities in the **Råneälven** show similar overall development as the densities in the other rivers of the assessment unit. The average densities have just been lower across the years in this river. One-summer old parr were observed in about the same proportion of sites as in last years.

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 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 smoltify. 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 2006, the estimated smolt runs increased from the previous year in the both rivers. The results of the smolt tarpping with mark-recapture experiments even indicated a wild smolt abundance of over one million smolts in the Tornionjoki. However, when the smolt trapping and parr density information was combined, the resulting estimate dropped to the level of 600,000-700,000 smolts. This result may underestimate the abundance because the parr density information predominantly affecting the 2006 smolt estimate was collected in 2004-2005 when the high river water level might bias the parr densities downward, i.e. faulty indicating low abundance.

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). Lately, only a few thousand smolts have annually been reared-origin. All salmon stocking except for research purposes was terminated in the **Tornionjoki** in 2002.

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

River catches and fishery

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 in **Piteälven** decreased 2006 to 20 salmon compared with 50 salmon 2005. The catch of salmon in **Åbyälven** 2006 was 15 and it's the same as in 2005 and 2004. 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 occured in 1996 when it was 4,788 kg and afterwards the catches shows a decreasing trend. The catch 2006 decreased with 70% from 240 salmon in 2005 to 101 salmon in 2006. Only two salmon was caught 2006 in **Sävarån.** The catches in Ume/Vindelälven deacresed from 200 salmon in 2005 to only 100 salmon in 2006 **.** In **Öreälven** the catch has been the same during 2004 - 2006 only 10 salmon were caught annually. In **Lögdeälven** the catches decreased 2006 to 50 compared to 2005 when the catches wax 70 salmon.

Spawning runs and their composition

In almost all rivers the counting is made by electronic, infrared fishcounter, "Riverwatcher", constructed by the Icelandic company Vaki Aquaculture System Ltd or by a underwater camera from the Swedish company Poro AB. In **Piteälven** a powerplant 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 the they installed a electronic fishcounter (Riwerwatcher). The run in the fish ladder is the entire run. The total run decreased in 2006 to 544 compared to to 1,012 in 2005. The numbers has since 1999 yearly somewhat increased to 2005 and now it is back to the level before 1999 (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 powerplant company installed a electronic fishcounter (Riverwatcher) in 2000. The run in the fish ladder is part of the entire run. The total run in 2006 decreased to only 32 salmon compared to 2005 when 94 salmon passed . (Table 3.2.1.2, Figure 3.2.1.3). The highest salmon run accured in 2001 when 112 salmon passed the ladder. 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.

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 chances for salmon to pass the natural waterfall while high water level decreases the possibility to force the waterfall. The total run has decreased yearly the three latest years from 1,707 in 2004 to 665 in 2006   (Table 3.2.1.2, Figure 3.2.1.3)..

In **Rickleån** the powerplant company built four ladders in 2002, fishpassage is controlled with a electronic counter (Poro) in the uppermost ladder. Before construction of ladders salmon passage has been closed since building the powerplant stations. The run in the fish ladder is part of the entire run. The water level don't 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 two salmon passed the fishway in 2006 and one salmon in 2005.

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. In 2006 the total run decreased to 2,548 divided in 2,362 wild and 188 reared compared to 2005 when the total run was 4, 088 (wild + reared) (Table 3.2.1.2, Figure 3.2.1.3). 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 6,052 passed the ladder (6,832 including reared).

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 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 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 m². In the summer 2006, circumstances for electrofishing were extraordinary because of the very low river water level, i.e. the circumstance were opposite to those prevailing in 2004-2005. The densities of salmon parr in electro fishing 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 2006 was made in 85 sites in 8 rivers. The densities of 0+ parr were higher in some rivers and in some the density decreased or stayed at same value as in 2005.

In **Piteälven** no consistent electro fishing surveys has been made during the 1990´s. In 2002 and 2006 surveys was carried out. The density of 0+ parr were low for both years (Table 3.2.2.1) and (Figure 3.2.2.1).

In **Åbyälven**, the mean densities of 0+ parr between 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 2006 the densities reached the highest observed density 27.2 parr/100m². In 2005 the densities of 0+ parr was 6.4/100 m² which is almost the same as in 2004. One-summer old parr were observed in about 90% 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 between 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 2006 one-summer old parr were observed in about all of 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 between 1988-1997 were about 0.6 parr/100 m² and from 1998 the mean densities has increased to 2.5 parr/100 m². The densities 2006 was almost the same as in 2005 3.9 parr/100 m². One-summer old parr were observed in about 86% of the study sites (Table 3.2.2.1), which is an increase of the average for the last four years.

In **Sävarån**, the mean densities of 0+-parr between 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 2004 and 2001. The density 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 2006 the density increased to 16.9 parr/100 m². One-summer old parr were observed in about 60% of the study sites (Table 3.2.2.1), which is the average of the last years.

In **Ume/Vindelälven**, the mean densities of 0+-parr between 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 it was 21.6 and 24.0 parr/100 m², respectively. The densities increased in 2006 compared to 2005 from 3.7 to 16.4 parr/100 m² (Table 3.2.2.1).

In **Öreälven**, the mean densities of 0+-parr between 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 in 2006 was 5,9 parr/100 m² that is almost the same as in 2005 (Table 3.2.2.1).

In **Lögdeälven**, the mean densities of 0+-parr between 1986-1997 were about 1.4 parr/100 m². In 1998 the densities increased to 13.7 parr/100m², which is the highest occurred densities. For the three latest years the densities hasincereased and in 2005 it were 11.2, which is almost the same level as in previous years. The density 2006 decreased to 6,7 parr/100 m² which is half compared to 2005. One-summer old parr were observed in almost all the study sites (Table 3.2.2.1).

In **Sävarån** 2005 and 2006 smolts of salmon and sea trouts were caught on their downstream migration using two "Rotary-Screw-traps", positioned c. 15 km upstream the mouth of the river. In 2006 total 812 wild salmon smolts and 140 sea trout were caught. In 2005 the amount was 583 wild salmon and 195 wild sea trout smolt. 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 class among caught smolts of salmon (n 232) and sea trout (n 151) was 3 years.

Control groups of caught wild and hatchery salmon and sea trout smolts were tagged 2005. The number of recaptured tagged fish varied between c. 7- 27 % per group of fish with highest rate of recapture for wild salmon smolts (26,9 %) while tagged hatchery salmon smolts showed the lowest number of recaptures (7 %) (Lundqvist et al. 2006).

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 decreased 2006 to 40 compared with 61 in 2005.. In 2002, only one salmon was caught and in 2001 and 2000 18 and 2 salmon were caught by angling, respectively.

Parr densities

The densities in **Ljungan** of 0+ parr/100 m² between 1990-2005 varies between 3.1 and 45.3, and the mean densities was 15.10+ 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 (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**, the catches was almost the same in 2006 as in 2005 only 9 salmon where caught compared to 12 salmon in 2005. In 2004 and 2003 the catch was 89 respective 83 salmon. The catches in 2002 were 143 salmon. 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 now days basically a catch and release fishing. This could be a reason for the decreasing catches.

In **Mörrumsån**, the catches decreased 2006 to 171 salmon compared to 325 salmon in 2005. The catch in 2004 and 2003 was 536 respectively 411 salmon. 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.

Parr densities

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 1992-2005 between 24–71 parr/100 m² and the mean density during this time is 47 parr/100 m². The highest densities of 0+ parr occurred in 1997. The density in 2006 decreased to 13. 0+ parr/100 m² compared to 2005 when the density was 60 0+ parr/100 m², and 45 0+ parr in 2004. The densities of older parr have varied between 2-10 parr/100 m² in 1992-2006.

In contrast to other Swedish rivers, the smolt production in Emån river has not showed any positive signs after the regulations that were initiated in the 90´s (Michelsens et al. 2007). An analyses 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 (WGBAST 2007; working paper no 6). Earlier work in WGBAST has estimated the spawning areas available for salmon in Emån River 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 **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 1973-2006 between 12–307 parr/100 m². The highest densities occurred in 1989. In 2006 the densities of 0+ parr decreased to 61 parr/100 m² compared to 2005 when the density was 98 parr/100 m². The densities have, during the five last years, been just below 100 parr/100 m². 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 2006 only one 0+ parr hybrid was caught, the proportion of older hybrid parr was about 5%. In 2005 the density of 0+ hybrids was 14 parr/100 m² which is higher than in last three years. 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)

Smolt production estimates reported in earlier years (e.g. Table 6.3.5.1, WGBAST report 2006) for Latvian rivers before 2001 have been excluded, except in the cases of the rivers Salaca and Gauja (Table 5.3.5.1). The reason why they are excluded is the lack of documentation on methods and basic data collected. Also, the smolt production estimates of the Lithuanian river Nemunas basin have been revised downward for the years before 1999 (Table 5.3.5.1).

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 1996-2006. The number of parr/100m^2 was low during all period (Table 3.2.5.1 and Figure 3.2.5.1). Parr were found in 2005 and 2006 compared to 2003 and 2004 when no parr where found. A part of potential spawning area was cleaned from excessive vegetation and loosens in autumn 2004 and 2005 but no effects was observed in 2006.

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 electro fishing stations.

The salmon parr was found in background monitoring station too. It means that all together the salmon and sea trout as well other fish species monitoring system was improved.

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

In 2006, 20 sites were sampled in the river **Salaca** and their tributaries- 10 in the rapid and 10 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, too. Average density of 0+ salmon parr was 77.3 per 100/m^2. Density of 0+ wild salmon parr in the river Jaunupe was 7.0 individuals per/100 m^2. Density of 1+ and older salmon parr was 17.9 per sampling unit.

Smolt trap in the river **Salaca** was in operation between 25 of April till 8 of June, 2006. In total salmon 2798 and 1174 sea trout smolts were caught, 978 of them were marked using streamer tags and 165 by finclipping for total smolt run estimation. The rate of catch efficiency was same like in previous years and fluctuated from 3- 20% (11.3% in average). As estimated, in total 30,000 salmon and 12,000 sea trout smolts migrated from the river **Salaca** in 2006. This is in coherence with the high parr densities observed in the previous year.

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 decreased in comparison with previous year.

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

Wild salmon par was found in the river Vitrupe. Age structure testify that salmon reproduction occurred in the river at least in 2004 and 2005. The 0+ parr densities in this river was 16.7, as well older parr 0.3 per/100m^2.

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

Lithuanian rivers

Lithuanian rivers are typical lowland ones. 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 (Kesminas, Virbickas, 2001). River trout inhabits 76 rivers, Baltic salmon spawned in 14-16 Lithuanian rivers. Leaning on historical data and today's situation, salmon rivers can be divided into some groups in Lithuania: 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 (Salmon restoration program, 1998).

All data during the last decade suggest that in Nemunas basin rivers total amount of salmon smolts consist only 5200 individuals (annual mean). All artificially reared smolts didn't include in this statistic. At present river, **Zheimena**, and its tributary **Mera** and **Saira** inhabits purely natural salmon population. Mixed, i.e. natural and reared populations are in the rivers

Neris, **Šventoji**, **Vilnia**, **B. Šventoji** and **Dubysa** and **Siesartis**. Populations formed of reared salmon inhabit **Virinta**, **Vokė** and **Minija** rivers and some of their smaller tributaries. In the latter rivers artificially reared salmon juveniles are being released several years already

Electrofishing is the main monitoring method for evaluation of 0+ and older salmon abundance. At 2006, monitoring of salmonids covered 150 sites, 80 rivers in Lithuania. Monitoring covers all main salmon rivers (including all potential rivers) in Lithuania. In 2004 salmon parr were found in 4 biggest rivers in the Lithuania: southeastern part - **Zheimena**, **Neris**, **Šventoji** - **Vilnia**, **Vokė** and **Siesartis**. In the western Lithuania, salmon parr were found in river **Šventoji** (Baltic sea) in central Lithuania river **Dubysa** and some small tributaries.

Density of salmon juveniles in Lithuanian rivers ranged within 0.0-4.1 ind./100 m^2, (mean 0.9 ind./100 m^2). Data on salmon juvenile densities are presented in Table 3.2.5.2 and Figures 3.2.5.3 and 3.2.5.4.

River **Neris**: In 2006 wild salmon parr were caught in 3 sites in Neris River, their density ranged within 0.1 – 0.67 ind./100 m^2 (average density is low – 0.06 ind./100 m^2).

In river **Zheimena** in 2006 the average density of salmon parr in the index river Žeimena was 2,5 ind./100 m^2. The maximum density – 5,0 ind./100 m^2 was recorded in middle river course. Because of contrararily the last few years, salmon parr wasn't recorded in the tributary Mera. In 2006 the average density of salmon 0+ parr in the index river Žeimena increased to 2.5 ind./100 m^2 compared to 1.3 parr/100 m^2 in 2005. The maximum density (14.4 ind/100 m^2) was recorded in 2004 below the town Pabradė.

A salmon restocking program started in 1998 in Lithuania and every year there are a lot of measures taken to increase salmon population – artificial rearing, construction of fish ladders, protection of spawning ground, stock monitoring, scientific projects. Implementation of these measures helped to stabilize salmon population in Lithuania and prevented possibility for salmon to extinct in Lithuania, therefore salmon production is increasing very slowly. Also salmon smolt production is affected by other factors as well. Last few years summer temperature in Lithuania were well above average and as result water levels in the rivers were well bellow normal and water temperatures stayed very high for few moths. Also one of main concerns in salmon rivers remains pollution. Another important factor in Lithuanian rivers which are lowland type only there are lack of suitable habitats for salmon parr as only some stretches are suitable to parr. In Lithuanian rivers have quite high mortality rate caused due to high predator's density which are significantly higher compare with typical salmon rivers in north 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. A renewal of potential salmon rivers has 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 programme 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 3.3.2.1).

3.3.2 Potential rivers by country

Finland

The rivers **Kuivajoki**, **Kiiminkijoki** and **Pyhäjoki** have been 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. In 2006, totally 50,500 smolts (Tornionjoki stock) and 145,000 one-year old parr (Oulujoki stock) were stocked in the Pyhäjoki. In the Kuivajoki, 30,000 smolts and 152,400 one-year old parr of the Simojoki origin were stocked. In the Kiiminkijoki, 47,300 smolts and 278,300 parr of the river Iijoki origin were stocked in 2006. In comparison with the few previous years, the number of stocked parr increased, but the number of stocked smolts decreased.

In 2006, river catches of salmon were very poor in all these rivers. In total, 77 kg salmon were caught from the river **Kiiminkijoki** and 16 kg from the **Pyhäjoki**. No salmon were caught from the river **Kuivajoki**

The natural reproduction of salmon in the potential rivers has been monitored by electrofishing of one-summer old (0+) parr (Table 3.3.2.1). Wild parr densities in the **Pyhäjoki** (0.2 wild parr/100 m^2) stayed at a very low level as in previous years. Remarkable decrease happened in the **Kiiminkijoki** (2.3 wild parr/100 m^2) from the year 2005 (8.2 wild parr/100 m^2), but this was mainly due to exceptionally high density in one sampling site in 2005, which strongly affected the average value of that year. The amount of wild salmon parr slightly increased in the **Kuivajoki,** where the wild salmon parr densities rose up to 3.2 parr/100 m^2. This is the highest average density detected in the Kuivajoki since the restocking program was started in 1998.

Small-scale natural reproduction was observed also in the **Merikarvianjoki** at the Bothnian Sea (sub-div 30), and in the **Vantaanjoki** at the Gulf of Finland (sub-div 32). The density of wild salmon parr in the lower reaches of the **Kymijoki** (sub-div 32) has been in recent years rather high, about 60 parr/100 sq.m in 2005 and 29 parr/100sq.m in 2006. In these rivers, salmon smolt 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 3.3.1), and the results are described in more details under the Section 6.

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 (0+ fry) and in autumn (0+ parr). In May 2006 30.000 salmon smolts were released into the 3 potential rivers: **Šventoji** (Neris Basin)**, Dubysa and Minija**. The results of stocking were monitored by electrofising. Research results revealed that restocking efficiency varies in different years. The ratio of survived/released juveniles (in %) over the first summer in smaller rivers was as follows: **Vilnia** – 11.0% **Kena** -17%, **Siesartis** – 17.3%, **Vokė** 31.0 %. Results of restocking in larger rivers – **Neris**, **Šventoji** were worse. Restocking efficiency was only 1.8-5.7%. The survey indicates that in the larger rivers mortality of juveniles is greater, the estimation error being greater. Data on releases of artificially reared salmon are presented in Table 3.3.2.1.

Salmon density was higher in the some larger tributaries of Neris and Šventoji River: salmon parr were recorded in the one stretch **Šventoji River** was -12.67 ind./100 m^2, average densities in this rive was 4.5 (0+ – 3.15 >0+ - 1.35) ind./100 m^2 and **Vilnia River** 3.12 (0+ -

0.94, >0+- 2.63) ind./100 m^2. In the next potential salmon rivers parr density is low (average 0- 1.0 ind/100 m^2) Table 3.3.2.1.

Estonia

The rivers **Valgejõgi, Jägala** and **Vääna** were selected as potential rivers for Salmon Action Plan. In all these rivers were carried out enhancement releases. In 2005 the total number of released one year old salmon was 30 000 and two years old salmon about 24 000.. In 2006 about 32 000 and 16 000 respectively.

In the River **Valgejõgi** wild parr occured in 1999-2006, in the River **Jägala** in 1999, 2001, 2004 and 2005, in the River **Vääna** in 1998, 2000, 2002 and 2006. On the River **Jägala** 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 next years.

Poland

There are no officially stated, according to IBSFC criteria, potential rivers in Poland. 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.

In 2006 spawners were observed in **Vistula** River system but there are no data on wild progeny. About 100 fish were caught for breeding. It was similar as in previous years and has allowed to collect ca. 300,000 eggs. Totally 242,000 smolt and 265,000 fry were stocked in the drainage system.

Natural spawning was observed in the **Drawa** R. (the **Odra** R. system) but numbers of salmon nests were lower then in previous years and not higher then 5. There are still no evidence of wild progeny resulting from this spawning. Total of 34,000 of smolts and 70,000 fry were released in the river system.

Some nests, assumed to be salmon nests, were also stated in **Wieprza** River. Number of spawners caught 2006 in this river for breeding was similar as in 2005 what allowed to collect c.a 500,000 egges 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 2006 total of 178,000 smolt, 95,000 fry and parr and 30,000 alevins were released into Pomeranian rivers.

Russia

The river **Gladyshevka** has been selected to the Russian Salmon Action Plan programme. The salmon stocking with hatchery reared (Narva origin) parrs and smolts are going on in this river. About 3500 of one-year old salmon parr were released here in 2006.

Wild salmon parrs have occurred here since 2004. In 2006 one-summer old and two-summer old wild salmon's parr were detected on three of the Gladyshevka's rapids, too. The densities were on the level 3-18 parrs / 100 m^2 (the mean — about 14 parrs / 100 m^2).

Sweden

In Sweden, four 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 in recent year (Table 3.3.2.1).

3.4 Reared salmon populations

The reared stocks in Sweden were severely affected by the M74-syndrome from the spring of 1992 onwards. The mortality caused by M74 decreased in 1998 and increased slightly again in 1999. The M74 mortality decreased to very low levels in 2003 and stayed low in 2004-2005 and in 2006 M74 increased to 20% and preliminary results for 2007 indicates that the mortality will be the same level as last year. 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 2006 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 8 (eight) salmon spawners were caught. The reason was uncertain but it is believed that seal predation may be an 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 2007 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. An 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 extincted in the mid 1980s. A restoration programme was started in 1984 when eyed eggs of Daugava salmon was imported. Import off 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 2006 smolt releases has increased to 0.47.

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. 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 it is expected that 16,000 tagged salmon will be released. After this no more releases has 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 (Figure 8.1.2.1) Lower catches have been explained by reduced TAC and strong regulations in coastal fishery. However, no sub-stantial 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 2003-2006 indicate that the proportion of reared salmon has been less than 50 % in many of the Baltic Sea fisheries (Table 2.8.1). On the basis on the ratio in the smolt phase, the expected proportion was about 20 %. When proportions are extrapolated to the total catches the results suggest a significantly lowered initial survival for the reared smolts and being also lower than the wilds' one.

Releases

The total number of released smolts in assessment units 1-5 (sub-divisions 22–31) was about 4.7 million and 0.7 million in assessment unit 6 (sub-division 32) making a grand total of 5.5 million smolts in 2006 (Table 3.4.1).

Releases of younger life stages are presented in the Table 3.4.2. and 3.4.3. These releases have consisted in many areas of hatchery surplus and releases has been carried out at a poor rearing habitats. In such cases mortality among parr is high and releases gain only to small amounts of smolts. In stead when releases has taken place at the potential or wild salmon rivers with a 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 year in the most of the assessment units. Roughly estimated these releases from year 2005 will produce less 0.2 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

In the 1990s there was an outbreak of the M74 syndrome in the Baltic Sea. The 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 hatcheries in hatching years 1992-1996 (Table 3.5.1). Apart from the observations in the hatcheries, the indices of syndrome was also found as decreased parr densities in some of the wild salmon populations from 1992 onwards (Karlström 1999). Romakkaniemi et al. (2003) also stated that despite of rather high levels of spawners during the early 1990s the parr densities declined. According to them, the lowest number of age-0 parr occurred during 1992-1994, and also in the years 1995 and 1996 the parr numbers were low in many rivers. Since 1997 the M74 frequency, as a mean of monitored populations, has been in most cases below 40%, but in the years 1999 and 2002 in some rivers over 50% M74 frequencies, expressed as the % of females whose offspring were affected by M74, have been observed in the monitoring. The year 1998 was the year of the lowest M74 frequency since 1992. In 2001 it was about 28%, and in 2002 again increased to 40%

The mean yolk-sac fry mortality in Finnish rivers in 2003 was, for the first time for over a decade, below 10%; only 3-11% of the spawners, which ascended the Rivers Simojoki, Tornionjoki and Kymijoki produced M74 offspring, and the M74 was modest so that only a part of the yolk-sac fry of each M74 female died. Neither in 2004, when the M74 frequencies were 0-7% in Finnish rivers, no offspring group with total M74 mortalities were detected, however, in 2005 (when no material from the River Tornionjoki was in monitoring) among females caught from the Rivers Simojoki and Kymijoki one such offspring group was observed resulting in M74 frequencies 3% and 6%, respectively. In Swedish rivers M74 frequency was similarly low, 0-17%, 0-4% and 0-7% in different rivers in 2003, 2004 and 2005, respectively (Table 3.5.1). The mean M74 frequency of the monitored Finnish and Swedish populations was 9%, 3% and 3% in the years 2003, 2004 and 2005, respectively. The data of the years 1992-2005 was based on the results from two to three Finnish and from seven to nine Swedish rivers. In 2006 the River Kemijoki from Finland was involved in the monitoring. Then the mean M74 frequency of Finnish and Swedish monitored rivers was clearly higher than in 2003-2005, on average 20% with a variation among the rivers of the Gulf of Bothnia ranging between 18-39%. The highest percentage was from the River Kemijoki.

In Estonia in 2002 (hatching year) the offspring of 3 females out of 41 caught in the River Narva (7%) suffered from M74. Five females from the River Selja did not show the M74 syndrome. Offspring of 3 females from 40 caught in the River Narva in 2003 had M74 syndrome. Three females from the River Selja were healthy. Offspring of one female out of 50 caught in the River Narva suffered from M74 syndrome in 2005. Data of year 2006 hatching was not available.

The mortality in Table 3.5.1 has predominantly been given as the percentage of females whose offspring were affected by M74 or, from three rivers before the year 1995, as the percentage of the mortality of yolk-sac fry (see annotation 2 in the Table 3.5.1). The estimates from Swedish rivers are in all cases given as the percentage of females affected by M74. In the Rivers Simojoki and Tornionjoki (assessment unit 1, sub-division 31) as well as in the River Kymijoki (assessment unit 6, sub-division 32), the estimates of the mortality since the years 1992, 1994 and 1995, respectively, have been made in Finland using both methods (Table 3.5.2). In the River Simojoki in 1992-2002 the mean yolk-sac fry mortality was 53% and the proportion of M74-females was 61% indicating a mean difference of 8% between the two methods. In the River Tornionjoki in 1994-2002 the mean yolk-sac fry mortality was 52% and the proportion of M74-females was 56% with the mean difference of 4%. 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. However, in years when the proportion of females whose all offspring die is high, the yolk-sac fry mortality may be even higher than the proportion of M74 females, i.e., the M74 frequency.

In 1995-2002 there was a tendency that the M74-mortality was higher in Finland than in Sweden (Figure 3.5.1), but differences among stocks of about the same magnitude occur also within Sweden. Most probably the difference between Finnish and Swedish estimates arises from the fact that in Finland the eggs of all females caught are taken in monitoring, whereas is Sweden the eggs of females that display wiggling behaviour have been excluded from monitoring since 1993 or 1994. Very low thiamine content in the females causes “wiggling” behaviour (Bengtsson et al. 1999), and all offspring of such females always die due to M74 syndrome. Earlier, the reason to the difference between the Finnish and Swedish numbers was thought to be the difference in the incubation times between Finland and Sweden, i.e. that in Finland the development of yolk-sac fry is monitored for a more extended period (450 as day-degrees) and then also milder, later appearing M74 cases are registered. However, this explanation is not apparent. The established practice results in most cases in slightly higher percentage in M74 frequency than in the mean yolk-sac fry mortality.(http://www.rktl.fi/english/fish/environment_of_fish/syndrome_in_baltic/).

Obviously there are river-specific differences in M74 intensity. In the River Kymijoki M74 has in many years also been milder than in the Rivers Simojoki and Tornionjoki.

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).

It seems highly likely that M74 is linked to the diet of salmon in the Baltic and changes in the ecosystem (see Ikonen 2006). The incidence of M74 is statistically well correlated with parameters describing the sprat stock (Karlsson et al. 1999), but any causal connection has not been shown. The occurrence of M74 has been linked to low levels of thiamine (vitamin B1), and yolk-sac fry suffering from M74 can be restored in hatchery to a healthy condition by treatment with thiamine (Koski et al. 1999). A low level of carotenoids (pale colour) in eggs is also statistically linked to occurrence of M74 in female spawners, but there does not seem to be such a causal relation as for thiamine. However, it is not excluded that some M74 symptoms are also due to deficiency of carotenoids, principally that of astaxanthine (Pettersson and Lignell 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). These fish were collected in the winter 1994-1995. The concentrations of dioxins and PCBs were higher in sprat (3-10 years old) than in herring (1-3 years old) and in particular contents of some compounds were high in all age groups of sprat. The concentrations of the same organochlorines in salmon spawners ascended the River Simojoki increased coincidently with the outbreak of the M74 syndrome indicating that sprat might have been the principal source of organochlorines for salmon (Vuorinen et al. 2002).

The thiamine content in eggs is a good indicator of the occurrence of M74, because thiamine is measured chemically (Vuorinen and Keinänen 1999). In the River Simojoki salmon the mean yolk-sac fry mortality in 1994-2003 correlated significantly ($P < 0.01$) negatively with the mean free thiamine concentration in unfertilised eggs, and thiamine can to some degree be used to predict the percentage of M74 females. The thiamine-based prognoses in hatching year 2007 in Table 3.5.1 are based on analysis of thiamine concentrations in eggs of individual females and suggests in the River Tornionjoki a higher M74 frequency than in the years 2003-2005.

The influence of M74 on the development of wild populations particularly in the Gulf of Bothnia has been a major concern. 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 (Figure 3.5.2). It shows that the densities of 0+ parr were low in years 1993-1995 when the incidence of M74 was high (see also Karlström

1999 and Romakkaniemi et al. 2003), while parr densities were better correlated to the egg deposition in years when the incidence of M74 was low (1986-1991 and 1996-2004).

In section 6.3.6, a Bayesian hierarchical model is applied to the Gulf of Botnian (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 6.3.6.1, Figure 6.3.6.1). The most of the wild stocks and all small stocks of the GOB belong to this group as occurrence of M74 is not monitored in them. The results demonstrate the substantial uncertainty in our knowledge about the M74 mortality in unmonitored stocks. The results anyhow indicates that, particularly in the last few years, the actual M74 mortality among offspring has been lower than what proportions of M74-females indicated.

3.6 Summary of the information on wild and potential salmon rivers

Wild smolt production versus the carrying capacity (smolt production capacity) is one of the ultimate measures of management success, and this measure has been selected as the basis of the current Baltic salmon management. 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 (assessment units 1-3) rivers have shown increase in abundance while, most of the Main Basin (assessment units 4-5) 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 minuscule flickering 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.

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 3.5.3), 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 were caused by 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 have 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 shows a yearly increase in most of the rivers. In some rivers the density of older parr increased in 2006 to the highest level ever recorded. One explanation can be the very low water level which can increase the catchability of especially older parr.

Catch statistics and fish ladder counts indicate differences in the development of the number of spawning migrants among rivers since the late 1990s. Although difficult electrofishing conditions in 2004 hampered data collection, it seems very likely that the parr year-class hatched in 2004 is one of the weakest in this decade. This is in coherence with the decrease in spawner counts from 2002 to 2003 in some rivers, however, not all rivers have shown similar reduction. Thus, in two last years 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 in 2002-2003 and 2006 which might have affected river catches and the fish migration in some ladders especially in 2006. Counted number in 2006 of salmon in ladders decreased with about 50% overall compared to 2005.

Whatever the actual development in spawning runs has been, most data from the Gulf of Bothnia rivers have shown that the increasing trend has now levelled off in the juvenile production, or even turned to **decrease** as in the river **Ljungan** (assessment unit 3) except for 2005 when the densities increased to the highest measured value. 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 decrease until 2005 in M74 mortality has probably prevented collapse of wild reproduction but in 2006 and 2007 the M74 mortality seems to increase (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 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 threshold level which is highly likly dependent on insufficient numbers of salmon enter 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 **Pärnu** river in 2003-2004 but in 2005 and 2006 the densities increased (Table 3.2.5.1, Figure 3.2.5.1). Since 1997, parr densities in the river **Salaca** in Latvia have been on a higher level than before that (Table 3.2.5.1, Figure 3.2.5.2). There has been remarkable variation in the annual parr densities, as well between different rivers too. In the river Salaca wild salmon parr production stay at the high level ~100 ind./100 m². In the river Gauja and Venta parr production level decreased in comparison with 2004- 2005. It seems that in some of the small and weak salmon rivers Barta, Saka, Peterupe, Vitrupe salmon reproduction occurs only occasionally. With regard to set the management objective and management regime the small salmon rivers stocks might be unrecoverable..

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 precarious state of several wild salmon stocks in the assessment unit 5. These stocks might be in a greater risk of extinction than any of the stocks in the assessment units 1-3 (Gulf of Bothnia).

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 -2006. Also, in the river **Mörrumsån** and **Rickleån** opening of a new fish ladder in 2004 respectively 2002 has increased reproduction area accessible for salmon to spawn.

In Lithuania yearly 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 lacks of suitable habitats for salmon parr.

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 Tornionjoki/Torneälven.

	Simojoki (au1) catch, kilo	Kalixälven (au1) catch, kilo	Byskeälven (au2) catch, kilo	Tornionjoki/ Torneälven (au 1) Finnish catch, kilo	Swedish catch, kilo	Total catch, kilo	CPUE grams/day
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)]/736[3)]
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	8690	2700	25560	12458	38018	541
2006		3140	555	11640	4336	15976	311

1) Ban of salmon fishing 1994 in Kalixälven and Byskeälven and the Swedish tributaries of Torneälven.
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										222	177	443	14
1985					30					569	330	904	10
1986					28					175	128	227	2
1987					18					193	87	246	13
1988					28					367	256	446	23
1989					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	2044	185	116	220	10	14	447	721	1614	802	2208	52
2000	1398	2519	204	119	534	11	36	908	1157	946	601	3367	
2001	4239	9367	668		863	44	112	1435	2085	1373	951	5476	
2002	6190	8930	1243		1378	52	95	1079	1316	3182	2123	6052	
2003	3902	4961	1305		1418	15	21	706	1086	1726	1112	2290	
2004	3606	4022	1269		1628	25	51	1331	1707	1338	661	3275	
2005	4732	6631	897		1012	19	94	900	1285	2464	1479	3536	
2006	2164	3302	496		544	22	32	528	665	1733	1093	2362	

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
N:o of samples	728	283	734	2114	505	355	244	438	628	210
A1 (Grilse)	9%	53%	35%	7%	33%	21%	18%	21%	8%	6%
A2	60%	31%	38%	59%	51%	64%	34%	48%	49%	45%
A3	29%	13%	24%	28%	12%	13%	40%	25%	38%	40%
A4	2%	2%	3%	4%	2%	1%	7%	4%	2%	6%
>A4	0%	1%	<1 %	2%	2%	2%	2%	2%	2%	3%
Females, proportion of biomass	About 45 %	49%	75%	71%	64%	67%	77%	64%	62%	63%
Proportion of reared origin	7%	46 %*	18%	15%	21%	7%	9%	3%	3%	1%

* 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 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
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	
Tornionjoki							
1986	0.51	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	1.31	47%	32	
1990	0.51	0.78	0.36	1.14	40%	68	
1991	2.37	0.61	0.45	1.05	69%	70	
1992	0.24	1.80	0.36	2.16	16%	37	Flood; only a part of sites were fished.
1993	0.51	0.44	2.49	2.93	44%	64	
1994	1.00	0.48	1.32	1.80	43%	92	
1995	0.50	1.47	0.64	2.11	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	13.24	4.41	0.53	4.94	92%	84	
1999	8.34	8.78	4.20	12.98	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	

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Table 3.2.1.4 continues…

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
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	
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	

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				Simojoki				Sävarån	
	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%

*) 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 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
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			1.69		7	
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	

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Table 3.2.2.1 continues…

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
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	
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	

table continues on next page

Table 3.2.2.1 continues…

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
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	4.6			5.2	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	
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			1,1	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	
Öreälven							
1989	0			0.01	0%	14	
1990	0			0	0%	8	
1991	0			0,25	0%	8	
1992	0			0,25	0%	6	
1993	0			0.03	0%	13	
1994	0			0	0%	8	
1995	0,21			0,04	30%	10	
1996	0,44			0	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			0.8	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	

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Table 3.2.2.1 continues…

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Lögdeälven							
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			4.1	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	

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 m2 by age group 0+	1+	2+ & older	>+0 (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Ljungan							
1990	5.5			4.8	67%	3	
1991	16.5			0.6	100%	3	
1992							
1993							
1994	6.9			0.2	100%	3	
1995	11.9			0.9	100%	3	
1996	8.6			6.5	100%	3	
1997	19.6			2.1	100%	6	
1998						0	No sampling because of flood
1999	17.4			7.9	80%	5	
2000	10.6			6.5	86%	7	
2001						0	No sampling because of flood
2002	23.9			2.6	100%	8	
2003	11.6			0.2	100%	8	
2004	3.1			1.4	56%	9	
2005	45.3			2.3	100%	9	
2006							No sampling because of flood

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 m² by age group 0+	>0+	Number of sampling sites
Mörrumsån			
1973	32	33	
1974	12	21	
1975	77	13	
1976	124	29	
1977	78	57	
1978	145	49	
1979	97	65	
1980	115	60	
1981	56	50	
1982	117	31	
1983	111	74	
1984	70	67	
1985	96	42	
1986	132	39	
1987			
1988			
1989	307	42	11
1990	114	60	11
1991	192	55	11
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

River year	Number of parr/100 m² by age group 0+	>0+	Number of sampling sites
Emån			
1967	52	4	
1980-85	52	8	
1992	49	10	
1993	37	9	2
1994	24	7	2
1995	32	4	4
1996	34	8	4
1997	71	6	4
1998	51	6	2
1999	59	7	4
2000	51	3	4
2001	37	3	4
2002	57	4	4
2003	46	4	7
2004	45	4	6
2005	60	4	7
2006	13.1	1.3	7

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	Number of parr/100 m^2 by age group		Number of sampling
year	0+	>0+	sites
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
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
Gauja			
2003	<1	<1	5
2004	7.9	<1	7
2005 [2]	2.7	1.3	5
2006	<1	0	7
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
Amata			
2003	0.0	<1	3
2004	7.9	3,4*	3
2005	2.7	1.3	3
2006	16.7	3.4	3

[2]) tributaries to Gauja

*) reard fish

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

River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
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
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
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
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	

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	Parr and smolt production from releases	Spawners in the river	Wild parr production	Wild smolt production
Kåge älv	SE	31	yes	3,4	39	700-11600	yes	yes	c,f,j,n	2	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	2	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/Montta	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/Montta	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
Valgejögi	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	Nemunas	no	no	0	0
Sventoji	LI	26	yes	2,3	7	12000	yes	yes	m,c	2	Nemunas	yes	yes	555	219
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/Drav	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 3.3.1.2 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 m² 0+	Number of parr /100 m² >0+	Number of sampling sites
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
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
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
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

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 m² 0+	>0+	Number of sampling sites
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
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
Estonia	6	32	**Valgejõgi**			
			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
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	<1	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
Russia	6	32	**Gladyshevka**			
			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

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
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
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
Lithuani	5	26	**Širvinta**			
			2004	1.00	0.00	2
			2005	1.00	0.00	2
			2006	0.00	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
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
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
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

Table 3.4.1 Salmon smolt releases by country and assessment units in the Baltic sea (x1000) in 1987-2006.

			year																			
Assessment unit	**Country**	**Age**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
1	Finland	1yr	76																			
		2yr	1445	1671	1377	1106	1163	1273	1222	1133	1438	1394	1433	1530	1542	1679	1630	1541	1361	1551	1184	1395
		3yr			21	5			0			1	1	1			1					
1 Total			1521	1671	1398	1111	1163	1273	1223	1133	1438	1395	1434	1531	1542	1679	1630	1541	1361	1551	1184	1395
2	Sweden	1yr	292			8					22						5					
		2yr	976	901	771	813	809	816	901	804	675	711	786	803	784	693	795	802	758	748	779	685
2 Total			1267	901	771	821	809	816	901	804	698	711	786	803	784	693	800	802	758	748	779	685
3	Finland	1yr	202	92	105	172	130	97	210	100	95	103	47	36	29	34	16	17	31	7	27	4
		2yr	435	486	313	277	175	178	135	201	235	257	125	188	202	189	235	211	155	163	294	270
		3yr	19																			0
	Sweden	1yr			10	12	11	41	10		103	43	69	43	38	35	47	84	162	96	273	268
		2yr	1026	983	1170	973	962	1024	1041	808	457	1011	1063	1072	864	1060	933	867	902	808	888	719
3 Total			1682	1561	1598	1434	1278	1339	1396	1109	889	1414	1304	1339	1132	1317	1231	1178	1248	1074	1482	1262
4	Denmark	1yr	62	60	46	60	13	64	80		70		103	30	35	72			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
4 Total			317	323	509	435	407	337	548	246	87	76	167	35	35	84	9	7	19	19	23	28
5	Estonia	1yr			17	18	15	18	15													
	Poland	1yr		1						22	129	40	280	458	194	309	230	186	262	207	161	385
		2yr								2	107	77	30	80	175	60	24	86	53	58	69	79
	Latvia	1yr	686	1015	1145	668	479	580	634	616	793	699	932	902	1100	1060	1069	867	961	777	566	814
		2yr	224	49	39	36	31	34	86	58	33	60	8	49	41	46		64	34	38	175	61
	Lithuania	1yr													11				9	4	11	
		2yr																				30
5 Total			910	1065	1201	722	525	632	735	698	1062	876	1250	1489	1521	1475	1324	1203	1317	1084	983	1371
sment units 1-5 Total			**5697**	**5521**	**5476**	**4523**	**4181**	**4397**	**4802**	**3990**	**4174**	**4472**	**4940**	**5197**	**5015**	**5248**	**4993**	**4730**	**4704**	**4476**	**4451**	**4741**
6	Estonia	1yr							22	33		30	18	52	36	69	129	101	86	82	96	125
		2yr		1									29	90	58	35	34	40	35	46	46	48
	Finland	1yr	278	81	85	80	67	149	167	165	135	169	77	60	109	83	85	89	86	62	75	13
		2yr	429	415	372	363	331	315	190	198	284	346	222	253	326	362	400	338	266	274	325	276
		3yr	12																			
	Russia	1yr	85	113	81	100	102	13	128	78	124	102	174	85	165	77	103	136	70	271	233	247
		2yr	3	2	2	30			9	22	18	18	6	12	12	41	135	1	107	85	81	33
6 Total			**808**	**611**	**541**	**574**	**500**	**477**	**516**	**496**	**561**	**665**	**526**	**552**	**705**	**668**	**886**	**705**	**650**	**820**	**856**	**742**
Grand Total			**6505**	**6133**	**6016**	**5096**	**4682**	**4875**	**5319**	**4486**	**4735**	**5138**	**5465**	**5749**	**5720**	**5916**	**5879**	**5434**	**5354**	**5296**	**5307**	**5483**

Table 3.4.2. Releases of salmon eggs, alevin , fry and parr to the Baltic Sea rivers by assessment unit in 1995-2006.

		age						
Assessment unit	year	eyed egg	alevin	fry	1s parr	1yr parr	2s parr	2yr parr
1	1996	73	278	92	338	685	15	
	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					390	10	
	2004				63	256		
	2005		98		96	453	15	
	2006		330		14	794		
2	1996			362	415	117		
	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	1996	255		614	414	1		
	1997	482	2	596	390	60	47	
	1998	691		468	359	99	148	
	1999	391		16	443	4		
	2000	516		158	239	30		
	2001	177		736	263			
	2002	74		810	161			
	2003			655	56	5		
	2004			503	6			
	2005			151	2	48		
	2006			295		119		
4	1996			114	7	20	56	
	1997			159				
	1998				7		4	
	1999					3	1	
	2001			40			2	
	2002			88				
	2003			42				
	2005			70				
	2006			45				
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		
6	1996	449			15			
	1997				6	159		
	1998	514				121		
	1999					158		
	2000	267	11			150		
	2001		74			165		
	2002	20	102		640	248	13	5
	2003	21	120	120	240	242	35	
	2004		294		229	205	3	
	2005	80	26		263	119		
	2006				197			
	1998				7		4	
	1999					3	1	
	2001			40			2	
	2002			88				
	2003			42				
	2005			70				
	2006			45				
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		
6	1990	13	176			206		
	1991	622	122			203		
	1992		201		100	85		
	1993	448	19	100	4	148	15	
		620				153		
	1995	268	74			168		
	1996	449			15			
	1997				6	159		
	1998	514				121		
	1999					158		
	2000	267	11			150		
	2001		74			165		
	2002	20	102		640	248	13	5
	2003	21	120	120	240	242	35	
	2004		294		229	205	3	
	2005	80	26		263	119		
	2006				197			

Table 3.4.3. Releases of salmon eggs, alevin , fry and parr to the Baltic Sea rivers by country unit in 1996-2006.

		age						
country	year	eyed egg	alevin	fry	1s parr	1yr parr	2s parr	2yr parr
Estonia	2001					55		
	2002				179	34	11	
	2003				210	86		
	2004				94	82		
	2005				48	24		
	2006					12		
Finland	1996	522	278	92	353	685	15	
	1997		1035	459	326	993	14	
	1998	514	687	198	690	703		
	1999		1054	25	532	1081	15	
	2000	267	846	27	402	1085		
	2001		74		98	1189		
	2002	20	102	19	145	854	7	5
	2003	21	120			481	10	
	2004		294		63	378		
	2005	80	124		96	548	15	
	2006		330		14	896		
Lithuania	2001			100	20			
	2002			70	1	8		
	2003			109				
	2004			120	30			
	2005			60	33			
	2006							
Latvia	2001				76	14		
	2002				105	25		
	2003				295			
	2004						10	
	2005				50			
	2006				181			
Poland	2002			90				
	2003				220			
	2004				22	11		
	2005		420	139	141			
	2006		30	376	56	1		
Russia	2002				461	136		
	2003			120	30	70	35	
	2004				135		3	
	2005				215			
	2006				197			
Sweden	1996	255		1090	836	138	56	
	1997	482		1580	785	146	47	
	1998	691		1437	760	289	154	
	1999	391		386	961	74	5	
	2000	516		646	716	101		
	2001	177		1597	606	83	2	
	2002	74		1157	496	127		
	2003			1140	298	45		
	2004			703	161			
	2005			933	62	48		
	2006			341	80	54		

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 1985-2006 with projections for year 2007. 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
Simojoki (2)	31		*6*	2	6	*3*	*14*	4	53	74	*53*	92	*86*	91	31	59	44	41	47	7	7	3	*18*	
Torne älv (2)	31				5	6	1	29	70	76	89	76			*25*	*61*	34	41	*69*	3	*0*		*27*	8-13
Kemijoki	31																						39	
Lule älv	31								58	66	62	50	52	38	6	34	21	29	37	4	4	1	18	21
Skellefteälven	31								40	49	69	49	77	16	5	42	12	17	19	7	0	2	3	
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	
Angermanälven	30								50	77	66	46	63	21	4	28	21	25	46	13	4	3	28	
Indalsälven	30	4	7	8	7	3	8	7	45	72	68	41	64	22	1	20	22	6	20	4	0	3	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	
Dalälven	30	28	8	9	20	11	9	21	79	85	56	55	57	38	17	33	20	33	37	13	4	7	20	9
Mörrumsan	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*	
Mean River Simojoki, Torne älv and			6	2	6	5	8	17	62	75	71	84	86	91	28	60	39	41	58	5	4	3	28	
Mean River Lule, Indalsälven, Dalälven (5)		16	8	9	14	7	9	14	61	74	62	49	58	33	8	29	21	23	31	7	3	4	19	
Mean total		30	18	22	17	16	23	27	56	77	66	59	61	38	15	40	25	28	40	9	3	3	18	

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

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 (%) 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 1986-2006), 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 is in italics.

	Total average yolk-sac fry mortality among offspring (%)			Proportion of females with offspring affected by M74 (%)			Proportion of females without surviving offspring (%)		
	Simo-joki	Tornion-joki	Kemi-joki	Simo-joki	Tornion-joki	Kemi-joki	Simo-joiki	Tornion-joki	Kemi-joki
1986	*6*	NA		*0*	NA		NA	NA	
1987	2	NA		0	NA		NA	NA	
1988	6	5		0	NA		NA	NA	
1989	*3*	6		*0*	NA		NA	NA	
1990	*14*	1		*0*	NA		*12*	NA	
1991	4	29		0	NA		NA	NA	
1992	52	70		53	NA		47	NA	
1993	75	76		74	NA		74	NA	
1994	*55*	84		*53*	89		*53*	55	
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	54	*62*		59	*61*		38	*56*	
2000	38	34		44	34		22	24	
2001	41	35		41	41		26	21	
2002	33	*61*		47	*69*		25	*46*	
2003	2	4		7	3		0	0	
2004	4	*2*		7	*0*		0	*0*	
2005	5	NA		3	NA		3	NA	
2006	*11*	9	25	*18*	*27*	39	6	*0*	19

Table 3.5.3 Summary of M74 data for nine different Atlantic salmon stocks (1985-2007), 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		Skellelteälven		Ume/Vindel älven		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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11	91	NA	NA

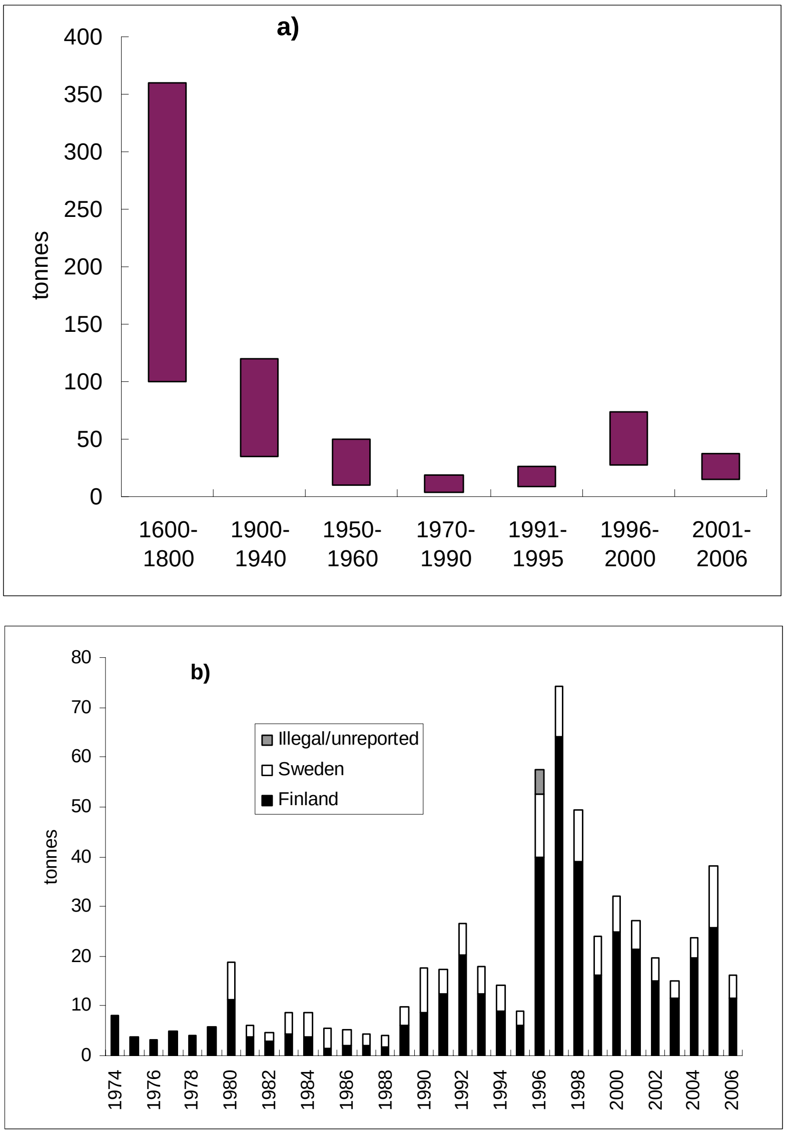

Figure 3.2.1.1. Total river catches in the River Tornionjoki (assessment unit 1). a) Comparison of the periods from 1600 to present. b) 1974-2006. Swedish total catch estimates are provided from 1980 onwards.

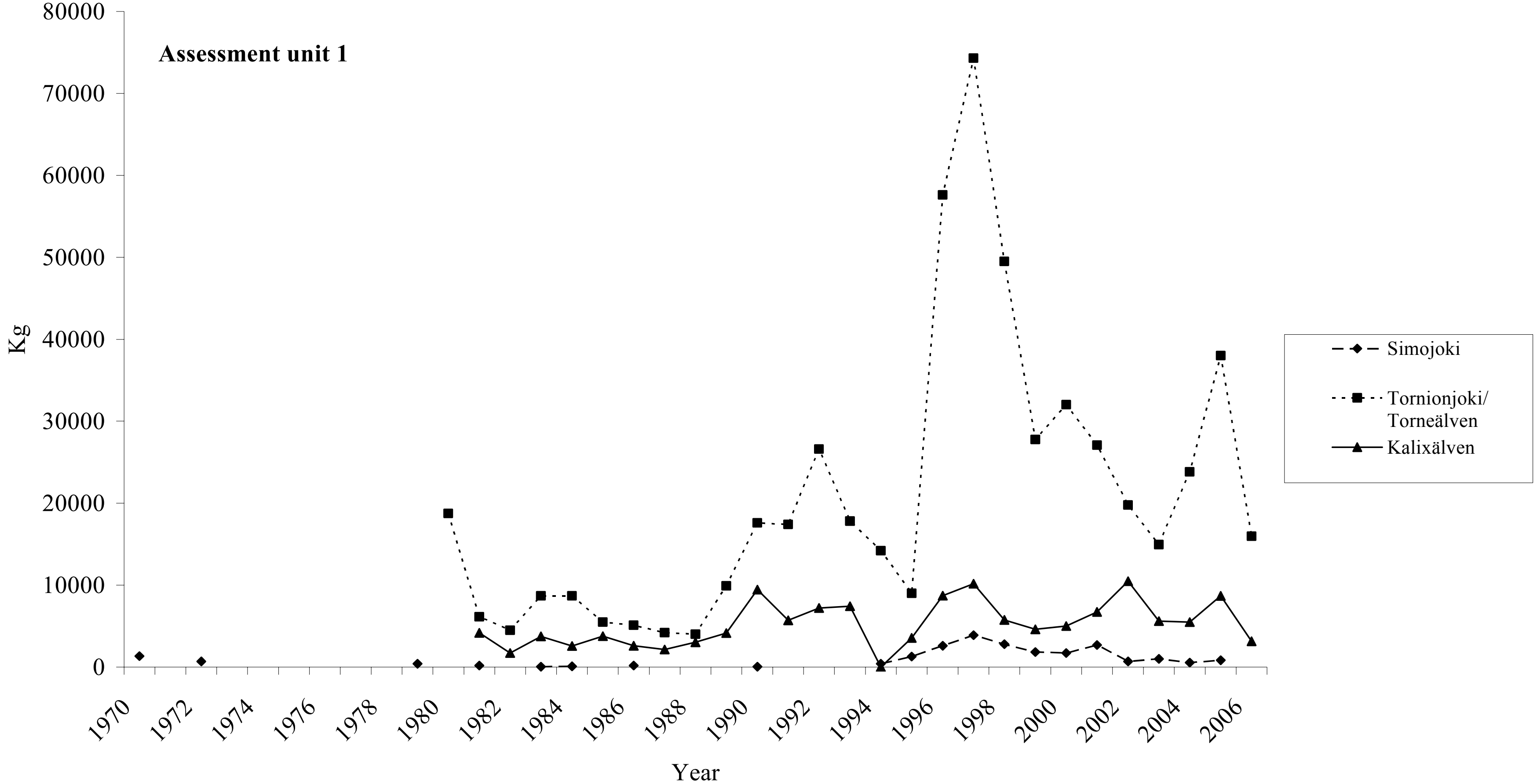

Figure 3.2.1.2 Salmon catch in the rivers Simojoki, Tornionjoki/Torneälven(finnish and swedish combined) and Kalixälven, Gulf of Bothnia, assessment unit 1.1970-2006. Ban of salmon fishing 1994 in the rivers Kalixälven.

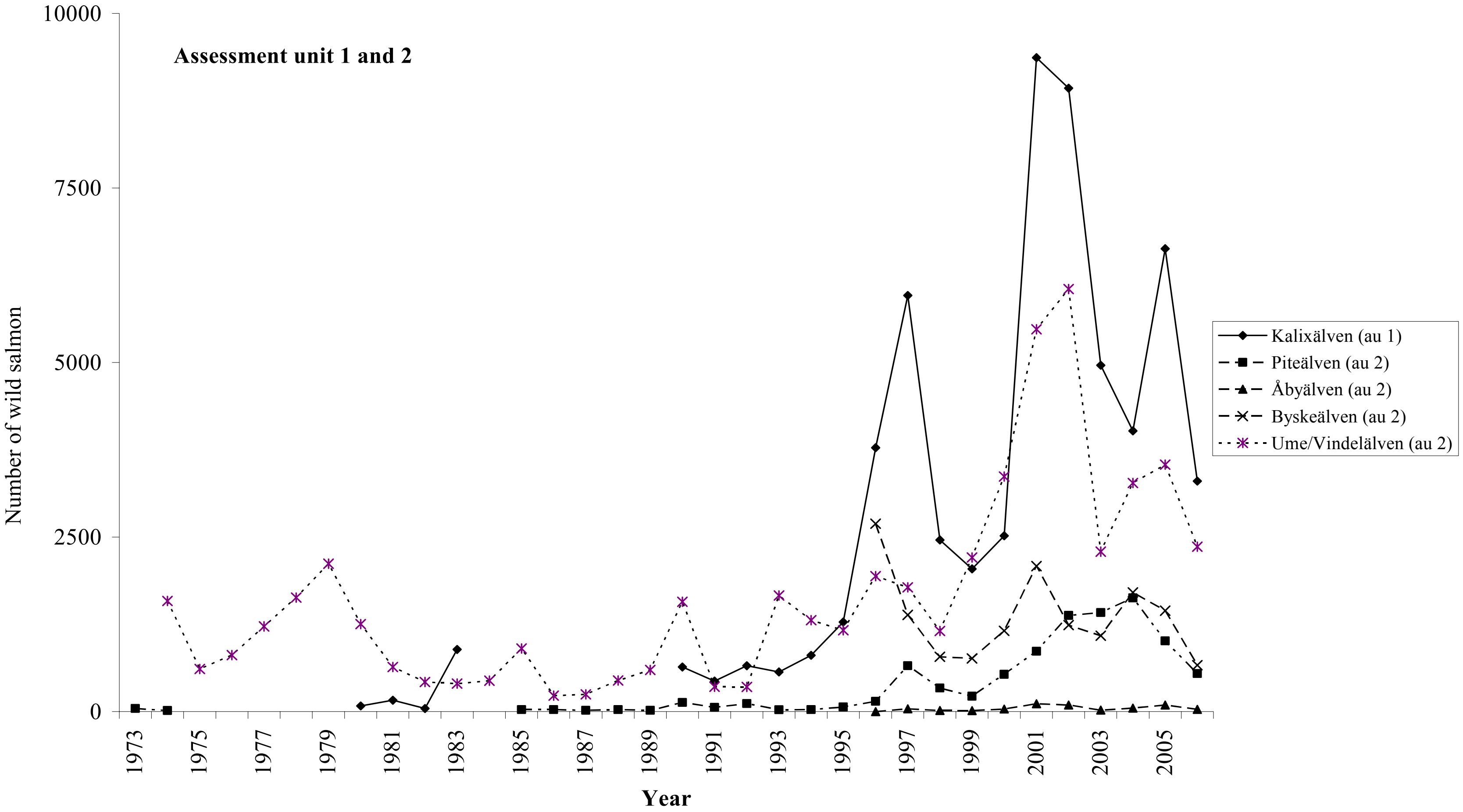

Figure 3.2.1.3 Total wild salmon run in fish ladders in rivers in assessment unit 1 and 2, in 1973-2006.

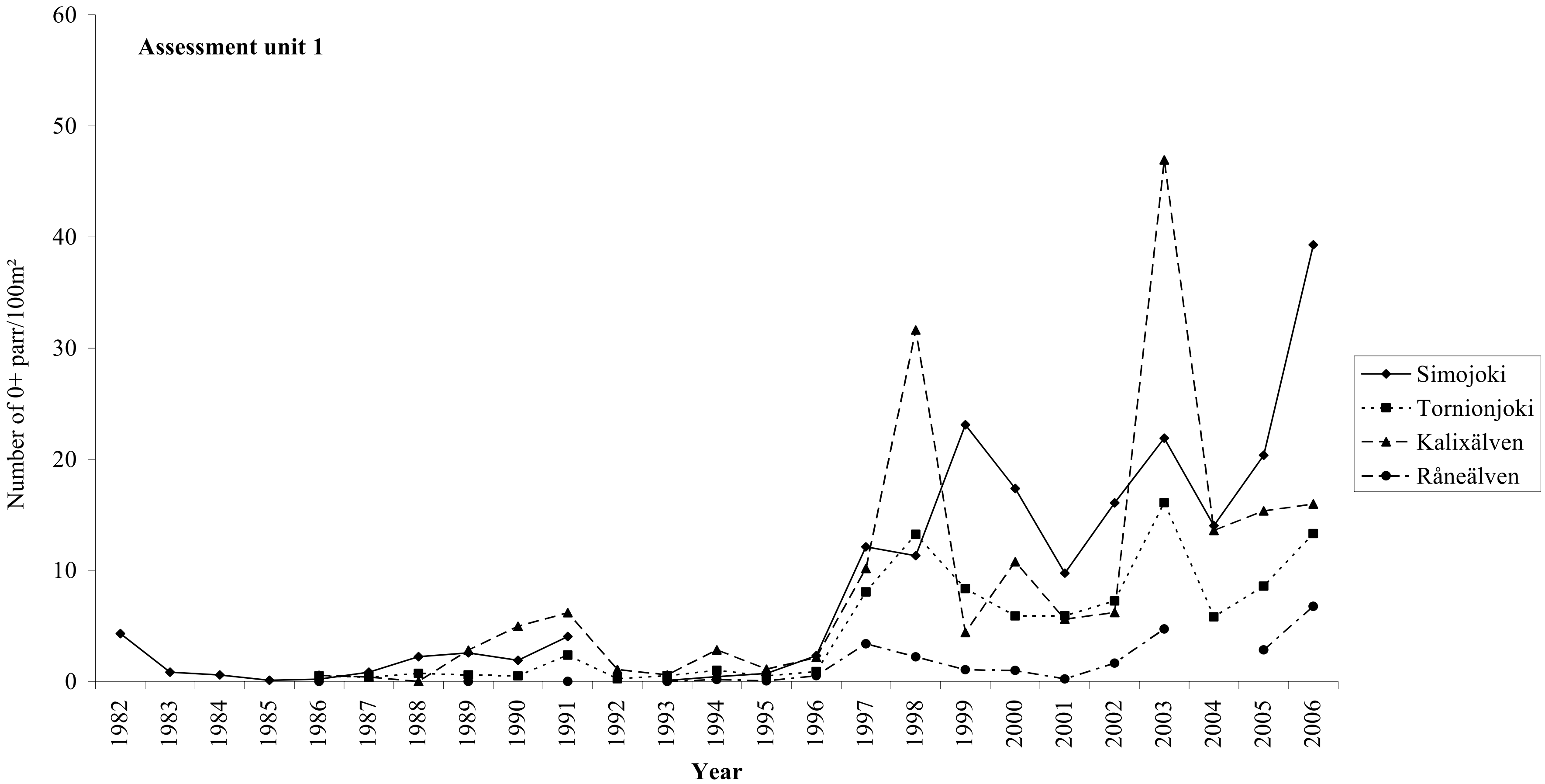

Figure 3.2.1.4 Densities of 0+ parr in riveres in the Gulf of Bothnia (Sub-division 31) assessment unit 1, in 1982-2006.

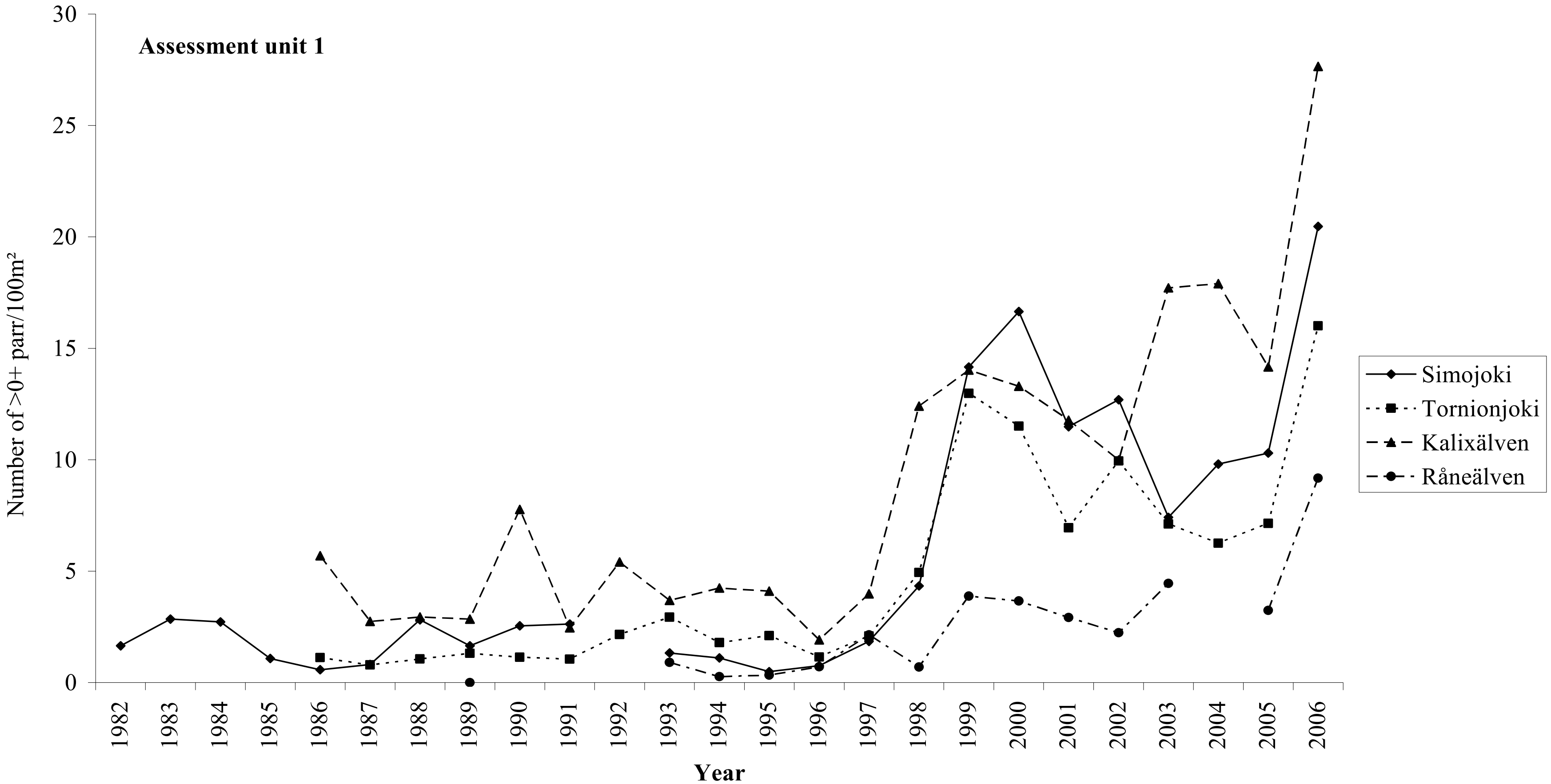

Figure 3.2.1.5 Densities of >0+ parr in riveres in the Gulf of Bothnia (Sub-division 31) assessment unit 1, in 1982-2006.

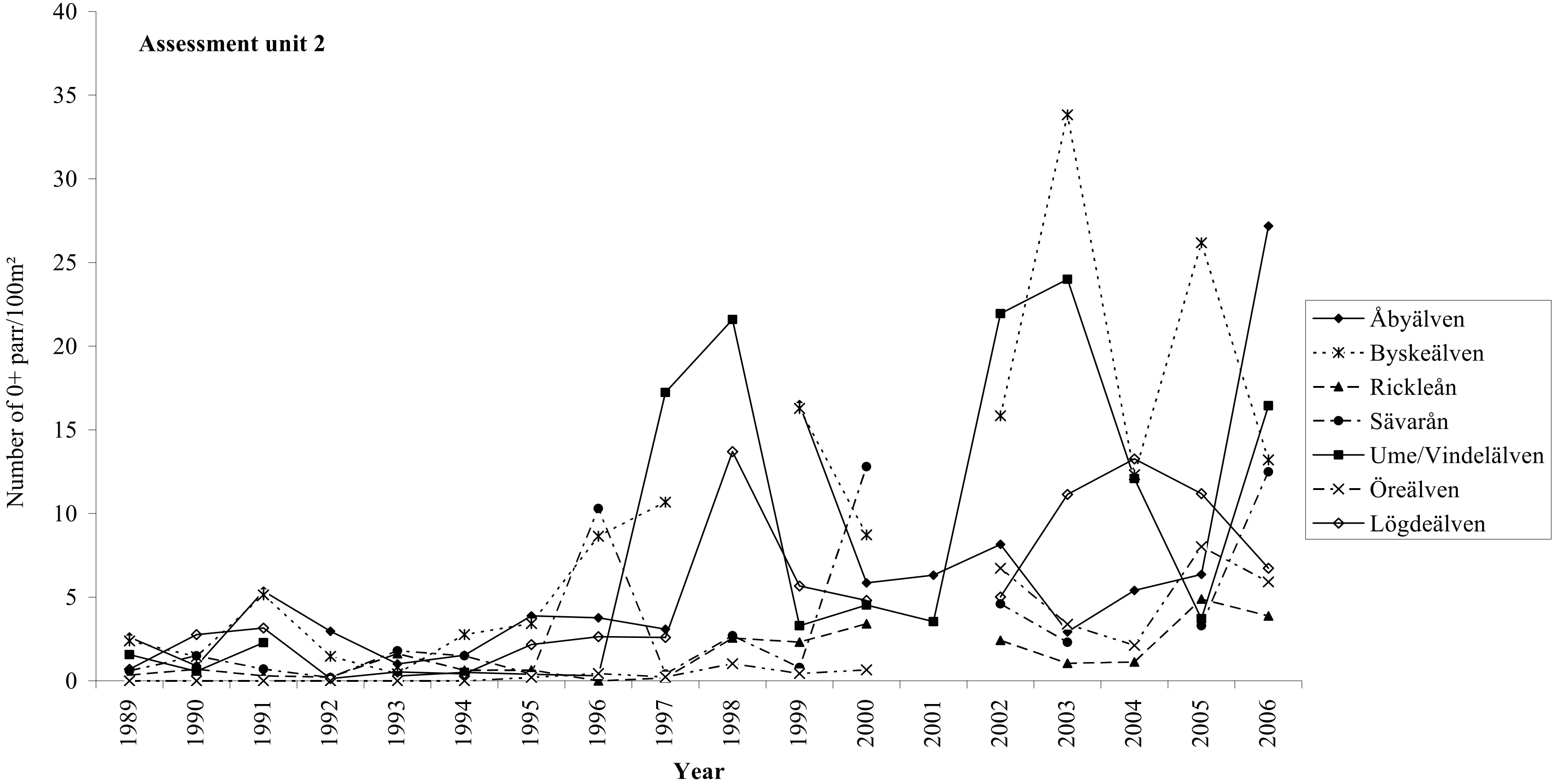

Figure 3.2.2.1 Densities of 0+ parr in rivers in the Gulf of Bothnia (Sub-division 31) assessment unit 2, in 1989-2006.

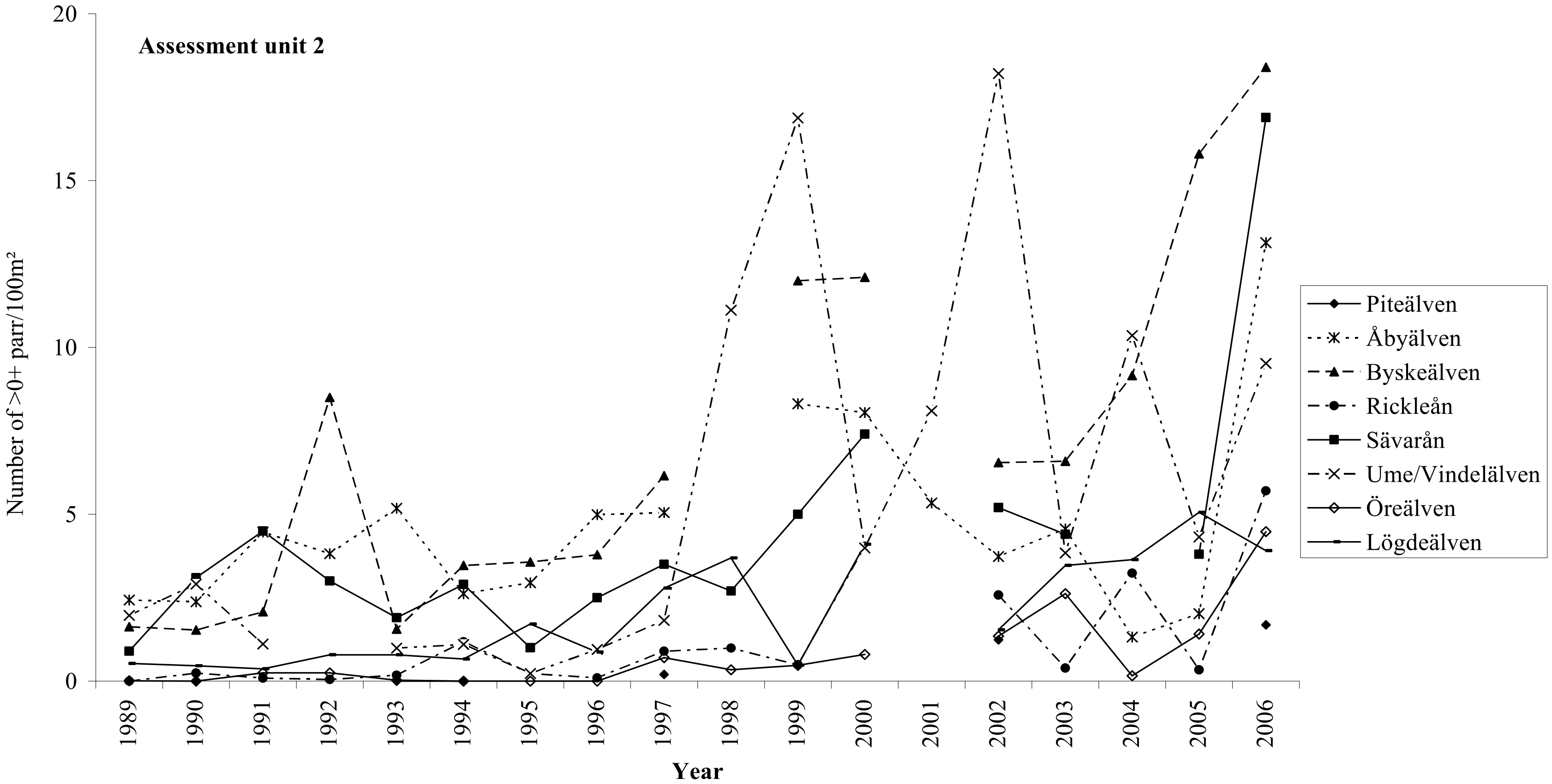

Figure 3.2.2.2 Densities of >0+ parr in riveres in the Gulf of Bothnia (Sub-division 31) assessment unit 2, in 1989-2006.

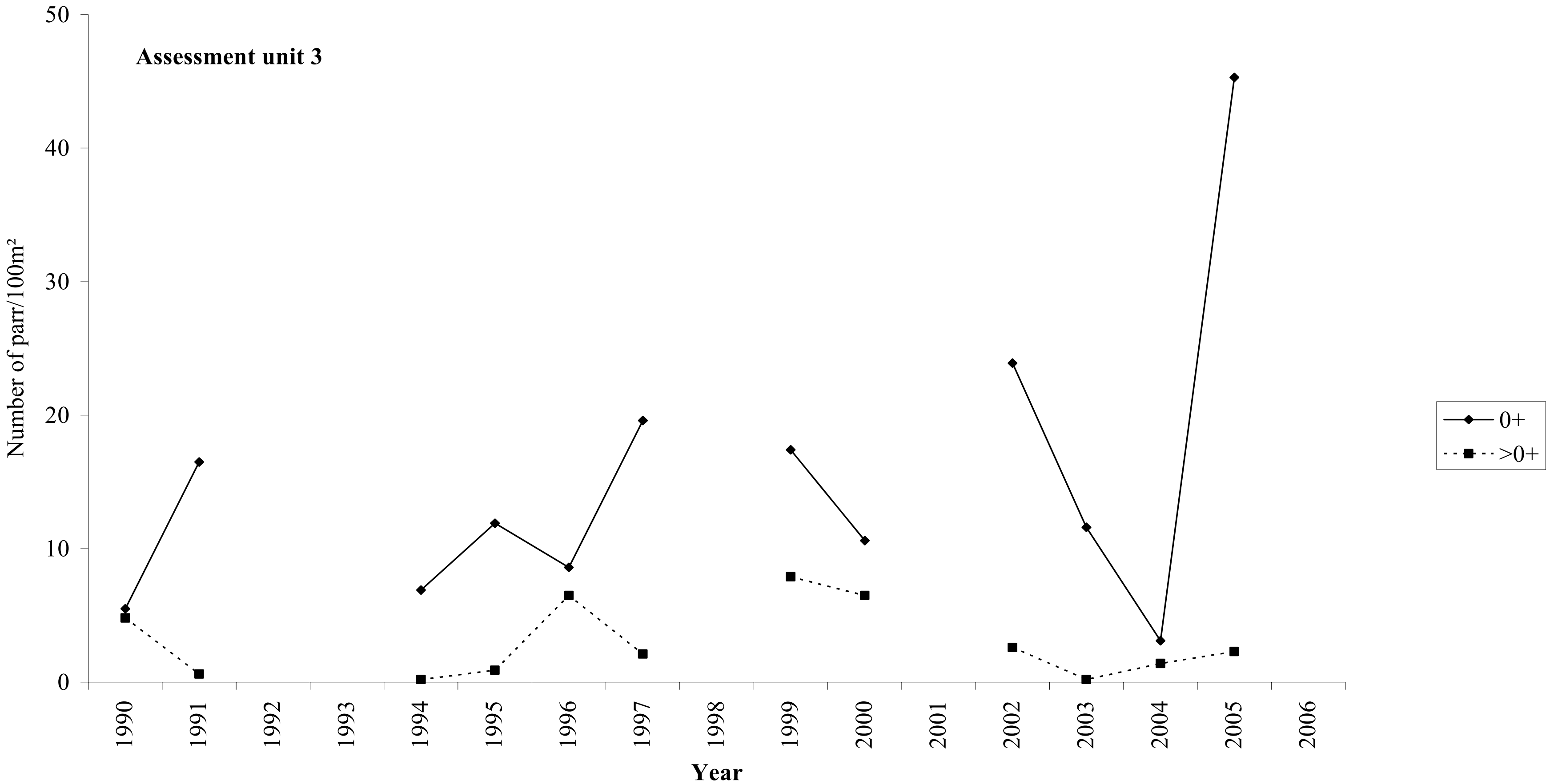

Figure 3.2.3.1 Densites of parr in Ljungan in the Gulf of Bothnia (Sub-division 30) assessment unit 3, in 1990-2006.

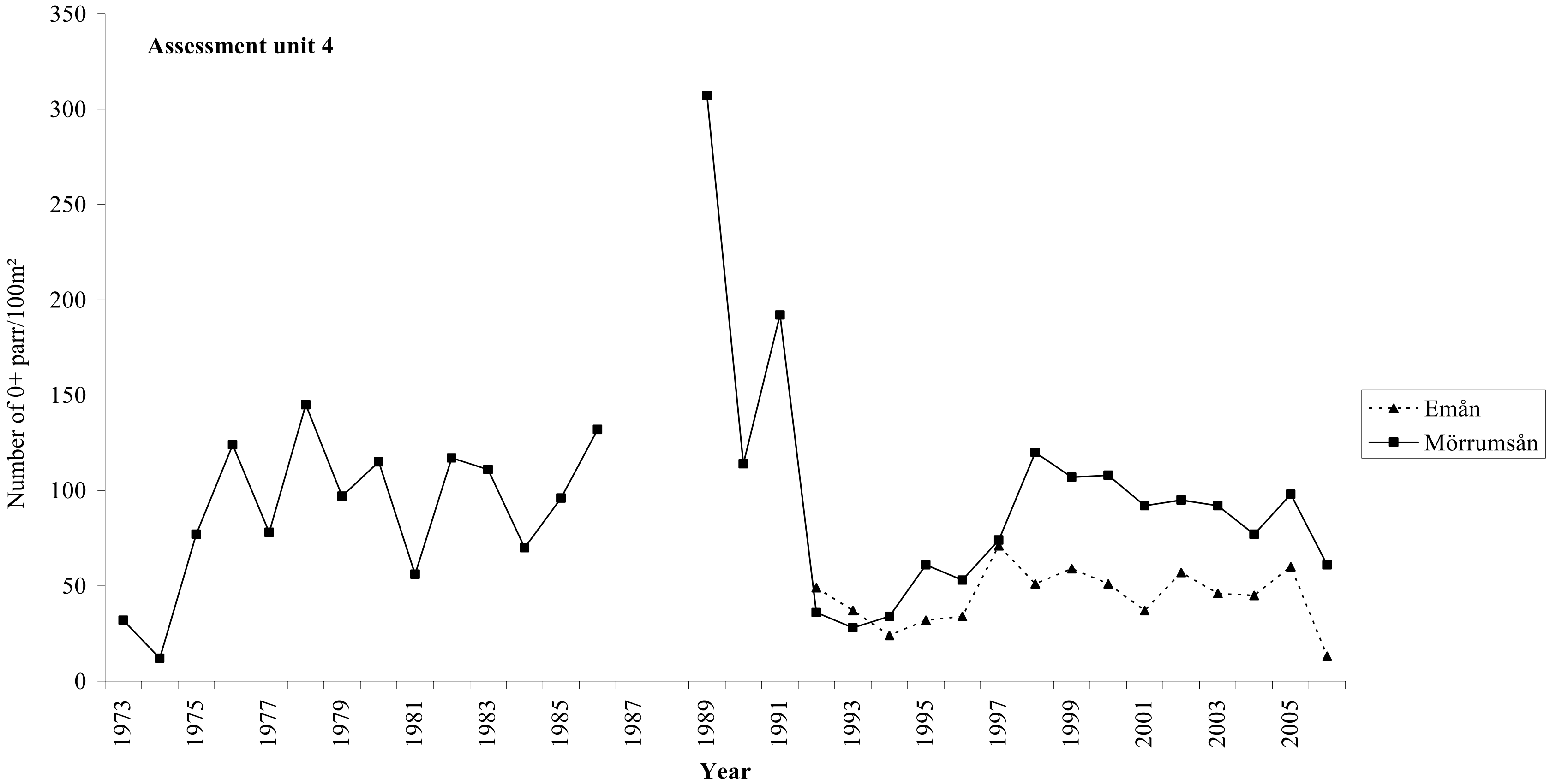

Figure 3.2.4.1 Densities of 0+ parr in rivers in the Main Basin (Sub-division 25-27) assessment unit 4, in 1973-2006.

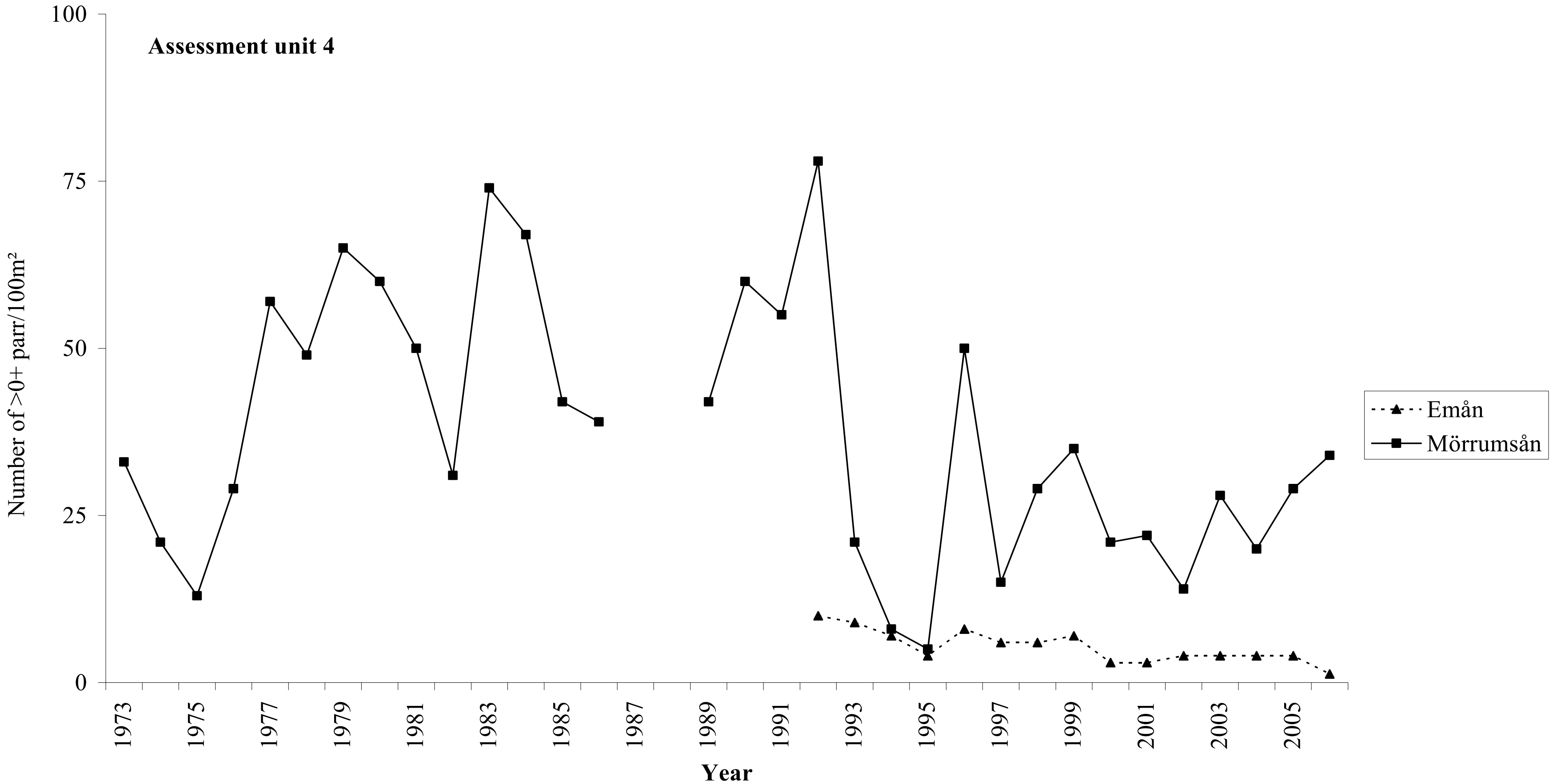

Figure 3.2.4.2 Densities of >0+ parr in riveres in the Main Basin (Sub-division 25-27) assessment unit 4, in 1973-2006.

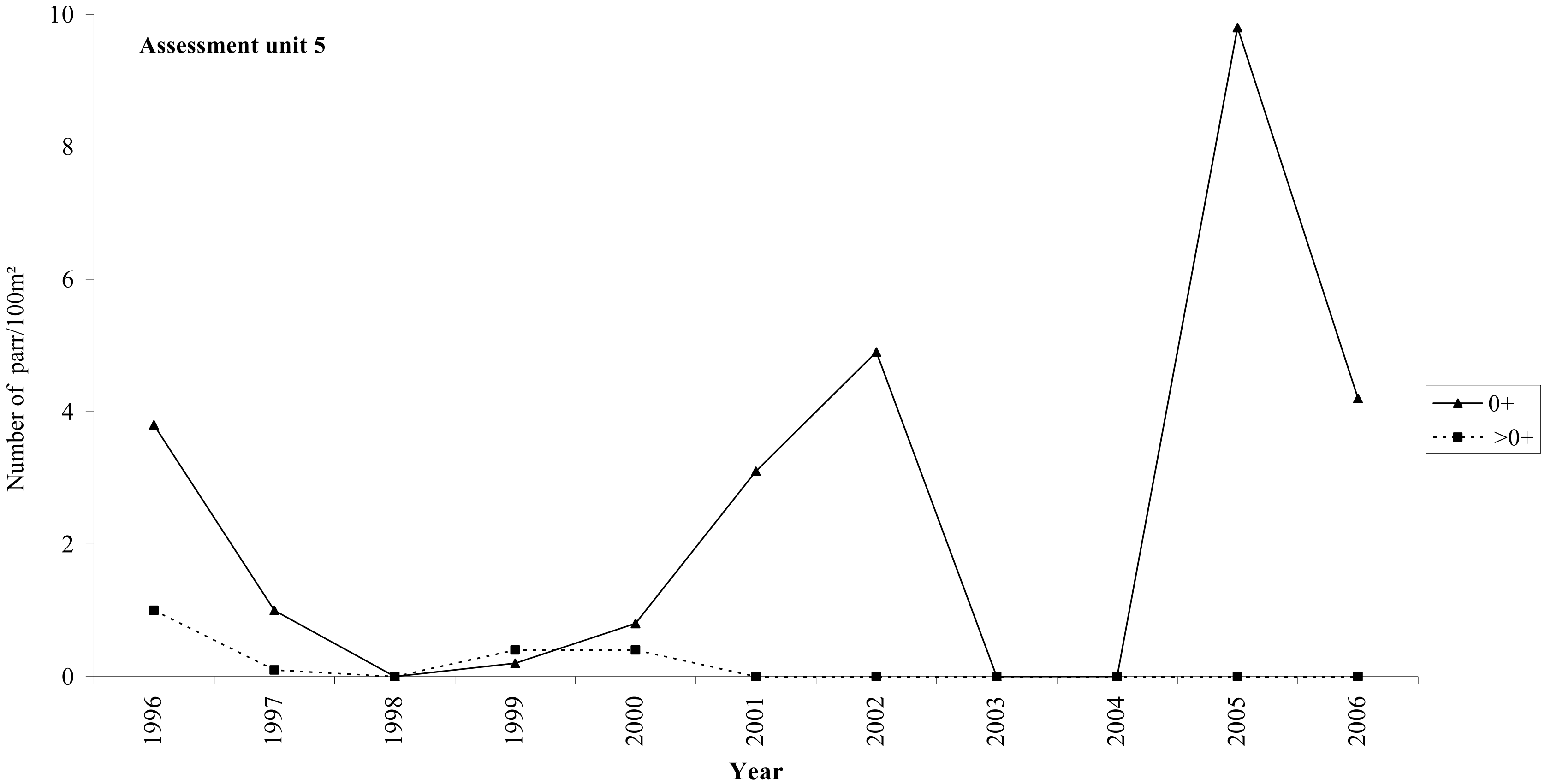

Figure 3.2.5.1 Densities of parr in the river **Pärnu** Main Basin (Sub-division 22-29) assessment unit 5, in 1996-2006.

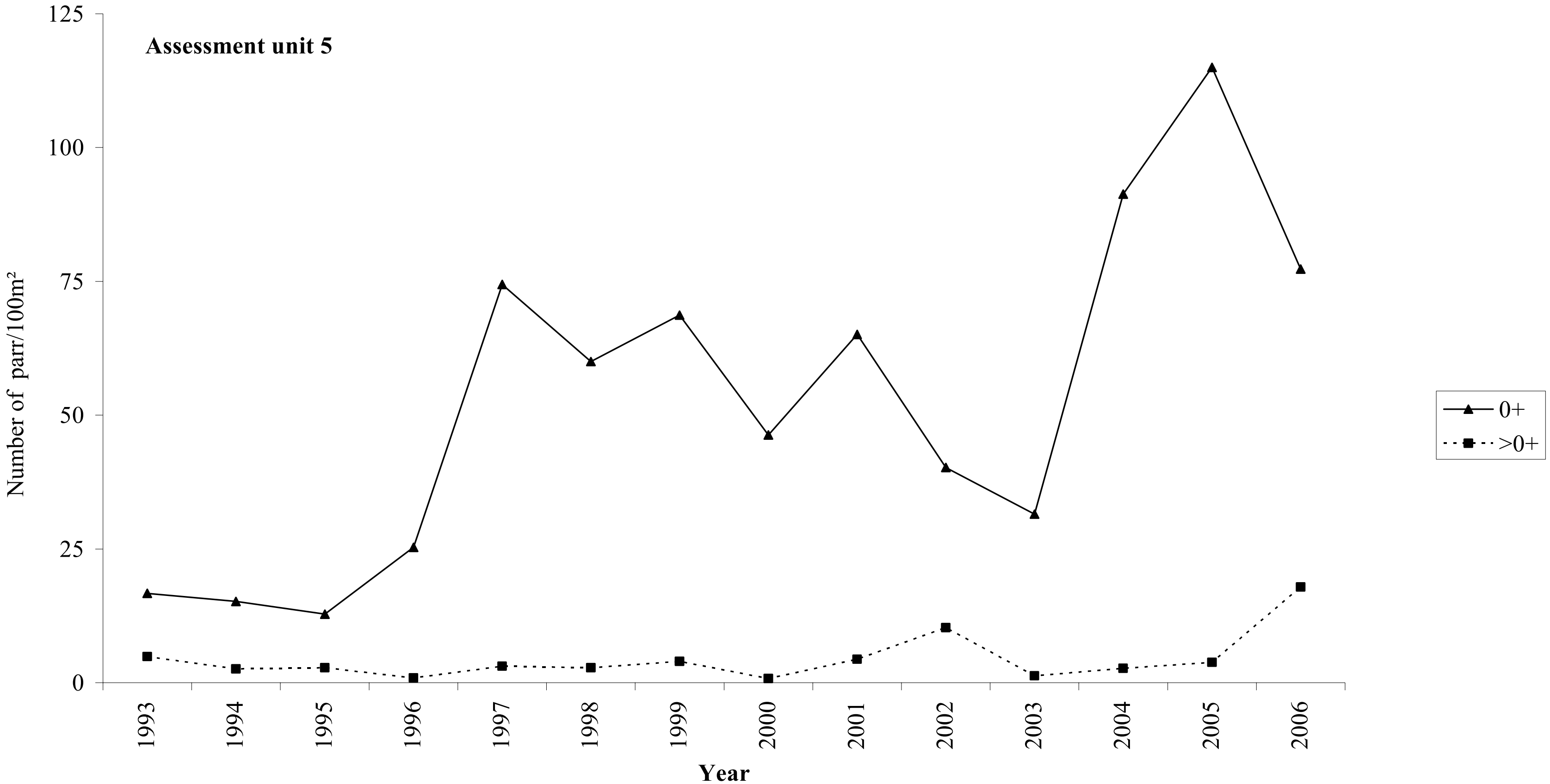

Figure 3.2.5.2 Densites of parr in the river **Salaca** Main Basin (Sub-division 22-29) assessment unit 5, in 1993-2006.

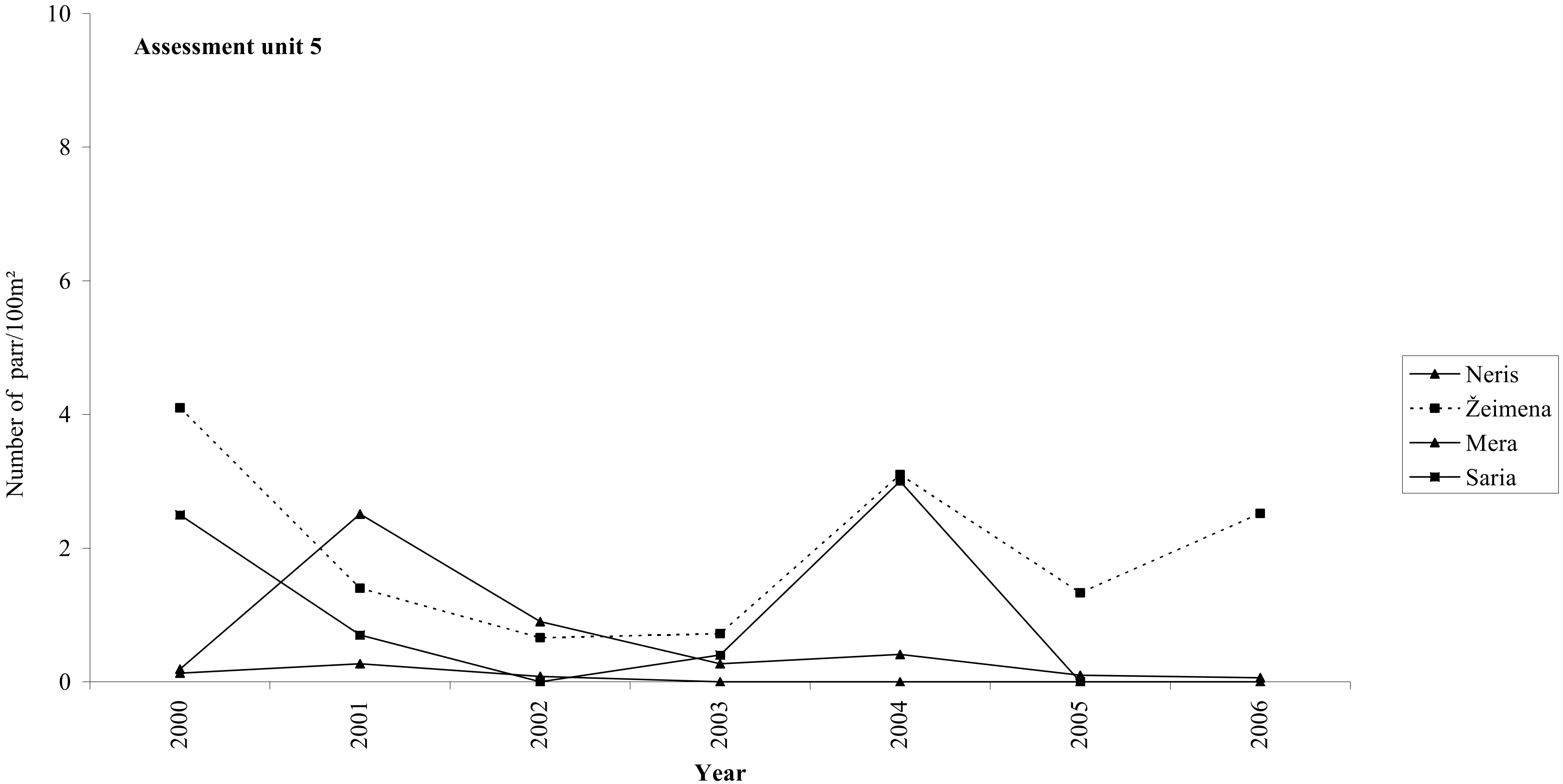

Figure 3.2.5.3 Densites of 0+ parr in the Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2006.

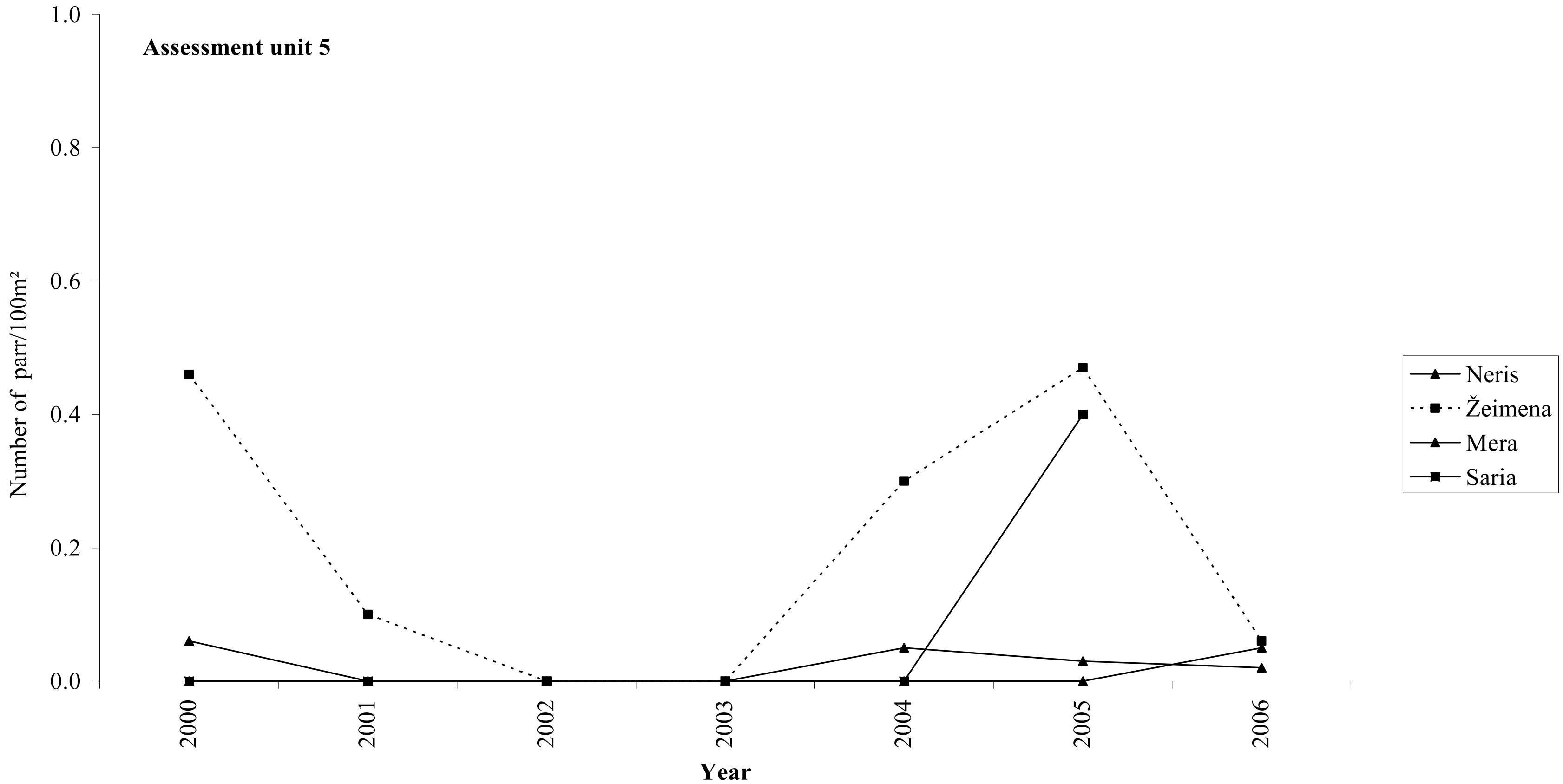

Figure 3.2.5.4 Densities of >0+parr in the Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2006.

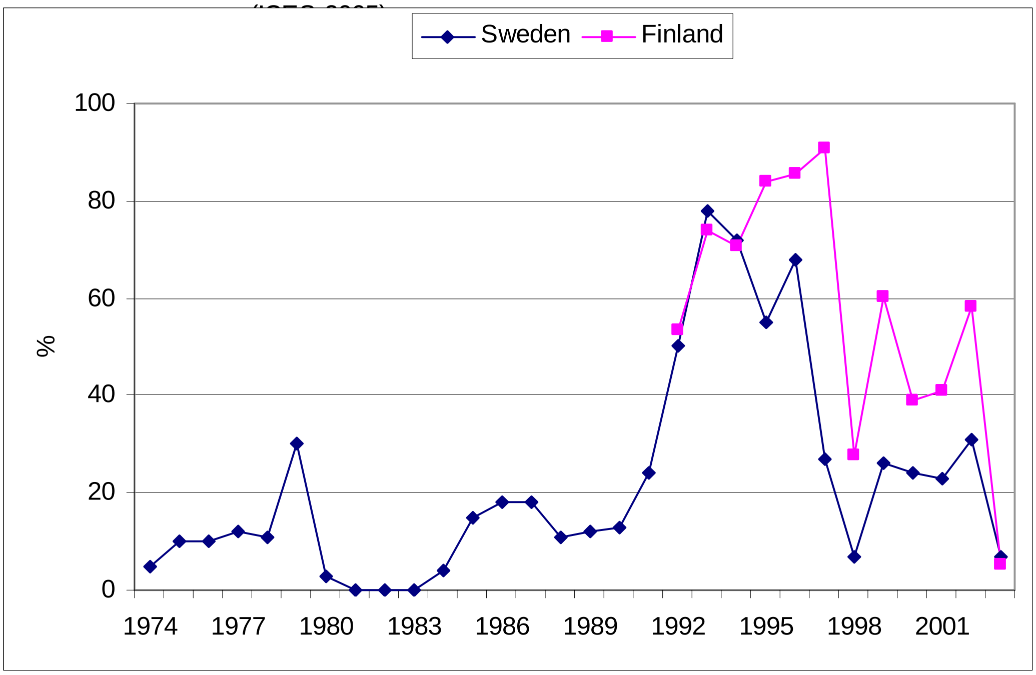

Figure 3.5.1. Proportion of M74 positive females in Swedish and Finnish hatcheries. Swedish data from Hans Börjeson in 1994-1999 (Ref. Amkoff 2000) and later years (ICES 2005). Finnish data (Keinänen et al 2000) 2001 and later years unpublished data.

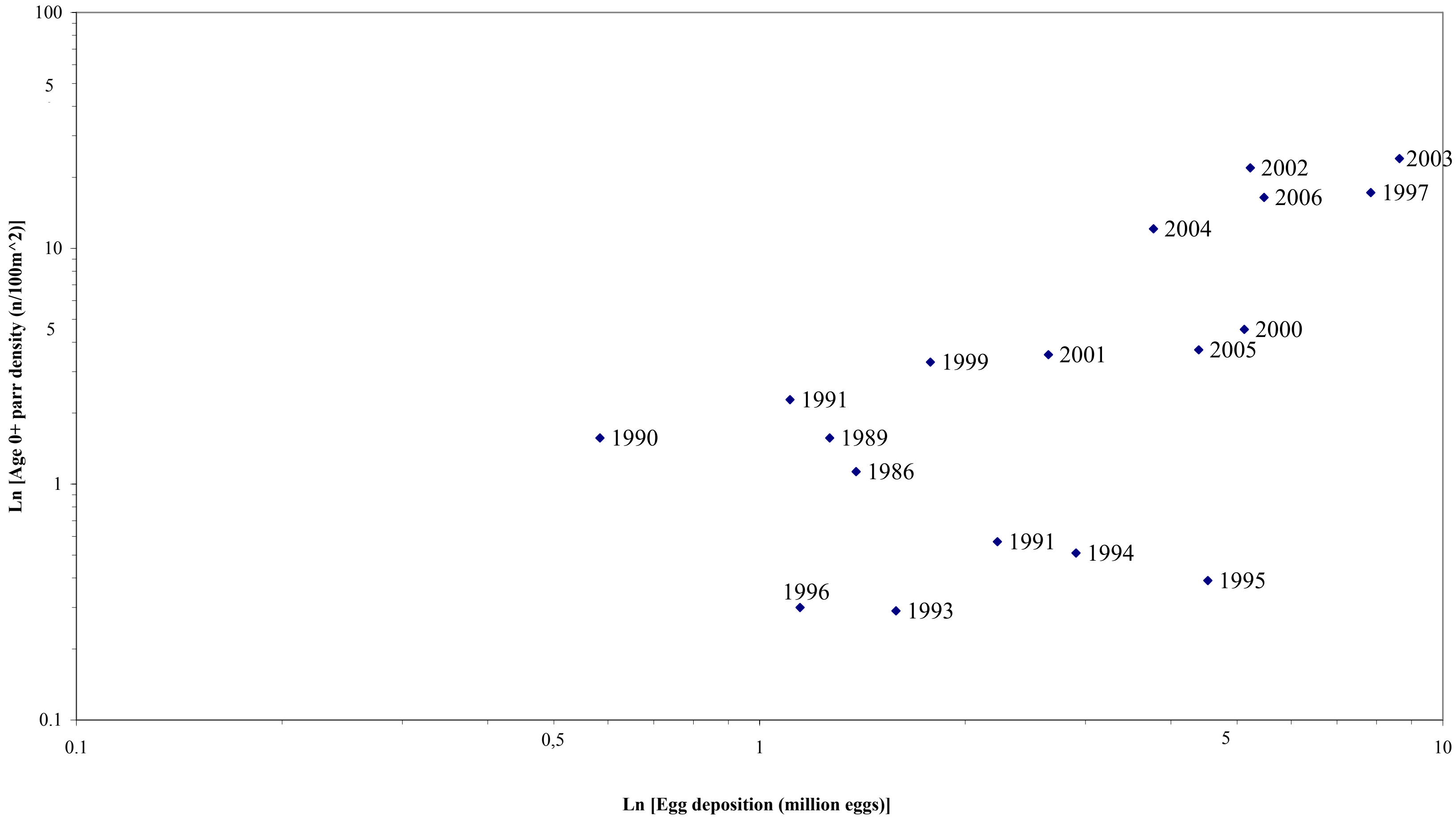

Figure 3.5.2 Densities of 0+ parr versus egg deposition in River Ume/Vindelälven, assessment unit 2 in hatching years 1986 - 2006.