6 Salmon in the Gulf of Finland

6.1 Introduction

The Gulf of Finland is a separate management unit and therefore the data on the catches, fisheries and status of the populations in the area are handled separately from the Main Basin and Gulf of Bothnia. In the light of present data this division is rather contrived from the assessment point of view, because the populations of the area are to a substantial rate feeding in the in the Main Basin area and partly harvested there. Also the populations from the other area, both wild and reared, contribute markedly to the catches in the Gulf of Finland. The stocks of the area, however, distinguish genetically from the stocks in the Main Basin and Gulf of Bothnia.

The latest analytical assessment that has been conducted for the area encompasses the year 2004 (ICES 2005). The following factors created the main uncertainty to the analysis: low catches, low number of tag returns, large uncertainty in recreational catch estimates, mixing of the stocks during the migrations between the Gulf of Finland, Main Basin and Gulf of Bothnia. The Group has, however, planned to include the Gulf of Finland (Assessment unit 6) to assessment model which is presently adapted to assessment units 1–5.

6.2 Catch and fisheries

The salmon landings in 2008 were 17 252 fish or 109 t (Tables 2.1.3 and 2.1.4), which was slightly higher than in 2007. The sea catches in Finland and Estonia were close to the TAC. Offshore fishery in the area was small (368 salmon) and the coastal fishery effort has levelled off to low level in Finnish coastal areas, where the main harvesting occurs. Main part (98%) of commercial catch was taken by trap nets. In many areas at the Finnish coast seals hinder the fishing at the traditional trapnet sites by damaging salmon in gears. Seal damages have escalated even to the inner archipelago in the last few years. According to Finnish logbook records, approximately 12% of the commercial salmon catch (2128 fish) was discarded due to seal damages. The rate of damages, however, was clearly lower than in years 2000–2004 possibly because fishers have partly changed their equipment to seal-proof models in the last four years (Table 6.2.1). Also in Estonia the harm caused by seals has increased in coastal fishery, but no estimates on these damages are available.

The total effort and catch in the Finnish offshore fishery (mainly long-lining) has strongly decreased in the last few years, and was so low in 2003–2008 that it was too uncertain to draw any conclusions regarding the cpue development. Because of the low cpue together with seal damages there has been decreased interest in long line fishing. Cpue in trap nets in the Finnish coastal waters was 1.2 salmon, which was slightly higher than in 2007 (Table 6.2.2). Fishermen operate closer to a shore and with fewer trap nets than earlier, as it is necessary for them to examine the trapnets in shorter intervals to keep seal damages low. The adoption of seal-proof trapnet models, however, has to some extent permitted a return back to the outer sites, too.

Only Finnish vessels operated in the off-shore. There was no significant offshore fishery for salmon, only 368 salmon (2 t) was reported, comprising about 2% of the total catch in the Gulf of Finland area (Table 2.1.3).

The catch distribution between offshore, coastal and river catches has drastically changed in the last ten years. Exploitation has moved from the offshore fishery to coastal areas. By year 1987 about 80% of the total catch in the Gulf of Finland was taken offshore. In 1988 and 1989 the offshore fishery share was about 60% and in 1990–1994 offshore fishery was about 40% of the total catch. Since 1995 the offshore fishery has taken only about 20% or less of the total catch. In the last five years share of offshore catch has been less than 5% (Figure 6.2.1). There is no directed commercial salmon fishery in the Estonian and Russian coast but salmon are caught as bycatch in other coastal fisheries. In Estonia licensed sport fishing and fishing for breeding purposes is permitted in some rivers. In Russian rivers all salmon fishery is prohibited except fishing for breeding purposes for hatcheries.

6.3 Status of salmon populations

6.3.1 General

In Estonia salmon reproduce in three wild salmon rivers: Kunda, Keila and Vasalemma. These rivers are small and their potential production is low. In addition there is natural reproduction in other seven rivers: Purtse, Selja, Loobu, Valgejõgi, Jägala, Pirita and Vääna. In these rivers, however, the natural reproduction is low and enhancement releases has been carried out during the last ten years (Table 6.3.1.1). In River Luga as well as in River Kymijoki, salmon populations are mostly based on smolt releases but also natural reproduction occurs in them (Table 6.3.1.2 and Figure 6.3.1.1). Salmon in the rivers Narva, Neva and Vantaanjoki are of reared origin (Figure 5.3.1.3).

6.3.2 The water level in the small Estonian salmon rivers

In the small Estonian salmon rivers the spawning migration occurs shortly before spawning (in October and November). It seems that there is a certain effect of the water level before and during spawning season on the strength of next year class. The water level data from 1990s onward is collected from river Kunda and Keila. The mean water level in October and November and 0+ parr density in a following year was significantly correlated only in river Keila (Figure 6.3.2.1), but similar trend (however insignificant) can be seen also in river Kunda (Figure 6.3.2.2).

6.3.3 Status of wild and mixed populations

In Estonia, ten rivers supported wild salmon reproduction in 2008 (Table 6.3.3.1). Due to high flow conditions catchability was poor in river Purtse, Valgejõgi and Pirita. In 2008 one summer old parr density was higher in river Selja, Loobu, Jägala, Pirita Vääna and Keila (Figures 6.3.3.1 and 6.3.3.2).

In the river Valgejõgi the restoration stocking of salmon was initiated in 1996, in river Jägala in 1998 and in river Purtse in 2005. The enhancement stockings were carried out in the river Selja in 1997–2008, river Pirita 1998-2008, river Loobu 2002–2008 and river Vääna 1999–2005. In r. Vääna the stocking was quit due to the high risk of returning adults straying in to the neighbouring river Keila, which is considered to be wild stock.

According to the rearing programme by Estonian Ministry of Environment (for the period 2002–2010) the releases will be continued in these rivers. Salmon used for stocking in late 1990s originate from spawners caught in the river Narva and Selja brood fisheries and in addition Neva strain was imported as eyed eggs from a Finnish hatchery. In 2003–2008 brood fish were caught from the river Narva and captive brood stock from river Kunda was established in 2007 in Polula Fish Rearing Centre. Since 2008 the releases of river Narva salmon (Neva strain) will be limited only to river Narva and Purtse, all other salmon releases are replaced with Kunda stock. The most important change in the 1990s was the occurrence of natural spawning after many years interval in the river Selja, Valgejõgi and Jägala. In 2006 wild salmon parr were found also in river Purtse and Vääna.

In the Finnish side of the Gulf of Finland all wild salmon populations were lost by 1950s due to establishment of paper mill industry and closing the river Kymijoki by dams. The nearest available salmon strain, Neva salmon, was imported in 1970s. Status of mixed population in the river Kymijoki is based on hatchery reared smolt releases and the magnitude of natural reproduction (21 000 in 2008) is still small compared to the number of released smolts (303 000 in 2008). The brood stock of salmon is held in hatcheries and has been partially renewed by the ascending spawners.

In the Finnish rivers Kymijoki and Vantaanjoki the salmon population is based on annual smolt releases, which have been started in the early 1980s. The Neva strain has been used in these releases. The River Kymijoki is mainly used for hydroelectric production and pulp industries. The quality of water, however, has improved significantly since early 1980s, and today salmonid species reproduce naturally in the river. In addition, significant amounts of reproduction habitat areas still exist on the lowest 40 kilometres of the river. Ascending spawners originating mainly from hatchery-reared smolt releases spawn in the river, and annual natural production has been estimated to vary between 2000 and 44 000 thousand smolts in the last ten years.

A study on the river Kymijoki from 2006 explored the smolt production areas in the eastern branches of the river and it suggested a total area of 75 ha between the sea and Myllykoski (40 km from sea), the uppermost site which salmon could originally reach. About 15 ha of the rapids are situated in the lower reaches with no obstacles for migration and about 60 ha beyond the dams, accessible only in years with high discharge. The potential smolt production was assessed on the basis of parr density (max > 1 parr/ 1 m^2) and smolt age (1–3 yr). The annual mean potential was assessed to be 1340 smolts per ha, and the total potential of the river about 100 000 smolts per year. From this potential, annually about 20 000 smolts could be produced in the lower reaches and 80 000 smolts in the upper reaches of the river (Table 6.3.1.2).

Despite of the very rainy autumns most of the nursery areas in the lower part dried because of the water regulation between the power plants. Better production habitats are above the lowest power plants, but only a small part of the spawning salmon has access there. The smolt production areas beyond the dams are now only occasionally and partially utilised. In the most eastern branch (Korkeakoski), there is no fish ladder or possibility to ascend the dam. The fish ladders in the neighbouring Langinkoski branch do not function well and salmon can ascend the dam only in rainy summers with high discharge. Trials to move ascending salmon over the dam in the Korkeakoski branch have shown that salmon can successfully ascend and spawn also in the upper reaches of the river. Usually the most of the spawning salmon ascend to the Korkeakoski branch which has no fish ladder. The success of ascending salmon to find their way to the stream supplied with the fish ladder (Langinkoski) is depending on the drainage arrangements between the three main streams. Building an additional fish ladder to the other main branches would allow for an access to a much higher number of spawning salmon to the better spawning and rearing habitats above the dams. This would increase the natural smolt production of the river significantly.

At present, the annual smolt production is highly dependent on the discharge and on the regulation of river flow for the electric power plants. Especially earlier the lower branches below the dams had in some winters so low discharge that the shallow parts of the rapids dried or froze and the spawn thus largely died. Now the regulation has partially been changed and the present minimum discharge of 4 m^3/s in winter allows a continuous smolt production but does not ensure the maintenance of the full potential in this area.

Due to a rainy summer in year 2004 the flow in the Kymijoki was on exceptional high level and for the spawners the river was easy to ascent. The spawning areas above the lowest power stations were also occupied, and high parr densities were observed both above and below the powers stations in 2005 and 2006. In 2007 the parr densities were on the moderate level (Figure 6.3.3.1). In the river Vantaanjoki no electrofishing was carried out in 2008.

In Russian rivers Luga and Neva the salmon populations are supported by large long-term releases. Neva strain has been used in the river Neva. In the river Luga released smolts are based on ascending Luga and Narva river spawners as well as on the brood stock of mixed origin. In River Luga a smolt trapping survey has been conducted in 2001–2008. The natural reproduction was estimated to be from about 2000 to 8000 smolts in different yeas. No evidence on natural smolt production in the River Neva exists for last years. The status of potential salmon river Gladyshevka is described in Section 3.3.

6.3.4 Status of reared populations

The Estonian/Russian river Narva lost its native salmon stock in 1950s. A new population was established using Neva stock and strains from Latvian rivers. During 1990s all hatchery production is based on ascending spawners caught in the river. No evidence on natural smolt production in river exists. The number of spawners returning to River Narva has been sufficient for breeding purposes in the last two years.

6.4 M74

In the River Kymijoki, in 2007 the M74 syndrome exacerbated after four good years: the mean yolk-sac fry mortality among 23 monitored offspring groups (females) was 23% and the M74 frequency (the proportion of females with offspring that displayed M74 symptoms was 26%) while the proportion of females whose all offspring died of M74 was 13% (Table 3.5.1). In 2002 the mean yolk-sac fry mortality was 37%, the proportion of M74 females 43% and the proportion of females, whose all offspring died, was 39%. In the years 2003–2006 the mean yolk-sac fry mortality was below 10% (affected females 0−11%). Arrangement of salmon from the River Kymijoki for 2008 M74 monitoring did not succeed. Neva stock spawners of the River Kymijoki have been caught every second or third year to add genetic material to the brood stock. M74 mortality among these brood fish was estimated to be 45%−70% in 1992−1993. Since 1995, M74 has been monitored annually with some exceptions, during which time period the yolk-sac fry mortality has been at its highest 56%, in 1997, when the proportion of salmon females whose offspring were affected by M74 was over 70% (Table 3.5.1). In other years from 1995 to 2002 (year 2001 and 2008 data is missing) the mean yolk-sac fry mortality has varied from 24% to 47% (the proportion of M74 females from 23% to 57%).

In the Estonian hatchery Põlula the M74 mortality was less than 10% in 1997–2006, in 2007 M74 was not observed (n=52). Data for the year 2008 is not available yet. In Estonia there is no clear evidence of the existence of the M74 syndrome in wild populations. However, the abundance of salmon parr shows large variation (Table 6.3.3.1).

Data for M74 mortality in Russian hatcheries are not available.

6.5 Smolt production

Natural smolt production in Estonian, Finnish, and Russian rivers in the Gulf of Finland area was estimated at about 27 000 in 2008. Hatchery-reared smolt releases were 777 000 smolts in 2008 (Table 3.4.1). The smolt releases in the region has increased in the last ten years (Figure 6.5.1).

6.6 Indices of post-smolt mortality and yield

Tagging results of the releases in the area shows that the post-smolt survival has been very low in last seven years compared to the early 1990s (Figure 2.9.2.1.). However, no quantitative estimate of initial smolt survival of wild salmon populations in the area is available for the last few years.

Although there is exchange of salmon in terms of feeding and spawning migration between the Gulf of Finland and Main Basin and Gulf of Bothnia, the rough analysis of comparing the catches in the area and the number of released smolts indicates a dramatic change in the yield of the releases (Figure 6.2.1). There are no indications that any significant numbers of the surplus salmon would exist in the rivers with releases in the area.

6.7 Harvest pattern of wild and reared salmon

Salmon originating from the Gulf of Bothnia and Baltic Sea Main Basin contribute to the catches in the Gulf of Finland (Bartel 1987; ICES 1994). The salmon from the Main Basin stocks migrate to the Gulf of Finland for feeding, meanwhile the salmon from Gulf of Bothnian stocks appearing in the catches in the Gulf of Finland, visit the area in the early summer during their spawning migration to the Gulf of Bothnia. In 2002–2007 catch samples has been collected from Finnish commercial fisheries, however in the last four year only from the coastal fishery in the eastern part of the area. Offshore catches were simply too small to get a hold of them for sampling.

Catch samples were aged and defined by wild/reared origin by scale reading and stock proportions were estimated by DNA-analysis methods. The latest analysis results for year 2007 suggested that the clearly largest contribution (61%) was made by locally released Neva salmon. The proportion of wild stocks originating from the Gulf of Bothnia was about 27%. (ICES 2008a). The Estonian wild stocks were not recorded in these catch samples. As the numbers of the feeding wild salmon from the Estonian rivers are low at present the probability to observe them is minimal in the catch samples collected from different fisheries in their feeding area in the Gulf of Finland and Main Basin. Some part of the smolts migrates from the Gulf of Finland to the Main Basin for the feeding. According to tagging results from the Finnish releases to the river Kymijoki 9–37% of the fish has been caught from the Main Basin during the last 25 years. Recently the share returned tags from the Main Basin has reduced significantly (Table 6.7.1). Tagging results from Estonian releases in 1997–2006 suggested an average share of 37% of returns being caught from the Main Basin. In the Main Basin off-shore fishery these fish have been exposed to about 20–30% harvest rate since mid-1990s (ICES 2008a). Harvesting in the Main Basin has further reduced as a result of closed driftnet fishing. Taking into account a rather high proportion of salmon from the Gulf of Bothnia and Main Basin observed in the catches in 2003–2008 (ICES 2008a), the exchange of recruits between the areas has considered being significant. The balance of exchange of salmon, however, between the areas has not been quantified.

In Estonia, most stocked parr and all stocked smolts have been adipose fin clipped since late 1990s. The share of adipose fin clipped salmon in Estonian coastal fishery was 77% in 2005, 59% 2006, 40% 2007 and 62% 2008. These proportions of fin clipped salmon are clearly smaller than expected based on the share of wild and reared smolt production in Estonia.

Table 6.2.1 Salmon cathes (in numbers) by year, country and fishery in the Gulf of Finland in 2000-2008.

YEAR	COUNTRY	Commercial catch	Recreational catch	Discards, seal damages	Discards, other reasons	Grand Total
2000	EE	3166				3166
	FI	19844	11200	3631	66	34741
	RU	914				914
2000 Total		23924	11200	3631	66	38821
2001	EE	2344				2344
	FI	12082	11200	3394	15	26691
	RU	808				808
2001 Total		15234	11200	3394	15	29843
2002	EE	2076				2076
	FI	9371	5700	3127	30	18228
	RU	426				426
2002 Total		11873	5700	3127	30	20730
2003	EE	1358				1358
	FI	6865	4200	3454	2	14521
	RU	431				431
2003 Total		8654	4200	3454	2	16310
2004	EE	858				858
	FI	6892	4900	3682	14	15488
	RU	497				497
2004 Total		8247	4900	3682	14	16843
2005	EE	1126	206			1332
	FI	9462	6200	1711	2	17375
	RU	636				636
2005 Total		11224	6406	1711	2	19343
2006	EE	865	138			1003
	FI	10798	5100	2598	9	18505
	RU	450				450
2006 Total		12113	5238	2598	9	19958
2007	EE	1053				1053
	FI	10348	1577	1757	1	13683
	RU	520				520
2007 Total		11921	1577	1757	1	15256
2008	EE	820	295			1115
	FI	13827	182	2128		16137
	RU	220				220
2008 Total		14867	477	2128		17472

Table 6.2.2 Catch per unit effort in number of salmon caught in trapnets, driftnets and long-lines in the Finnish fisheries in Sub-division 32 (number of salmon per trapnetdays, 100 driftnetdays, 1000 hookdays).

Year	CPUE		
	Trapnet	Driftnet	Long-line
1988	0.70		
1989	1.00		
1990	1.60		
1991	1.50		
1992	1.50		
1993	1.40		
1994	0.86		
1995	1.15		
1996	1.27		
1997	1.52		
1998	1.34		
1999	1.30		
2000	0.94	7.60	23.90
2001	0.92	7.00	23.20
2002	0.95	7.80	22.00
2003	0.67	5.20	8.00
2004	0.87	4.90	13.60
2005	1.10	4.40	17.80
2006	1.30	5.70	12.70
2007	1.00	5.70	18.40
2008	1.20	0.00	23.20

Table 6.3.1.1 Estonian wild and mixed salmon rivers in the Gulf of Finland.

River	Wild or mixed	Water quality1)	Flow m3/s		First obstacle km	Undetected parr cohorts 1997-2008	Production of >0+ parr 1997-2008
			mean	min			
Kunda	wild	III	4.3	0.8	2	0	0.3–21.5
Selja	mixed	V	2.4	0.8	42	3	0.1–4.1
Loobu	mixed	II	2.0	1.3	10	1	0.5–7.1
Valge-jogi	mixed	IV	3.4	0.6	8	2	0.8–4.9
Jagala	mixed	II	7.3	0.7	2	6	0–<1
Pirita	mixed	V	6.8	0.4	24	2	0.3–6.4
Vaana	mixed	V	1.9	0.3	21	8	0–0.3
Keila	wild	V	6.2	0.5	2	2	0–6.8
Vasa-lemma	wild	II	3.5	0.2	4	2	0–1.5

1) Classification of EU Water Framework Directive.

Table 6.3.1.2. Natural salmon smolt reproduction in 1993-2008 in assessment unit 6 (Sub-division 32). Most probable number (x 1000) of smolts from natural reproduction with the associated uncertainty (95% probability interval). In the previous report medians of the probability distributions were presented in the corresponding smolt production table. Because of the change in presentation, current point estimates are generally lower than previous ones . Extention of these time series backwards are made to provide longer time series as results of the modeling; the extension is based on old WGBAST reports and should be regarded as preliminary. Uncertainty associated with some of the estimates are missing. Also some of the predictions of the 2007-2008 are not available.

Assessment unit, sub-division, country	Category	Reprod. area (ha, mode)	Potential (*1000)	Wild smolt production (x 1000)																Pred 2009	Method of estimation		Reared smolts 2008
				1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		Pot. prod.	Pres. prod.	
Finland:																							
Kymijoki	mixed	$15^{1)}+60^{2)}$	$20^{1)}+80^{2)}$	3	18	4	3	18	2	3	2	13	14	22	14	7	25	44	21	13	7	4	303
95% PI			57-224	2-4	14-21	3-5	2-4	14-22	1-3	2-4	1-3	10-16	11-17	17-27	11-18	5-9	20-31	34-53	16-25				
Russia:																							
Neva	mixed	20	20			7	7	7	7	7	7	6	6	6	0	0	0	0	0	0	7	2	54
95% PI			13-36			4.5-13	4.5-13	4.5-13	4.5-13	4.5-13	4.5-13	3.8-11	3.8-11	3.8-11									
Luga	mixed	40	80			4	4	4	4	4	5	2.5	8	7.2	2	2.6	7.8	7	3	5	7	2	97
95% PI			51-144			3.8-4.2	3.8-4.2	3.8-4.2	3.8-4.2	3.8-4.2	4.8-5.2	2.4-2.6	7.7-8.3	6.9-7.5	1.9-2.1	2.0-3.5	5.1-16.5	4-10	1,9-4,1				
Estonia:																							
Purtse	mixed	6	6																0.05	1.6	7	4	40.8
95% PI																							
Kunda	wild	1.5	2.1	+	+	+	+	+	+	+	1.8	0.8	1.5	0.5	0.4	0.08	1	1	0.5	0.1	7	3	0
95% PI											1.4-2.4	0.6-1	1.2-2	0.4-0.7	0.3-0.5	0.04-0.12	0.8-1.2	0.8-1.2	0.4-0.6				
Selja	mixed	9	10	+	+	+	+	+	0.0	0.0	1.4	0.2	2.2	0.0	0.1	0.4	1.3	0.3	0.06	3.2	7	4	15.7
95% PI									0-0.1	0-0.1	0.6-7.4	0.1-1.1	0.9-11.6	0-0.1	0-0.5	0.2-0.6	1.0-1.7	0.1-0.5	0-0.16				
Loobu	mixed	10	6	+	+	+	+	+	+	0.0	0.3	0.3	0.2	0.0	1.2	1.6	2.9	0.9	0	0.2	7	4	10.7
95% PI										0-0	0.2-0.5	0.2-0.5	0.1-0.4	0-0.1	0.8-2.2	1.2-2.3	2.2-3.6	0.7-1.3	0				
Pirita	mixed	10	10	+	+	+	+	0.0	0.0	0.0	0.0	0.6	0.2	0.3	1.5	1.0	3.0	1.6	2.5	2.9	7	3, 8	11.6
95% PI								0-0	0-0	0-0	0-0	0.4-0.9	0.1-0.3	0.2-0.4	1.1-2.2	0.8-1.3							
Vasalemma	wild	2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.03	0.1	7	4	0
95% PI				0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0.1-0.3	0.1-0.3	0-0.1	0-0	0.0-0.1	0.0-0.1	0.1-0.4	0-0.06				
Keila	wild	3.5	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.5	0.5	0.2	0.0	0.0	0.6	1.6	0.6	1	7	4	0
95% PI				0-0	0-0	0-0	0-0	0-0	0-0	0-0	0.2-0.4	1.2-2	0.4-0.7	0.2-0.3	0-0	0.0-0.1	0.4-0.8	1.3-2.0	0.5-0.7				
Valgejögi	mixed	1.5	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.4	0.4	0.2	0.5	0.4	7	4	10.2
95% PI				0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.5	0.1-1.1	0-0.1	0-0.5	0.3-0.7	0.3-0.7	0.1-0.4	0.3-1.1				
Jägala	mixed	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	7	4	5.4
95% PI				0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0	0	0	0				
Vääna	mixed	3.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.15	0	7	4	0
95% PI				0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.7				
Sum of +, Estonia				0.04	0.04	0.04	0.04	0.05	0.06	0.07	4	4	5	1	3	4	9	6	4	10			
Assessment unit 6 (Sub-div. 32), total			**243**			**15**	**14**	**29**	**13**	**14**	**19**	**26**	**35**	**36**	**19**	**13**	**47**	**55**	**27**	**28**			**548**
95% PI			177-334			12-21	11-20	24-36	10-19	11-20	15-26	21-31	29-44	31-43	16-24	11-16	39-56	47-66	25-36				

Table 6.3.3.1 Densities of wild salmon parr in electrofishing surveys at permanent stations in rivers discharging into the Gulf of Finland, Sub-division 32.

River	Year	Number of parr/100m2		Number of parr	River	Year	Number of parr/100m2		Number of parr
		0+	1+ and older	in survey			0+	1+ and older	in survey
Kunda					Pirita				
(wild)	1992	7.4	12.9	118	(mixed)	1992	1.9	0.7	11
	1993	0	4.5	26		1993			
	1994	2.4	0	7		1994	0	0	0
	1995	15.4	3.1	60		1995	0	0	0
	1996	22.6	13.7	98		1996	0	0.1	1
	1997	1.2	21.5	78		1997			
	1998	13.8	0.9	68		1998	0	0	0
	1999	6.4	18.1	103		1999	6.5	0	55
	2000	20.8	7.6	75		2000	0	0.9	13
	2001	30.3	14.7	156		2001	1.2	0.3	18
	2002	13.2	4.9	55		2002	0	0.3	10
	2003	0.7	3.6	13		2003	0	2.3	38
	2004	23.8	0.3	70		2004	0.2	1.5	8
	2005	5.3	10.2	38		2005	12.8	6.4	185
	2006	18.6	13.3	91		2006	5	1.5	84
	2007	5.1	4.7	69		2007	2.2	1.8	56
	2008	3.5	0.4	9		2008***	11.3	4.1	79
Selja					Vääna				
(mixed)	1995	1.3	6.5	18	(mixed)	1998	0	0.1	1
	1996	0	0.4	1		1999	0	0	0
	1997	0	0	0		2000	0.1	0	1
	1998	0	0	0		2001	0	0	0
	1999	0.1	2.3	26		2002	0	0.2	1
	2000	1.2	0.4	32		2003	0	0	0
	2001	1.4	3.7	33		2004	0	0	0
	2002	0	0	0		2005	0	0	0
	2003	0.0	0.1	1		2006	13.9	0	42
	2004	0	0.6	3		2007	0	0	0
	2005	4.3	2.1	58		2008	9.5	0	54
	2006	1.3	0.7	18	Keila				
	2007	0.2	0.1	3	(wild)	1994	1.1	1.1	12
	2008	31.9	4.1	157		1995	6.9	0.3	105
Loobu						1996	11.7	1.1	115
(mixed)	1994	1.2	2.8	23		1997	0	5.2	47
	1995	0.2	0.2	2		1998	0	1.1	10
	1996	0	0.4	2		1999	95	1.3	154
	1997	0	0.3	3		2000	3.8	6.6	52
	1998	0.2	0	1		2001	0	2.2	21
	1999	10.5	0.8	70		2002	6.3	0.7	38
	2000	0.6	0.8	17		2003	0	0	0
	2001	0	0.5	3		2004	0.2	0	2
	2002	0.1	0.1	2		2005	25.2	2.5	76
	2003	0	2.9	21		2006	5	6.8	26
	2004	1	3.9	30		2007	15.4	2.5	58
	2005	2.5	7.1	112		2008	37.4	3.8	43
	2006	0.8	1.8	27					
	2007	2.5	0	36	Vasalemma				
	2008	6.3	0.3	44	(wild)	1992	3.4	2.6	23
Valgejõgi						1993			
(mixed)	1998	0	0	0		1994	1.9	0	7
	1999	2.4	0	26		1995	18.7	0.4	99
	2000	0.4	1	14		1996	4.8	5	51
	2001	4.4	1.6	58		1997	0	1.5	8
	2002	7.1	0	3		1998	0	0.2	2
	2003	0.2	0.8	5		1999	13.5	0	80
	2004	0.5	3.7	16		2000	3.5	1.7	27
	2005	5.4	2.7	66		2001	0.4	0.9	3
	2006	9.5	2.1	86		2002	7.1	0.3	23
	2007	6.6	4.9	100		2003	0	0	0
	2008***	4.9	3.4	39		2004	0	0	0
Jägala						2005	18.4	0	39
(mixed)	1998	0	0	0		2006	7.8	0.8	32
	1999	0.5	0	2		2007	3.3	0.2	19
	2000	0	0	0		2008	1.4	0.7	12
	2001	16.2	0	38					
	2002	0	0	0	Purtse				
	2003	0	0	0	(mixed)	2006	2.5	0	12
	2004	0.5	0	3		2007	4.3	0.14	32
	2005	1.9	0	6		2008***	0.5	3.2	30
	2006	0	0.1	1					
	2007	0.1	0	1					
	2008	6.6	0	31					

*) = no electrofishing
**)= flow was extremely small and fish were concentrated on amall area
***)=high flow, poor catchability
\+ = minor production.

Table 6.7.1 Share of tag returns from the Main Basin for the salmon released to the river Kymijoki in 1980-2008.

Year class	Share of recaptures from the Main Basin	Total (n) recaptures	Total (n) tagged	Recapture rate total
1980	20%	168	1792	9%
1981	18%	640	5976	11%
1982	25%	693	3999	17%
1983	25%	843	6920	12%
1984	32%	564	5409	10%
1985	19%	831	5955	14%
1986	31%	1783	10223	17%
1987	19%	610	3478	18%
1988	15%	840	6045	14%
1989	12%	633	4915	13%
1990	9%	528	4988	11%
1991	8%	262	3449	8%
1992	9%	1091	9837	11%
1993	8%	500	3974	13%
1994	2%	125	1998	6%
1995	11%	198	3996	5%
1996	5%	94	1997	5%
1997	24%	21	998	2%
1998	12%	51	2000	3%
1999	28%	25	1999	1%
2000	16%	49	4500	1%
2001	38%	42	3999	1%
2002	42%	12	1991	1%
2003	25%	16	1994	1%
2004	16%	57	2992	2%
2005	14%	49	3996	1%
2006	0%	5	1991	0%
2007	11%	27	3997	1%
2008	0%	11	3997	0%

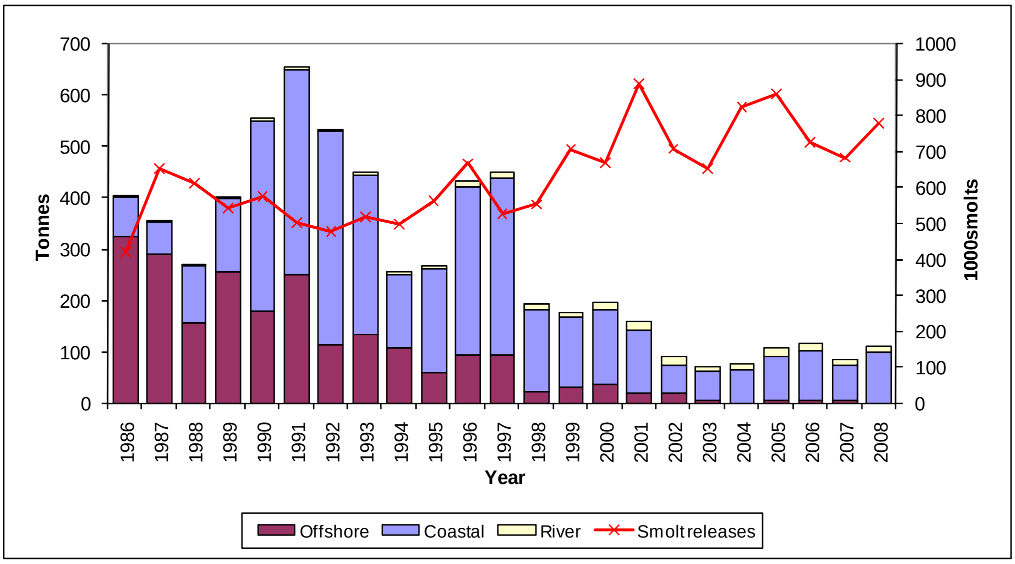

Figure 6.2.1. Salmon catches and smolt releases in the Gulf of Finland in 1986–2008.

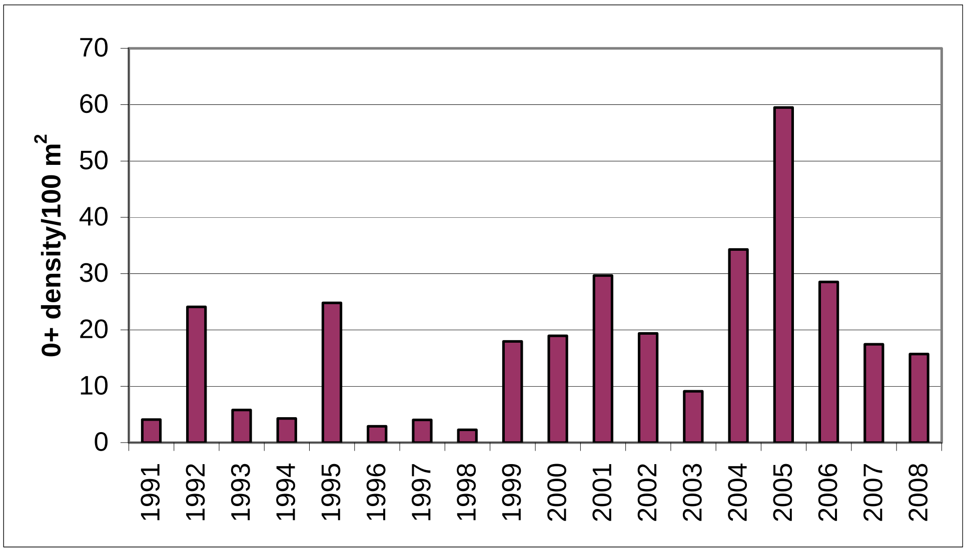

Figure 6.3.1.1. Average densities of wild 0+ salmon parr on five regular electrofishing sites in the river Kymijoki in 1991–2008.

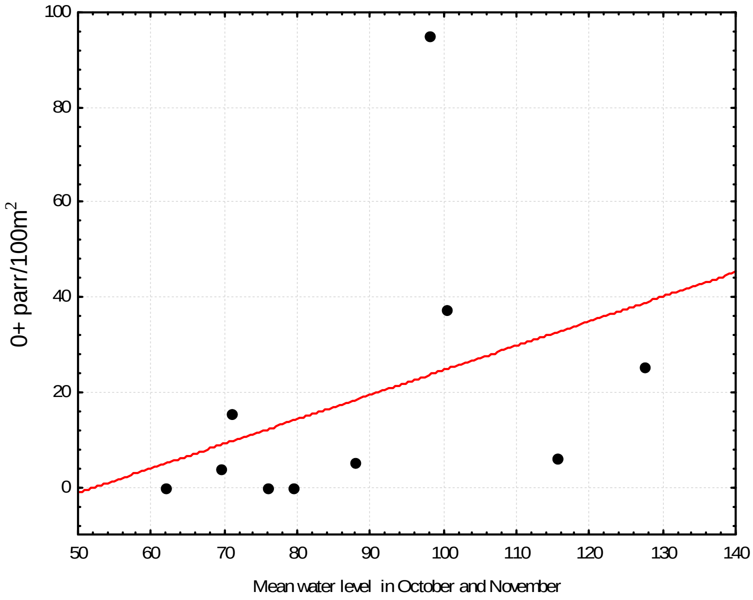

Figure 6.3.2.1. Correlation between mean water level during spawning season (October and November) and 0+ parr density during following year in R. Keila (r_s = 0.64, p = 0.044, n = 10).

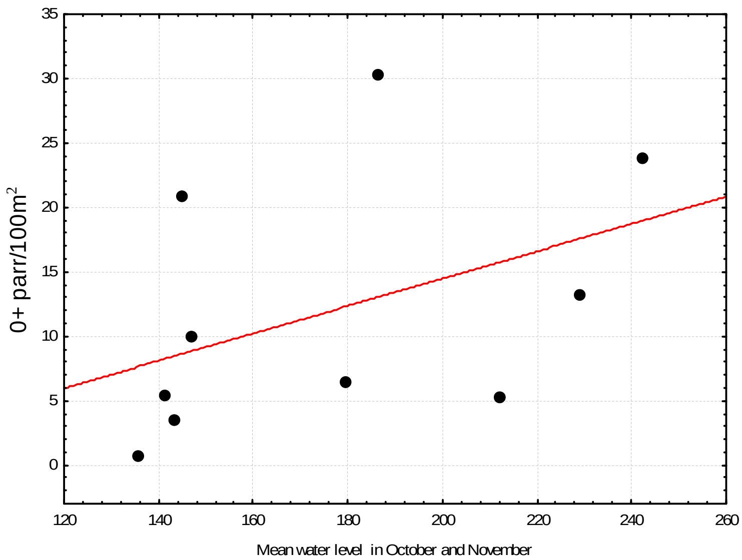

Figure 6.3.2.2. Correlation between mean water level during spawning season (October and November) and 0+ parr density during following year in R. Kunda (r_s = 0.62, p = 0.53, n = 10).

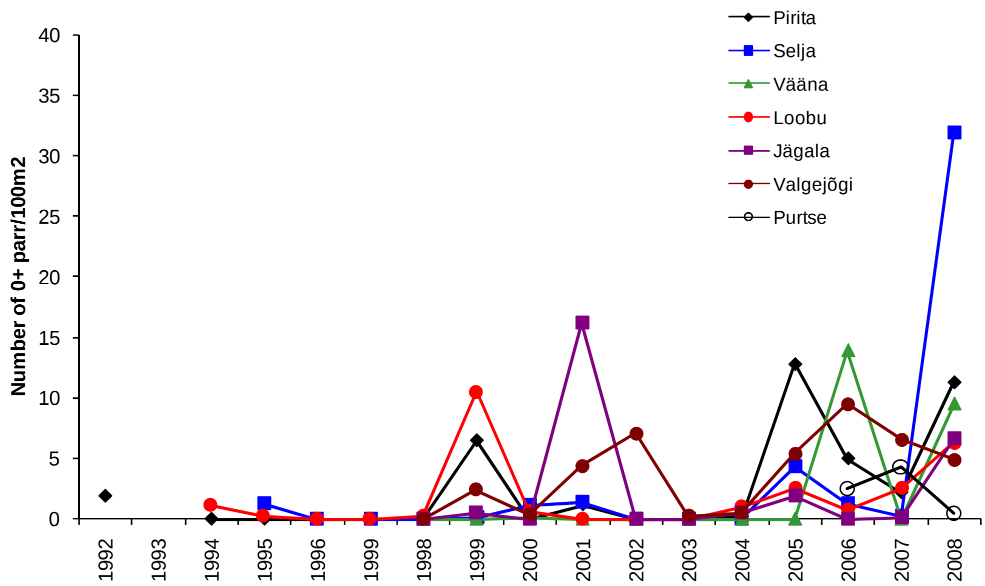

Figure 6.3.3.1 Densities of 0+ (one-summer old) salmon parr in the seven Estonian mixed salmon rivers.

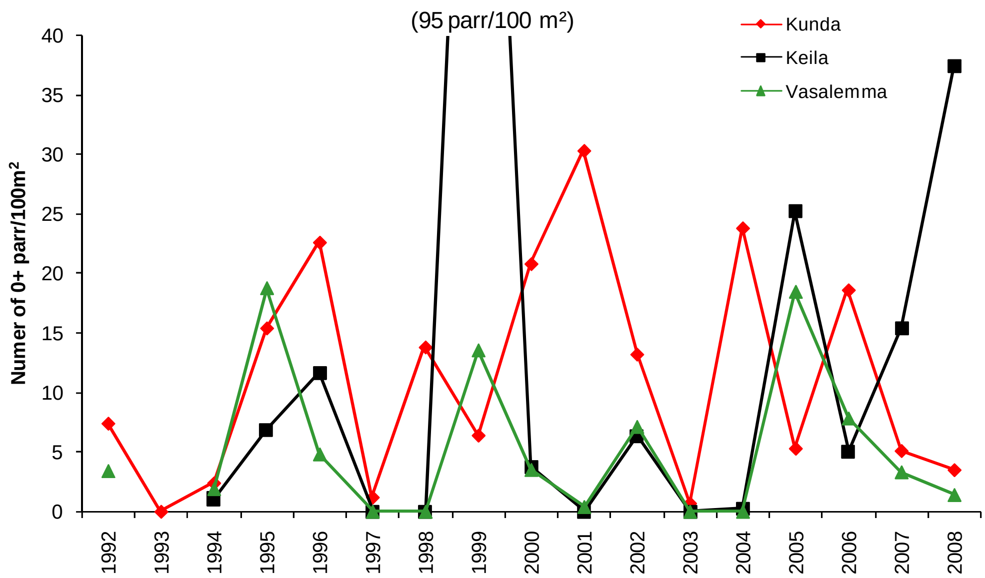

Figure 6.3.3.2 Densities of 0+ (one-summer old) salmon parr in the three wild Estonian salmon rivers. In 1999, the exceptionally high parr density (95 ind./100 m²) was observed in Keila in the conditions of summer drought.

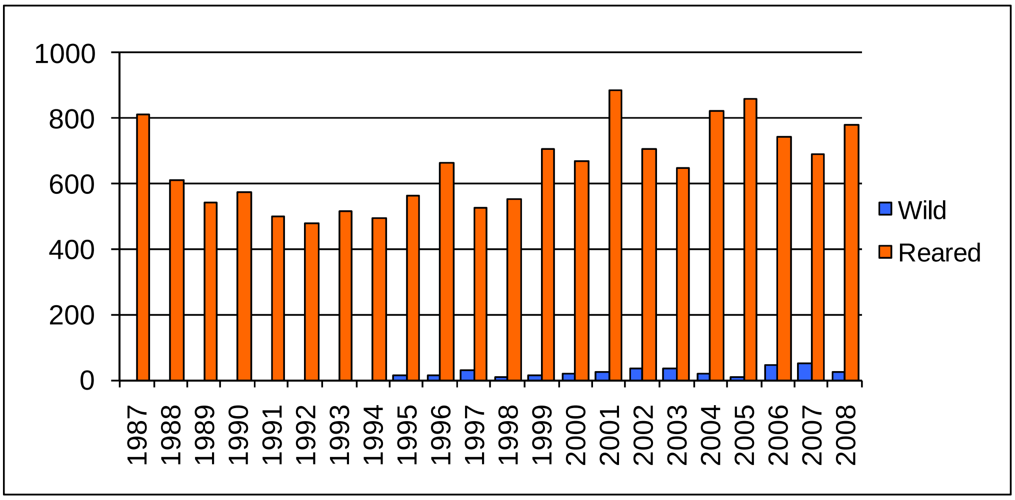

Figure 6.5.1. Annual production of wild and reared smolts in the Gulf of Finland. No information of the wild production is available before 1995.