

Atlantic salmon (*Salmo salar*) in Subdivision 32 (Gulf of Finland)

ICES stock advice

ICES advises that when the precautionary approach is applied, fisheries-related mortality on wild salmon from all wild and mixed (hatchery–wild) rivers in the Gulf of Finland should be as low as possible. Most of the salmon in the Gulf of Finland are of reared origin. Effort in fisheries catching salmon should not increase and measures to focus the fishing effort on reared salmon should be implemented. Such measures should include relocation of coastal fisheries away from sites likely to be on the migration paths of Gulf of Finland wild salmon. Fin-clipping of reared salmon stocks would allow wild salmon to be distinguished from non-wild salmon, as well as helping to identify wild salmon locations and fisheries on wild salmon. Relocation of fisheries away from rivers and rivers mouths supporting wild or mixed stocks, should be maintained. Wild salmon returning to rivers should be protected from poaching.

Assuming that the amount of reared salmon released in 2017 is similar to previous years, the total commercial sea catch in 2018 should not exceed 11 800 salmon (focusing the fishing effort on reared salmon). Applying the same catch proportions estimated to have occurred in 2016, this would correspond to commercial landings (the reported wanted catch) of 9 558 salmon.

Effort in the salmon fishery in the Main Basin (subdivisions 24–29) should not increase, as wild salmon from the Gulf of Finland use the Main Basin as a feeding area.

Stock development over time

Wild stocks: The only wild salmon stocks in Subdivision 32 exist in three Estonian rivers. According to expert judgment, the smolt production has been generally above 50% of the potential smolt production capacity (PSPC) in the past three years (2014–2016) in rivers Keila and Kunda (Figure 1). Wild smolt production in 2016 for the three wild rivers was close to, or above levels of maximum sustainable yield (MSY), corresponding to 75% of the potential smolt production capacity (ICES, 2008a, 2008b). However, smolt production in river Vasalemma is highly variable and predicted to be very low in 2017.

Mixed hatchery-wild stocks: On aggregated stocks, wild smolt production in rivers that are stocked with hatchery fish (further referred to as mixed rivers) in Subdivision 32 is considered to be below 50% of the PSPC (Figure 1). Of the seven Estonian mixed salmon stocks in the Gulf of Finland only one is currently expected to be over 50% of its PSPC (Figure 3). Smolt production in Estonian mixed rivers is variable and has generally been higher in the last decade. Wild smolt production in the mixed river Luga (Russia) has stayed well below 50% of their potential, without any obvious trend (Figure 4). Smolt production in the mixed river Kymijoki (Finland) has generally been at a 20–30% level in relation to the estimated PSPC, but smolt production is expected to increase considerably in 2017 (Figure 4).

Reared stocks: Most of the salmon in the Gulf of Finland originate from smolt releases (Figure 5). Despite major releases, catches have decreased considerably in the last decade, indicating low post-smolt survival of reared salmon. However, some increase in catches has been observed in recent years.

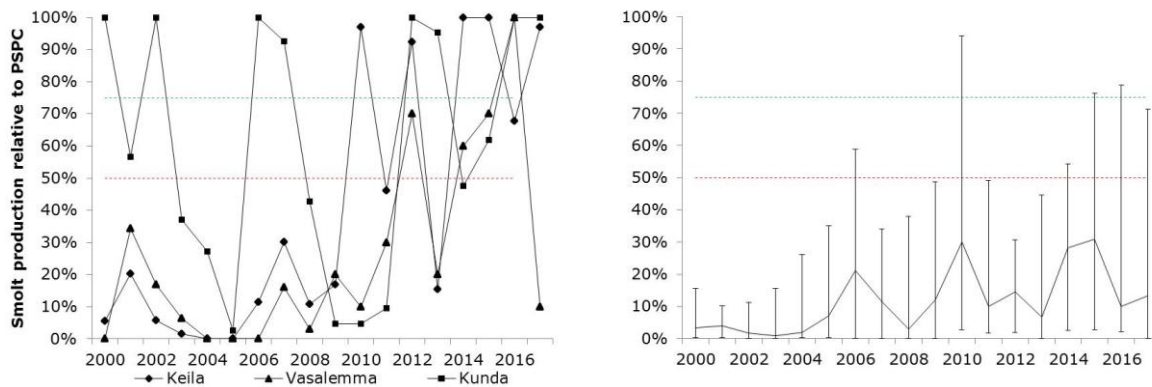


Figure 1 Atlantic salmon in Subdivision 32 (Gulf of Finland). Smolt production in Subdivision 32 in relation to the potential smolt production. Left panel: The three wild salmon stocks. Right panel: The mixed salmon populations, presenting the median and 90% interval across these stocks. The results are based on monitored parr densities and expert judgement. The potential smolt production is calculated only up to the lowermost impassable migration obstacle; many rivers have considerably higher total potential.

Catch options

No quantitative assessment or forecast could be provided.

The new data available (catch statistics and parr densities) do not change the perception of the Gulf of Finland salmon stocks. Therefore, the same catch advice provided last year is still applicable for 2018. Assuming that the amount of reared salmon released in 2017 is similar to previous years, and provided that the fisheries do not target wild salmon, this corresponds to a total commercial catch at sea not exceeding 11 800 salmon (where the fisheries selection should be focused on the reared stocks).

Applying the same proportions estimated to have occurred in 2016, the 11 800 total commercial sea catch would be split as follows: 16% unwanted catch (previously discarded) and 84% wanted catch (81% reported and 3% unreported).

Basis of the advice

Table 1 Atlantic salmon in Subdivision 32 (Gulf of Finland). The basis of the advice.

Advice basis	Precautionary approach.
Management plan	EC proposal (EC, 2011), not formally adopted.

Quality of the assessment

Information about the exploitation rate of wild salmon in the mixed-stock fisheries is limited, and there is a lack of knowledge about the level of mixing of stocks during the migrations between the Gulf of Finland, Main Basin, and the Gulf of Bothnia.

The establishment of an index river, where electrofishing and counting of smolts and spawners is regularly carried out, is needed in the Gulf of Finland. Currently all of these variables are monitored only in river Pirita (Estonia), where a monitoring programme has been in place since 2014.

The magnitude of the recreational sea and river catch is uncertain.

There has been no reported catch of salmon from Russian sea fisheries in the last few years. No fishery is currently targeting salmon, but salmon may be caught as a bycatch in the coastal fishery (by trapnets and gillnets).

For assessment purposes and advice, Gulf of Finland salmon stocks are treated as a group separate from salmon in subdivisions 22–31. Construction of a separate full life history model for Gulf of Finland, similar to that used for salmon in subdivisions 22–31, is under planning. Regional differences in development of wild and mixed salmon stocks have to be considered in this work. Because of data needs and potential technical difficulties with the model development, it is difficult to determine an exact time frame for an analytical assessment of the Gulf of Finland stocks.

Prior to the landings obligation, unwanted catch was discarded. This unwanted catch is composed of undersized salmon, seal-damaged salmon, and salmon discarded for other reasons (Table 5). A proportion of the undersized discards was expected to survive, depending on the gear type. There is considerable uncertainty about the amount of salmon discarded and even greater uncertainty about the proportion that survives when discarded. Seal-damaged salmon are all dead, but there is also uncertainty on the amount of seal-damaged salmon. The values used in this advice represent the current available knowledge. They are based on data from a variety of sources (such as logbooks or Data Collection Framework (DCF) sampling data), but these data are generally sparse. Expert judgement has been applied when no data are available, or to supplement the sparse data. Because of this uncertainty, current estimates of discards should be considered only as an order of magnitude and not as precise estimates.

Issues relevant for the advice

In the absence of a quantitative assessment, it is difficult to evaluate the response of Gulf of Finland wild stocks to management measures. Making the TAC restrictive on catches would not necessarily protect wild stocks. Any TAC consistent with the production of reared salmon in this area could still cause a bycatch of wild salmon, leading to unsustainable exploitation, so a key aspect is to conduct fisheries in a way that minimizes catches of wild salmon. Rather than merely restricting mixed-stock fisheries through a TAC system, the protection of wild salmon requires the adoption of management measures and fishing methods that target reared stocks and enhance survival of released fish. Increased fin-clipping of hatchery-reared salmon would allow better estimation of the proportion of wild and reared salmon in the catches and help management to direct the fishery more towards reared salmon.

Effort in fisheries catching salmon in the Gulf of Finland should not increase, and improved measures to focus selection on the reared stocks should be implemented. Effort in the fishery in the Main Basin should not increase, as salmon from the Gulf of Finland use the Main Basin as a feeding area.

Salmon from the Gulf of Finland also migrate to the Main Basin and effective protection of these wild stocks would need coordinated management of the Main Basin and Gulf of Finland fisheries. Tagging data and genetic studies have also shown that salmon from Gulf of Bothnia rivers are present in catches taken in the Gulf of Finland. The proportion of those stocks in the Gulf of Finland catch is unknown and warrants further study.

In Estonia, regulations have been in force since 2011 to relocate the coastal fisheries away from river mouth areas where these fisheries are likely to catch Gulf of Finland wild salmon. As part of those regulations, the closed area at the river mouth was extended to 1500 m during the main spawning migration period in all wild and most of the mixed rivers. Extra effort has been directed towards protecting wild salmon from poaching in the rivers when they return to spawn. In addition there has been a recent decrease in the longline fishery in the Main Basin. These measures may have contributed to the recent positive trend in smolt production.

Reference points

To evaluate the current state of salmon stocks in the Baltic Sea, ICES uses the smolt production relative to the 50% and 75% level of the natural production capacity (potential smolt production capacity; PSPC) on a river-by-river basis. Preliminary PSPC values have been proposed, based on expert opinion. No stock–recruit data exist at the moment, precluding validation of these preliminary PSPC values.

Basis of the assessment

ICES has established six assessment units for salmon in the Baltic Sea, where the Gulf of Finland constitutes assessment unit six (Figure 6). The division of stocks into units is based on biological and genetic characteristics. Stocks of a particular unit are assumed to exhibit similar migration patterns. It can therefore be assumed that they are subjected to the same fisheries, experience the same exploitation rates, and could be managed in the same way.

Table 2 Atlantic salmon in Subdivision 32 (Gulf of Finland). The basis of the assessment.

ICES stock data category	3 (ICES, 2016).
Assessment type	Qualitative assessment based on monitored parr densities and expert judgement.
Input data	Commercial catches (1984–2016; international landings, fishing effort, tag returns). Survey indices (parr densities from all wild and salmon mixed rivers (1992–2016), smolt counts in some mixed rivers; 2001–2016).
Discards and bycatch	Included in the assessment (estimates based partly on data and partly on expert evaluation).
Indicators	None.
Other information	The assessment is based on the benchmark in 2012 (IBP Salmon; ICES, 2012). The data and model options were considered in 2017 (WKBaltSalmon; ICES, 2017a).
Working group	Assessment Working Group on Baltic Salmon and Trout (WGBAST).

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 3 Atlantic salmon in Subdivision 32 (Gulf of Finland). ICES advice, catch corresponding to advice, and TAC for the Gulf of Finland (Subdivision 32). All numbers are in individual fish.

Year	ICES advice	Catch corresp. to advice	TAC	Landings at sea [^]	Catch at sea ^{^^}	River catch
1993	TAC for reared stock.	109000	109000	*	*	*
1994	TAC for reared stock.	65000	120000	*	*	*
1995	Catch as low as possible in offshore and coastal fisheries.	-	120000	*	*	*
1996	Catch as low as possible in offshore and coastal fisheries.	-	120000	*	*	*
1997	Offshore and coastal fisheries should be closed.	-	110000	*	*	*
1998	Offshore and coastal fisheries should be closed.	-	110000	*	*	*
1999	Offshore and coastal fisheries should be closed.	-	100000	*	*	*
2000	Only fishery on released salmon should be permitted.	-	90000	*	*	*
2001	Only fishery on released salmon should be permitted.	-	70000	28371	33651	2943
2002	Only fishery on released salmon should be permitted.	-	60000	14015	18675	3608
2003	Only fishery on released salmon should be permitted.	-	50000	10848	15569	2056
2004	Only fishery on released salmon should be permitted.	-	35000	11023	15986	1814
2005	Only fishery on released salmon should be permitted.	-	17000	13891	17018	3326
2006	Only fishery on released salmon should be permitted.	-	15000	11924	16101	2363
2007	Retain sea fishery low. Special stock rebuilding measures for Estonian wild salmon rivers.	-	15000	11431	14561	1957
2008	No catch of wild salmon in the Gulf of Finland.	-	15000	15593	19647	1909
2009	Same advice as last year.	-	15000	13779	17198	2734
2010	Same advice as last year.	-	15000	6593	8313	1076
2011	No catch of Estonian wild salmon in the Gulf of Finland. Any increase in total catches from present levels should be prevented.	13000	15000	8147	10065	1255
2012	No catch of Estonian and Russian wild salmon in the Gulf of Finland. No increase in total catches from present levels (2006–2010 average).	12000	15000	14781	17338	1214
2013	Catch of wild salmon should be kept to a minimum. Reduce effort.	-	15000	13171	15391	1358
2014	No effort increase in fisheries catching salmon in SD 32. No fishing targeting wild salmon from the Gulf of Finland and measures to reduce bycatch of wild salmon in fisheries. Advice is for total commercial removals (dead catch) in SD 32 (corresponding landings are given in brackets).	9000 (8000)	13000	12047	13913	986
2015	No effort increase in fisheries catching salmon in SD 32. No fishing targeting wild salmon from the Gulf of Finland and measures to reduce bycatch of wild salmon in fisheries. Advice is for total commercial sea catch in SD 32 (estimates of the split of the catch in 2013 into: unwanted, wanted and reported, wanted and unreported – percentages are given in brackets).	11800 (11%, 81%, 8%)	13100	10124	11975	556
2016	Fishing mortality on wild salmon as low as possible. No effort increase in fisheries catching salmon and improved measures to focus selection on the reared stocks. Advice is for total commercial sea catch in SD 32 (estimates of the split of the catch in 2015 into: unwanted, wanted and reported, wanted and unreported – percentages are given in brackets).	11800 (10%, 83%, 7%)	13100	10060	11321	1044
2017	Fishing mortality on wild salmon as low as possible. No effort increase in fisheries catching salmon and improved measures to focus selection on the reared stocks. Advice is for total commercial sea catch in SD 32 (estimates of the split of the catch in 2014 into: unwanted, wanted and reported, wanted and unreported – percentages are given in brackets).	11800 (16%, 81%, 3%)	10486			
2018	Fishing mortality on wild salmon as low as possible. No effort increase in fisheries catching salmon and improved measures to focus selection on the reared stocks. Advice is for total commercial sea catch in SD 32 (estimates of the split of the catch in 2016 into: unwanted, wanted and reported, wanted and unreported – percentages are given in brackets).	11800 (16%, 81%, 3%)				

[^]Total reported landings, including recreational catches.

^{^^}Estimated total catches, including landings, discards (dead and alive), and mis- and unreporting.

* Estimates for the total catch (including unreporting and discards) are compiled only for 2001 onwards.

History of catch and landings

Exploitation of salmon in the Gulf of Finland over the last twenty years has changed substantially (Table 6), from targeting mixed stocks offshore to focusing on local stocks in coastal areas and rivers.

The major commercial salmon fishery in the area is the trapnet fishery at the Finnish coast. The Finnish salmon fisheries have caught about 90% of the commercial landings in Subdivision 32 in the years 2010–2015. The fishing effort had been of an equal magnitude for the preceeding ten years, but a significant (~30%) decrease has been noted in preliminary estimates for 2015. The coastal fishery with trapnets has moved from the outer archipelago to areas closer to the coast and river mouths. Trapnets with modifications to prevent seals entering the trap are in use.

Off the Estonian coast salmon are caught as bycatch (mainly in gillnet fisheries) where the share of salmon forms less than 1% (by weight) of the total annual catches. In 2016, the salmon catch reported by commercial fishers represented about 63% of all salmon caught in Estonia.

Estimates of recreational salmon catch are very uncertain. Estimates are available from Finland and also from Estonia in some years. The major part of the recreational salmon catch is taken at sea using gillnets. The river fishery takes place in the Finnish and Estonian rivers and is mainly rod fishing. The river Kymijoki has comprised the major proportion of the recreational river catches in the area. However, in 2017 total river catches in Estonian rivers increased to almost 2 t. River fishing is allowed in all but one (Loobu) of the mixed rivers, and it is prohibited in the three wild rivers.

Table 4 Atlantic salmon in Subdivision 32 (Gulf of Finland). Catch distribution by category in 2016 as estimated by ICES.

Atlantic salmon in Subdivision 32 (Gulf of Finland): Catch distribution by category in 2016 as estimated by ICES.			
Catch in 2016 (dead catch, including non-commercial and river catches)	Landings		Discards (dead)
65 tonnes	Nominal landings (commercial and non-commercial in sea and in rivers) 97%	Unreported and misreported 3%	6.5 tonnes
	58.5 tonnes		

Table 5 Atlantic salmon in Subdivision 32 (Gulf of Finland). Catches in sea and river fisheries by year (in numbers). Commercial sea landings are split into reported (nominal) and unreported (proportional to the reported component, based on expert evaluation). Discard estimates of undersized fished are proportional to the reported commercial landings, based on expert evaluation. Estimates of seal damages are based partly on logbook data and partly on expert evaluations. Estimates of discards for other reasons are from logbooks. Recreational catch at sea is only Finnish and is estimated by national surveys. River catches are based on the catch reports from the recreational fishers. The final column of the table (total commercial sea removal) is obtained by subtracting from the total commercial sea catch the undersized discards estimated to survive (around 50% survival, although the survival estimate is very uncertain). With the exception of commercial reported landings, all values in the table are imprecise and should be considered only as an order of magnitude.

Year	Sea fisheries					Recreational catch (±95% C.I.)	River fishery	Total commercial sea catch	Total commercial sea removal (dead catch)
	Commercial fisheries								
	Landings		Discards						
	Reported	Unreported	Discarded undersized (died + survived)	Seal damages	Discarded for other reasons				
2001	14191	1093	471	3701	15	14180 (±5780)	2943	19471	19275
2002	11465	826	390	3412	32	2550 (±750)	3608	16125	15998
2003	8298	690	270	3759	2	2550 (±750)	2056	13019	12896
2004	7933	660	270	4019	14	3090 (±1430)	1814	12895	12770
2005	10801	903	350	1872	2	3090 (±1430)	3326	13928	13756
2006	11744	979	385	2804	9	180 (±110)	2363	15921	15725
2007	11251	941	362	1826	1	180 (±110)	1957	14381	14182
2008	14863	1251	484	2319	0	730 (±350)	1909	18917	18649
2009	13049	1114	427	1876	2	730 (±350)	2734	16468	16247
2010	6233	538	206	974	2	360 (±400)	1076	7953	7850
2011	7787	667	288	932	31	360 (±400)	1255	9705	9566
2012	11331	974	448	1062	73	3450 (±3170)	1214	13888	13697
2013	9721	835	565	593	227	3450 (±3170)	1358	11941	11773
2014	9317	793	362	657	54	2730 (±3270)	923	11183	11020
2015	7394	298	243	1300	10	2730 (±3270)	556	9245	9122
2016	7329	302	245	700	14	2731 (±3270)	1044	8590	8471

Table 6 Atlantic salmon in Subdivision 32 (Gulf of Finland). Nominal landings in round fresh weight, from sea, coast, and river in Subdivision 32.

Year	River	Coast	Offshore	Commercial coastal and offshore ¹		Total ²	
	tonnes	tonnes	tonnes	tonnes	thousand fish	tonnes	thousand fish
1987	2	61	290			353	
1988	2	112	156			270	
1989	2	145	254			401	
1990	6	369	178			553	
1991	5	398	250			653	
1992	3	418	111			532	
1993	6	310	133			449	111
1994	7	142	106			255	57
1995	7	201	58			266	39
1996	12	327	93			432	80
1997	10	345	93			448	77
1998	13	160	21			194	31
1999	10	137	29			176	30
2000	16	144	37	125	23	197	35
2001	16	121	20	86	14	157	26
2002	16	56	18	60	11	90	18
2003	9	57	3	46	8	69	13
2004	11	62	3	47	8	75	13
2005	17	79	3	64	11	99	18
2006	13	70	3	72	12	86	14
2007	11	69	3	71	11	83	13
2008	10	100	2	96	15	112	18
2009	14	80	1	77	13	96	16
2010	5	39	0	38	6	45	7
2011	5	48	0	45	8	53	9
2012	7	91	0	72	11	98	16
2013	7	84	0	64	10	92	15
2014	5	79	0	62	9	85	13
2015	3	59	0	42	7	62	11
2016*	5	64	0	47	7	69	12

*Preliminary.

¹ For comparison with TAC. Catch data in 1987–1999 are missing because commercial and recreational catches could not be separated in those years.

² Total catch includes catches from recreational fisheries.

Summary of the assessment

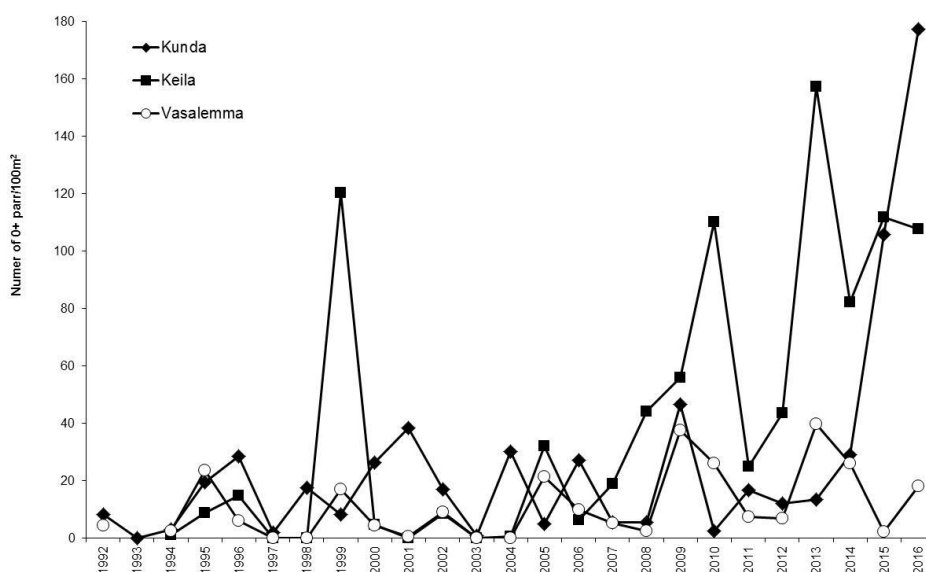


Figure 2 Atlantic salmon in Subdivision 32 (Gulf of Finland). Densities of 0+ (one-summer-old) salmon parr in the three wild Estonian salmon rivers. The exceptionally high parr density in river Keila in 1999 was observed under conditions of summer drought.

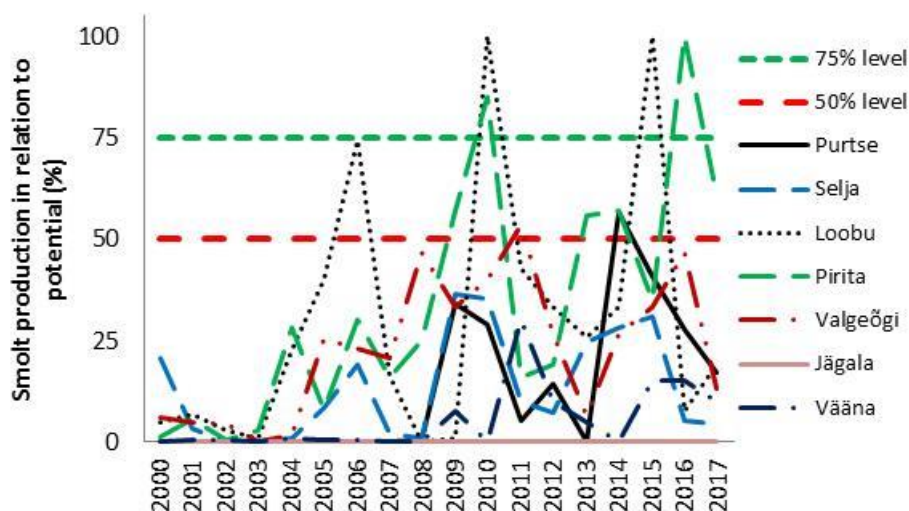


Figure 3 Atlantic salmon in Subdivision 32 (Gulf of Finland). Smolt production in relation to the potential smolt production in the seven Estonian mixed salmon stocks. The results are based on monitored parr densities and expert judgement.

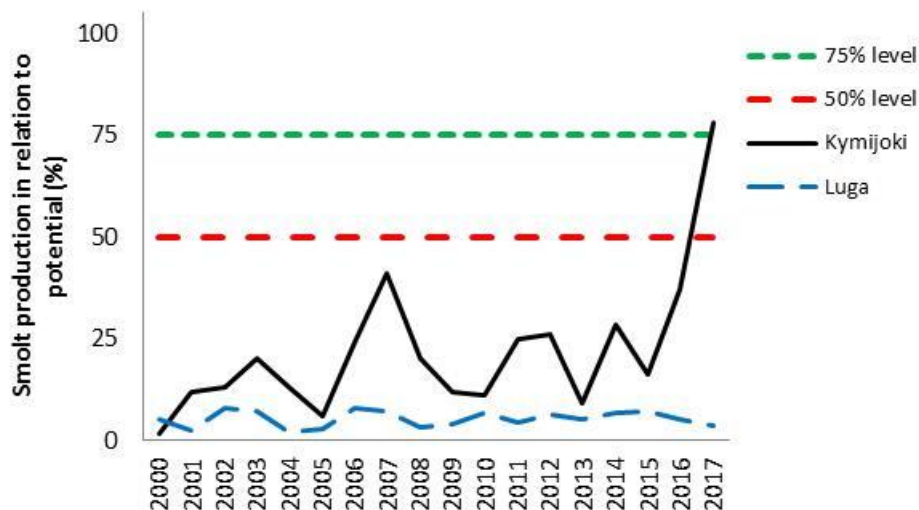


Figure 4 Atlantic salmon in Subdivision 32 (Gulf of Finland). Smolt production in relation to the potential smolt production in the mixed salmon stocks of Russia (river Luga) and Finland (river Kymijoki). The results are based on monitored parr densities and expert judgement.

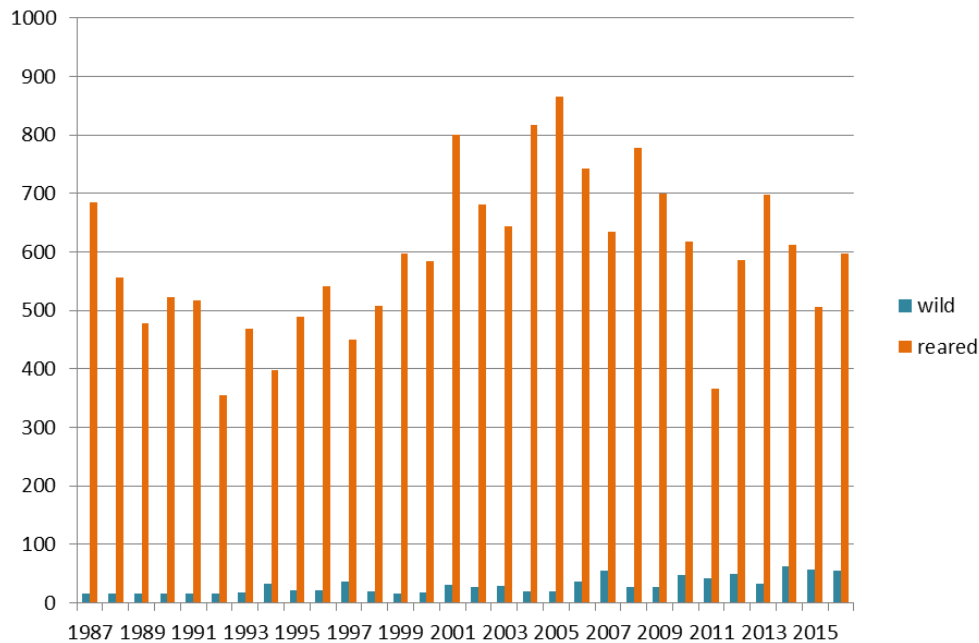


Figure 5 Atlantic salmon in Subdivision 32 (Gulf of Finland). Annual production (in thousands of fish) of wild and reared smolts in the Gulf of Finland.

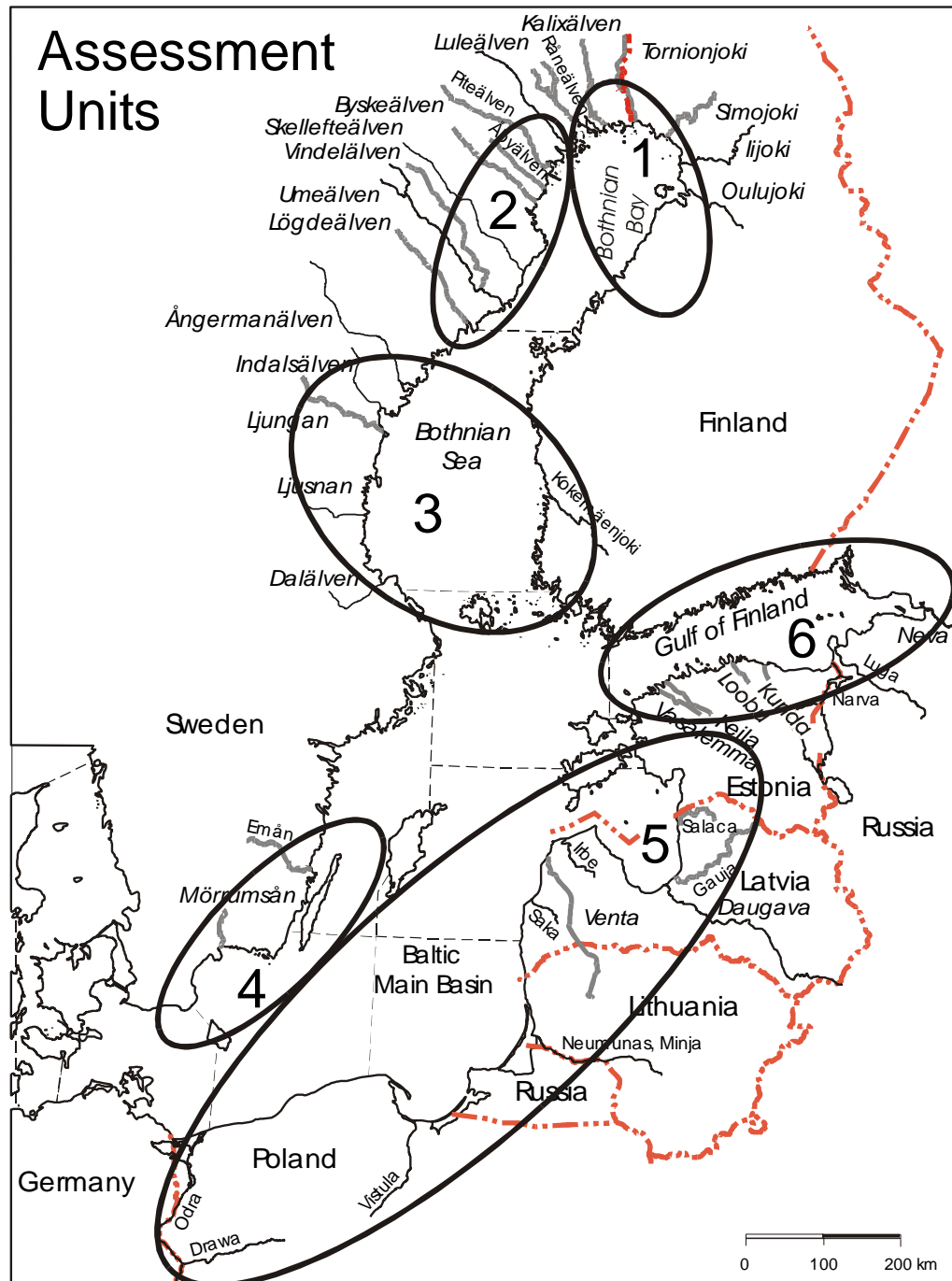


Figure 6 Atlantic salmon in Subdivision 32 (Gulf of Finland). Grouping of salmon stocks in six assessment units in the Baltic Sea. Assessment Unit 6 corresponds to Subdivision 32.

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