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Atlantic salmon (*Salmo salar*) in subdivisions 22–31 (Baltic Sea, excluding the Gulf of Finland)

ICES stock advice

ICES advises that when the maximum sustainable yield (MSY) approach is applied, total commercial sea catch in 2018 should not exceed 116 000 salmon. Applying the same catch proportions estimated from observations in the 2016 fishery, this catch would be split as follows: 9% unwanted catch (previously referred to as discards) and 91% wanted catch (68% reported, 7% unreported, and 16% misreported).

ICES advises that management of salmon fisheries should be based on the status of individual river stocks. Fisheries on mixed stocks that cannot target only river stocks with a healthy status, present particular threats to stocks that do not have a healthy status. Fisheries in open-sea areas or coastal waters are more likely to pose a threat to depleted stocks than fisheries in estuaries and rivers. Effort in these mixed-stock fisheries has been reduced to low levels and should not increase.

The salmon stocks of rivers Rickleån, Kågeälven, and Testeboån in the Gulf of Bothnia, Emån in southern Sweden, and several rivers in the southeastern Main Basin are especially weak. These stocks need longer-term, stock-specific rebuilding measures, including fisheries restrictions in estuaries and rivers, habitat restoration, and removal of physical barriers. In order to maximize the potential recovery of these stocks, exploitation should not increase along their feeding and spawning migration routes at sea. The offshore fishery in the Main Basin catches all weak salmon stocks on their feeding migration. The coastal fishery catches weak stocks from northern rivers when the salmon pass the Åland Sea and the Gulf of Bothnia on their spawning migration.

Stock development over time

To evaluate the status of wild stocks, ICES uses smolt production relative to the potential smolt production capacity (PSPC) on a river-by-river basis. Time-series indicate that the status for most stocks has improved over the last five years. The number of rivers where smolt production has reached 50% and 75% of the PSPC with a probability of >70% has increased (Table 9) compared to the last analytical assessment in 2015. Of the 29 rivers assessed in subdivisions 22–31:

- the probability that smolt production in 2016 reached 50% of the PSPC is above 70% for 18 rivers, between 30% and 70% for three rivers, and below 30% for eight rivers.
- the probability that smolt production reached 75% of PSPC in 2016 is above 70% for 14 rivers.

With a few exceptions, the rivers in the northern Baltic Sea area present a better status than the southern ones.

The 2017 assessment indicates that total wild smolt production has increased tenfold in assessment units (AUs) 1–2 since the Salmon Action Plan (ICES, 2008a) was adopted in 1997 (Figure 2a). Smolt production in AU 3, however, only shows a weak positive trend, while it has remained at around the same level in AU 4. Despite the overall increase in wild smolt production, the decline in post-smolt survival (Figure 3) from the late 1980s until the mid-2000s has impacted fishing opportunities. Post-smolt survival has improved slightly since 2005 and appears to have remained stable in recent years.

Smolt production estimates for AU 5 rivers are based on parr density data in combination with expert judgement about mortality rates. Smolt production in AU 5 has been low for many years (Figure 2a), but in 2015 and 2016 it increased in several rivers and, based on parr density data, may be expected to increase in the near future.

The harvest rate of salmon has decreased considerably since the beginning of the 1990s (Figure 2b). The overall trend in the status of the pre-fishery stock abundance is estimated to have remained largely unchanged over the last few years (Figure 2c).

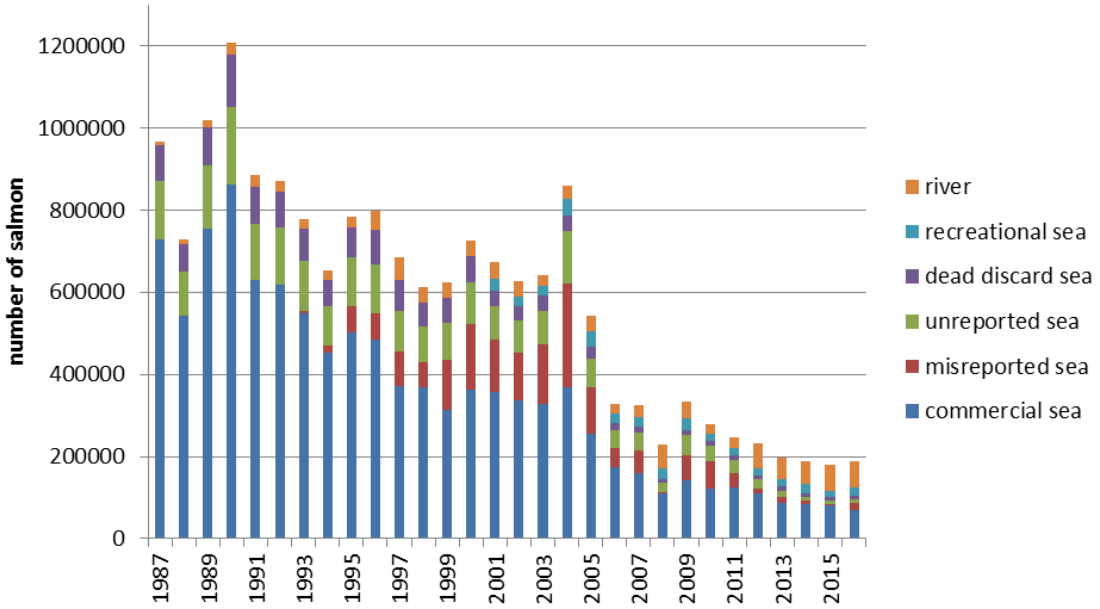

Figure 1 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Total removals (dead catch) in numbers in the years 1987–2016: river catches (mainly recreational, but including also some commercial fishing) and removals at sea (split into commercial and recreational nominal landings, unreported and misreported landings, and dead discards). Commercial sea catch also includes recreational sea catch in 1987–2000.

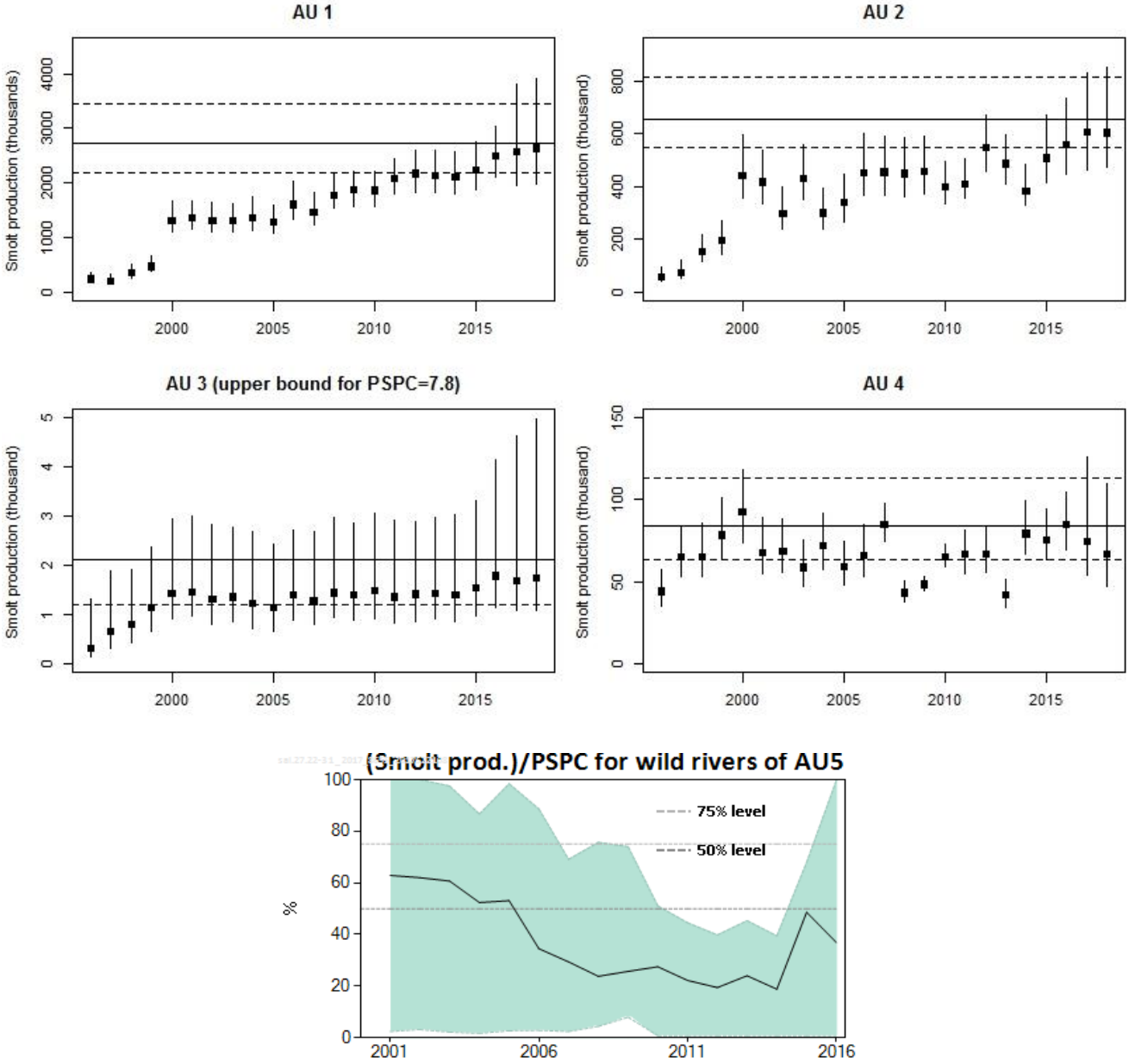

Figure 2a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Top and middle rows: Smolt production (time-series) and PSPC (horizontal solid line) for AUs 1–4 (median estimate for the entire unit and 90% probability intervals). Bottom: Smolt production relative to PSPC for AU 5 (median estimate across the wild rivers and 90% probability interval).

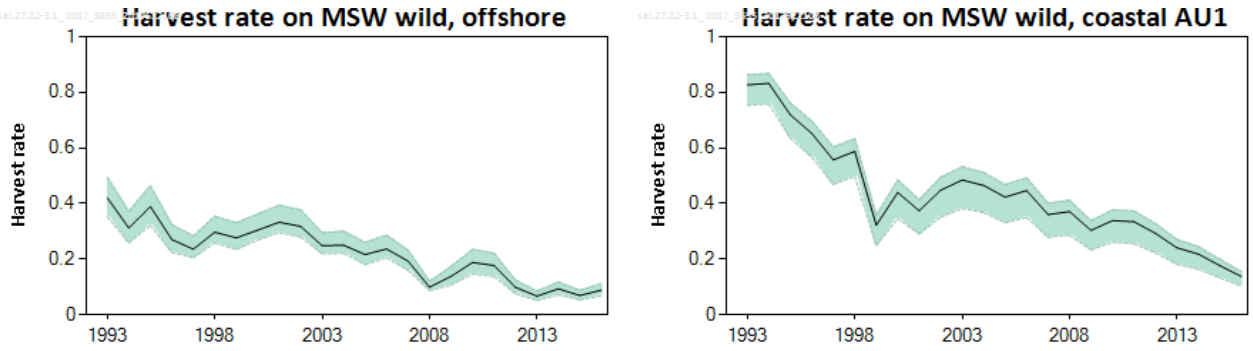

Figure 2b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Harvest rates in offshore (by fishing season; left) and coastal (by calendar year; right) fisheries.

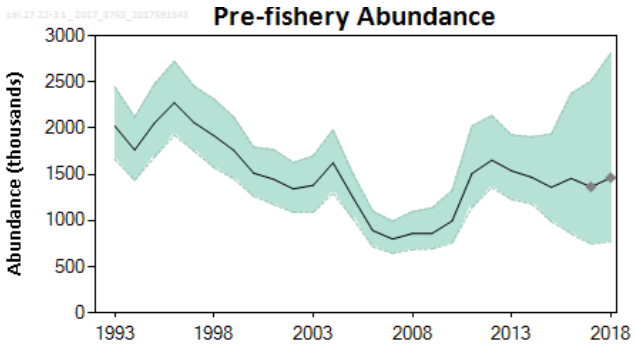

Figure 2c Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Estimated pre-fishery abundance in the sea (PFA; wild and reared, 1SW and MSW fish in total) for scenario 1 (Table 1). The median estimate and 90% probability intervals are plotted, diamond symbols indicate projections from the model.

Catch options

Five fishing scenarios were considered for 2018 (Table 1). Scenario 1 corresponds to the total commercial catch at sea advised by ICES for 2014–2017 (116 000 salmon per annum). Scenarios 2 and 3 represent a 20% increase and a 20% decrease in catch, respectively, compared with scenario 1. Scenario 4 follows the EU Commission's proposal for a multiannual plan for Baltic salmon (EC, 2011). Two options are presented under scenario 4: (a) F = 0.1 covers the commercial catch at sea; (b) F = 0.1 covers total (commercial and recreational) catch at sea. Both of these options, scenarios 4(a) and 4(b), are calculated based on estimates of pre-fishery abundance (PFA) at the beginning of 2018. Scenario 5 illustrates stock development under no fishing, neither at sea nor in rivers.

The outlook table for 2018 (Table 1) splits the total commercial catch at sea into similar components as in previous years, using the proportions estimated to have occurred in 2016: wanted catch reported (67.5%), wanted catch unreported (7.0%), wanted catch misreported (16.2%), and unwanted catch (9.3%; this is the catch that would be discarded if discarding was allowed). The 9.3% unwanted catch is the sum of 2.6% (undersized salmon) and 6.6% (seal-damaged salmon). Seal-damaged salmon are always dead, whereas some of the undersized salmon would survive if they were discarded. All scenarios assume additional recreational catches at sea that constitute 16.8% of the total (commercial + recreational) sea catch, based on the available data for 2016, and a constant harvest rate in rivers on returning salmon.

Table 1 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). The catch options for 2018.

Scenario	Commercial catch at sea in subdvisions 22–31 in 2018					
	Total commercial catch at sea	Wanted catch Reported	Unwanted catch (dead + alive)		Wanted catch Unreported	Wanted catch Misreported
			Undersized	Seal damaged		
1	116.0	78.4	3.1	7.7	8.1	18.8
2	139.2	94.0	3.7	9.2	9.7	22.6
3	92.8	62.7	2.5	6.1	6.5	15.1
4(a)	139.1	94.0	3.7	9.2	9.7	22.6
4(b)	115.8	78.2	3.1	7.7	8.1	18.8
5	0.0	0.0	0.0	0.0	0.0	0.0

Scenario	Recreational catch at sea 2018	Total sea catch (comm. + recr.) 2018	River catch 2018	Spawners 2018
1	23.4	139.4	52.0	180.0
2	28.1	167.3	49.0	170.0
3	18.7	111.5	55.0	190.0
4(a)	28.1	167.2	49.0	170.0
4(b)	23.4	139.1	52.0	180.0
5	0.0	0.0	0.0	288.0

All values in the table are in thousands of fish.
Note: The figures in the table are rounded. Calculations were done with unrounded inputs and computed values may not match exactly when calculated using the rounded figures in the table.

MSY approach

Figures 5a–b present the river-specific annual probabilities of meeting 75% of the PSPC under each scenario for the 16 wild rivers of AUs 1–4 included in the stock projections. Table 10 shows these probabilities for year 2023 (for stocks in AUs 1–3) or 2022 (for stocks in AU 4), which is approximately one full generation ahead from now. The results indicate relatively small differences between scenarios 1–4; only scenario 5 (zero fishing) is clearly different. There are, however, differences between rivers, with some of them having a much lower probability of reaching 75% of the PSPC. Rivers Emån (southern Sweden) and Simojoki and Rickleån (Gulf of Bothnia) have the lowest probabilities, though Rickleån shows positive trends under most scenarios.

Figure 6a–b displays estimated smolt production in the past and projected future smolt production under scenario 1. For all rivers except Emån and Mörrumsån, smolt production in 2022–2023 is expected to remain around current levels or to increase.

The status of the stock, based on the PFA abundance, is estimated to have remained largely unchanged, and the commercial catch at sea advised last year (scenario 1 in the catch options) is considered to provide the upper limit for exploitation under the MSY approach. This would imply a total commercial sea catch not exceeding 116 000 salmon in 2018.

Stock projections have not been conducted for Testeboån (AU 3) and for stocks in AU 5. Although a few rivers in AU 5 have shown signs of recovery in 2015 and 2016, the majority of these stocks are still regarded as weak. Mixed-stock fisheries pose a special problem in the fisheries management for these stocks. Effort in the fisheries has been reduced to low levels in recent years and should not increase. The reasons for the low productivity of southern stocks is not entirely clear but may, at least partly, be caused by conditions in the freshwater environment (ICES, 2014, 2015). Special actions (not only fishery-related) for these stocks are required in addition to the TAC.

Management plan

According to the management plan proposed by the EC "*the annual TAC for salmon stocks at sea shall not exceed the level corresponding to a fishing mortality rate of 0.1*". It is further stated that "*the TAC will only cover marine fisheries but will include masters of non-fishing vessels offering services for recreational fisheries*" (EC, 2011). The plan does not specify exactly how to interpret F = 0.1, or whether this value covers the total catch at sea or only the commercial part of this catch. Different fisheries occur at different points in time and space, and many fisheries catch only maturing salmon.

Hence, any catch calculation based on F = 0.1 is only approximate. ICES calculated the 2018 catch option by calculating the abundance at sea on September 1st for 1-sea-winter (1SW) fish and on July 1st for multi-sea-winter (MSW) fish, accounting for natural mortality from the start of the year, and then applying the exploitation rate.

If F = 0.1 covers only the commercial catch at sea (scenario 4(a)), this corresponds to a total commercial catch at sea not exceeding 139 128 salmon in 2018.

If, however, F = 0.1 covers the total catch at sea (scenario 4(b)), this corresponds to a total commercial catch at sea not exceeding 115 754 salmon in 2018.

ICES has not evaluated the proposed EC management plan for consistency with the precautionary approach and MSY.

Basis of the advice

Table 2 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). The basis of the advice.

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

Quality of the assessment

The assessment model could not be run with the addition of the 2016 data. The reasons remain unexplained, and ICES is currently exploring modelling options. The present assessment was therefore made using the same assessment model as previously, with data up to and including 2015. However, the predictions for 2016 from the model and the available observations for 2016 were in agreement with the assessment (ICES, 2017a). Because the most recent data (2016) could not be included in the model, the evaluation of the current status of the stocks and the stock projections are considered to be more uncertain.

The assessment produced somewhat higher estimates of pre-fishery abundance (PFA) in the sea than in the previous assessment (2015), particularly for future predictions, but with high uncertainty (Figure 7).

A benchmark process (WKBaltSalmon; ICES, 2017b) was held in 2016–2017 to evaluate available data and develop the assessment methods for Baltic salmon. Needs for improvement regarding data and methods identified during WKBaltSalmon have not yet been taken into consideration in the assessment.

The status assessment for a few river stocks (Piteälven, Öreälven, Lögdeälven, Emån, and Mörrumsån) should be regarded as uncertain, as basic input data for these rivers (river production area, potential smolt production capacity and/or smolt production priors) that were updated during WKBaltSalmon have not been included in the present assessment (ICES, 2017a, 2017b).

There are indications of currently increasing M74 mortality, as well as reported deaths of spawners due to disease problems, which may affect the projection. This extra mortality could reduce smolt production and PFA beyond the advice year, though the likely impacts are uncertain. The present advice has not taken into account a potential further increase in M74 mortality.

New data indicate that the recreational trolling catch estimates are underestimated (ICES, 2017a). Work is ongoing to refine these estimates, though the new estimates have not yet been included in the assessment.

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 and are based on data from a variety of sources (such as logbooks, interviews with fishers, agreed sampling schemes with skippers, 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

Salmon harvest rates are lower than experienced in the past and as such fishing mortality, as a proportion of total mortality, is lower now than in the past (Figure 2b). This implies that natural processes, mainly post-smolt and adult natural mortalities, currently have a higher relative impact than fishing mortality on the chances of reaching the management objective.

Fisheries on mixed stocks that cannot exclusively target river stocks with a healthy status, present particular threats to stocks that do not have a healthy status. Fisheries in open-sea areas or coastal waters are more likely to pose a threat to depleted stocks than fisheries in estuaries and rivers.

Exploitation in the Main Basin offshore fisheries affects possibilities for recovery of the Gulf of Finland salmon stocks as Gulf of Finland salmon is partly caught in the Main Basin.

A range of problems in the freshwater environment play a significant role in explaining the poor status of stocks in the southern Baltic rivers (ICES, 2012a, 2014).

Recent efforts to re-establish self-sustaining salmon stocks in "potential" rivers, where salmon stocks have been extirpated in the past, present exceptional challenges to management. The numbers of spawners in the "potential" rivers are likely to be particularly low following initial reintroductions, and productivity is likely to be lower than average. The considerations presented in this advice for the existing weak salmon stocks (e.g. habitat restorations, fishery restrictions, etc.) also apply to re-established stocks.

Reference points

To evaluate the state of the stock, ICES uses the smolt production relative to 50% and 75% of the natural production capacity (potential smolt production capacity; PSPC) on a river-by-river basis. 75% of the PSPC reference is based on the MSY approach (ICES, 2008a, 2008b), whereas 50% of the PSPC has no formal status as a reference point in ICES but is widely considered an interim objective for weak stocks. The 50% objective is therefore also included as part of the stock status evaluation.

Basis of the assessment

ICES uses five assessment units for salmon in the Baltic Main Basin and the Gulf of Bothnia (Figure 8). 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 subject to the same fisheries, experience the same exploitation rates, and could be managed in the same way (e.g. using coastal management measures might improve the status of all stocks in a specific assessment unit). Even though stocks of AUs 1–3 have the highest current smolt productions and, therefore, have an important role in sustaining economically viable fisheries, the stocks in AUs 4 and 5 contain a relatively high proportion of the overall genetic variability of Baltic salmon stocks.

Table 3 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Assessment areas.

Assessment unit	Name	Salmon rivers included
1	Northeastern Bothnian Bay stocks	On the Finnish–Swedish coast from Perhonjoki northward to the river Råneälven, including River Tornionjoki.
2	Western Bothnian Bay stocks	On the Swedish coast between Lögdeälven and Luleälven.
3	Bothnian Sea stocks	On the Swedish coast from Dalälven northward to Gideälven and on the Finnish coast from Paimionjoki northwards to Kyrönjoki.
4	Western Main Basin stocks	Rivers on the Swedish coast in ICES subdivisions 25–29.
5	Eastern Main Basin stocks	Estonian, Latvian, Lithuanian, and Polish rivers.

Table 4 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). The basis of the assessment.

ICES stock data category	1 (ICES, 2016)
Assessment type	Bayesian state–space model for a majority of rivers in AUs 1–4; assessment by expert judgement for AU 5. Uncertainties about estimated quantities from the Bayesian model are expressed as probability distributions.
Input data	Commercial removals (international landings and effort by fishery (1987-2015), wild and reared proportions, tag returns); recreational catch; estimated unreported and misreported catch; spawner counts in some rivers, parr densities from all rivers, smolt counts in some rivers.
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, 2012b). The data and model options were re-examined in 2017 (WKBaltSalmon; ICES, 2017b), but more work is required to update the assessment approach.
Working group	Assessment Working Group on Baltic Salmon and Trout (WGBAST)

The PSPC is estimated based on a combination of expert knowledge and spawner/smolt estimates (based on river-specific stock–recruit relationships) which are derived by fitting the assessment model to the data. The assessment model updates the estimates of smolt production historically and the PSPC for each river.

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 5 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). ICES advice for salmon, landings, total catches, and agreed TACs; all numbers in thousands of fish. Landings and total catch figures for 2016 are preliminary.

Year	ICES advice	Predicted catch corresponding to advice	TAC	Landings at sea^	Catch at sea^^	River catch
1987	No increase in effort	-		729	957	11
1988	Reduce effort			543	716	13
1989	TAC	850		755	1001	18
1990	TAC			861	1179	28
1991	Lower TAC	-		630	857	27
1992	TAC	688		619	845	26
1993	TAC	500	650	549	753	25
1994	TAC	500	600	454	630	21
1995	Catch as low as possible in offshore and coastal fisheries	-	500	501	758	27
1996	Catch as low as possible in offshore and coastal fisheries	-	450	486	753	44
1997	Catch as low as possible in offshore and coastal fisheries	-	410	370	629	56
1998	Offshore and coastal fisheries should be closed	-	410	369	575	37
1999	Same TAC and other management measures as in 1998	410	410	313	588	37
2000	Same TAC and other management measures as in 1999	410	450	363	689	35
2001	Same TAC and other management measures as in 2000	410	450	388	634	39
2002	Same TAC and other management measures as in 2001	410	450	362	590	36
2003	Same TAC and other management measures as in 2002	410	460	350	614	29
2004	Same TAC and other management measures as in 2003	410	460	410	828	32
2005	Current exploitation pressure will not impair the possibilities of reaching the management objective for the stronger stocks.	-	460	293	504	39
2006	Current exploitation pressure will not impair the possibilities of reaching the management objective for the larger stocks. Long-term benefits for the smaller stocks are expected from a reduction of the fishing pressure, although it is uncertain whether this is sufficient to rebuild these stocks to the level indicated in the Salmon Action Plan.	-	460	196	304	24
2007	ICES recommends that catches should not increase.	324	429	182	296	30
2008	ICES recommends that catches should be decreased in all fisheries.	-	364	136	171	58
2009	ICES recommends no increase in catches of any fisheries above the 2008 level for SDs 22–31.	-	310	172	293	41
2010	TAC for SDs 22–31	133	294	141	257	23
2011	TAC for SDs 22–31	120	250	144	221	25
2012	TAC for SDs 22–31	54	123	128	170	63
2013	TAC for SDs 22–31	54	109	106	146	51
2014	TAC for SDs 22–31, corresponding to reported commercial sea landings assuming discards, unreporting, and misreporting as in 2012 (corresponding total commercial sea removals are given in brackets)	78 (116*)	107	110	134	55
2015	Total commercial sea catch for SDs 22–31 (estimates of the split of the catch in 2013 into: unwanted, wanted and reported, wanted and unreported, wanted and misreported, are given in brackets).	116 (11%, 68%, 10%, 11%)	96	97	117	64
2016	Total commercial sea catch for SDs 22–31 (estimates of the split of the catch in 2014 into: unwanted, wanted and reported, wanted and unreported, wanted and misreported, are given in brackets).	116 (10%, 77%, 7%, 6%)	96	90	124	65
2017	Total commercial sea catch for SDs 22–31 (estimates of the split of the catch in 2014 into: unwanted, wanted and reported, wanted and unreported, wanted and misreported, are given in brackets).	116 (10%, 77%, 7%, 6%)	96			
2018	Total commercial sea catch for SDs 22–31 (estimates of the split of the catch in 2016 into: unwanted, wanted and reported, wanted and unreported, wanted and misreported, are given in brackets).	116 (9%, 68%, 7.0%, 16%)				

^Total reported landings including recreational catches.

^^Estimated total catches including discards, mis- and unreporting.

*Value corresponds to total commercial sea removals, including reported landings, unreporting, misreporting, and dead discards.

History of catch and landings

Table 6 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Catch distribution by category in 2016 as estimated by ICES.

Catch (2016; dead catch including non-commercial and river catches)	Landings		Discards (dead)
1 109 tonnes	Nominal landings (commercial and non-commercial in sea and in rivers) 77%	Unreported and misreported 23%	45 tonnes
	1 064 tonnes		

Table 7 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Nominal landings (reported) of Baltic salmon in round fresh weight and in numbers: landings from rivers, coast, and offshore; total; commercial (in numbers) from coast and offshore combined; agreed TAC for subdivisions 22–31.

Year	Rivers		Coast		Offshore		Total		Coast and offshore*	TAC
	thousand tonnes	thousand fish	thousand tonnes	thousand fish	thousand tonnes	thousand fish	thousand tonnes	thousand fish	thousand fish	thousand fish
1993	0.11		0.83		2.57		3.52		676	650
1994	0.10		0.58		2.25		2.93		584	600
1995	0.12		0.67		1.98		2.77		553	500
1996	0.21	35	0.77	168	1.73	366	2.71	570	456	450
1997	0.28	45	0.80	149	1.50	282	2.58	476	396	410
1998	0.19	30	0.59	104	1.52	314	2.30	449	334	410
1999	0.17	30	0.59	104	1.23	256	1.99	391	286	410
2000	0.18	30	0.52	100	1.45	313	2.15	442	312	450
2001	0.16	30	0.57	121	1.19	262	1.92	413	355	450
2002	0.14	28	0.59	126	1.03	234	1.75	388	336	450
2003	0.12	28	0.43	113	1.00	235	1.56	376	327	460
2004	0.13	25	0.77	161	1.11	247	2.01	433	365	460
2005	0.17	31	0.61	118	0.86	175	1.64	323	254	460
2006	0.10	19	0.40	71	0.63	124	1.12	213	172	460
2007	0.14	23	0.35	69	0.55	111	1.04	204	159	429
2008	0.26	45	0.46	92	0.21	43	0.93	180	109	364
2009	0.18	32	0.55	113	0.27	56	1.00	201	138	310
2010	0.11	18	0.37	66	0.35	71	0.84	155	118	294
2011	0.17	20	0.37	66	0.33	73	0.87	159	122	250
2012	0.33	50	0.45	72	0.29	53	1.06	175	108	123
2013	0.26	39	0.45	68	0.21	38	0.92	146	87	109
2014	0.32	43	0.42	74	0.19	36	0.93	153	85	107
2015	0.31	49	0.41	71	0.16	26	0.87	146	81	96
2016**	0.32	50	0.41	68	0.14	24	0.87	142	71	96

*For comparison with TAC (includes only commercial catches, except for the years 1993–2000 when also recreational catches at sea are included).

**Preliminary.

Table 8 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). The table shows total catches (from sea, coast, and river) of salmon, in numbers, in the whole Baltic (subdivisions 22–32), split into: nominal catches by country, discards (including seal-damaged salmon), and unreported catches (PI = probability interval = 90% since 2001 = 95% before then). Discards and unreported catches for the years 2001–2016 are estimated by a different method than for the years 1993–2000. Catch figures for 2016 are preliminary.

Year	Country									reported	Discard		Estimated misreported catch**	Total unreported catches***		Total catches	
	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	total	median	PI		median	95% PI	median	PI
1993 *	111840	5400	248790	6240	47410	2320	42530	9195	202390	676115	95162	57550–146900	4100	136604	44110–307000	930761	810200–1088100
1994	139350	1200	208000	1890	27581	895	40817	5800	158871	584404	74979	45150–116300	16572	126716	51191–267771	805001	706471–936071
1995	114906	1494	206856	4418	27080	468	29458	7209	161224	553113	76541	46060–118500	64046	173150	98095–310945	821265	723545–948445
1996	105934	1187	266521	2400	29977	2544	27701	6980	206577	649821	97938	58360–152200	62679	196649	103608–368478	967938	846478–1128678
1997	87746	2047	245945	6840	32128	879	24501	5121	147910	553117	81897	46910–130500	85861	202355	121361–353661	858277	752661–999961
1998	92687	1629	154676	8379	21703	1069	26122	7237	166174	479676	67571	41080–103800	60378	157603	92777–275177	720768	636677–830077
1999	75956	2817	129276	5805	33368	1298	27130	5340	139558	420548	61785	36980–95760	122836	209558	150425–317635	706612	629835–807135
2000	84938	4485	144260	8810	33841	1460	28925	5562	165016	477297	71015	39450–115200	159251	261698	190230–397350	828764	735850–955850
2001	90388	3285	122419	7717	29002	1205	35606	7392	153197	450211	39170	35910–43290	126100	219900	193300–275400	686800	659600–743400
2002	76122	3247	104856	5762	21808	3351	39374	13230	140121	407871	36540	33410–40520	115000	204200	178500–258400	628700	602400–683900
2003	108845	2055	99364	5766	11339	1040	35800	4413	117456	386078	41400	37380–46520	143200	233100	205400–295100	638600	610000–701800
2004	81425	1452	130415	7087	7700	704	17650	5480	195662	447575	41290	37260–46830	254400	388500	345900–483200	854400	810900–950900
2005	42491	1721	113378	4799	5629	698	22896	3069	146581	341262	29290	27020–32290	110900	193900	170500–241700	546100	522200–594500
2006	33723	1628	64679	3551	3195	488	22207	1002	98663	229136	21610	20110–23510	46900	96350	83010–122600	333300	319700–359900
2007	16145	1315	75270	3086	5318	537	18988	1408	96605	218672	17780	16600–19310	54300	105000	91340–131600	329600	315600–356500
2008	7363	1890	80919	4151	2016	539	8650	1382	92533	199443	10240	9577–11140	3300	42320	32510–59590	244300	234400–261700
2009	16072	2466	78080	2799	2741	519	10085	584	107241	220587	14860	13040–17850	62900	121900	105400–153400	347300	330700–379600
2010	29637	1941	44523	1520	1534	427	5774	491	80518	166365	12770	10970–15760	65500	111400	98280–137600	282000	268600–308600
2011	21064	2030	49567	1850	1271	546	6204	470	89978	172980	11940	10770–13660	33500	73540	63400–91970	249800	239400–268600
2012	23175	2680	73447	1362	1056	568	5689	412	84332	192721	9895	9078–10980	12200	50050	41200–64170	245600	236600–259800
2013	24657	2291	56393	1430	2083	1210	5412	387	67082	160157	12730	10850–14650	14000	40220	33510–51180	203100	196300–214200
2014	24482	2076	69135	1264	1878	582	3118	418	62680	165633	10030	8427–11650	6800	28370	22710–37530	195900	190100–205100
2015	19355	2600	62476	2034	1839	2661	3896	406	62608	157875	10500	8099–10390	4300	25860	19940–36250	190600	179100–195500
2016	17684	3180	60521	1616	1853	3864	3769	419	60740	153646	9310	8336-10100	16990	39540	34090-48190	194900	189400-203500

The data for 1993–1994 include subdivisions 24–32; the catches in subdivisions 22–23 are normally less than one tonnes. From 1995 data include subdivisions 22–32.

Catches from the recreational fishery are included in reported catches for Finland, Sweden (all years), and Denmark (only since 1998). Other countries have no, or very low recreational catches.

* In 1993 the Faroe Islands caught 3200 individuals, which is included in the total Danish catches.

** Corresponds only to Polish catch.

*** Including also the estimated misreported catch.

Summary of the assessment

Table 9 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Overview of the status of the Gulf of Bothnia and Main Basin stocks in terms of their probability of having reached 50% and 75% of the potential smolt production capacity in 2016. The probability values are classified in four groups: Above 90% (V.likely), between 70% and 90% (Likely), between 30% and 70% (Uncert.), and below 30% (Unlikely). For stocks in AUs 1–4 (except Testeboån) the results are based on the assessment conducted in 2017. Results for Testeboån and AU 5 stocks are based on expert judgement and no precise probabilities can be presented for these stocks.

		Prob to reach 50%					Prob to reach 75%				
		Prob	V.likely	Likely	Uncert.	Unlikely	Prob	V.likely	Likely	Uncert.	Unlikely
Unit 1	Tornionjoki	1.00	X				0.79		X		
	Simojoki	0.92	X				0.50			X	
	Kalixälven	1.00	X				0.93	X			
	Råneälven	0.96	X				0.76		X		
Unit 2	Piteälven*	1.00	X				0.98	X			
	Åbyälven	0.98	X				0.87		X		
	Byskeälven	1.00	X				0.91	X			
	Kågeälven	0.45			X		0.27				X
	Rickleån	0.10				X	0.01				X
	Sävarån	0.94	X				0.79		X		
	Ume/Vindelälven	0.99	X				0.77		X		
	Öreälven*	0.74		X			0.48			X	
	Lögdeälven*	0.95	X				0.79		X		
Unit 3	Ljungan	0.92	X				0.78		X		
	Testeboån	n.a.				X	n.a.				X
Unit 4	Emån*	0.02				X	0.00				X
	Mörrumsån*	1.00	X				1.00	X			
Unit 5	Pärnu	n.a.				X	n.a.				X
	Salaca	n.a.	X				n.a.	X			
	Vitrupe	n.a.	X				n.a.	X			
	Peterupe	n.a.	X				n.a.		X		
	Gauja	n.a.			X		n.a.				X
	Daugava	n.a.				X	n.a.				X
	Irbe	n.a.			X		n.a.				X
	Venta	n.a.		X			n.a.				X
	Saka	n.a.				X	n.a.				X
	Uzava	n.a.		X			n.a.			X	
	Barta	n.a.				X	n.a.				X
	Nemunas	n.a.				X	n.a.				X

* Status uncertain. Updated priors for PSPC and/or smolt production not in present assessment.

Table 10 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). River-specific probabilities of achieving 75% of the PSPC in 2022 or 2023 (depending on the assessment unit) under the projection scenarios from the 2017 assessment (ICES, 2017a). Probabilities greater than 0.70 are shaded green.

River	Year of comparison	Probability to meet 75% of PSPC				
		Scenario				
		1	2	3	4(a)	5
Tornionjoki	2023	0.76	0.74	0.77	0.73	0.88
Simojoki	2023	0.37	0.35	0.40	0.33	0.69
Kalixälven	2023	0.87	0.89	0.90	0.88	0.93
Råneälven	2023	0.77	0.73	0.79	0.74	0.90
Piteälven*	2023	0.87	0.88	0.89	0.87	0.92
Åbyälven	2023	0.80	0.79	0.81	0.78	0.87
Byskeälven	2023	0.85	0.85	0.86	0.84	0.92
Rickleån	2023	0.16	0.13	0.18	0.14	0.36
Sävarån	2023	0.73	0.73	0.75	0.72	0.86
Ume/Vindelälven	2023	0.89	0.89	0.89	0.91	0.91
Öreälven*	2023	0.60	0.55	0.64	0.59	0.75
Lögdeälven*	2023	0.77	0.78	0.80	0.77	0.89
Ljungan	2023	0.70	0.68	0.72	0.68	0.81
Mörrumsån*	2022	0.91	0.90	0.93	0.90	0.97
Emån*	2022	0.00	0.00	0.00	0.00	0.02
Kågeälven	2023	0.64	0.64	0.67	0.62	0.78

* Status uncertain. Updated priors for PSPC and/or smolt production not in present assessment.

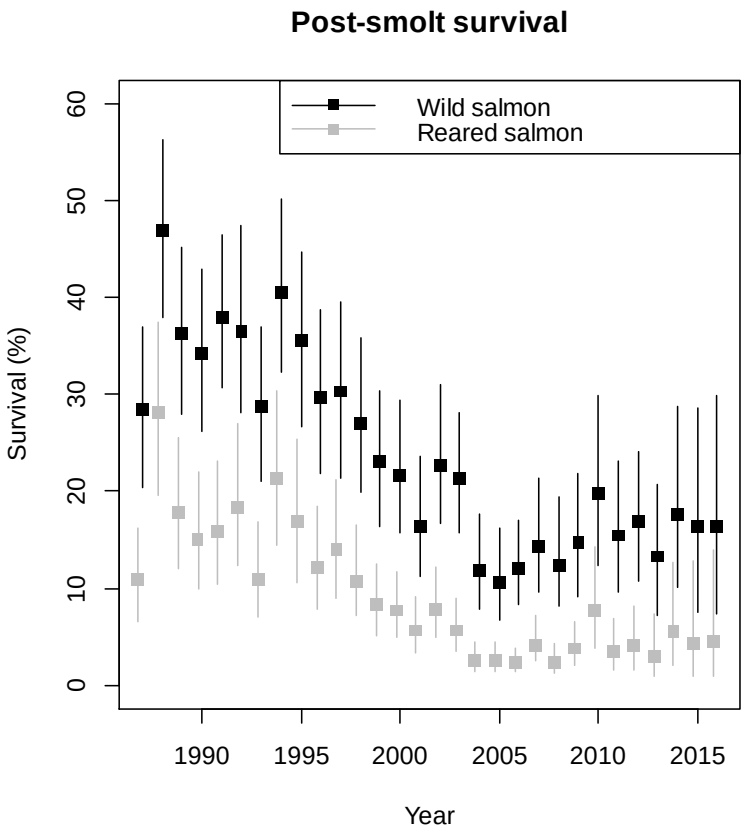

Figure 3 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Post-smolt survival for wild and hatchery-reared salmon. Posterior probability distribution (median and 90% PI).

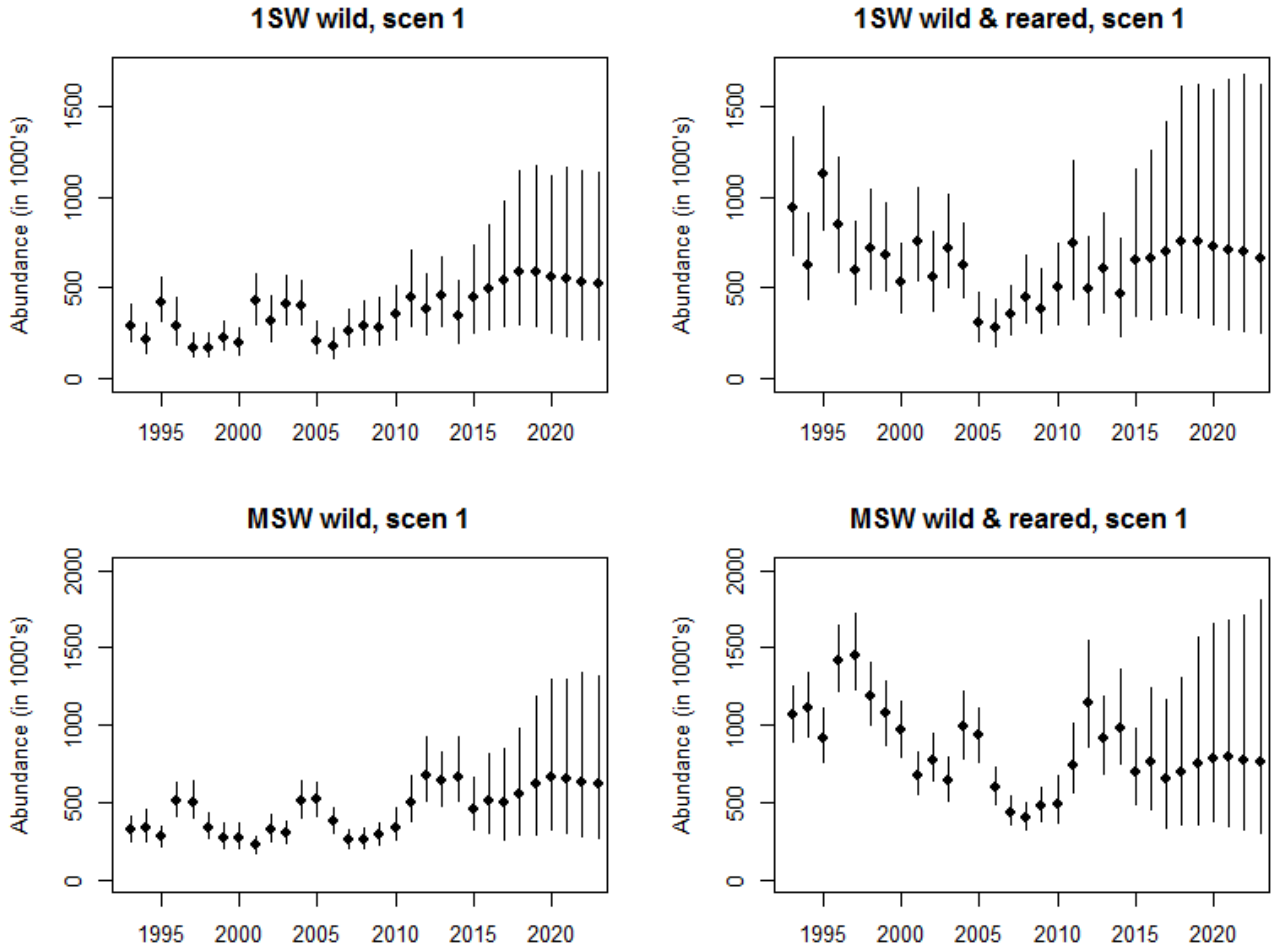

Figure 4 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Top panels: Annual abundances of 1-sea-winter salmon (1SW) available to the fisheries. Four months of adult natural mortality are taken into account (from 1 May until 1 September) to cover natural mortality during the fishing season after the post-smolt mortality phase. Bottom panels: Annual abundances of multi-sea-winter salmon (MSW) available to the fisheries. Six months of adult natural mortality are taken into account (from 1 January until 1 July) to cover natural mortality during the fishing season. The left panels are for wild salmon and the right panels for wild and reared salmon together. The predicted development in abundance following projection scenario 1 is also indicated.

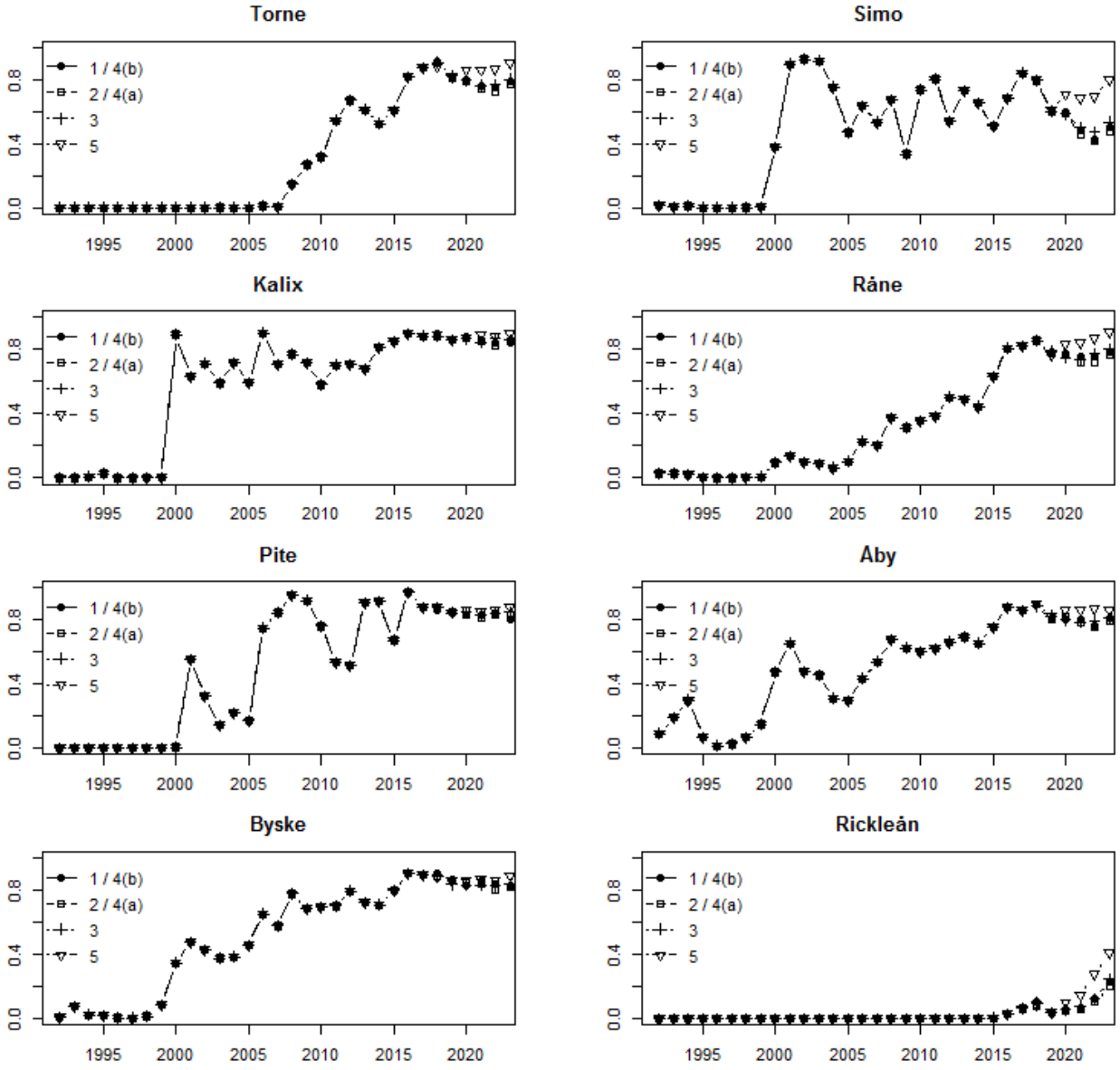

Figure 5a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2018 mainly affects smolt production in the years 2021–2023.

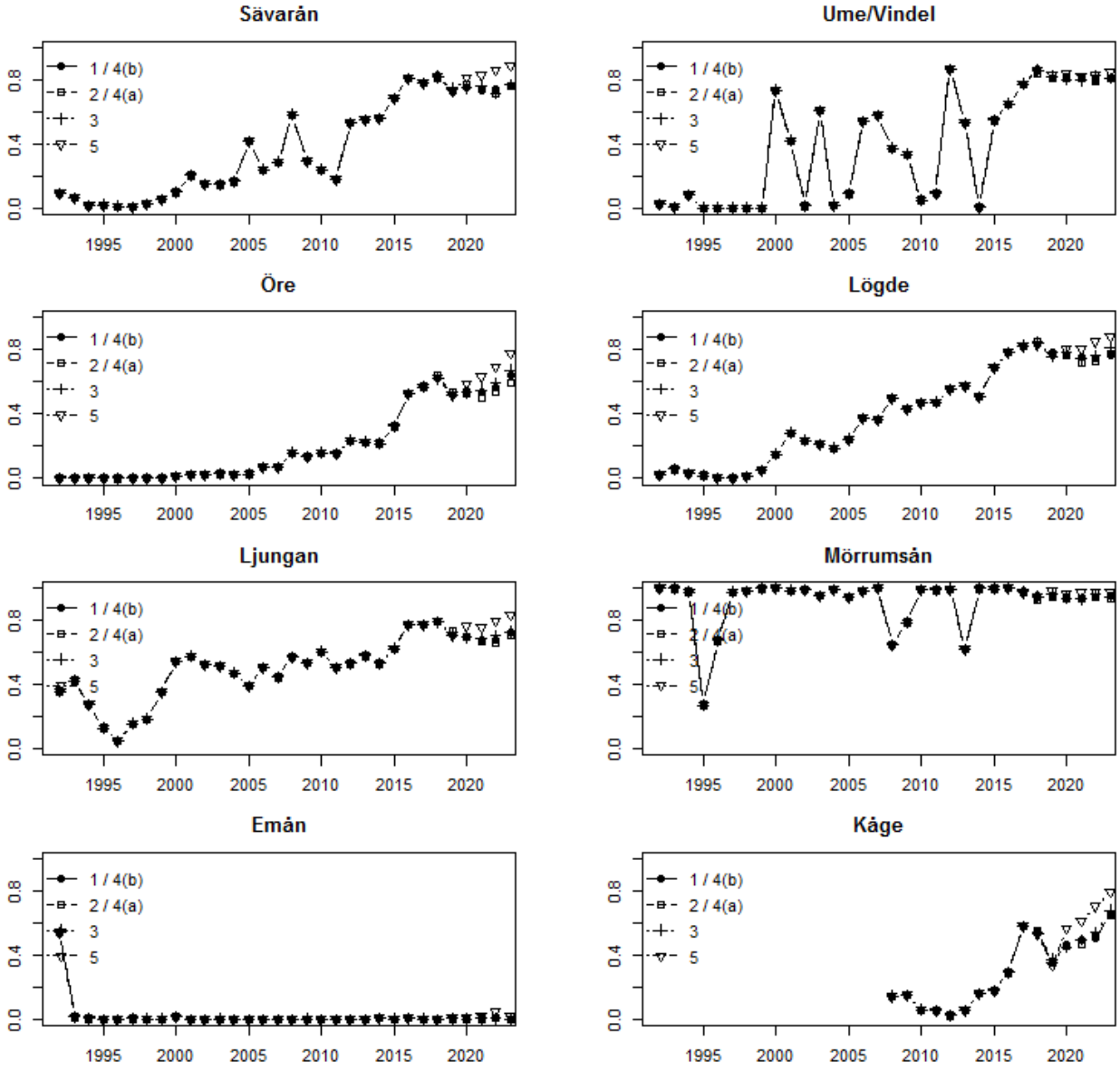

Figure 5b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2018 mainly affects smolt production in the years 2021–2023.

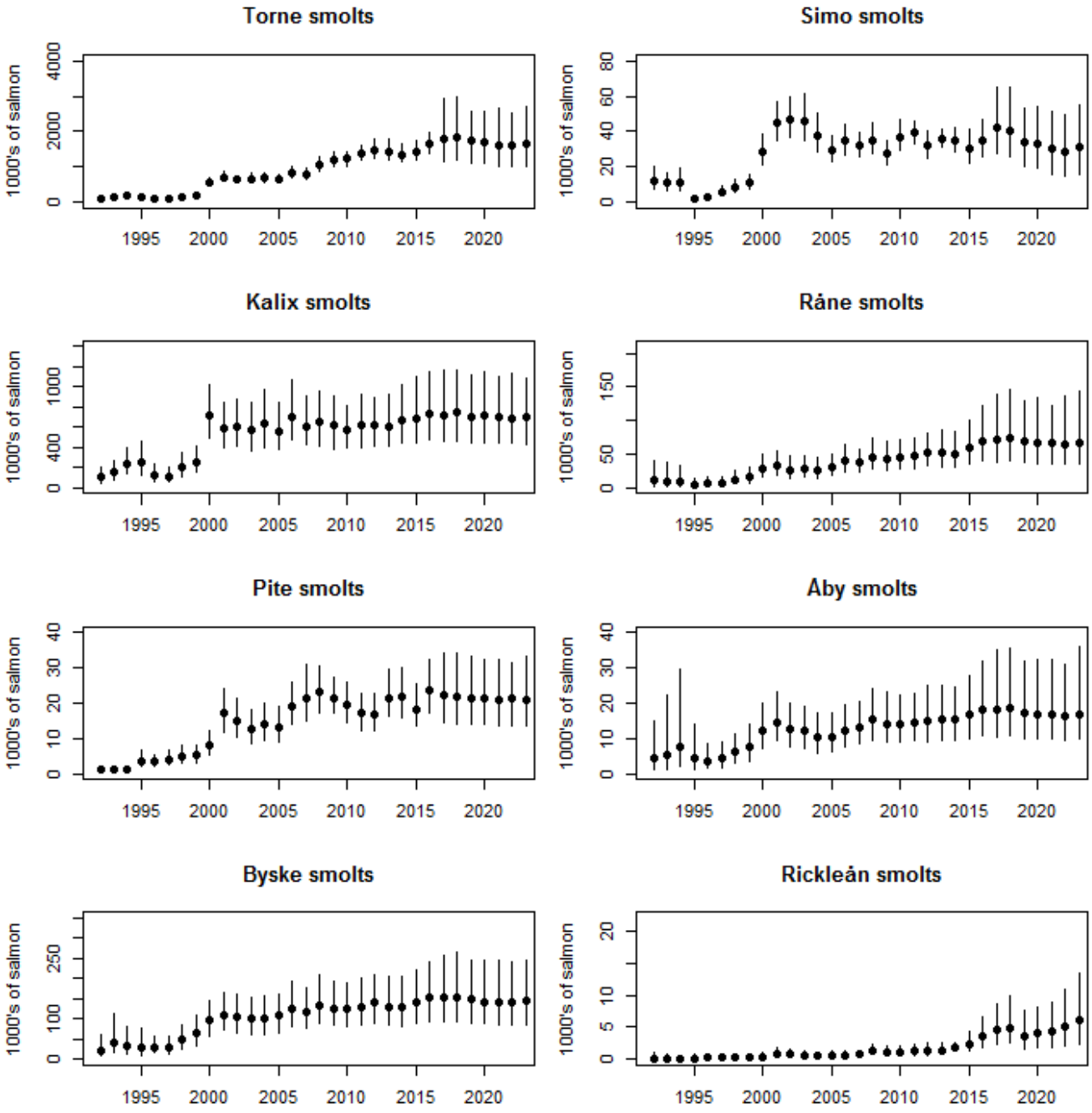

Figure 6a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt abundances in different rivers in projection scenario 1. Fishing in 2018 mainly affects smolt production in the years 2021–2023.

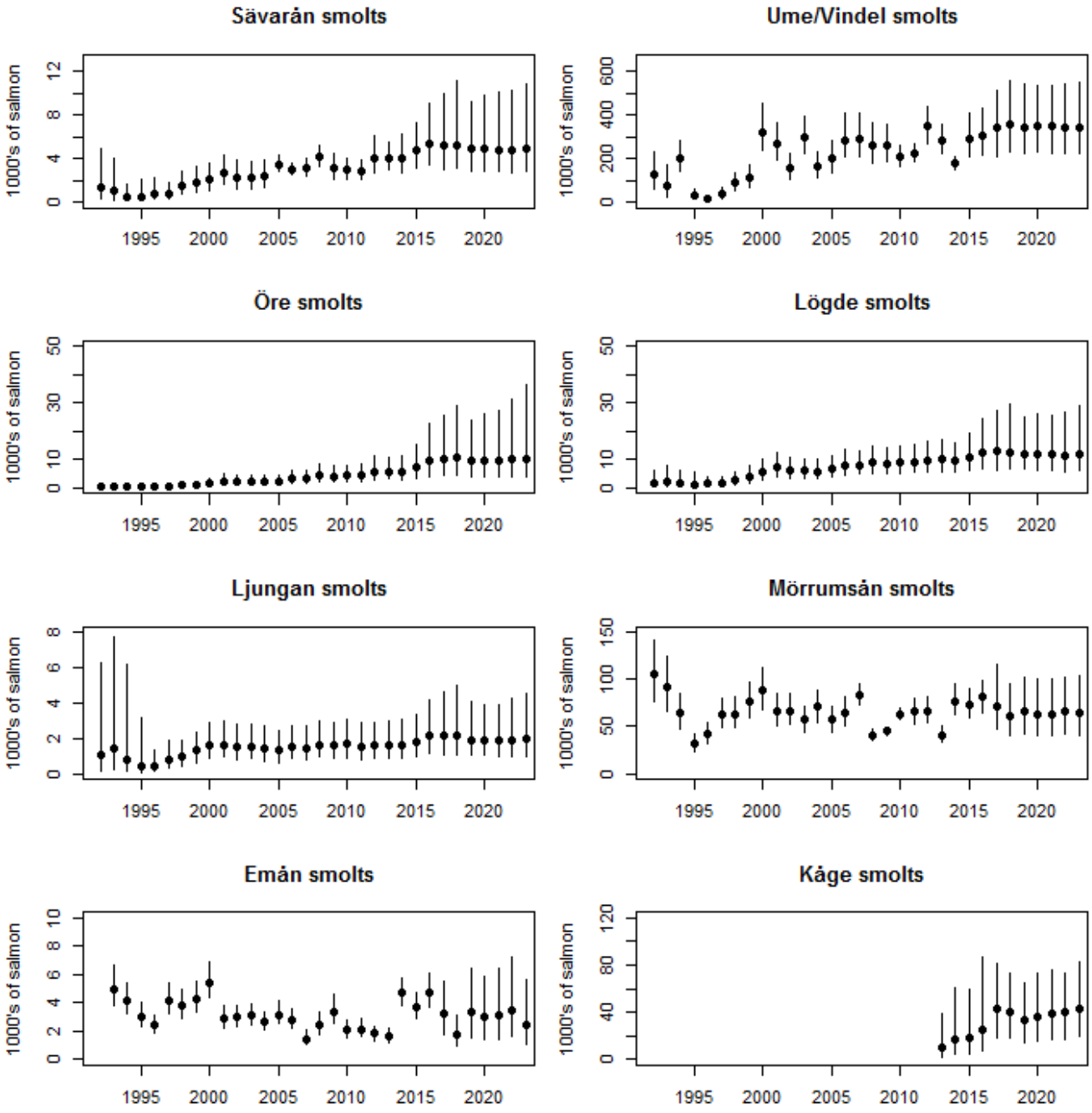

Figure 6b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt abundances in different rivers in projection scenario 1. Fishing in 2018 mainly affects smolt production in the years 2021–2023.

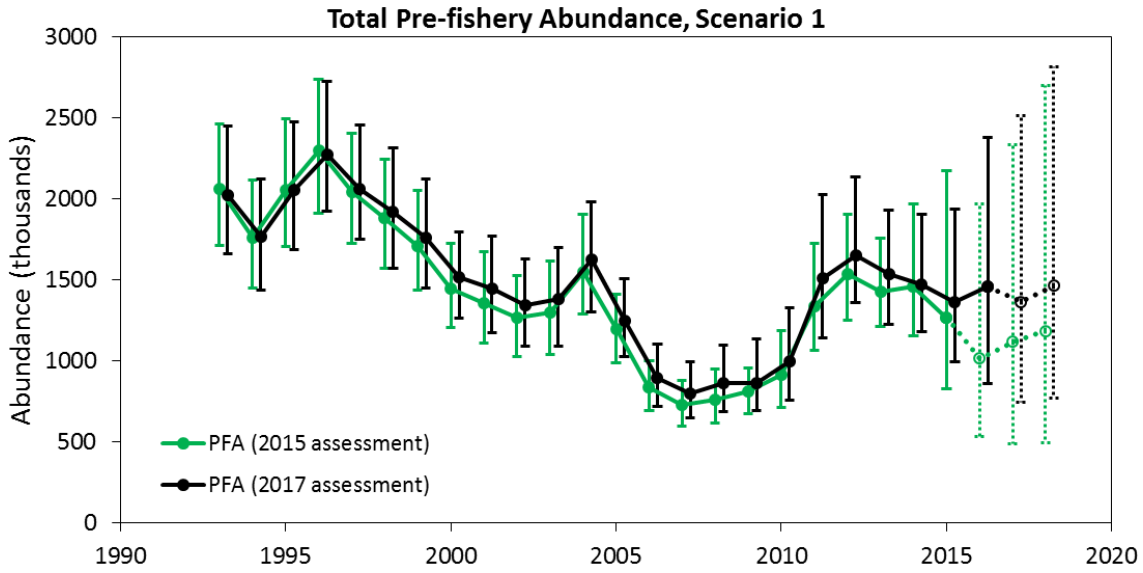

Figure 7 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Estimated pre-fishery abundance in the sea (PFA; wild and reared, 1SW and MSW fish in total) for scenario 1 in the current (2017, data up to 2015; black) and previous (2015, data up to 2014; green) assessment, respectively. The median estimate and 90% probability intervals are plotted, hollow points with dashed tick marks indicate projections from the model.

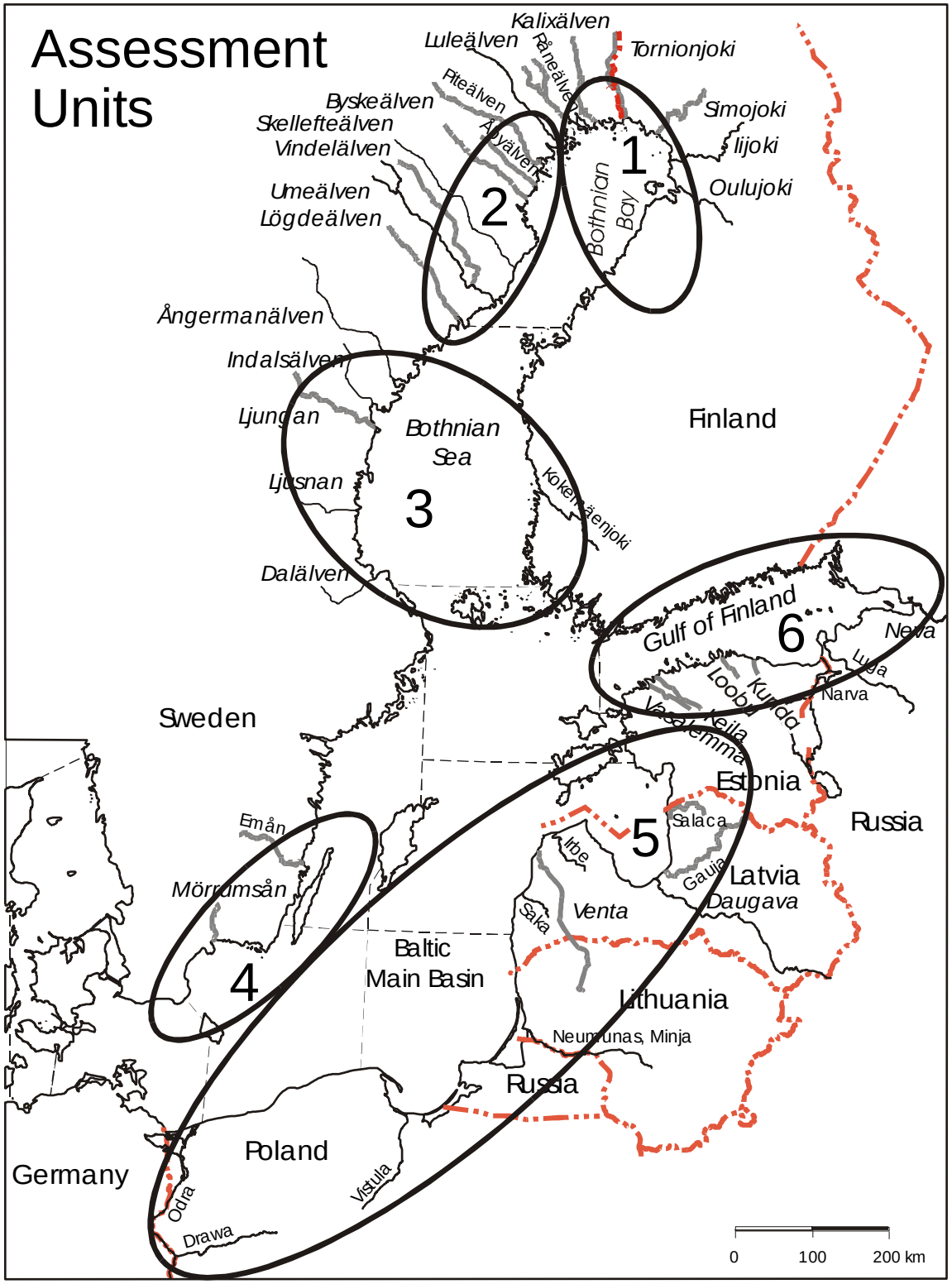

Figure 8 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Grouping of salmon stocks in six assessment units in the Baltic Sea. The genetic variability between stocks of an assessment unit is smaller than the genetic variability between stocks of different units. In addition, the stocks of a particular unit exhibit similar migration patterns.

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