Published 31 May 2018
https://doi.org/10.17895/ices.pub.4391

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

ICES advice on fishing opportunities

ICES advises that when the maximum sustainable yield (MSY) approach is applied, total commercial sea catch in 2019 should be no more than 116 000 salmon. Applying the same catch proportions estimated from observations in the 2017 fishery, the catch in 2019 would be split as follows: 11 600 unwanted catch (10%; previously referred to as discards) and 104 400 wanted catch (90%; i.e. 55% reported, 6% unreported, and 29% misreported). This would correspond to commercial landings (the reported wanted catch) of 63 300 salmon.

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 wild 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 in healthy wild and reared rivers. Effort in these mixed-stock fisheries has been reduced to low levels and should not increase.

The salmon stocks of rivers Rickleån, Sävarån, Öreälven, Lögdeälven, and Testeboån in the Gulf of Bothnia, Emån in southern Sweden, and all rivers in the southeastern Main Basin (AU 5) are especially weak. The offshore and coastal fisheries in the Main Basin catch all these weak salmon stocks on their feeding migration. The coastal fishery in the Åland Sea and Gulf of Bothnia catches salmon from weak stocks from northern rivers on their spawning migration. These stocks need longer-term, stock-specific rebuilding measures, including fisheries restrictions in estuaries and rivers, habitat restoration, and removal of physical barriers. For these weak stocks exploitation should not increase along their feeding and spawning migration routes at sea.

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 time.

The 2018 assessment indicates that since the Salmon Action Plan (ICES, 2008a) was adopted in 1997 (Figure 2a), total wild smolt production has increased tenfold in assessment units (AUs) 1–2, the largest contributors to the overall (AUs 1–5) smolt production. 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, without an obvious trend in recent years.

Smolt production estimates for AU 5 rivers are mainly 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) and large uncertainties make it difficult to assess trends. Based on parr density data, minor increases in smolt production are expected in 2018 (Table 4.2.3.3 in ICES, 2018).

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

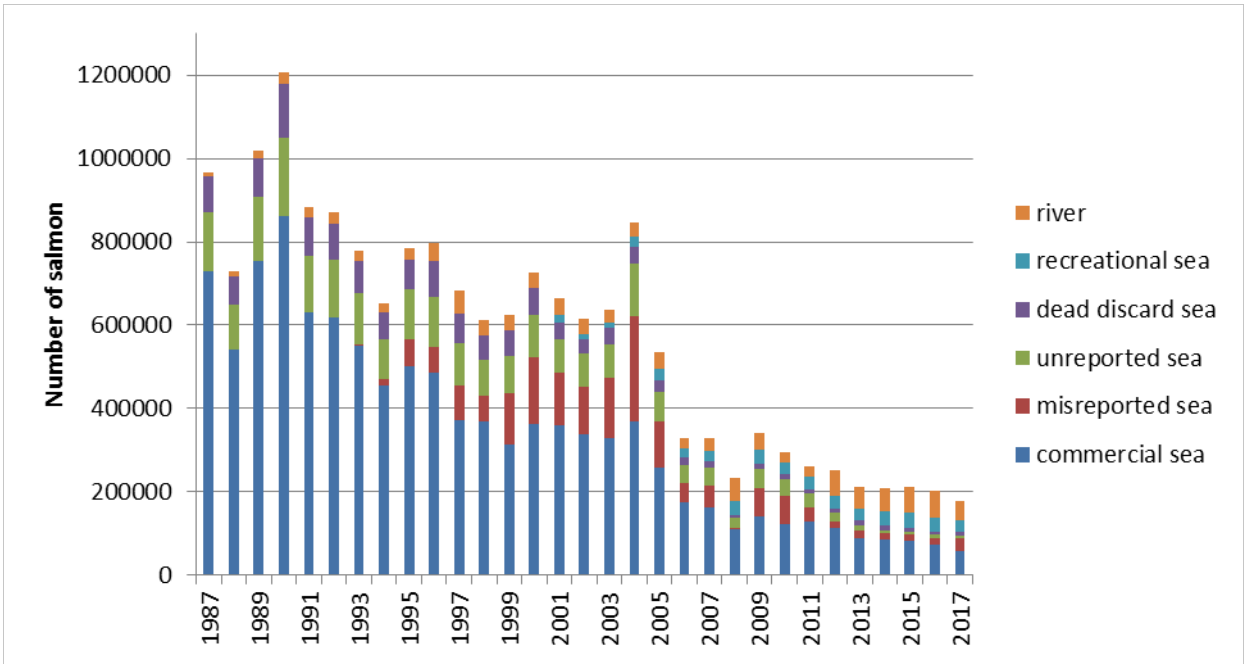

Figure 1 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Total number of removals (dead catch) in the years 1987–2017: river catches (mainly recreational, but including also some commercial fishing) and removals at sea (split into commercial and recreational nominal landings, unreported and misreported landings, and dead discards). Commercial sea catch also includes recreational sea catch in 1987–2000. Recently updated expert estimates of trolling catches from some countries and years (ICES, 2018) are included in the "recreational sea" category.

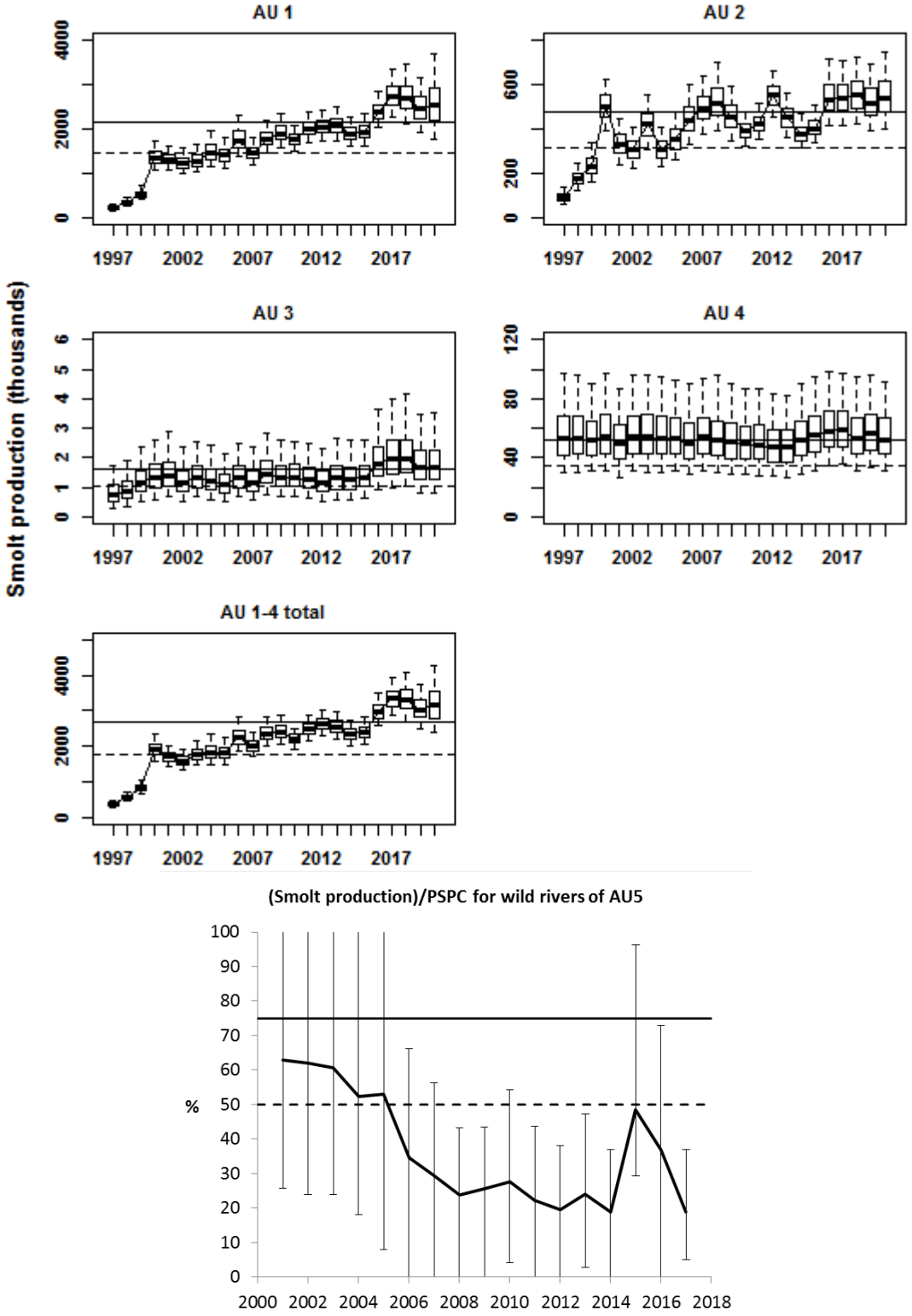

Figure 2a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Top: Smolt production (median estimates, boxes and whiskers indicate 50% and 90% probability intervals, respectively) relative to 50% (dashed line) and 75% of the potential smolt production, PSPC (solid line). Bottom: Percent of smolt production relative to PSPC in AU 5 (median estimate across the wild rivers and 90% probability interval) relative to 50% (dashed line) and 75% of PSPC (solid line).

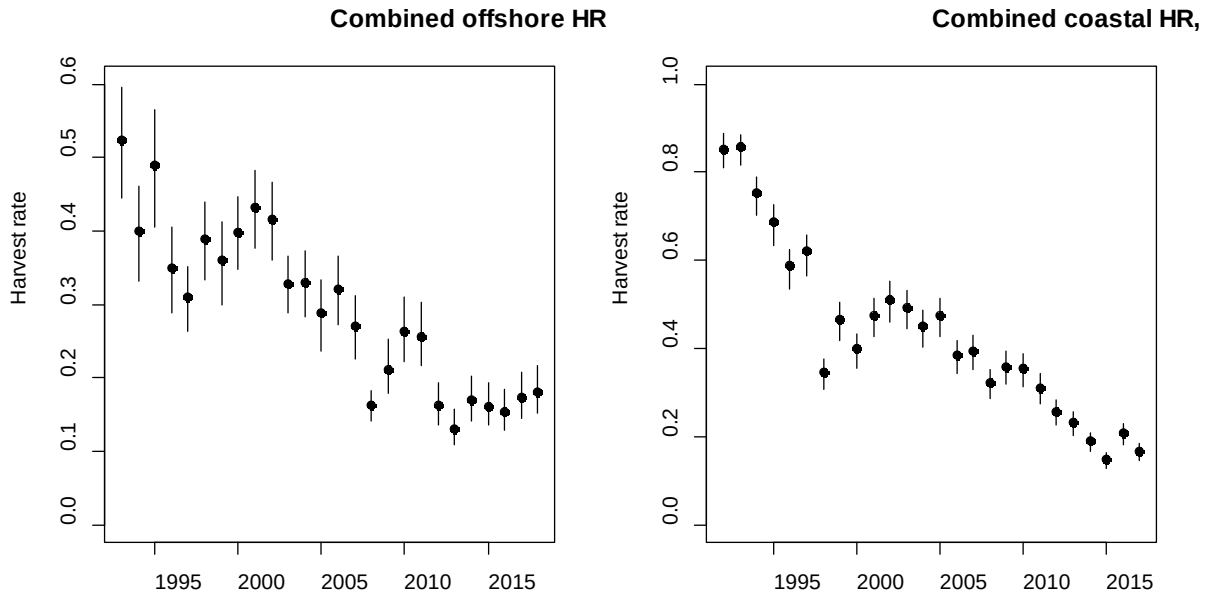

Figure 2b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Harvest rates in offshore (by fishing season; left) and coastal (by calendar year; right) fisheries. The plots show median values (points) and 90% probability intervals (vertical lines).

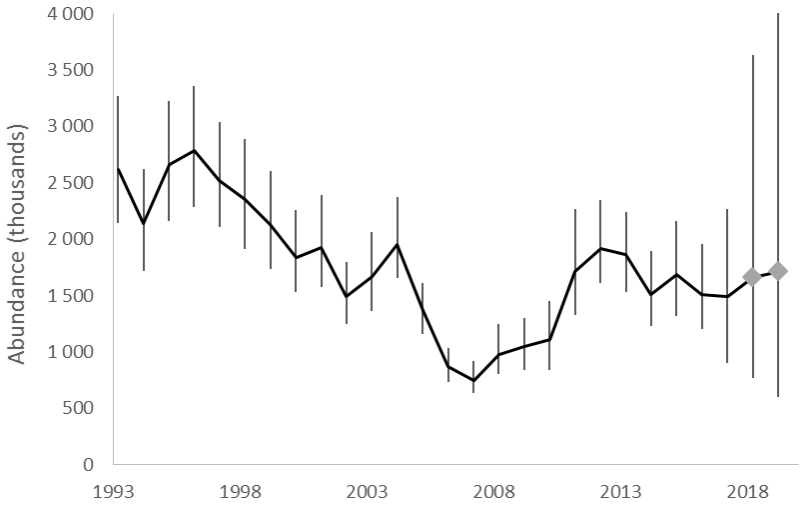

Figure 2c Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Estimated pre-fishery abundance in the sea, 1993–2019 (PFA; wild and reared, 1SW and MSW combined) for scenario 1 (Table 2). The median estimate and 90% probability intervals are plotted, diamond symbols indicate future model projections.

Stock and exploitation status

Of the 29 rivers assessed in subdivisions 22–31, the number of rivers where smolt production has reached 50% and 75% of the PSPC is shown in Table 1. In summary, the probability that smolt production reached 75% of PSPC in 2017 is above 70% for seven rivers. The probability that smolt production in 2017 reached 50% of the PSPC is above 70% for 11 rivers, between 30% and 70% for seven rivers, and below 30% for 11 rivers.

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

Table 1 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Overview of the status of the Gulf of Bothnia and Main Basin wild and mixed (shaded in grey) stocks in terms of their 2017 probability of having reached 50% and 75% (an MSY reference point proxy) of the potential smolt production capacity. 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 model run in 2018. The categorization of Testeboån and AU 5–6 stocks is based on expert judgments – for these rivers there are no defined probabilities (column 'Prob').

			Prob to reach 50%					Prob to reach 75%				
	Stock	Category	Prob	V.likely	Likely	Uncert.	Unlikely	Prob	V.likely	Likely	Uncert.	Unlikely
Unit 1	Tornionjoki	wild	1.00	X				0.88		X		
	Simojoki	wild	0.96	X				0.67			X	
	Kalixälven	wild	0.98	X				0.83		X		
	Råneälven	wild	0.95	X				0.72		X		
Unit 2	Piteälven	wild	0.82		X			0.12				X
	Åbyälven	wild	0.96	X				0.74		X		
	Byskeälven	wild	0.99	X				0.82		X		
	Kågeälven	wild	0.73		X			0.35			X	
	Rickleån	wild	0.45			X		0.11				X
	Sävarån	wild	0.67			X		0.33			X	
	Ume/Vindelälven	wild	1.00	X				0.89		X		
	Öreälven	wild	0.39			X		0.15				X
	Lögdeälven	wild	0.27				X	0.12				X
Unit 3	Ljungan	wild	0.86		X			0.64			X	
	Testeboån *)	wild				X						X
Unit 4	Emån	wild	0.47			X		0.18				X
	Mörrumsån	wild	0.99	X				0.79		X		
Unit 5	Pärnu	mixed	n.a.				X	n.a.				X
	Salaca	wild	n.a.			X		n.a.				X
	Vitrupe	wild	n.a.				X	n.a.				X
	Peterupe	wild	n.a.				X	n.a.				X
	Gauja	mixed	n.a.				X	n.a.				X
	Daugava	mixed	n.a.				X	n.a.				X
	Irbe	wild	n.a.				X	n.a.				X
	Venta	mixed	n.a.			X		n.a.				X
	Saka	wild	n.a.				X	n.a.				X
	Uzava	wild	n.a.				X	n.a.				X
	Barta	wild	n.a.				X	n.a.				X
	Nemunas	wild	n.a.				X	n.a.				X

*) Preliminary evaluation

Catch scenarios

Five fishing scenarios were considered, using estimates of pre-fishery abundance (PFA) at the beginning of 2019 (Table 2). Scenario 1 corresponds to the total commercial catch at sea advised by ICES for 2014–2018 (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), i.e. a harvest rule of F = 0.1 that covers the commercial catch at sea. Scenario 5 illustrates stock development under no fishing, neither at sea nor in rivers.

The outlook table for 2019 (Table 2) splits the total commercial catch at sea into similar components as in previous years, using the proportions estimated to have occurred in 2017: wanted catch reported (55%), wanted catch unreported (6%), wanted catch misreported (29%), and unwanted catch (10%; this is the catch that would be discarded if discarding was allowed). The 10% unwanted catch is the sum of 2% (undersized salmon) and 8% (seal-damaged salmon). Seal-damaged salmon are always dead, whereas some of the undersized salmon would survive if they were discarded. All scenarios

assume a fixed additional recreational catch at sea of 32 400 salmon, based on average catches in 2015–2017, and a constant harvest rate in rivers on returning salmon. In Table 2, fishing mortality (F) is also indicated for all scenarios.

Table 2 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). The catch scenarios for 2019.

Scenario	Commercial catch at sea in subdivisions 22–31 in 2019						
	Total commercial catch at sea	F of commercial catch	Wanted catch Reported	Unwanted catch (dead + alive)		Wanted catch Unreported	Wanted catch Misreported
				Undersized	Seal damaged		
1	116.0	0.07	63.3	2.9	8.8	7.3	33.7
2	139.2	0.08	76.0	3.5	10.6	8.7	40.4
3	92.8	0.06	50.7	2.3	7.0	5.8	27.0
4	162.8	0.10	88.9	4.0	12.4	10.2	47.3
5	0.0	0.00	0.0	0.0	0.0	0.0	0.0

Scenario	Total sea catch (comm. + recr.) 2019	F of total catch at sea	Recreational catch at sea 2019	River catch 2019	Spawners 2019
1	148.4	0.09	32.4	65.1	187.2
2	171.6	0.11	32.4	62.6	179.9
3	125.2	0.08	32.4	67.5	194.5
4	195.2	0.12	32.4	60.0	171.7
5	0.0	0.00	0.0	0.0	293.0

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–d present the river-specific annual probabilities of meeting the MSY proxy (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 2024 (for stocks in AUs 1–3) or 2023 (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 scenarios 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 Simojoki, Rickleån, Öreälven, Lögdeälven (Gulf of Bothnia), and Emån (southern Sweden) have the lowest probabilities, though all these rivers (except Simojoki) show positive trends under most scenarios.

Figures 6a–d display estimated past and projected future smolt production and spawner abundance under scenarios 1, 4 and 5. For all rivers except Simojoki and Vindelälven, smolt production in 2023–2024 is expected to remain around current levels or to increase under most scenarios.

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 smolt production decreased in 2017 and a 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.

The status of the mixed stock, based on the PFA abundance, is estimated to have remained largely unchanged with an expected minor increase in the coming few years. Until specific management objectives have been agreed and shown to be precautionary, the commercial catch at sea advised last year (scenario 1 in the catch scenarios) would allow the weakest stocks to continue to improve (Figures 5a–d), which is considered to be consistent with exploitation under the MSY approach. This would imply a total commercial sea catch (including unreporting, misreporting, and dead discards) not exceeding 116 000 salmon in 2019.

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 vary 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 2019 catch option by calculating the abundance at sea on 1 September for 1-sea-winter (1SW) fish and on 1 July for multi-sea-winter (MSW) fish, accounting for natural mortality from the start of the year. If F = 0.1 covers only the commercial catch at sea (scenario 4), this corresponds to a total commercial catch at sea not exceeding 162 800 salmon in 2019.

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

Basis of the advice

Table 3 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

A benchmark process (WKBaltSalmon; ICES, 2017) was held in 2016–2017 to evaluate available data and develop the assessment methods for Baltic salmon. Some needs for improvement regarding data and methods identified during WKBaltSalmon have been taken into consideration in 2018 and incorporated in the assessment model. The most important changes include:

- change of software for running the assessment model (from WinBUGS to JAGS),
- updated stock–recruitment parameterization (Model 3 from WKBALTSalmon, ICES, 2017),
- updated recreational trolling catch estimates for the period 1987–2017 (included as a part of the offshore longline fishery),
- use of updated priors for production areas for a few rivers,
- a new model for estimation of smolt production in AU 4 rivers, used as "smolt priors" in the assessment model, and
- modification of the assessment model to accommodate for river- and year-specific spawner sex ratios.

More details about model updates, and evaluations of those, can be found in the working group report (ICES, 2018).

There are indications that M74 mortality is currently increasing, as well as reported deaths of spawners due to an unidentified disease, 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.

Misreported catch as a proportion of the total estimated catch increased to 29% in 2017 compared to 16% in 2016. This is caused by a large increase in the reported catch of sea trout by Poland with long-lines in the offshore fishery, from about 10 800 individuals reported in 2016 to 22 400 in 2017. Based on observer data, these catches are almost entirely composed of salmon and therefore misreported.

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 approximate and not as precise estimates.

The release of reared salmon (currently contributing up to 30% of the mixed-stock PFA in the Main Basin) is accounted for when assessing fishery opportunities.

Issues relevant for the advice

With no adopted EC management plan, there are no guidelines for how quickly (within which time frames) weak salmon stocks should recover, what proportion should recover, and to what level. Therefore, under the current conditions with one TAC for subdivisions 22–31 and many stocks with variable status, any catch advice for the mixed-stock sea fishery on Baltic salmon will be associated with trade-offs between exploitation possibilities and the time required to achieve management objectives.

Salmon harvest rates are lower than in the past and as such fishing mortality, as a proportion of total mortality, is also currently lower 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 potential of reaching the 75% PSPC objective.

Fisheries on mixed stocks that include reared salmon, may present particular threats to wild 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 healthy wild and reared rivers. For some weak stocks, additional measures (beside TAC restrictions) are required to increase the number of spawners. Such measures could include, for example, reduced fisheries on the migration routes of weak stocks. In addition, as problems in the freshwater environment play a significant role in explaining the poor status of stocks in the southern Baltic rivers (ICES, 2012a, 2014), work to improve river habitats and migration possibilities and actions to reduce poaching may also be needed to increase the status of weak stocks.

Exploitation in the Main Basin offshore fisheries affects possibilities for recovery of the Gulf of Finland salmon stocks, as some Gulf of Finland salmon are caught in the Main Basin.

Very low parr densities observed in Vindelälven (2016–2017) and Ljungan (2017) are expected to result in a drastically reduced smolt production in 2019–2020 (ICES, 2018). However, it should be noted that the estimated pre-fishery abundance of salmon from these rivers, exploited in the fishery during the advice year (2019), is not affected by the reduced parr densities in 2016–2017. Regardless, the situation in the two rivers is alarming, and local management actions aimed at protecting ascending spawners appear warranted.

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. The 75% of the PSPC reference is based on the MSY approach (ICES, 2008a, 2008b). The 50% of the PSPC reference 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 fisheries, the stocks in AUs 4 and 5 contain a relatively high proportion of the overall genetic variability of Baltic salmon stocks.

Table 4 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Assessment units.

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 5 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 (1987–2017), 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, 2017), and several improvements of the assessment model have been conducted in 2018 (ICES, 2018).
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–recruitment 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 6 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). ICES advice for salmon, landings, total catches, and agreed TACs; all numbers are in thousands of fish. Landings and total catch figures for 2017 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	636	39
2002	Same TAC and other management measures as in 2001	410	450	362	592	36
2003	Same TAC and other management measures as in 2002	410	460	350	616	29
2004	Same TAC and other management measures as in 2003	410	460	410	830	32
2005	Current exploitation pressure will not impair the possibilities of reaching the management objective for the stronger stocks.	-	460	293	505	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	305	24
2007	ICES recommends that catches should not increase.	324	429	182	295	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	297	41
2010	TAC for SDs 22–31	133	294	141	261	23
2011	TAC for SDs 22–31	120	250	144	225	25
2012	TAC for SDs 22–31	54	123	128	176	63
2013	TAC for SDs 22–31	54	109	106	152	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	143	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	129	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	92	125	64
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	80	117	46
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%)	91			
2019	Total commercial sea catch for SDs 22–31 (estimates of the split of the catch in 2017 into: unwanted, wanted and reported, wanted and unreported, wanted and misreported, are given in brackets).	116 (10%, 55%, 6%, 29%)				

^Total reported landings including recreational catches.
^^Estimated total catches including discards, mis- and unreporting.
^^^Estimated total catches including unreporting.
*Value corresponds to total commercial sea removals, including reported landings, unreporting, misreporting, and dead discards.

History of catch and landings

Table 7 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Catch distribution by category in 2017 as estimated by ICES (median values from probability distributions).

Catch (2017; dead catch, including non-commercial and river catches)	Landings		Discards (dead)
933 tonnes	Nominal landings (commercial and non-commercial in sea and in rivers) 76%	Unreported and misreported 24%	53 tonnes
	880 tonnes		

Table 8 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
	tonnes	thousand fish	tonnes	thousand fish	tonnes	thousand fish	tonnes	thousand fish	thousand fish	thousand fish
1993	110		830		2570		3520		676	650
1994	100		580		2250		2930		584	600
1995	120		670		1980		2770		553	500
1996	210	35	770	173	1730	361	2710	570	456	450
1997	280	45	800	153	1500	278	2580	476	396	410
1998	190	30	590	111	1520	307	2300	449	334	410
1999	170	30	590	108	1230	252	1990	391	286	410
2000	180	30	520	100	1450	315	2150	444	312	450
2001	160	30	570	125	1190	264	1920	419	355	450
2002	140	28	590	125	1030	237	1750	390	336	450
2003	100	28	430	113	1020	238	1550	373	327	460
2004	130	25	770	159	1130	250	2030	435	365	460
2005	170	31	610	115	880	178	1650	324	254	460
2006	100	19	400	69	640	126	1130	215	172	460
2007	140	23	350	68	570	114	1050	205	159	429
2008	260	45	460	91	220	45	930	182	109	364
2009	180	32	550	112	290	60	1020	204	138	310
2010	110	18	370	66	370	5	860	159	118	294
2011	120	20	370	67	390	77	900	164	122	250
2012	320	50	440	70	310	57	1070	177	108	123
2013	260	39	440	68	210	38	910	145	87	109
2014	320	43	450	74	190	35	980	152	85	107
2015	320	49	400	71	160	26	880	147	81	96
2016	340	52	440	66	140	25	920	144	71	96
2017**	200	36	370	58	130	23	700	117	57	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 9 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 2001–2017 are estimated by a different method than for the years 1993–2000. Catch figures for 2017 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	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	41300	37660-45880	126100	219800	193300-275000	687800	660500-743800
2002	76122	3247	104856	5762	21808	3351	39374	13230	140121	407871	38440	35130-42600	115000	204200	178600-257300	629400	603100-683400
2003	108845	2055	99364	5766	11339	1040	35800	4413	117456	386078	43460	39220-48700	143200	232900	205400-293400	639200	611000-701200
2004	81425	1452	130415	7087	7700	704	17650	5480	195662	447575	43750	39450-49600	254400	388500	346000-480800	855300	812000-949900
2005	42491	1721	113378	4799	5629	698	22896	3069	146581	341262	30880	28370-34140	110900	193700	170400-241900	546600	522900-596100
2006	33723	1628	64679	3551	3195	488	22207	1002	98663	229136	22740	21060-24850	46900	96280	83120-122100	333800	320300-360100
2007	16145	1315	75270	3086	5318	537	18988	1408	96605	218672	18740	17390-20480	54300	104600	91250-130300	329500	316000-355700
2008	7363	1890	80919	4151	2016	539	8650	1382	92533	199443	10190	9571-11050	3300	42250	32690-58690	244300	234700-260900
2009	16072	2466	78080	2799	2741	519	10085	584	107241	220587	13780	12490-15500	65100	124700	108300-156100	350500	333800-382400
2010	29637	1941	44523	1520	1534	427	5774	491	80518	166365	12100	10710-14070	67500	114000	100700-140800	285800	272100-313200
2011	21064	2030	49567	1850	1271	546	6204	470	89978	172980	11810	10810-13150	35400	75910	65730-94390	253100	242700-271900
2012	23175	2680	73447	1362	1056	568	5689	412	84332	192721	10220	9351-11440	15900	54870	45750-69130	251000	241800-265400
2013	24657	2291	56393	1430	2083	1210	5412	387	67082	160157	13470	11470-15520	18000	45890	38750-57410	208900	201700-220500
2014	24482	2076	69135	1264	1878	582	3118	418	62680	165633	11030	9355-12700	13600	36230	30390-45360	204000	198100-213100
2015	19355	2600	62476	2034	1839	2661	3896	406	62608	157875	10790	9422-11980	14700	37140	31640-45960	196800	191300-205700
2016	17684	3180	62738	1616	1853	3864	3769	419	60740	155863	9900	8903-10670	17100	39610	33990-48440	195100	189500-204000
2017	9488	2705	52715	5371	1759	1734	6558	380	47627	128337	11210	9594-12490	30500	46480	42600-52660	177300	173300-183600

The data for 1993–1994 include subdivisions 24–32; the catches in subdivisions 22–23 are normally less than one tonne. 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 10 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). River-specific probabilities of achieving 75% of the PSPC in 2023 or 2024 (depending on the assessment unit) under the projection scenarios from the 2018 assessment (ICES, 2018). Probabilities greater than 0.70 are shaded green.

		Probability to meet 75% of PSPC				
River	Year of	Scenario				
	comparison	1	2	3	4	5
Tornionjoki	2024	0.63	0.63	0.66	0.60	0.74
Simojoki	2024	0.43	0.44	0.44	0.39	0.62
Kalixälven	2024	0.75	0.75	0.76	0.77	0.78
Råneälven	2024	0.65	0.63	0.68	0.65	0.74
Piteälven	2024	0.65	0.66	0.69	0.63	0.75
Åbyälven	2024	0.66	0.66	0.66	0.66	0.76
Byskeälven	2024	0.73	0.73	0.73	0.71	0.80
Rickleån	2024	0.30	0.28	0.31	0.27	0.50
Sävarån	2024	0.45	0.45	0.47	0.40	0.61
Ume/Vindelälven	2024	0.57	0.58	0.62	0.57	0.69
Öreälven	2024	0.35	0.34	0.38	0.34	0.51
Lögdeälven	2024	0.26	0.27	0.27	0.23	0.39
Ljungan	2024	0.55	0.54	0.56	0.48	0.65
Mörrumsån	2023	0.72	0.71	0.72	0.73	0.77
Emån	2023	0.16	0.15	0.17	0.13	0.29
Kågeälven	2024	0.52	0.49	0.49	0.49	0.65

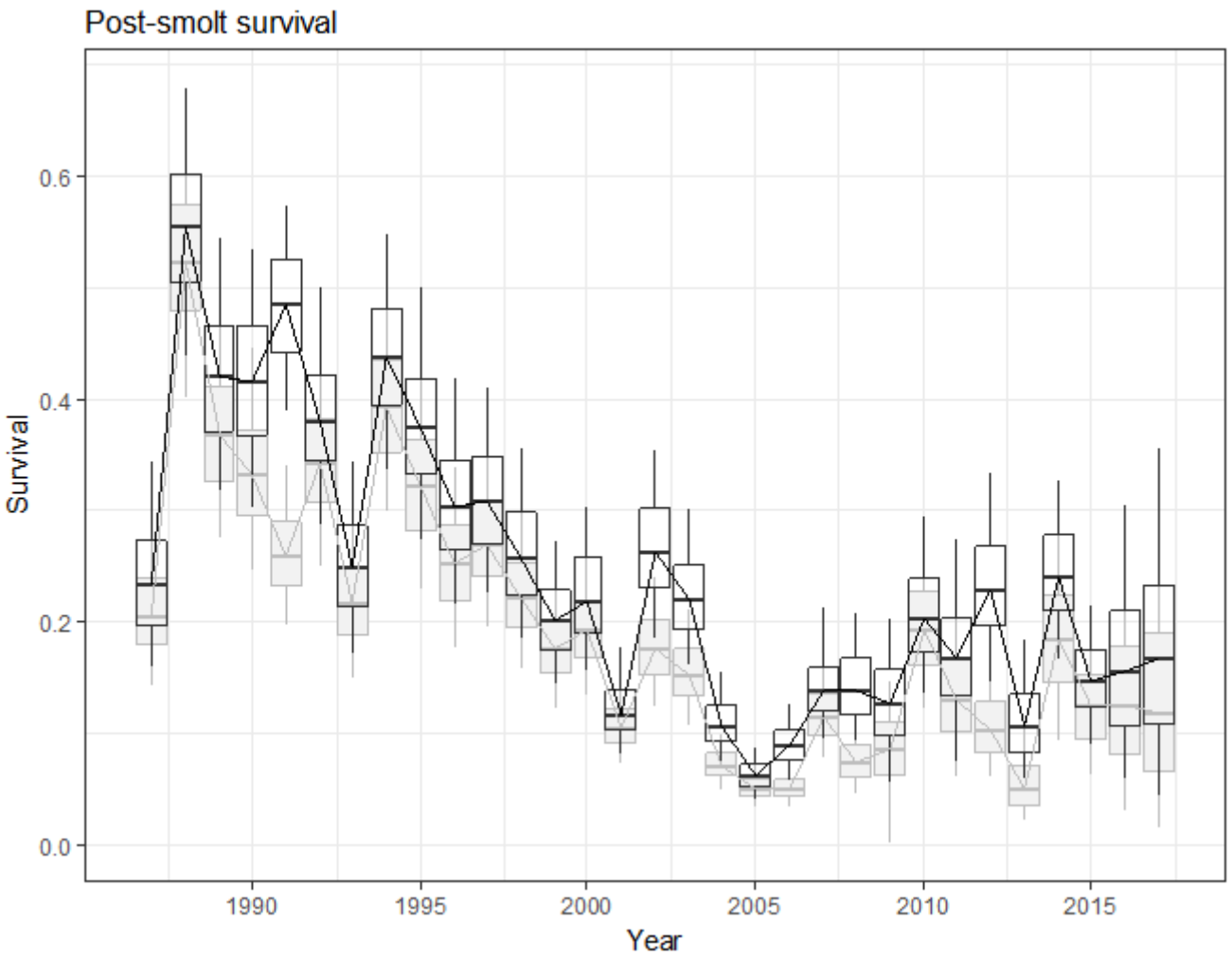

Figure 3 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Post-smolt survival (median) for wild (black boxplots) and hatchery-reared (grey boxplots) salmon. Boxes and whiskers indicate 50% and 90% probability intervals, respectively.

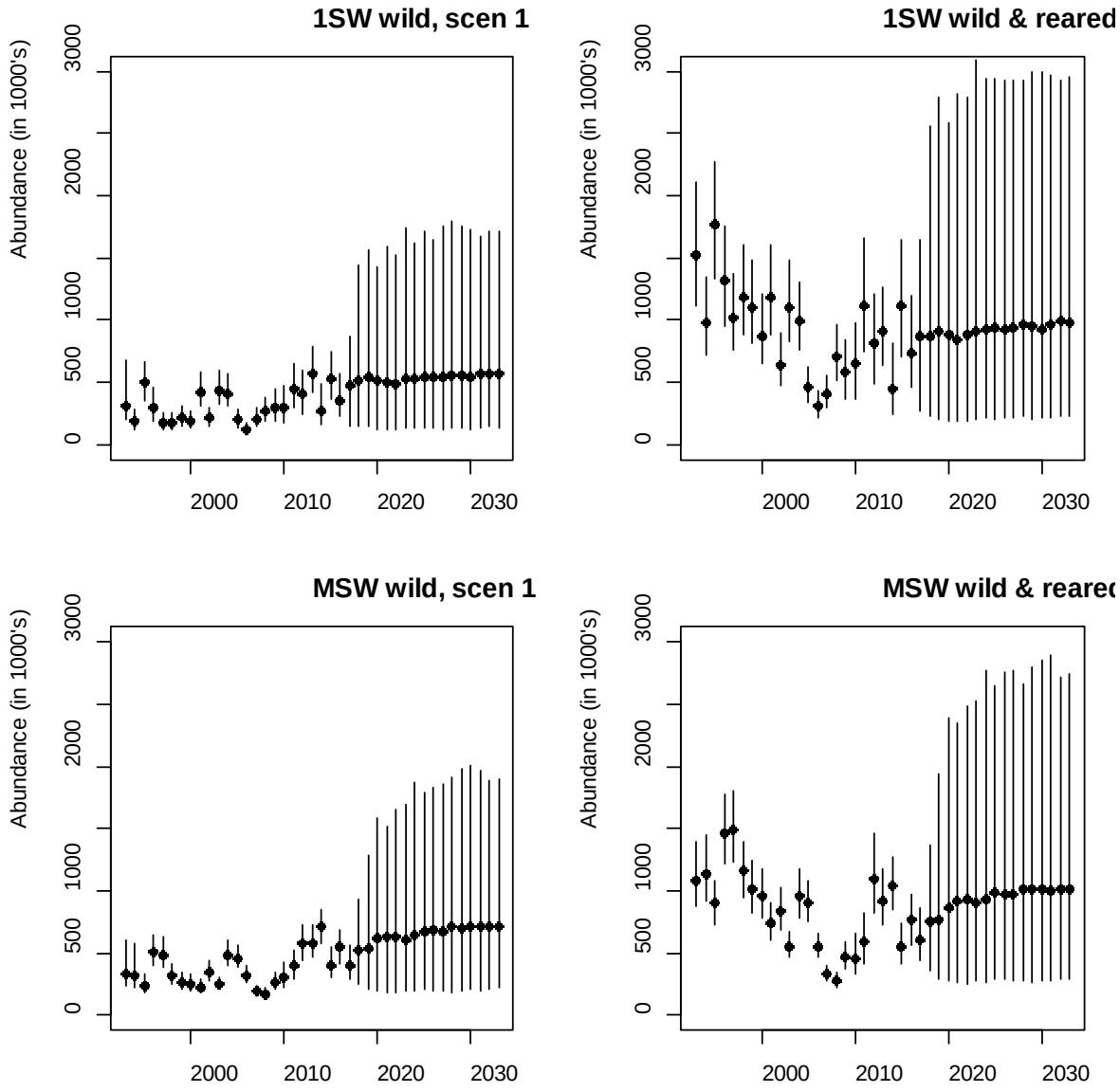

Figure 4 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Top panels: Annual abundances of 1-sea-winter salmon (1SW) available to the fisheries. Four months of adult natural mortality are taken into account (from 1 May until 1 September) to cover natural mortality during the fishing season 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 future development (2018–2033) in abundance following projection scenario 1 is also indicated.

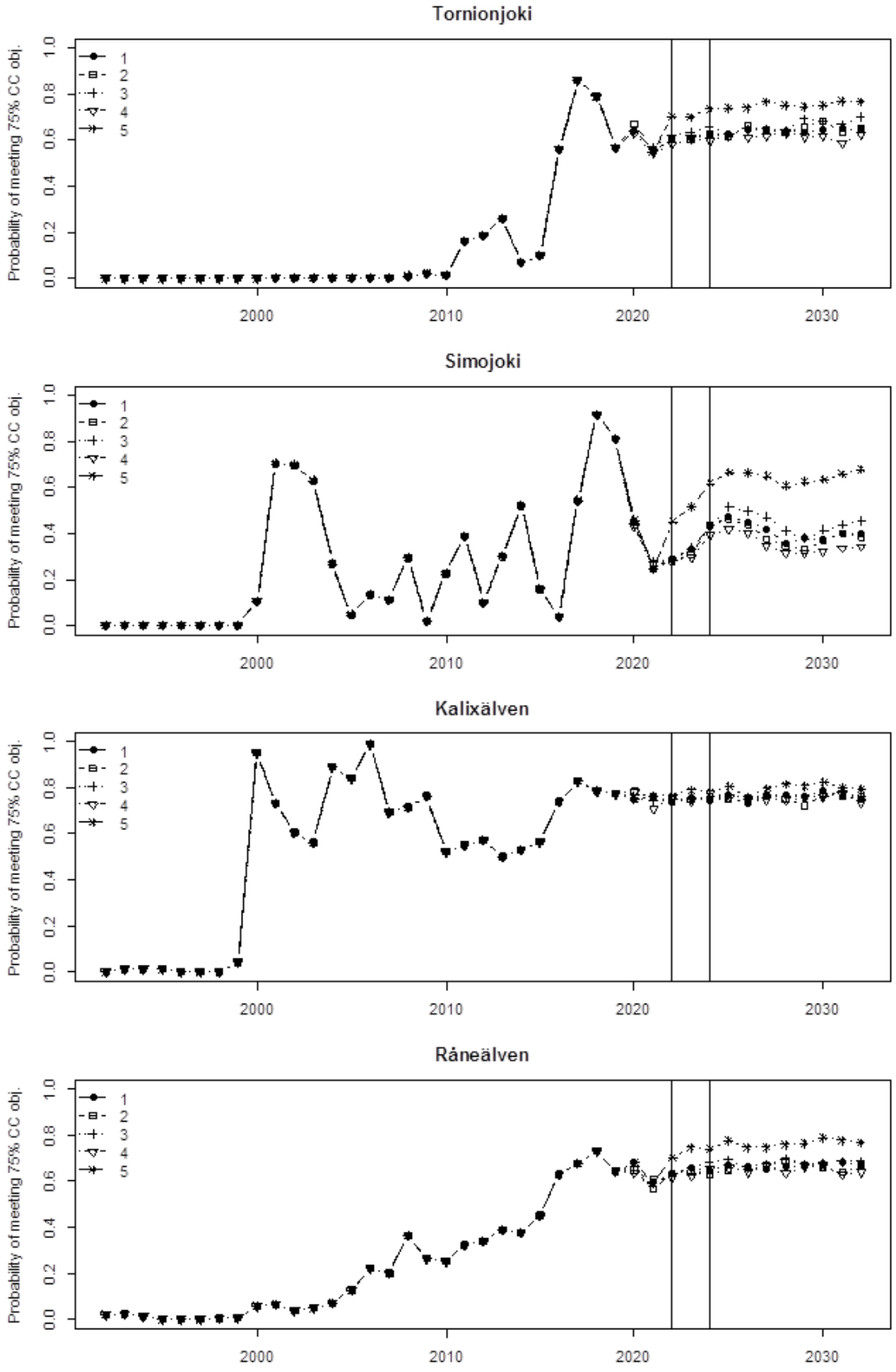

Figure 5a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2019 mainly affects smolt production in the years 2023–2024.

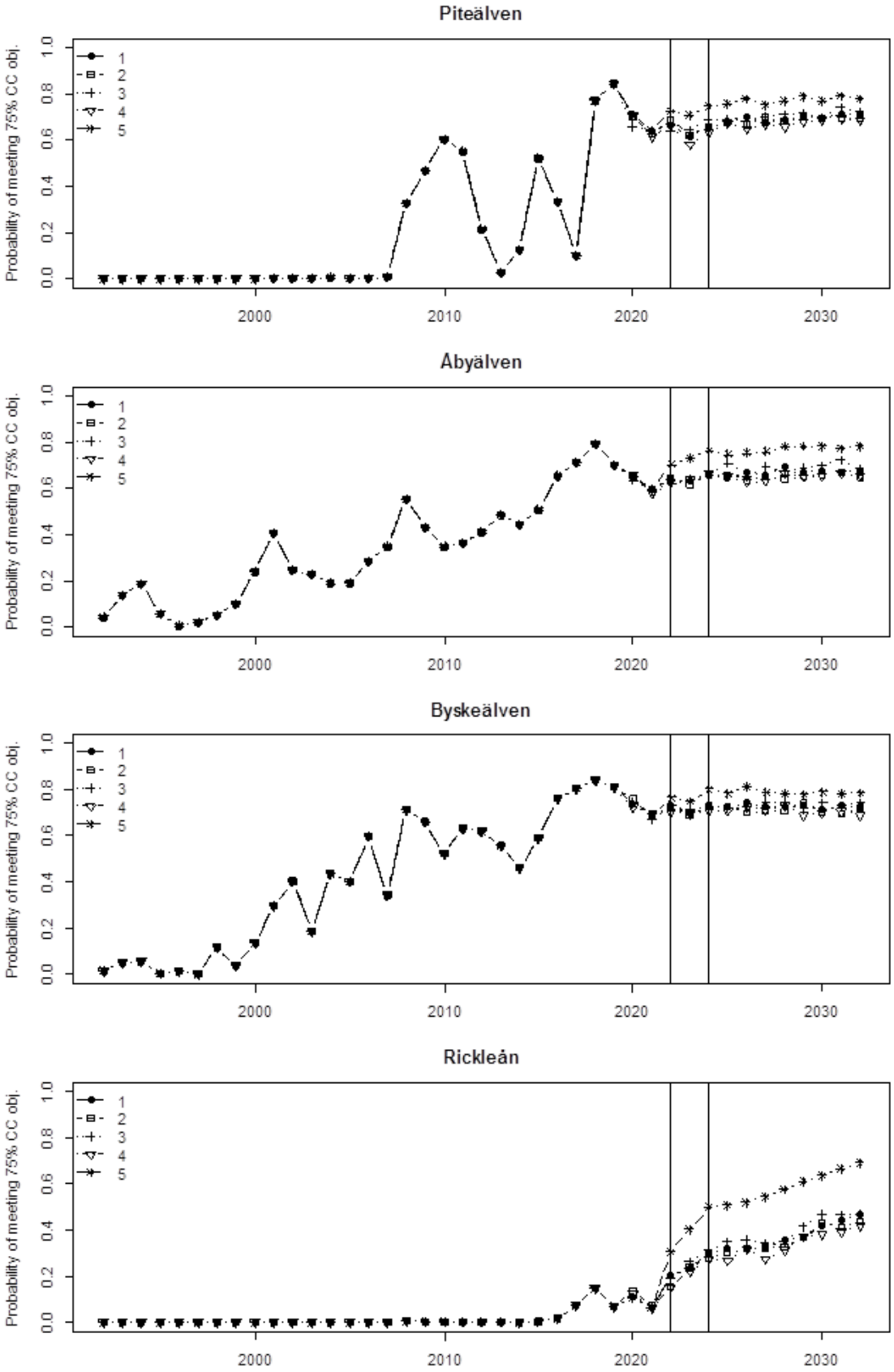

Figure 5b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2019 mainly affects smolt production in the years 2023–2024.

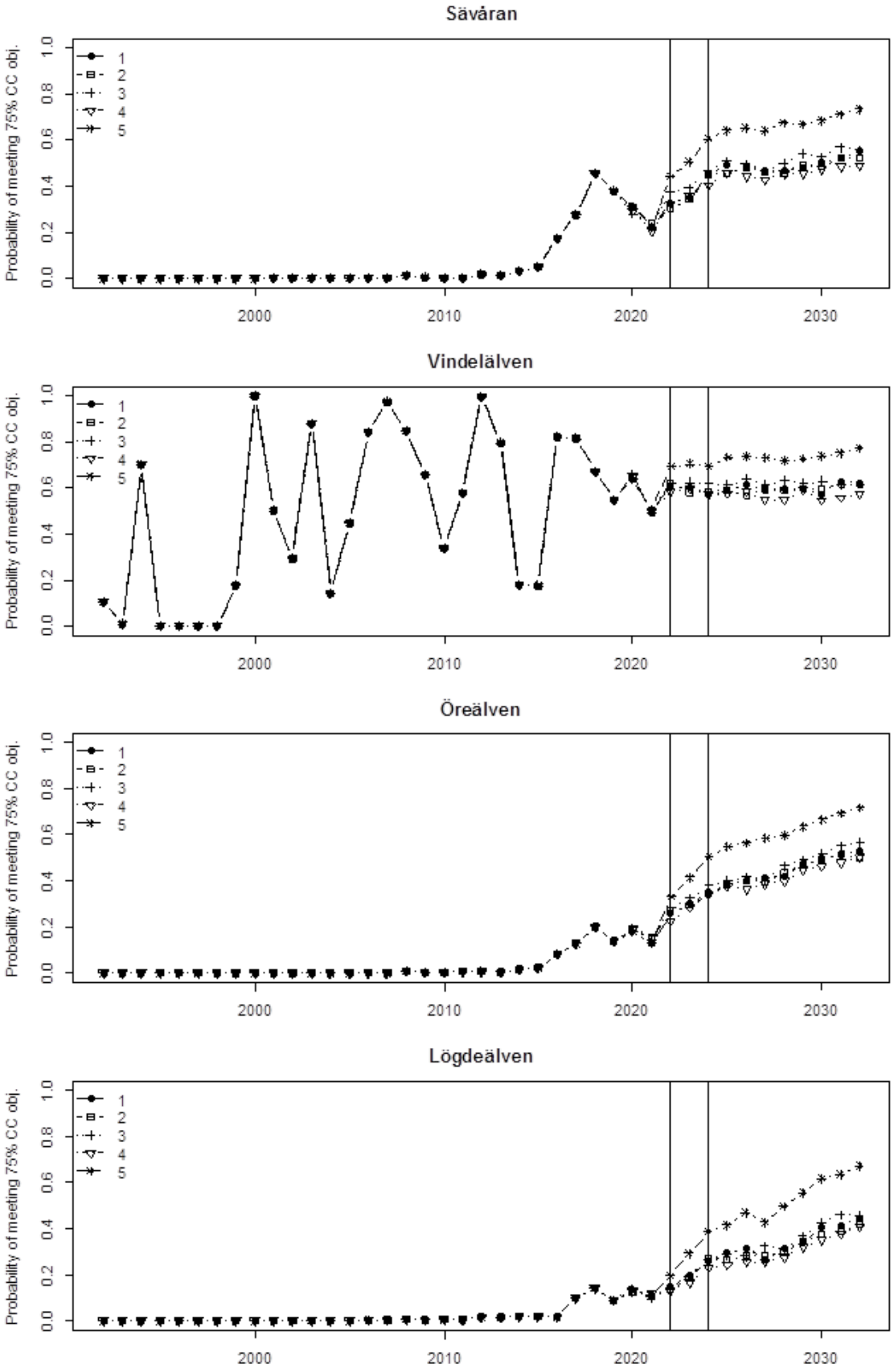

Figure 5c Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2019 mainly affects smolt production in the years 2023–2024.

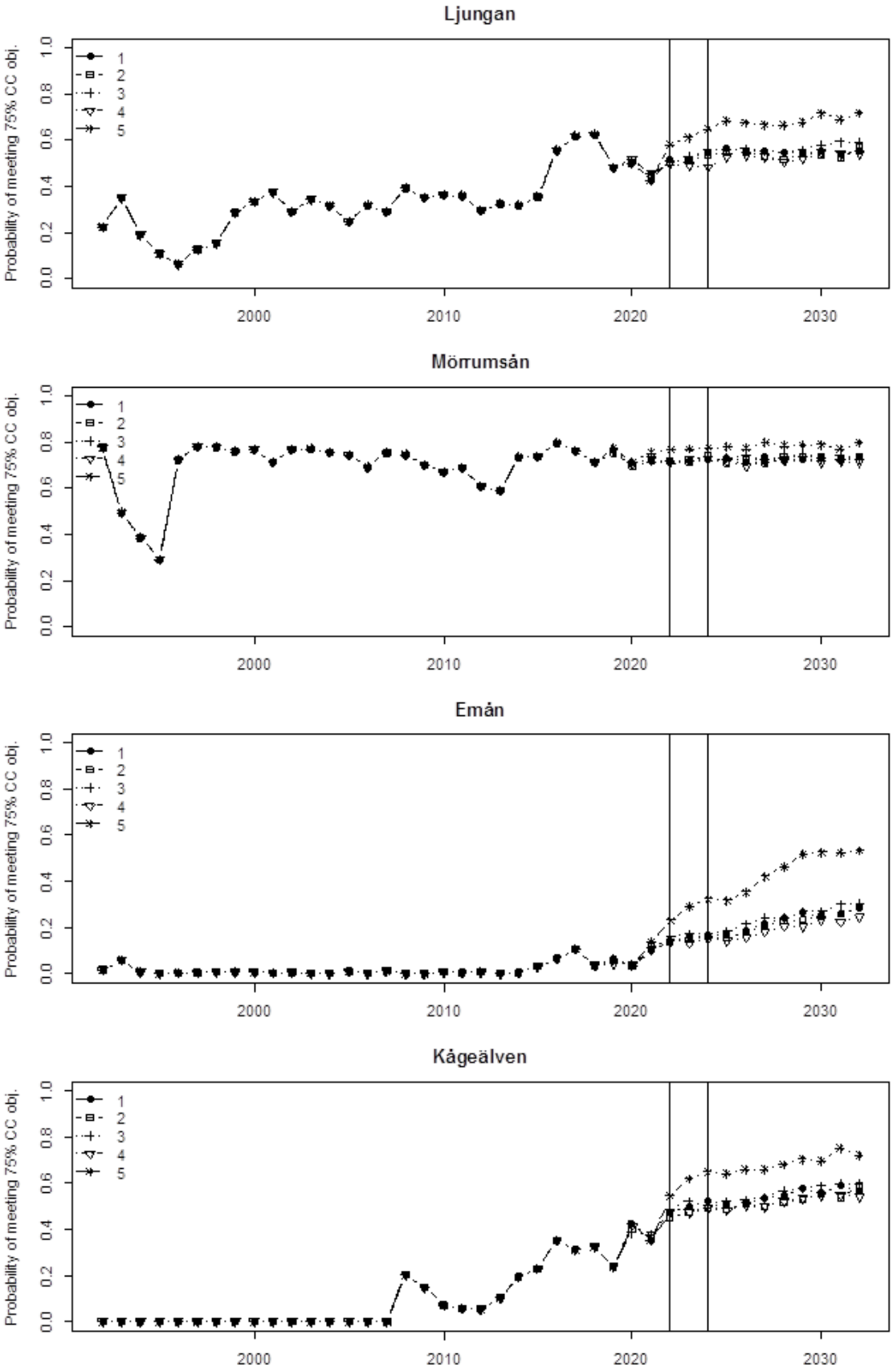

Figure 5d Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Probabilities for stocks to meet an objective of 75% of potential smolt production capacity under different projection scenarios. Fishing in 2019 mainly affects smolt production in the years 2023–2024.

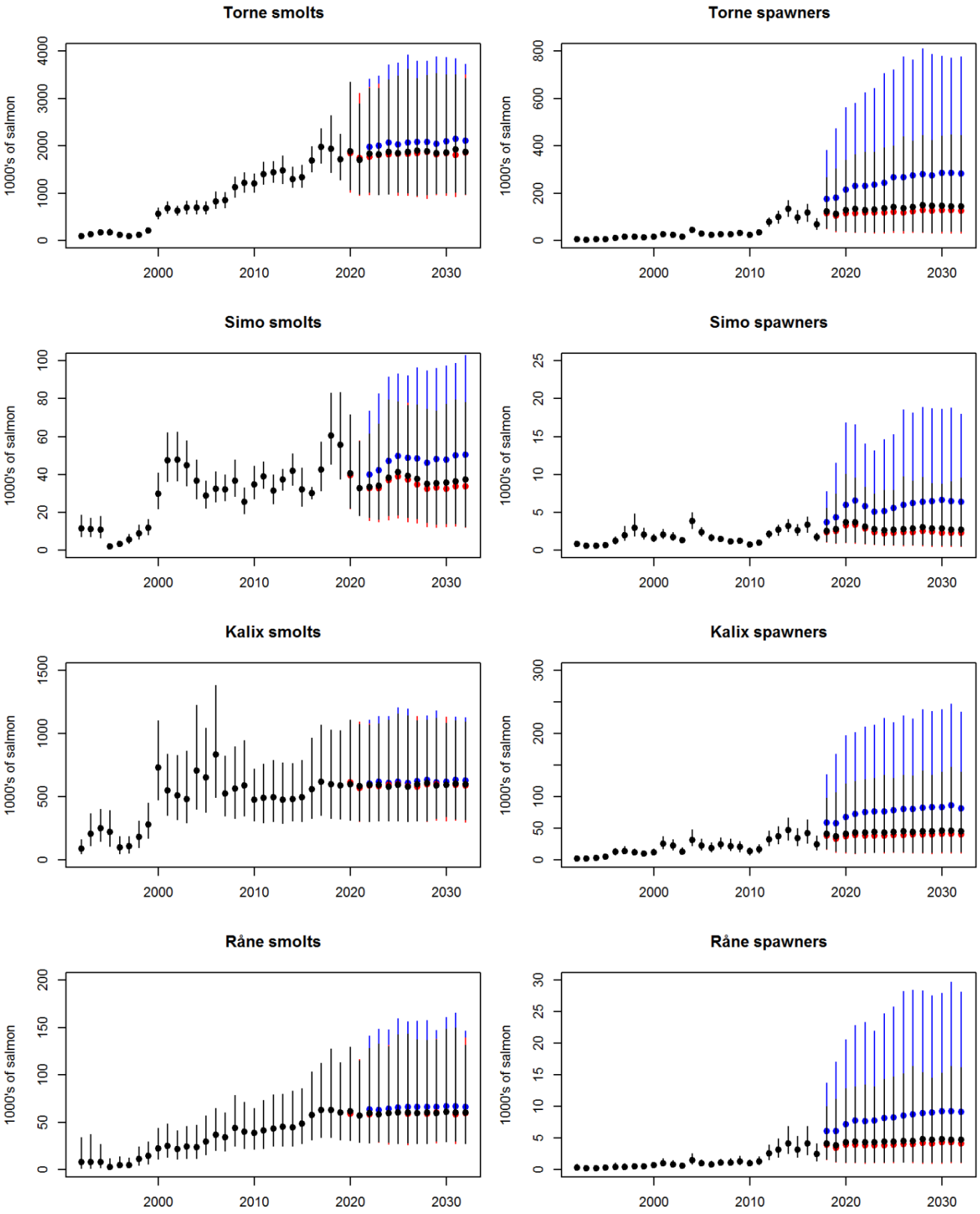

Figure 6a Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt and spawner abundances in different rivers in projection scenarios 1 (black), 4 (red), and 5 (blue). Fishing in 2019 mainly affects smolt production in the years 2023–2024.

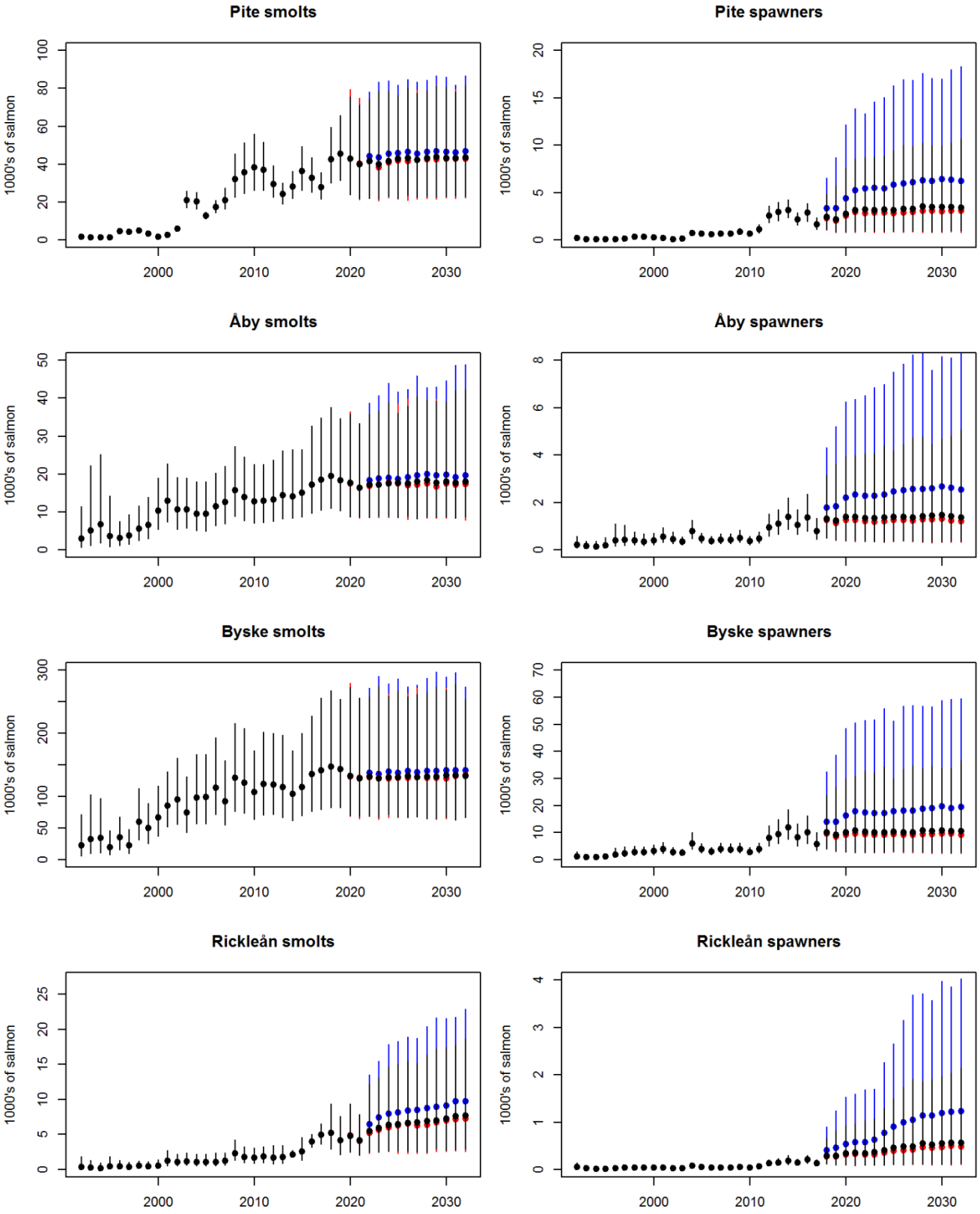

Figure 6b Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt abundances in different rivers in projection scenarios 1 (black), 4 (red), and 5 (blue). Fishing in 2019 mainly affects smolt production in the years 2023–2024.

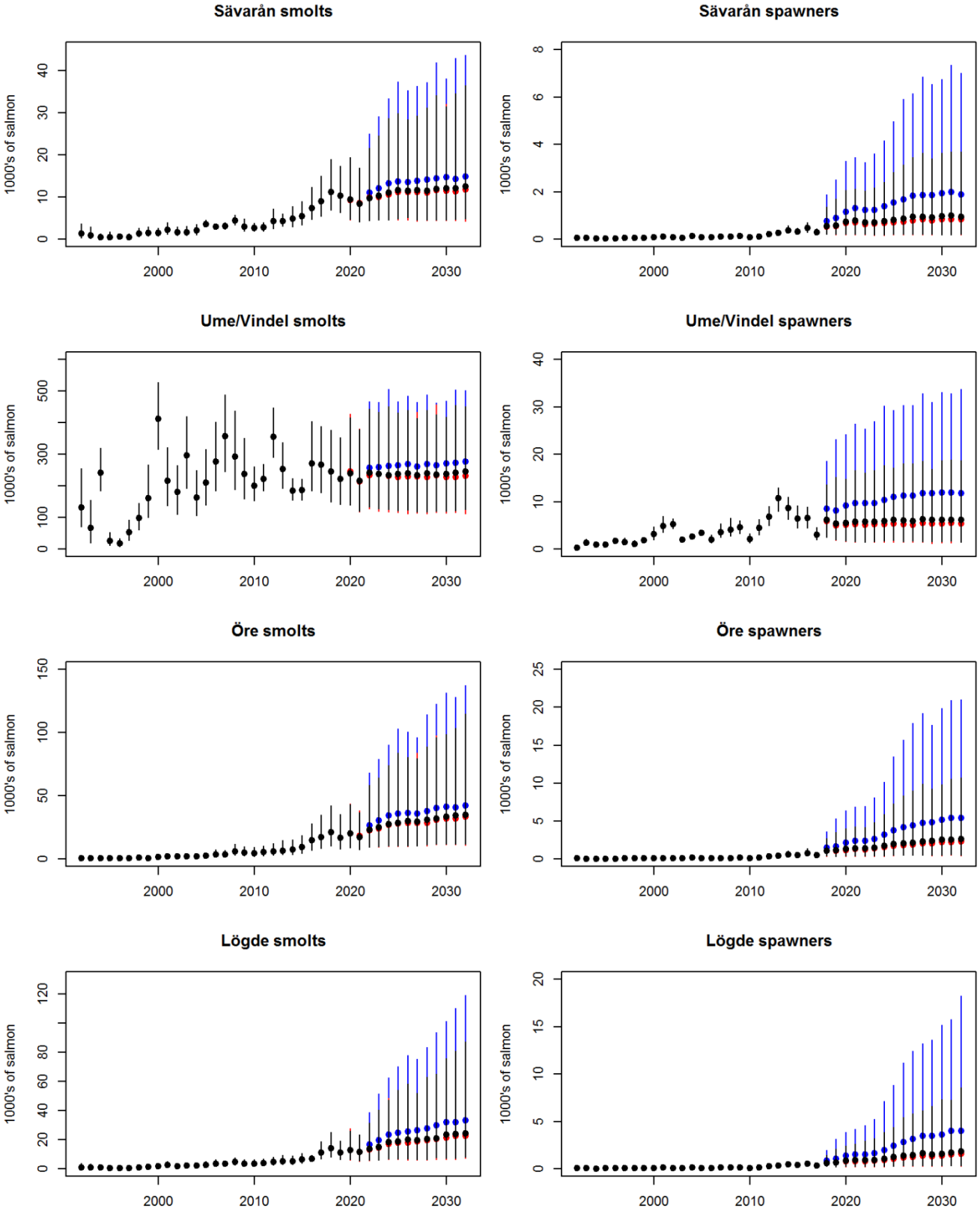

Figure 6c Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt abundances in different rivers in projection scenarios 1 (black), 4 (red), and 5 (blue). Fishing in 2019 mainly affects smolt production in the years 2023–2024.

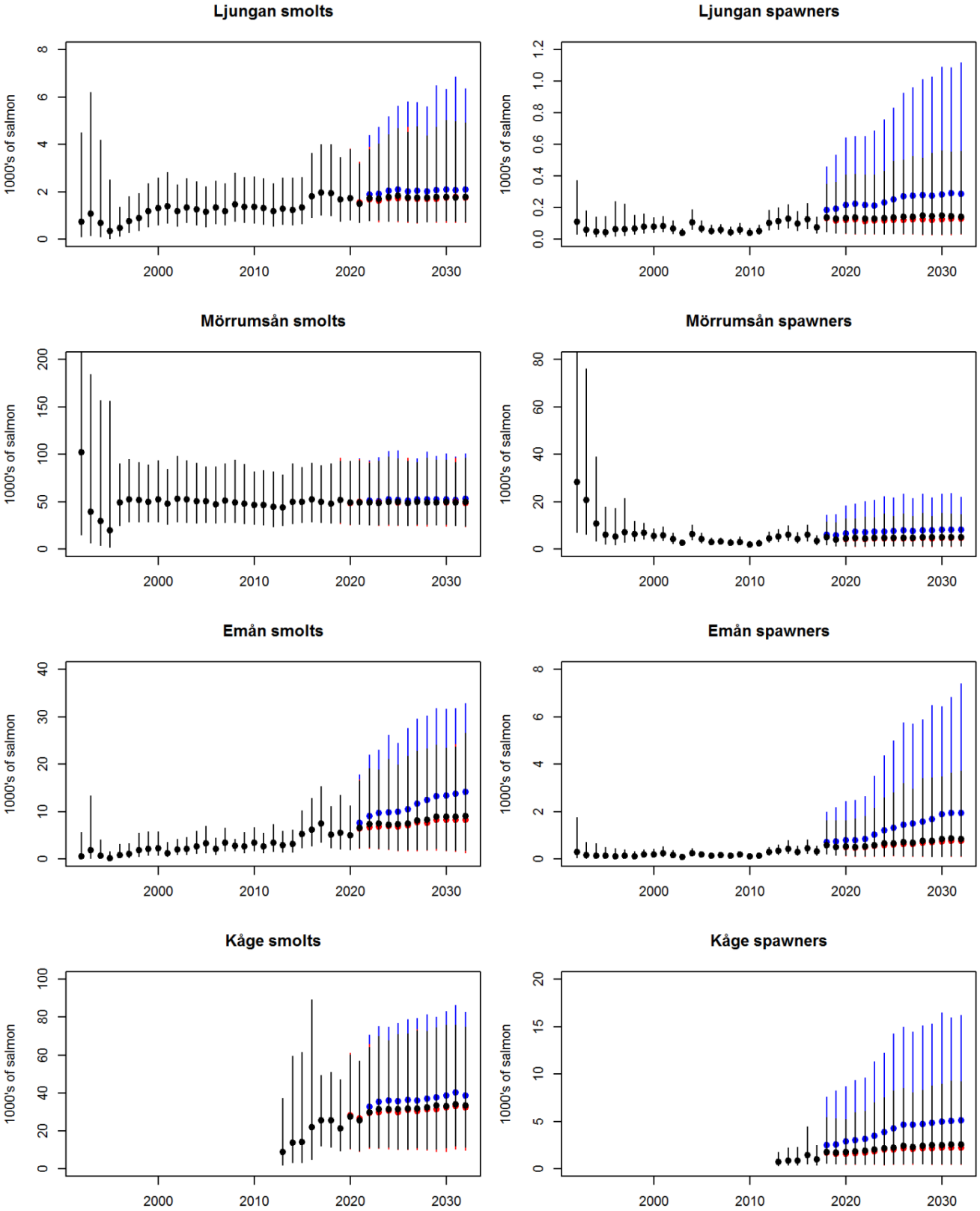

Figure 6d Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Median values and 90% probability intervals for smolt abundances in different rivers in projection scenarios 1 (black), 4 (red), and 5 (blue). Fishing in 2019 mainly affects smolt production in the years 2023–2024.

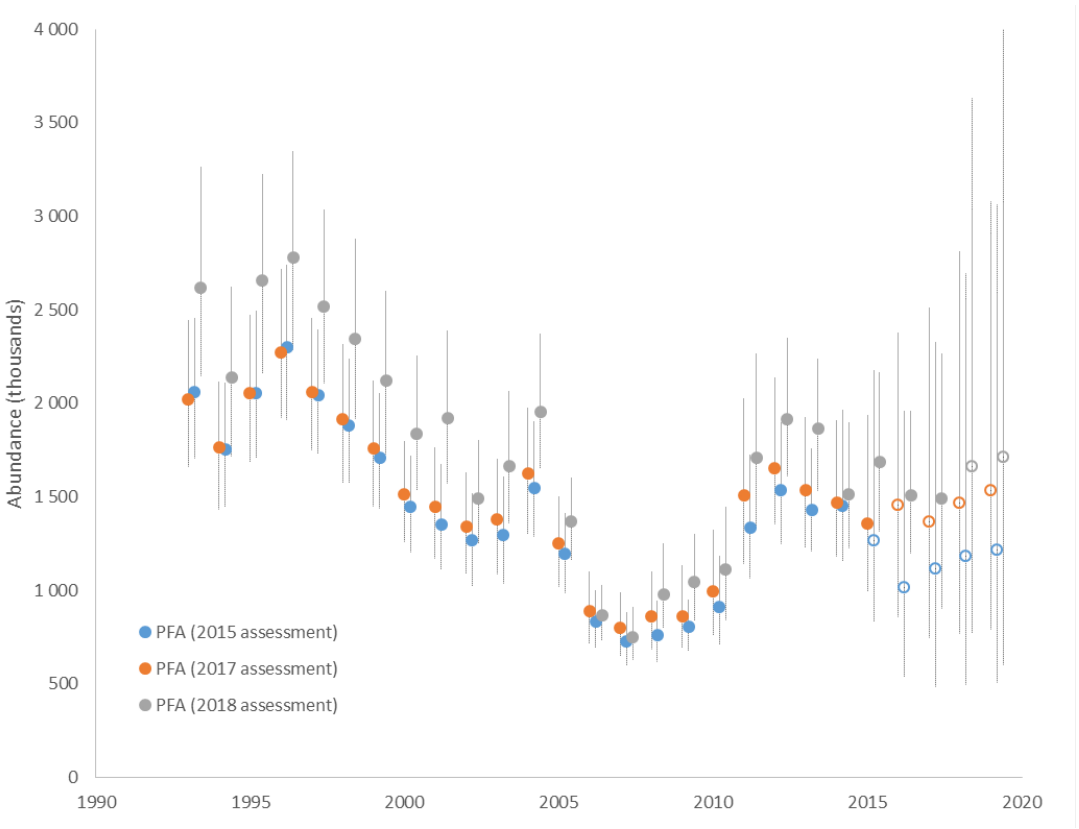

Figure 7 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Estimated pre-fishery abundance in the sea (PFA; wild and reared, 1SW and MSW fish in total) for scenario 1 in the current (2017, data up to 2015; black) and previous (2015, data up to 2014; green) assessment, respectively. The median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

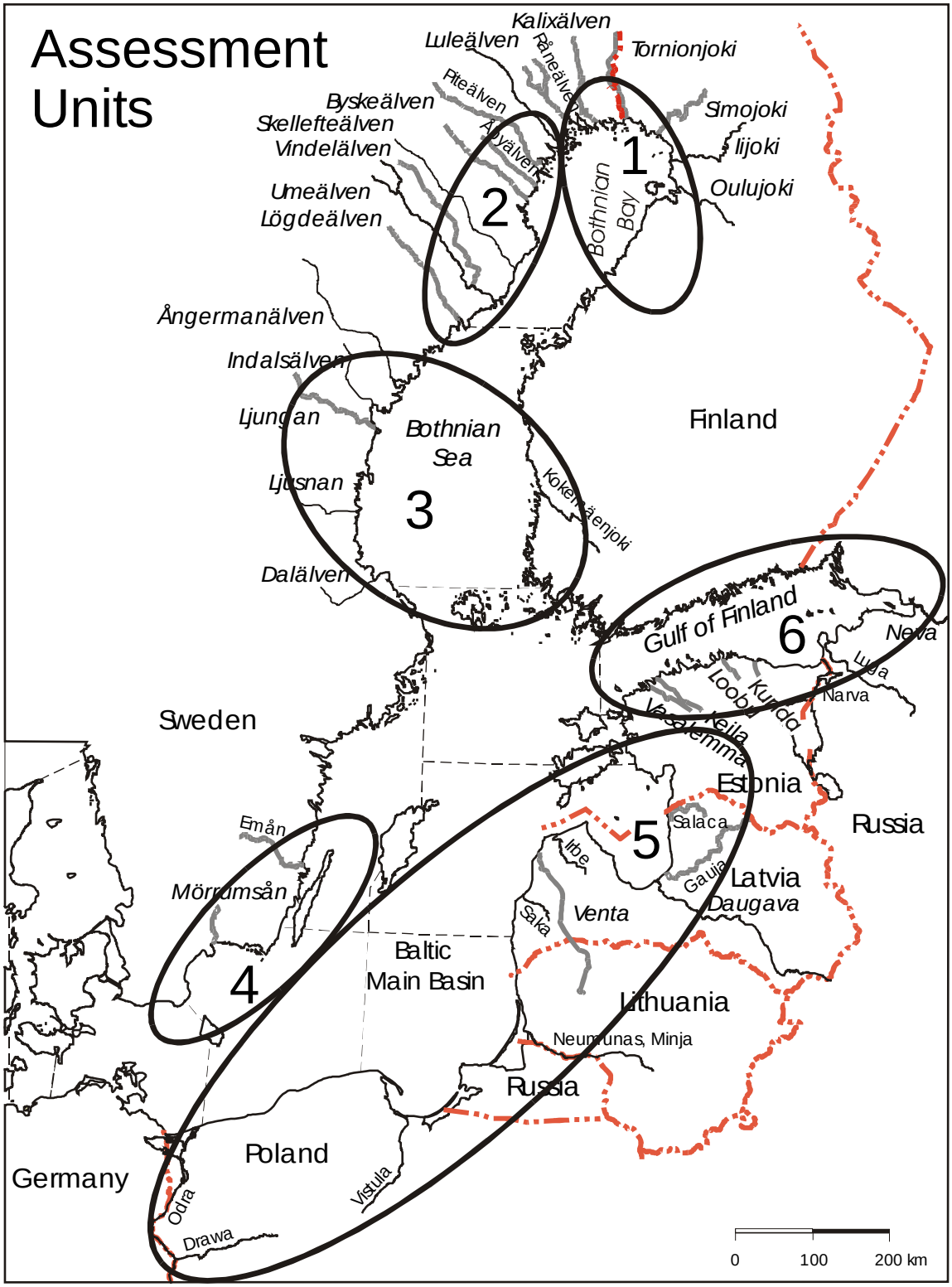

Figure 8 Salmon in subdivisions 22–31 (Main Basin and Gulf of Bothnia). Grouping of salmon stocks in six assessment units in the Baltic Sea, including the Gulf of Finland. The genetic variability between stocks of an assessment unit is smaller than the genetic variability between stocks of different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

Sources and references

EC. 2011. Proposal for a Regulation of the European Parliament and of the Council establishing a multiannual plan for the Baltic salmon stock and the fisheries exploiting that stock. Brussels, 12.8.2011. COM/2011/0470 final – 2011/0206 (COD). 23 pp. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011PC0470.

ICES. 2008a. Report of the Workshop on the Baltic Salmon Management Plan Request (WKBALSAL), 13–16 May 2008, ICES Headquarters, Copenhagen, Denmark. ICES CM 2008/ACOM:55. 61 pp.

ICES. 2008b. Baltic Sea. Report of the ICES Advisory Committee, 2008. ICES Advice 2008, Book 8. 133 pp.

ICES. 2012a. Report of the Baltic Salmon and Trout Assessment Working Group (WGBAST), 15–23 March 2012, Uppsala, Sweden. ICES CM 2012/ACOM:08. 353 pp.

ICES. 2012b. Report of the Inter-Benchmark Protocol on Baltic Salmon (IBPSalmon). By correspondence 2012. ICES CM 2012/ACOM:41. 100 pp.

ICES. 2014. Report of the Baltic Salmon and Trout Assessment Working Group 2014 (WGBAST), 26 March–2 April 2014, Århus, Denmark. ICES CM 2014/ACOM:08. 347 pp.

ICES. 2015. Report of the Baltic Salmon and Trout Assessment Working Group 2015 (WGBAST), 23–31 March 2015, Rostock, Germany. ICES CM 2015/ACOM:08. 362 pp.

ICES. 2016. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2017. Report of the Benchmark Workshop on Baltic Salmon (WKBaltSalmon), 30 January–3 February 2017, ICES HQ, Copenhagen, Denmark. ICES CM 2017/ACOM:31. 112 pp.

ICES. 2018. Report of the Baltic Salmon and Trout Assessment Working Group (WGBAST), 20–28 March 2018, Turku, Finland. ICES CM 2018/ACOM:10. 369 pp.