BALTIC SALMON AND TROUT ASSESSMENT WORKING GROUP (WGBAST)

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i Executive summary

The Baltic Salmon and Trout Assessment Working Group was mandated to assess the status of salmon in Gulf of Bothnia and Main Basin (subdivisions 22–31), Gulf of Finland (Subdivision 32) and sea trout in subdivisions 22–32, and to propose consequent management advices for fisheries in 2021. Salmon in subdivision 22–31 were assessed using Bayesian methodology with a stock projection model (data up to 2018) for evaluating impacts of different catch options on the wild river stocks.

Section 2 of the report covers catches and other data on salmon in the sea, and summarizes information affecting the fisheries and management of salmon. Section 3 reviews data from salmon spawning rivers, stocking statistics and health issues. Status of salmon stocks in the Baltic Sea is evaluated in Section 4. The same section also covers methodological issues of assessment as well as sampling protocols and data needs for assessment. Section 5 presents data and assessed stock status for sea trout.

- Total salmon catches have decreased continuously since the 1990s, although more slowly in recent years. The fishery related mortality for salmon in 2019 (including estimates of unreported, misreported and discarded catches and recently revised estimates for recreational trolling) decreased considerably compared to 2018. This is mainly due to significant decrease of misreporting in the open sea fishery. Reported efforts in commercial salmon fisheries have also remained historically low.
- The level of estimated misreporting of salmon as sea trout decreased to 600 in 2019 compared to 42 600 in 2018.
- The share of recreational catches of Baltic salmon in sea and rivers has increased over time, and at present, they represent about half of the total fishing mortality. In particular, the offshore trolling fishery for salmon has developed rapidly since the 1990s and early 2000s. According to updated estimates, the total landed (retained) catch from recreational trolling has in recent years ranged from about 15 000 to 25 000 salmon per year.
- Since the 1990s, production of wild salmon smolts has gradually increased in the Gulf of Bothnia and Gulf of Finland. For most rivers in Gulf of Bothnia, smolt production is predicted to decrease slightly 2020. Long-term trends for smolt production in southern Main Basin rivers have remained stable or slightly decreasing.
- The current (2019) total wild production in all Baltic Sea rivers is about 2.8 million smolts, corresponding to about 73% of overall potential smolt production capacity. In addition, about 4.7 million hatchery reared smolts were released into the Baltic Sea in 2019.
- Over time, an increasing proportion of the wild salmon stocks have reached the management target (75% of potential smolt production capacity) with high or very high certainty, especially in the northern Baltic Sea. Also in the Gulf of Finland, wild Estonian rivers show recovery. As assessed previously, most weak stocks are located in the Main Basin. Several of the rivers in this area are far below a good state, and have showed a negative development in recent years.
- The exploitation rate of Baltic salmon in the commercial sea fisheries has been reduced to such a low level that most stocks (for which analytical projections are currently available) are predicted to maintain present status or recover at current levels of fishing pressure and natural mortality. However, due to local environmental issues, many weak stocks are not expected to recover without longer term stock-specific rebuilding measures, including fisheries restrictions in estuaries and rivers, habitat restoration and removal of potential migration obstacles. In particular, nearly all Main Basin stocks require such measures.

- M74-related juvenile salmon mortality increased in hatching years 2016–2018, but is expected to again decrease somewhat in spring 2019. It is hard to predict future levels of M74. Recent disease outbreaks and fish with apparent lack of energy, resulting in large numbers of dead spawners and low parr densities in some wild rivers, is another future concern. Most alarming is the situation in Vindelälven and Ljungan where parr densities have collapsed. Despite ongoing research, the reason(s) behind the deteriorating salmon health remains largely unknown.
- Some positive development can be seen for sea trout in the Baltic Sea region, but many populations are still considered vulnerable. Stocks in the Gulf of Bothnia are particularly weak, although spawner numbers and parr densities show signs of improvement. Status for sea trout stocks is generally higher in most of the Main Basin and in southern Gulf of Finland. Populations in Lithuania and Germany are weak, however, probably in part due to natural causes, but they are also affected by coastal fishing.
- In general, exploitation rates in most fisheries that catch sea trout in the Baltic Sea area should be reduced. This also holds for fisheries of other species where sea trout is caught as bycatch. In regions where stock status is good, existing fishing restrictions should be maintained in order to retain the present situation.

ii Expert group information

Expert group name	Baltic Salmon and Trout Assessment Working Group (WGBAST)
Expert group cycle	Annual
Year cycle started	2020
Reporting year in cycle	1/1
Chair	Martin Kesler, Estonia
Meeting venue and dates	31 March–8 April 2020, by WebEx (25 participants)

1 Introduction

1.1 Presentation of the working group and report

The Baltic Salmon and Trout Assessment Working Group within ICES (WGBAST) contains around 30 experts from all nine countries surrounding the Baltic Sea. The group is mandated to assess status and propose management advice for salmon in Baltic Main Basin and Gulf of Bothnia (ICES subdivisions 22–31), Gulf of Finland (Subdivision 32) and sea trout in subdivisions 22–32. Compilation of data (biological and fisheries related) and stock assessment is performed annually in relation to a working group meeting. The working group report is externally reviewed before publication, and the status assessment constitutes the basis for ICES advice on fishing possibilities.

The present report contains updated data series and results from the last meeting in 2019. Section 1 contains background information and responses to last year's review comments, whereas section 2 of covers catches and other data on salmon in the sea, and summarizes information affecting the salmon fisheries and management. Section 3 reviews data from salmon spawning rivers, stocking statistics and health issues. Status of salmon stocks in the Baltic Sea is evaluated in Section 4. The same section also covers methodological issues of assessment as well as sampling protocols and data needs for assessment. Section 5 presents data and stock status for sea trout.

In addition to the above, sections mainly focused on recent results and long-term trends, various important information of more static nature is presented in the so-called "Stock Annex" (Annex 2). The annex contains background descriptions of Baltic salmon biology, rivers and assessment units, fisheries, data collection, and estimation methods and models used for status assessment. The stock annex is only updated when needed, for example following larger changes to the assessment methodology that have been reviewed separately by external experts (during so-called "benchmarks").

1.2 Terms of reference

2019/2/FRSG01 The following ToRs apply to: AFWG, HAWG, NWWG, NIPAG, WGWIDE, WGBAST, WGBFAS, WGNSSK, WGCSE, WGDEEP, WGBIE, WGEEL, WGEF, WGHANSA and WGNAS.

The working group should focus on:

a) Consider and comment on Ecosystem and Fisheries overviews where available;
b) For the aim of providing input for the Fisheries Overviews, consider and comment for the fisheries relevant to the working group on:
    1. descriptions of ecosystem impacts of fisheries,
    2. descriptions of developments and recent changes to the fisheries,
    3. mixed fisheries considerations, and
    4. emerging issues of relevance for the management of the fisheries.
c) Conduct an assessment on the stock(s) to be addressed in 2020 using the method (analytical, forecast or trends indicators) as described in the stock annex and produce a **brief** report of the work carried out regarding the stock, summarising where the item is relevant:
    1. Input data and examination of data quality;

2. Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;
3. For relevant stocks (i.e., all stocks with catches in the NEAFC Regulatory Area) estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2019;
4. Estimate MSY proxy reference points for the category 3 and 4 stocks;
5. The developments in spawning–stock biomass, total stock biomass, fishing mortality, catches (wanted and unwanted landings and discards) using the method described in the stock annex;
6. The state of the stocks against relevant reference points;
7. Catch scenarios for next year(s) for the stocks for which ICES has been requested to provide advice on fishing opportunities;
8. Historical and analytical performance of the assessment and catch options with a succinct description of quality issues with these. For the analytical performance of category 1 and 2 age-structured assessment, report the mean Mohn's rho (assessment retrospective (bias) analysis) values for R, SSB and F. The WG report should include a plot of this retrospective analysis. The values should be calculated in accordance with the "Guidance for completing ToR viii) of the Generic ToRs for Regional and Species Working Groups - Retrospective bias in assessment" and reported using the ICES application for this purpose.

d) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines;
e) Review progress on benchmark processes of relevance to the Expert Group;
f) Prepare the data calls for the next year update assessment and for planned data evaluation workshops;
g) Identify research needs of relevance for the work of the Expert Group;
h) Review and update information regarding operational issues and research priorities and the Fisheries Resources Steering Group SharePoint site;
i) Take 15 minutes, and fill a line in the audit spread sheet 'Monitor and alert for changes in ecosystem/fisheries productivity'; for stocks with less information that do not fit into this approach (e.g. higher categories >3) briefly note in the report where and how productivity, species interactions, habitat and distributional changes, including those related to climate-change, have been considered in the new ToR.

Material and data relevant for the meeting must be available to the group on the dates specified in the 2020 ICES data call. WGBAST will report by 15 April 2020 for the attention of ACOM.

Following correspondence with the ICES ACOM leadership, it was decided that specific ToR b) (planning of a scoping workshop) could be handled via correspondence later in 2019. In the report, generic ToRs for regional and species working groups are addressed primarily in Sections 4 (salmon) and 5 (sea trout). A short summary of the group's response to specific ToR c) on the EU Data Collection Framework and EU-MAP is provided in Appendix 1.

1.3 Participants

The following experts participated at WGBAST in 2020:

Name		Country
Janis Baijnskis	(participating remotely)	Latvia
Rafał Bernaś	(participating remotely)	Poland
Johan Dannewitz	(participating remotely)	Sweden
Piotr Debowski	(participating remotely)	Poland
Harry Hantke	(participating remotely)	Germany
Anders Kagervall	(participating remotely)	Sweden
Anastasiia Karpushevskaia	(participating remotely)	Russia
Martin Kesler (chair)	(participating remotely)	Estonia
Vytautas Kesminas	(participating remotely)	Lithuania
Marja-Liisa Koljonen	(participating remotely)	Finland
Antanas Kontautas	(participating remotely)	Lithuania
Adam Lejk	(participating remotely)	Poland
Katarina Magnusson	(participating remotely)	Sweden
Samu Mäntyniemi	(participating remotely)	Finland
Hans Jakob Olesen	(participating remotely)	Denmark
Tapani Pakarinen	(participating remotely)	Finland
Stefan Palm	(participating remotely)	Sweden
Stig Pedersen	(participating remotely)	Denmark
Atso Romakkaniemi	(participating remotely)	Finland
Stefan Stridsman	(participating remotely)	Sweden
Susanne Tärnlund	(participating remotely)	Sweden
Sergey Titov	(participating remotely)	Russia
Didzis Ustups	(participating remotely)	Latvia
Rebecca Whitlock	(participating remotely)	Sweden
Ireneusz Wójcik	(participating remotely)	Poland

1.4 Code of Conduct

In 2018, ICES introduced a Code of Conduct that provides guidelines to its expert groups on identifying and handling actual, potential or perceived Conflicts of Interest. It further defines the standard for behaviours of experts contributing to ICES science. The aim is to safeguard the reputation of ICES as an impartial knowledge provider by ensuring the credibility, salience, legitimacy, transparency, and accountability in ICES work. Therefore, all contributors to ICES work are required to abide by the ICES Code of Conduct.

At the beginning of the 2019 WGBAST meeting, the chair raised the ICES Code of Conduct with all attending member experts. In particular, they were asked if they would identify and disclose an actual, potential or perceived Conflict of Interest as described in the Code of Conduct. After reflection, none of the members identified a conflict of interest that challenged the scientific independence, integrity, and impartiality of ICES.

1.5 Ecosystem considerations

1.5.1 Salmon and sea trout in the Baltic ecosystem

Salmon (*Salmo salar)* and sea trout (*Salmo trutta)* are among the top fish predators in the Baltic Sea. Together with European eel (*Anguilla anguilla*) and migratory whitefish (*Coregonus lavaretus*/*Coregonus maraena*) they form the group of keystone diadromous species in the Baltic Sea. Annex 2 contains background descriptions related to ecosystem aspects for Baltic salmon, including basic biology, ecological functioning, environmental pressures, disease outbreaks, effects of climate change, and fisheries impacts, whereof most are common for both species. At the beginning of Section 5, a short description is also given on how the life history and ecology of sea trout differs from that of salmon.

1.5.2 Data for HELCOM salmon and sea trout core indicators

The core indicator used by HELCOM for evaluation of salmon stock status is based on the comparison of assessed smolt production versus assessed potential smolt production capacity on the assessment unit (AU) level. To facilitate data transfer, AU-specific smolt production estimates needed for the HELCOM indicator are presented in Annex 5, where AU 1–2 have been combined to better match the division used for HELCOM assessment units. The indicator for evaluation of sea trout stock status is based on the comparison of observed to expected (potential) parr density in various habitats concerned. Assessment results presented in Section 5.5 support the HELCOM evaluation.

1.6 Response to last year's Technical Minutes

The aim of this section is to facilitate efficient use by the working group of constructive questions and comments presented in the Technical Minutes of last year report, as well as a feedback to the review group how its advice is being used to improve the assessment. Below, specific comments from last year's review are repeated, with responses from the group *in italics*:

Section 3. River data on salmon populations

In AU5, the text notes that Pärnu is now considered a mixed river. ICES has explicit targets about abundances (0.5 or 0.75 R_0), but it's not clear if maintaining "wild" rivers is also a priority. If so, what are the measures taken to recover Pärnu to reduce reliance on hatchery supplementation?

As, I mentioned last year, it would be helpful to expand Table 3.2.1.1 (on restoration programmes in potential rivers) to mixed and wild rivers, especially for cases like Pärnu to ensure that additional restoration programmes are in fact in place.

Besides salmon releases many measures to increase natural reproduction are applied in river Pärnu. Most importantly, the Sindi dam was removed in 2018. This action enables salmon to reach all potential rearing areas. Secondly, salmon fishing is prohibited in the river and all year round closed area around river mouth was extended from 500 m to 1000 m. Thirdly, parr density monitoring was extended in 2013. If monitoring shows improvement in wild reproduction, the supplementary releases will be decreased. Long-term objective is to rebuild wild self-sustaining salmon population.

In AU6, the index river Pirita, is a mixed river, but the intention of index rivers is to inform "status of wild salmon". Was Pirita chosen because there were no suitable wild salmon rivers? Some justification, and implications of this choice, would be helpful. In particular, trends and status of Pirita may be more related to hatchery practices than natural survival or habitat suitability.

Supplementary releases in river Pirita are small, and no releases will be carried out 2018 onward. Spawner counting has shown that in most years reared fish constitute less than 10% to the spawners. Therefore, the river Pirita will become "wild" in near future.

3.2 Potential rivers
3.2.2 Potential rivers by country

<u>Potential rivers in Finland.</u> The relatively weak rebuilding of populations in the Kuivajoki and Pyhäjoki might also be due to reared salmon being poorly adapted to the natural environment. Although there is evidence for natural spawning in some rivers (in Finland and other countries), is there evidence of 2nd generation natural spawners, i.e. natural spawners with hatchery parents that complete an entire life cycle in the wild? Alternately, are all natural spawners first generation natural spawners who produce unfit progeny not adapted to the wild? This latter situation is the case for many Pacific salmon stocks on Vancouver Island (Chinook salmon), which results in the appearance of a healthy stock that actually rely entirely on hatchery supplementation.

There is practically no information (direct observations) about whether the few spawners which returned to Kuivajoki and Pyhäjoki are all first or second generation natural spawners. However, natural spawning has produced so few 2nd generation fish in these rivers that it is possible that none of them have survived to spawning from their feeding migration. However, in Kiiminkijoki natural spawning has been more successful and up to thousands of wild-born smolts have left the river already since 1990s. So, simply because of their abundance, it is likely that a notable number of 2nd generation spawners are spawning in Kiiminkijoki.

3.3.2 Straying

This section describes low stray rates into Tornionjoki, a river with very high wild production relative to the small number of strays. However, strays from large rearing facilities into small rivers may have much larger impacts. Indeed, stray rates of 3–4% (as estimated from tag–recapture data) may be have significant genetic impacts where rearing production is high and wild production is weak (and may contribute to a much larger percentage of spawning in depleted, wild rivers).

"Highest straying rate of tagged salmon is often observed in reared rivers and annual releases, due to high total exploitation rate from the commercial, recreational and broodstock collection, and probably also because broodstock fisheries are carried out close to the river mouths" **(p.22).** Does this refer to observed estimates of straying, which may be biased by these factors, or direct impacts on straying? How do climate variables and diseases impact stray rates?

Estimated straying rates to reared rivers are based on proportions of observed tagged salmon originating from other rivers. Since broodstock fisheries are located close to river mouths, it is possible that these rates are high compared to how many of these strays that would have stayed until spawning in the "wrong" river (if given possibility). For the same reason, straying rates in wild rivers, based on tagging and/or observations of fin-clipped salmon from fish-counters equipped with cameras, may also be higher than the associated levels of gene flow. How climate change and disease may affect straying is an interesting question, but we are not aware of results showing how this may have affected Baltic salmon.

For Kågeälven and Testeboån, why are there high smolt abundances at zero egg abundances?

The most likely explanation seems to be that these plots include early historical years where both smolt abundance and spawner abundances were very uncertain (note that both Testeboån and Kågeälven are "new" rivers, i.e. they relatively recently received wild status and were then added to the FLHM with data going back fewer years in time than for other rivers). Number of eggs do not reach zero, although abundances are very low. Having many years of low spawner abundance packs up a lot of simulations close to zero, thus intensifying the blue color on that region. For each year, the smolt abundance is very uncertain but low. Stacking up many such years on top each other with transparent color creates the visual impression of high smolt abundance.

Section 4 Reference points and assessment of salmon
4.2.1 Changes in assessment methods

The posterior distribution of *K* for Tornionjoki is bimodal (Figure 4.2.1.1a). Is this because of wild and semi-wild fish? This bimodal pattern was not evident in the posteriors for R_0 last year.

Good approximation of the PCPC for Tornionjoki by MCMC sampling has almost always been difficult. The convergence of the parameters defining the S/R dynamics in this river have converged slower than most of the other parameters of the FLHM. The same applies also for the same parameters of a few other rivers in the FLHM (and which have not all been stocked). It is important to remember that MCMC sampling by JAGS software has so far shown substantial mixing problems of chains. Apart from problems related to the MCMC approximation, it is not impossible that semi-wild fish (which were relatively abundant in Tornionjoki in the early part of the analysed time-series) could contribute to the bimodality of K estimate. However, a more likely explanation is that the relatively rigid structure of the assumed S/R relationship (B–H curve) together with very widely ranging abundance of spawners displaying only one-way development (i.e. recovery) in the time-series results in fitting problems of the S/R curve. This can especially be the case for Tornionjoki, where 'S/R data' appear very certain due to the river being data-rich. Consequently, the 'S/R data' may easily indicate two alternative forms for the S/R curve, one with a lower and another with a higher K value.

4.2.3 Status of AU 1–4

Drawing parameters from a combination of chain 1 and chain 2 means that correlations among parameters within chains are not preserved. Although on one hand this may be may result in more plausible values when compared with previous year values, it does result in stabilization of outputs from last year to this year. I suggest explicitly mentioning this stabilization. Why not just take only parameters from chain 2 to preserve these correlations? I assume the parameter closest to last year's estimates was chosen? In which case a "default" is not necessary.

Both chains had parameters that were stuck in implausible values. However, in all cases visually inspected one of the chains was sampling plausible values. Most often, it was chain 2 producing the plausible values, but there were also examples showing the opposite. Using only chain 2 would have meant that those implausible values would have been included. This is the main reason for using both chains. Chain 2 was used as default in order to preserve as much of the parameter correlations as possible.

Figure 4.2.3.4 highlights the impacts of time-varying PSPC (R_0), especially for Ume/Vindelälven. In periods when marine survival is low then PSPC is reduced and it is easier to achieve conservation objectives. This may be appropriate in most cases, except perhaps at extremes or where declines in survival are thought to be within management control. For example, is there a lower absolute limit for PSPC (e.g. below 1000 fish, an IUCN minimum abundance threshold) below which depensatory dynamics may occur? The upper limit would be bounded by K presumably. Also, if declines are due to, e.g. disease or freshwater mortality which may be at least in part under management control, then revising PSPC downward under periods of low survival may mask triggers for increased management intervention. The text suggests problems for these very low R_0 values for Ume/Vindelälven, where it recommends, "the stock status should not only be evaluated against (declined) final PSPC's (R0's)". How else should stock status be evaluated?

The above quote was added to highlight that problems like those health-related seen recently for Vindelälven, with associated reduced PSPC estimates, may signal a false picture of decent stock status (i.e. as long as smolt production has not yet declined faster than the decrease in PSPC). We yet have no good solution on how to handle this dilemma. But, to (also) compare current smolt production with an average for PSPC across some years back in time could at least give an indication that "something has changed".

4.5 Conclusion

I agree that river-specific exploitation rates should be included once spatial-temporal model completed, and that spatial management measures should be considered once the model is implemented. In addition, could the spatial distribution of discards from seal damage and/or natural mortality from seals be included, given changes in spatial distribution of seals and increasing predation on salmon?

To add more detailed information on how seal mortality may affect certain river stocks is probably doable from a technical perspective. The main challenge would rather be related to access of raw data, as spatially fine-scaled information from fisheries on seal predation is rare and associated with quality issues.

2nd paragraph: Although increasing fishing +/- 20% does not affect probability of recovery to 50% or 75% of PSPC for most AU 1–4 rivers, that is not necessarily the case for AU 5–6, though projections are not possible here. Also, for AU3, the favourable performance of Testoboån is in part due to underestimation of R_0 (Section 4.4.2, 4.2.3, and Table 4.2.3.2). I suggest mentioning these caveats. To what extent might this also be an issue for Piteälven (Table 4.2.3.2, where large decline in R_0 from 2017 to 2018).

We have added a comment on the caveat related to AU 3 stocks in this year's report. The mentioned change in R0 for Piteälven was related to the change made to the model in 2019 (spawner counts used directly in the model instead of using them to produce smolt production priors as earlier). This resulted in significant updates of estimated spawner and smolt abundances, as well as stock–recruit parameters (see comment in last year's report, p. 159).

4.6 Ongoing and future development

I agree that improvements in computation and model convergence is critical for a variety of reasons. For example, if multiple runs of the model were possible, simulation-evaluation could be used to evaluate benefits/shortcomings of changes in assessment and monitoring on achieving conservation objectives. The model could be run over various simulated datasets with known underlying biological trends and with different of simulated levels of assessments/monitoring to identify levels required to achieve objectives with a specified probability (as in Management Strategy Evaluation). This would help prioritize where to focus effort on new data collection (4.7). Also, does the work plan include comparison of results between platforms, if changed?

We fully agree on the need to improve computation and convergence speed, and a change of platform has been discussed. A few trials with the NIMBLE R-package was carried out in last year, but without real success (the FLHM indeed run very fast but with exceedingly poor convergence, resulting in a total run time of about same length as presently for JAGS). Further attempts will be needed to solve this issue.

Section 5. Sea trout
5.5 Recruitment status and trends

Figures 5.5.1–5.5.3 show recruitment status relative to recruitment potential with 95%CIs. How are 95%CIs calculated for each figure?

*We assume normal distribution CL = t * SE*

For example, in Figure 5.5.1, are they the 95% CIs among rivers within an AU, or combined uncertainties from individual parr surveys, or otherwise? For a number of the AUs, the uncertainties at the aggregate level (Figure 5.5.1) are smaller than for the component SDs and countries (Figure 5.5.3), and I wonder if uncertainty is underestimated at the aggregate scale (e.g. if the 95% CIs represent variation among SDs within AUs) providing assessments that are overly confident. For 3-year average assessments in Figures 5.5.1–5.5.3, are years of missing river assessment rivers infilled?

No – it is a simple crude average. Problematic in years where no sites are fished in a given year = three year average is on two year average (this year in 29 EE).

For example, some rivers were not assessed this year, making it difficult to compare previous year's estimate to the current year. Similarly, averaging across years is only valid if missing years are infilled (e.g. with a mean value or other algorithm). Given challenges in com-paring assessment across years that include different rivers, would it be useful to include a metric of proportion of rivers assessed each year (added to Figures), providing an indication of uncertainty in the estimate. For example in years where only a small portion of rivers are monitored, missing values could be infilled, but results de-emphasized given high uncertainties.

Underlying problem is the low number of electrofishing sites in sea trout streams. Present assessment still aims to include as many rivers as possible, despite gaps in data.

5.5.1 Recruitment status

"In assessment area **West** (SD 27 and 29; Figure 5.3.2.1) only sites in SD 28 were available this year, except one Swedish sites in 29 (Figure 5.5.2)" (p. 14). Is this a typo since SD28 is in the east assessment area? If there is only one river in SD 29 in 2018, why do 95% CIs differ for SD 29 in Figures 5.5.1 and 5.5.2 (blue bars)?

"Recruitment status for year 2018 compared to an average computed for the three-year period 2016–2018 show differences in some assessment units, indicating interannual variation" (p. 14). If missing rivers are not infilled, then high inter-annual variation may be due to differences in assessed rivers among years.

Mistake fixed.

5.5.2 Recruitment trends

How are 95%CIs calculated for each level of aggregation (Figures 5.5.4, 5.5.5, and 5.5.6)? They are very large for most cases (spanning -1 to +1), but quite narrow for a few, which is not intuitive. For example, why are the 95%CIs relatively narrows for GoB, but very large for component SDs, 30 and 31? It looks like 95%CIs at the aggregate AU level account for variability in mean values among SDs, but not underlying uncertainty within SDs. If these 95%CIs can be justified, I suggest emphasizing these large uncertainties in trends in the section.

Instead of Pearson correlation coefficient, *r*, between recruitment and year, the average annual change in recruitment (the slope of linear regression) might be a more intuitive trend metric. The 95% CIs in the slope parameter would provide maximum and minimum annual changes, also more intuitive than 95%CIs in Pearson *r*. Linear trend lines could be added to the recruitment time-series plots with 95% confidence intervals in the slope showing the minimum and maximum average annual changes.

We illustrated this in a different way, Figures 5.5.4–5.5.6. This was done already in 2019 assessment.

5.8 Assessment results

"A positive long-term development has in more recent years been observed in many sea trout populations around most of the Baltic Sea" (p. 19). This conclusion is not aligned with results in Section 5.5.2 and Figures 5.5.4–5.5.6) on recruitment trends. The discrepancy may be in the time period. Does this sentence refer to long-term (~5 year), recent trends (last year to this year) trends, or another time period?

I actually think that it can be a bit confusing to have two different ways to illustrate trend. But the difference also lies in what is shown. Figures 5.55.1–5.5.3 shows averages for the previous three year for ALL sites in the area, whereas the other trend figures show trend for only sites with continuous data for last 5 years.

Fish in numerous rivers have been negatively impacted by warm summer temperatures in recent years. What is the long-term prognosis for sea trout in the Baltic, given climate change projections of warmer temperatures in this region? Although formal projections are not possible here, is it possible to provide qualitative advice that survival is expected to decline over the next 50 years under expected climate projections? In the future if quantitative advice were possible, perhaps it could be included in forward projections?

This is beyond the scope of present report. Potentially the last question might to some extent be possible.

2 Salmon fisheries

2.1 Overview of Baltic salmon fisheries

The fishery for Baltic salmon is heterogeneous. Commercial and recreational fisheries occur in the sea (offshore and coast) and in rivers, using a variety of gears. Below follows a brief overview of the most important fisheries and gears. A more comprehensive description of various fisheries including descriptions of gears and methods used is given in the Stock Annex (Annex 2). More extensive descriptions of this, as well as historical gear development in Baltic salmon fisheries, are also available in ICES (2003). Information on catches, effort, discards, unreporting, and misreporting is provided in Sections 2.2–2.4.

Commercial fisheries

Coastal commercial fishing targeting salmon occurs mainly in Gulf of Bothnia and Gulf and Finland, along the coasts of Sweden and Finland, but to some extent also in Estonia and Latvia. At the present time, this fishery stands for the majority of the commercial landings. Gears used include different types of trapnets. The fishery occurs during spring and summer and targets salmon on their spawning migration. Some commercial fisheries also exist in fresh water close to river mouths, such as in a few Swedish rivers with reared salmon and in River Daugava, Latvia.

Offshore commercial salmon fishing is mainly carried out in Southern Baltic Sea (Main Basin), although it has periodically occurred also in Southern Gulf of Bothnia. Currently the commercial offshore fishery is more or less limited to vessels from Denmark, Poland and Lithuania, whereas earlier several other countries were also involved. Besides, Finland has a minor offshore fishery in the Gulf of Finland. Historically, driftnets was the most important gear, but after a driftnet ban enforced in 2008 commercial offshore fisheries consist mainly of longlining and to some extent anchored floating gillnets. The offshore fishery takes place mainly during the period November to March, and targets non-mature salmon in their feeding areas.

Recreational fisheries

Recreational trolling is an increasingly common and popular fishing method to catch salmon in the Baltic Sea. So far, the trolling fishery is most developed in Sweden, Denmark, Germany and Poland. Also, in Latvia and Lithuania trolling fishery is developing. The trolling season varies between different sea areas and depends on the feeding and spawning migration of salmon and/or seasonal closures. In western Baltic and Main Basin, it typically starts in late fall and ends in the middle of May. In the Åland Sea and Gulf of Bothnia, the season starts in the end of May and continues until late summer. Over the past few decades, the trolling fishery has increased, whereas the commercial offshore catches have declined. Thus, the relative importance of the recreational fishery has increased over time.

The river fishing for salmon in the Baltic region has a very long history. Until the mid-1990s, nets and weirs were used in many rivers throughout the Baltic region. Currently the river fishery for wild salmon is entirely recreational and to a major part restricted to angling (rod and reel fishing). The most productive wild Baltic salmon rivers are by far the Finnish and Swedish large rivers flowing into the northern Baltic Sea. The main fishing season is between May–September, during the spawning run. Rod fishing for salmon in these rivers is very popular, attracting several thousands of anglers every year. The recreational river fishing for salmon in other countries surrounding the Baltic Sea is more limited, although salmon, to some extent, is caught in Estonian, Lithuanian, Latvian and Polish rivers. Russia has no recreational salmon fishery in their rivers feeding into the Baltic Sea, and no Baltic salmon rivers exist in Denmark and Germany.

While the recreational salmon catch is largely dominated by angling (offshore trolling and rod fishing in rivers) there are other types of recreational fisheries carried out in some countries. Where passive gears such as trapnets, gillnets or longlines are being used for catching salmon, either as a target species or bycatch, in both coastal and riverine recreational fisheries. These catches are generally estimated to be of minor importance, in terms of impact on the stocks (i.e. removals).

Brood stock fisheries

Brood stock fisheries are aimed at collecting mature individuals for breeding purposes. Either within sea-ranching programmes, where mature breeders are caught annually to produce salmon for stocking, or to renew closed brood stocks kept in captivity during the whole life cycle. Brood stock fisheries usually occur in rivers with reared salmon, but adult salmon are also caught for breeding purposes in some wild salmon rivers. Catches for breeding purposes are, however, rather limited and occur in Estonia, Finland, Latvia, Lithuania, Poland, Russia and Sweden.

2.2 Catches

This section contains information on commercial and recreational Baltic salmon catches from sea, coast and rivers in 2019 and over time. The catches presented are, unless otherwise stated, landed (retained) salmon.

Commercial catch statistics provided for ICES WGBAST are based on EU logbooks, national reporting system for vessels not obliged carrying logbook, and/or sales notes. As described in more detail in the Stock Annex (Annex 2), non-commercial recreational catches are typically estimated by a combination of different types of national surveys targeting various recreational fisheries (e.g. using access-point surveys, questionnaires, camera surveillance, etc.) and expert evaluations or expert opinion 'guesstimates'. Further details on the collection of salmon catch data in the Baltic Sea (in total and by country) are given in Annex 2.

Due to the increasing share of recreational fishermen practicing catch-and-release, voluntarily or due to regulations, there is a need for separate time-series including released salmon. Further, since the effects of catch-and-release on the management of the stocks largely are unknown, reliable data on survival rates and other effects on fish that have been caught and released are needed.

2019 data presented are principally data delivered in the ICES WGBAST and the WGBAST 2020 data calls respectively when parts of the data still were preliminary. Quality checks during the meeting resulted in a few changes in the dataset. Besides changes in conjunction with further quality checks, any future revision of data over time may e.g. be due to additional landings reported in the commercial fisheries or adjustments of catch estimates in the recreational fisheries.

The following seven tables with salmon catches divided in various ways (as described below) are annually updated and referred to in this report:

- Table 2.2.1.1: nominal reported and total salmon catches in *weight* by country for the years 2001–2019 (including discarded, unreported and misreported fish). Estimates of discards and unreported and misreported catches are presented separately.
- Table 2.2.1.2: corresponding annual catch data as in Table 2.2.1.1 in *numbers*.

- Table 2.2.1.3: nominal reported catches in *weight* from sea, coast and rivers divided by region (SD 22–29, 30–31 and 32) and country for the years 2001–2019.
- Table 2.2.1.4: corresponding annual catch data as in Table 2.2.1.3 in *numbers*.
- Table 2.2.1.5: nominal catches from last year (2019) in *weight* and *numbers* from sea, coast and river, divided by country and by SD.
- Table 2.2.1.6: nominal *commercial landings in numbers* (2001–2019) from sea and coast compared to TAC, divided by fishing nation and region (SD 22–31 and 32).
- Table 2.2.1.7: nominal *recreational (non-commercial) catches in numbers* from sea and coast (pooled) and rivers, divided by country and region (SD 22–31 and 32) in 2001–2019.

In addition to tables, a number of figures on salmon catch data are also presented that illustrate catch development over time.

The estimated discards, unreported and misreported catches are not included in the nominal reported catches, but presented separately. The estimated catches are calculated using conversion factors and reported in terms of the most likely value with a 90% probability interval (PI). More details on the estimating procedures are given in Section 2.3 (see also the Stock Annex, Annex 2, Section B.1.3). In the Stock Annex, an overview of management areas (regions) and rivers is also presented.

2.2.1 Catch development over time

There has been a long-term decline of the total nominal catches in the Baltic Sea, starting from 5636 tonnes in 1990 down to just 900 tonnes in 2010. After that, the catches have remained rather stable. In 2019, the total nominal catch was 967 tonnes (Table 2.2.1.1) or 144 861 salmon (Table 2.2.1.2). Where the weight was slightly higher than in the previous year and the numbers slightly lower.

After the driftnet ban was enforced in 2008, the percentage of the total commercial offshore catch by this gear has been zero. At the same time, commercial catches with trapnets along the coast have increased their share. Consequently, the proportion of the coastal catch has gradually increased over time, and in 2019, it was 49% out of the nominal total catch (in weight) (Table 2.2.1.3). In the same year, approximately 77.5% of all commercial catches (in weight) were taken in coastal trap (or fyke) nets.

Over the years, the total share represented by river catches has been fluctuating. However, in the latest years they have remained rather stable, being approximately 30% of the total (in weight). In Table 2.2.1.3 the distribution of total catches (in weight) from offshore, coastal and riverine fisheries are presented (see Table 2.2.1.4 for corresponding catches in numbers). The distribution of nominal catches in 2019 by country, per subdivision, offshore, coast and river are presented in Table 2.2.1.5.

A comparison of landings (coastal and offshore) per country compared to the EU TAC in 2019 is presented in Section 2.2.3. Compiled information on landings versus TAC is also presented in Table 2.2.1.6. Note that data presented in Section 2.2.3 are the latest available. Discards, unreported and misreported catches are not included in the utilisation of the TAC, but in Figure 2.2.1.1 total catches of salmon are presented (as a percentage of TAC) where such catches have been added. In this figure, the recreational landed catches are also included.

A notable change in the catch distribution occurring in the past few decades is that the proportion of non-commercial catches has grown in relation to the commercial catches. The development for the proportion of non-commercial catches (including river catches and expert trolling estimates) from 2004 and onwards is illustrated in Figure 2.2.1.2. In 1994, non-commercial catches comprised just 10% of the total nominal catches (in weight), whereas since 2013 the share has fluctuated between 40 and 50%. Nominal recreational (non-commercial) catches in numbers from sea and coast (pooled) and rivers in 2001–2019, divided by country and regions (SD 22–31 and 32), are presented in Table 2.2.1.7.

In 2020, WGBAST continued the work initiated in 2017 to pay extra attention to the recreational salmon fisheries that are becoming proportionally more important. For the growing trolling fishery, a time-series of trolling catches from an expert elicitation initiated in 2017 (ICES, 2017a; 2017c) was updated (Figure 2.2.1.3). The estimates were partly updated until 2019, to take into account new information from earlier years received from new surveys. The update resulted in a slightly modified time-series compared to in previous years, with lower annual estimates for most years. The estimates are, however, still more than 20 000 salmon larger than previously assumed (i.e. for the 2010–2016 assessments). Trolling catches from the Main Basin (SD 22–28) are dominating, and are only to a lesser degree taken in SD 29–32. Catches in the Main Basin have been declining since 2015, but in 2019, an increase was observed. The 2019 Main Basin estimate was about 23 000 salmon caught and retained, including estimated post-release mortality (Figure 2.2.1.3). In contrast to 2017, when the assessment model for salmon in AU 1–4 did not perform, the new updated trolling catch estimates have been included in later years' stock assessments (Section 4).

In subdivisions 22–31, the total recreational river catch in 2019 was similar to 2017 and 2018 with just under 30 000 salmon retained. In SD 32, the river catch in 2019 was 311 salmon. Compared to 2018, this was a slight increase, however there is a strong downward trend in the SD 32 recreational river catches since the beginning of the 2000s (Figure 2.2.1.4). No further analysis of the recreational river catches has been made. In Section 3.1, details on specific river catches are presented.

2.2.2 Catches by country (2019)

Denmark: The Danish salmon fishery is an open sea fishery. The total commercial and recreational catches (excluding discards and seal damaged salmon estimates) in 2019 were 13 809 salmon. The amount of discarded BMS salmon was negligible, while the number of seal damaged salmon according to logbooks was 1581. All catches, including the recreational, were in ICES SD 24–25. The commercial fishery uses longlines, and it takes place from late autumn to spring (October–May). In 2019, the Danish fleet participating in the commercial fishery for salmon consisted of approximately ten vessels (majority <10 m long). It is likely that the effort in the commercial salmon fishery has decreased in recent years due to the increasing number of seals in the waters close to the Island of Bornholm, combined with the poor status of the Eastern Baltic cod stock. The latter is an important species targeted by the salmon fishers outside of the salmon season. Despite a small decrease in effort the commercial landings in numbers in 2019 was 6009, which is very similar to the 2018 landings (5993). The landings in weight in 2019 was 29.7 tonnes (2018: 31.0 tonnes). The recreational fishery is mainly trolling, but some recreational passive gear fishing, i.e. longlining, also takes place in waters close to Bornholm. This fishery has according to local recreational fishers, in most recent years been effected in a negative way by the many seals around Bornholm, and the catches in 2019 are thought to be negligible. The estimate resulting from an Internet based recall survey in 2019 targeting annual licence holders yielded a result of 7796 salmon landed for trolling alone. However, the result is believed to be an overestimate due to recall- and avidity bias as respondents participating in such surveys often are the most avid anglers and the recall period is long (six months). An on-site survey has been established to adjust the recreational catch estimates from the off-site survey. From the off-site survey the estimated number of salmon caught and released in 2019 was 2200 salmon.

Estonia: There is no specific Estonian salmon fishery. In the coastal fishery, salmon is a bycatch and the main targeted species are sprat, flounder and perch. The share of salmon in the total coastal catch is less than 1%. In 2019, similar to in previous years the Estonian salmon sea catch was below 1 tonne. The coastal catch (commercial and recreational) was 11.6 tonnes, which is similar to 2018 catches (11.3 tonnes). The vast majority of salmon is caught in the Gulf of Finland (SD 32). There are about 570 commercial fishermen in Gulf of Finland, and in addition up to 6433 monthly gillnet licences are distributed annually (standard length of a net is 70 meters). The commercial fishery takes 68% of the total catch. The vast majority of the salmon (88%) is caught in gillnets and the rest in trapnets. About 75% of the annual catch is taken in September, October and November. Nearly all caught salmon are spawners.

Finland: In 2019, Finnish fishers caught a total of 55 355 salmon (380 tonnes) in the Baltic Sea, which was 18% more than in 2018. The landed commercial catch was 34 255 salmon (238 tonnes). The recreational catch (including river catches) was 21 100 salmon (142 tonnes). All commercial catch was taken in the coastal fishery, mainly by trapnets, and the catch increased with about 14% compared to 2018. Commercial catch data for the year 2019 are preliminary. Catch estimate of the recreational fishery in the sea was assumed to be the same as for the year 2018 (the latest survey year) and highly uncertain. River catch was 17 360 (112 tonnes) increasing 19% from 2018. Recreational catch estimates in the sea for the years 2018–2019 are based on the results of the Finnish Recreational Fishing 2018 –survey. National surveys are carried out every second year. For the missing odd years, the same sea-catch estimates are assumed than in the preceding year. Estimates should be taken with caution.

Finnish professional fishermen mainly use trapnets. In 2019, 153 coastal fishermen caught salmon with 279 trapnets, and total effort in the trapnet fishery was 12 795 gear days, being about 26% less than in previous year. Reported discards of seal damages were 2396 salmon (14 tonnes). The increase compared with previous year was 31%. Seals caused severe damages to all fisheries mainly in subdivisions 29–32 where seal damages comprised about 7% of the total commercial catch in the region. Other discards (seagulls, cormorants, etc.) were 20 salmon. Commercial salmon catch in subdivisions 22–31 was 26 137 salmon (186 tonnes) of which 1760 (10 tonnes) was caught from rivers (from the River Iijoki and River Kemijoki). Recreational catch was 20 840 salmon (141 tonnes) of which 15 540 was caught from rivers (most from the River Tornionjoki). According to the national survey in 2018 about two thirds of recreational sea catch was taken from the Gulf of Bothnia (5300 salmon, 39 tonnes, notice high uncertainty CV>50%). In the coastal fishery, 123 fishermen caught salmon with 198 trapnets. The total fishing effort was 8013 trapnet-days being 27% less than in year 2018 (2019 data are preliminary). In Åland Islands, about 2700 salmon (18.6 tonnes) were caught with anchored floating nets. Discards of seal damaged salmon were 1568 fish (9 tonnes) comprising 6% of total commercial catch in subdivisions 29–31. The total fishing quota was 26 178 salmon (=23 548 salmon + 2630 salmon of transferred unutilized quota from previous year) in management unit 22–31. The quota was utilised to 93%. Commercial salmon catch in Subdivision 32 was 8118 salmon (53 tonnes) and it was taken in the coastal fishery. Recreational catch in the area was 260 salmon (1 tonne). River catch (all recreational) was 60 salmon (<1 tonne) and almost all of it was taken from the River Kymijoki. In 2018 (the latest survey year) the recreational catch the Gulf of Finland was very small (200 salmon, 1 tonne, CV>50%) compared to previous estimate in 2016. The 2016 estimate is probably a rich overestimate and 2018 estimate an underestimate. Practically all commercial salmon catch in the area was taken by trapnets. In all 30 fishermen fished salmon with 81 trapnets with the effort of 4782 trapnet days being 24% less than in 2018. There was only sporadic longline fishing for salmon in the area (94 salmon, 1 tonne). Discards of the seal damaged salmon were 828 fish (5 tonnes) being 10% of the total commercial catch in the area. The fishing quota was utilised to 84% of total 9712 salmon (= 8708 salmon + 1004 salmon of transferred unutilized quota from previous year).

The official catch estimate of the recreational fishery is based on a national survey. The last survey covers the year 2016, and was conducted in 2017. Note that in this national survey, salmon (and sea trout) catch estimates are highly uncertain because these fishers are so rare in the total population (just 17 salmon trawlers among all respondents). National surveys are carried out every second year. For the missing 'odd' years, the same sea-catch estimate as in the preceding year is assumed. The catch estimate in 2016 was 55–137 tonnes (7000–17 000 salmon). Results suggest that almost 90% of the catch was taken by trolling. In 2017, the Finnish Federation for Recreational Fishing conducted a questionnaire among salmon trolling skippers (92 replies were received). The skippers are considered to represent the most active part of all trolling fishers. An expert estimate of the total number of active trolling boats in Finland is 300–400. In addition, about the same amount of less active boats exist that only go to sea 1–2 days per year (maybe not even for trolling). The responding skippers fished on average eight days in 2017 (range: 0–25 days) and the average catch was 0.2 salmon per fishing day in the Gulf of Finland and 0.4 salmon per fishing day at the Åland Islands and in Gulf of Bothnia. Extrapolation of these parameters to the estimated whole fleet suggests a total catch of about 300–1600 salmon in 2017.

Germany: The total reported commercial salmon catch in 2019 (SD 22–24) in numbers was 939 with a total weight of 4.7 tonnes (using a mean weight of 5 kg per salmon). This is an 18% increase in numbers, but a 31% decrease in weight compared to 2018 (795 individuals and 6.8 tonnes). In recent years, virtually no German commercial fishery has directly targeted salmon; hence, most of the salmon are caught as bycatch in other fisheries (mainly passive gear fisheries). The German TAC for 2019 was 2101 salmon (total for subdivisions 22–31) and the quota was utilized to 44.7%.

Recreational salmon fishing occurs almost exclusively from trolling boats in the waters off the island of Ruegen (SD 24) in Germany. Since 2017 (pilot in 2016), a regular survey has been established to monitor the recreational salmon trolling fishery in Germany. Recreational salmon boat fishing effort is evaluated by trolling boat trip counting via remote cameras in three relevant marinas on the island of Ruegen (covering ~ 60% of the total fishing effort) during the salmon trolling season from December until May (see Kaiser (2016), ICES (2018) and Hartill *et al*. (2020) for details). Salmon trolling effort from marinas not monitored by cameras (n = 4) is extrapolated using monthly (in 2019 every two weeks) instantaneous trolling boat counts covering all marinas and the proportions of boats that went out for fishing derived from the marinas with camera monitoring. The camera monitoring is complemented by random on-site interviews of trolling anglers in four relevant marinas (including the marinas where the trolling boat trip counting was conducted) to determine catch per unit of effort in order to estimate catches and collect biological catch data and socio-economic information. In 2019, a total of 56 random on-site samplings were conducted and 423 trolling boats with 974 anglers targeting salmon were interviewed. The total number of retained salmon was estimated to be 5 525 salmon in 2019. In addition, 258 salmon have been released, resulting in a release rate of 4.7%.

There are no data available on freshwater salmon catches. However, commercial and recreational salmon freshwater catches are most likely insignificant as there are no rivers with significant salmon spawning migration and fishery along the German Baltic coast.

Latvia: The Latvian salmon landing statistics are based on the logbooks and landing declarations from the offshore and logbooks from coastal and inland fisheries. Landing data from a small scale recreational fishing in the river Salaca and Venta are based on questionnaires.

In 2019, the total number of Latvian salmon landings (commercial, recreational and brood stock fisheries) was 4118 salmon (19.3 tonnes). Landings were distributed with 2832, 957 and 329 salmon on commercial, recreational and brood stock fishery respectively. Salmon commercial landings in the open sea (offshore) was 10 tonnes, which is significantly larger amount than in 2018 (as in 2018 only two vessels reported fishing at sea in 2019). Coastal landings (commercial and recreational) were 3.7 tonnes. Vast majority of salmon was caught in SD 28. Commercial fishermen comprised 69% of the total landings. The majority of salmon in 2019 was caught by gillnets and longlines.

Lithuania: Lithuanian salmon catch statistics are based on logbooks. In 2019, Lithuanian fishermen caught 670 salmon (3.473 tonnes). This number decreased 1.1 times compared to the last year. Part of it - 350 (2.058 tonnes) were caught in the open sea and 163 fish (0.834 tonnes) were caught in coastal fisheries and the part of the catch - 157 (0.581 tonnes) individuals were caught in the Curonian lagoon. In addition, 51 salmon individuals were caught in the Curonian lagoon at migration period for scientific purposes, 32 (0.191 tonnes) salmon individuals were caught in rivers for artificial reproduction (brood stock). Total catches in the recreational fishery was about 3268 individuals (14.462 tonnes): open sea (trolling) 1238 (4.312 tonnes) and in rivers 2030 (10.150 tonnes).

Poland: Total sea, coastal and river commercial catch was 6504 salmon (37.40 tonnes). Total catch was 24% lower than in 2018 mainly due to the unfavourable weather conditions. Main gears in use for salmon are the same as for sea trout and this is why the vessels have fishing licences for both species. Main gear in salmon fishery was LLD - 88% of offshore catch, and GNS - 82% of coastal catch. Other gears were: fykenets and trawls. Commercial sea and coastal catch statistics are based on e-logbooks of vessels longer than 12 m and on monthly reports of vessels smaller than 12 m. Most of the catch (80%) was taken from Subdivision 26. Out of the total catch, the coastal catch was higher (55%), then offshore (45%). Salmon fishery in Subdivision 24 was occasional. All fish was caught within Polish EEZ.

A pilot study relating to salmon and sea trout recreational fisheries was continued in 2019. Trolling catch estimates for 2019 are 4416 landed (retained) salmons and 177 released salmons (below minimum landing size fish). Several monitoring methods will be implemented to the regular monitoring since 2020. It is planned to update catch data for 2017–2019, based on obtained results. Another pilot study of Polish river recreational catches was initiated in 2017 and continued in 2018 and 2019. According to results for four rivers, Slupia, Rega, Ina and Parseta, average catch, based on catch records, in years 2013–2017 was 140, 274, 295 sea trout, and 458 in the years 2017–2018 for Parsęta. Salmon average catches were very low and reached respectively in same years seven, two, one salmon and four in Parseta. Results from on-site surveys performed in 2017–2019 show that the average catch per angler ranged from 0.9 sea trout (2016–2017) to 2.7 in (2018–2019). Taking into consideration underestimation of registers, the recreational catch in Polish rivers can be roughly estimated to 40–80 salmon specimens (and 5–10 tonnes of sea trout) yearly.

Russia: There is no specific Russian salmon fishery, but salmon (and sea trout) can be caught as bycatch in the coastal fishery (pelagic/demersal trawls, trapnets and gillnets) where the main targeted species are cod, flounder, herring, sprat, smelt, perch and pikeperch. No official statistics on bycatches are available, and accordingly no salmon were reported caught in offshore and coastal fisheries. In 2019, 602 salmon (2.81 tonnes) were caught in rivers during brood stock fishing.

Sweden: The total salmon catch in 2019 was 50 570 salmon (339 tonnes). In 2019, the total number of salmon in the commercial sea fishery was 24 021 (171 tonnes). Coastal fishery with mainly trap- and fykenets made up 99.98 percentage of the salmon catches (in number). Additionally, a total of 11 463 salmon were landed in the commercial riverine trapnet fisheries and all were landed in SD 31 in Luleälven (preliminary data). Total weight of the commercial riverine salmon catches were 70.9 tonnes. The commercial river catches of salmon has been fluctuating over the years. The latest five years (2015–2019) the annual catch in SD 31 has been 2–3 times higher compared to the average annual catch in the period 2001–2014. In SD 30, the annual catch has moved towards zero the latest three years (2017–2019). In the period 2012–2016, the average annual catch in SD 30 where over 1000 salmon.

The data from the recreational fisheries represent a combination of reported and estimated catches with addition of expert evaluations, therefore, the quality of the data varies a lot. In the

2019 recreational sea fisheries in Sweden, 2400 salmon are estimated to have been landed. An additional 5600 are estimated to have been released. No expert evaluations for landed weight have been made for these catches. In 2019, the total estimated riverine catches in the recreational fisheries were 12 686 salmon including both catches from anglers, subsistence fishermen and brood stock fisheries. Overall, recreational fishermen with fishing-rods (angling) took around 73% of all river caught salmon (in numbers) in the recreational fisheries in 2019. Compared to 2018, the anglers have taken a larger proportion 2019 (in 2018 it was 53%). Catches from non-commercial subsistence fishing with seines, gillnets and other gears, accounted for 19 percent. The subsistence fishermen have taken a similar proportion 2019 as last year (in 2018 it was 21%). The share of the brood stock fisheries of 8 percent was much lower in 2019 (in 2018 it was 26%).

2.2.3 Landings by country compared with the EU TAC 2019

The total allowable catch (TAC) or fishing opportunity for Baltic salmon in 2019 was stated in COUNCIL REGULATION (EU) 2018/1628 of 30 October 2018. In SD 22–31, 71% of the original TAC of 91 132 individuals was utilized and in SD 32, 96% of the original TAC of 9703 individuals was utilized.

By fishing region and country, the 2019 original national quotas for Baltic salmon were allocated and utilized as follows:

Country	SD 22–31			SD 32		
	Quota 2019 (No.)	Catch[1)] 1) (No.)	Utilized (%)	Quota 2019 (No.)	Catch[1)] (No.)	Utilized (%)
Denmark	18 885	6 009	32	-	-	-
Estonia	1 919	544	28	995	1 182	119
Finland	23 548	24 377	104	8 708	8 118	93
Germany	2 101	939	45	-	-	-
Latvia	12 012	2 591	22	-	-	-
Lithuania	1 412	513	36	-	-	-
Poland	5 729	5 500	96	-	-	-
Sweden	25 526	24 021	94	-	-	-
Total EU	91 132	64 494	71	9 703	9 300	96
Russia [2)]	-	-	-	-	-	-
TOTAL	91 132	64 494	71	9 703	9 300	96

[1)] N.B Data on landings presented here are the latest available, hence, they have been updated since the WGBAST 2020 data call.

[2)] No international agreed quota between Russia and EC. No reported Russian commercial catches in the Baltic Sea.

As mentioned above, the national quotas presented are the original set ones. A country has the possibility to save a share of its quota from one year and transfer it to the next. Besides transferring quota shares between years, countries can also exchange (swap) quotas from different stocks between each other. Hence, in practice, less than 100% of the final national quotas were utilized in most countries. For example:

- Sweden had a final national quota of 27 388 salmon in 2019, out of which 88% was used. The final quota was obtained by a transfer of 1862 salmon from unutilized quota part 2018 to 2019.
- Finland had a final national quota of 26 178 salmon in 2019, out of which 93% was used. The final quota was obtained by a transfer of 2630 salmon from unutilized quota part 2018 to 2019.

From 1993 and onwards the Baltic salmon TAC is given in numbers. Until 1992, it was given in tonnes. The coastal and offshore commercial official landings in numbers (excluding river catches) compared to the EU TAC 2019, by fishing nations and regions in 2001–2019, are presented in Table 2.2.1.6. See also Figure 2.2.1.1 where the total catch of salmon (including estimated discarding, unreporting and misreporting) are presented as a percentage of TAC.

Finally note that over time the proportion of the annual commercial sea catch (regulated by the TAC) out of the total catch has decreased, at the same time as the proportion of the recreational catch has increased (see Figure 2.2.1.2). Hence, the importance of TAC as a means of fishery control has decreased over time.

2.3 Discards, unreporting and misreporting of catches

Data on discards in the **commercial fisheries** are to some extent reported in the official statistics, and the latest country specific information on this is presented in Section 2.3.2. However, the quality of these data is very unsure. Therefore, additional estimates are made (see below). For obvious reasons, there are no official reports of unreported and misreported catches. However, for some countries information collected from diverse sources is still available. In Section 2.3.3, the issue of misreporting is elaborated on further.

Data for the period 1981–2000 on discards and unreporting of salmon from different commercial fisheries in the Baltic Sea are incomplete and fragmentary. For years 2001–2019 the estimates for discards and unreporting have been computed with a new method based on updated expert evaluations (adopted in WGBAST 2013). The resulting parameter values for the elicited priors and pooled (average) probability distributions for different conversion factors are given in Table 2.3.1. In WGBAST 2020 the same parameter values were used for 2019 fisheries as for 2018, because experts saw the situation remained unchanged in terms of discarding, unreporting rates, proportions of BMS salmon and seal damages. For detailed information about estimation procedures for these conversion factors, see Stock Annex (Annex 2, Section B.1.3).

The estimated unreported catch and discarding for the whole Baltic Sea are presented in Tables 2.2.1.1 (weight) and 2.2.1.2 (numbers). A comparison of estimated unreporting and discards between the periods 1981–2000 and 2001–2018 shows that the main difference is related to the estimates of discards. This is mainly because of updated expert opinions and partly the adoption of new computing model in 2013. A main part of discards is seal damaged salmon, which occurs in the coastal trapnet and gillnet fishery, but also in the offshore longline fishery (Table 2.3.2.). In the offshore fishery, it is small amounts of undersized salmon that are estimated to be discarded. Since 2015, there has been a landing obligation for the longline fishery; however, it has not been fully implemented since little reporting of such landings has occurred. Since 2018, the exemption in the landing obligation allows BMS salmon to be released back to sea in all fisheries. Estimates for discards, unreporting and misreporting by management area are presented in Table 2.3.3. The estimates are uncertain and should be considered mainly as an order of magnitude.

In the **recreational fisheries** on the other hand, almost no data on discarded (caught and released), unreported and misreported catch are collected and no estimates are currently made by WGBAST.

2.3.1 Estimated discards

In 2019, approximately 4300 salmon are estimated to have been discarded due to seal damages in the Baltic Sea. About half of discards took place in the fishery in the south Baltic Sea and other half in the coastal trapnet fisheries in the northern Baltic Sea (Table 2.3.2). Estimates were based on the observed proportion of seal damaged catch in subsamples that has been extrapolated to the total catch. In this calculation, also potential misreporting and unreporting was included in the total catch. In WGBAST 2019, the Danish expert evaluation was updated retrospectively for years 2016 and 2017 using the same estimate as for 2018. Basis for the update was that there were no logbook data on discarded seal damaged salmon from Denmark in 2016–2017 and the previously estimated discard rate of 50% (5–65%) was based on sparse observer data in 2016 (i.e. no data in 2017). In 2018, logbooks records on seal damages were available, and these suggested an average discard rate of 20% (5%–45%) in the offshore longline fishery, which was approximately same order of discard rate as estimated in 2015 (Table 2.3.1). Consequently, in the Danish longline fishery in 2016–2018 approximately 20% (5–45%) of the catch was seal damaged. In the Polish longline fishery, sea damages fell mainly on SD 26 where about 35% (5%–65%) of catch was damaged. Representativeness of these estimates is unknown to the WG, but the amount of seal damaged catches in the Main Basin have undoubtedly increased gradually to significant rates starting around 2013, as a result of increase in grey seal population in the area. Monitoring will be needed to attain reliably estimates of the seal damages in the region.

In the northern Baltic Sea, seal damages started to escalate gradually from 1993, but since the introduction of 'seal-safe' trapnets the catch losses in coastal fisheries have levelled off. In 2019, the total seal damaged discards was about 1700 salmon in the Gulf of Bothnia and 800 salmon in the Gulf of Finland. Most of the damages were reported from Finnish coastal trapnet fisheries. In Finland, data on seal damages are based on logbook records. In Sweden, the level of seal damages is estimated based on data from a voluntary logbook system and available data on seal interaction in the official statistics, for which an additional expert assessment has been made. The reported amounts of seal damaged salmon should, however, be regarded as a minimum estimate.

The reporting rate of the seal damaged catch is assumed to be the same as for the undamaged catch in the coastal fishery. For the time being, logbook based data on numbers of sea damaged salmon are available from Finland, Sweden and in 2018–2019, also from Denmark, Poland Estonia and Latvia. However, the reported amounts of sea-damaged salmon are minimum estimates and true volumes are potentially higher. In other countries, estimates are based on proportional damage rates derived from either logbook or expert evaluation.

Dead discards of undersized salmon in 2019 were estimated to about 1800 salmon in the whole Baltic Sea (Table 2.3.2). Proportions of undersized salmon in the catches of different fisheries are mainly based on sampling data (Table 2.3.1) and are considered rather accurate. Mortality estimates of the discarded undersized salmon released back to the sea are based on expert opinions. Mortality of the undersized salmon released from longline hooks back to sea is currently assumed to be high (around 80%), but few studies have been carried out on this issue and the true rate is uncertain. In the trapnet fishery, post-release mortality is assumed to be lower (around 40%), but again the true rate is uncertain. Both the experimental design and the settings to study these mortalities are challenging, but such empirical studies are needed in order to get better estimates on the survival rate of salmon discarded.

Post-smolts and adult salmon are frequently caught as bycatch in pelagic commercial trolling for sprat (mostly for supplying fish for production of fishmeal and oil), but are probably often unreported in logbooks because the relative amount of salmon in these catches is low and can be identified only during unloading (ICES, 2011). Because of insufficient data, however, estimates of these potential removals are so uncertain that they are not taken into account in the present assessment. Besides, there is no estimate on the potential unreporting of bycatch of legally sized salmon in the pelagic trawl fishery. Only the reported catch from the trawls is accounted for in the catch data, although it has been very low over the years.

2.3.2 Reported information by country

Below follows country-specific information on reported discards (seal-damaged fish or fish allowed to discard), and for some countries short general information on seal interactions is also included. If available, any records on eventual unreporting and misreporting of catches are provided.

In **Denmark**, damages to caught salmon that were caused by seals have been reported by fishermen to reach a level of 40–50%. However, in two trips in December 2015 with observers on board, the proportion of seal-damaged salmon was approximately 4%, and in two other trips in February 2016, the proportion was 0.8%. Recently, seals have been observed to attack salmon being hooked in the recreational trolling fishery. Anglers have also observed seal-damaged salmon in their catches. There is no information in the Danish official statistics from which it is possible to estimate discard percentages in the commercial fisheries, even if this should be available from the DCF/EU-MAP data collection. Since the quota for salmon in recent years has not been fully utilized, it seems unlikely (however uncertain) that there are unreported catches in the commercial salmon fishery. The potential unreported landings would likely be any salmon with a weight above 7.9 kg, since it is not allowed landing these salmon for human consumption. The bycatch of salmon in other fisheries has been observed to be quite low. For example, in the winter 2017–2018 observers from DTU-Aqua participated in the Baltic herring and sprat fishery during about 50 days, and bycatches of only a few salmon were observed in this fishery. There are no records of misreporting of salmon as other species (e.g. sea trout).

In **Estonia**, the seal damages are serious problem in salmon and sea trout gillnet fishery. According to the personal communications of fishermen, damages are very common. Quantitative assessment of damages is not available as fishermen in most cases did not present claims for gear compensation.

In **Finland** reported discards of seal damages were 2396 salmon (14 t). The increase compared with previous year was 31%. Seals caused severe damages to all fisheries; mainly in subdivisions 29–32 where seal damages comprised about 7% of the total commercial catch in the region. Other discards (seagulls, cormorants, etc.) were 20 salmon. The compensation of seal damages is based on recorded catches (all species accounted), which is considered to improve the catch reporting. The rate of unreporting of catches is considered to have decrease to a very low magnitude as a consequence of the recent developments in the fishing regulations. In 2017, an individual quota system was initiated and since then, also all landed salmon have had to carry a landing mark which probably steers to a careful catch reporting. There are no available records of misreporting.

In **Germany** there are no data available on predation by seals. The current seal population in German Baltic waters is small but increasing. No seal-damaged salmon have been reported to the authorities in 2019. Concerning the current seal density and the low level of the commercial catches, it seems unlikely that predation by seals is an important issue in the commercial fishery in German waters. However, this situation may change in the future. Furthermore, German commercial fishers reported increased predation rates on salmon longline catches around the island of Bornholm in recent years, which has led to the cessation of the directed salmon fishery by German vessels in 2016.

In **Latvia** the direct catch losses of salmon due to seal damages has increased from 2003 and onwards. There are two sources of information on seal depredation on salmon and trout available in Latvia. First, the fishermen logbook statistics and second, the BIOR pilot programme 2018–2019 involving six selected fishermen in different coastal locations on special agreement with BIOR. The percentage (by weight) of salmon damaged by seal in the coastal fishery in 2019 according to fisher logbooks was 28%, which is significantly more than in the previous two years. Catch direct lose evaluation in numbers in 2019 was not possible because only a few fishermen reported damaged fish numbers. The inspection of logbooks reveals also high seasonal and spatial variation of catch losses. Thus, the data should be treated with caution.

Much higher loses are indicated in BIOR pilot programme. The percentage (by weight) of salmon damaged by seal indicated in BIOR pilot programme was 44.3% in trapnet coastal fishery and 13.4% in gillnet fishery. However, the data are only indicative because the subsample of six fishermen would not be sufficient to extrapolate the information on whole fishery segment. This is due to high variation in fishing gear (especially trapnets) construction in different local areas as well as the fishing strategy and gear modifications. There are no records of discards and no available records on unreporting or misreporting.

In **Lithuania**, reported data of seal damages, discards, unreporting and misreporting are not available.

In **Poland**, a rapidly increasing amount of seal damages has been observed in recent years, both in offshore and coastal fisheries in SD 25–26 (Gulf of Gdańsk area). So far, no damages have been reported in SD 24. Preliminary data from 2013, indicate that the share of seal-damaged fish in separate catches was on average 25% (minimum 5%, maximum 65%). In 2019, losses of 422 salmon and 258 sea trout were recorded in logbooks. In 2018, less salmon (201 individuals) and more sea trout (301 individuals) were reported In addition, 1978 salmonids (both salmon and sea trout) have been reported to the Ministry of Maritime Economy and Inland Waterways in 2019 due to compensations for losses caused by mammals in sea areas. It is a higher number than in 2018 (1416 fish, both salmon and sea trout). The seal colony at the Vistula River mouth has grown to 300 individuals that are hunting on neighbouring fishing grounds. The large amount of seals in the area has almost completely stopped the previous salmon and sea-trout fishery in the lowest few kilometres of the Vistula. In the last few years, no catch was reported, and in the autumn brood stock fisheries, no spawners of sea trout or salmon could be collected in the Vistula river mouth due to seal attacks. In the past, Vistula used to be the best place for sea trout fishing and for collecting live spawners. Further, sampling of 2015–2017 longline catches resulted in a total of 2% undersized fish. No undersized salmon were reported in the gillnet fishery. There are no data available on unreported catches. Misreporting of salmon as sea trout in the Polish fisheries is treated below (Section 2.3.3).

In **Russia**, no information on seal damages, discard, unreporting and misreporting is available. However, unofficial information indicates presence of significant poaching of salmon and sea trout, both in the coastal area and in rivers.

In **Sweden**, in the official commercial catch statistics seal interaction on a fishing trip should be reported. Seal interaction includes seal-damaged gears and/or seal-damaged fish. These records form the basis for the system that handles seal-damage compensation from the government to commercial fishermen. Discards should also be reported in the official statistics. Fish registered as discarded (but not seal damaged) include allowed discards. In 2019, a total of 480 seal-damaged salmon were reported as discarded (compared to 601 in 2018 and 1120 in 2017). In addition, 311 salmon were reported as discarded (compared to 203 in 2018 and 1005 in 2017). In a fishery without an exemption from the landing obligation, all fish have to be landed. There are no available records of unreporting or misreporting.

2.3.3 Misreporting of salmon as sea trout

From 2019, it has been prohibited to fish for sea trout beyond four nautical miles, and to limit bycatches of sea trout to 3% of the combined catch of sea trout and salmon in order to contribute to preventing misreporting of salmon catches as sea trout catches (Council Regulation (EU) 2018/1628 of 30 October 2018 fixing for 2019 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2018/120 as regards certain fishing opportunities in other waters). This regulation in combination with unfavourable weather conditions and increasing seal damages, had a major impact on the Polish fisheries in 2019. Both the effort and the total catch in the offshore fishery were reduced and misreporting of salmon as a sea trout disappeared almost completely (estimated misreporting in 2019 was only 600 salmon). The coastal fisheries targeting sea trout, increased compared with previous years. Although there is no wild or mixed salmon rivers in Poland, about 3000 salmon were reported in the coastal waters in 2019. Although the sampling intensity is not fully representative for the whole fishery, the limited biological sampling in coastal waters 2019, here scientific observers indicate that only sea trout has been caught and reported.

Misreporting of salmon as sea trout occurs in all countries with different scale, but apart from Poland, provided data have not indicated substantial misreporting. Until 2019, Polish data on catches of salmon and sea trout deviated markedly from corresponding data delivered by other countries fishing with the same gears in southern Main Basin open sea, indicating that salmon have been misreported as sea trout in the Polish offshore fishery. To be able to fit the assessment model to fairly realistic offshore catches of salmon, the working group agreed on estimation procedures that have evolved over the years depending on availability of data. Estimation process is described e.g. in WGBAST 2019.

The total catch of the Polish offshore fishery decreased significantly until 2014, but increased again after that, and in 2017 and 2018, it grew strongly. The total estimated misreporting in 2018 was 42 600 salmon, almost three times higher than as estimated for 2014 (Table 2.2.1.2). This increase was mainly due to an increase of effort, but partly also due to increase in CPUE in the offshore fishery. The Polish reported catch in the 2018 offshore fishery was 7012 salmon and 44 085 sea trout. In 2019, the corresponding catch dropped to 2500 salmon and 674 sea trout.

Misreporting in the coastal gillnet fishery has not been estimated. However, the Polish sampling data suggest very small proportions of salmon in coastal catches (annually maximum 5%).

Last, note that misreporting estimates should be considered as rough order of magnitudes.

2.4 Fishing effort

In the **commercial fisheries**, data on effort are reported in the official catch statistics. Further analysis are needed to evaluate the overall quality and accuracy of available effort data. The total fishing effort by gears in the Main Basin, and in the three main assessment areas for the coastal commercial salmon fishery (AU 1–3), excluding Gulf of Finland, is presented in Table 2.4.1. This table includes Baltic salmon fishery catches offshore and along the coasts in 1987–2019. The coastal fishing effort on AU 1 stocks refers to the total Finnish coastal fishing effort and partly to the Swedish effort in SD 31. The coastal fishing effort on AU 2 stocks refers to the Finnish coastal fishing effort in SD 30 and partly to the Swedish coastal fishing effort in SD 31. The coastal fishing effort on stocks of AU 3 refers to the Finnish and Swedish coastal fishing effort in SD 30. Because sea trout in Poland is targeted with the same gear type as salmon, effort from the Polish fishery targeting sea trout was included in the table before 2003.

The development over time in fishing effort for the commercial offshore fishery is presented in Figure 2.4.1. When the driftnet fishery was closed 2008, the effort in the longline fishery consequently increased. However, in later years the total effort in the longline fishery has levelled off and in 2019 the effort decreased to 302 641 hook-days (i.e. number of fishing days times number of hooks) from 1 047 168 in 2018, to be compared with 2 639 116 hook-days in 2010 (Figure 2.4.1 and Table 2.4.1).

An overview of the longline offshore fishery for salmon in SD 22–32 during the latest six years (2014–2019) is presented in Table 2.4.2. Catch per unit of effort (CPUE) by country is also presented in this table. For equivalent information for the years 1999–2013, see WGBAST 2018 report (ICES, 2018a). The total effort decreased in 2019 to less than one-third compared to the effort in 2018. This is mainly explained by changes in the fishing activity of the Polish offshore fleet. In Section 2.3.3, reasons for the changes in the Polish fisheries in 2019 are described. Besides Poland, also Denmark, Latvia and Lithuania had active vessel(s) in the longline fisheries in 2019. It is not possible to draw any conclusions on the overall number of vessels that were active due to that data on this are only available from Poland.

Unit of effort in the coastal trapnet fisheries is gear-days (number of fishing days times the number of gears). Seen in a longer perspective, effort in the coastal commercial fisheries has decreased markedly. In more recent years this trend has levelled off (Figure 2.4.2, Table 2.4.1). Though in 2019, the total reported effort in the trapnet fisheries in AU 1, 2 and 3 decreased further to 22 917 gear days compared to 32 853 gear-days in 2018.

Table 2.4.3 shows effort and CPUE (number of salmon caught per gear-day) over time (1988–2019) in the Finnish trapnet fishery in Subdivision 32. In 2019, CPUE in this fishery was higher (1.7 salmon per gear and day) than in the nine preceding years (average 0.68). Substantial differences can be seen when comparing CPUE in the Finnish and Swedish Gulf of Bothnia (SD 30–31) trapnet fisheries. Further analyses are needed to evaluate these differences and the quality of current and past effort data in Finnish and Swedish official catch statistics.

For **recreational fisheries** designated data collection of effort data is not yet implemented on any larger scale, and WGBAST is not currently analysing the sparse data that are available.

2.5 Biological sampling of salmon

General information on the structure of data collection in different fisheries, including length of time-series, is presented in the Stock Annex (Annex 2). The national work plans under the EU-MAP include data collected offshore, along the coasts and in rivers. Biological sampling is conducted both in commercial, recreational and brood stock fisheries. Biological sampling is also included in surveys targeting parr and smolts. General and future perspectives on sampling is further elaborated on in Section 4.7.

2.5.1 Age sampling by country (2019)

The table below gives an overview of EU-MAP age samples (biological sampling) collected in 2019. Information on Russian biological sampling in 2019 is also included (although not a member of the EU). In the biological sampling, a set of individual information is typically collected, e.g. scales for age and/or genetic analysis, length, weight, sex and wild/reared origin.

Number of scale samples for ageing collected in 2019 by country and subdivision(s):

Country	Month (No.)	Fishery	Gear(s)	Number of sampled salmon by SD					
				22–28	29	30	31	32	Total
Denmark	2	Offshore	Longlines	221					**221**
			Trolling	13					**13**
Estonia	1–12	Coastal	Gillnets					164	**164**
Finland	5–9	Coastal	Trapnets & longlines		203	307	1 090	457	**2 057**
	5–8	River					463		**463**
Latvia	4–11	Coastal & River	Trapnets & Gillnets	158					**158**
Lithuania	8–10	River	Gillnets	51					**51**
Sweden	4–7	River	Various	144		70	497		**711**
Russia	10–11	River	Gillnets					574	**574**
Total				**587**	**203**	**377**	**2 050**	**1 195**	**4 412**

Below follow short country-by-country summaries of biological sampling of salmon in 2019 with some comments:

Denmark: In 2019, 234 scale samples were collected from the Danish offshore salmon fisheries. All samples were age read. 221 of the samples were salmon caught in commercial longlining and 13 in recreational trolling.

Estonia: 164 age samples were collected. Sampling takes place occasionally and is carried out in cooperation with fishermen collecting the scales.

Finland: In 2019, catch sampling yielded 2057 salmon scale samples from the Finnish commercial salmon fisheries and 463 samples from recreational river fisheries. All were aged by scale reading. In addition, genetic analyses of 846 of the samples from subdivisions 30–31 were done and funded by national means.

Germany: No commercially caught salmon was sampled in 2019. Catch sampling of salmon from the commercial fishery is very challenging, as salmon is only bycaught. Further, the total catch is low and in most cases only very few individuals are caught per trip. Biological sampling of salmon in the recreational trolling fishery off the Island of Rügen is ongoing since 2016, but in 2019, no recreationally caught salmon were sampled.

Latvia: Sampling was carried out from coastal and river fisheries. Small amount of analysis were carried out for salmon caught in trolling. In coastal fisheries, salmon biological sampling was performed from April till November in few locations in coast of Main Baltic sea and Gulf of Riga coast, including river Daugava (reared population) and Salaca (wild population) outlets. Largest coastal salmon fisheries operated in the river Daugava outlet region now shift to fishing in the river due to large number of grey seal in coastal waters. Accordingly, largest part of the river

Daugava salmon biological sampling is carried out from these river trapnet landings. In total 158 adult salmon were sampled in 2019 from which 157 were aged by scale reading.

Lithuania: A total of 51 samples were collected in the Curonian lagoon (SD 28). No Lithuanian fishermen were engaged in a commercial fishery targeting salmon.

Poland: Neither commercial nor recreational caught salmon were sampled in 2019.

Russia: There is no ongoing biological sampling programme running in Russia. Despite this, 574 salmon were collected and sampled for age, length and weight from brood stock fishing in 2019. Since Russia is not an EU Member State, the country is not obliged to follow EU regulations.

Sweden: Age sampling of smolts in rivers is included in the Swedish EU-MAP work plan. These data are needed in the WGBAST assessment modelling work; hence, the sampling is motivated on the ground of end-user needs. In 2019, scales from a total of 711 smolts were collected and age read (144 in SD 25, 70 in SD 30 and 497 in SD 31). In the commercial coastal fishery, no biological sampling of salmon was carried out in 2019. An exemption for this mandatory sampling was applied in the Swedish national work plan, due to that these data are presently not used in the stock assessment. Occasionally, outside the EU-MAP, age samples are from time to time also collected from brood stock fisheries and from salmon caught by anglers.

2.5.2 Growth of salmon

Below a short summary of an ongoing study on growth of Baltic salmon in relation to composition of the overall fish community is presented.

The average weight of salmon by age group increased around year 1990, simultaneously with an increase in sprat abundance (Figure 2.5.2.1). Despite some annual variation, the level of growth has remained rather stable. In 2016–2019, catch samples indicate a slight increase in mean weights by age (particularly in the A.3 and A.4 groups) which is potentially a result of improved feeding conditions e.g. of strong 2014 year classes of sprat and Baltic herring. Despite that salmon shares feeding areas with cod in the southern Baltic Main Basin, there is no clear reduction in the growth rate of salmon as has been observed for cod in the last few years. The estimated post-smolt survival decreased strongly from the mid-1990s until 2005 (Figure 4.2.3.1) but this cannot be recognised in the growth data. Mortality mechanisms seem to affect salmon populations in such a way that survived individuals grow approximately as large in periods of high mortality as in periods of low mortality.

2.6 Genetic composition of Baltic salmon catches

In this section, results from recent analyses of stock proportions in catches are presented. Description of the genetic methodology used and how results are applied can be found in the Stock Annex (Annex 2).

2.6.1 Salmon stock and stock group proportions in Baltic salmon catches in the Bothnian Bay based on DNA microsatellite and freshwater age information

Combined DNA- and smolt-age data have been used to estimate stock and stock group proportions of salmon catches in the Baltic Sea with a Bayesian method since the year 2000 (Pella and Masuda, 2001; Koljonen, 2006; ICES, 2019). In 2019, Finnish coastal salmon catches from the Gulf of Bothnia were analysed from three fishing zones with temporal regulation of opening days. The regulation of the Finnish salmon fishing in the Gulf of Bothnia was changed in 2017, making it possible to start the fishing earlier (advanced starting date) than in previous years. To provide comparable data for the time-series from previous years, the estimates of stock and stock group proportions in salmon catches from the fishing regulation zones were analyzed separately for catches preceding and succeeding the pre-2017 opening dates of the temporal regulation (Salmon fishing opening dates in 2016: Bothnian Sea: 10.6., the Quark area: 15.6., Bothnian Bay: 20.6, and the northernmost Bothnian Bay: 25.6).

2.6.2 Methods

The salmon river stock genotype baseline data used for the 2018 catches were also used for analysis of the 2019 catch samples (Table 2.6.1, Figure 2.6.1) (ICES, 2019). The current baseline river stock dataset includes information on 17 DNA microsatellite loci assayed in samples from 39 Baltic salmon stocks from six countries, totalling 4453 individuals (Table 2.6.1).

As the temporal fishing regulation in the Gulf of Bothnia in Finland was changed in 2017, two separate collections of samples were carried out in 2019. One sample (N=506) was collected from the late period which was used also before the changed regulations in 2017. Another sample (N=312) was from the early summer catches in 2019. Both samples were taken from three out of four fishing zones (Bothnian Sea, the Quark area, Bothnian Bay and Northern Bothnian Bay). In all, 818 salmon catch scales were analysed for these stock and stock group estimates.

Because smolt age information was used for stock proportion estimation, the fish in the catch samples were divided into two smolt age classes according to smolt age information from scale reading: 1–2 year old smolts and 3–5 year old smolts. As all released hatchery smolts are younger than three years, salmon in catch samples with a smolt age of older than two years originated presumably, or *a priori*, from the wild stocks, whereas individuals with a smolt age of one or two years could have originated either from a wild or a reared stock. This assumption is consistent with scale reading results. Correspondingly, smolt-age distributions were needed for all baseline stocks in addition to genetic data (Table 2.6.2). Smolt age distributions of wild smolts in Tornionjoki, Simojoki, Kalixälven and Råneälven were updated to represent the smolt-age distributions of smolt year classes from 2016 to 2018, of which the catches of adult salmon in 2019 were mainly composed. For the other stocks an average of smolt ages over the years was used (Table 2.6.2).

2.6.3 Results

In the Finnish **Bothnian Bay** salmon catch samples from the latter part of the summer fishing season (comparable to time of sampling in the years before 2017), the proportion of wild stocks was somewhat higher (72% PI: 67–76%) than in 2017 and 2018 when it was only 61–66% (Table 2.6.3). The proportion of wild stocks was about 70% in 2015 and 2016 and even 80% in the maximum year of 2014. The proportion of wild salmon in the 2019 catches is the same as the long-term mean of 69%, over years 2009–2019. The increase in amount of wild salmon in catches in 2019 back to the level of years 2015 and 2016 (Figure 2.6.2) can partly be due to variation between years in stocking amounts.

The proportion of wild fish was slightly higher in 2019, about 75% (PI: 70–81%), during the advanced fishing season than during the late fishing season (72%; PI: 67–76%) (Table 2.6.3, Figure 2.6.2.). The difference in stock composition between early and late fishing seasons in 2019 was, however, not as large as in 2017 and 2018. The reason for the observed differences between years is not known, but it may be a result of wild salmon having an earlier migration timing than reared salmon in combination with differences in relative abundance of wild and reared salmon between years. In addition, variation between years in age distribution among spawners may also affect the relative proportion of wild and reared salmon during different periods of the migration season. Moreover, the survival of hatchery salmon improves relatively more in years with good conditions for survival (Saloniemi, 2004), thus affecting relative abundances of wild and reared salmon during different time periods.

Focusing on only the three years when the early season fishing was allowed (2017–2019), the difference between the wild stock group proportions during the early (80%) and late season (66%) fisheries was on average 14% (Table 2.6.4.). The clearest difference is in the very north area of the Bothnian Bay, where the mean proportion of wild stocks over three years was 86% during the early season, and only 61% in the late fishing period. In the Bothnian Sea catches, the difference between wild stock group proportions during the early and late seasons was on average 7% and in the Quark area on average 5%. There were no Swedish hatchery fish in the advanced (early) fishing season catches, which also indicates the different migration timing tendencies of these two stock groups.

The individual river stock proportions in the 2019 salmon catches during the late season was very similar to the long term (2013–2019) average proportions (Table 2.6.5). Nearly half of the catch came from the wild born Tornionjoki salmon (49%), the second most common was Kalixälven salmon (18%). When stock proportions of early and late fishing seasons were compared, the clearest difference was in the Kalixälven salmon proportion. It was usually high, on average 27%, during the early season, but decreased to 14% during the late season (Table 2.6.6). Many salmon originating from Kalixälven seem to leave the Finnish coast later in the season, whereas wild Tornionjoki salmon remain in high proportion in the late season catches as well. During the early advanced fishing season, the stock composition of the catches was quite homogenous in all three fishing zones. Iijoki salmon were less common in the very north area than in the southern zones. During the late normal season, Iijoki salmon were less common (9%) in the Bothnian Sea catches than in the more northern zones (15–18%), and Kalixälven salmon less common (8%) in the most northern area, than in the more southern zones (15–19%, Table 2.6.6). The early season fishery is targeting mainly wild born salmon, and grilse are missing in those catches. Grilse migrate later in summer and reared stocks predominate among them.

2.7 Management measures influencing the salmon fishery

2.7.1 International regulatory measures

Detailed information and evaluations of international regulatory measures are presented in the Stock Annex (Annex 2).

Exemption from landing obligation. In 2014, the European Commission decided to introduce a discard ban for commercial fisheries, covering all species under TACs (Commission Delegated Regulation (EU) No 1396/2014 of 20 October 2014). Salmon fisheries in the Baltic Sea have an exemption from the landing obligation for salmon caught with trapnets, creels/pots, fykenets and poundnets (see Annex 2 for more details). The exemption for salmon fisheries using particular gears is based on the assumption that fish caught in these gears has a high likelihood of survival after capture, handling and release (Commission delegated regulation (EU) 2018/211). However at that time, information about survival rates of released salmon caught in the Baltic Sea commercial fishery, particularly in the most commonly used pontoon/push-up traps, was rather limited.

A review of recent studies carried out in the Baltic Sea (Östergren *et al.*, 2020) indicate that discard mortality in the Baltic salmon coastal fishery is strongly dependent on the type of gear used, as well as emptying procedures and handling time. In addition, external factors, in particular high-water temperature and poor health status of the fish, may have a large negative impact on post-release survival. In the studies reviewed by Östergren *et al*. (2020), total discard mortality of salmon caught in pontoon traps varied between studies in the range of 47–88% when the gear was emptied using the traditional technique. These estimates include both immediate mortality and subsequent post-release mortality (usually only estimated for shorter periods). Recent studies also show that the mortality could be reduced by using emptying procedures where the fish is handled more gently. When a netbag, in Swedish "Vittjanpåse", was attached to Pontoon traps, the total discard mortality was reduced to 17–63%.

The current exemption from the landing obligation for Baltic salmon fisheries will cease to apply on 31 December 2020. Whether there will be a continued exemption from 2021 and onwards will be handled by BALTFISH, STECF and EU COM during spring and summer 2020.

2.7.2 National regulatory measures

National regulatory measures are, unlike the international regulatory measures, updated more often, at times on a yearly basis, and therefore they are presented here and not in the Stock Annex. Effects of national regulatory measures on stock development are generally not evaluated by WGBAST.

In **Denmark**, no new national regulatory measures were implemented in 2019. For the commercial sea fishery, the following national regulations are applied in the period 2014–2020:

- all vessels targeting salmon should be registered as salmon fishing boats and have a specific permission for salmon fishery;
- vessels with a catch of ten or more salmon must notify the Fisheries Inspection before entering the harbour.

For recreational trolling fisheries no national legislation is in practice. However, voluntary restrictions are recommended by angler association(s).

<u>Further restrictions</u>: Throughout the year, all streams with outlets wider than 2 m are protected by closed areas within 500 m from the mouth. Otherwise, the closure period is four months at the time of spawning run. Estuaries are usually protected by an extended zone. Gillnetting is not permitted within 100 m of the low waterline. A closed period for salmon (and sea trout) has been established from 16th of November to 15th of January in freshwater. In the sea, this only applies for sexually mature fish in spawning dress (coloured). A maximum of three gillnets and three fykenets/sets of hooks are allowed per fisher.

Around Bornholm, a maximum of six sets of gear (nets or hooks) are permitted per fisher. Fishing with hooks is permitted only between 1st of October and 1st of May. For each set of hooks, a maximum of 100 hooks is allowed. Maximum length of the six nets allowed is 270 m in total. Between 16th September and the last day in February, nets may be combined as follows; either: (A) up to six bottom gillnets, or (B) up to five bottom gillnets and one floating net (maximum 45 m length, maximum height 3 m, minimum mesh size (total) 157 mm (called 'Salmon nets') OR five bottom gillnets and one floating net 45 m length and height 12 m with minimum mesh size (total) 57 mm (called 'Bornholmer nets'), or (C) up to four bottom gillnets and one floating gillnet maximum 45 length and 3 m height, and one 'salmon net'. Between 1st of March and 15th of September, maximum three of the six gillnets allowed can be floating (maximum length 135 m). <u>Further restrictions around Bornholm:</u> On water with less than 30 m depth: a maximum of three gillnets is allowed (all year). Use of floating gillnets is prohibited from 16 September to the last day of February. Between 1st of March and 30th of April, maximum mesh size (total) is 60 mm in floating gillnets. All year, the use of both *'Bornholmer nets'* and *'Salmon nets'* is prohibited. On water with more than 30 m depth: use of *'Bornholmer nets'* is prohibited between 1st of December and 31st of May. All year only one 'Salmon net' is permitted. Harvest of sea trout is limited to maximum three fish per man per day (and maximum three per boat per day). No mandatory bag limit exists for salmon, though local trolling fishers have agreed to harvest maximum two salmon per fisher per day, minimum length 75 cm and preferably retain only released (fin-clipped) salmon.

In **Estonia**, there were new national regulatory measures implemented in 2019 concerning the recreational sector.

- In river Pühajõgi, Loobu, Selja, Pirita, Vääna and Purtse recreational fishery for salmon and sea trout is closed from 20th of October and 30th of November;
- Recreational salmon fishing was banned in Valgejõgi.

In general, since 2011, the following restrictions are in practice:

- no commercial fishery in salmon (and sea trout) spawning rivers is permitted, with the exception of lamprey fishing;
- only licensed angling is permitted.

Some specific management regulations are also in place on a river basis regarding closure periods for angling. A closed period for salmon (and sea trout) angling is established in rivers Narva, Purtse, Kunda, Selja Loobu, Valgejõgi, Jägala, Pirita, Keila, Vasalemma, and Pärnu from 1 September–30 November, and in other rivers from 1 September–31 October. Exceptions for these closures are allowed by decree of the Minister of Environment in rivers with a reared (Narva) or mixed salmon stock (Purtse, Selja, Valgejõgi, Jägala, Pirita and Vääna). Below of dams and waterfalls, all kind of fishing is prohibited at a distance of 100 m. In the River Pärnu, below Sindi dam, this distance is 500 m.

Furthermore, there is an all-year-round closed area of 1000 m radius at the river mouths of the present or potential salmon spawning rivers Purtse, Kunda, Selja, Loobu, Valgejõgi, Jägala, Pirita, Keila, and Vasalemma, and at the river mouths of the sea trout spawning rivers Punapea, Õngu, and Pidula. Since 2011, the closed area for fishing around the river mouth was extended from 1000–1500 m for the time period 1 September–31 October for rivers Kunda, Selja, Loobu, Valgejõe, Pirita, Keila, Vääna, Vasalemma and Purtse. In rivers Selja, Valgejõgi, Pirita, Vääna and Purtse, recreational fishery for salmon (and sea trout) is banned from 15 October to 15 November. In the case of the most important Estonian sea trout spawning rivers (Pada, Toolse, Vainupea, Mustoja, Altja, Võsu, Pudisoo, Loo, Vääna, Vihterpadu, Nõva, Riguldi, Kolga, Rannametsa, Vanajõgi, Jämaja) a closed area of 500 m is established from 15th of August to 1st of December. In most of the salmon (and sea trout) rivers, angling with natural bait is prohibited.

In **Finland,** the national coastal salmon fishing regulation for the Gulf of Bothnia was latest renewed in 2017. Furthermore, an individual quota system was implemented in the commercial salmon fishery (and as well as in the Baltic herring and sprat fishery). In the Main Basin, offshore salmon fishery has been forbidden for Finnish vessels since 2013.

In the Gulf of Bothnia, salmon fishing for commercial fishermen is allowed to start with one trapnet in the following dates in four zones: 1. Bothnian Sea (59°00’N–62°30’N) May 1st; 2. Quark (62°30’N–64°N) May 6th; 3. Southern Bothnian Bay (64°00’N–65°30’N) May 11th; and 4. Northern Bothnian Bay (65°30’N–>) May 16th.

An increased effort (one additional trapnet) is allowed from the following dates zone by zone: 1. Bothnian Sea - June 10th; 2. Quark - June 15th; 4. Southern Bothnian Bay - June 20th; and 4. Northern Bothnian Bay (65°30’N–>) June 25th.

After one week from the above dates, two more trapnets are allowed (i.e. maximum of four trapnets per fisher per year). In the recently initiated individual quota system, all salmon have to be marked with a coded landing mark. In the first period of the season (when only one trapnet is allowed) fishers are allowed to utilize up to 25% of their individual quota.

Also, in 'terminal fishing areas' outside reared rivers, the number of trapnets and fishing period was restricted. Earlier, the number of trapnets in terminal fishing areas was unlimited, and only in the Kemi terminal area there was a closure in the early summer. Now the regulation in terminal areas is more similar to the rest of the region. Fishing with one trapnet is allowed to start at the same time as outside these areas, but the number of trapnets can be raised up to three on June 17th and up to eight on June 25th (with up to two and four traps for fishers with a turnover of less than or equal to 10 000 €, respectively). In the coastal area outside River Simojoki, salmon fishing may start on July 16th, and outside the mouth of Tornionjoki on June 17th. Since 2015, recreational fishermen are not allowed to use larger fykenets (height limit 1.5 meters).

Salmon fishing with longlines and gillnets is forbidden in the Archipelago Sea and Gulf of Bothnia from 1st of April to 16th of June or June 21st or June 26th or July 1st depending on location (position). Finally, note that the above does not include the Åland Islands where a separate regulation is in place.

In **Germany,** no new national regulatory measures were implemented in 2019. Since several years there is no quota allocated in the commercial sector, i.e. there is no directed commercial salmon fishery anymore. There are two federal states bordering the Baltic coast: Schleswig-Holstein, (SH) and Mecklenburg-Western Pomerania (MV). Commercial (coastal) fishing and recreational fishing is under the jurisdiction of the German federal states. Consequently, marine coastal fishing is managed with different legislation. The fishing season is closed both for commercial and recreational fisheries during autumn, in SH 1st of October–31st of December (only coloured fish) and in MV 15th of September–14th of December. Closed areas in both federal states include protected spawning grounds in coastal waters, 300–400 m around spawning streams/rivers. For commercial fisheries there is also a 200 m gillnet ban in front of the coastline. In MV, trolling fisheries is permitted at a distance >1 km from the coastline between September 15th and March 15th and there is a rod limit of three rods per angler in place. In MV, there is also a bag limit in place allowing landing of three salmonids (sea trout or salmon) per day and angler. Recreational fishery for salmon (and sea trout) is allowed on a licence basis. The minimum landing size is 60 cm in both states.

In **Latvia**, no new national regulatory measures were implemented in 2019. In summary, current national legislation in commercial offshore and in coastal waters includes the following restrictions:

- In the Gulf of Riga, salmon driftnet and longline fishing is not permitted;
- In coastal waters, salmon fishing is prohibited from 1st of October–15th November;
- Salmon fishing in coastal waters has been restricted indirectly, by limiting the number of gears in the fishing season.

In the recreational trolling fishery, one person is allowed to use a maximum number of three fishing rods in the waters of the Baltic Sea and the Gulf of Riga, if each gear has no more than three hooks of any type (including treble hooks), and where more than one treble-hook hook is allowed only if it is free (moving) attached to one artificial bait. It is prohibited to use natural bait for salmon and trout. Daily bag limit is one salmon and one sea trout per person. Minimum size limit is 60 cm for salmon and 50 cm for sea trout.

In the rivers with natural reproduction of salmon, all angling and fishing for salmon and sea trout is prohibited with exception of licensed angling for sea trout and salmon during the spring season in the rivers Salaca and Venta. Daily bag limit is one sea trout or one salmon. Since 2013, all gillnetting is prohibited all year round in a 3 km zone around the River Salaca outlet. In 2004, the restriction zones were enlarged from 1 to 2 km for the rivers Gauja and Venta. In rivers Daugava and Bullupe (connects rivers Lielupe and Daugava) angling and commercial fishing of salmon is allowed since 2007. However, it is prohibited to use gillnets in these rivers.

In **Lithuania**, no new national regulatory measures were implemented in 2019. The commercial fishery is regulated during time of salmon (and sea trout) migration in the Klaipėda strait and the Curonian lagoon. Fishing is prohibited all year-round in a predefined part of the Klaipėda strait. From the 1st of September–31st of October, during the salmon (and sea trout) migration, fishing with nets is prohibited on the eastern stretch of the Curonian lagoon between Klaipėda and Skirvytė, at a 2 km distance from the eastern shore.

Recreational salmon (and sea trout) fisheries along the coast are regulated by one set of rules, whereas in inland waters another set of rules regulates the fisheries. For recreational fishing of salmon (and sea trout) in the Baltic Sea, one either needs to buy a fishing ticket or be entitled to special fishing rights to fish. In inland waters, you need a recreational fishing card for fishing. Both in the sea and in inland waters, there is a bag limit of one salmon or sea trout per angler and fishing day. In inland waters, the minimum size has been extended to 65 cm.

In the period September 15th to 31st of October, recreational fishing is prohibited within a 0.5 km radius from the Šventoji and Rėkstyne river mouths, and from the southern and northern breakwaters of Klaipėda Strait. During the same period, commercial fishing is prohibited within a 0.5 km radius from Šventoji River mouth, and 3 km from the Curonian lagoon and Baltic Sea confluence. From 1st of October to 31st of December, all types of fishing are prohibited in 161 streams, because of brown trout and sea trout spawning.

In larger rivers, such as Neris and Šventoji (with twelve rivers/tributaries in total), special protected zones have been selected where schooling of salmon and sea trout occurs. In these selected zones, licensed fishing is only permitted from 16th of September until 15th of October. Last year, the angling of salmon and sea trout in this selected river zones was limited by a 'catch and release' rule (from 1st until 15th October). From 16th of October to 31st of December, any kind of fishing is prohibited in these areas. From 1st of January, licensed salmon (and sea trout) kelt fishing is permitted in the Minija, Veiviržas, Skirvytė, Jūra, Atmata, Nemunas, Neris, Dubysa, Siesartis and Šventoji river. Fishing with a licence is allowed from 1st of January to 1st of October in designated stretches of the listed rivers. In the inland waters, regulation of fishing is more complex. In case of retaining a salmon (or sea trout), a specific part of the recreational fishing card must be removed not later than within five minutes. Such a marked recreational fishing card means that you are not allowed to continue fishing there and then.

In **Poland**, no new national regulatory measures were implemented in 2019 but there was a new quota allocation among the 173 commercial vessels. In addition to EC measures, seasonal closures and fixed protected areas are in force within territorial waters managed by Regional Fisheries Inspectorates. Fishing for salmon (and sea trout) in the sea is not allowed between 15th of September and 15th of November within a predefined belt along the coastal zone (<4 Nm). A new law for recreational salmon fishing in Polish EEZ was introduced in 2015 including:

- catch quotas (per day/per angler);
- minimum size limits (TL);
- periods and areas for protected fish species;
- minimum distance between anglers.

Rod fishing (coastal fishing, boat/belly boat fishing, and organized cruises on board fishing vessels) and spear fishing is allowed. Recreational fishing with nets is not allowed. A new system of obtaining fishing licences has been established. Currently, proof of a bank transfer with specified personal information is needed for legal fishing. The permit can be issued for a period of one week, one month or one year.

Since 2005, commercial fisheries for salmon (and sea trout) in rivers is based on new implemented rules. Fisheries opportunities were sold in 2005 by the state on a tender basis, where the bidder had to submit a fishing ten-year operational plan including restocking. Commercial river fisheries directed for sea trout and salmon already exist almost only in the Vistula River. However, salmon are rare. In Pomeranian rivers, some salmon are collected annually for brood stock during spawning run.

In the rivers, angling for salmon and sea trout is forbidden between 1st of October and 31st of December. A fishing licence and permit are needed for fishing in the rivers. Only rod fishing is allowed for fishing for salmon and sea trout in the rivers. In addition, in Rivers Ina, Rega, Parsęta and Słupia, anglers must release all salmon that have been caught.

In **Russia**, no changes in the national regulations have been implemented since 2001. The international fishery rules are extended to the coastline. In all rivers, and within one nautical mile of their mouths, fishing and angling for salmon is prohibited during all year, except fishing for brood stock for hatcheries.

In **Sweden**, several new national regulatory measures were implemented in 2019. As in recent years, the main bulk of the national quota in 2019 for the salmon commercial fishery was allocated to the coastal fishery, as the Swedish offshore longline fishery targeting salmon was phased out in 2012. National management measures for salmon include an early summer ban. The aim of the early summer ban in the coastal fishery is to ensure that a part of the spawning migrating population ascend rivers before the fishing season starts. Starting dates of the commercial coastal fishing season in 2019 were the same as in 2018, with one exception regarding the protection area outside Umeälven (see below). North of latitude 62º55′N the fishing season started 17th of June. Exemptions from this seasonal regulation of the salmon fishery were allowed by the local county board to professional fishermen in the area north of latitude 62º55′N up to the border between the counties Västerbotten and Norrbotten, so that a limited fishery could start on 12th of June. South of latitude 62º55′N, commercial coastal fishing in 2019 was allowed from 1st of April.

With the further aim of increase exploitation of reared salmon stocks and reducing exploitation of weak wild ones, the Swedish TAC is divided between three coastal regions SD 22–29, SD 30 and SD 31. Of the Swedish quota for 2019 (27 388 salmon), 26 400 salmon were allocated to the commercial coastal fishery and were divided between ICES subdivisions (SD) in a similar way as in the last few years. In SD 31 the regional quota was set to 19 200 salmon. Among those, 2000 salmon were allocated specifically to the protection area outside River Umeälven, where fishing started 1 July. The aim of the changed regulations outside Umeälven was to protect the (early migrating) weak wild salmon population in the tributary Vindelälven during the spawning migration. In SD 30, the regional quota was set to 7000 salmon. In SD 22–29 the regional quota was set to 200 salmon because of the higher expected proportion of salmon from weaker populations in these catches (as compared to SD 30 and 31). According to the latest information, commercial total catches in 2019 marginally exceeded the regional quota in SD 31 (landed share of the quota was 102%) but were below regional quotas in SD 30 and in SD 22–29 (landed share of quota was 61% and 68%, respectively).

Sweden has applied for and received a temporally exemption from the landing obligation for salmon and cod caught in traps (and a few other gears) in the Baltic, because the survival rate is expected to be high after release back into the sea. More information on this is given in the Stock Annex (Annex 2). In addition, Sweden has increased the Minimum Conservation Reference Sizes (MCRS) for salmon caught in SD 31 from the EU-regulated 50 cm to 60 cm. Catches from commercial fisheries in reared rivers (freshwater) are not counted against the TAC, and therefore these fisheries can continue after the commercial coastal fishery is stopped.

Recreational fisheries in the sea and in rivers are also managed through national regulations. Recreational coastal fisheries with trapnets in the counties of Norrbotten, Västerbotten and part of Västernorrland were, as in the latest years, allowed from 1st of July until the quota of salmon within the commercial fishery was fulfilled. In SD 31, the salmon fishery was stopped 22nd of July when the regional salmon quota was filled. Hence, it was possible to conduct recreational fishing with trap nets in SD 31 in 2019, but the recreational fishery using these gears is most likely very small or non-existent.Furthermore, according to information from the County Administrative Board, there are no active recreational trapnet fishers in SD 30 despite the longer fishing season in this area. This could be due to the ban for recreational fishermen in the Baltic Sea to sell their catches. Hence, many recreational trapnet fishermen have applied for a commercial licence and therefore, their catches are now included in the quota. National management measures for the Swedish recreational offshore trolling fishery (mainly in Main basin) have been in practice since 2013. Only salmon without an adipose fin (i.e. fin-clipped reared salmon) are allowed to retain.

In all rivers, there is a general bag limit of one salmon and one trout per fisherman and day. In addition, fishing periods are regulated on a national level. In Gulf of Bothnian wild rivers, for example, angling for salmon is forbidden from 1st of September until 31st of December, and in some rivers angling is also forbidden between 1st of May and 18th of June. In addition to national regulations, local fishing and management organizations may decide on more restrictive river-specific fishing regulations.

Management of salmon fisheries in Torneälven/Tornionjoki, including also the coastal area directly outside the river mouth, is handled through a Swedish-Finnish agreement. This agreement includes, for example, a specified time period within which the commercial coastal fishery in the river mouth is allowed to start. Regulations targeting the river fishery are also handled in the agreement. Deviations from the agreed fishing regulations are negotiated and decided upon on an annual basis by the Swedish Agency for Marine and Water Management (according to a Government commission from the Swedish Ministry of Enterprise and Innovation) and the Finnish Ministry of Agriculture and Forestry.

2.8 Other factors influencing the salmon fishery

The incitement to fish salmon compared with other species is likely to be influenced by a number of factors, such as the possibilities for selling the fish, the market price for salmon compared to other species, eventual opportunities to target and catch other species and problems with damages to the catches caused by seals and possibly birds.

Further, the possibilities for selling the fish is evidently affected by co-factors such as levels of contaminants, e.g. dioxin. Detailed information about dioxin contents in Baltic salmon, and how this affects the fishery, is presented in Stock Annex (Annex 2, Section A.2.6). Also, the overall health status of the fish is of importance. See Section 3.4.4 for a summary of disease problems seen in several rivers and areas in later years.

Year	Country									Reported total catch	Estimated misreported catch	Estimated unreported catch		Estimated discarded catch		Total catch	
	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden			median	90% PI	median	90% PI	median	90% PI
2001	443	16	633	39	136	4	180	37	636	2124	630	277	215-373	207.5	190-230	3117	3051-3219
2002	334	16	510	29	108	11	197	66	580	1851	575	265	204-368	181.3	166-201	2769	2704-2876
2003	454	10	410	29	47	3	178	22	462	1615	716	219	167-306	193.7	175-218	2637	2580-2731
2004	370	7	655	35	34	3	88	16	894	2102	1271	316	236-458	221.5	201-251	3783	3699-3929
2005	214	9	617	24	23	3	114	15	731	1750	554	271	207-380	157.8	145-174	2629	2562-2741
2006	178	8	371	18	14	2	117	5	506	1219	234	196	150-274	120.3	112-131	1697	1650-1778
2007	79	7	409	15	26	2	95	6	492	1131	272	185	142-254	94.66	88-103	1605	1560-1675
2008	34	9	452	21	9	2	44	6	471	1048	16	199	149-285	53.27	50-58	1269	1219-1355
2009	82	7	423	14	15	2	49	2	508	1102	333	212	158-315	67.24	61-76	1695	1639-1800
2010	145	5	270	8	13	1	48	2	411	902	374	165	124-239	62.72	55-73	1485	1443-1560
2011	105	5	288	7	7	2	31	2	457	903	185	175	132-255	60.77	56-68	1320	1275-1401
2012	118	7	473	7	8	2	28	2	468	1113	87.5	215	165-299	56.71	52-64	1476	1425-1560
2013	138	9	373	6	12	1	24	2	398	964	75	168	126-234	70.44	60-81	1263	1220-1329
2014	143	7	453	6	11	2	15	2	372	1011	68	154	114-217	62.82	53-73	1295	1255-1357
2015	112	9	367	10	10	13	18	2	381	922	83	141	106-197	60.29	52-67	1169	1134-1225
2016	94	13	438	8	9	19	18	2	386	986	130	152	115-211	59.6	53-65	1290	1252-1349
2017	46	14	343	42	8	8	34	2	265	762	160	91	69-123	64.41	56-72	1030	1008-1063
2018	74	12	335	49	6	11	57	2	324	871	213	107	81-147	71.44	60-81	1238	1211-1279
2019	98	13	380	49	19	10	56	3	339	967	3	115	82-176	37.03	32-48	1113	1078-1173

Table 2.2.1.2. Total catch: Nominal reported catches plus discards (incl. seal damaged salmon), unreported and misreported catches of Baltic Salmon in numbers from sea, coast and river by country in 2001-2019 sub-divisions 22-32. See ICES (2019) for catches before year 2001.

Year	Country									Reported total catch	Estimated misreported catch	Estimated unreported catch		Estimated discarded catch		Total catch	
	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden			median	90% PI	median	90% PI	median	90% PI
2001	90388	3285	122419	7717	29002	1205	35606	7392	153197	450211	126100	61040	47090-82590	41280	37670-45760	658700	644000-681400
2002	76122	3247	104856	5762	21808	3351	39374	13230	140121	407871	115000	59200	45530-82030	38410	35090-42680	603400	588900-627200
2003	108845	2055	99364	5766	11339	1040	35800	4413	117456	386078	143100	52820	40230-73160	43480	39250-48800	603600	590000-625400
2004	81425	1452	130415	7087	7700	704	17650	5480	195662	447575	254300	67400	50360-97410	43760	39490-49690	790000	772100-820800
2005	42491	1721	113378	4799	5629	698	22896	3069	146581	341262	110800	53610	40920-75130	30880	28390-34080	518900	505700-541100
2006	33723	1628	64679	3551	3195	488	22207	1002	98663	229136	46900	36970	28270-51450	22720	21060-24870	323000	313900-338000
2007	16145	1315	75270	3086	5318	537	18988	1408	96605	218672	54310	35780	27470-49180	18740	17390-20460	315500	307000-329200
2008	7363	1890	80919	4151	2016	539	8650	1382	92533	199443	3295	37940	28370-54660	10190	9570-11050	243500	233900-260400
2009	17116	2064	77105	2799	3323	310	9873	584	111263	224437	66500	42790	31680-64420	13870	12570-15640	340600	329200-362500
2010	29714	1459	44981	1520	2307	243	9520	491	83318	173553	74800	30050	22670-43400	12480	11000-14560	283300	275700-296900
2011	21125	1332	49613	1483	1470	317	6149	470	90276	172235	37000	31310	23640-45160	11770	10770-13140	244200	236400-258300
2012	23180	1915	73450	1362	1371	355	5605	412	84331	191981	17500	34380	26490-47330	10250	9369-11520	247100	239200-260200
2013	25461	2426	56287	1210	2842	285	4808	387	62566	156272	15000	27080	20260-37730	13000	11090-14950	201000	194100-211800
2014	24596	2139	69132	1264	2650	388	2999	418	58056	161642	13600	22740	16940-31720	11090	9405-12740	200000	194200-209000
2015	19367	2597	62476	2009	2572	2580	3745	406	63309	159061	16600	22600	17070-31600	11060	9646-12280	200300	194700-209300
2016	17701	3180	62738	1623	2881	3803	3659	419	62549	158553	26000	23850	18140-32920	11380	10060-12300	210400	204600-219500
2017	9644	3005	52478	5632	2435	1702	7075	380	50770	133121	32000	16870	12770-23420	11360	9713-12650	184300	180100-190900
2018	14588	2534	49065	6586	1531	1967	10640	458	56732	144101	42600	18760	13530-28140	13240	10650-15040	208400	203000-217800
2019	13805	2773	55355	6464	4118	1258	9916	602	50570	144861	600	17540	12680-26220	6277	5518-7802	167300	162300-176100

The catches in sub-divisions 22-23 are normally less than one tonnes.

From 1995 data includes sub-divisions 22-32.

Catches from the recreational fishery are included in reported catches as follows: Finland from 1980, Sweden from 1988, Denmark from 1998.

Other countries have no, or very low recreational catches.

1) In 1993 Fishermen from the Faroe Islands caught 3200 individuals, which is included in the total Danish catches.

Table 2.2.1.3. Nominal catches of Baltic Salmon in tonnes round fresh weight, from offshore, coast and river by country and region in 2001 - 2019. O=offshore, C=coast, R=river. See ICES (2018) for catches before year 2001.

Year	Main Basin (Sub-divisions 22-29)																											
	Denmark		Estonia		Finland			Germany		Latvia			Lithuania			Poland			Russia			Sweden			Total			
	O	C	O	C	O	C	R	O	C	O	C	R	O	C	R	O	C	R	O	C	R	O	C	R	O	C	R	GT
2001	433	10	0	4	135	64	0	39	0	66	71	0	1	4	0	165	9	6	33	0		313	2	7	1184	163	13	1361
2002	319	15	0	6	154	51	0	29	0	47	61	0	1	9	0	178	9	10	64	0		228	2	6	1021	153	16	1190
2003	439	15	0	3	115	33	0	29	0	33	14	0	0	3	0	154	22	3	20	0		210	3	3	999	94	5	1098
2004	355	15	0	3	169	74	0	35	0	19	13	2	0	2	0	83	0	5	14	0		433	5	3	1108	111	11	1230
2005	199	15	0	1	188	58	0	24	0	15	8	0	0	2	0	104	5	5	12	0		314	5	2	856	95	8	959
2006	163	15	0	1	105	22	0	18	0	9	5	0	0	2	0	100	12	6	3	0		220	3	1	617	60	7	684
2007	64	15	0	2	158	11	0	15	0	16	3	7	0	2	0	75	15	5	4	0		216	4	2	548	52	14	614
2008	19	15	0	2	46	16	0	21	0	0	5	4	0	2	0	30	8	6	4	0		88	6	2	207	55	11	273
2009	82	0	0	2	39	16	1	14	0	0	10	5	0	1	1	42	8	0	0	0		82	8	1	258	45	7	310
2010	145	0	0	1	36	11	1	8	0	0	4	10	0	1	1	40	7	0	0	0		128	5	1	357	28	12	398
2011	105	0	0	1	38	18	1	7	0	0	4	4	0	0	1	22	9	0	0	0		162	5	1	335	37	7	378
2012	118	0	0	2	23	27	0	7	0	0	2	6	0	1	1	25	3	0	0	0		88	6	2	261	40	10	312
2013	138	0	0	2	0	21	0	6	0	0	6	5	0	0	1	21	3	0	0	0		0	5	1	166	37	7	210
2014	143	0	0	2	1	29	0	6	0	0	5	5	0	1	1	13	3	0	0	0		0	6	1	163	46	8	216
2015	112	0	0	3	2	24	0	10	0	1	6	3	3	0	9	15	3	0	0	0		0	1	2	143	37	15	195
2016	94	0	0	3	1	24	0	8	0	0	7	1	8	0	11	15	3	0	0	0		0	3	1	126	41	13	180
2017	46	0	0	3	0	21	0	42	0	0	5	3	5	0	3	28	6	0	0	0		0	2	0	121	36	6	163
2018	74	0	0	3	0	26	0	49	0	2	1	3	6	1	4	52	5	0	0	0		0	2	0	182	38	7	227
2019	98	0	0	3	0	32	0	49	0	12	4	4	7	1	2	39	17	0	0	0		0	1	1	204	57	7	268

Table 2.2.1.3 Continued.

Year	Gulf of Bothnia (Sub-divisions 30-31)										Main Basin + Gulf of Bothnia (Sub-divisions 22-31) Total			
	Finland			Sweden			Total							
	0	C	R	0	C	R	0	C	R	GT	0	C	R	GT
2001	9	234	26	1	195	117	10	430	143	583	1194	593	157	1943
2002	5	202	20	1	241	101	6	444	121	571	1027	597	137	1761
2003	1	176	25	2	172	73	2	347	98	447	1002	441	103	1546
2004	3	309	32	0	368	86	3	677	118	798	1111	788	129	2028
2005	6	239	37	1	286	123	6	525	160	691	862	621	167	1650
2006	1	148	17	6	204	71	7	352	88	448	624	412	96	1132
2007	3	134	27	1	168	101	4	302	128	434	552	354	142	1048
2008	0	209	78	0	208	167	0	417	245	662	207	472	256	935
2009	1	237	43	0	290	127	1	527	170	698	259	572	177	1008
2010	0	151	32	0	208	69	0	359	101	459	357	387	113	857
2011	0	148	37	0	208	81	0	356	118	474	335	393	125	853
2012	0	231	103	0	163	209	0	394	312	706	261	434	322	1018
2013	0	196	73	0	212	179	0	409	252	661	166	446	260	871
2014	0	207	138	0	200	165	0	406	303	710	163	453	311	926
2015	0	175	112	0	189	202	0	364	314	678	143	401	329	873
2016	0	201	149	0	193	190	0	394	339	734	126	436	352	914
2017	0	181	87	0	155	114	0	336	201	537	121	372	207	701
2018	0	146	85	0	194	134	0	340	219	559	182	378	227	787
2019	0	183	112	0	170	167	0	353	279	632	204	410	286	900

Table 2.2.1.3 Continued.

Year	Gulf of Finland (Sub-division 32)												Sub-division 22-32			
	Estonia			Finland			Russia		Total				Total			
	O	C	R	O	C	R	C	R	O	C	R	GT	O	C	R	GT
2001	0	10	2	14	139	11	0	3	14	150	16	180	1208	742	173	2076
2002	1	10	0	17	46	15	0	2	18	56	16	90	1044	653	154	1851
2003	0	7	0	3	50	8	0	1	3	57	9	70	1005	498	112	1615
2004	0	4	0	2	57	9	1	1	3	62	11	75	1114	850	140	2103
2005	0	6	1	3	72	15	1	2	3	79	18	100	865	700	185	1749
2006	0	5	2	3	65	10	1	2	3	70	13	87	627	482	109	1219
2007	0	4	1	3	64	9	0	1	3	69	11	83	555	423	153	1131
2008	0	6	2	2	94	7	1	2	2	100	10	112	209	571	267	1047
2009	0	4	1	1	74	11	1	2	1	79	14	94	260	650	191	1102
2010	0	2	1	1	36	2	0	2	1	39	5	45	358	426	118	902
2011	0	3	1	0	43	3	0	2	0	45	5	51	335	438	131	904
2012	0	4	1	0	85	4	0	2	0	89	6	96	262	523	328	1113
2013	0	7	0	0	78	5	0	2	0	84	7	92	166	530	267	963
2014	0	5	0	0	74	4	0	2	0	79	6	85	163	531	316	1011
2015	0	6	0	0	53	1	0	2	0	59	3	62	143	460	332	935
2016	0	7	2	0	62	1	0	2	0	69	5	74	127	505	357	988
2017	0	9	2	1	52	1	0	2	1	62	4	67	122	434	212	768
2018	0	8	1	1	51	2	0	2	1	59	5	64	183	437	232	851
2019	0	9	1	1	53	0	0	3	1	62	5	67	204	472	291	967

Table 2.2.1.4. Nominal catches of Baltic Salmon in numbers, from offshore, coast and river by country and region in 2001-2019 O=offshore, C=coast, R=river. See ICES (2018) for catches before year 2001.

Year	Main Basin (Sub-divisions 22-29)																										
	Denmark		Estonia		Finland			Germany		Latvia			Lithuania			Poland			Russia		Sweden			Main Basin (sub-divisions 22-29) Total			
	O	C	O	C	O	C	R	O	C	O	C	R	O	C	R	O	C	R	O	C	O	C	R	O	C	R	GT
2001	90388	0	122	819	26616	8706	0	7717	0	18194	10808	0	152	1053	0	33017	1764	825	6584	0	82674	485	890	265464	23635	1715	290814
2002	76122	0	0	1171	32870	8003	25	5762	0	11942	9781	85	363	2988	0	35636	1804	1934	12804	0	64275	556	699	239774	24303	2743	266820
2003	108845	0	16	681	24975	5021	25	5766	0	8843	2496	0	74	966	0	30886	4282	632	3982	0	55335	575	469	238722	14021	1126	253869
2004	81425	0	0	594	35567	11024	50	7087	0	4984	2316	400	49	655	0	16539	0	1111	4983	0	100444	900	441	251078	15489	2002	268569
2005	42491	0	0	286	36917	7936	25	4799	0	2787	2054	788	0	691	0	20869	1025	1002	2433	0	67961	715	337	178257	12707	2152	193116
2006	33723	0	0	291	19859	3152	20	3551	0	1705	1490	0	9	474	0	19953	1371	883	552	0	47319	546	180	126671	7324	1083	135078
2007	16145	0	0	325	30390	1468	20	3086	0	2960	1478	880	0	529	0	14924	3098	966	888	0	45263	598	243	113656	7496	2109	123261
2008	7363	0	0	432	9277	2324	35	4151	0	0	1410	157	0	518	0	5933	1683	1034	697	0	18602	1040	317	46023	7407	1543	54973
2009	17116	0	0	740	8039	2435	109	2799	0	0	2549	774	0	166	144	8301	1572	0	0	0	24080	1326	154	60335	8788	1181	70304
2010	29714	0	0	538	6966	1587	140	1520	0	0	1092	1215	0	106	137	8029	1491	0	0	0	32857	817	210	79086	5631	1702	86419
2011	21125	0	0	414	7193	2340	140	1483	0	0	1013	457	0	59	258	4429	1720	0	0	0	40157	726	144	74387	6272	999	81658
2012	23180	0	0	713	4088	3560	50	1362	0	0	576	795	0	142	213	5094	511	0	0	0	23798	862	288	57522	6364	1346	65232
2013	25461	0	0	766	66	2699	30	1210	0	0	2038	804	0	72	213	4215	593	0	0	0	2468	724	160	33420	6892	1207	41519
2014	24596	0	0	891	108	3840	15	1264	0	0	1884	766	0	101	287	2494	505	0	0	0	2413	826	147	30875	8047	1215	40137
2015	19367	0	0	1186	235	3081	8	2009	0	137	1923	512	620	72	1888	3180	565	0	0	0	2419	120	212	27967	6947	2620	37534
2016	17701	0	0	1158	152	3196	10	1623	0	0	2728	153	1510	97	2196	3102	557	0	0	0	2409	440	102	26497	8176	2461	37134
2017	9644	0	0	863	0	2978	10	5632	0	0	1864	614	996	48	658	5909	1166	0	0	0	2405	217	41	24586	7136	1323	33045
2018	14588	0	0	1042	64	3375	0	6586	0	347	937	247	1236	131	600	9751	976	3	0	0	2407	216	45	34979	6677	895	42551
2019	13805	0	0	1036	8	4154	0	6408	56	2226	1138	754	875	0	384	6889	3027	0	0	0	2404	131	100	32615	9542	1238	43394

Table 2.2.1.4. Continued.

Year	Gulf of Bothnia (Sub-divisions 30-31)										Main Basin + Gulf of Bothnia (Sub-divisions 22-31) Total			
	Finland			Sweden			Total							
	O	C	R	O	C	R	O	C	R	GT	O	C	R	GT
2001	1904	53280	4610	122	47804	25022	2026	101084	29632	132743	267491	124719	31347	423557
2002	864	44073	3567	174	57033	21417	1038	101106	24984	127129	240812	125409	27727	393949
2003	166	53562	4468	297	45075	16839	463	98637	21307	120407	239185	112658	22433	374276
2004	604	65788	5942	0	77904	17207	604	143692	23149	167445	251682	159181	25151	436014
2005	1045	45403	6690	99	57154	21749	1144	102557	28439	132140	179401	115264	30591	325256
2006	162	26228	2590	1150	35912	15190	1312	62140	17780	81232	127983	69464	18863	216310
2007	604	27340	3521	195	33054	17671	799	60394	21192	82385	114455	67890	23301	205646
2008	11	41589	11992	0	41916	31377	11	83505	43369	126885	46034	90912	44912	181858
2009	129	45342	6848	0	62203	23500	129	107545	30348	138022	60464	116333	31529	208326
2010	0	25539	4744	2	37448	11984	2	62987	16728	79717	79088	68618	18430	166136
2011	13	26891	5381	0	35704	13545	13	62595	18926	81534	74400	68867	19925	163192
2012	0	38890	12925	0	24013	35370	0	62903	48295	111198	57522	69267	49641	176430
2013	0	30041	10605	0	31612	27602	0	61653	38207	99860	33420	68545	39414	141379
2014	0	34661	18865	0	31731	22939	0	66392	41804	108196	30875	74439	43019	148333
2015	9	35391	14412	0	28311	32247	9	63702	46659	110370	27976	70649	49279	147904
2016	79	29894	19880	0	28863	30735	79	58757	50615	109451	26576	66933	53076	146585
2017	0	27400	12883	0	23370	24737	0	50770	37620	88390	24586	57906	38943	121435
2018	0	25412	14528	0	27455	26609	0	52867	41137	94004	34979	59544	42032	136555
2019	3	25512	17300	0	23886	24049	3	49398	41349	90750	32618	58940	42587	134144

Table 2.2.1.4 cont.

Year	Gulf of Finland (Sub-division 32)												Sub-divisions 22-32			
	Estonia			Finland			Russia		Total				Total			
	O	C	R	O	C	R	O [1)]	R	O	C	R	GT	O	C	R	GT
2001	62	1965	317	2804	23458	1900	82	726	2866	25505	2943	31314	270357	150224	34290	454871
2002	108	1968	0	3652	8269	3200	18	408	3760	10255	3608	17623	244573	135664	31335	411571
2003	17	1341	0	553	8862	1700	75	356	570	10278	2056	12904	239755	122936	24489	387180
2004	36	822	0	480	9501	1500	183	314	516	10506	1814	12837	252198	169687	26965	448851
2005	34	1298	103	536	12016	2800	213	423	570	13527	3326	17423	179971	128791	33917	342679
2006	48	955	334	506	10431	1700	121	329	554	11507	2363	14425	128537	80972	21226	230735
2007	64	764	162	451	10032	1395	120	400	515	10916	1957	13388	114970	78806	25258	219034
2008	0	1114	344	392	14161	1100	220	465	392	15495	1909	17796	46426	106407	46821	199654
2009	0	1067	257	228	11912	2063	170	414	228	13149	2734	16111	60692	129482	34263	224437
2010	0	736	185	129	5476	400	0	491	129	6212	1076	7417	79217	74830	19506	173553
2011	0	733	185	91	6964	600	0	470	91	7697	1255	9043	74491	76564	21180	172235
2012	0	990	212	62	13285	590	0	412	62	14275	1214	15551	57584	83542	50855	191981
2013	0	1619	41	37	11879	930	0	387	37	13498	1358	14893	33457	82043	40772	156272
2014	0	1185	63	89	11049	505	0	418	89	12234	986	13309	30964	86673	44005	161642
2015	0	1373	38	48	9134	158	46	360	48	10553	556	11157	28024	81202	49835	159061
2016	0	1629	393	51	9228	248	16	403	51	10873	1044	11968	26627	77806	54120	158553
2017	0	1842	300	0	8999	208	0	380	0	10841	888	11729	24586	68747	39831	133164
2018	0	1333	159	114	5487	85	0	458	114	6820	702	7636	35093	66364	42734	144191
2019	0	1486	251	94	8224	60	0	602	94	9710	913	10717	32712	68650	43500	144861

Table 2.2.1.5. Nominal catches of Baltic salmon in tonnes round fresh weight and numbers from sea, coast and river, by country and sub-divisions in 2019. Subdivisions 22-32. O=offshore, C=coast, R=river, W=weight (tonnes), N=number of fish

SD	Fishery	-	DE	DK	EE	FI	LT	LV	PL	RU	SE	Grand Total
22	O	W	0									0
		N	39									39
23	O	W									0	0
		N									4	4
24	O	W	48	6					0			55
		N	6350	1186					10			7546
	C	W	0						0			0
		N	56						2			58
25	O	W		23					3			26
		N		4823					509			5332
	C	W							1		1	2
		N							277		131	408
	R	W									1	1
		N									95	95
26	O	W	0				7	5	12			24
		N	19				875	1094	1954			3942
	C	W					1	0	16			17
		N						125	2748			2873
	R	W					2					2
		N					384					384
27	C	W									0	0
		N									5	5
28	O	W						6				6
		N						1132				1132
	C	W			2			3				5
		N			679			1013				1692
	R	W						4				4
		N						754				754
29	O	W				0						0
		N				8						8
	C	W			1	32						32
		N			357	4154						4511
	O	W				0						0
		N				3						3
30	C	W				34					34	69
		N				4775					4244	9019
	R	W				0					42	42
		N				0					4661	4661
31	C	W				110					136	246
		N				15437					19642	35079
	R	W				112					125	237
		N				17300					19388	36688
32	O	W				1						1
		N				94						94
	C	W			9	53						62
		N			1486	8224						9710
	R	W			1	0				3		5
		N			251	60				602		913
200	O	W		68					24			92
		N		7796					4416		2400	14612
300	C	W				39						39
		N				5300						5300
Total 22-31	O+C+R	W	49	98	3	327	10	19	56	0	339	900
		N	6464	13805	1036	46977	1258	4118	9916	0	50570	134144
Total 32	O+C+R	W	0	0	10	54	0	0	0	3	0	67
		N	0	0	1737	8378	0	0	0	602	0	10717
	O	W	49	98	0	1	7	12	39	0	0	204
		N	6408	13805	0	105	875	2226	6889	0	2404	32712
	C	W	0	0	12	268	1	4	17	0	171	472
Grand Total		N	56	0	2522	37890	0	1138	3027	0	24022	68655
	R	W	0	0	1	112	2	4	0	3	168	291
		N	0	0	251	17360	384	754	0	602	24144	43495
	O+C+R	W	49	98	13	380	10	19	56	3	339	967
		N	6464	13805	2773	55355	1258	4118	9916	602	50570	144861

Table 2.2.1.6. Nominal catches (commercial) of Baltic Salmon in numbers from sea and coast, excluding river catches, by country in 2001–2019 and in comparison with TAC. Subdivisions 22–32. See ICES (2018) for catches before year 2001.

YEAR	Baltic Main Basin and Gulf of Bothnia (subdivisions 22–31)											
	Fishing Nation									Total	TAC	TAC (%)
	DE	DK	EE	FI	LT	LV	PL	RU	SE			
2001	7,717	88,388	941	77,057	1,205	29,002	34,781	6,584	112,842	351,933	450,000	78
2002	5,762	73,122	1,171	82,171	3,351	21,723	37,440	12,804	100,099	324,839	450,000	72
2003	5,766	105,845	697	80,084	1,040	11,339	35,168	3,982	85,259	325,198	460,000	71
2004	7,087	78,425	594	97,163	704	7,300	16,539	4,983	155,075	362,887	460,000	79
2005	4,799	39,491	286	75,481	691	4,841	21,894	2,433	106,564	254,047	460,000	55
2006	3,551	30,723	291	43,221	483	3,195	21,324	552	70,536	173,324	460,000	38
2007	3,086	13,145	325	53,622	529	4,438	18,022	888	66,763	159,930	437,437	37
2008	4,151	4,363	296	44,111	518	1,410	7,616	697	47,030	109,495	371,315	29
2009	2,799	14,116	740	46,855	166	2,549	9,873	-	68,242	145,340	309,733	47
2010	1,520	26,714	538	30,822	106	1,092	9,520	-	56,778	127,090	294,246	43
2011	1,483	18,125	414	33,167	59	1,013	6,149	-	65,006	125,416	250,109	50
2012	1,362	20,180	713	43,448	142	576	5,605	-	38,125	110,151	122,553	90
2013	1,210	21,961	486	29,716	72	1,280	4,808	-	28,288	87,821	108,762	81
2014	1,264	21,096	563	30,059	101	1,112	2,999	-	28,411	85,605	106,366	80
2015	2,009	15,867	638	30,166	72	1,327	3,745	-	27,907	81,731	95,928	85
2016	1,623	9,701	726	24,821	97	1,752	3,659	-	29,312	71,691	95,928	75
2017	1,176	3,045	593	21,878	48	1,210	7,075	-	23,592	58,617	95,928	61
2018	1,360	5,993	581	23,551	367	987	8,545	-	27,678	69,062	91,132	76
2019	939	6,009	544	24,377	0	2,591	5,500	-	24,021	63,981	91,132	70

Table 2.2.1.6. Continued.

YEAR	Baltic Main Basin and Gulf of Bothnia (Subdivision 32)					
	Fishing Nation		Total	ECTAC	TAC (%)	RU
	EE	FI				
2001	2,027	12,082	14,109	70,000	20	82
2002	2,076	9,371	11,447	60,000	19	18
2003	1,358	6,865	8,223	50,000	16	75
2004	858	6,892	7,750	35,000	22	183
2005	1,126	9,462	10,588	17,000	62	213
2006	865	10,758	11,623	17,000	68	121
2007	828	10,303	11,131	15,419	72	120
2008	820	13,823	14,643	15,419	95	220
2009	1,067	11,410	12,477	15,419	81	170
2010	736	5,245	5,981	15,419	39	-
2011	733	6,695	7,428	15,419	48	-
2012	990	9,897	10,887	15,419	71	-
2013	1,254	8,466	9,720	15,419	63	-
2014	908	8,408	9,316	13,106	71	-
2015	896	6,452	7,348	13,106	56	46
2016	1,028	6,279	7,307	13,106	56	16
2017	1,384	5,999	7,383	13,106	56	-
2018	1,043	5,401	6,444	10,003	64	-
2019	1,182	8,118	9,300	9,703	96	-

Table 2.2.1.7. Non-commercial (recreational) catches of Baltic Salmon in numbers from sea, coast and river by country in 2001–2018 in subdivisions 22–31 and Subdivision 32 (O = Offshore, C = Coast, PI = probability interval). See ICES (2018) for catches before year 2001.

Subdivisions 22–31																			
Year	**Denmark**	**Estonia**		**Finland**		**Germany**	**Latvia**		**Lithuania**		**Poland**		**Russia**		**Sweden**		**O+C**	**River**	**Grand**
	O+C	O+C	River	O+C (95% PI)	River	O+C	O+C	River	O+C	River	O+C	River	O+C	River	O+C	River	**Total**	**Total**	**Total**
2001	2000	-		13450 (±5490)	4610	na	0	-	0	0	0	0	0	0	18243	22216	33693	26826	60519
2002	3000	-		3640 (±1070)	3592	na	0	85	0	0	0	0	0	0	21939	16945	28579	20622	49201
2003	3000	-		3640 (±1070)	4493	na	0	-	0	0	0	0	0	0	16023	13424	22663	17917	40580
2004	3000	-		15820 (±7300)	5992	na	0	-	0	0	0	0	0	0	24173	14687	42993	20679	63672
2005	3000	-		15820 (±7300)	6715	na	0	-	0	0	0	0	0	0	19365	15260	38185	21975	60160
2006	3000	-		6180 (±3710)	2610	na	0	-	0	0	0	0	0	0	14391	12229	23571	14839	38410
2007	3000	-		6180 (±3710)	3541	na	0	-	0	0	0	0	0	0	12347	14429	21527	17970	39497
2008	3000	136		9090 (±4380)	12027	na	0	157	0	0	0	0	0	0	14528	24501	26754	36685	63439
2009	3000	-		9090 (±4380)	6957	3000	0	192	0	0	0	0	0	0	19367	18505	34457	25654	60111
2010	3000	-		3270 (±3600)	4884	3000	0	22	0	0	0	0	0	0	14346	9325	23616	14231	37847
2011	3000	-		3270 (±3600)	5521	3000	0	-	0	0	0	0	0	0	11581	9886	20851	15407	36258
2012	3000	-		3090 (±2830)	12975	3000	0	-	0	0	0	0	0	0	10548	25523	19638	38498	58136
2013	3500	280		3090 (±2830)	10635	3500	758	-	0	0	0	0	0	0	6516	22057	17644	32692	50336
2014	3500	328		8550 (±5450)	18880	3500	772	-	0	0	0	0	0	0	6559	19265	23209	38145	61354
2015	3500	548		8550 (±5450)	14420	3500	733	-	620	1749	0	0	0	0	2943	19261	20394	35430	55824
2016	8000	432		8550 (±4000)	19890	8000	976	13	1510	2010	0	0	0	0	2400	18711	29868	40624	70492
2017	6599	270		8550 (±4000)	12893	4456	660	-	996	562	0	0	0	0	2400	16094	23931	29549	53480
2018	8595	461		5300 (CV>50%)	13528	5226	297	98	1000	600	2092	0	0	0	2400	15235	25371	29461	54832
2019	7796	492		5300 (CV>50%)	15540	5525	773	184	875	384	4416				2400	12686	22277	28794	51071

Table 2.2.1.7. Continued.

	Subdivision 32										subdivisions 22–32		
Year	**Estonia**		**Finland**		**Russia**		**O+C**	**River**	**Grand**	**O+C**	**River**	**GT**
	O+C	River	O+C (95% PI)	River	O+C	River	**Total**	**Total**	**Total**	**Total**	**Total**	
2001	0	na	14180 (±5780)	1900	0	0	1418	1900	3318	35111	28726	63837
2002	0	na	2550 (±750)	3200	0	0	2550	3200	5750	31129	23822	54951
2003	0	na	2550 (±750)	1700	0	0	2550	1700	4250	25213	19617	44830
2004	0	na	3090 (±1430)	1500	0	0	3090	1500	4590	46083	22179	68262
2005	206	103	3090 (±1430)	2800	0	0	3296	2903	6199	41481	24878	66359
2006	138	112	180 (±110)	1700	0	0	318	1812	2130	23889	16651	40540
2007	0	162	180 (±110)	1395	0	0	180	1557	1737	21707	19527	41234
2008	294	268	730 (±350)	1100	0	0	1024	1368	2392	27778	38053	65831
2009	0	257	730 (±350)	2063	0	0	730	2320	3050	35187	27974	63161
2010	0	185	360 (±400)	400	0	0	360	585	945	23976	14816	38792
2011	0	185	360 (±400)	600	0	0	360	785	1145	21211	16192	37403
2012	0	212	3450 (±3170)	590	0	0	3450	802	4252	23088	39300	62388
2013	365	41	3450 (±3170)	930	0	0	3815	971	4786	21459	33663	55122
2014	277	63	2730 (±3270)	505	0	0	3007	568	3575	26216	38713	64929
2015	477	38	2730 (±3270)	158	0	0	3207	196	3403	23601	35626	59227
2016	601	393	3000 (±3270)	248	0	0	3601	641	4242	33469	41265	74734
2017	458	159	3000 (±3000)	208	0	0	3458	367	3825	27389	29916	57305
2018	290	251	200 (CV>50%)	232	0	0	490	483	973	25861	29944	55805
2019	304	251	200 (CV>50%)	60			504	311	815	22781	29105	51886

Table 2.3.1. Summary of the uncertainty associated to fisheries data series according to the expert opinions from different countries backed by data (D) or based on subjective expert estimation (EE). The conversion factors (mean) are proportions and can be multiplied with the nominal catch data in order to obtain estimates for unreported catches and discards, which altogether sum up to the total catches. Driftnet fishing has been closed from 2008. Finland and Sweden have had no off-shore fishing for salmon after 2012.

Parameter	Country	Year	Source	min	mode	max	mean	SD
Share of unreported catch in offshore fishery	DK	2001-2019	EE	0.001	0.01	0.10	0.04	0.022
	FI	2001-2012	EE	0.001	0.01	0.10	0.04	0.023
	PL	2001-2013	EE	0.001	0.25	0.40	0.22	0.082
		2014	EE	0.010	0.02	0.10	0.04	0.020
		2015-2016	EE	0.010	0.02	0.08	0.04	0.015
		2017-2019	EE	0.001	0.01	0.05	0.02	0.011
	SE	2001-2012	EE	0.050	0.15	0.25	0.15	0.041
	Others	2001-2019					0.08	0.014
Share of unreported catch in coastal fishery	FI	2001-2014	EE	0.001	0.10	0.15	0.08	0.031
		2015-2019	EE	0.001	0.01	0.10	0.04	0.023
	PL	2001-2012	EE	0.001	0.10	0.20	0.10	0.041
		2013-2019	EE	0.001	0.05	0.10	0.05	0.020
	SE	2001-2012	EE	0.100	0.30	0.50	0.30	0.082
		2013-2014	EE	0.001	0.15	0.30	0.15	0.062
		2015-2019	EE	0.050	0.15	0.25	0.15	0.041
	Others	2001-2019					0.12	0.018
Share of unreported catch in river fishery	FI	2001-2016		0.050	0.20	0.35	0.20	0.062
		2017-2019	EE	0.050	0.15	0.25	0.15	0.041
	PL	2001-2009	EE	0.010	0.10	0.15	0.09	0.029
		2010-2017	EE	0.500	0.80	1.00	0.77	0.103
	SE	2001-2019	EE	0.100	0.20	0.40	0.23	0.062
Average share of unreported catch in river fishery	Others	2001-2019					0.29	0.029
Share of discarded undersized salmon in longline fishery	DK	2001-2007	D, EE	0.100	0.15	0.20	0.15	0.020
		2008-2019	D, EE	0.005	0.03	0.05	0.03	0.009
	FI	2001-2012	D, EE	0.010	0.03	0.05	0.03	0.008
	PL	2001-2012	D	0.010	0.03	0.04	0.03	0.006
		2013-2019	D	0.010	0.02	0.04	0.02	0.006
	SE	2001-2012	D, EE	0.005	0.02	0.03	0.02	0.005
Average share of discarded undersized salmon in longline fishery	Others	2001-2019					0.05	0.004
Mortality of discarded undersized salmon in longline fishery	DK	2001-2019	EE	0.750	0.80	0.85	0.80	0.020
	FI	2001-2012	EE	0.500	0.67	0.90	0.69	0.082
	SE	2001-2012	EE	0.750	0.85	0.95	0.85	0.041
	PL	2001-2019	D, EE	0.600	0.72	0.90	0.74	0.062
Average mortality of discarded undersized salmon in longline fishery	Others	2001-2019					0.77	0.028
Share of discarded undersized salmon in driftnet fishery	DK	2001-2007	EE, D	0.001	0.03	0.05	0.03	0.010
	FI	2001-2007	D	0.001	0.02	0.03	0.02	0.006
Average share of discarded undersized salmon in driftnet fishery	Others	2001-2007					0.02	0.006
Mortality of discarded undersized salmon in driftnet fishery	DK	2001-2007	EE, D	0.600	0.65	0.70	0.65	0.020
	FI	2001-2007	EE	0.500	0.67	0.80	0.66	0.061
Average mortality of discarded undersized salmon in driftnet fishery	Others	2001-2007					0.65	0.032
Share of undersized salmon in trapnet fishery (released back to sea)	FI	2001-2016	EE	0.010	0.03	0.05	0.03	0.008
		2017-2019	D	0.010	0.06	0.15	0.07	0.029
	SE	2001-2019	EE, D	0.010	0.03	0.05	0.03	0.008
Average share of discarded undersized salmon in trapnet fishery	Others	2001-2019					0.04	0.010
Mortality of discarded undersized salmon in trapnet fishery	FI	2001-2019	EE, D	0.100	0.20	0.50	0.27	0.085
	SE	2001-2017	EE, D	0.300	0.50	0.70	0.50	0.082
Average mortality of discarded undersized salmon in trapnet fishery	Others	2001-2019					0.38	0.059
Share of discarded sealdamaged salmon in longline fishery	FI	2001-2007	D	0.001	0.00	0.02	0.01	0.005
		2008-2012	D	0.001	0.03	0.06	0.03	0.012
	SE	2001-2012	EE, D	0.020	0.05	0.08	0.05	0.012
	DK	2001-2007	EE, D	0.001	0.03	0.05	0.03	0.010
		2008-2012	EE	0.001	0.05	0.10	0.05	0.020
		2013-2014	EE, D	0.050	0.15	0.30	0.17	0.051
		2015	EE	0.050	0.20	0.35	0.20	0.061
		2016-2019*)	D	0.050	0.20	0.45	0.33	0.101
	PL	2001-2012	D	0.001	0.01	0.02	0.01	0.004
		2013-2015	EE, D	0.050	0.25	0.65	0.32	0.126
		2016-2019	D	0.050	0.35	0.65	0.35	0.124
	Others	2001-2019					0.16	0.021
Share of discarded sealdamaged salmon in driftnet fishery and other open sea gillnet fishery (GNS in Poland)	DK	2001-2007	EE, D	0.001	0.03	0.05	0.03	0.010
	FI	2001-2007	D	0.010	0.02	0.04	0.02	0.006
	PL	2008-2012		0.001	0.01	0.02	0.01	0.004
		2013-2015	EE,D	0.050	0.25	0.65	0.32	0.125
		2016-2019	D	0.050	0.35	0.65	0.35	0.122
	Others	2001-2007					0.15	0.035
Share of discarded sealdamaged salmon in trapnet fishery	FI	2001-2019	D	0.050	0.09	0.15	0.10	0.021
	SE	2004-2017	EE, D	0.010	0.02	0.04	0.02	0.006
	Others	2001-2019					0.06	0.011

*) updated retrospectively (backwards) for years 2016-2017 in WGBAST 2019

Table 2.3.2. Estimated number of discarded undersized salmon and discarded seal damaged salmon by management unit in 2001-2019. Estimates of discarded undersized salmon are proportional to nominal cathes by the conversion factors (see Table 2.3.1). Estimates of seal damages age based partly on the logbook records (Finland and Sweden) and partly to the estimates proportional to nominal catches by conversion factors. Estimates should be considered as a magnitude of discards.

Management unit	Year	Discard undersized (dead)				Discard seal damaged				Total
		Driftnet	Longline	Trapnet	Other gears	Driftnet	Longline	Trapnet	Other gears	
		Disc_GND	Disc_LLD	Disc_TN	Disc_OT	Seal_GND	Seal_LLD	Seal_TN	Seal_OT	
SD22-31	2001	3129	11840	1148	578	8606	3323	5555	1034	35213
	2002	2213	12360	1231	577	6841	3804	5455	302	32783
	2003	2343	15720	1186	418	6954	4366	5233	1484	37703
	2004	2676	13400	1564	745	7621	4483	5529	1277	37295
	2005	1875	7862	1066	398	7648	3567	4166	560	27141
	2006	1235	5554	685	234	4472	2642	1997	1485	18304
	2007	1237	3487	701	205	3785	1854	3804	376	15449
	2008	13	814	982	308	0	1032	3178	559	6885
	2009	0	2768	1286	320	0	2938	2843	361	10515
	2010	0	3460	794	159	0	3764	2029	265	10470
	2011	0	2299	839	165	0	4349	1925	179	9756
	2012	0	1483	821	189	0	2495	2764	336	8088
	2013	0	972	729	176	0	6603	2781	227	11487
	2014	0	812	734	185	0	5586	2258	281	9856
	2015	0	752	709	206	0	5342	1530	488	9026
	2016	0	766	650	247	0	6297	1419	545	9923
	2017	0	730	890	285	0	5870	1640	271	9686
	2018	0	992	985	311	0	7940	1694	382	12303
	2019	0	194	932	369	0	1278	1734	466	4973
SD32	2001	3	59	109	86	3	56	2696	657	3669
	2002	10	64	63	90	71	170	2611	292	3372
	2003	2	9	74	60	19	29	3219	198	3610
	2004	3	5	75	46	40	7	3430	226	3832
	2005	3	7	104	62	24	36	1492	173	1900
	2006	5	2	118	53	89	4	1579	912	2763
	2007	3	3	121	33	41	5	1594	43	1844
	2008	0	9	163	43	0	23	1850	264	2353
	2009	0	5	132	60	0	1	1495	229	1922
	2010	0	2	59	24	0	3	826	63	977
	2011	0	2	82	24	0	0	790	66	964
	2012	0	1	120	38	0	0	818	157	1134
	2013	0	1	106	38	0	2	500	43	690
	2014	0	2	102	33	0	0	586	19	743
	2015	0	1	76	30	0	0	1059	200	1365
	2016	0	1	75	30	0	0	594	82	783
	2017	0	5	169	39	0	0	742	55	1010
	2018	0	3	150	40	0	0	437	25	654
	2019	0	2	231	37	0	0	794	43	1108

Table 2.3.3. Estimated number of seal damaged salmon, dead discard of undersized salmon, unreported salmon in sea and river fisheries and misreported salmon by management unit in 2001-2019. Estimates should be condsidered as order of magnitude.

	Sea fisheries							River fisheries	
	Seal damage		Discards (dead)		Unreported catch		Misreported catch	Unreported catch	
	median	90 % PI	median	90 % PI	median	90 % PI		median	90 % PI
SD22-31									
2001	23200	17700-23200	21400	14100-21400	76900	35100-76900	128600	16700	5000-16700
2002	20500	15700-20500	21100	13900-21100	77700	34500-77700	117200	14600	4600-14600
2003	22800	17000-22800	25500	16200-25500	71200	31200-71200	146000	11800	3800-11800
2004	24600	17700-24600	24600	15400-24600	97200	40200-97200	259300	12600	4200-12600
2005	19700	15700-19700	14400	9300-14400	69600	29200-69600	113000	15500	5200-15500
2006	13100	10500-13100	10000	6700-10000	47900	20200-47900	47800	10100	3100-10100
2007	12000	9700-12000	7500	5000-7500	44000	18900-44000	55400	12100	4000-12100
2008	5700	5000-5700	3100	1900-3100	42200	14600-42200	3400	22800	7600-22800
2009	8100	5900-8100	6700	4000-6700	58700	19800-58700	67800	16800	5700-16800
2010	8500	5400-8500	6500	3700-6500	41000	15800-41000	76300	9300	3400-9300
2011	8500	6400-8500	4500	2700-4500	42300	16200-42300	37700	10300	3700-10300
2012	7500	5400-7500	3500	2200-3500	30800	12300-30800	17900	25600	8700-25600
2013	12000	7800-12000	2700	1600-2700	25000	8600-25000	15300	20500	7200-20500
2014	10200	6600-10200	2400	1400-2400	17100	5700-17100	13900	20700	7500-20700
2015	9100	6300-9100	2300	1300-2300	12200	5000-12200	16900	24900	9100-24900
2016	9700	7200-9700	2300	1300-2300	12600	5100-12600	26500	25800	9600-25800
2017	9100	6500-9100	3100	1400-3100	10000	4000-10000	32600	17800	6300-17800
2018	11300	7700-11300	3600	1700-3600	11700	4700-11700	43400	19400	6800-19400
2019	3800	3300-3800	2700	1000-2700	9500	3600-9500	600	18900	7100-18900
SD32									
2001	4100	3500-4100	400	200-400	2100	600-2100		1300	500-1300
2002	3700	3300-3700	400	200-400	1500	500-1500		1800	500-1800
2003	4100	3600-4100	200	100-200	1400	400-1400		1000	300-1000
2004	4400	3900-4400	200	100-200	1300	400-1300		900	300-900
2005	2100	1800-2100	300	100-300	1800	500-1800		1600	500-1600
2006	3100	2700-3100	300	100-300	2100	500-2100		1100	400-1100
2007	2000	1800-2000	300	100-300	2000	500-2000		900	300-900
2008	2500	2200-2500	400	100-400	2700	600-2700		800	300-800
2009	2100	1800-2100	300	100-300	2200	600-2200		1300	400-1300
2010	1100	900-1100	100	100-100	1000	300-1000		500	200-500
2011	1000	900-1000	200	100-200	1300	300-1300		500	200-500
2012	1200	1000-1200	400	200-400	2000	500-2000		500	200-500
2013	700	600-700	500	300-500	1700	400-1700		600	200-600
2014	700	600-700	300	100-300	1700	400-1700		400	200-400
2015	1400	1300-1400	200	100-200	800	100-800		200	100-200
2016	700	700-700	200	100-200	700	100-700		400	200-400
2017	900	800-900	500	100-500	700	200-700		300	200-300
2018	500	500-500	400	100-400	700	100-700		300	100-300
2019	900	800-900	600	100-600	900	200-900		400	200-400

Table 2.3.3.1. Number salmon and sea trout in the catch of sampled Polish long-line vessels in 2009-2017 (SAL=salmon and TRS=sea trout). No sampling in 2018 and 2019.

SamplingType	Year	Month	Trip_id	SAL	TRS	% SAL
Sea sampling	2009	1	146	34	2	94%
			304	141	3	98%
		2	148	264	2	99%
			150	114	7	94%
			305	149	2	99%
			306	92	4	96%
			307	94	3	97%
	2009 Total			**888**	**23**	**97%**
	2010	2	1059	174	1	99%
			1222	509	0	100%
			1228	341	0	100%
		3	1223	102	2	98%
			1224	48	0	100%
	2010 Total			**1173**	**3**	**100%**
	2011	2	1287	81	0	100%
			1288	43	2	96%
		3	1650	169	0	100%
		11	1515	51	1	98%
		12	1528	78	0	100%
			1529	265	0	100%
	2011 Total			**687**	**3**	**100%**
	2012	1	1566	107	0	100%
		3	1639	89	0	100%
		12	1823	128	3	98%
			1827	36	1	97%
	2012 Total			**360**	**4**	**99%**
	2013	1	1830	70	0	**100%**
		1	1844	21	0	**100%**
		1	1845	50	1	**98%**
		1	1846	55	0	**100%**
		1	1877	84	1	**99%**
		2	1879	104	2	**98%**
		1	1880	46	1	**98%**
		1	1881	122	0	**100%**
		12	2076	37	3	**93%**
	2013 Total			**589**	**8**	**99%**
	2014 Total	1-12		**701**	**5**	**99%**
	2015 Total	1-12		**717**	**42**	**94%**
	2016 Total	1		**132**	**2**	**99%**
		2		**589**	**1**	**100%**
		3		**209**	**0**	**100%**
		10		**1**	**0**	**100%**
		12		**12**	**0**	**100%**
	2017 Total	1		**240**	**1**	**100%**
		2		**33**	**0**	**100%**
		3		**188**	**2**	**99%**
		4		**67**	**0**	**100%**
		12		**63**	**3**	**95%**
Sea sampling Total				**6058**	**91**	**99%**
Market sampling	2009	12	1034	35	1	97%
	2009 Total			**35**	**1**	**97%**
	2010	12	1271	20	0	100%
	2010 Total			**20**	**0**	**100%**
Market sampling Total				**55**	**1**	**98%**
Grand Total				**3163**	**34**	**99%**

Table 2.4.1 Fishing efforts in commercial Baltic salmon fisheries at sea and at the coast in 1987-2019 in subdivision 22-31 (excluding Gulf of Finland). The fishing efforts are expressed in number of geardays (number of fishing days times the number of gear) per year. The yearly reported total offshore effort refers to the sum of the effort in the second half of the given year and the first half of the next coming year (e.g., effort in second half of 1987 + effort in first half of 1988 = effort reported in 1987, etc.). The coastal fishing effort on stocks of assessment unit 1 (AU 1) refers to the total Finnish coastal fishing effort and partly to the Swedish effort in subdivision (SD) 31. The coastal fishing effort on stocks of AU 2 refers to the Finnish coastal fishing effort in SD 30, and partly to the Swedish coastal fishing effort in SD 31. The coastal fishing effort on stocks of AU 3 refers to the Finnish and Swedish coastal fishing effort in SD 30.

				AU 1		AU 2		AU 3	
Year	Offshore driftnet	Offshore longline	Commercial coastal driftnet	Commercial coastal trapnet	Commercial coastal other gear	Commercial coastal trapnet	Commercial coastal other gear	Commercial coastal trapnet	Commercial coastal other gear
1987	4036455	3710892	328711	71182	263256	43694	243511	42704	526101
1988	3456416	2390537	256387	84962	245228	55659	259404	58839	798038
1989	3444289	2346897	378190	68333	345592	41991	384683	40135	463067
1990	3279200	2188919	364326	111333	260768	71005	233540	68152	279610
1991	2951290	1708584	431420	103077	461053	70979	360360	73177	404327
1992	3205841	1391361	473579	115793	351518	68096	282674	61703	339384
1993	2155440	1041997	621817	119497	288245	76398	161474	79911	215710
1994	3119711	851530	581306	83936	194683	59488	210927	55256	205848
1995	1783889	932314	452858	70670	152529	44607	147259	42165	141905
1996	1288081	1251637	78686	58266	100409	42055	92606	29029	90245
1997	1723492	1571003	118207	63102	107432	44605	81923	34095	84639
1998	1736495	1148336	112393	28644	8391	20204	5449	15771	5221
1999	1644171	1868796	126582	43339	9325	31845	5715	20889	5071
2000	1877308	2007775	107008	34934	8324	23384	5587	20397	5371
2001	1818085	1811282	102657	40595	3879	23743	2661	34886	2514
2002	1079893	1828389	86357	46474	3778	30333	3251	31389	3153
2003	1329494	1439370	95022	47319	8903	27060	7138	37614	9984
2004	1344588	792737	103650	41570	4315	28219	1610	25828	2278
2005	1378762	1099118	84223	45002	5886	33683	4914	30075	5844
2006	1177402	695597	77915	33817	4196	24374	3546	19487	5486
2007	413622	639638	45557	35406	4298	23920	2888	21790	4602
2008	0	1980394	0	27736	10252	16434	3917	25959	5226
2009	0	2135367	0	32676	7062	24174	5149	15718	5411
2010	0	2639116	0	34040	4192	25399	2393	17405	2487
2011	0	1441613	0	27927	3625	18347	2768	15788	3067
2012	0	667347	0	21309	2911	11714	1539	10355	1551
2013	0	1176124	0	20619	3177	13734	2488	11277	2478
2014	0	800824	0	20782	3608	16234	3121	9084	3135
2015	0	1262088	0	16463	3214	11279	2498	7820	2578
2016	0	1506037	0	15931	5701	9068	4154	8565	4813
2017	0	1105411	0	15068	5278	9498	4622	9399	4626
2018	0	377379	0	15028	4964	8909	4572	8917	4553
2019	0	359469	0	10268	5958	5864	5498	6785	5546

Table 2.4.2. For the commercial out at sea longline salmon fisheries: Effort in hook days (number of hooks x number of days) 2014-2019. The yearly reported effort in longline salmon fisheries refers to the sum of the effort in the given year. And when available, effort in days per ship by country and area (Sub-divisions 22-31 and Sub-division 32), where number of fishing days divided in 5 groups, 1-9 fishing days, 10-19 fishing days, 20-39 fishing days, 40-59 fishing days and 60-80 fishing days. CPUE expressed as number of salmon caught per 1000 hooks.

Year	Area	Country	Effort in hook days	CPUE	Effort in days per ship						Comments
					60-79	40-59	20-39	10-19	1-9	Total	
					Number of fishing vessels						
2014	Sub-divisions 22-31	Denmark	173,540	121.6	1	6	5	3	3	18	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	8,213	13.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	0	0	0	0	0	0	0	0	
		Lithuania	0	0	0	0	0	0	0	0	
		Poland	811,786	2.8	0	4	5	2	31	42	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	10,319	8.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Sub-divs 22-32	**Total**	1,003,858		1	10	10	5	34	60	
2015	Sub-divisions 22-31	Denmark	132,860	119.1	3	4	1	3	7	18	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	15,470	15.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	n.a.	n.a.	0	0	0	1	0	0	reported catch, but no information on effort
		Lithuania	0	0	0	0	0	0	0	0	
		Poland	727,889	3.6	0	5	4	7	28	44	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	6,390	7.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Sub-divs 22-32	**Total**	882,609		3	9	5	11	35	62	
2016	Sub-divisions 22-31	Denmark	151,860	63.9	1	1	2	2	7	13	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	16,233	14.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	0	0	0	0	0	0	0	0	
		Lithuania	0	0	0	0	0	0	0	0	
		Poland	1,054,021	2.1	0	3	9	12	29	53	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	6,820	7.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Sub-divs 22-32	**Total**	1,228,934		1	4	11	14	36	66	
2017	Sub-divisions 22-31	Denmark	90,320	33.6	1	0	3	0	8	12	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	0	0	0	0	0	0	0	0	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	0	0	0	0	0	0	0	0	
		Lithuania	0	0	0	0	0	0	0	0	
		Poland	1,439,987	2.8	0	6	8	9	70	93	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	0	0	0	0	0	0	0	0	
	Sub-divs 22-32	**Total**	1,530,307		1	6	11	9	78	105	
2018	Sub-divisions 22-31	Denmark	96,020	49.7	1	0	2	2	3	8	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	3,370	19.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	n.a.	n.a.	0	0	0	2	0	0	reported catch, but no information on effort
		Lithuania	14,000	16.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Poland	980,764	5.1	0	3	15	18	56	92	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	9,263	12.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Sub-divs 22-32	**Total**	1,103,417		1	3	17	22	59	100	
2019	Sub-divisions 22-31	Denmark	76,550	50.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Estonia	0	0	0	0	0	0	0	0	
		Finland	1,420	7.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
		Germany	0	0	0	0	0	0	0	0	
		Latvia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	reported catch, but no information on effort
		Lithuania	38,000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	data on number of salmon not available
		Poland	181,029	11.8	0	0	2	7	60	69	
		Russia	0	0	0	0	0	0	0	0	
		Sweden	0	0	0	0	0	0	0	0	
	Sub-div. 32	Estonia	0	0	0	0	0	0	0	0	
		Finland	5,642	16.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
	Sub-divs 22-32	**Total**	302,641		0	0	2	7	60	69	

Table 2.4.3. Trapnet effort and catch per unit of effort in number of salmon caught in trapnets in the Finnish fisheries in Subdivision 32 (CPUE in number of salmon per trapnetday) 1988–2019.

	Effort	CPUE
1988		0.70
1989		1.00
1990		1.60
1991		1.50
1992		1.50
1993		1.40
1994		0.90
1995		1.20
1996		1.30
1997		1.50
1998		1.30
1999		1.30
2000	12866	0.90
2001	9466	0.90
2002	5362	1.00
2003	8869	0.70
2004	7033	0.90
2005	7391	1.10
2006	7917	1.20
2007	9124	1.10
2008	9902	1.30
2009	9413	1.10
2010	9161	0.50
2011	10818	0.60
2012	11119	0.90
2013	12062	0.70
2014	11199	0.70
2015	9861	0.60
2016	9094	0.70
2017	7614	0.70
2018	6328	0.80
2019*)	4782	1.70

*) preliminary

Table 2.6.1. List of Baltic salmon river stocks included in the genetic baseline database (17 microsatellites) used to produce stock proportion estimation of catches.

	Salmon riverstocks	Sampling year	Propagation	N
1	Tornionjoki, W	2011	Wild	210
2	Tornionjoki, H	2006, 2013	Hatchery	187
3	Simojoki	2006, 2009, 2010	Wild	174
4	Iijoki	2006, 2013	Hatchery	179
5	Oulujoki	2009, 2013	Hatchery	135
6	Kalixälven	2012	Wild	200
7	Råneälven	2003, 2011	Wild	150
8	Luleälven	2014	Hatchery	90
9	Piteälven	2012	Wild	53
10	Åbyälven	2003, 2005	Wild	102
11	Byskeälven	2003	Wild	105
12	Kågeälven	2009	Wild	44
13	Skellefteälven	2006, 2014	Hatchery	58
14	Rickleå	2012, 2013	Wild	52
15	Säverån	2011	Wild	74
16	Vindelälven	2003	Wild	149
17	Umeälven	2006, 2014	Hatchery	87
18	Öreälven	2003, 2012	Wild	54
19	Lögdeälven	1995, 2003, 2012	Wild	102
20	Ångermanälven	2006, 2014	Hatchery	79
21	Indalsälven	2006, 2013	Hatchery	144
22	Ljungan	2003, 2014	Wild	101
23	Ljusnan	2013	Hatchery	123
24	Testeboån	2014	Wild	104
25	Dalälven	2006, 2014	Hatchery	98
26	Emån	2003, 2013	Wild	148
27	Mörrumsån	2010, 2011, 2012	Wild	185
28	Neva, Fi	2006	Hatchery	149

	Salmon riverstocks	Sampling year	Propagation	N
29	Neva, Rus	1995	Hatchery	50
30	Luga	2003, 2011	Wild, Hatchery	147
31	Narva	2009	Hatchery	109
32	Kunda	2009, 2013	Wild, Hatchery	170
33	Keila	2013	Wild	63
34	Vasalemma	2013	Wild	60
35	Salaca	2007, 2008	Wild	46
36	Gauja	1998	Hatchery	70
37	Daugava	2011	Hatchery	170
38	Venta	1996	Wild	66
39	Neumunas	2002–2010	Hatchery	166
	Total			4453

Table 2.6.2. Prior proportion of 1–2 year old smolts in the baseline stocks used for Baltic salmon catch composition analysis for the 2019 catches.

Smolt age frequencies of the 1-2 year old smolts in the salmon baseline data.					
River stock	Smolt age	2.50%	Median	97.50%	Years
Tornionjoki, W	1-2 years	3.0	4.2	5.7	2016–2018
Tornionjoki, H	1-2 years	99.8	100.0	100.0	All
Simojoki	1-2 years	43.0	49.9	57.3	2016, 2018
Iijoki	1-2 years	99.8	100.0	100.0	All
Oulujoki	1-2 years	99.8	100.0	100.0	All
Kalixälven	1-2 years	2.5	4.1	6.1	2016–2018
Råneälven	1-2 years	1.6	4.5	9.6	2016–2018
Luleälven	1-2 years	99.8	100.0	100.0	All
Piteälven	1-2 years	16.6	20.0	23.8	All
Åbyälven	1-2 years	22.0	30.2	40.0	All
Byskeälven	1-2 years	22.4	30.7	39.5	All
Kågeälven	1-2 years	21.8	30.3	39.8	All
Skellefteälven	1-2 years	99.8	100.0	100.0	All
Rickleå	1-2 years	19.7	25.2	31.8	All
Säverån	1-2 years	19.6	25.1	31.8	All
Vindelälven	1-2 years	30.7	37.0	43.6	All
Umeälven	1-2 years	99.8	100.0	100.0	All
Öreälven	1-2 years	14.4	21.6	29.4	All
Lögdeälven	1-2 years	21.2	29.4	38.4	All
Ångermanälven	1-2 years	99.8	100.0	100.0	All
Indalsälven	1-2 years	99.8	100.0	100.0	All
Ljungan	1-2 years	27.8	37.4	46.4	All
Ljusnan	1-2 years	99.8	100.0	100.0	All
Testeboån	1-2 years	28.8	37.1	46.4	All
Dalälven	1-2 years	99.8	100.0	100.0	All
Emån	1-2 years	92.8	97.1	99.3	All
Mörrumsån	1-2 years	92.9	97.0	99.3	All

Smolt age frequencies of the 1-2 year old smolts in the salmon baseline data.					
River stock	Smolt age	2.50%	Median	97.50%	Years
Neva, Fi	1-2 years	99.8	100.0	100.0	All
Neva, Rus	1-2 years	85.9	90.0	93.3	All
Luga	1-2 years	92.8	96.1	98.1	All
Narva	1-2 years	99.8	100.0	100.0	All
Kunda	1-2 years	97.7	99.0	99.7	All
Keila	1-2 years	97.9	99.0	99.6	All
Vasalemma	1-2 years	97.8	99.0	99.6	All
Salaca	1-2 years	97.9	99.0	99.7	All
Gauja	1-2 years	99.8	100.0	100.0	All
Daugava	1-2 years	99.8	100.0	100.0	All
Venta	1-2 years	99.8	100.0	100.0	All
Neumunas	1-2 years	99.8	100.0	100.0	All

Table 2.6.3. Medians and probability intervals of stock group proportion estimates (%) in Finnish salmon catch samples from the Gulf of Bothnia separately for the dates according to the previous fishing season before 2017 from years 2009 to 2019 and for the advanced, early summer catches from 2017 to 2019, based DNA-microsatellite and smolt age-class information. Samples from the "Finnish advanced fishing season" are indicated as F_Adv. and previous season as F. (see text for details).

	GoB, WILD	2.5 %	97.5 %	GoB, HATC, FIN	2.5 %	97.5 %	GoB, HATC, SWE	2.5 %	97.5 %	Others	2.5 %	97.5 %	Sample size	Scale reading - wild %
Gulf of Bothnia Finnish catch														
2019$^{F_Adv.}$	**75**	70	81	**24**	19	30	**0**	0	0	**0**	0	0	**312**	-
2018$^{F_Adv.}$	**79**	71	86	**20**	13	29	**0**	0	1	**0**	0	1	**156**	-
2017$^{F_Adv.}$	**83**	76	88	**17**	11	23	**0**	0	1	**0**	0	2	**246**	-
Mean^{F_Adv}.	**79**	72	85	**20**	15	27	**0**	0	1	**0**	0	1	**714**	
2019^{F}	**72**	67	76	**27**	23	31	**1**	0	0	**0**	0	0	**506**	-
2018^{F}	**66**	58	72	**27**	20	34	**7**	4	11	**0**	0	1	**235**	-
2017^{F}	**61**	55	66	**38**	33	44	**1**	0	3	**0**	0	0	**397**	-
2016^{F}	**70**	64	75	**26**	21	32	**4**	2	7	**0**	0	1	**307**	64
2015^{F}	**69**	62	76	**28**	21	35	**3**	1	6	**0**	0	1	**219**	64
2014^{F}	**82**	77	86	**18**	14	23	**0**	0	1	**0**	0	1	**319**	76-77
2013^{F}	**59**	52	66	**39**	33	46	**0**	0	3	**0**	0	2	**220**	54-55
2012^{F}	**62**	54	69	**36**	29	43	**2**	1	5	**0**	0	1	**212**	54-55
2011^{F}	**78**	71	83	**21**	16	28	**1**	0	2	**0**	0	1	**220**	70
2010^{F}	**76**	69	82	**23**	18	30	**0**	0	2	**0**	0	1	**215**	68
2009^{F}	**66**	58	73	**32**	25	39	**2**	1	5	**0**	0	1	**252**	55
Mean^{F}	**69**	63	75	**29**	23	35	**2**	1	4	**0**	0	1	**3102**	

Table 2.6.4. Medians and probability intervals of stock group proportion estimates (%) in Finnish salmon catch samples from the Gulf of Bothnia for the three temporal fishing regulation zones as pooled estimate over three years (2017–2019) for the previous fishing season and advanced fishing season separately, based on DNA-microsatellite and smolt age-class information.

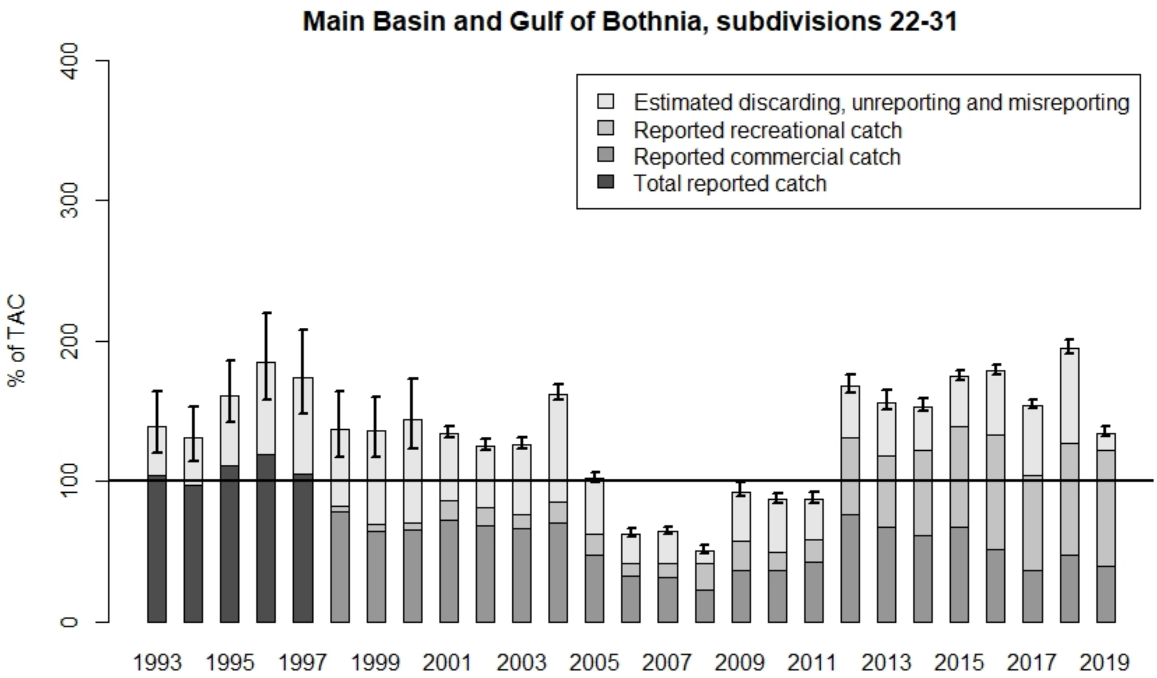
Sea area	Starting date	Finishing date	GoB, WILD	2.5 %	97.5 %	GoB, HATC, FIN	2.5 %	97.5 %	GoB, HATC, SWE	Others	Sample size
Advanced fishery											
Bothnian Sea	15.5.	9.6.	76	66	86	23	14	33	0	0	283
Quark area	21.5.	16.6.	77	66	87	22	12	33	0	0	218
Bothnian Bay North	9.6.	24.6.	86	78	92	13	8	22	0	0	213
Total			80	70	88	19	11	29	0	0	714
Normal season											
Bothnian Sea	10.6.	17.7.	63	53	72	33	24	42	4	0	400
Quark area	16.6.	22.7.	72	64	80	25	18	33	2	0	477
Bothnian Bay N	25.6.	27.7.	61	51	71	38	29	48	0	0	428
Total			66	56	74	32	23	41	2	0	1305

Table 2.6.5. Medians of individual river-stock proportion estimates in Finnish salmon catches from the Gulf of Bothnia for the catches from the previous, late season (2009–2019) and the advanced season (2017–2019) separately.

Year/fishery	Tornionj.Wild	Tornionj. Hatch.	Simojoki, W	Iijoki, H	Oulujoki, H	Kalixälven, W	Råne, W	Luleälven, H	Piteälven, W	Åbyälven, W	Byskeälven, W	Kågeälven, W	Skellefteälven, H	Ricleå, W	Sävarån, W	Vindelälven, W	Sample size
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Gulf of Bothnia, Finnish catch																	
2019^{F_Advanced}	53	5	2	18	1	18	0	0	0	0	0	0	0	0	0	0	312
2018^{F_Advanced}	53	2	4	17	0	21	0	0	0	0	0	0	0	0	0	0	156
2017^{F_Advanced}	49	9	7	7	0	25	0	0	0	0	0	0	0	0	0	0	246
Mean advanced season	**52**	5	4	**14**	0	**21**	0	0	0	0	0	0	0	0	0	0	714
2019^{F}	49	9	2	14	4	18	0	0	0	1	0	0	0	0	0	1	506
2018^{F}	54	8	1	15	3	9	0	7	0	0	0	0	0	0	0	0	235
2017^{F}	43	13	2	17	8	13	0	1	0	0	0	0	0	0	0	0	397
2016^{F}	55	0	2	9	17	8	0	3	1	0	0	2	0	0	0	0	307
2015^{F}	48	5	2	13	9	18	0	2	0	0	0	0	0	0	0	1	219
2014^{F}	45	0	3	7	11	30	0	0	0	0	0	3	0	0	0	0	319
2013^{F}	32	0	5	17	21	18	0	0	0	0	3	-	0	0	0	0	220
Mean late season	**47**	5	2	**13**	**10**	**16**	0	2	0	0	0	1	0	0	0	0	2203

Table 2.6.6. Medians of individual river-stock proportion estimates in Finnish salmon catches from the Gulf of Bothnia from three temporal fishing regulation zones as pooled estimate over three years (2017–2019), both for the dates according to the previous fishing season and for the advanced fishing season separately, based on DNA-microsatellite and smolt age-class distribution information.

Sea area	Starting date	Finishing date	Sample size	Tornionj. Wild	Tornionj. Hatch.	Simojoki, W	Iijoki, H	Oulujoki, H	Kalixälven, W	Råne, W	Luleälven, H	Piteälven, W	Åbyälven, W	Byskeälven, W	Kågeälven, W	Skellefteälven, H	Ricleå, W	Sävarån, W	Vindelälven, W
Advanced fishery																			
Bothnian Sea	15.5.	9.6.	283	46	7	4	14	0	24	0	0	0	0	0	0	0	0	0	0
Quarq area	21.5.	16.6.	218	42	4	4	16	1	27	0	0	0	0	0	0	0	0	0	0
Bothnian Bay North	9.6.	24.6.	213	49	4	4	9	0	32	0	0	0	0	0	0	0	0	0	0
Total			714	45	5	4	13	0	27	0	0	0	0	0	0	0	0	0	0
Normal, late season																			
Bothnian Sea	10.6.	17.7.	400	39	18	1	9	4	19	0	3	0	0	0	0	0	0	0	1
Quarq area	16.6.	22.7.	477	52	2	3	18	4	15	0	2	0	0	0	0	0	0	0	0
Bothnian Bay N	25.6.	27.7.	428	51	18	0	15	4	8	0	0	0	0	0	0	0	0	0	0
Total			1305	47	13	1	14	4	14	0	2	0	0	0	0	0	0	0	0



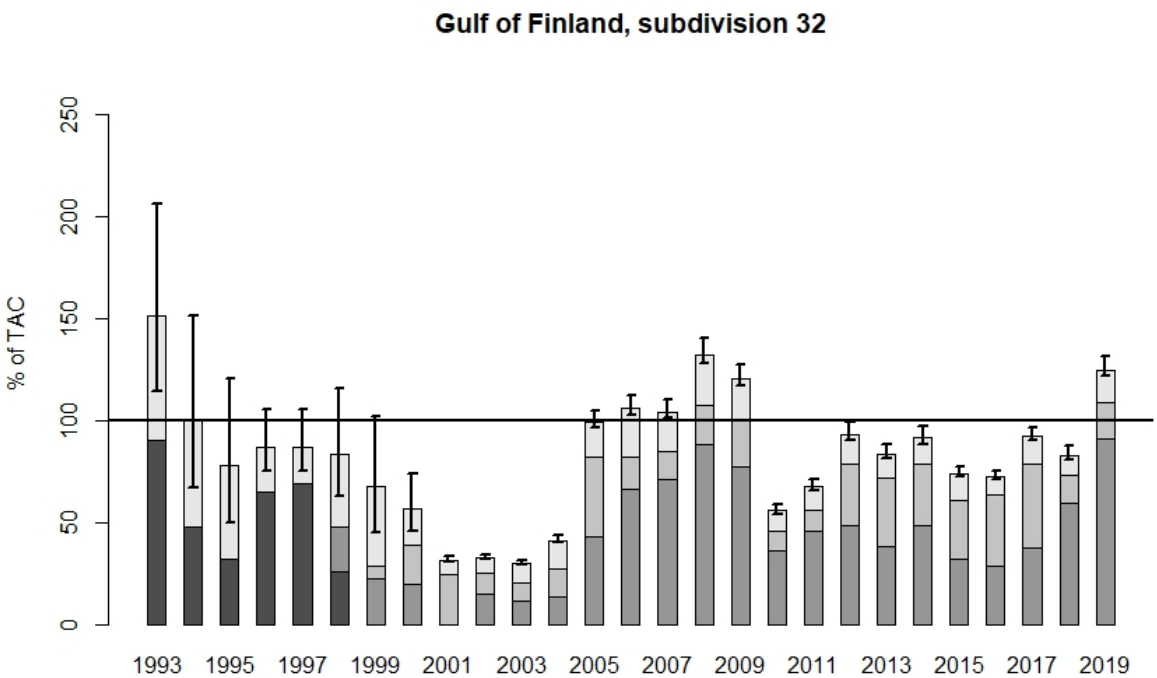


Figure 2.2.1.1. Catches of salmon in % of TAC in 1993–2019. For years 1993–1997 (1993–1998 for Gulf of Finland) it is not possible to divide the total reported catch into commercial and recreational catches. Estimates of discards and unreported catches are presented separately in Table 2.2.2.

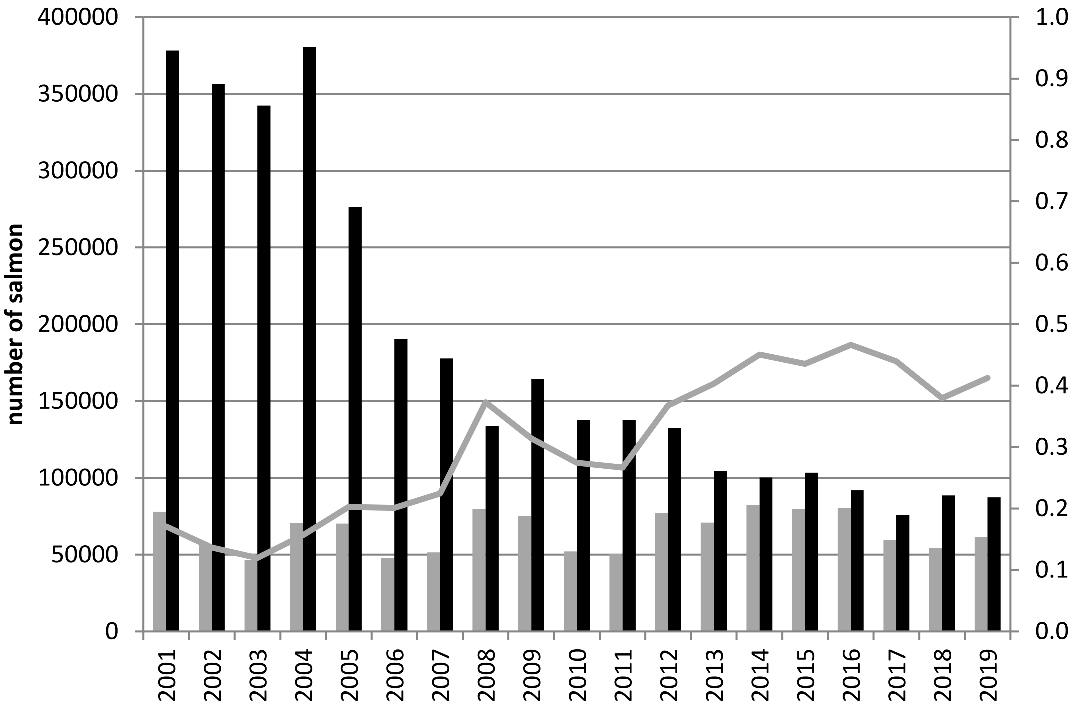


Figure 2.2.1.2. Commercial (black columns) and recreational (grey columns) catches of salmon in numbers in years 2000–2019 for subdivisions 22–32. The recreational catch proportion of the total catch (commercial and recreational) is shown for the same time period (grey line). The recreational catches include all components (river, coastal and sea), also the expert opinion trolling estimates depicted in Figure 2.2.1.3.

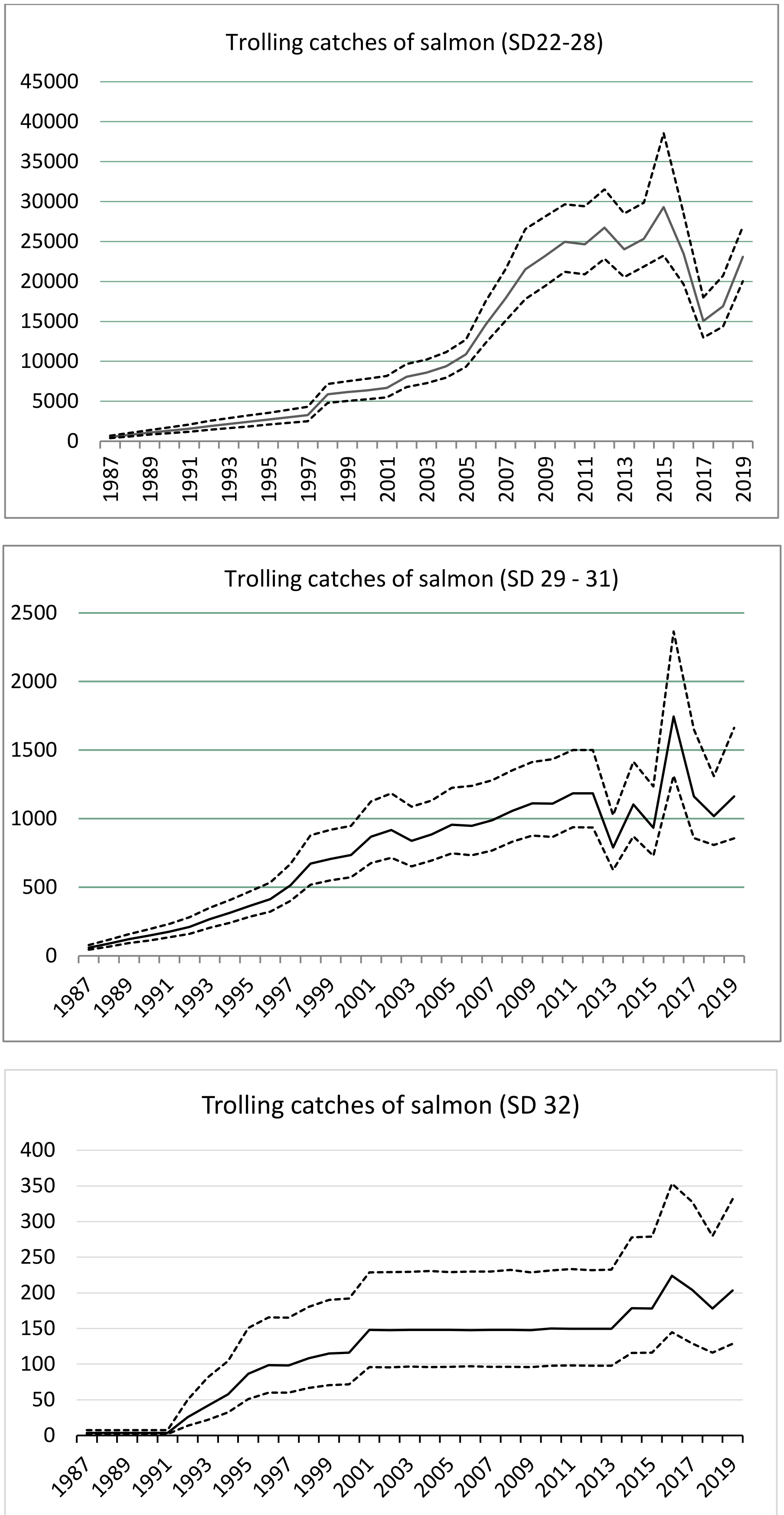


Figure 2.2.1.3. Combined expert estimates of total trolling catches in numbers (including retained fish and a 25% post-release mortality for released fish) for Baltic salmon, 1987–2019 (medians with 95% p.i.).

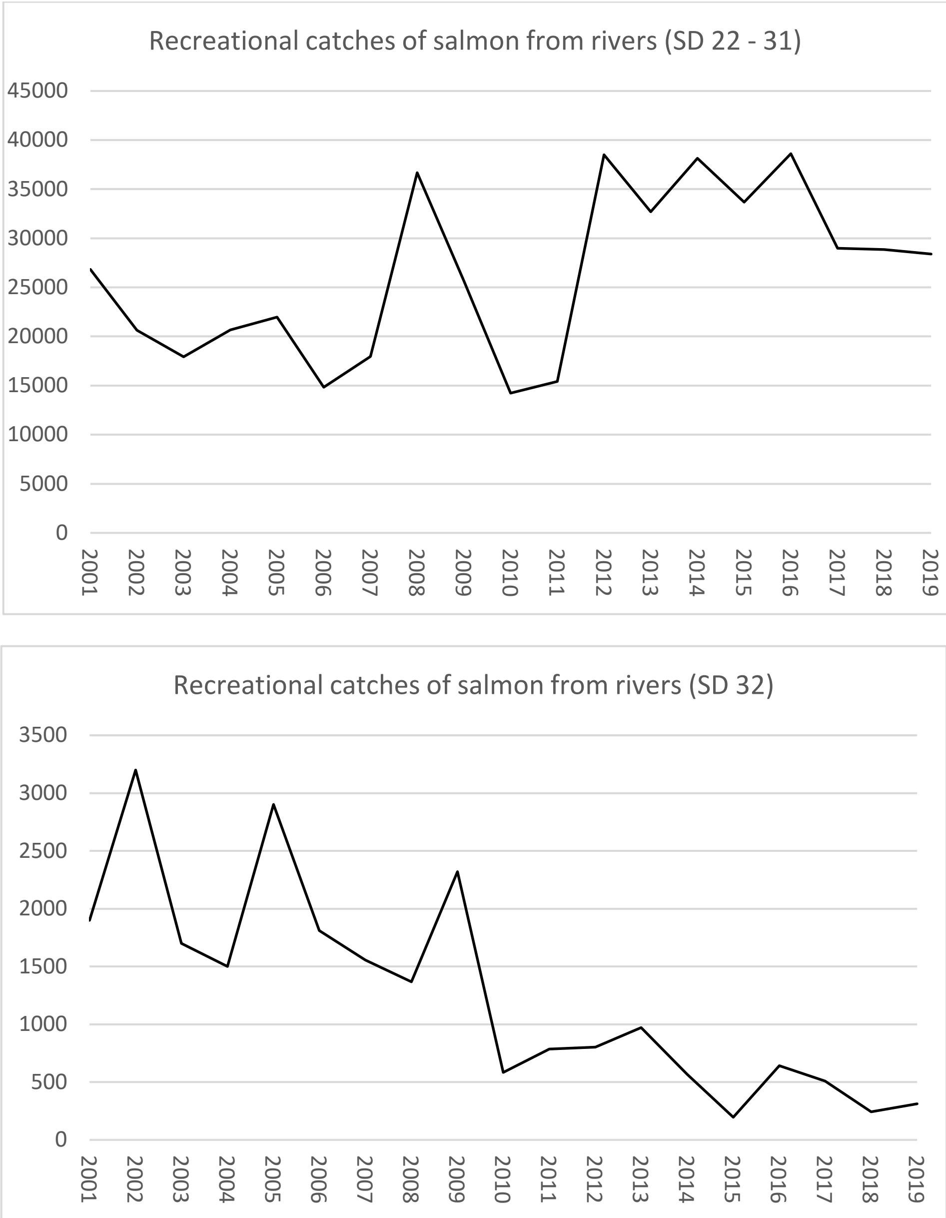


Figure 2.2.1.4. Recreational river catches for Baltic salmon, 2001–2019 (SD 22–31 and SD 32). Catch in numbers.

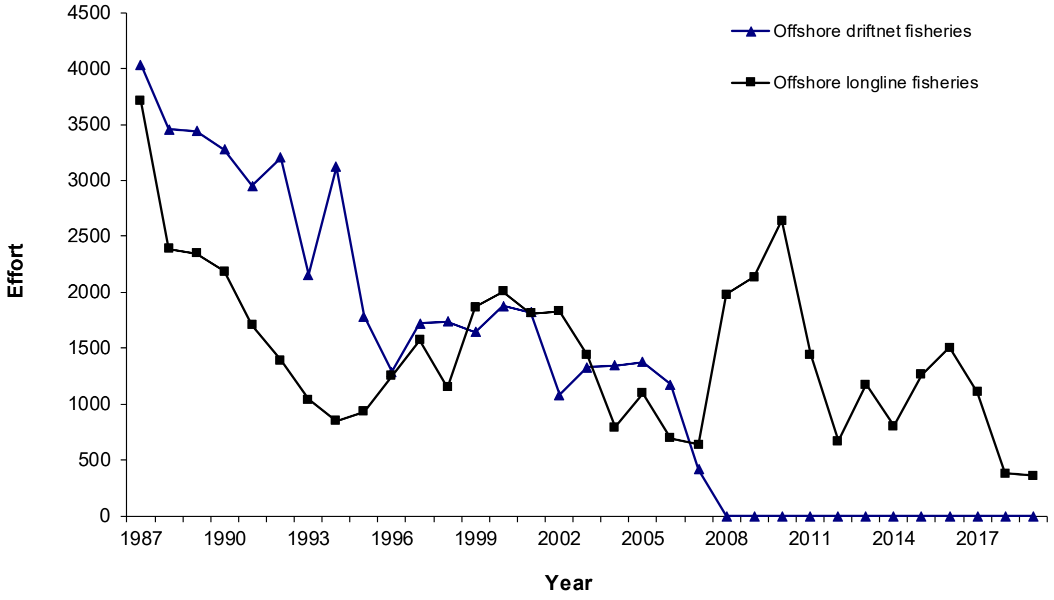


Figure 2.4.1. Fishing effort in Main Basin offshore fisheries (x 1000 gear days) in 1987–2019.

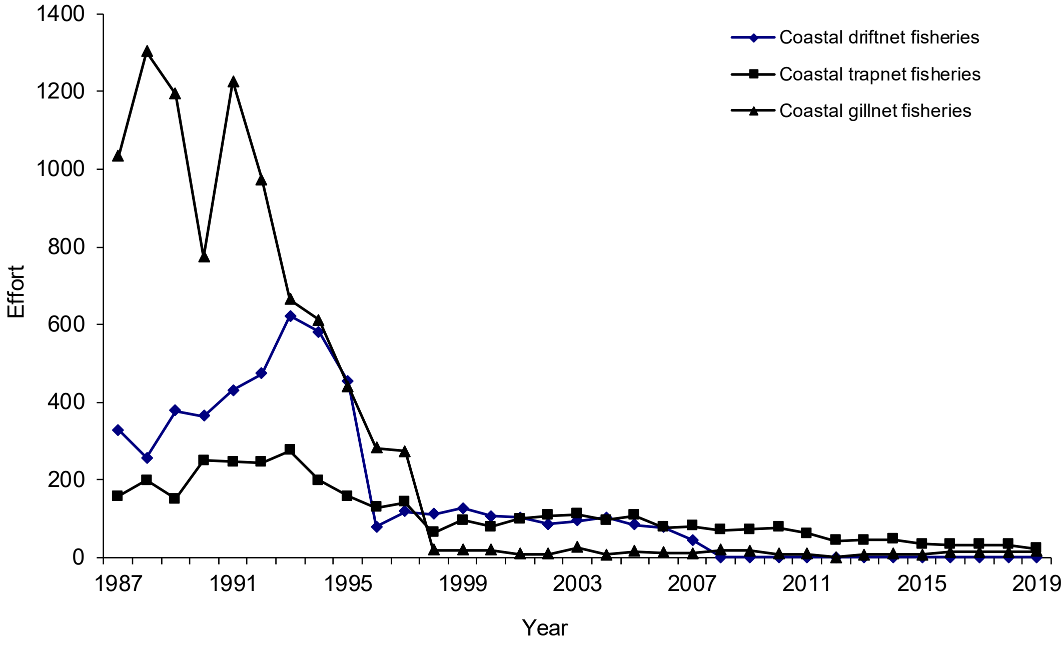


Figure 2.4.2. Effort in Main Basin and Gulf of Bothnia coastal fisheries (x 1000 gear days) in 1987–2019.

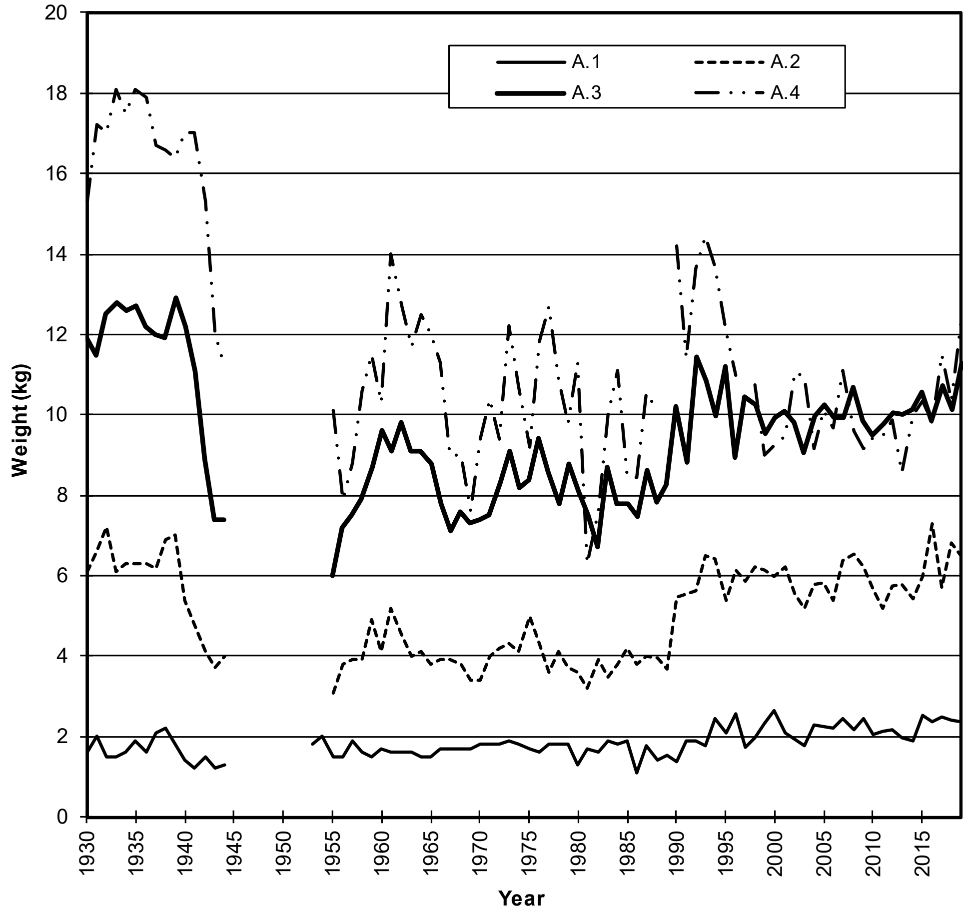


Figure 2.5.2.1. Mean weight of spawners in the Gulf of Bothnia by year. Values in 1930–1944 from catch statistics in the Rivers Oulu and Torne. Values in 1953–1985 are from Swedish tagging records and in 1986–2019 from the Finnish catch sampling data. Weights of A.4 salmon based on sampling performed 1953–2019 (where smaller sample sizes some of the years).

GENETIC DISTANCES BETWEEN SALMON BASELINE STOCK SAMPLES

Figure 2.6.1. Neighbour joining dendrogram (based on Nei's pairwise DA genetic distances) depicting genetic relationships among salmon baseline samples used for catch analysis. Numbers represent percentage support values based on 1000 bootstraps.

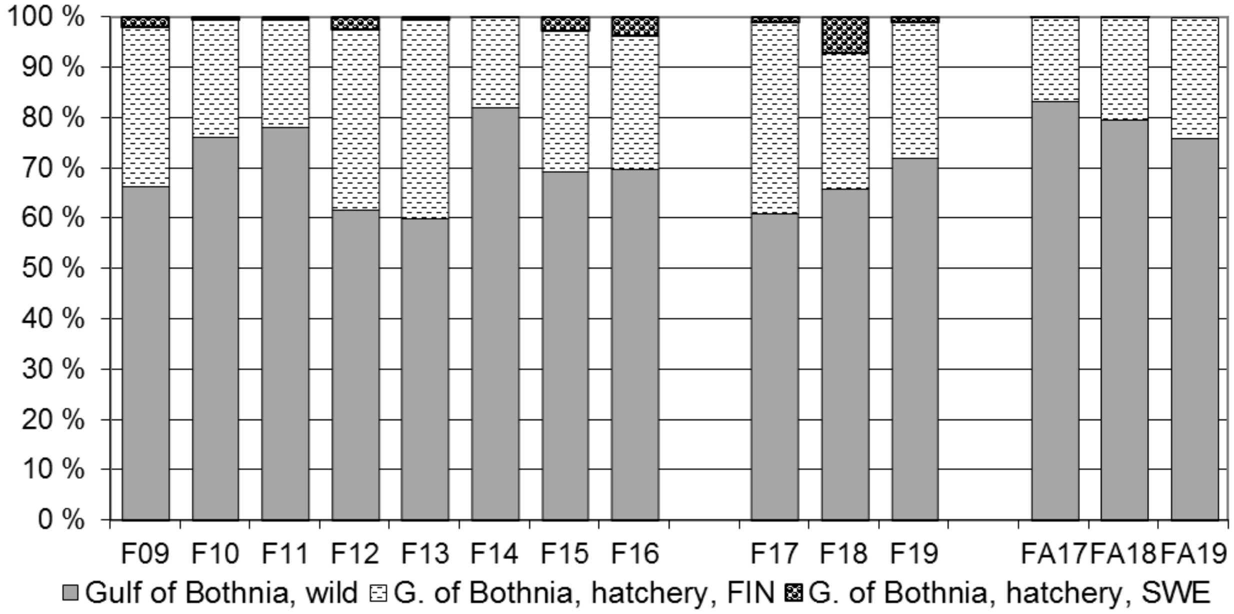


Figure 2.6.2. Proportions of salmon stock groups in Finnish salmon catches in the Gulf of Bothnia from 2009 to 2019. The catches from the advanced fishing season in 2017, 2018 and 2019 are analysed separately (FA2017, FA2018 and 2019).

3 River data on salmon populations

The Baltic salmon rivers are divided into four main categories: **wild**, **mixed**, **reared** and **potential**. Details on how rivers in countries and assessment units (AUs) are classified into these four river categories are given in the Stock Annex (Annex 2). At present there are 58 salmon rivers out of which 27, 14 and 17 are considered as wild, mixed (i.e. with both natural and reared production) and reared, respectively. In addition, it currently exist 21 potential salmon rivers in five countries (Section 3.2).

Over the years, some rivers have received altered status and further changes are likely to occur in the future. For example, in 2013 and 2014 the formerly potential salmon rivers **Testeboån** (AU 3) and **Kågeälven** (AU 2) in Sweden received status as wild, as they had fulfilled criteria previously set up by WGBAST (ICES, 2008c). Among the 14 rivers currently classified as mixed, the present level of salmon releases in Estonian rivers **Pirita** and **Väänä** (AU 6) are already close to the threshold of less than 10% reared smolt production adopted by WGBAST as a criteria for wild rivers (Annex 2, Table A.1.2.1). Hence, if stocking would be further reduced or stopped, these rivers could become candidates for receiving wild status by WGBAST. Conversely, the previously wild river **Pärnu** in Estonia (AU 5) was listed in 2018 as mixed, because of an ongoing restoration programme that includes substantial annual releases of hatchery-reared juveniles (ICES, 2018a; 2018b). In the coming years, WGBAST plans to review its criteria and update the list of wild, mixed, and potential salmon rivers, according to river specific information, new studies and internationally recognized recommendations.

3.1 Wild salmon populations in Main Basin and Gulf of Bothnia

Current wild salmon rivers in Main Basin and Gulf of Bothnia are listed per country and assessment unit in the Stock Annex (Annex 2).

3.1.1 Rivers in assessment unit 1 (Gulf of Bothnia, SD 31)

River catches and fishery

In 2012, the catch in **Tornionjoki** was three times higher than in 2011 and for the first time since the beginning of the time-series with annual catch statistics, it exceeded 100 tonnes (Table 3.1.1.1). In 2014, the catch increased to 147 tonnes, and in 2016 it reached the present record of 161 tonnes (Table 3.1.1.1).). In 2017 and 2018, the catch again declined to around 90 tonnes, but in 2019, it increased again and was 111 tonnes.). In 2017 and 2018, the catch again declined to around 90 tonnes, but in 2019 it increase again and was 111 tonnes. Catch levels similar to those observed in 2012–2019 were observed in the early 20th century (Figure 3.1.1.1). Salmon catches in **Simojoki** did not rise much in 2012–2013, which is partly due to a low fishing effort. However, in 2014 and 2015 there was a clear increase in the catch and the rising trend continued until 2016, when the catch was 1.8 tonnes (Table 3.1.1.1).). As in Tornionjoki, 2017 catches dropped also in Simojoki, and they have been between 0.5–1 tonnes in 2017–2019. The catches in **Kalixälven** have decreased in later years, mostly depending on not functional catch reporting system and they do not correspond to the registered number of salmon that have passed the fishway, totally 250 salmon were caught and out of which 100 were retained.

A special kind of fishing from boat (rod fishing by rowing) dominates the salmon fishing in **Tornionjoki.** This type of fishing also occurs in **Kalixälven,** but there it is not as dominating as in

Tornionjoki. CPUE of this fishery in Tornionjoki has increased tens of times since the late 1980s (Table 3.1.1.1), apparently reflecting the parallel increase in the abundance of spawners in the river. The CPUE has been high (over 1000 grams/fishing day) in 1997, 2008 and 2012–2016, when the total river catches were also peaking. In 2017 CPUE dropped to 860 g/day. In 2018, it increased to 1200 g/day and in 2019 the CPUE was 970 g/day. Annual changes in CPUE and in total river catch generally follow each other. However, in 2019 the CPUE was exceptionally low compared to the total catch.

In **Råneälven,** the local administration has since 2014 utilized a seasonal catch bag limit regulation of maximum of three salmon per person and season. Both obligatory tagging of killed fish (maximum of three tags per person and year) and a digital catch reporting system has been utilized to aid in enforcement. Most (80–90%) of the salmon caught with rod are released back; in 2017, a total of 56 salmon were caught, out of which 45 were released, whereas in 2018 only two salmon were caught and tagged (retained). The catch in 2019 was 45 salmon out of which seven were tagged and retained.

Spawning runs and their composition

In **Kalixälven** salmon are counted in the fishway at the waterfall in Jockfall about 100 km from the river mouth. From 2007 to 2012, the mean annual run was 5500 salmon. In 2013, the run increased to the highest observed when more than 15 000 salmon passed the fishway. The counted runs in 2014–2018 stayed at a lower level (between 5000–8000 salmon). In 2019, nearly 10 000 were registered in the fish counter (Table 3.1.1.2). Yearly very few reared (adipose finclipped) salmon has been registered in the fish counter. Between 2015 to 2018, no reared salmon was registered in the counter. In 2019, six reared salmon was registered of 9957 salmon which results in very low proposion of strayers.

A hydro-acoustic split-beam technique was employed in 2003–2007 to count the spawning run in **Simojoki**. It seems evident that these counts covered only a fraction of the total run, as there are irregularities in the river bottom at the counting site, allowing salmon to pass without being recorded. Since 2008, the split-beam technique has been replaced by an echo sounder called DIDSON (Dual frequency IDentification SONar). According to monitoring results, the seasonal run size has ranged from less than 1000 up to more than 5000 fish (Table 3.1.1.2). Spawning runs gradually increased from 2004 to 2008–2009, but again dropped in 2010–2011. In 2012, the run increased fourfold from the previous year (to about 3000) and also the runs in 2013–2015 were about as abundant (3000–4000 salmon). The 2016 run was record-high with 5400 salmon counted. In 2017, the run dropped below 2000 salmon but increased in 2018 and 2019 to about 4000 salmon/year (Table 3.1.1.2). A lot of back-and-forth movement of salmon has been detected in Simojoki, especially in 2018, which erodes the accuracy of the counts. There have also been problems connected to the separation of species.

The spawning runs into **Tornionjoki** have also been monitored using the DIDSON technique since 2009, but in 2019, the already fairly old DIDSON units were replaced by the next generation version of DIDSON, i.e. ARIS sonars. The observed seasonal run size has ranged from 17 200 (year 2010) to 100 200 (year 2014) salmon (Table 3.1.1.2). Grilse account for a minority (7–24%) of the annual spawning runs. The run size in 2016 (98 300 salmon) was almost as high as in the record year 2014 (101 000 salmon), but as in the Simojoki, the run again dropped in 2017 (to about 41 000 salmon). In 2018 the counted amount increased only slightly (to 47 000 salmon), but in 2019 the total count increased further, to 65 500 salmon.

The Tornionjoki counting site is located about 100 km upstream from the river mouth. Therefore, salmon which are either caught below the site or stay to spawn below the site, must be assessed and added into the hydro-acoustic count, in order to get an estimate of the total run size into the river (Lilja *et al.*, 2010). Also, according to auxiliary studies, a small fraction of the spawners pass the counting site via the fast-flowing mid-channel without being detected by sonars. The 2018 and 2019 counts probably represents a smaller-than-normal proportion of the total run size into the river; observations were made of unusually high amounts of salmon staying on the lower-most river until autumn 2018. Moreover, the very low prevailing water level in 2018 and 2019 probably allowed many spawners to pass the hydro-acoustic counter via the deepest mid-channel where they may have remained undetected.

In 2014–2019, the spawning run in **Råneälven** has been monitored with an ultra-sound camera (SIMSONAR). The technique is similar to that used in Tornionjoki and Simojoki. The counting site is located about 35 km upstream from the river mouth, and the counts are expected to represent the total run as almost no salmon spawning areas exist downstream. The total counted salmon runs in the period 2014–2018 has varied between 1000–4000 and in 2019 the salmon run was 2132 (Table 3.1.1.3).

Over 13 000 catch samples have been collected from the **Tornionjoki** salmon fishery since the mid-1970s. Table 3.1.1.3 shows sample size, sea age composition, sex composition and proportion of reared fish (identified either by the absence of adipose fin or by scale reading) of the data for the given time periods. Caught fish have generally become older, and the proportion of repeat spawners has increased in parallel with a decreasing sea fishing pressure (see Section 4). The strong spawning runs into Tornionjoki in 2012–2016 were a result of fish from several smolt cohorts. In these years, the proportion of females has been fairly stable, about two thirds of total biomass, but in 2018 and 2019 only about 55% of the total biomass were females. The proportion of repeat spawners has generally been between 5–10% during the last decade. However, a record high proportion of repeat spawners (14%) was observed in 2014, and the proportion was high (12%) also in 2018. In 2019, the proportion of repeat spawners was only 3%. Very few salmon of reared origin (<1%) have been observed in the Tornionjoki catch samples in the last decade (Table 3.1.1.3).

Parr densities and smolt trapping

The lowest parr densities in AU 1 rivers were observed in the mid-1980s (Table 3.1.1.4, Figures 3.1.1.4 and 3.1.1.5). During the 1990s, densities increased in a cyclic pattern with two 'jumps'. The second higher jump started in 1996–1997. Between these increases, there was a collapse in densities around the mid-1990s, when also the highest M74 mortality was observed (see below). Average parr densities are nowadays 5–60 times higher than in the mid-1980s. Since the turn of the millennium, annual parr densities have varied 2–6 fold. In **Simojoki**, some years with higher-than-earlier densities of 0+ parr have been observed recently, but annual variation has been large and densities of older parr have often not increased in this river after years with high 0+ densities. In the other AU 1 rivers, however, parr densities have continued to increase rather steadily until in the mid-2010s.

In some years, like in 2003, high densities of parr hatched in **Simojoki, Tornionjoki** and **Kalixälven** despite relatively low preceding river catches (indicating low spawner abundance)**.** Similarly, high densities of 0+ parr were observed in **Tornionjoki** in 2008 and 2011, although river catches in the preceding years were not among the highest. Possible reasons for this inconsistency include exceptionally warm and low summer-time river water, which might have affected fishing success in the river and even measurements of parr densities. In years 2006, 2013, 2014, 2018 and 2019 conditions for electrofishing were favourable because of very low river water levels, whereas they were the opposite in 2004 and 2005. These kinds of changes in electrofishing conditions may have affected the results, and one must therefore be somewhat cautious when interpreting the data obtained.

In **Simojoki** the mean density of one-summer old parr increased by about 50% from 2015 to 2016 and it continued to increase in 2017 (Table 3.1.1.4). The 2019 density of 0+ parr (40.9 ind./100 sqm) is record high in the time-series, although most of the uppermost sites still lack 0+ parr. The density of older parr increased rapidly from 2015 (6.5 ind./100 sqm) to a record high level in 2018 (42 ind./100 sqm). In 2019, however, the density dropped to 14.4 ind./100 sqm. In **Tornionjoki** the densities of 0+ parr in 2014 and 2015 were clearly higher than in any earlier year in the time-series. In 2016, the average density of 0+ parr on the sampled sites was somewhat lower than in 2015. Several flood peaks due to heavy rains prevented electrofishing on the lower and on some of the middle and upper sections of the river system. In 2017, the average density of 0+ parr increased and was the third highest in the time-series (28.5 ind./100 sqm). In 2018 the mean 0+ parr density again dropped to only 18.3 ind./100 sqm, however in 2019 the density increased to 25.5 ind./100 sqm. The average density of older parr in 2017 (17.2 ind./100 m^2) dropped from the two earlier years, and in 2019 a further decrease (to 15.2 ind./100 sqm) was observed. Thus, in Tornionjoki parr production has turned to decrease after the record years in the mid-2010s.

In **Kalixälven** the mean density of 0+ decreased in 2019 compared to the average for the five latest years. The density of older parr has been relative stable, varying between 12–20 ind./100 sqm during the five latest year. (Table 3.1.1.4). In **Råneälven** the density of 0+ parr increased 2019 twice compared with the three latest years. The density of older parr decreased and is the lowest observed within the latest six years.

Smolt production has been monitored in **Simojoki** and **Tornionjoki** by annual partial smolt trapping and mark–recapture experiments (see Annex 2 for methodology) since 1977 and 1987, respectively (Table 3.1.1.5). A so-called river model (also referred to as “hierarchical linear regression analysis”) has been applied to combine information from electrofishing and smolt trapping results, to obtain updated estimates of wild smolt production in years when high water flow has prevented complete trapping, including also rivers without smolt trapping (Annex 2).

With a 1–3 year time-lag (needed for parr to transform to smolts) wild smolt runs have followed changes in wild parr densities. In the late 1980s, the annual estimated wild smolt run was only some thousands in **Simojoki** and less than 100 000 in **Tornionjoki** (Table 3.1.1.5). The first increase in the production occurred in the early 1990s, and a second, higher jump occurred in the turn of the millennium. Since then, smolt runs have not increased in **Simojoki**, while in **Tornionjoki** the runs have continued to increase, especially during the last ten years. Since the turn of the millennium, annual estimated runs of wild smolt have exceeded 20 000 and 500 000 smolts with high certainty in **Simojoki** and **Tornionjoki,** respectively. Since 2008, estimates of wild smolt runs have exceeded one million smolts in the **Tornionjoki**.

Smolt trapping in 2019 was successfully conducted in **Tornionjoki**, resulting in a smolt run estimate of 2.0 million (median value, 90% PIs 1.4–3.3 million) individuals. The river model updated with 2019 data estimated the 2019 smolt run to be approximately 1.6 million smolts (median value, 90% PIs 1.3–2.0 million). The same model further predicts about 1.5 million smolts to leave the river in both 2020 and 2021.

Smolt trapping in **Simojoki** was conducted successfully in 2019, although the trap was not functioning in 2–3 days at a flood peak occurring near the peak migration period. Therefore, the smolt run estimate from the trapping is likely an underestimate of the true smolt run. The mark–recapture experiment resulted in an estimate of about 21 000 smolts (median value, 95% PIs 15 800–30 300) (Table 3.1.1.5), whereas the river model with electrofishing and smolt trapping data up to 2019 updated the smolt run estimate to about 33 000 smolts for 2019 (median value, 90% PIs 24 000–44 000 inds.). Moreover, the river model predicts an increase to approximately 60 000 smolts/year for 2020–2021.

3.1.2 Rivers in assessment unit 2 (Gulf of Bothnia, SD 31)

River catches and fishery

The 2019 catches in **Piteälven** and **Åbyälven** stayed at the same low level as in previous years. The retained catch in **Byskeälven** 2019 increased to 98 (289 released) compared to only nine salmon (32 released) in 2018 (Table 3.1.1.1). In **Kågeälven** (wild river since 2014) the sport fishery was regulated in 2012 by the local administration to become 100% catch and release, with all fish released to be registered in an obligatory reporting system. In the period 2015–2018 on average about 75 salmon per year (range: six to 92) have been caught and released in Kågeälven. In 2019, 25 salmon were caught and released.

In **Rickleån** only six (30 released) salmon were retained in 2019, compared with two salmon in 2018 and 2017. In the period 2008–2016, the retained catches varied between 10–20 salmon with releases ranging from 13 to 23.

In **Sävarån** the catches have been very low in recent years; no (four released) salmon were retained in 2019, and in 2018 only five salmon were caught and released. In 2017 no salmon were caught, compared to in 2016 when 13 salmon were caught and released. The catch in **Ume/Vindelälven** increased to 300 salmon compared with 2018 when only one single salmon was retained (and 103 released). All reported caught salmon in the four latest year showed signs of disease. In **Öreälven**, the catch in 2017 decreased to 95 salmon (whereof 60 released) compared to 600 (whereof 400 released) in 2016. No salmon was retained in 2018 (four released). In 2019, the catch was 106 salmon whereof 29 were retained. In **Lögdeälven**, the catch in 2017 was 143 salmon (whereof 61 released), compared to 135 (28 released) in 2016. The 2018 catch was 80 salmon (whereof 46 released). In 2019, the salmon catch were 71 and the released increased compared to previous years to 143 salmon.

Spawning runs and their composition

In the fishway in **Piteälven** the counted salmon run in 2019 was 2089, which is the highest recorded so far. 2018 was 1431, which is the same amount as in 2017 (Table 3.1.1.2, Figure 3.1.1.3).

In the fishway in **Åbyälven** the counted salmon run in 2019 was 93, which is at the same level as the three previous year (Table 3.1.1.2, Figure 3.1.1.3). In 2018, the hydropower station owner has sent in an application to the environmental court asking for reconstruction of the fishway to achieve a higher passage efficiency.

In the two fishways at Fällforsen in **Byskeälven**, the total counted salmon run increased in 2019 to 5306 registered salmon compared with the two previous years (Table 3.1.1.2, Figure 3.1.1.3). The counter (Riverwatcher) in the fishway where a majority of the salmon run occurs had several breaks due to problems with different hardware issues. During those periods the run was extrapolated by the company Fiskevårdsteknik AB, who is responsible for analysing the registrations, against the registrations before and afterwards the breaks.

In **Rickleån** a total of 55 salmon passed the fishways in 2019, which is the highest recorded number so far. In 2017, a total of 15 salmon passed the fishways, which is at the same level as in the two previous years (Table 3.1.1.2).

In **Ume/Vindelälven** a total of 12 683 salmon passed the fishway in 2019 which is at the same level as previous year, whereof a high portion were MSW (76%). In 2017, the run was only 4100 salmon (Table 3.1.1.2, Figure 3.1.1.3). Severe disease outbreaks have occurred in Ume/Vindelälven since 2015 and very few females passed the fishway in 2018 but in 2019, the amount of female increased to earlier level (see Section 3.4.4). In 2019, modification was carried in the very last pool of the technical fishway so that fish more efficiently can detect the next pool and continue the upstream migration. Also, other modification is planned to take place in 2020 in the inlet of the fishway. In the beginning of the run season 2019 a large proportion of adult salmon suffered of some form of disease and died in the fishway or soon after passing the fishway, this also occurred previous year. In the middle of the summer, very few salmon passed the fishway. From August and onwards the salmon run increased, the signs that salmon were suffering from visible diseases more or less disappeared, at the same time as the performance in the fishway improved.

In **Öreälven** the control of ascending fish ended in 2000 (Table 3.1.1.2). The reason was high water levels that destroyed the part of the dam where the fish trap was located.

Parr densities and smolt trapping

Densities of salmon parr in electrofishing surveys in AU 2 rivers (Gulf of Bothnia, ICES SD 31) are shown in Table 3.1.2.1 and in Figures 3.1.2.1 and 3.1.2.2. In the summers of 2006, 2013 and 2014 conditions for electrofishing were extraordinary because of very low water levels, opposite to the conditions prevailing in 2004–2005. For the electrofishing carried out in 2009, 2010, 2012 and 2015, the water levels were normal, but in 2011 and 2016 high water levels due to rain prevented surveys in several rivers. In 2019, the water levels were low from late summer into autumn.

Due to problems to electrofish large parts of **Piteälven**, only the number of ascending adults is used for indirectly estimating smolt abundance (details in Section 4.2.1). No consistent electrofishing surveys were made in the 1990s. The density of 0+ parr has been rather low in most of the years (Table 3.1.2.1). No surveys were done in 2011 and 2012 due to high water levels. In 2014, the densities of 0+ parr was the highest recorded (12 ind./100 sqm). In 2016, the average density increased compared to in the previous year. The density of older parr has also been low, varying between 4–9 ind./100 sqm the latest four years. No surveys were carried out in 2017, 2018 and 2019.

In **Åbyälven**, the mean densities of 0+ parr in 1989–1996 were about three ind./100 sqm. In 1999, the densities of 0+parr increased to 17 ind./100 sqm, about five times higher than earlier. In 2016, the average 0+ density increased to the so far highest recorded level (37 ind./100 sqm) and it stayed at about that level in 2017. In 2018 the densities decreased to 23 ind./100 sqm and stayed at the same level in 2019. The densities of older parr have been stable in the last seven years with a mean of 14 ind./100 sqm, and the densities 2017 were the highest observed so far and stayed at same level in 2018 and 2019 (Table 3.1.2.1).

In **Byskeälven**, the mean densities of 0+ parr in 1989–1995 were about five ind./100 sqm. In 1996–1997, the densities increased to about 11 ind./100 sqm, and in 1999 and 2000 the 0+ parr densities increased further (they were about 70% higher than in 1996–1997). During the 2000s, the densities have been on rather high levels with a few exceptions, and in 2016 the 0+ density increased to the so far highest recorded level (43 ind./100 sqm) and it stayed at the same high level in 2017. In 2018, the densities decreased by half, compared with the two previous years. In 2019 the 0+ density increased to the highest recorded (52 ind./100 sqm) so far. The densities of older parr have remained rather stable during later years with a mean around 20 ind./100 sqm but dropped 2019 to 15 ind./100 sqm (Table 3.1.2.1).

In **Kågeälven**, the last releases of reared salmon parr were made in 2004, which means that the wild-born 0+ observed in 2013 were mainly offspring of spawners which themselves were wild-born. Stable occurrence of parr in recent years with means around 15 ind./100 sqm for both 0+ and older parr (Table 3.1.2.1) indicates that the population has become self-sustaining but in 2019 the densities decreased by half for both 0+ and older parr. Spawning also occurs along the whole river stretch available for salmon.

In **Rickleån**, the mean density of 0+ parr were only about 0.5 ind./100 sqm in 1988–1997, whereas since 1998 the mean density has been around 3.7 ind./100 sqm (Table 3.1.2.1). The mean 0+ density has decreased in every year since 2016 but in 2019, the densities of 0+ increased to the highest observed (20 ind./100 sqm) so far. Older parr decreased in 2019 to the lowest observed within several previous years. In Table 3.1.2.1 also average densities from extended electrofishing surveys in Rickleån are presented, including sites in the upper part of the river that was recently colonized (for more details see Section 4.2.2 in ICES, 2015). Since some years, weighted mean densities including these extended electrofishing surveys have served as input in the river model used to calculate prior smolt abundances.

In 2014–2017, smolts of salmon and sea trout were counted during their downstream migration in Rickleån using a smolt wheel ('Rotary-Screw-trap') and mark–recapture experiments. The trap was positioned close to the river mouth. In 2014, a total of 434 salmon smolts were caught. The calculated recapture rate for tagged salmon was 20.3%, which was used to estimate a total smolt production of 2149 (Table 3.1.1.5). Because of many breaks when drifting the screw-trap in 2015, no reliable estimate of the smolt production could be obtained in that year. In 2016 and 2017, the estimated total run was about 4000 and 4800 salmon smolts, respectively (Table 3.1.1.5). No smolt trapping was performed in 2018 and 2019 (the trap was moved to Råneälven).

In **Sävarån** the mean densities of 0+ parr in 1989–1995 were about 1.4 ind./100 sqm. In 1996, the average density increased to 10.3 ind./100 sqm, and in 2000 to 12.8 ind./100 sqm. No electrofishing was made in 2001 and 2004. The 0+ density in 2015 was the so far highest recorded (45 ind./100 sqm) followed by the highest for older parr in 2016 (34 ind./100 sqm). The densities of 0+ parr have decreased in the four lasts years, and in 2019 the density was 9 ind./100 sqm. Also the density of older parr significantly decreased in 2019 compared to in previous years (Table 3.1.2.1).

From 2005 to 2013, smolts of salmon and sea trout were caught in Sävarån on their downstream migration from mid-May to mid-June using a smolt wheel (originally, two parallel wheels were used). The trapping site was positioned 15 km from the river mouth. Estimates of total salmon smolt production are presented in Table 3.1.1.5. On average ca. 470 wild salmon smolts per year were caught. Smolts were measured for length and weight, with scale samples taken for age determination and genetic analyses. The dominating age group was three years. The proportion of recaptured tagged fish in the trap varied between 4–31 % corresponding to an average estimated annual smolt abundance close to 3000 (Table 3.1.1.5). No trapping of smolts has been carried out since 2014, as the smolt trap was moved and used in Rickleån during 2014–2017 (see above).

In **Ume/Vindelälven**, mean densities of 0+ parr in the 1990s were only about 0.8 ind./100 sqm. During the 2000s, densities have fluctuated within the range of 5–25 ind./100 sqm. No surveys were carried out in 2011 due to high water level. In 2014, the density of 0+ parr increased to the so far highest recorded (39 ind./100 sqm) followed by a decrease in 2015 with almost 50%. In years 2016–2019 the mean 0+ parr density has declined to very low values (<5 ind./100 sqm), levels not seen in the river since the peak years of M74 (fry mortality) in the early 1990s. In 2018, only two 0+ parr were caught across 27 electrofished sites. The reason for the very low density seems to be linked to the record small proportion of females passing the fish ladder in Stornorrfors in 2017 and 2018 and also in 2015 and 2016 (Table 3.1.1.2; Figure 3.1.2.3) combined with a low survival rate after having passed the ladder. In recent years, a large proportion of the ascending spawning fish have suffered from (a still unknown) disease followed by secondary fungus (Section 3.4.4). The establishment of fungus has weakened the fish and resulted in high mortality, which has been observed in the fishway, at the intake grid to the hydropower station, and in the hatchery facilities where fish have died long before spawning time. In addition, the M74-frequency increased in the spawning years 2015–2017 (Section 3.4). These factors combined probably have led to a low egg deposition in autumns 2015, 2016, 2017 and 2018 and to the very low densities of 0+parr seen in 2016–2019. The densities of older parr has also decreased because of the low 0+ parr densties latest years.

In Table 3.1.2.1, average densities from extended electrofishing surveys in Vindelälven are also shown, including additional sites from upper parts in the river that recently have been colonized (see Section 4.2.2 in ICES, 2015). Since some years, weighted mean densities including these extended electrofishing surveys have served as input in the river model used to calculate prior smolt abundances.

A smolt fykenet for catching smolts, similar to the one used in Tornionjoki, was operated in Vindelälven between 2009 and 2015. The entire smolt production area is located upstream of the trapping site. On average around 2500 salmon smolts were caught, and the annual proportion of recaptured tagged fish varied between 2.2–3.6%. In 2009, the trap was operated from end of May to beginning of July, and smolts were likely caught during the whole time period with a peak in mid-June. In 2010, a pronounced spring flood caused problems to set up the fykenet and a considerable part of the smolt run was missed. In 2011, a period with very high water flow late during the season again prevented smolt trapping. Although the break was rather short (six days) a very high smolt catch the day immediately before the break indicated presence of a significant 'peak' that was likely missed. In 2012–2015, several episodes of high water flow again resulted in repeated breaks, and for those years, it was difficult to even produce crude guesses of the proportion of the total smolt run that was missed.

Due to the above mentioned interruptions in the function of the trap, direct smolt estimates from the mark–recapture experiments with the fykenet have not been possible to produce. However, estimates have still been obtained based on data for returning 1SW adults (grilse) that can be identified from their smaller body size even without age data. Since 2010, all captured smolts have been marked using PIT-tags. VAKI counters and PIT-antennas in the Ume/Vindelälven fishway record all marked and unmarked wild returning spawners. Assuming a common smolt-to-adult survival rate for marked and unmarked grilse, the size of a given smolt cohort has thus been possible to estimate indirectly (see Table 3.1.1.5) and used as prior information for the river model.

Since 2016, the Vindelälven smolt trapping has been moved to a newly built permanent smolt trap within the fishway at Stornorrfors (hydropower dam that must be passed by down-migrating smolts) just a few kilometres downstream the former trapping site. In 2016–2018, however, there have been technical problems with the new smolt trap, and as a consequence, only few smolts were caught and marked. During 2019 the smolt trapping improved and wild smolt where pit tag marked.

In **Öreälven**, mean densities of 0+ parr in 1986–2000 were very low, just about 0.5 ind./100 sqm. The densities increased somewhat during the early 2000s, and then stayed around 3–10 ind./100 sqm until in 2015 when the density increased by three times compared with earlier to the highest value recorded so far (21.6 ind./100 sqm). In 2016 and 2017 the mean 0+ density showed a slight decrease compared to previous years, and in 2018 the mean density decreased to only 1.3 ind./100 sqm (Table 3.1.2.1). In 2019 the densities of 0+ increased to the same level as in 2015. Densities of older parr has stayed at the same mean level (seven ind./100 sqm) during 2015-2018 but decreased with half in 2019. In Table 3.1.2.1, also average densities from extended electrofishing surveys in Öreälven are shown, including sites from upper parts of the river that recently have been colonized (see Section 4.4.2 in ICES, 2017a). Since the 2018 assessment, weighted mean densities including these extended electrofishing surveys have served as input in the river model used to calculate prior smolt abundances.

In **Lögdeälven**, mean densities of 0+ parr in 1990s were about 1.5 ind./100 sqm. Densities during the 2000s have fluctuated between three and almost 15 ind./100 sqm. In 2017, the mean 0+ density decreased with about 50% compared to in the three previous years, and in 2018 the densities decreased to a very low level (1.5 ind./100 sqm), similar to as in the 1990s. In 2019, the densities of 0+ increased to previous years' level at 15 ind./100 sqm (Table 3.1.2.1). The densities of older parr in 2019 stayed at same level as during the five latest years. In Table 3.1.2.1 also average densities from extended electrofishing surveys in Lögdeälven are shown, including sites from upper parts of the river that recently have been colonized (see Section 4.4.2 in ICES, 2017a). Since the 2018 assessment, weighted mean densities including these extended electrofishing surveys have served as input in the river model used to calculate prior smolt abundances.

In 2015–2016, a smolt wheel was operated in Lögdeälven, close to the river mouth. The number of caught salmon smolts were 299 (2015) and 463 (2016), with 11% and 10% of the marked smolts being recaptured. In 2015, the trap had to be closed before the migration was finished, and the total smolt run for this year was therefore likely underestimated. In 2016, however, the whole run was monitored, yielding an estimate of about 5200 smolts. No smolt trapping was done in 2017, 2018 and 2019 (Table 3.1.1.5).

3.1.3 Rivers in assessment unit 3 (Gulf of Bothnia, SD 30)

Spawning runs and their composition

In **Testeboån**, an electronic fish counter was installed in late August 2015 in the new built fishway; a total of five salmon and 54 sea trout were counted in that incomplete season. In 2016, 2017 and 2018, a total of 73, 67 and 21 salmon were registered in the fishway, respectively. In 2019, the counted number of salmon in Testeboån was the highest recorded so far, even though fish could pass through the spill gates during a period of one month in the beginning of the spawning run (Table 3.1.1.2). In 2016, salmon may have passed beside the counter in early June during high water flow, but on the other hand, salmon migration may not have started at that time of the year. In 2017 and 2018, in principle the entire run salmon passed through the fishway.

River catches and fishery

In **Ljungan**, the salmon angling catch in 2019 was 95 salmon and all were released. In 2018, was 210 salmon caught whereof 190 released. Compared to an average annual total catch of 220 salmon in the period 2010–2016. In general, the catches have increased since the early 2000s, but in the last year, the catch decreased to a level similar to that in the early 2000s. As detailed below, Ljungan is one of the wild salmon rivers where considerable disease problems have occurred in recent years. In **Testeboån** (wild river since 2013) landing of salmon is not allowed.

Parr densities and smolt trapping

Parr densities from **Ljungan** are missing for several years, due to high water levels in late autumn making electrofishing impossible. For example, the relatively high value for 2012 only mirrors data from one electrofishing site (Table 3.1.3.1) as the other sites could not be fished due to high water levels. Recorded average densities of 0+ salmon varied markedly from three to 45 ind./100 sqm between 1990 and 2008, but without any clear trend (Table 3.1.3.1 and Figure 3.1.3.1). However, in 2012, 2014 and 2015 (especially) parr densities showed signs of increase. In 2017, the mean 0+ density in Ljungan dropped markedly to just 0.8 ind./100 sqm and in 2018 no 0+ parr were caught. In 2019 the densities of 0+ was low (3.4 ind./100 sqm). The densities of older parr in 2018 and 2019 was also very low (0.2 resp. 0.0 ind./100 sqm). This low density likely reflects that many adults died before spawning in the preceding autumn (Section 3.4.4).

Testeboån received status as a wild salmon river by WGBAST in 2013. The latest releases of reared salmon (fry) in the river occurred in 2006, which means that the wild-born 0+ parr observed at electrofishing from 2012 and onwards most likely were offspring to salmon which themselves were wild-born. Fairly stable levels of 0+ parr densities in recent years, except for in 2008 when 0+ parr were absent due to a very poor spawning run in 2007, indicates that the population is self-sustaining (Table 3.1.3.1). The mean density of 0+ parr decreased in 2014 compared to in the four previous years, but after that it increased, and in 2016 it was the so far highest recorded (about 28 ind./100 sqm). In 2017, the average 0+ density decreased to about the same level as in 2014 and it stayed at the same low mean density in 2018 (five ind./100 sqm). In 2019, the densities decreased even more to only three ind./100 sqm (Table 3.1.3.1).

Smolt trapping using a smolt wheel has taken place in Testeboån since 2014. In 2015, the river was equipped with permanent facilities for counting of both smolts and ascending adults. Hence, since 2018 Testeboån represents a full index river. Annual estimates of the total smolt runs in 2014–2017 have varied in the range from about 2000 to 4300 smolts. In 2018, smolt trapping could not be carried out due to a high water level. In 2019, the total smolt catch in the smolt wheel was 102 smolts and due to low recapture rate the estimation of the total run was not possible.

3.1.4 Rivers in assessment unit 4 (Western Main Basin, SD 25 and 27)

River catches and fishery

In **Emån**, anglers have increasingly applied catch and release over the past 10–15 years, and the river fishery is nowadays basically a 'no-kill fishing'. Therefore, the retained catches have decreased markedly, from more than 100 salmon fish per year in the early 2000s to nearly zero in recent years. In 2019, a total 105 salmon was caught whereof five salmon was retained. In 2018, the total river catch was 19 salmon, out of which none was retained.

In **Mörrumsån** the salmon catch in 2019 was 490 salmon whereof 95 was retained. Between 2010 and 2017, the total river catch has on average been 777 salmon, with large annual variation (range: 462–1511). Similar to in Emån, anglers have increasingly applied catch and release, which largely explains a decline in retained catches seen in recent years.

Parr densities and smolt trapping

Parr densities from electrofishing surveys in the two AU 4 rivers are displayed in Table 3.1.4.1, and in Figures 3.1.4.1 and 3.1.4.2.

For **Emån**, only densities of parr in electrofishing surveys below the first partial obstacle are displayed in the graphs referred to above. The densities of 0+ parr in the lowermost part of the river varied between 13–71 ind./100 sqm during 1992−2007, with a mean density of 43. The highest 0+ density so far occurred in 1997. The density of 0+ parr was 53 ind./100 sqm in 2016 and stayed at about the same level in 2017, which is just over the mean value for earlier years in the time-series. In 2018 the densities of 0+ parr decreased to the lowest, nine ind./100 sqm, recoded since electrofishing surveys started. In 2019, the densities of 0+ increased to 27 ind./100 sqm. The densities of older parr have varied from 1–10 ind./100 sqm during the period 1992–2019 with a mean value of five ind./100 sqm in recent years.

Table 3.1.4.1 also contains average densities calculated across all sections in Emån that are accessible for salmon, including sites above partial obstacles (dams with fish ladders) located in habitats that currently seem to be recolonized. For the present assessment, these weighted mean densities were used as input in the recently developed Southern river model (ICES, 2017c) to calculate prior AU 4 smolt abundances (Section 4).

The estimated smolt production in River Emån has appeared very low compared to the presumed production capacity. In 2007, an overview of the conditions in the river concluded that probably the difficulties for particularly salmon spawners, and to a minor extent also sea trout, to ascend fishways may give rise to low production of juveniles above the fishways. Electrofishing sites in these upstream areas do therefore normally show low juvenile abundance. On the other hand, there is a highly successful sea trout and salmon fishery in the lower part of the river (at Em), and this fishery has not shown signs of lesser abundance of either species. On the contrary, salmon seems to have increased in abundance.

Monitoring of salmon migration in one fishway during 2001–2004 also suggested that very few salmon could reach some of the upstream potential spawning areas. In 2006, the lowermost dam (at Emsfors) was opened permanently, and since then increased electrofishing densities for salmon have been recorded at the closest upstream electrofishing site. Activities are also ongoing to facilitate up- and downstream migration at the second dam counted from the sea, above which significant habitats regarded suitable for salmon reproduction are located.

In **Mörrumsån**, the 0+ parr densities increased (119 ind./100 sqm) in 2019 to the higest observed since 1998. The 0+ parr densities in the period 1973–2011 varied between 12–307 ind./100 sqm (Table 3.1.4.1, Figures 3.1.4.1 and 3.1.4.2). The by far highest average density so far was observed in 1989 (>300 ind./100 sqm). At that time, however, substantial supplementary hatchery releases based on smolts from returning spawners were ongoing, with aim to support the fishery.

In 2011, the average 0+ density decreased to 36 ind./100 sqm, the lowest value since the mid-1990s. One reason for the low density in 2011 could be high water level, as only part of the survey sites was possible to electrofish. However, it should be noted that the number of ascending salmon counted in the preceding autumn (2010) was also the lowest recorded at the Marieberg power plant, ca. 13 kilometres from the sea, since an electronic counter was installed in the fishway in 2002. A decision has been taken to remove the Marieberg dam, most likely in summer 2020. Important aims are to assist fish migration and to recreate spawning and nursery habitats for salmonids. As a consequence, new locations and methods for counting of adults and smolts in Mörrumsån are currently investigated.

Table 3.1.4.1 also contains average densities calculated across all sections in Mörrumsån (weighted according to relative habitat areas) that are currently accessible for salmon, including sites in upstream habitats that recently have been recolonized following the construction of two fishways in 2004 (see below). For the present assessment, these weighted mean densities have been used as input for the recently developed Southern river model (ICES, 2017c) to calculate prior AU 4 smolt abundances (Section 4).

Since 2015, the average parr densities in Mörrumsån has decreased, and in 2018, the 0+ density decreased more than half of the mean for the years 2012–2014. The recent decline may reflect current disease problems, with a large number of dead and affected salmon and sea trout in the river since 2014. Notably, however, this decrease cannot be seen in the average densities for all river sections (above). For several years, a slight decline in average parr densities could be seen in the downstream river sections, whereas the uppermost (most recently accessible) part seemed to be in a building-up phase with increasing densities. Therefore, two contrasting trends were partly counteracting each other in the weighted averages used for computing smolt prior estimates. Since the health problems accelerated in 2014, however, the most marked decreases in parr densities have be seen above the first migration obstacle (Marieberg dam), which may indicate that spawners in poor condition have not managed to migrate upstream.

In Mörrumsån, hybrids between salmon and trout have been found during electrofishing since the early 1990s. In 1993–1994, at a period with high levels of M74-mortality and disease problems, the proportion of hybrids was high, up to over 50% in some sampling sites. After that, the occurrence of hybrids has varied. In 1995 and 1996, it was only some percent of the total catch. In 2005, the density of 0+ hybrids were 14 ind./100 sqm which is higher than in the three years before. The amount of hybrids has decreased during 2006–2019. In 2019, the densities of hybrids were 0.6 ind./100 sqm. Occasionally over the years, genetic markers have been used to evaluate identifications made in the field of salmon/trout hybrid parr; in a majority of those cases, identifications were found to be correct.

In 2004, two new fishways were built at the power plant station about 20 km from the river mouth, which opened up about 9 km of suitable habitat for salmon, including about 16–21 ha of production area. In 2009–2019, a smolt wheel has been operated in Mörrumsån, ca. 12 km upstream from the river mouth. About 55% of the total production area for salmonids is located upstream the trap. A main reason for choosing this upstream, location was that ascending adults are counted in a nearby fishway close to the smolt trap site, which should allow comparisons among numbers of ascending spawners and smolts from the upper part of Mörrumsån. So far however, only preliminary numbers of ascending adult spawners exist; to obtain such reliable estimates, further work will be needed that accounts for (i) a relatively large share of missing or unclear species identifications (due to absent or low quality camera images from the fishway) and (ii) the fact that a rather large proportion of salmon–trout hybrids exists in the river (Palm *et al*., 2013).

In 2009–2012, the estimated smolt production in the upstream parts of the river was lower than expected (ca. 2000–8000 per year). As a comparison, Lindroth (1977) performed smolt trapping in 1963–1965 at a site close to the one currently used, and estimated the average annual salmon smolt production to 17 600 (range 12 400–25 000). However, since 2013, the smolt production in the monitored upper reaches of Mörrumsån has increased. In 2013, it was estimated to ca. 15 000, and in 2014, it was estimated to be the highest recorded so far (ca. 21 400). In 2015, the estimated smolt production decreased to ca. 10 000, but in 2016, it again increased to ca. 18 000. In 2017, the smolt production decreased to 10 200 and has after that, continued to decline to only 3000 smolt in 2019.

3.1.5 Rivers in assessment unit 5 (Eastern Main Basin, SD 26 and 28)

Estonian rivers

The River **Pärnu** flows into the Gulf of Riga and is the only Estonian salmon river in the Main Basin. The first obstacle for salmon migrating in the river is the Sindi dam, located 14 km from the river mouth. The fish ladder at the dam has not been effective due to its small size and the location of the entrance. The quality of spawning areas above the dam is relatively good, and parr abundancy is associated with poor accessibility.

Electrofishing surveys on the spawning and nursery ground below the dam have been performed since 1996; the number of individuals per 100 sqm has been very low during the whole period (Table 3.1.5.1 and Figure 3.1.5.1). No salmon parr were found in 2003, 2004, 2007, 2008, 2010 and 2011. In 2018, the 0+ parr density below Sindi dam was 1.4 ind./100 sqm. The habitat quality below the dam is poor, and that is the main cause for the low parr density. Since 2013, electrofishing is also carried out upstream from the Sindi dam. Above the dam, salmon parr have been found only in some years, and densities have been very low. In 2017, however, average 0+ parr density (four sites electrofished) was 26 parr/100 m^2. In 2018, 13 sites were electrofished upstream the dam; salmon parr were found at only two of these, with an average density of 0.1 parr/100 m^2. In 2019 average 0+ parr density was 6.5 ind./100 sqm.

In autumn 2018, removal of the Sindi dam started, and ascending salmon were able to pass the dam in November same year. As salmon now has free access to all spawning grounds, the population should be able to recover. A juvenile supplemental release programme was also initiated in 2012 aimed at assisting population recovery. The first juvenile salmon were released in 2013, and as pointed out initially in this section, under present conditions with large numbers of juveniles being stocked every year, Pärnu should be considered as a mixed river.

Latvian rivers

There are seven wild salmon rivers in Latvia, mainly flowing into the Gulf of Riga. Some rivers have been annually stocked with hatchery-reared parr and smolts, and salmon in these rivers thus consist of a mixture of wild and reared fish. In 2018, salmon parr were found at 31 sites

(15 rivers) sampled by electrofishing. Parr densities are presented in Table 3.1.5.1 and Figure 3.1.5.2.

The wild salmon population in river **Salaca** has been monitored by smolt trapping since 1964 and by parr electrofishing since 1993. From 2000, no releases of artificially reared salmon have been carried out. In 2019, eleven sites were electrofished in the river and its tributaries. All sites in the main river held 0+ age salmon parr. Salmon 0+ parr also occurred in the tributaries Jaunupe, Svētupe and Korģe. The average density of 0+ salmon was 68 ind./100 sqm, whereas the density of 1+ and older parr was 0.5/100 m². The smolt trap in the river Salaca was in operation between April 18 and May 22, 2019. In total, 501 salmon and 301 sea trout smolts were caught; 178 of them were marked using streamer tags for total smolt run estimation. The smolt trap catch efficiency was 9.6%. Thus, in total 5100 salmon and 3200 sea trout smolts were estimated to have migrated from the Salaca in 2019.

In river **Venta**, wild salmon parr were found above the Rumba waterfall because of a high water level in the autumn of 2017. In 2019, only 3 ind./100 sqm 0+ and 0.1 ind./100 sqm 1+ and older parr were caught in river Venta. Average parr production has negative trend due to high water temperatures and low water level in recent summers.

In river **Gauja** 2019, wild salmon 0+ parr production increased (6.2 ind./100 sqm) compared to in 2018 (5.2 ind./100 sqm). In **Amata,** which is a tributary to Gauja, salmon 0+ parr production was also lower than in the previous three years (0.9 ind./100 sqm).

In 2019, wild salmon parr were also found in the small Gulf of the Riga rivers **Vitrupe, Aģe** and **Pēterupe**. Age structures of parr in these rivers testify that salmon reproduction does not occur in every year. Parr production seems to be most stable an on a higher level in **Aģe**.

Only 0+ parr in low densities were caught in the Main Basin river **Irbe**. No wild salmon parr were caught in **Tebra** (Saka river system) and **Užava** in 2019.

In 2018, habitat mapping was initiated to re-evaluate productive habitat sizes in Latvian rivers. According to the first results from river **Bārta**, the total area of riffles suitable for salmon spawning and nursery constituted only 0.6 ha in the river section from the Latvian-Lithuanian border to Lake Liepājas, which is many times less than the 10 ha estimated earlier. None of the mapped riffles were evaluated to have high or good quality, 67% of the habitats had moderate quality, whereas the remaining ones had poor quality. Problems with habitat siltation and overgrowing are common in the river.

In 2019, habitat re-assessment was carried out in the **Irbe**, **Užava** river and **Saka** river basin. In the **Irbe** river deposition of sand and silt in rapids suitable for salmon reproduction is visible problem. Rapids and riffles suitable for salmon spawning and nursery constitute 0.21 ha instead of 10 ha assumed previously. Habitat mapping in **Užava** river show that canalization in 1960s has left considerable effect on available habitats in this river. Total available and suitable habitats constitute only 0.59 ha (0.46 ha with good quality). The size of the reproduction area was previously thought to be 5 ha. In the **Saka** river basin, upper parts of **Tebra** 2.4 ha of suitable habitats for salmon spawning and nursery areas were found. Previous estimate was 20 ha.

Lithuanian rivers

Lithuanian salmon rivers are listed in the Annex 2. Salmon inhabits 12 tributaries in the **Nemunas** river basin and river **B. Šventoji** that flows directly into the Baltic Sea. Purely natural salmon population inhabits only the Nemunas tributary **Žeimena** and its tributaries **Mera** and **Saria**. The index river Žeimena has never been stocked with artificially reared salmonids. Its tributary Mera is a typical sea trout river and therefore has the salmon production been very low all the time. Mixed populations are found in the **B. Šventoji** (river that flows directly in to the Baltic Sea) and the following tributaries of river Nemunas; **Neris**, **Šventoji**, **Vilnia**, **Dubysa**, **Siesartis**,

Širvinta, **Virinta**, **Minija**, **Vokė**. Reared populations occur in the Nemunas tributary river **Jūra** and some smaller tributaries. In these rivers, salmon releases are been made regularly for several years.

Electrofishing is the main monitoring method for evaluation of occurrence and densities of 0+ and older salmon parr. Parr densities in Lithuanian rivers are presented in Table 3.1.5.2 and Figures 3.1.5.3 and 3.1.5.4. The abundance of salmon parr depends on hydrological conditions, spawning success, and protection of spawning grounds.

In 2019, the average density of salmon 0+ parr in the index river **Žeimena** increased to 8.2 ind./100 sqm and on older parr was found. The 2019 density is above the mean values for the whole survey period. Parr density in **Neris** in 2019 was on a highest observed level. Average 0+ parr density was 13 ind./100 m^2 and older parr density was 0.03 ind./100 m^2 (Table 3.1.5.2).

The correlation between salmon juvenile density and water temperature during July, the warmest month of the year, has been investigated in two rivers characterized by different thermal regimes; Neris (r = -0,530, p =0,035) and Žeimena (r = -0,555, p =0,021). It was found that during a period of several years, water temperatures in July varied within a range of a few degrees (19.1°C on average). However, in 2010 the water temperature reached 22.6°C, which could have had a lethal impact on some of the weaker juveniles in the river. In that year, the parr density was also estimated to be the lowest in Žeimena recorded so far; only 0.2 ind./100 sqm. The average temperature during July in Neris is 20.9°C. Temperatures above the 'stress level' (>22°C) were seen seven times during a period of 17 years; in 2001, 2002, 2006, 2010, 2012, 2014 and 2018. These results illustrate that the thermal regime is a very important determinant for salmon production in Lithuanian rivers. Other concerns include pollution, and that rivers are of lowland type with scarce parr rearing habitats. Finally, quite high mortality rates are expected due to predation; densities of several predators are significantly higher than in more northern Baltic salmon rivers.

3.1.6 Rivers in assessment unit 6 (Gulf of Finland, SD 32)

All three wild salmon populations in the Gulf of Finland area are located in Estonia: **Kunda**, **Keila** and **Vasalemma**. These rivers are small and their potential production is small. In addition, there is natural reproduction supported with regular releases in ten other rivers: **Kymijoki**, **Gladyshevka**, **Luga**, **Purtse**, **Selja**, **Loobu**, **Valgejõgi**, **Jägala**, **Pirita** and **Vääna**. In these mixed rivers, natural reproduction is variable, and enhancement releases have been carried out since year 2000. The salmon in rivers **Narva, Neva** and **Vantaanjoki** are of reared origin.

Status of wild and mixed AU 6 populations

Parr density in the wild river **Keila** started to increase significantly in 2005 and has increased furthermore since 2013. The parr density has remained on a high level in recent years. Therefore, it can be stated that the river Keila population is in a good and seemingly stable state (Figure 3.1.6.1). The parr densities in river **Kunda** have been varying and a positive trend is only evident in the past four years (Table 3.1.6.2). In comparison, the river **Vasalemma** is in a more precarious state, although some stronger year classes have occurred. The average 0+ density in 2017 increased to 52 ind./100 sqm but again decreased to 27.8 ind./100 sqm in 2018. In 2018, the Vanaveski dam in river Vasalemma was opened, and salmon gained access to all spawning and rearing areas. Previously only 2.4 ha of spawning areas below the dam were accessible, but now the total spawning area is at least 5 ha (the exact size of the added habitat area needs to be investigated). Despite free access no salmon parr was found upstream of the Vanaveski dam in 2019.

The most important change in the 1990s was the occurrence of salmon spawning in the Estonian mixed rivers **Selja**, **Valgejõgi** and **Jägala**, after many years without natural reproduction. In 2006, wild salmon parr were also found in rivers **Purtse** and **Vääna**. Since then, a low and varying wild reproduction has occurred in all these mixed rivers (Table 3.1.6.3). In the period 2012–2015, parr densities increased to relatively high levels in these rivers. However, in 2016 parr densities were very low. In 2016, the Kotka dam in river **Valgejõgi** broke, and it will not be rebuilt. Thus, in autumn of 2016, salmon were able to ascend to potential spawning areas that before were not accessible, and a considerable increase in salmon abundance may be expected in coming years. So far, however, parr densities in upstream areas has remained very low.

Salmon releases are carried out annually in **Valgejõgi** (since 1996), in **Selja** (since 1997), in **Jägala** and **Pirita** (since 1998), in **Loobu** (since 2002) and in **Purtse** (since 2005). According to the rearing programme by Estonian Ministry of Environment (for the period 2011–2020) releases will be continued in these rivers. Salmon used for stocking in late 1990s originated from spawners caught in the rivers Narva and Selja brood-stock fisheries. In addition, salmon from the Neva strain were imported as eyed eggs from a Finnish hatchery in 1995–1999. In 2003–2009, brood fish were again caught from river Narva. A captive brood stock based on salmon from wild river **Kunda** was established in 2007 at Polula Fish Rearing Centre, and all current salmon releases in Estonia (SD 32) are based on that stock. In river **Vääna**, releases were carried out from 1999 to 2005. The stocking was stopped due to the high risk of returning reared adults to stray into neighbouring river **Keila**, which is considered as a wild salmon river.

On the north side of AU 6, all wild salmon populations in Finland were lost in the 1950s due to gradual establishment of a paper mill industry and construction of hydroelectric dams. The geographically nearest available strain, Neva salmon, was imported from Russia in the late 1970s, and releases into rivers Kymijoki and Vantaanjoki started in 1980. The water quality in the mixed river **Kymijoki** has improved significantly since the early 1980s. Reproduction areas exist on the lowest 40 kilometres of the river. Water conditions in winter influence the hatching success in productions areas below the lowest dams. In general, parr densities have been on a moderate level, but some improvement have occurred over time (Table 3.1.6.3). In 2011 and 2012, parr densities were low because of exceptional flow conditions, whereas higher water levels in mild and rainy winters were followed by high parr densities in 2005 and 2015 (when the 0+ density increased to its long-term maximum of 113 ind./100 sqm). In 2016 and in 2017, the parr densities were low to again increase considerably in 2018 and in 2019.

Despite rainy autumns, most of the nursery areas in the lower part of Kymijoki dry out, because of water regulation between the power plants. Good quality habitats are located above the lowest power plants, but currently spawners can only access those areas via two river branches with dams equipped with fishways. The fish ladders in the Langinkoski branch do not function well, and salmon can ascend the dam only in rainy summers when the discharge is high. Because of higher outflow, usually most of the spawning salmon ascend to the Korkeakoski branch, where a fish pass at the hydropower station was finished in 2016. So far, the smolt production areas beyond the dams are only partially utilized. The new fish pass is expected to allow access of a much larger number of spawners to the better spawning and rearing habitats located upstream. If the fish pass will work well, it is anticipated to increase the natural smolt production of the river significantly. However, in autumns 2016–2018 only some tens of adult salmon passed the new fish pass, although a much larger number of spawners were observed below the dam. Korkeakoski fish pass functioned much better in 2019. The overall number of spawners that pass the lower Kymijoki dams in 2016–2019 has been between 300–700.

Natural smolt production in Kymijoki has been estimated to vary between 7000 and 78 000 in the last fifteen years. Along with the gradual increase in natural production, smolt releases have been decreased in the last few years. The released number of smolts (on average 81 000 per year, 2014–2017) is, however, still clearly larger than the estimated natural production (on average 38 000 smolts per year, 2015–2019). The brood stock of salmon is held in hatcheries, and it has frequently been partially renewed by ascending spawners.

An inventory of rearing habitats in the river Kymijoki suggests 75 ha of smolt production area in the eastern branches of the river, between the sea and Myllykoski (40 km from the river outlet). Out of this total, about 15 ha of the rapids are situated in the lower reaches with no obstacles for migration, whereas about 60 ha are located beyond dams. Potential smolt production has been assessed based on assumed parr density and smolt age distribution. The annual mean potential was calculated to 1.34 smolts per ha, yielding a total potential of the river of about 100 000 smolts per year. From this potential, annually about 20 000 smolts could be produced in the lower reaches and 80 000 in the upper reaches of the river (Table 4.2.3.3).

In the river **Vantaanjoki**, electrofishing surveys in 2010–2014 have shown only sporadic occurrence of salmon parr at just a few sites.

In Russia, **Luga** and **Gladyshevka** are the only rivers with natural Baltic salmon reproduction. In Luga the salmon population is supported by large and long-term releases. The released smolts are based on ascending Luga and Narva river spawners, as well as on a brood stock of mixed origin. In the mixed River Luga, a smolt trapping survey has been conducted since 2001. The natural production has been estimated to vary from about 2000 to 8000 smolts per year. In 2019, the estimated smolt number was 8800 which is close to the long-term average. The total potential smolt production of the river has been assessed to be about 100 000–150 000 smolts, and the current wild reproduction is thus very far from its expected maximum level. The main reason for this poor situation in believed to be intensive poaching in the river.

3.2 Potential salmon rivers

3.2.1 General

The definition of a potential salmon river is a river with potential for establishment of natural reproduction of salmon (ICES, 2000). For most potential rivers, there exists documentation of historical salmon occurrence. The current status of restoration programmes in Baltic Sea potential salmon rivers is presented in Table 3.2.1.1. Releases of salmon fry, parr and smolt have resulted in natural reproduction in some rivers (see Table 3.2.2.1). Reproduction and occurrence of wild salmon parr has, in some potential rivers, occurred for at least one salmon generation. However, before any of these rivers may be transferred to the wild salmon river category, the Working Group needs more information on river-specific stock status and rearing practices. Such evaluations were made in 2013 and 2014, when the formerly potential salmon rivers Kågeälven and Testeboån in Sweden were assessed as wild, as they had fulfilled the criteria for wild salmon rivers.

3.2.2 Potential rivers by country

Finland

Eight potential salmon rivers are listed in Table 3.2.1.1. Out of these three rivers **Kuivajoki**, **Kiiminkijoki** and **Pyhäjoki** were selected to be included in the Finnish Salmon Action Plan (SAP) programme. These SAP rivers are all located in AU 1 (Subdivision 31). Densities of wild salmon parr in electrofishing surveys in the SAP rivers are presented in Table 3.2.2.1.

Hatchery reared parr and smolts have been stocked annually in the rivers since the 1990s. Due to poor success of stock rebuilding to date, especially in the Pyhäjoki and Kuivajoki, the monitoring activities and stocking volumes have been decreased. Current activities include regular salmon releases only in Kiiminkijoki. In 2019, 30 000 smolts of the river Iijoki origin were stocked in the Kiiminkijoki.

Electrofishing is currently conducted in **Kiiminkijoki**, when water level allows. In 1999–2019, the average densities of wild 0+ (one-summer old) parr have ranged between 0.7–8.2 individuals/100 m^2 (Table 3.2.2.1). There was no electrofishing in 2015–2017 due to high summer water levels in the river. In 2018, average 0+ parr density was low but in 2019 close to the long-term average observed in this river. In 2018–2019, the older parr originating from natural reproduction could be identified because of the fin-clipping of the stocked parr. The densities of these wild parr were 3.8 and 0.7 ind./100 sqm in 2018 and 2019, respectively.

In rivers **Kuivajoki** and **Pyhäjoki**, the observed densities in 1999–2007 ranged from 0–3.2 and 0–1.9 parr/100 m^2, respectively. The poor success of stock rebuilding is probably due to a combination of fishing pressure, insufficient quality of water and physical habitat in rivers and their temporally low flow, which together keep the lifetime survival and reproductive success of salmon low.

Small-scale natural reproduction has also been observed in rivers Merikarvianjoki and Harjunpäänjoki (tributary of Kokemäenjoki at the Bothnian Sea, Subdivision 30), and in the rivers Kiskonjoki (Subdivision 29), Vantaanjoki, Urpalanjoki, Rakkolanjoki and Soskuanjoki at the Gulf of Finland (Subdivision 32).

Lately, plans have emerged for building up fish ladders and rebuilding migratory fish stocks in the large, former Finnish salmon rivers. Projects are underway to study the preconditions for these activities in the rivers Kemijoki, Iijoki, Oulujoki and Kymijoki. Observed densities of the 0+ parr in River Kymijoki in 1991–2019 ranged from 2,3–113. During recent years, the trend has been increasing. For instance, salmon have been caught from the mouths of Iijoki and Kemijoki, and they have been tagged with radio transmitters, transported and released to the upstream reproduction areas. In the River Oulujoki a catching cage for spawners has been constructed in 2017 at the Montta hydro power station. From the cage spawners are transported by a truck into two upstream tributaries. The in-river behaviour of these salmon was monitored until the spawning time. Also, downstream migration and survival of smolts through dams have been studied in these rivers.

Sweden

Three potential Swedish salmon rivers are listed in Table 3.2.1.1: **Moälven**, **Alsterån** and **Helgeån**. Densities of wild salmon parr in electrofishing surveys in Alsterån are presented in Table 3.2.2.1.

Restoration efforts are ongoing at the regional–local level in several of the remaining potential Swedish salmon rivers. However, so far recent stocking activities and/or too low natural production have prevented them from having their status upgraded. Until next year (2021), the intention is to review and potentially update the list of Swedish potential salmon rivers.

Lithuania

Two potential Lithuanian salmon rivers, **Sventoji** and **Minija/Veivirzas**, are listed in Table 3.2.1.1.

In May 2019, 20 800 salmon smolts were released into five rivers: Neris, Šventoji (Neris basin), Dubysa, Minija, and Jūra. A total of 165 000 salmon fry were released divided as follows: 57 000 into Neris basin (Neris, Vilnia, Muse, Vokė, Dūkšta, Kena and Nemenčia), 45 000 into Šventoji basin (Šventoji, Širvinta, Siesartis, Virinta), 20 000 to Dubysa basin, 30 000 to Minija basin and 13 000 to Jūra basin. When summarizing the results of restocking efficiency it is notable that this year was good, but the results depended on river size and ecological conditions. In medium sized rivers, restocking efficiency was very good in Siesartis, Vokė and Kena. It was concluded that restocking efficiency in smaller rivers was much greater than in larger ones. The survey indicates that in larger rivers mortality of juveniles is greater, although the estimation error is also expected to be higher.

Electrofishing densities of wild salmon parr in potential (mixed) Lithuanian rivers are presented in Table 3.2.2.1. In some larger tributaries of Neris and Šventoji, salmon densities in 2019 were higher relatively to the long-term average. Parr densities in Šventoji basin increased compared to in the previous year to the higest observed so far. In the Siesartis tributary, the average density of salmon juveniles increased to the higest observed so far in 2019. In Virinta the density of 0+ decreased to 1.4 ind./100 sqm , no older parr where caught.

In Vilnia and Vokė, the density of 0+ salmon increased compared to the previous year and was considerably higher (29 ind. /100 sqm in Vilnia and 11 ind. /100 sqm in Vokė). In western Lithuania, the potential salmon river B. Šventoji showed same low 0+ parr density compared to in the previous year (1.5 parr/100 m^{2}.). In Dubysa the densities increased to the higest observed (11 ind./100 sqm) and Minija the densities of 0+ parr stayed at the same low level as previous year (0.7 ind./100 sqm).

Poland

Restoration programmes for salmon in seven potential Polish rivers (Table 3.2.1.1) were started in 1994, based on releases of hatchery reared Daugava salmon. To date, however, there is no good evidence of a successful re-establishment of any self-sustaining salmon population.

In 2019, the total number of released hatchery reared smolts was 216 590, mainly in **Rega** (SD 25), **Vistula** (SD 26) and **Parsęta** (SD 25) rivers, fry 471 750, mainly in the Vistula and Parsęta rivers, and 35 000 alevins in Parsęta. Since at least 2011, salmon spawners have been observed in the **Vistula** river system, but there are still no data on wild progeny.

In almost all Pomeranian rivers, ascending and spent adult salmon have been observed and caught by anglers, but so far wild parr has only been found in the **Slupia River** (but no electrofishing there in 2019) and for the first time in lower Łupawa River (SD 25).

Salmon spawning has been observed in the **Drawa River** (Odra R. system) for some years, but the number of redds has stayed on a low level (not higher than ten per year). Until present, there is only one piece of evidence of a few wild salmon progeny born in the river (result from spawning in 2013). In 2019, a new fish pass at the crucial dam "Kamienna" in lower Drawa has begun to operate and in autumn some salmon were recorded there.

Russia

The **Gladyshevka** River was selected as a potential river for the Russian Salmon Action Plan and is listed in Table 3.2.1.1. Stocking of salmon with hatchery-reared (Neva origin) young salmon is ongoing in this river. Since 2001, a total of nearly 190 000 salmon parr and smolts has been released in the river. About 15 000 of one-year old salmon (including 2000 tagged by T-bar tags) were released in 2018.

Densities of wild salmon parr from electrofishing surveys in **Gladyshevka** are presented in Table 3.2.2.1. Since 2004, wild salmon parr have occurred in the river. In 2015, the average density increased to the highest observed so far: 24 parr/100 m^2. No electrofishing surveys were carried out in 2016 due to high water level. In 2017, the densities stayed at almost the same level as previous year 18.4 parr/100 m^2. No electrofishing surveys were carried out in 2018. In 2019 the densites of 0+ parr increased to the higest observed so far (51 ind./100 sqm).

Estonia

No potential salmon rivers have been listed in Estonia.

Latvia

No potential salmon rivers have so far been listed in Latvia. However, rivers **Lielā Jugla** and **Mazā Jugla** in the lower part of the river Daugava system are regularly stocked by one summer salmon and sea trout parr. Electrofishing and habitat mapping is carried out, and the mapped potential reproduction areas in these rivers are 41 ha and 38 ha respectively.

Germany

No potential Baltic salmon rivers have been listed in Germany. So far, no rivers with outlet into the Baltic Sea exist with a known (former) wild salmon population. However, in recent years very few salmon were caught during upriver spawning migration in the river Warnow (W. Loch, pers. comm.). Nevertheless, those fish are most likely strayers and there is potentially no significant natural salmon smolt production in the German Baltic catchment area.

Denmark

No potential Baltic salmon rivers have been listed in Denmark.

3.3 Reared salmon populations

3.3.1 Releases

The total number of salmon smolts released in reared rivers around the Baltic Sea in 2018 is presented in Table 3.3.1.1 In AU 1–5 (subdivisions 22–31), about 3.7 million smolt were released, with an additional 0.9 million in AU 6 (Subdivision 32), making a grand total of 4.6 million smolts released in 2019.

Releases of younger life stages (eggs, alevins, fry, parr) are presented in Table 3.3.1.2. These releases have in many cases consisted of hatchery surplus, often carried out at areas with poor rearing habitats. In such cases, mortality among parr is high and releases correspond only to small amounts of smolts. On the other hand, when releases have taken place in potential, mixed or wild salmon rivers with good rearing habitats, they have had a true contribution to the smolt production. When comparing the total annual number of releases (of younger life stages) in the last two years, the number has stayed at the same level AU 1–3, whereas in AU 5–6, the releases has increases. In AU 4, there have been no releases since in 2012.

Seen from a longer perspective, releases of younger life stages have decreased in the majority of the assessment units, with exception of AU 5 where the observed trend is not as evident. Roughly, these releases are expected to produce less than 100 000 smolts in the next few years. However, the stocking statistics available to the working group do not allow distinction between single rivers and release categories (age stages), and therefore the corresponding number of smolts expected from releases of younger life stages has not been possible to estimate properly.

The yield from salmon smolt releases has decreased in the Baltic Sea during the last 10–15 years, according to results from ongoing national tagging studies (Figures 3.3.3.2–3.3.3.3). Possible explanations for lower catches include decreased offshore fishing and strong regulations in the coastal fishery. Initially, no substantial surplus of fish was observed in the rivers where compensatory releases were carried out, which most likely was due to decreased post-smolt survival. In recent years (2010–2019), however, the amount of salmon returning to reared rivers has increased, in some cases even considerably. In 2018, however, there was a decline in the amount of returning salmon to some Swedish rivers with compensatory releases that may partly be connected to the health issues described in Section 3.4.4.

In line with an increased wild smolt production since the mid-1990s, catch samples from the years 2000–2019 indicate that the proportion of reared salmon has decreased over time; currently reared salmon represents well below 50 percent of adults caught in most Baltic Sea fisheries (see Figure 4.2.3.9).

Releases country by country

Most releases in **Sweden** are regulated through water-court decisions. Since the reared (and wild) stocks were severely affected by the M74-syndrome in the early 1990s, the number of Swedish compensatory released salmon smolts in 1995 were only 60–70 percent of the intended amount. However, already in 1996 the releases increased to the levels set in the water-court decisions. From that year and onwards, the releases have been kept close to the intended level each year.

In 2019, a total of 1.52 million salmon smolts were released in Swedish AU 2, AU 3 and AU 4 rivers. The releases in AU 4 are minor and amounts to less than one percent of the total Swedish releases (Table 3.3.1.1). The number of one-year-old salmon smolts released in Sweden has increased over time, especially in the most southern rivers; in the period 2007–2019 the share of one-year old smolts has increased from 23% to 60% of the total releases. This development reflects a combination of high-energy feed (faster growth) and longer growth seasons due to early springs and warm and long autumns.

Many brood-stock traps in Swedish reared rivers were previously operated with equal intensity throughout the fishing season. The catch could therefore be considered as a relative index of escapement. A reduced fishing intensity in most rivers with smolt releases reflects the increasing abundance of returning adults during the last ten years. Brood-stock fishing at low intensity during the migrating season is nowadays sufficient to get the amount of spawners (eggs) needed to fulfil terms in court decisions, but the brood-stock catches cannot be used as indices of spawning run strengths.

In **Finland**, the production of smolts is based on brood stocks reared from eggs and kept in hatcheries. The number of captive spawners is high enough to secure the whole smolt production. A partial renewal of the brood stocks has been regarded necessary in order to avoid inbreeding, and is consequently enforced occasionally by brood-stock fishing in the specific river. In 2019, the total Finnish releases in AU 1 and AU 3 were 1.2 million smolts and in AU 6 it was 183 000 smolts (Table 3.3.1.1). When the Finnish compensatory release programmes were enforced in the early 1980s, the total annual salmon smolt releases were about 2 million in total, whereof 1.5 million released in AU 1 and AU 3, and 0.5 million in AU 6. In recent years, the releases have gradually been reduced. As in Sweden, the reared stocks in Finland have been affected by M74 over the years.

In **Russia** there are annual releases in AU 6; in 2019 a total of 662 000 reared smolts were stocked. In **Estonia** a rearing programme using the Neva salmon stock was started in 1994. Eggs were collected from the reared Narva stock and the mixed Selja stock. In the late 1990s, eggs were also imported from Finland. A captive stock based on spawners from river Kunda was established in 2007. One hatchery is at present engaged in salmon rearing. In 2019, the total annual smolt production was 63 000 smolts released in AU 6 (Table 3.3.1.1).

In **Latvia,** the artificial reproduction is based on sea-run wild- and hatchery-origin salmon brood stock. The brood-stock fishery is carried out in the coastal waters of the Gulf of Riga in October–November, as well as in the rivers Daugava and Venta. The mortality of yolk-sac fry has been low, indicating that M74 might be absent in this region. In 2018, the annual smolt production in Latvian hatcheries was 787 000 (Table 3.3.1.1). It is 200 thousand more than in 2018, but still below the average number of releases during the last decade. Earlier, from 1987 and onwards, the annual Latvian releases ranged up to 1.1 million smolts in several years. Occasionally, also **Lithuania** makes annual releases of a smaller number of smolts in AU 5; in 2019 a total of 21 000 smolts were released (Table 3.3.1.1).

In **Poland**, the last wild salmon population became extinct in the mid-1980s. A restoration programme was started in 1984, when eyed eggs of Daugava salmon were imported from Latvia. Import of eggs continued until 1990. In 1988–1995, eggs for rearing purposes were collected from a salmon brood stock kept in sea cages located in the Bay of Puck. In subsequent years, eggs have been collected from returning spawners caught in Polish rivers, besides from spawners reared in the Miastko hatchery. Spawners are caught mainly in the Wieprza River and in the mouth of Wisla River, but also from rivers Drweca, Parseta, Rega and Slupia. The yearly production amounts to 2.5–3.0 million eggs. Stocking material (smolts, one-year old parr and one-summer old parr) are reared in five hatcheries. In 2019, the total smolt production was 217 000 released in AU 5 (Table 3.3.1.1). Starting from 1994, the annual releases have fluctuated between 24 000 and 0.5 million smolts.

In **Germany**, no regular release programme for salmon exists in the Baltic region, as there are no known natural populations. Consequently, there were no official releases of salmon in rivers with outlet into the Baltic Sea in 2019. However, a few irregular releases have been reported recently and in the past (e.g. in rivers Trave and Warnow). There is a controversy regarding the potential historic existence of wild Baltic salmon populations in some German rivers.

Until 2005, a rearing programme was run in **Denmark** in a hatchery on the Island of Bornholm using the river Mörrumsån stock (AU 4). The last year releases occurred was 2005. No new releases have been planned.

3.3.2 Straying

Observations on straying rates of released salmon vary between areas. The level of straying is evidently dependent on several factors. For example, in Finland rearing of smolts is based on brood stocks kept in hatcheries, whereas in Sweden it is based on annual brood-stock fishing ('sea ranching'). These differences in rearing practices may also influence straying rates. Strayers are often observed in the lower stretches of the rivers into which they have strayed. This may indicate that not all strayers necessarily enter the spawning grounds and contribute to spawning, but instead that a proportion of them may only temporally visit the 'wrong' river. This also implies that the place and time of collecting observations about straying is expected to influence obtained estimates of straying rate. More information is needed to study these aspects of straying.

According to scale analysis of catch samples collected from the Tornionjoki river fishery in 2000–2011, only eight salmon out of a total of 4364 analysed were identified as potential strayers from releases in other Baltic rivers. This indicates that about 0.2% of the salmon run into Tornionjoki were from other (reared) rivers, which corresponds to about 100 strayers per year, if one assumes an average spawning run into Tornionjoki of about 50 000 salmon. Tag–recapture data of compensatory releases in the Finnish Bothnian Bay indicate that the straying rate of these reared fish to other rivers is 3–4%. From all these releases, however, strayers were found only among the Tornionjoki hatchery strain stocked into the mouth of Kemijoki, and all these strayers were observed in the Tornionjoki. Using these tag–recaptures to calculate the amount of strayers in the Tornionjoki, assuming no strayers from the Swedish releases, there would be annually about 200 strayers in the Tornionjoki spawning run (corresponding to 0.4% straying into the river, again assuming a spawning run of about 50 000 salmon).

In Sweden, tag recoveries indicate that the average straying rate of reared salmon into other rivers has been 3.5–4.0% on average, but for some releases, the straying rate has been as high as 10–30%. Highest straying rate of tagged salmon is often observed in reared rivers with annual releases, due to a high total exploitation rate from the commercial, recreational and brood-stock collection, and probably also because brood-stock fisheries are carried out close to river mouths.

3.3.3 Tagging data

Tagging data, mainly from external Carlin tags, have been used historically within the Baltic salmon assessment, to estimate population parameters as well as exploitation rates by different fisheries (see Annex 2 for further details). Both wild and reared salmon of different ages may be tagged, but a majority of the fish tagged over the years represent hatchery-reared smolts. For various reasons, the number of tag returns has become very sparse after 2009, and therefore, in later years, tag return data have not been used in the assessment. As the tagging used are from external tags, it is vital that fishermen find and report tags. However, earlier reports (summarised in e.g. ICES, 2014) indicate an obvious unreporting of tags.

As the tag return data influence e.g. the annual post-smolt survival estimates, which is a key parameter in the Baltic salmon assessment, there is a need to supplement or replace the sparse tagging data in the near future. The WGBAST 2010 (ICES, 2010) dealt with potential measures to improve and supplement the tagging data, including alternative tagging methods and supplementary catch sample data. In 2010, the WG also noted need for a comprehensive study to explore potential tagging systems, before a change to a new system in the Baltic Sea may be considered.

Since smolt abundance is included as a parameter in the EU-MAP, tagging has to be carried out as part of the data collection (for mark–recapture experiments) (Table 3.3.3.1). Furthermore, salmon smolts are tagged for other monitoring purposes. In 2019, the total number of Carlin tagged reared salmon released in the Baltic Sea was 6997 (Table 3.3.3.2), which was similar to 2018, and 22% less than in 2017. Carlin tagged salmon smolts were only released by Finland and Sweden. As alternative methods, T-bar anchor tags are also used for tagging of smolts in Estonia. Furthermore, in Sweden internal PIT-tags have also been used in several wild (index) rivers and also in reared rivers (Table 3.3.4.2) and for tagging adult fish e.g. in Poland. In addition, a batch marking method with alizarin red S dye was used in Finland in 2019 for experimental marking of salmon embryos and alevins (Table 3.3.4.2).

As mentioned above, tag return rates show decreasing trends, as illustrated in Figures 3.3.3.1 and 3.3.3.2 for salmon tagged and released in the Gulf of Bothnia and Gulf of Finland, respectively. Since 2015, the return rate of Finnish Carlin tagged reared salmon smolts released in the Gulf of Bothnia and Gulf of Finland was close to zero (Figure 3.3.3.1). The return rate of 1-year old Carlin tagged salmon smolts in the Gulf of Finland in Estonian experiments varied around 0.2% in years 2000–2004. There were no returns of tags in 2006, but in the following year, the recapture rate exceeded 0.8%. Because of the low recapture rate and changes in stocking practices, no 1-year-old salmon smolts have been Carlin tagged in Estonia since 2012. The mean recapture rate of 2-year-olds in Estonian experiments for years 2001–2008 was 0.7% and varied between 0.02–0.1% in years 2009–2014 (Figure 3.3.3.2). Since 2015, only T-bar anchor tags are used in Estonian experiments for tagging of salmon smolts. The recapture rate for fish from the 2015 cohort was around 0.39%. For fish from the 2016 cohort, the tag–recapture rate increased significantly compared to in the last years and was around 0.68%. But for fish from the cohort 2017 and 2018, it again decreased to 0.3% and 0.2% respectively. A similarly low recapture rate has been seen for Polish Carlin tags, where the reporting rate was around 1.5–2.0% in 2000–2008, whereas it decreased below 0.5% since 2009 (Figure 3.3.3.3). No salmon mass tagging with Carlin tags or other tagging methods was conducted in Poland in 2019, because of low recapture rates in previous years.

3.3.4 Fin-clipping

Fin-clipping makes it possible to distinguish between reared and wild salmon in catches. Such information has been used, e.g. to estimate proportion of wild and reared salmon in different mixed-stock fisheries. However, since not all Baltic salmon smolts released are fin-clipped, this type of information is not directly utilised in the WGBAST assessment model.

Since 2005, it has been mandatory in Sweden to fin-clip all released salmon (and sea trout). All reared Estonian and Latvian salmon smolts released in 2019 were also fin-clipped. In Poland, all types of tagging were stopped in 2013 and 2014, because of national veterinarian's objections. In 2015, tagging was again permitted in Poland; however, since 2016 fin-clipping of smolts has not continued. From 2017 and onwards, all salmon released in Finland are fin-clipped (except releases for enhancement purposes, mostly parr). Salmon smolts released 2019 in Russia, Lithuania, Poland, Germany and Denmark were not fin-clipped.

In Table 3.3.4.1 information on the total number of released adipose fin-clipped young salmon in years 1987–2019 is presented together with data on the proportion of adipose fin-clipped adult salmon in Latvian offshore catches in the period 1984–2007. In 2019, the total number of fin-clipped young salmon released was 3 830 000, an decrease of 5% compared to in 2018. Out of this total, 89 800 were parr and 3 740 000 smolts (Tables 3.3.4.1 and 3.3.4.2). Most fin-clipping (in numbers) were carried out in SD 30–32, but part of the fin-clipped fish were also released in SD 27–29 (Table 3.3.4.2).

3.4 M74, dioxin and disease outbreaks

In this section, updated information is provided on monitoring of M74, dioxin and disease outbreaks. See Stock Annex (Annex 2) for further background information.

3.4.1 M74 in Gulf of Bothnia and Bothnian Sea

The thiamine deficiency syndrome M74 is a reproductive disorder, which causes mortality among yolk-sac fry of Baltic salmon. The development of M74 is caused by a deficiency of thiamine (vitamin B1) in the salmon eggs that, in turn, is suggested to be coupled to an abundant but unbalanced fish diet with too low concentration of thiamine in relation to fat and energy content (Keinänen et al., 2012). More background information about the M74 syndrome can be found in Annex 2.

When calculated from all Swedish and Finnish data, the proportion of salmon females whose offspring displayed increased mortality in 2019 was on average 6%, compared to 18% in the preceding year (Table 3.4.1.1). Hence, the incidence of the M74 syndrome has decreased to the same low level as in 2012–2015 before the mortality started to increase in 2016. The prognosis for the proportions of offspring groups in spring 2020 suffering from M74 mortality was 0%. (Table 3.4.1.1).

The thiamine concentration in unfertilized eggs in autumn 2019 (reproductive period 2019/2020) as a mean for females of the Finnish side Bothnian Bay rivers, continued to increase somewhat compared to that in the preceding year (Figure 3.4.1.1), and was approximately similar as in the reproductive periods 2011/2012–2013/2014, when no M74-related mortality was reported in the Finnish M74 monitoring data (Table 3.4.1.2). Although the mean thiamine concentration was lower than in 2014/2015, significant M74 mortalities are not expected in spring 2020. In Swedish hatcheries, the proportion of offspring groups with increased M74-like mortality varied from 0–24% in 2019, compared to 11–25% in 2018 (Table 3.4.1.3; SLU Aqua, 2018).

No 'wiggling' females (i.e. with an uncoordinated swimming behaviour) were detected in either Swedish or Finnish rivers in autumn 2019. The average free thiamine concentrations in unfertilized eggs of salmon from the River Tornionjoki in autumn 2019 also had increased compared to those in autumns 2015–2018, but the concentrations still remained lower than those top concentrations found in salmon eggs from the R. Simojoki in autumn 2014 (Figure 3.4.1.2). In 2018, no eggs from Simojoki salmon could be included in the M74 monitoring due to a temporary regulation (river mouth was in 2018 located within an "IHN safety area"), neither it was included in 2019 although the regulation was already cancelled. The mean free thiamine concentration in eggs of River Tornionjoki salmon in autumn 2019 did not significantly differ from that of salmon ascended the River Kymijoki in the Gulf of Finland.

The prognosis for incidence of M74 in offspring groups (females) is based on the concentration of free thiamine in eggs vs. yolk-sac fry mortality (%) relating to thiamine deficiency in female-specific laboratory incubations (in Finnish M74 monitoring data from the reproduction period 1995/1996–2009/2010, n = 1009). The limit values of free thiamine used in prognosis are: for 100% mortality ≤0.2 nmol/g, for occurrence of M74 mortality ≤0.5 nmol/g, but excluding possible late M74 (M74?) ≤1.0 nmol/g.

The M74 incidence figures in Table 3.4.1.1 predominantly represent the percentage of females in a hatchery with a recorded increase in offspring mortality. In the rivers Simojoki, Tornionjoki, Kemijoki and Iijoki, however, mortalities are reported for the proportion of females affected by M74 and the mean percentage yolk-sac fry mortality (Table 3.4.1.2). In Finnish data, annual M74 figures are based on female-specific experimental incubations in which M74 symptom-related mortality has been ascertained by observations of yolk-sac fry (until the reproductive period 2009/2010) and/or comparing mortalities with the thiamine concentration of eggs (from 1994/1995 and onwards) (Figure 3.4.1.1). From 2011/2012 to 2017/2018, Finnish figures of the incidence of M74 are principally based on the free thiamine concentration of unfertilized eggs, which has a strong correlation with M74-related mortality of yolk-sac fry (Vuorinen and Keinänen, 1999; Keinänen *et al.*, 2014; 2018). However, control female-specific incubations have been run at a hatchery (Vuorinen *et al.*, 2014). Three figures are presented: (1) the average yolk-sac fry mortality, (2) the proportion of females with offspring affected by M74, and (3) the proportion of those females whose offspring have all died (Keinänen *et al.*, 2000; 2008; 2014; 2018; Vuorinen *et al.*, 2014). Mean annual yolk-sac fry mortalities and proportions of M74 females correlate significantly, but the M74 frequency has usually been somewhat higher than the offspring M74 mortality, especially in years when many offspring groups with mild M74 occur, i.e. when only a proportion of yolk-sac fry die. In years when the M74 syndrome is moderate in most offspring groups, the difference between the proportion of M74 females and mean yolk-sac fry mortality can exceed 20 percentage units (Keinänen *et al.*, 2008). In contrast, Swedish data are based only on the proportion of females whose offspring display increased mortality regardless of the proportion dying (Table 3.4.1.3).

Currently (from 2019/2020 on) the incidence of M74 in Finnish M74-monitoring is exclusively determined from the concentrations of free thiamine in unfertilized eggs. All three figures (proportions of M74 females and M74 mortalities) are derived from the model by relating the free thiamine concentrations with yolk-sac fry mortalities from laboratory incubations in the spawning years 1994–2009 from the Finnish M74 monitoring data.

In the hatching years 1992–1996, the M74 syndrome resulted in a high mortality of salmon yolk-sac fry with an M74 frequency (i.e. the proportion of the females whose offspring were affected) over 50% in most Swedish and Finnish rivers (Table 3.4.1.1). Since then the incidence of M74 has on average decreased. However, it has varied greatly even between successive years with elevated mortalities in some years (e.g. 1999, 2002, and 2006–2007) compared to others with low or non-existent mortalities (e.g. 1998, 2003–2005 and 2011–2015). In the reproductive period 2011/2012, the incidence of M74 could be considered as non-existent for the first time since the large outbreak in the 1990s. However, M74 returned in the reproductive period 2015/2016.

In years with a high M74 incidence, there has been a tendency that estimates of M74 mortality have been higher in Finland than in Sweden, but this difference seems to have disappeared in the years when the mortality has been low (Figure 3.4.1.3). The difference may be due to the fact that, in Finland all females caught for M74 monitoring have been included, whereas in Sweden females that have displayed uncoordinated swimming (wigglers) have been excluded from incubation.

Wiggling females are known to inevitably produce offspring that all die from M74. The proportion of wiggling females was high in the early and mid-1990s (Fiskhälsan, 2007). Trends and annual fluctuations in average proportions of M74-affected females have been very similar in Swedish and Finnish rivers (Figure 3.4.1.3). However, in some years M74 has been insignificant or absent in the Finnish M74 monitoring, whereas rather high M74 frequencies have been reported from some Swedish rivers. It seems that those Swedish results may rather result from technical failures or too high or variable water temperatures, as reported by Börjeson (2013).

In the Finnish M74 monitoring, but not in Sweden before 2015/2016, the mortality and female proportion figures for M74 incidence have been ascertained by measuring the thiamine concentration of eggs (Figure 3.4.1.1). In the Finnish M74 data, the annual M74 incidence among the monitored Bothnian Bay rivers has been very similar. Therefore, it is relevant to express the proportion of M74 females and annual M74 mortality as an average of all individual monitored salmon females (and respective offspring groups) that ascended those rivers (Keinänen *et al*., 2014). However, there may be some differences between salmon populations from rivers in the Bothnian Bay and in the Bothnian Sea, if migration routes and feeding grounds during the whole feeding migration differ, as reported by Jacobson *et al*. (2020). This would also explain different mortalities, reported during the early 1990s (Table 3.4.1.1), among offspring of salmon from the River Mörrum in AU 4, from where smolts descend directly into the Baltic Proper.

Evidently, as a consequence of strengthening of the cod (*Gadus morhua*) stock and flattening out of the sprat (*Sprattus sprattus*) stock (ICES, 2012) the incidence of M74 decreased and was virtually non-existent in 2012–2015. However, M74 returned, apparently principally as a consequence of an exceptionally strong year class of sprat hatched in 2014 (ICES, 2017b). Young sprat were exceptionally numerous in the northern areas of the Baltic Proper and Gulf of Finland. Moreover, the year class of herring (*Clupea harengus*) in 2014 was strong, e.g. in the Bothnian Sea (Raitaniemi, 2018). The thiamine concentrations in unfertilized eggs of salmon ascended the rivers of the Gulf of Bothnia decreased in autumn 2015 and were even lower in salmon ascended in autumn 2016. Thus, after several favourable years, M74 again impaired salmon yolk-sac fry survival in spring 2016. The M74 mortalities further increased in spring 2017 and prevailed in spring 2018. The western cod stock has strengthened in recent years, but the eastern cod stock appears not to be strong, although the estimates for it are not very reliable (Raitaniemi, 2018). However, the increased thiamine concentrations in eggs of salmon ascendants of autumns 2018 and 2019 indicate that balance between fish stocks has again been changed.

In unfertilized eggs of salmon having ascended the Lithuanian River Neris in autumn 2017, the free thiamine concentrations were considerable higher compared to salmon of the Gulf of Bothnian rivers, and the incidence of M74 in spring 2018 evidently was low (or, based on a small number of sampled fish, almost insignificant). Apparently those salmon have been feeding in the southern Baltic Proper, where the presence of cod, contrary to the northern Baltic Sea, has reduced sprat from its exceptionally high year class 2014 (ICES, 2017b). Thus young sprat from the year 2014 have been less numerous in the southern Baltic Proper than in the northern areas of the Baltic Sea (Raitaniemi, 2018), and the herring biomass as food for salmon, e.g. in SD 25, has been higher than that of sprat (Jacobson *et al*., 2018).

In the Stock Annex (Annex 2, Section C.1.6), a description is given of a Bayesian hierarchical model applied to the Gulf of Bothnian (GoB) monitoring data (Tables 3.4.1.2 and 3.4.1.3) of M74 occurrence from rivers in Finland and Sweden, to obtain annual estimates of the M74-derived yolk-sac fry mortality. This information is needed to fully assess the effects of M74 on the reproductive success of spawners. Besides annual estimates of M74 mortality in the rivers, where such has been recorded, the model provides annual estimates of the mortality for any GoB river, in which no monitoring has been carried out (Table 4.2.2.2, Figure 4.2.2.2). Most of the wild stocks, including all smaller wild rivers in the GoB, belong to this group. The results demonstrate that in some years, the actual M74 mortality among offspring has been lower than the proportion of M74 females indicated, which apparently is related (see above) to mildness of the syndrome, i.e. to partial mortalities in offspring groups.

3.4.2 M 74 in Gulf of Finland and Gulf of Riga

In the River Kymijoki in AU 6 (Gulf of Finland) the incidence of M74 has in many years been lower than in the northern AU 1 rivers Simojoki and Tornionjoki (Table 3.4.1.1; Keinänen *et al.*, 2008; 2014). However, in the reproductive period 1997/1998, for example, when M74 mortalities among salmon yolk-sac fry of the Gulf of Bothnia rivers were temporarily low, the situation was the opposite; evidently this reflected variation in sprat abundance between the main feeding areas, i.e. the Baltic Proper and the Gulf of Finland. The long-term tendency has however, been roughly similar. The River Kymijoki of the Gulf of Finland, with introduced salmon originating from the Neva stock, was included in the Finnish M74 monitoring programme from the year 1995, but no data for the years 2008–2013 and 2015–2019 exist, because of problems in salmon collection for monitoring. Therefore, the latest mortality data from the R. Kymijoki are from spring 2007 (Table 3.4.1.1). However, in autumn 2013 a few Kymijoki salmon females were caught for renewing of the brood stock. Based on relatively high concentrations of free thiamine in unfertilized eggs (mean 3.2 ± 1.1 nmol/g, N = 5) of all five females, M74 mortalities in spring 2014 were unlikely.

In Estonia, M74 has been observed in hatcheries in some years during the period 1997–2006, but the mortality has not exceeded 15%. A small number of spawners is collected for brood stock from river Kunda since 2013, and no fry mortality has been observed. However, in 2016 the eggs from one female (out of four) displayed mortality after hatching. This recent observation indicates that the incidence of M74 may have increased also in the Gulf of Finland, apparently as a consequence of the exceptionally strong 2014 year class of sprat (ICES, 2017b). According to Raitaniemi (2018) sprat had in subsequent years been highly abundant and more numerous than herring in the northern Baltic Proper and Gulf of Finland. In autumn 2019, salmon of the River Kymijoki were again caught for renewing of the brood stock. Similarly to salmon of the River Tornionjoki, the concentrations of free thiamine in eggs of salmon ascending the River Kymijoki were relatively high (mean 3.02 ± 0.31 nmol/g, N = 15). Thus, significant M74 mortalities are not expected in spring 2020 (Table 3.4.1.1).

There is no evidence to suggest that M74 occur in Latvian salmon populations. In the main hatchery Tome, the mortality from hatching until the start of feeding varied in the range of 2–10% in the years 1993–1999. In addition, parr densities in Latvian river Salaca did not decrease during the period in the 1990s when salmon reproduction in the Gulf of Bothnia was negatively influenced by M74 (Table 3.1.5.1). Before ascending the river, salmon from Daugava and Salaca feed in the Gulf of Riga, where the main prey species of salmon was herring during the years 1995–1997 (Karlsson *et al.*, 1999; Hansson *et al.*, 2001). Although sprat was the dominant prey species in the Baltic Proper during that time period, the salmon diet in the Gulf of Riga did not include sprat. Furthermore, in contrast to salmon feeding in the Baltic Proper or in the Bothnian Sea, the proportion of other prey species, such as sand eel (Ammodytes spp.), perch (*Perca fluviatilis*), smelt (*Osmerus eperlanus*) and cod, was considerable in the Gulf of Riga (Karlsson *et al.*, 1999;

Hansson *et al*., 2001). Salmon in River Daugava moreover ascended later than salmon in Gulf of Bothnia rivers (Karlsson *et al*., 1999).

3.4.3 Dioxin

In Sweden, the National Food Agency is responsible for sampling, analysis and dietary recommendations regarding dioxin in fish. In their latest report, the results indicate increased concentrations of dioxin in Baltic salmon caught along the coast (Fohgelberg and Wretling, 2015). The Swedish control programme is set up in accordance with EU regulation 589/2014. Limits are set out in EU Regulation 1881/2006 with updates in EU Regulation 1259/2011. Sweden has an exception to the limits of dioxin when it comes to salmon and a few other fish species in the Baltic Sea and in Lakes Vänern and Vättern. In 2018, EFSA (European Food Safety Authority) altered its statement on the risk posed to humans by dioxins and PCBs, something that has yet to be implemented by the Swedish National Food Agency. EFSA is in the process of performing a larger risk-benefit study about fish consumption and exposure to contaminants, which may have effects on guidelines for human consumption. Also, Finland has an exemption to the EC regulation 1259/2011 which allows selling of Baltic salmon and sea trout in the domestic market. No export of wild-caught salmon or sea trout is allowed. According to the Finnish survey for EU reporting (Airaksinen *et al*., 2018) the concentrations of dioxins in salmon had decreased approximately to half during the 2000s. However, dioxin concentrations in salmon sampled in 2016 still exceeded the maximum allowable value set by the EU (Airaksinen *et al*., 2018).

In Denmark, the following restrictions for marketing of salmon (and sea trout) were enforced from December 5th, 2016: Salmon ≤5.5 kg gutted weight caught in ICES subdivisions 24–26 must be trimmed (deep-skinned) before marketing. In the same SDs salmon weighing >5.5 kg and <7.9 kg can be marketed, if trimmed and the ventral part of the fish is removed. Each batch of salmon >2.0 kg caught in ICES SD 27–32 must also be analysed for dioxin before marketing. Dioxin concentrations in samples taken in 2006 and 2013 were comparable, while samples from 2011 contained slightly lower concentrations of dioxin.

3.4.4 Disease outbreaks

In the last 6–7 years, health issues for salmon related to specific rivers have been reported from several countries around the Baltic. There are similarities between these reports, but also differences, and there is a need for further research and evaluations before any overall conclusions for the current health status of Baltic salmon can be drawn. Besides national sampling programmes, the ICES Working Group on Pathology and Diseases of Marine Organisms (WGPDMO) has Baltic salmon health issues listed in its ToRs for the period 2019–2021; a synthesis with recommendations related to this ToR is planned for 2021.

Since 2014, an increasing number of reports from fishermen and local administrators of dying or dead salmon have come from Swedish and Finnish salmon rivers, spanning from Tornionjoki to Mörrumsån. Salmon affected have displayed various degrees of skin damage, from milder erythemas and bleedings, to UDN-like (Ulcerative Dermal Necrosis) lesions and more severe ulcers and traumatic wounds that are typically followed by secondary fungal infections causing death (SVA, 2017). To some extent also other fish species, such as trout, whitefish and grayling have been reported with similar symptoms.

The disease prevalence has varied considerably between both rivers and years. In some rivers, there are so far no reports of elevated levels of elevated salmon death. The most severe disease outbreaks occurred in Tornionjoki (2014–2015, 2019), Kalixälven (2015), Ume/Vindelälven (2015–2019), Ljungan (2016, 2018) and Mörrumsån (2014–2018). In several cases, the number of dead salmon (and other species) has been considerable, although quantitative estimates of total death rates are missing. However, in e.g. Mörrumsån, it has been noted that following a year with disease very few overwintered spawners (kelts) appear to remain the following spring according to river catches.

The poor health of returning salmon continued in 2019. Symptoms resembled those in previous years, again with large variation among rivers. The most severe problems with weak or dead wild salmon were reported from Torneälven/Tornionjoki. In addition to more abundant reports of dead or dying salmon than in some years, individuals with deviating behaviour were observed (swimming close to river surface, not afraid of boats, etc.) named "zombie-salmon" in Finnish media. Preliminary results received in 2018 and 2019 within an ongoing radio-tagging study of spawning migrating salmon (and sea trout) further revealed an alarmingly high proportion of individuals caught in the Torneälven/Tornionjoki estuary with "red bellies" or other skin-damages. In both years, a majority of the tagged salmon also left the river after having spent just some weeks in its lowermost part, i.e. long before the spawning period.

In Ljungan, very low 0+ salmon densities have been observed in 2017–2019, coinciding with recent health problems among adults (especially in 2016 and 2018). In Vindelälven, the average 0+ parr density also has declined and remained very low since 2016. The low current salmon production in Vindelälven reflects a combination of few ascending females in 2017–2018, elevated M74-mortality (Sections 3.1.2 and 3.4) and observed and presumed additional mortality among spawners after having passed the Norrfors fishway (where counting takes place).

Notably, only one out of 400 salmon (0.25%) tagged at the Ume/Vindelälven river mouth managed to pass the counter in the Norrfors fishway in 2017. Most of these tagged fish stayed further downstream in the river for some time, without managing to migrate further upstream, before finally leaving the river (Kjell Leonardsson, SLU, pers. comm.). In 2018, the proportion of tagged salmon passing the counter was higher (15%), but still low compared to most previous years with tagging experiments. In 2019, not a single one out of 200 tagged salmon passed the fish counter, but this very poor result is likely not representative for the entire season; all tagged salmon were handled relatively early, when the health situation in Vindelälven was bad (many dead or dying salmon and few females). However, later during the season, when the tagging study had been ended, the situation improved and the number of MSW salmon (including females) passing the fishway increased significantly. Finally it should be noted that in the past two decades the proportion of females in Ume/Vindelälven has decreased markedly over time; a development not yet seen in Torneälven/Tornionjoki (Figure 3.1.2.3) or in other rivers (with more scattered data) with less pronounced salmon health problems.

In 2015 and 2016, the Swedish National veterinary institute (SVA) and the Finnish food safety authority (Evira) conducted investigations aimed at identifying the cause of the salmon disease. Analyses of Tornionjoki salmon in 2015 showed that some of the sampled fish displayed UDN-like symptoms. Cultivation for virus and bacteria in 2016 did not provide conclusive answers, although in some cases bacteria associated with skin lesions were identified. Next generation sequencing indicated presence of herpes- and iridoviruses in individuals with erythemas. These viruses may cause skin lesions, but these findings need to be investigated further. Although it appears likely that the disease outbreaks in Swedish and Finnish salmon rivers during recent years have a common cause, likely linked to the Baltic Sea phase, this still remains to be proved.

In 2018, Swedish investigations on salmon from selected rivers continued (Axén *et al.*, 2019). Results from screening of various "biomarkers" did not indicate exposure to environmental contaminants to any larger extent. However, salmon from Torneälven/Tornionjoki demonstrated induced EROD activity and an elevated production of red blood cells, which warrants further investigations. In addition, a possible effect on the endocrine system was observed with elevated levels of glucose in fish from Umeälven, whereas altered levels of thyroid hormones were observed in salmon from Ume/Vindelälven and Torneälven/Tornionjoki.

During 2020, samples collected within the Swedish 2018 study (Axén *et al.*, 2019) will be analysed further. Markers of oxidative damage and enzymes involved in T3- and T4 metabolism will be studied, as well as possible correlations between biomarkers and a newly developed disease index. Physiological systems in affected salmon will be studied through metabolomics (SVA and the University of Gothenburg). Studies of possible effects on the immune system caused by a combination of deficiency of vitamins and exposure to environmental toxins (OH- BDE, OH-PCB and PFAS) will carried out at Stockholm university, whereas effects of environmental stress, diet and possible exposure to algal toxins will be studied at the Swedish University of Agricultural Sciences.

In 2020, salmon biologists and veterinarians in Sweden and Finland plan to jointly monitor and investigate the health status of Tornionjoki salmon over the whole migration season. The plan comprise documenting external condition of salmon, tagging salmon with radio transmitters, collecting tissue samples of salmon from different periods of the season, and conducting laboratory analyses of the tissue samples. In Sweden, there are also plans for evaluating whether fish-counters equipped with cameras can be used to identify salmon with visible wounds and/or fungus-infections, as a means to monitor proportions of affected salmon in certain rivers.

So far, there have been no reports of UDN-like disease problems in Russian or Estonian salmon rivers. Late in 2017, pre-spawning mortality in salmon (and sea trout) was reported for the first time from river Gauja in Latvia. Similar to in Swedish rivers, the fish were described as apathetic; they showed slow response to irritants and were easily caught. There were also multiple observations of skin wounds with fungal infections. Sea trout and salmon from Gauja were examined for presence of viruses: IHNV (infectious hematopoietic necrosis virus), VHSV (viral hemorrhagic septicemia virus) and IPNV (infectious pancreatic necrosis virus) and bacteria: *Aeromonas salmonicida*, *Aeromonas hydrophila*, Yersinia spp., Salmonella spp., Pseudomonas spp. and Plesiomonas spp. In addition, search for parasites and histological examinations of wounds were carried out. The investigations showed that the above mentioned pathogens were not the cause for the observed disease and pre-spawning mortality in Latvia. No new reports on health related mortality in adult salmonids were received from Latvian anglers in 2018 or 2019, and no further investigations have been conducted.

In 2018, elevated mortality among adult salmon (mainly) and sea trout was also reported from tributaries within the Neris catchment (Nemunas river system) in Lithuania. Fish were observed to die from skin infections of fungal and/or bacterial origin, possibly reflecting secondary infections associated with UDN (not confirmed). In some cases, the proportion of affected individuals during and after the spawning period exceeded 90%. In 2019, there were no new reports on salmon and sea trout health problems in Lithuanian rivers.

Potential consequences of health-related problems for the future development of wild salmon stocks, and how such extra mortality may be monitored and handled in stock assessment is briefly discussed in Section 4.7. See Section 5.8 for additional observations on health issues related to sea trout.

3.5 Summary of the information on wild and potential salmon rivers

Wild smolt production in relation to the smolt production capacity is one of the ultimate measures of management success. Among the wild rivers flowing into the Gulf of Bothnia and the Main Basin (assessment units 1–5), smolt abundance is measured directly in the current index rivers **Simojoki** and **Tornionjoki/Torneälven** (AU 1), **Vindelälven** (AU 2), **Testeboån** (AU 3), **Mörrumsån** (AU 4) and in **Salaca** (AU 5). In addition, 1–2 years of smolt counting has also been performed in **Lögdeälven** (AU 2) and **Emån** (AU 4) (Sections 3.1.2–3.1.4) and counting in additional rivers **Råneälven** initiated in 2019 and **Åbyälven** in 2018**.** The river model (Annex 2), which utilises all available juvenile abundance data, is a rigorous tool for formal assessment of current smolt production.

Differences in the status of wild stocks are apparent, not only in terms of the level of smolt production in relation to potential production (Section 4.2), but also in terms of trends for various abundance indices. Differences in trends are clear between regions: most Northern Gulf of Bothnia (AU 1–3) rivers have shown increases in abundance while many of the Southern Main Basin (AU 4–5) rivers have shown either decreasing or stable abundances, whereas the development in the AU 6 rivers generally falls between these two regions.

Rivers in the Gulf of Bothnia (assessment units 1–3)

The parr production in the hatching years of 1992–1996 was as low as in the 1980s (Tables 3.1.1.4, 3.1.2.1 and 3.1.3.1, and Figures 3.1.1.4, 3.1.1.5, 3.1.2.1, 3.1.2.2 and 3.1.3.1), although the spawning runs were apparently larger (Tables 3.1.1.1, 3.1.1.2, and Figures 3.1.1.2, 3.1.1.3). In those years, the M74 syndrome caused high mortality (Table 3.4.1.1 and Figure 3.4.1.1), which decreased parr production considerably. In the hatching years 1997–1999, parr densities increased to higher levels, about five to ten times higher than in the earlier years. These strong year classes resulted from large spawning runs in 1996–1997 and a simultaneous decrease in the level of M74. The large parr year classes hatching in 1997–1998 resulted in increased smolt runs in 2000 and 2001 (Table 3.1.1.5).

Despite some reduction in parr densities during 1999–2002, parr densities and subsequent smolt runs stayed on elevated levels compared to the situation in the mid-1990s. In 2003, densities of one-summer old parr increased in some rivers back to the peak level observed around 1998, while no similar increase was observed in other rivers. From 2004–2006, densities of one-summer old parr showed a yearly increase in most of the rivers, but in 2007 the densities of one summer old parr again decreased. Despite the relative high spawning run in 2009 the densities of one summer old parr in 2010 decreased substantially in most rivers, compared to the densities in 2009. The densities of one summer old parr in 2012 stayed at the same level as in 2011, or even increased, despite the relatively weak 2011 spawning run. The increased spawning run in 2012 did not substantially increase the densities of one summer old parr in 2013, whereas the increased spawning runs in 2013 and 2014 resulted in elevated densities of one summer old parr. The lower spawning run in 2017 and 2018 resulted in decreased densities of one summer old parr in 2018 and 2019.

Catch statistics and fishway counts also indicate some differences among rivers in the development in number of ascending spawners. To some extent, these differences may reflect problems with fish passages through fishways in certain rivers. For example, a survey in 2015 and 2016 of the efficiency of the fishway in Piteälven indicated a large delay in the spawning run and loss of salmon that didn't pass the fishway at the hydropower station located below the spawning areas. Similar observations have also been identified in Åbyälven (Section 3.1.2).

There has been pronounced annual variation in the indices of wild reproduction of salmon both between and within rivers. Variation in abundance indices might partly be explained to extreme summer conditions in the rivers during some years, e.g. in 2002–2003 and in 2006, which might have affected river catches and the fish migration in some fishways. Counted number of salmon in 2007 increased with about 50% compared to 2006. The additional increase in fishway counts in 2008 is in agreement with increased river catches, which more than doubled in 2008 compared to 2007 and were almost as high as in the highest recorded years (1996 and 1997). The spawner counts in 2010 and 2011 in combination with information on river catches indicated weak spawning runs in those years. The large increased spawning run in Tornionjoki in 2012, 2013, 2014 and 2016, as compared to 2011, resulted in increased total river catches with 40–70% compared to the two previous years. The spawning run in 2018 and 2019 was relatively weak in many rivers, and one reason could be that salmon was suffering from some kind of disease and relative high water temperatures during the summer in 2018. Likely, for the same reasons, most river catches decreased.

Most data from the Gulf of Bothnia rivers indicate an increasing trend in salmon production. Rivers in AU 1 have shown the most positive development, while stocks in the small rivers in AUs 2–3 have yet not shown as strong positive development. These small rivers are located on the Swedish coast close to the Quark area (northern Bothnian Sea, southern Bothnian Bay). The recent period with historically low M74-levels close to zero in spawning years 2010 to 2015 (Figure 3.4.1.3) most likely affected the wild production positively. After that, slightly higher M74 frequencies have followed. Preliminary data from thiamine analyses of eggs from two Swedish and two Finnish stocks indicate that M74-mortality among offspring hatching in 2020 (from spawning 2019) will further decrease somewhat; preliminary results from, Tornionjoki, Kemijoki, Ume/Vindelälven and Dalälven indicate that offspring mortality for those rivers may be around 5–15%. Disease outbreaks seen in recent years in several rivers is another mortality factor that may have a negative impact on future stock development (Sections 3.4 and 4.4.1).

Rivers in the Main Basin (assessment units 4–5)

The status of the Swedish AU 4 salmon populations in rivers **Mörrumsån** and **Emån** in the Main Basin differ, but they both show a similar slight negative trend in average parr densities (Table 3.1.4.1 and Figures 3.1.4.1 and 3.1.4.2). The outbreak of M74 mortality in the early 1990s might have decreased smolt production in mid-1990s, after reaching the historical highest parr densities in Mörrumsån at the turn of the 1980s and 1990s. In Emån, the smolt production has for long been far below the required level, which is most likely a result of insufficient numbers of spawners that so far have managed to find their way to reproduction areas further upstream in the river.

Updated production capacity priors for Mörrumsån and Emån (ICES, 2015) and smolt estimates from the river model tailored for southern rivers (ICES, 2017c) are now used in the full life-history model. The improvements allow more reliable status assessment of stocks in these rivers (Section 4.4). High disease related mortality among spawners in Mörrumsån (but not yet in Emån) in recent years is another factor that also may affect the future stock development (Sections 3.4 and 4.4.1). According to results from analytical assessment, present stock status is higher in Mörrumsån than in Emån (Section 4). Although average parr densities have not increased since the mid-1990s in Mörrumsån. Smolt trapping results for the production in the upper part of Mörrumsån showed a generally positive trend from 2009 and onwards. In 2019, however, the production decreased to the lowest observed during the nine latest years (Section 3.1.4).

Among rivers in AU 5, the **Pärnu** river exhibit the most precarious state: no parr at all were found in the river in 2003–2004. In 2005–2006, the densities increased slightly, but in 2007, 2008, 2010 and 2011 again no parr were found. Reproduction occurred in 2008, 2011 and 2012 resulting in low densities of parr in 2009 and 2012–2016. Parr density was remarkably high in 2017 but again decreased in 2018 to increase again in 2019 (Table 3.1.5.1, Figure 3.1.5.1). There has been very large annual variation in parr densities, both within and between rivers in AU 5. Since 1997, parr densities in the river **Salaca** in Latvia have been on relatively high levels (Table 3.1.5.1, Figure 3.1.5.2), but in 2010 and 2011 the densities decreased to the lowest observed level since the mid-1990s. In 2015 the density increased to the highest observed so far, and in 2017 the densities increased compared with previous year. However, in 2018 one summer parr densities dropped significantly, most likely due to high water temperatures and low water levels in summer. In

2019, the densities of one summer parr again increased. In river **Gauja**, parr density levels have been very low since 2004. In 2014, the 0+ parr density increased to a slightly higher level and it also increased in 2019 to the highest observed so far. It seems that in some of the AU 5 salmon rivers (**Saka**, **Užava** and **Irbe**) reproduction occurs only occasionally, as the salmon 0+ parr densities in some years are close to zero or zero.

Although only relatively short time-series of parr and smolt abundances are available from Lithuanian salmon rivers, the latest monitoring results (Table 3.1.5.2) indicate somewhat similar variation in juvenile production as seen in Latvian rivers. The observed parr densities are very low in relation to observed parr densities in most other Baltic rivers. This illustrates the poor state of several wild salmon stocks in AU 5. These stocks might have a higher risk of extinction than any of the stocks in AU 1–3 (Gulf of Bothnia). In Lithuania, various measures have been carried out since 1998 to assist the salmon populations (Section 3.1.5). The implemented measures have stabilized the populations in Lithuanian rivers, but production in different rivers and years still show significant fluctuations. Variation in climatic and ecological factors are believed to influence salmon parr densities and levels of smolt production. Pollution also affects the salmon rivers. Another important factor in Lithuanian rivers, which are of lowland type, is lack of suitable habitats for salmon parr.

Besides regulation of fisheries, many of the salmon rivers in the Main Basin (AU 4–5) may need habitat restoration and re-established connectivity, to stabilize and improve natural reproduction. For instance, in the **Pärnu** River, the Sindi dam prevented access to over 90% of the potential reproduction areas until 2018. Now salmon has access to all spawning areas in the river. In **Mörrumsån** and **Emån,** new fish passes have significantly increased the available reproduction areas for salmon. A new decision has also been taken to remove the dam in Marieberg in Mörrumsån, most likely this will take place in summer 2020. Important aims are to assist fish migration and to recreate spawning and nursery habitats for salmonids in the river.

Rivers in assessment unit 6 (Gulf of Finland, Subdivision 32)

The 0+ parr densities in Estonian wild rivers **Kunda** and **Keila** were high in 2017–2019. In **Vasalemma,** the 0+ parr density was on an average level in 2019. The status of river Keila and Kunda is considered to be good, whereas improvement has been modest in river Vasalemma. In 2018, a dam was opened in river Vasalemma, yet no salmon parr was found upstream of the dam in 2019. Because of highly variable annual parr densities in Vasalemma and Kunda, the status of these wild populations must still be considered uncertain.

In the Estonian mixed rivers **Purtse**, **Selja**, **Loobu**, **Valgejõgi**, **Jägala**, **Pirita** and **Vääna**, wild parr densities mostly decreased in 2016. However, in the preceding three years (2012–2015) parr density stayed above the long-term average in all of these rivers. In 2017 and 2018, parr densities increased to very high levels. The clearest positive trend can be seen in Selja, Valgejõgi, Loobu and Pirita. However, because of the high fluctuations in recruitment, the status of these populations remains uncertain. To safeguard these stocks additional regulatory measures were enforced in 2011 and more recently in 2019 (see Section 2.7.2) and positive effect of these measures can be seen as increases in wild parr densities and as a relatively satisfactory amount of ascending spawners to R. Pirita in recent years (2014–2019).

In Russia, wild salmon reproduction occurs in rivers **Luga** and **Gladyshevka**. The status of both these stocks is considered very uncertain. However, high densities of 0+ salmon parr occurred in Gladyshevka in 2015, 2017 and 2019. Since 2003, there is no information that suggests natural salmon reproduction in river **Neva**.

In Finland, natural reproduction in the mixed river **Kymijoki** has increased during the last ten years. However, reproduction varies a lot between years and it mainly takes place on the lower part of the river, although possibilities for salmon to access above the first dams have been improved. Smolt production still remains well below the river's potential (Section 3.1.6).

Total natural smolt production in Estonian, Finnish, and Russian rivers in the Gulf of Finland area was estimated to about 52 600 in 2018. In 2019, the estimated wild AU 6 smolt production decreased to about 48 000. It is estimated that the wild smolt production will increase to 99 000 in 2020. The AU 6 smolt releases since year 2000 have been on a stable level. The exception was year 2011, when releases were reduced with almost 50% (Table 3.3.1).

Table 3.1.1.1. Salmon catches (in kilos) in four rivers of the subdivision 31, and the catch per unit of effort (CPUE) of the Finnish salmon rod fishing in the river Tornionjoki/Torneälven.

	Simojoki (au1) catch, kilo	Kalixälven (au1) catch, kilo	Byskeälven (au2) catch, kilo	Tornionjoki/ Torneälven (au 1) Finnish catch, kilo	Swedish catch, kilo	Total catch, kilo	CPUE grams/day
1970	1330						
1971							
1972	700						
1973							
1974				7950			
1975				3750			
1976				3300			
1977				4800			
1978				4050			
1979	400			5850			
1980				11250	7500	18750	
1981	200	4175	531	3630	2500	6130	
1982		1710	575	2900	1600	4500	
1983	50	3753	390	4400	4300	8700	9
1984	100	2583	687	3700	5000	8700	8
1985		3775	637	1500	4000	5500	14
1986	200	2608	251	2100	3000	5100	65
1987		2155	415	2000	2200	4200	33
1988		3033	267	1800	2200	4000	42
1989		4153	546	6200	3700	9900	65
1990	50	9460	2370	8800	8800	17600	113
1991		5710	1857	12500	4900	17400	106
1992		7198	1003	20100	6500	26600	117
1993		7423	2420	12400	5400	17800	100
1994[1)]	400	0	109	9000	5200	14200	97
1995	1300	3555	1107	6100	2900	9000	115
1996	2600	8712	4788	39800	12800	57600[4)]	561[2)]/736[3)]
1997	3900	10162	3045	64000	10300	74300	1094
1998	2800	5750	1784	39000	10500	49500	508
1999	1850	4610	720	16200	7760	27760	350
2000	1730	5008	1200	24740	7285	32025	485
2001	2700	6738	1505	21280	5795	27075	327
2002	700	10478	892	15040	4738	19778	300
2003	1000	5600	816	11520	3427	14947	320
2004	560	5480	1656	19730	4090	23820	520
2005	830	8727	2700	25560	12840	38400	541
2006	179	3187	555	11640	4336	15976	311
2007	424	5728	877	22010	13013	35023	553
2008	952	10523	2126	56950	18036	74986	1215
2009	311	4620	1828	30100	7053	37153	870
2010	300	1158	1370	23740	7550	31290	617
2011	334	1765	870	27715	15616	43331	773
2012	588	3855	2679	84730	37236	121966	1253
2013	260	4570	1664	57990	14313	72303	1322
2014	1205	3652	1388	124025	22707	146732	2210
2015	1500	2809	1480	101713	29300	131013	1252
2016	1800	1523	1179	125980	34995	160975	1662
2017	600	200	171	71320	3080	74400	860
2018	750	542	58	74934	12511	87445	1200
2019	940	480	940	88809	14419	103228	970

1) Ban of salmon fishing 1994 in Kalixälven and Byskeälven and the Swedish tributaries of Torneälven.
2) Calculated on the basis of a fishing questionnaire similar to years before 1996.
3) Calculated on the basis of a new kind of fishing questionnaire, which is addressed to fishermen, who have bought a salmon rod fishing license.
4) 5 tonnes of illegal/unreported catch has included in total estimate.

Table 3.1.1.2. Numbers of wild salmon (MSW=MultiSeaWinter) in fishways and hydro-acoustic counting in the rivers of the assessment units 1, 2, 3 and 4 (subdivisions 30–31, Gulf of Bothnia) and (subdivisions 25 and 27, Western Main Basin).

Year	Number of salmon																		
	Simojoki (au 1)		Tornionjoki (au 1)		Kalixälven (au 1)		Råneälven (au 1)	Piteälven (au 2)		Åbyälven (au 2)		Byskeälven (au 2)		Rickleån (au 2)	Ume/Vindelälven (au 2)			Testeboån (au3)	Mörrumsån (au4)
	MSW	Total	MSW	Total	MSW	Total	Total	MSW	Total	MSW	Total	MSW	Total	Total	MSW	Females	Total	Total	Total
1973									45										110
1974									15							716	1583		129
1975																193	610		no control
1976																319	808		109
1977																456	1221		90
1978																700	1634		30
1979																643	2119		38
1980					62	80									842	449	1254		47
1981					79	161									293	196	638		115
1982					11	45									216	139	424		105
1983					132	890									199	141	401		288
1984					no control										222	177	443		247
1985					no control				30						569	330	904		190
1986					no control				28						175	128	227		262
1987					no control				18						193	87	246		404
1988					no control				28						367	256	446		502
1989					no control				19						296	191	597		1685
1990					139	639			130						767	491	1572		1450
1991					122	437			59						228	189	356		771
1992					288	656		57	115						317	258	354		no control
1993					158	567		14	27				227		921	573	1663		no control
1994					144	806		14	30				258		984	719	1309		no control
1995					736	1282		23	66			157	786		619	249	1164		no control
1996					2736	3781		89	146	1	1	2421	2691		1743	1271	1939		no control
1997					5184	5961		614	658	38	39	1025	1386		1602	1064	1780		no control
1998					1525	2459		147	338	12	15	707	786		447	233	1154		no control
1999					1515	2013		185	220	10	14	447	721		1614	802	2208		no control
2000					1398	2459		204	534	10	31	908	1157		946	601	3367		no control
2001					4239	8890		668	863	40	95	1435	2085		1373	951	5476		no control
2002					6190	8479		1243	1378	49	81	1079	1316	17	3182	2123	6052		902
2003	936	n/a			3792	4607		1305	1418	14	18	706	1086	0	1914	1136	2337		438
2004	680	n/a			3206	3891		1269	1628	23	43	1331	1707	2	1717	663	3292		497
2005	756	n/a			4450	6561		897	1012	16	80	900	1285	1	2464	1480	3537		557
2006	765	n/a			2125	3163		496	544	20	27	528	665	6	1733	1093	2362		392
2007	970	n/a			4295	6489		450	518	62	93	1208	2098	7	2636	1304	4023		923
2008	1004	1235			6165	6838		471	723	158	181	2714	3409	5	3217	2167	5157		968
2009	1133	1374	26 358	31 775	4756	6173		904	1048	180	185	1186	1976	0	3861	2584	5902		666
2010	699	888	16 039	17 221	2535	3192		473	532	47	47	1460	1879	0	2522	1279	2697		232
2011	791	1167	20,326	23,076	2202	2562		571	597	36	36	1187	1433	0	3992	1505	4886		547
2012	2751	3630	52,828	59,606	7708	8162		1196	1418	74	88	2033	2442	0	5842	1765	8058		1407
2013	2544	3121	46,580	52,268	12247	15039		1168	1343	92	113	3137	3761	0	10002	5058	13604		1762
2014	3322	3816	92,167	100,210	7343	7638	3756	1221	1339	94	94	5417	5888	27	7852	2633	10407		1185
2015	2549	2950	45,456	57,152	5221	8288	1004	1566	1907	78	80	4224	5311	13	2781	790	7521		1057
2016	5125	5435	91,137	98,338	6368	8439	1454	1609	2009	116	155	5533	7280	17	4238	2741	9134	73	712
2017	1642	1918	36,409	40,952	4687	5174	1781	1335	1455	108	108	3465	4125	15	2582	908	4100	67	980
2018	3231	4016	35,866	47,028	5409	7215	4184	1222	1431	113	113	1305	2168	36	2777	728	12754	21	183
2019	3749	4039	52,738	65,520	8681	9957	2132	1922	2089	81	93	4578	5306	55	9668	3389	12683	159	no control

Simojoki: Hydroacoustic counting near the river mouth, started 2003.
Tornionjoki: Hydroacoustic counting 100 km upstream from the sea, started 2009.
Kalixälven: Fishcounting in the fishway is a part of the run. No control during 1984 - 1989.
Råneälven: Hydroacoustic counting 40 km upstream from the sea, started 2014.
Piteälven: New fishway built 1992. Fishcounting is the entire run.
Åbyälven: New fishway built in 1995. Fishcounting is only part of the total run.
Byskeälven: New fishway built 2000. Fishcounting is part of the total run.
Rickleån: New fishways built 2002. Fishcounting is part of the total run.
Umeälven/Vindelälven: Fishcounting in the fishway is the entire run.
Öreälven: Fishcounting in the trap is part of the run. The trap was destroyed by high water levels in 2000.
Testeboån: Fishcounting sice 2015 in the fishway. The counted number represent majority of the run.
Mörrumsån: The fishcounting site is 12 km from rivermouth. Until 1991 the control was done manually. From 2002 fish are counted by electronic fishcounter.

Table 3.1.1.3. The age and sex composition of ascending salmon caught by the Finnish river fishery in the River Tornionjoki since the mid-1970s.

	Year(s)										
	1974-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016	2017	2018	2019
N:o of samples	728	283	734	2114	2170	1879	2988	849	432	413	448
A1 (Grilse)	9%	53%	35%	7%	20%	8%	10%	6%	11%	37%	17%
A2	60%	31%	38%	59%	50%	53%	43%	76%	69%	30%	60%
A3	29%	13%	24%	28%	26%	31%	38%	11%	18%	21%	21%
A4	2%	2%	3%	4%	3%	6%	6%	5%	1%	10%	3%
>A4	0%	1%	<1 %	2%	2%	2%	3%	1%	1%	2%	0.4 %
Females, proportion of biomass	About 45 %	49%	75%	71%	65%	67%	62%	67%	64%	55%	54%
Proportion of repeat spawners	2%	2%	2%	6%	6%	8%	9%	8%	3%	12%	3%
Proportion of reared origin	7%	46 %*	18%	15%	9%	1%	0.3%	0.3%	0.5%	0.2%	0.0%

* An unusually large part of these salmon were not fin-clipped but analysed as reared on the basis of scales (probably strayers). A bulk of these was caught in 1989 as grilse.

Table 3.1.1.4. Densities and occurrence of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 1 (Subdivision 31).

River	Number of parr/100 m² by age group				Sites	Number of	
year	0+	1+	2+ & older	>0+ (sum of two previous columns)	with 0+ parr (%)	sampling sites	Notes
Simojoki							
1982	3.90			1.50	50%	14	No age data of older parr available
1983	0.75			2.20	57%	14	No age data of older parr available
1984	0.53			2.29	44%	16	No age data of older parr available
1985	0.10			0.98	8%	16	No age data of older parr available
1986	0.19			0.53	19%	16	No age data of older parr available
1987	0.74			0.71	27%	22	No age data of older parr available
1988	2.01	2.30	0.24	2.54	36%	22	
1989	2.32	1.15	0.34	1.49	41%	22	
1990	1.71	1.74	0.56	2.30	36%	25	
1991	3.67	1.74	0.65	2.38	32%	28	
1992						0	No sampling because of flood.
1993	0.08	0.35	0.86	1.21	19%	27	
1994	0.39	0.47	0.53	1.00	16%	32	
1995	0.66	0.32	0.13	0.45	31%	29	
1996	2.09			0.76	28%	29	No age data of older parr available
1997	10.98	1.39	0.28	1.67	72%	29	
1998	10.22	3.47	0.46	3.94	100%	17	Flood; only a part of sites were fished.
1999	20.77	10.39	2.41	12.80	93%	28	
2000	15.76	12.17	2.95	15.12	84%	30	
2001	9.03	7.38	3.29	10.67	67%	31	
2002	15.44	8.56	3.30	11.85	81%	31	
2003	19.97	5.38	1.44	6.82	84%	30	
2004	12.97	7.68	1.30	8.98	74%	19	Flood; only a part of sites were fished.
2005	18.49	7.46	1.89	9.35	70%	27	Flood; only a part of sites were fished.
2006	35.82	12.37	6.14	18.51	83%	36	
2007	4.47	2.61	1.21	3.82	37%	35	
2008	17.75	3.19	1.40	4.60	72%	36	
2009	28.56	13.14	2.15	15.29	76%	36	
2010	13.15	8.26	2.45	10.71	80%	35	
2011	27.93	6.87	2.58	9.45	83%	35	
2012	14.98	10.09	1.43	11.52	83%	36	
2013	11.32	10.60	3.64	14.24	78%	36	
2014	34.30	4.94	2.96	7.90	75%	36	
2015	18.55	5.70	0.80	6.50	86%	36	
2016	28.08	10.19	3.54	13.73	83%	35	
2017	38.06	19.07	8.68	28.38	86%	37	
2018	30.60	25.62	16.37	41.99	83%	36	
2019	40.93	7.22	7.15	14.37	83%	36	
Tornionjoki							
1986	0.52	0.89	0.23	1.12		30	
1987	0.38	0.31	0.48	0.79		26	
1988	0.73	0.60	0.46	1.06	46%	44	
1989	0.58	0.68	0.64	1.32	47%	32	
1990	0.52	0.82	0.36	1.18	40%	68	
1991	2.35	0.63	0.48	1.12	69%	70	
1992	0.24	1.80	0.36	2.16	16%	37	Flood; only a part of sites were fished.
1993	0.52	0.44	2.49	2.94	44%	64	
1994	1.02	0.49	1.35	1.84	43%	92	
1995	0.49	1.45	0.65	2.10	48%	72	
1996	0.89	0.33	0.82	1.15	39%	73	
1997	8.05	1.35	0.74	2.09	78%	100	
1998	12.95	4.43	0.53	4.96	92%	84	
1999	8.37	8.83	4.23	13.06	85%	98	
2000	5.90	4.70	6.81	11.51	83%	100	
2001	5.91	3.13	3.82	6.94	78%	101	
2002	7.23	6.03	3.92	9.94	78%	101	
2003	16.09	4.19	2.93	7.12	81%	100	
2004	5.79	4.99	1.27	6.25	80%	60	Flood; only a part of sites were fished.
2005	8.60	2.86	4.28	7.15	81%	87	
2006	13.33	10.57	5.44	16.01	83%	80	
2007	10.33	8.62	5.61	14.23	75%	81	
2008	26.00	10.66	8.70	19.36	94%	81	
2009	19.71	11.65	5.63	17.27	96%	79	
2010	14.42	11.39	6.89	18.28	89%	81	
2011	22.18	14.35	10.06	24.41	90%	78	
2012	19.47	8.04	4.96	13.00	92%	79	
2013	24.13	11.04	6.14	17.18	95%	81	
2014	36.08	10.82	4.41	15.23	97%	75	
2015	40.61	16.96	5.29	22.25	99%	80	
2016	25.24	3.85	3.93	22.46	98%	61	Flood; only a part of sites were fished.
2017	28.52	9.59	7.58	17.18	99%	80	
2018	17.60	10.86	5.33	16.20	92%	80	
2019	25.48	9.53	5.63	15.16	94%	80	

table continues on next page

Table 3.1.1.4. Continues.

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>0+ (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Kalixälven							
1986	0.55	1.59	4.10	5.69	50%	6	
1987	0.40	1.11	1.64	2.75	33%	9	
1988	0.00	0.87	2.08	2.95	0%	1	
1989	2.82	0.99	1.86	2.85	75%	24	
1990	4.96	5.67	2.1	7.77	91%	11	
1991	6.19	1.37	1.09	2.46	79%	19	
1992	1.08	3.54	1.87	5.41	54%	11	Flood; only a part of sites were fished.
1993	0.59	0.66	3.05	3.69	42%	19	
1994	2.84	1.16	3.08	4.24	69%	26	
1995	1.10	3.16	0.94	4.10	67%	27	
1996	2.16	0.77	1.15	1.92	71%	28	
1997	10.16	2.98	1	3.98	86%	28	
1998	31.62	9.81	2.6	12.41	78%	9	Flood; only a part of sites were fished.
1999	4.41	7.66	6.36	14.02	87%	30	
2000	10.76	4.99	8.31	13.30	93%	29	
2001	5.60	5.48	6.3	11.78	79%	14	
2002	6.21	6.22	3.77	9.99	93%	30	
2003	46.94	12.51	5.2	17.71	87%	30	
2004	13.58	14.65	3.25	17.90	88%	24	
2005	15.34	5.53	8.63	14.16	87%	30	
2006	15.96	19.33	8.32	27.65	90%	30	
2007	11.63	7.65	6.53	14.18	80%	30	
2008	25.74	15.91	8.40	24.31	97%	30	
2009	28.18	10.17	5.76	15.93	80%	30	
2010	14.87	10.96	4.71	15.67	83%	30	
2011	36.92	29.62	15.68	45.30	89%	9	Flood; only a part of sites were fished.
2012	16.07	10.07	6.42	16.49	87%	30	
2013	29.51	15.45	11.95	27.40	100%	30	
2014	25.69	14.44	6.03	20.47	100%	30	
2015	48.84	15.27	5.87	21.14	93%	30	
2016	14.80	11.75	6.18	17.93	100%	30	
2017	17.21	5.88	5.72	11.60	97%	30	
2018	26.15	11.56	7.22	18.78	83%	30	
2019	19.56	10.75	3.76	14.51	90%	30	Ordinary sites
2019	19.86	10.30	3.71	14.01	85%	40	Extended sites included
Råneälven							
1993	0.00	0.08	0.83	0.91	0%	9	
1994	0.17	0	0.27	0.27	22%	9	
1995	0.06	0.13	0.21	0.34	18%	11	
1996	0.52	0.38	0.33	0.71	25%	12	
1997	3.38	1.00	1.14	2.14	90%	10	
1998	2.22	0.35	0.35	0.70	100%	1	Flood; only a part of sites were fished.
1999	1.05	2.22	1.66	3.88	50%	12	
2000	0.98	1.67	1.99	3.66	69%	13	
2001	0.23	0.53	2.39	2.92	40%	10	
2002	1.65	0.92	1.32	2.24	43%	14	
2003	4.71	3.34	1.11	4.45	57%	14	
2004						0	No sampling because of flood.
2005	2.83	1.14	2.10	3.24	64%	14	
2006	6.75	4.06	5.12	9.18	50%	14	
2007	2.74	2.36	2.83	5.19	57%	14	
2008	6.25	1.83	3.64	5.47	64%	14	
2009	4.13	4.66	3.67	8.33	86%	7	
2010	5.87	3.57	7.79	11.36	64%	14	
2011	2.92	2.52	2.63	5.15	57%	14	
2012	3.30	2.16	3.21	5.37	71%	14	
2013	8.19	4.15	7.76	11.91	79%	14	
2014	7.42	3.85	4.12	7.97	79%	14	
2015	9.61	5.47	4.02	9.49	79%	14	
2016	4.66	5.16	5.75	10.91	86%	14	
2017	3.41	2.64	4.86	7.50	100%	5	Flood; only a part of sites were fished.
2018	3.86	1.79	5.85	7.64	64%	14	
2019	9.15	3.47	1.98	5.45	86%	14	

Table 3.1.1.5. Estimated number of smolt by smolt trapping in rivers Simojoki and Tornionjoki (assessment unit 1), and Sävarån, Ume/Vindelälven, Rickleån and Lögdeälven (assessment unit 2). The coefficient of variation (CV) of the trapping estimates has been derived from the used mark–recapture model (Mäntyniemi and Romakkaniemi, 2002) for the last years of the time-series. In the Ume/Vindelälven, however, another technique has been applied, in which smolts are tagged during the smolt run and recaptures are monitored from adults (grilse) ascending the year one year later. Ratios of smolts stocked (as parr)/wild smolts in trap catches are available in some years, even though total run estimate cannot be provided (e.g. in the cases of too low trap catches). The number of stocked smolts is based on stocking statistics.

	Tornionjoki (AU 1)				Simojoki (AU 1)				Sävarån (AU 2)		Ume/Vindelälven (AU 2)		Rickleån (AU 2)		Lögdeälv (AU 2)	
	Smolt trapping, original estimate	CV of estimate	Ratio of smolts stocked as parr/wild smolts in catch	Number of stocked reared smolts (point estimate)	Smolt trapping, original estimate	CV of estimate	Ratio of smolts stocked as parr/wild smolts in catch	Number of stocked reared smolts (point estimate)	Smolt trapping, original estimate	CV of estimate	Smolt trapping, original estimate	CV of estimate	Smolt trapping, original estimate	CV of estimate	Smolt trapping, original estimate	CV of estimate
1977	n/a				29,000				n/a		n/a		n/a		n/a	
1978	n/a				67,000				n/a		n/a		n/a		n/a	
1979	n/a				12,000				n/a		n/a		n/a		n/a	
1980	n/a				14,000				n/a		n/a		n/a		n/a	
1981	n/a				15,000				n/a		n/a		n/a		n/a	
1982	n/a				n/a				n/a		n/a		n/a		n/a	
1983	n/a				n/a				n/a		n/a		n/a		n/a	
1984	n/a				19,000				n/a		n/a		n/a		n/a	
1985	n/a				13,000				n/a		n/a		n/a		n/a	
1986	n/a				2,200				n/a		n/a		n/a		n/a	
1987	50,000 *)		1.11	32,129	1,800		1.78	14,800	n/a		n/a		n/a		n/a	
1988	66,000		0.37	11,300	1,500		3.73	14,700	n/a		n/a		n/a		n/a	
1989	n/a		1.22	1,829	12,000		0.66	52,841	n/a		n/a		n/a		n/a	
1990	63,000		0.20	85,545	12,000		1.41	26,100	n/a		n/a		n/a		n/a	
1991	87,000		0.54	40,344	7,000		1.69	60,916	n/a		n/a		n/a		n/a	
1992	n/a		0.47	15,000	17,000		0.86	4,389	n/a		n/a		n/a		n/a	
1993	123,000		0.27	29,342	9,000		1.22	5,087	n/a		n/a		n/a		n/a	
1994	199,000		0.16	17,317	12,400		1.09	14,862	n/a		n/a		n/a		n/a	
1995	n/a		0.38	61,986	1,400		7.79	68,580	n/a		n/a		n/a		n/a	
1996	71,000		0.60	39,858	1,300		28.5	140,153	n/a		n/a		n/a		n/a	
1997	50,000 **)			20,004	2,450		6.95	144,939	n/a		n/a		n/a		n/a	
1998	144,000		0.57	60,033	9,400		2.28	75,942	n/a		n/a		n/a		n/a	
1999	175,000	17%	0.67	60,771	8,960		0.75	66,815	n/a		n/a		n/a		n/a	
2000	500,000	39%	0.17	60,339	57,300		0.48	50,100	n/a		n/a		n/a		n/a	
2001	625,000	33%	0.09	4,000	47,300		0.15	49,111	n/a		n/a		n/a		n/a	
2002	550,000	12%	0.08	3,998	53,700		0.29	51,300	n/a		n/a		n/a		n/a	
2003	750,000	43%	0.06	4,032	63,700		0.26	18,912	n/a		n/a		n/a		n/a	
2004	900,000	33%	0.02	4,000	29,100		0.30	1,900	n/a		n/a		n/a		n/a	
2005	660,000	25%	0.00	4,000	17,500	28%	0.10	4,800	3,800	15%	n/a		n/a		n/a	
2006	1,250,000	35%	0.00	3,814	29,400	35%	0.11	809	3,000	12%	n/a		n/a		n/a	
2007	610,000	48%	0.00	8,458	23,200	20%	0.01	8,000	3,100	18%	n/a		n/a		n/a	
2008	1,490,000	37%	0.00	6,442	42,800	29%	0.00	4,000	4,570	18%	n/a		n/a		n/a	
2009	1,090,000	42%	0.00	4,490	22,700	29%	0.00	1,000	1,900	49%	n/a		n/a		n/a	
2010	n/a		0.00	4,965	29,700	28%	0.00	23,240	1,820	32%	193,800	21%	n/a		n/a	
2011	1,990,000	27%	0.00	3,048	36,700	13%	0.00	0	1,643	28%	210,000	14%	n/a		n/a	
2012	n/a		0.00	4,437	19,300	37%	0.00	0	n/a		352,900	19%	n/a		n/a	
2013	n/a		0.00	5,300	37,000	11%	0.00	500	3,548	31%	302,600	25%	n/a		n/a	
2014	n/a		0.00	4,800	36,600	19%	0.00	0	n/a		180,600	13%	2,149	16%	n/a	
2015	2,032,000	47%	0.00	0	n/a		0.00	0	n/a		186,000	13%	n/a		n/a	
2016	2,914,000	27%	0.00	0	29,900	7%	0.00	0	n/a		n/a		3,961	15%	5,211	22%
2017	952,000	27%	0.00	0	n/a		0.00	0	n/a		243,800	20%	4,794	22%	n/a	
2018	n/a		0.00	0	41,300	18%	0.00	0	n/a		148,400	27%	n/a		n/a	
2019	1,857,000	29%	0.00	0	20,400	18%	0.00	0	n/a		n/a		n/a		n/a	

*) trap was not in use the whole period; value has been adjusted according to assumed proportion of run outside trapping period

**) Most of the reared parr released in 1995 were non-adipose fin clipped and they left the river mainly in 1997. Because the wild and reared production has been distinguished on the basis of adipose fin, the wild production in 1997 is overestimated. This was considered when the production number used by WG was estimated.

Table 3.1.2.1. Densities and occurrence of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 2 (subdivisions 30–31). Detailed information on the age structure of older parr (>0+) is available only from the Åbyälven and Byskeälven.

River year	Number of parr/100 m² by age group 0+	1+	2+ & older	>0+ (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Piteälven							
1990	0.00			0.00		1	
1991							No sampling
1992							No sampling
1993	0.00			0.00		1	
1994	0.00			0.00		4	
1995							No sampling
1996							No sampling
1997	0.31			0.20		2	
1998							No sampling because of flood.
1999							No sampling
2000							No sampling
2001							No sampling
2002	5.37			1.24		5	
2003							No sampling
2004							No sampling
2005							No sampling
2006	3.92	1.39	0.30	1.69	71%	7	
2007	0.00	2.08	0.42	2.50	0%	5	
2008	5.06	0.81	1.04	1.85	100%	6	
2009							No sampling
2010	2.22	1.69	0.99	2.68	86%	7	
2011							No sampling because of flood.
2012							No sampling because of flood.
2013	6.56	6.55	2.08	8.63	100%	7	Varjisån included
2014	12.15	6.39	2.92	9.31	100%	5	
2015	4.87	3.57	0.69	4.26	100%	7	
2016	7.64	4.73	1.22	5.95	100%	4	
2017							No sampling
2018							No sampling
2019							No sampling
Åbyälven							
1986	1.11	1.15	0.00	1.15	100%	2	
1987	1.69	0.75	0.79	1.54	100%	4	
1988	0.28	0.11	0.69	0.80	67%	3	
1989	2.62	0.17	2.26	2.43	100%	4	
1990	0.90	2.13	0.25	2.38	50%	4	
1991	5.36	0.00	4.47	4.47	100%	2	
1992	2.96	3.65	0.17	3.82	100%	1	
1993	1.01	0.56	4.62	5.18	75%	4	
1994	1.53	0.67	1.95	2.62	67%	6	
1995	3.88	1.53	1.42	2.95	86%	7	
1996	3.77	3.89	1.10	4.99	71%	7	
1997	3.09	1.99	3.06	5.05	67%	7	
1998						0	No sampling because of flood.
1999	16.51	6.57	1.74	8.31	71%	7	
2000	5.85	4.43	3.62	8.05	71%	10	
2001	6.31	1.58	3.76	5.34	100%	4	
2002	8.16	1.63	2.10	3.73	100%	10	
2003	2.93	3.73	0.83	4.56	80%	10	
2004	5.40	0.49	0.83	1.32	70%	10	
2005	6.36	1.40	0.62	2.02	90%	10	
2006	27.18	10.37	2.77	13.14	90%	10	
2007	5.26	6.30	4.76	11.06	80%	10	
2008	12.48	2.19	3.95	6.14	80%	10	
2009	16.79	4.21	3.24	7.45	90%	10	
2010	7.16	3.83	2.06	5.89	100%	10	
2011	27.01	9.07	5.65	14.72	100%	10	
2012	12.82	7.54	4.36	11.90	90%	10	
2013	16.29	7.32	5.22	12.54	100%	10	
2014	28.73	6.73	5.67	12.40	100%	10	
2015	18.82	9.79	3.33	13.12	100%	10	
2016	37.04	8.33	6.18	14.51	100%	10	
2017	33.11	11.88	5.42	17.30	100%	10	
2018	22.96	7.43	10.21	17.64	100%	10	
2019	24.37	10.00	5.42	15.42	90%	10	Ordinary sites
2019	21.11	10.76	5.08	15.84	93%	16	Extended sites included

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Table 3.1.2.1. Continues.

River year	Number of parr/100 m² by age group 0+	1+	2+ & older	>0+ (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Byskeälven							
1986	0.10	0.85	0.54	1.39	29%	7	
1987							No sampling
1988							No sampling
1989	2.39	0.48	1.15	1.63	75%	8	
1990	1.45	1.14	0.39	1.53	80%	5	
1991	5.14	1.25	0.83	2.08	73%	11	
1992	1.46	5.85	2.65	8.50	50%	10	
1993	0.43	0.21	1.35	1.56	57%	7	
1994	2.76	0.97	2.5	3.47	80%	10	
1995	3.42	2.15	1.42	3.57	91%	11	
1996	8.64	2.53	1.26	3.79	83%	12	
1997	10.68	4.98	1.18	6.16	100%	12	
1998						0	No sampling because of flood.
1999	16.28	7.45	4.55	12.00	100%	15	
2000	8.72	8.38	3.72	12.10	100%	12	
2001						0	No sampling because of flood.
2002	15.84	4.3	2.25	6.55	93%	14	
2003	33.83	4.89	1.7	6.59	93%	15	
2004	12.32	6.83	2.33	9.16	93%	15	
2005	26.18	8.78	7.02	15.80	100%	15	
2006	13.20	14.39	4.01	18.40	87%	15	
2007	6.76	5.49	6.09	11.58	93%	15	
2008	20.49	6.80	5.61	12.41	93%	15	
2009	36.59	10.55	4.28	14.83	100%	15	
2010	18.71	9.14	3.47	12.61	93%	15	
2011							No sampling because of flood.
2012	18.35	5.50	3.77	9.27	93%	15	
2013	24.00	14.27	9.48	23.75	93%	15	
2014	37.78	6.79	6.19	12.98	100%	15	
2015	35.86	13.95	5.08	19.03	100%	15	
2016	43.11	14.58	6.76	21.34	100%	15	
2017	40.10	15.51	7.04	22.55	100%	15	
2018	24.10	13.10	9.54	22.64	100%	15	
2019	52.35	9.07	6.34	15.41	93%	15	
Kågeälven							
1987	0.00			0.00	0%	5	
1988	0.00			0.00	0%	1	
1989	0.00			0.00	0%	3	
1990	0.00			0.00	0%	1	
1991	0.51			0.00	25%	4	
1992	1.62			0.54[α]	50%	2	
1993	0.00			1.13[α]	0%	5	
1994	0.00			0.46[α]	0%	5	
1995						0	No sampling
1996						0	No sampling
1997						0	No sampling
1998						0	No sampling
1999	19.74			14.07[α]	58%	26	
2000	1.46			3.02[α]	30%	10	
2001	9.47			7.05[α]	33%	9	
2002	8.73			5.64[α]	54%	26	
2003	8.34			1.17[α]	46%	26	
2004	7.00			6.17[α]	44%	25	
2005	13.95			1.52[α]	58%	26	
2006	30.65			27.03[α]	82%	17	
2007	4.10			6.20	40%	25	
2008	2.49			7.07	29%	14	
2009	8.16			2.87	85%	12	
2010	5.81			2.69	69%	12	
2011	2.76			2.09	38%	12	
2012	18.10			10.34	69%	12	
2013	10.02			14.03	92%	12	
2014	26.35			9.78	100%	13	
2015	19.79			14.98	100%	13	
2016	8.09			4.25	90%	10	
2017	17.47			12.98	100%	7	
2018	13.40			18.38	90%	11	
2019	7.52			4.02	75%	12	

Table 3.1.2.1. Continues.

Rickleån		* 0+	* >0+				
1988	0.00	0.00	0.11	0.23	0%	2	
1989	0.34	0.16	0.00	0.00	33%	6	
1990	0.69	0.32	0.11	0.24	29%	7	
1991	0.30	0.14	0.04	0.09	29%	7	
1992	0.22	0.10	0.02	0.05	43%	7	
1993	1.63	0.77	0.08	0.18	50%	8	
1994	0.63	0.30	0.56	1.18	38%	8	
1995	0.64	0.30	0.11	0.23	50%	8	
1996	0.00	0.00	0.05	0.10	0%	7	
1997	0.17	0.08	0.43	0.90	29%	7	
1998	2.56	1.21	0.47	0.99	86%	7	
1999	2.32	1.10	0.23	0.49	86%	7	
2000	3.41	1.61	1.90	4.04	100%	7	
2001						0	No sampling because of flood.
2002	2.42	1.14	1.22	2.58	43%	7	
2003	1.05	0.50	0.19	0.39	43%	7	
2004	1.13	0.53	1.53	3.24	43%	7	
2005	4.88	2.30	0.16	0.34	43%	7/*11	
2006	3.88	1.83	2.69	5.70	86%	7	
2007	0.00	0.00	0.09	0.19	0%	7/*11	
2008	4.16	1.96	1.02	2.16	43%	7/*11	
2009	1.09	0.51	0.00	0.00	57%	7	
2010	3.73	1.76	2.94	6.23	100%	7	
2011	0.00	0.00	0.46	0.97	0%	7	
2012	0.91	0.43	0.98	1.96	86%	7/*14	
2013	4.94	2.59	2.01	2.98	57%	7/*13	
2014	2.66	1.56	0.65	0.77	86%	7/*9	
2015	14.60	8.08	2.58	4.69	100%	7/*9	
2016	11.77	5.85	3.92	7.80	100%	7/*11	
2017	9.20	4.62	4.63	8.78	100%	7/*11	
2018	4.83	2.50	7.04	13.21	57%	7/*12	
2019	19.64	11.06	1.41	2.75	100%	7/*12	

*) Average densities from extended electrofishing surveys in Rickleån, also including areas and sites in the upper parts of the river which have recently been colonized by salmon (for more details se section 4.2.2). These average densities are used as input in the river model (see stock annex).
α) stocked and wild parr. Not possible to distinguish stocked parr from wild.

Table 3.1.2.1 continues…

River year	Number of parr/100 m² by age group 0+	1+	2+ & older	>0+ (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Sävarån							
1989	0.60			0.90	25%	4	
1990	1.50			3.10	56%	9	
1991	0.70			4.50	29%	7	
1992	0.20			3.00	43%	7	
1993	1.80			1.90	29%	7	
1994	1.50			2.90	33%	6	
1995	0.40			1.00	33%	9	
1996	10.30			2.50	44%	9	
1997	0.40			3.50	33%	9	
1998	2.70			2.70	63%	8	
1999	0.80			5.00	44%	9	
2000	12.80			7.40	100%	4	
2001						0	No sampling because of flood.
2002	4.60			5.20	63%	8	
2003	2,30			4.40	56%	9	
2004						0	No sampling because of flood.
2005	3.30			3.80	56%	9	
2006	12.49			16.89	67%	9	
2007	4.70			9.20	67%	9	
2008	7.30			8.10	78%	9	
2009	10.22			12.06	78%	9	
2010	4.99			14.09	67%	9	
2011	6.87			8.46	67%	9	
2012	14.43			21.70	89%	9	
2013	20.17			18.31	89%	9	
2014	11.49			10.58	78%	9	
2015	45.30			34.31	100%	9	
2016	32.18			38.61	100%	9	
2017	21.58			34.47	89%	9	
2018	14.69			31.72	100%	12	
2019	8.87			15.18	75%	12	
Ume/Vindelälven		* 0+	* >0+				
1989	1.57	1.13	1.41	1.97	67%	3	
1990	0.57	0.41	2.09	2.91	50%	12	
1991	2.28	1.64	0.80	1.11	50%	6	
1992							
1993	0.29	0.21	0.71	0.99	33%	6	
1994	0.51	0.37	0.79	1.10	24%	25	
1995	0.39	0.28	0.17	0.23	37%	19	
1996	0.30	0.94	0.69	0.95	14%	21	
1997	17.23	12.40	1.31	1.82	79%	19	
1998	21.59	15.53	8.00	11.12	100%	6	Flood; only a part of sites were fished.
1999	3.29	2.36	12.14	16.88	28%	18	
2000	4.53	3.26	2.87	3.99	75%	12	
2001	3.54	2.54	5.83	8.10	72%	18	
2002	21.95	15.79	13.10	18.21	89%	18	
2003	24.00	17.27	2.76	3.84	89%	18	
2004	12.09	8.69	7.45	10.36	83%	18	
2005	3.71	2.67	3.11	4.32	79%	19	
2006	16.44	11.83	6.85	9.52	63%	19/*25	
2007	15.30	11.00	6.07	8.43	79%	19/*25	
2008	8.46	6.09	3.99	5.55	79%	19/*25	
2009	15.05	10.86	4.23	5.42	74%	19/*30	
2010	12.60	9.11	13.67	18.48	100%	19/*32	
2011							No sampling because of flood.
2012	21.15	15.25	8.71	11.65	95%	19/*25	
2013	15.78	11.35	12.83	17.83	95%	19/*26	
2014	39.35	30.76	9.34	11.82	100%	18/*34	
2015	20.47	16.18	10.99	10.62	95%	19/*31	
2016	1.05	0.75	3.76	3.77	47%	19/*29	
2017	4.24	3.05	3.91	3.92	78%	9/*15	Only 9 of 19 sites were fished because of flood
2018	0.15	0.11	1.57	2.11	10%	20/*27	
2019	3.52	2.77	1.02	1.42	50%	20/*28	
Öreälven		* 0+	* >0+				
1989	0	0.00	0.00	0.01	0%	14	
1990	0	0.00	0.00	0.00	0%	8	
1991	0	0.00	0.12	0.25	0%	8	
1992	0	0.00	0.12	0.25	0%	6	
1993	0	0.00	0.01	0.03	0%	13	
1994	0	0.00	0.00	0.00	0%	8	
1995	0.21	0.10	0.02	0.04	30%	10	
1996	0.44	0.22	0.00	0.00	30%	10	
1997	0.23	0.38	0.37	0.70	50%	10	
1998	1.02	1.03	0.21	0.34	75%	8	
1999	0.44	1.01	0.29	0.47	40%	10	
2000	0.60	1.35	0.48	0.80	67%	9	
2001						0	No sampling because of flood.
2002	6.73	4.92	0.79	1.35	60%	10	
2003	3.39	3.53	1.44	2.62	60%	10	
2004	2.12	3.16	0.24	0.16	56%	9	
2005	8.02	6.35	0.88	1.41	44%	9	
2006	5.91	5.98	2.14	4.84	60%	10	
2007	1.36	3.58	0.42	0.39	30%	10	
2008	1.16	3.74	0.78	1.09	40%	10	
2009	10.69	8.73	1.08	1.64	100%	10/*20	
2010	3.59	4.53	2.50	2.45	80%	10/*21	
2011	3.69	3.33	1.17	1.06	89%	9	
2012	7.35	3.90	2.14	4.32	80%	10/*15	
2013	3.96	3.06	1.13	1.89	56%	9/*13	
2014	6.04	6.25	1.59	2.05	100%	10/*14	
2015	21.64	20.97	4.46	7.35	100%	10/*13	
2016	17.50	12.90	5.79	9.13	80%	10/*13	
2017	15.29	11.27	4.87	7.67	80%	10	
2018	1.67	1.16	4.90	6.38	50%	10/*16	
2019	19.85	18.70	1.70	2.92	100%	10/*16	

*) Average densities from extended electrofishing surveys in Vindelälven, Öreälven also including areas and sites in the upper parts of the river which have recently been colonized by salmon (for more details se section 4.2.2). These average densities are used as input in the river model (see stock annex).

Table 3.1.2.1. Continues.

River year	Number of parr/100 m2 by age group 0+	1+	2+ & older	>0+ (sum of two previous columns)	Sites with 0+ parr (%)	Number of sampling sites	Notes
Lögdeälven		* 0+	* >0+				
1989	0.69	0.25	0.30	0.53	50%	8	
1990	2.76	1.00	0.26	0.46	44%	9	
1991	3.16	1.14	0.21	0.37	88%	8/*9	
1992	0.14	0.05	0.45	0.79	38%	8	
1993	0.53	0.19	0.45	0.79	38%	8	
1994	0.42	0.20	0.45	0.66	38%	8	
1995	2.17	1.05	1.16	1.71	88%	8	
1996	2.64	1.28	0.59	0.87	89%	9	
1997	2.59	1.42	1.96	2.79	88%	8	
1998	13.7	5.31	2.21	3.69	100%	6	
1999	5.67	3.25	1.97	0.48	100%	8	
2000	4.80	2.41	2.59	4.10	86%	7	
2001						0	No sampling because of flood.
2002	5.01	3.44	1.42	1.54	100%	7	
2003	11.14	5.23	2.40	3.47	100%	8	
2004	13.26	6.16	2.56	3.64	100%	8	
2005	11.19	7.61	3.31	5.06	100%	8	
2006	6.73	5.35	2.75	3.91	88%	8	
2007	2.86	3.42	2.15	2.70	63%	8	
2008	9.68	7.30	2.79	3.76	100%	8	
2009	11.63	8.53	3.92	5.72	100%	8/*12	
2010	12.19	10.85	3.15	2.44	100%	8/*18	
2011	10.9	9.44	3.53	2.93	88%	8	
2012	5.42	5.80	3.80	3.20	100%	8/*19	
2013	9.55	11.22	3.87	1.49	100%	8/*14	
2014	14.85	11.98	5.48	7.43	100%	8/*14	
2015	16.53	14.99	11.27	7.97	100%	8/*11	
2016	16.93	13.90	7.95	9.44	100%	8/*11	
2017	8.50	6.98	10.61	12.60	100%	8	
2018	1.90	9.70	9.25	8.94	100%	8/*13	
2019	14.36	20.48	6.81	7.83	100%	8/*13	

*) Average densities from extended electrofishing surveys in Lögdeälven also including areas
and sites in the upper parts of the river which have recently been colonized by salmon (for more details se section 4.2.2).
These average densities are used as input in the river model (see stock annex).

Table 3.1.3.1. Densities and occurrence of wild salmon parr in electrofishing surveys in the assessment unit 3 (Subdivision 30). Detailed information on the age structure of older parr (>0+) is not available.

River year	Number of parr/100 m² by age group 0+	1+	2+ & older	>0+	Sites with 0+ parr (%)	Number of sampling sites	Notes
Ljungan							
1990	5.5			4.8	67%	3	
1991	16.5			0.6	100%	3	
1992							
1993							
1994	6.9			0.2	100%	3	
1995	11.9			0.9	100%	3	
1996	8.6			6.5	100%	3	
1997	19.6			2.1	100%	6	
1998						0	No sampling because of flood
1999	17.4			7.9	80%	5	
2000	10.6			6.5	86%	7	
2001						0	No sampling because of flood
2002	23.9			2.6	100%	8	
2003	11.6			0.2	100%	8	
2004	3.1			1.4	56%	9	
2005	45.3			2.3	100%	9	
2006						0	No sampling because of flood
2007	7.7			2.0	89%	9	
2008	18.9			0.3	100%	3	Flood; only a part of sites were fished.
2009						0	No sampling because of flood
2010						0	No sampling because of flood
2011						0	No sampling because of flood
2012	91			5.6		1	Only one site fished because of flood
2013							No sampling because of flood
2014	49			0.7	100%	6	
2015	107			12.2	100%	9	
2016	27			4.5	100%	9	
2017	0.8			2.3	20%	10	
2018	0.0			0.2	0%	6	
2019	3.4			0.0	80%	10	
Testeboån							
2000	17.6			n/a		10	
2001	32.7			n/a		10	
2002	40.0			n/a		10	
2003	16.7			n/a		10	
2004	17.8			n/a		10	
2005	12.3			n/a		5	
2006	8.2			n/a		5	
2007	10.8			17.8		10	
2008	0.0			4.9		11	
2009	8.8			0.8		11	
2010	12.3			6.9		11	
2011	11.1			2.4		11	
2012	10.2			6.0		11	
2013	15.7			9.9		11	
2014	5.2			7.9		11	
2015	11.1			0.8	73%	11	
2016	27.8			6.0	73%	11	
2017	6.6			6.7	64%	11	
2018	4.9			5.7	73%	11	
2019	2.7			3.9	55%	11	

n/a = reared parr, which are stocked, are not marked;
natural parr densities can be monitored only from 0+ parr

Table 3.1.4.1. Densities of wild salmon parr in electrofishing surveys in the rivers of the assessment unit 4 (subdivisions 25–26, Baltic Main Basin).

River year	Number of parr/100 m² by age group		Number of sampling sites	Number of parr/100m² by age group from extended surveys		Number of sampling sites from extended surveys
	0+	>0+		α) 0+	α) >0+	
Mörrumsån						
1973	32	33				
1974	12	21				
1975	77	13				
1976	124	29				
1977	78	57				
1978	145	49				
1979	97	65				
1980	115	60				
1981	56	50				
1982	117	31				
1983	111	74				
1984	70	67				
1985	96	42		33	15	6
1986	132	39		53	14	5
1987						
1988						
1989	307	42	11	116	15	6
1990	114	60	11	61	18	6
1991	192	55	11	116	18	5
1992	36	78	11	24	26	5
1993	28	21	11	25	9	6
1994	34	8	11	23	5	6
1995	61	5	11	47	3	9
1996	53	50	11	37	18	9
1997	74	15	14	44	12	9
1998	120	29	9	63	16	10
1999	107	35	9	58	20	10
2000	108	21	9	55	12	10
2001	92	22	9	49	13	10
2002	95	14	9	49	9	10
2003	92	28	9	51	16	10
2004	80	21	7	51	16	6
2005	98	29	9	56	16	10
2006	61	34	9	36	19	10
2007*	54	10	4			
2008	102	16	9	60	8	10
2009	61	14	8	48	7	10
2010	97	27	8	69	15	11
2011	36	18	5	27	9	8
2012	96	14	5	45	7	14
2013	99	30	7	64	16	18
2014	95	23	8	48	14	17
2015	81	31	8	56	25	14
2016	72	20	8	38	11	18
2017	58	14	9	40	12	18
2018	39	15	8	26	11	17
2019	119	6	8	65	3	18

*) Flood, only a part of sites were fished.

α) Average densities from extended electrofishing surveys also including areas and sites in the upper parts of the river which have recently been colonized by salmon. These weighted averages are used as input in the river model (see stock annex)

Table 3.1.4.1. Continued.

River year	Number of parr/100 m² by age group		Number of sampling sites	Number of parr/100m^2 by age group from extended surveys		Number of sampling sites from extended surveys
	0+	>0+		α) 0+	α) >0+	
Emån						
1967	52	4				
1980-85	52	8				
1992	49	10				
1993	37	9	2	7	3	2
1994	24	7	2	3	1	5
1995	32	4	4	10	1	4
1996	34	8	4	13	2	5
1997	71	6	4	23	1	4
1998	51	6	2	33	3	5
1999	59	7	4	17	1	5
2000	51	3	4	8	0	8
2001	37	3	4	18	1	3
2002	57	4	4	21	1	5
2003	46	4	7	20	1	5
2004	45	4	6	22	2	5
2005	60	4	7	28	2	8
2006	13	1	7	9	1	9
2007	36	2	5	27	1	5
2008	35	3	6	25	2	8
2009	61	3	4	45	5	8
2010*						
2011	25	2	6	26	3	7
2012	47	4	4	28	3	10
2013	30	10	4	23	8	9
2014	27	3	7	31	4	9
2015	25	5	7	32	6	9
2016	53	8	7	53	8	11
2017	48	7	7	41	6	11
2018	9	4	7	8	4	12
2019	27	2	7	30	1	11

* no sampling because of flood

Table 3.1.5.1. Densities of wild salmon parr in electrofishing surveys in the Latvian and Estonian wild salmon rivers of the assessment unit 5 (Gulf of Riga. Subdivision 28).

River year	Number of parr/100 m² by age group 0+	>0+	Number of sampling sites
Pärnu			
1996	3.8	1.0	1
1997	1.0	0.1	1
1998	0.0	0.0	1
1999	0.2	0.4	1
2000	0.8	0.4	1
2001	3.1	0.0	1
2002	4.9	0.0	1
2003	0.0	0.0	1
2004	0.0	0.0	1
2005	9.8	0	1
2006	4.2	0	1
2007	0	0	1
2008	0	0	1
2009	18.4	0	1
2010	0	0	1
2011	0	0	1
2012	1.7	0	1
2013	1	0.1	5
2014	0.5	0	5
2015	5.4	0.2	6
2016	0.1	0.3	6
2017	22.8	0.2	5
2018	0.6	0.1	14
2019	6.5	0	5
Salaca			
1993	16.7	4.9	5
1994	15.2	2.6	5
1995	12.8	2.8	5
1996	25.3	0.9	6
1997	74.4	3.1	5
1998	60	2.8	5
1999	68.7	4	5
2000	46.3	0.8	5
2001	65.1	4.4	5
2002	40.2	10.3	6
2003	31.5	1.3	5
2004	73.8	2.7	5
2005	129.4	3.8	7
2006	69.7	17.9	6
2007	69.6	6.9	10
2008	92.3	4.9	5
2009	70.1	10.3	5
2010	26.5	7.4	5
2011	34.5	1.2	5
2012	72.2	1.9	5
2013	43.4	10.4	5
2014	59.1	3.8	5
2015	137.6	5.7	5
2016	67.7	5.5	5
2017	99.9	7.3	5
2018	21.3	8.2	5
2019	67.6	0.5	5

Table 3.1.5.1. Continued.

Gauja			
2003	0	0	1
2004	6	0.3*	6
2005	0	0	1
2006	0.2	0	5
2007	0	0	5
2008	0.1	0.1	3
2009	0.7	0.3	3
2010	0.1	0.9	3
2011	0.4	1.6	3
2012	0.8	0	3
2013	0.3	0.1	4
2014	3.9	0.1	4
2015	1.8	1.6	4
2016	0.3	0.1	4
2017	4.4	0.4	4
2018	5.2	0.1	4
2019	6.2	0.1	4
Venta			
2003	0.5	0.2	7
2004	20.8	5.6	7
2005	29.9	1.1	6
2006	2.6	2.9	5
2007	10.1	0.1	5
2008	18	1.5	5
2009	9.7	0.1	5
2010	0.2	0.2	5
2011	4.4	0	5
2012	12.3	0.7	5
2013	6	0.1	5
2014	10.9	0.4	5
2015	16.7	0.1	5
2016	3.8	0.1	5
2017	5.3	0.2	5
2018	0.8	0	5
2019	3	0.1	5
Amata[2)]			
2003	0.0	4.1*	3
2004	7.9	3.4*	3
2005	2.7	1.3	3
2006	16.7	3.4	3
2007	0.0	5.8	3
2008	6.2	1.8	3
2009	8.5	6.3	3
2010	3.3	3.9	3
2011	1.2	0.5	3
2012	1.0	1.4	3
2013	4.6	2.1	3
2014	15.6	3.5	3
2015	12.1	1.2	3
2016	0.0	0.9	3
2017	1.7	0.8*	3
2018	15.0	1.3	3
2019	0.9	0.8	3

[2]) tributaries to Gauja
*) reard fish

Table 3.1.5.2. Densities of salmon parr in electrofishing surveys in rivers in Lithuanian of the assessment unit 5 (Baltic Main Basin).

River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites	River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Neris				**Mera**			
2000	0.19	0.06	10	2000	0.13	0.00	3
2001	2.51	0.00	10	2001	0.27	0.00	3
2002	0.90	0.00	11	2002	0.08	0.00	4
2003	0.27	0.00	11	2003	0.00	0.00	4
2004	0.41	0.05	10	2004	0.00	0.00	3
2005	0.10	0.03	9	2005	0.00	0.00	2
2006	0.06	0.02	9	2006	0.00	0.05	2
2007	1.68	0.36	9	2007	0.22	0.22	2
2008	7.44	0.32	9	2008	0.00	0.50	2
2009	7.31	0.27	9	2009	0.00	0.25	3
2010	0.10	0.16	9	2010	0.00	0.00	3
2011	1.19	0.16	10	2011	0.00	0.05	3
2012	3.30	0.20	9	2012	0.00	0.00	3
2013	0.56	0.02	10	2013	0.08	0.00	3
2014	0.90	0.01	12	2014	0.00	0.30	4
2015	4.60	0.15	11	2015	0.00	0.00	3
2016	1.52	0.30	11	2016	0.00	0.17	3
2017	3.00	0.20	11	2017	0.00	0.00	4
2018	3.46	0.70	11	2018	0.17	0.08	3
2019	12.95	0.03	11	2019	0.59	0.09	3
Žeimena				**Saria**			
2000	4.10	0.46	7	2000	2.5	0.00	1
2001	1.40	0.10	7	2001	0.7	0.00	1
2002	0.66	0.00	6	2002	0.00	0.00	1
2003	0.72	0.00	6	2003	0.4	0.00	1
2004	3.10	0.30	6	2004	3.00	0.00	1
2005	1.33	0.47	5	2005	0.00	0.4	1
2006	2.52	0.06	5	2006	n/a	n/a	
2007	4.20	0.80	5	2007	0.00	0.00	1
2008	2.80	0.10	7	2008	n/a	n/a	
2009	3.50	0.40	7	2009	1.96	0.00	1
2010	0.20	0.00	7	2010	n/a	n/a	
2011	5.70	1.20	5	2011	n/a	n/a	
2012	1.40	0.60	6	2012	0.8	0.00	2
2013	2.37	0.30	6	2013	n/a	n/a	
2014	2.90	0.90	6	2014	n/a	n/a	
2015	9.20	0.00	6	2015	1.05	0.15	2
2016	3.30	0.40	6	2016	n/a	n/a	
2017	2.80	0.00	6	2017	n/a	n/a	
2018	6.20	2.50	6	2018	0.55	0.55	1
2019	8.18	0.00	6	2019	0.00	0.00	1

Table 3.1.6.1. Estonian wild and mixed salmon rivers in the Gulf of Finland.

River	Wild or mixed	Water quality[1)]	Flow m³/s		First obstacle km	Undetected parr cohorts 1997-2019	Production of >0+ parr 1997-2019
			mean	min			
Purtse	mixed	IV	6.7	3.7	4.9	1 (since 2006)	0-8.4
Kunda	wild	III	4.3	0.8	2	1	0.4-49.3
Selja	mixed	V	2.4	0.8	42	6	0-7.7
Loobu	mixed	II	2.0	0.3	10	2	0-16.6
Valgejõgi	mixed	IV	3.4	0.6	85	2	0.8-7.2
Jagala	mixed	II	7.3	0.7	2	7	0-0.9
Pirita	mixed	V	6.8	0.4	70	4	0-8.8
Vaana	mixed	V	1.9	0.3	21	9	0-4.2
Keila	wild	V	6.2	0.5	2	3	0-48.9
Vasalemma	wild	II	3.5	0.2	34.8	3	0-8.9

[1)] Classification of EU Water Framework Directive

Table 3.1.6.2. Densities of salmon parr rivers with only wild salmon populations, Subdivision 32.

River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Kunda			
1992	8.3	7.7	1
1993	0.0	5.3	1
1994	3.1	0.0	1
1995	19.5	3.6	1
1996	28.6	16.2	1
1997	1.9	25.4	1
1998	17.5	1.0	1
1999	8.2	21.4	1
2000	26.4	8.9	1
2001	38.4	17.4	1
2002	17.0	5.9	1
2003	0.8	4.3	1
2004	30.1	0.4	1
2005	5.0	49.3	1
2006	27.2	14.6	3
2007	5.5	5.8	3
2008	5.5	0.4	1
2009	46.5	0.8	1
2010	2.5	1.2	1
2011	16.6	14.6	1
2012	12.1	13.8	1
2013	13.5	6.5	3
2014	29.0	8.9	1
2015	105.8	14.1	1
2016	177.2	25.5	1
2017	139.6	20.2	1
2018	268.5	29.9	1
2019	246.9	15.8	1
Keila			
1994	1.2	1.1	1
1995	8.9	0.4	1
1996	14.9	1.3	1
1997	0.0	6.2	1
1998	0.0	6.6	1
1999	120.3	1.5	1
2000	4.8	5.4	1
2001	0.0	1.5	1
2002	8.4	0.4	1
2003	0.0	0.0	1
2004	0.6	0.0	1
2005	31.9	3.0	1
2006	6.3	8.0	1
2007	18.9	2.8	1
2008	44.2	4.3	1
2009	55.8	25.8	1
2010	110.1	12.3	1
2011	25.0	24.7	1
2012	43.5	3.9	3
2013	157.1	33.8	1
2014	82.2	48.9	1
2015	111.8	18.1	1
2016	107.6	25.8	1
2017	283.1	27.0	1
2018	179.5	40.6	1
2019	233.7	23.4	1

Table 3.1.6.2. Continued.

Vasalemma			
1992	4.3	3.1	1
1993	*	*	0
1994	2.4	0.0	1
1995	23.7	0.5	1
1996	6.1	5.9	1
1997	0.0	1.8	1
1998	0.0	0.1	1
1999	17.1	0.0	1
2000	4.4	2.0	1
2001	0.5	1.0	1
2002	8.9	0.4	1
2003	0.0	0.0	1
2004	0.0	0.0	1
2005	21.4	0.0	1
2006	9.9	1.0	2
2007	5.2	0.3	2
2008	2.5	1.1	2
2009	37.6	0.0	2
2010	26.0	1.9	2
2011	7.3	4.1	2
2012	6.8	1.1	2
2013	39.8	3.5	2
2014	26.1	4.2	2
2015	2.1	6.4	2
2016	18.2	0.5	2
2017	52.4	4.4	2
2018	27.8	8.9	2
2019	16.7	2.6	4

*) = no electrofishing

Table 3.1.6.3. Table Densities of wild salmon parr in rivers where supportive releases are carried out, Subdivision 32.

River	Number of parr/100 m² by age group		Number of sampling sites
year	0+	>0+	
Purtse			
2005	0.0	0.0	2
2006	3.5	1.1	2
2007	12.5	0.2	3
2008	0.6	4.9	3
2009	1.8	4.1	3
2010	0.1	0.7	3
2011	0.0	2.1	3
2012	36.3	0.0	3
2013	15.3	8.4	3
2014	36.6	5.7	3
2015	8.4	4.0	3
2016	3.7	2.5	3
2017	43.9	1.7	3
2018	76.2	7.5	3
2019	25.5	6.8	3
Selja			
1995	1.7	7.7	1
1996	0.0	0.5	1
1997	0.0	0.0	1
1998	0.0	0.0	1
1999	0.0	2.3	7
2000	1.5	0.3	3
2001	1.8	4.4	2
2002	0.0	0.0	2
2003	0.0	0.1	3
2004	0.0	0.9	2
2005	5.2	2.1	4
2006	0.9	0.2	3
2007	0.3	0.1	4
2008	19.3	5.1	3
2009	19.8	4.9	4
2010	9.3	1.4	4
2011	1.9	1.0	4
2012	22.8	3.4	4
2013	38.2	4.0	4
2014	14.6	4.4	3
2015	37.8	0.7	3
2016	1.9	0.7	3
2017	131.2	0.5	3
2018	122.5	6	3
2019	66.4	2.8	3
Valgejõgi			
1998	0	0	2
1999	1.7	0.9	6
2000	0.3	0.7	5
2001	2.4	0.7	4
2002	8.9	0.0	1
2003	0.1	0.3	3
2004	0.8	3.6	2
2005	7.4	3.3	3
2006	12.4	3.0	3
2007	8.8	6.7	3
2008	8.5	5.2	3
2009	20.2	5.7	3
2010	5.6	7.2	3
2011	0	3.6	3
2012	11	0.8	3
2013	19.2	3.5	3
2014	21.6	5.1	3
2015	16.8	6.8	3
2016	0.6	3	3
2017	13	2	5
2018	7.1	1.1	11
2019	13.2	1.6	6
Jägala			
1998	0.0	0.0	1
1999	1.3	0.0	1
2000	0.0	0.0	1
2001	18.9	0.0	1
2002	0.0	0.0	1
2003	0.0	0.1	1
2004	0.6	0.0	1
2005	4.4	0.0	1
2006	0.0	0.2	1
2007	0.0	0.0	1
2008	6.6	0.0	1
2009	0.4	0.9	1
2010	4.4	0.0	1
2011	0.0	0.0	1
2012	11.6	0.0	1
2013	0.3	0.0	1
2014	1.5	0.0	1
2015	0.0	0.0	1
2016	3.2	0.0	1
2017	1.3	1.3	1
2018	1.2	0.0	1
2019	0.0	0.0	1

Table continue on next page

*) = no electrofishing

Table 3.1.6.3. Continued.

River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Loobu			
1994	1.5	3.3	2
1995	2.9	0.7	2
1996	0.0	1.9	3
1997	0.0	0.0	1
1998	0.2	0.0	2
1999	6.3	0.5	4
2000	0.5	0.7	4
2001	0.0	0.3	4
2002	0.2	0.1	3
2003	0.0	2.4	4
2004	1.5	4.2	4
2005	3.0	7.8	5
2006	0.8	1.7	5
2007	3.1	0.0	5
2008	17.7	0.2	4
2009	26.8	15.0	4
2010	57.1	6.4	4
2011	0.4	5.1	4
2012	28.3	3.9	4
2013	64.5	5.0	4
2014	1.8	16.6	4
2015	37.6	1.2	4
2016	4.3	9.0	4
2017	36.3	0.9	4
2018	64.0	10.2	4
2019	52.7	9.5	4
Kymijoki			
1991	4.1	NA	5
1992	24.1	NA	5
1993	5.8	NA	5
1994	4.3	NA	5
1995	24.8	NA	5
1996	2.9	NA	5
1997	4.0	NA	5
1998	2.3	NA	5
1999	18.0	NA	5
2000	19.0	NA	5
2001	29.7	NA	5
2002	19.4	NA	5
2003	9.1	NA	5
2004	34.3	NA	5
2005	59.5	NA	5
2006	28.5	NA	5
2007	17.5	NA	5
2008	15.7	NA	5
2009	36.6	NA	5
2010	37.8	NA	5
2011	13.0	NA	5
2012	12.7	NA	5
2013	23.1	NA	5
2014	54.0	NA	5
2015	112.7	NA	5
2016	33.7	NA	5
2017	11.0	NA	5
2018	95.2	NA	5
2019	62.8	NA	5

*) = no electrofishing

River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Pirita			
1992	2.4	0.8	1
1993	*	*	0
1994	0.0	0.0	1
1995	0.0	0.0	1
1996	0	0.1	1
1997	*	*	0
1998	0	0	6
1999	7.7	0.1	5
2000	0.0	0.6	4
2001	1.5	0.1	6
2002	0.0	0.3	6
2003	0.0	2.8	6
2004	0.2	0.8	4
2005	24.0	8.7	4
2006	8.9	3.0	4
2007	3.2	3.4	4
2008	14.6	5.8	4
2009	23.1	6.5	7
2010	12.2	5.4	4
2011	0.6	1.8	4
2012	11.2	0.3	8
2013	38.3	8.1	4
2014	15.8	3.7	4
2015	49.3	2.3	4
2016	3.0	8.8	4
2017	81.4	1.9	4
2018	27.9	8.2	4
2019	23.9	3.2	4
Vääna			
1998	0.0	0.1	5
1999	0.0	0.4	4
2000	0.1	0.0	4
2001	0.0	0.0	2
2002	0.0	0.2	4
2003	0.0	0.0	4
2004	0.0	0.0	2
2005	0.0	0.0	4
2006	17.6	0.0	4
2007	0.0	0.6	3
2008	12.1	0.0	3
2009	9.0	4.2	3
2010	0.0	1.1	3
2011	0.0	0.3	3
2012	3.3	0.0	3
2013	4.7	0.6	3
2014	12.1	1.5	3
2015	0.0	1.5	3
2016	0.0	0.2	3
2017	10.8	0.1	3
2018	12.2	1.8	3
2019	6.2	0.3	3

Table 3.2.1.1. Current status of reintroduction programmes in Baltic Sea potential salmon rivers. Potential production estimates are uncertain and currently in the process of being re-evaluated.

River	Description of river						Restoration programme						Results of restoration			
	Country	ICES sub-division	Old salmon river	Cause of salmon population extinction	Potential production areas (ha)	Potential smolt production (num.)	Officially selected for reintroduction	Programme initiated	Measures	Releases	Years with releases	Origin of population	Parr and smolt production from releases	Spawners in the river	Wild parr production	Wild smolt production
Moälven	SE	31	yes	3,4	7	2000	no	yes	c,l	2	2	Byskeälven	yes	yes	>0	>0
Alsterån	SE	27	yes	2,3	4	4000	no	no	c,g,l	4	2	**	**	yes	>0	>0
Helgeån	SE	25	yes	2,3	7	3200	no	yes	c,e,m	2	3	Mörrumsån	yes	yes	>0	>0
Kuivajoki	FI	31	yes	1,2	58	17000	yes	yes	b,c,f	1, 4	4	Simojoki	no	no	no	0
Kiiminkijoki	FI	31	yes	1,2	110	40000	yes	yes	b,c,d,f	2	5	Iijoki	yes	yes	yes	>0
Siikajoki	FI	31	yes	1,2,3	32	15000	no	yes	b,g,m	1, 4	4	Mixed	no	*	0	0
Pyhäjoki	FI	31	yes	1,2,3	98	35000	yes	yes	b,c,d,f,m	1, 4	5	Tornionjoki/Oulujoki	no	no	no	0
Kalajoki	FI	31	yes	1,2,3	33	13000	no	yes	b,e, m	1, 4	2		no	*	*	*
Perhonjoki	FI	31	yes	1,2,3	5	2000	no	yes	b,f	1, 4	4	Tornionjoki/Oulujoki	yes	*	*	*
Merikarvianjoki	FI	30	yes	1,2,3	8	2000	no	yes	b,c,f,e	1, 4	5	Neva	yes	yes	>0	*
Kiskonjoki	FI	29	no?	2.3	2	2000	no	yes	b,c f,i,l	2	1	Neva	yes	yes	>0	*
Uskelanjoki	FI	29	no?	2.3	6	3000	yes	yes	b,c,f,i,m	1	5	Neva	yes	yes	*	*
Vantaanjoki	FI	32	no?	2,3,4	16	10000	no	yes	b,c,f,i,m	1	5	Neva	yes	yes	>0	>0
Porvoonjoki	FI	32	no?		6	5000	no	yes	b,c f,l	1	2	Neva	yes	yes	0	*
Koskenkylänjoki	FI	32	no?	2.3	6.5	5000	yes	yes	b,c f,l	1	2	Neva	yes	yes	>0	*
Urpalanjoki	FI	32	yes	2.3	2.3	2000	yes	yes	a,b,c,f,i,m	1	2	Neva	yes	yes	>0	*
Rakkolanjoki	FI	32	no?	2,3,4	2.5	2500	no	yes	a,b,c,f,i,m	1	2	Neva	yes	yes	>0	*
Sventoji	LI	26	yes	2,3	7	15000	yes	yes	m,c	2	*	Nemunas	yes	yes	6020	2730
Minija/Veivirzas	LI	26	yes	*	6	30000	yes	yes	c	2	*	Nemunas	no	no	0	0
Wisla/Drweca	PL	26	yes	1,2,3,4	*	*	yes	yes	b,m	2	5	Daugava	yes	yes	*	*
Slupia	PL	25	yes	1,2,3,4	*	*	yes	yes	b,m	2	5	Daugava	yes	yes	yes	*
Wieprza	PL	25	yes	1,2,3,4	*	*	yes	yes	b,m	2	5	Daugava	yes	yes	*	*
Łeba	PL	25	yes	1,2,3,4	*	*	yes	yes	b,m	2	3	Daugava	yes	yes	*	*
Parseta	PL	25	yes	1,2,3,4	*	*	yes	yes	b,m	2	5	Daugava	yes	yes	*	*
Rega	PL	25	yes	1,2,3,4	*	*	yes	yes	b	2	5	Daugava	yes	yes	*	*
Odra/Notec/Drawa	PL	24	yes	1,2,3,4	*	*	yes	yes	b,m	2	5	Daugava	yes	yes	*	*
Reda	PL	24	yes?	1,2,3,4	*	*	yes	yes	b	2	5	Daugava	yes	yes	*	*
Gladyshevka	RU	32	yes	1,2,4	1.5	1500	no	yes	a,g,k,n	2	4	Neva	yes	yes	>0	>0

Cause of salmon popul. extinction
1 Overexploitation
2 Habitat degradation
3 Dam building
4 Pollution

* No data
** Not applicable

Measures
Fisheries
a Total ban of salmon fishery in the river and river mouth
b Seasonal or areal regulation of salmon fishery
c Limited recreational salmon fishery in river mouth or river
d Professional salmon fishery allowed in river mouth or/and river

Habitat restoration	Dam removal	Fish ladder
e partial	i planned	l planned
f completed	j completed	m completed
g planned	k not needed	n not needed
h not needed		

Releases
1 Has been carried out, now finished
2 Going on
3 Planned
4 Not planned

Years with releases
1 Releses 0-5 years
2 Releses 6-10 years
3 Releses 11-15 years
4 Releses 16-20 years
5 Releses >20 years
*) add if not releases every year

Table 3.2.2.1. Densities of wild salmon parr in electrofishing surveys in potential rivers. Note that all the Lithuanian rivers listed are currently stocked (and therefore could be called 'mixed').

Country	Assess-ment unit	Sub-div	River and year	Number of parr /100 m² 0+	Number of parr /100 m² >0+	Number of sampling sites
Sweden	4	27	**Alsterån**			
			1997	13.3	0	1
			1998	23.8	5.4	1
			1999	6.8	7	1
			2000	8	3.4	1
			2001	1.5	1.3	1
			2002	36.2	0.4	1
			2003	0	4.4	1
			2004	0	0	1
			2005	13.2	0	1
			2006	0	3.6	1
			2007	0	0	1
			2008	0	0	1
			2009	0	0	1
			2010			no sampling
			2011	8.5	6	1
			2012	0	4.3	1
			2013	0	0	1
			2014	1.9	0	1
			2015	4.6	0	1
			2016			no sampling
			2017			no sampling
			2018			no sampling
			2019	0	0	1
Finland	1	31	**Kuivajoki**			
			1999	0	n/a	
			2000	0	n/a	8
			2001	0	n/a	16
			2002	0.2	n/a	15
			2003	0.4	n/a	15
			2004	0.5	n/a	15
			2005	0.6	n/a	14
			2006	3.2	n/a	14
			2007	0.2	n/a	14
			2008-2019			no sampling
Finland	1	31	**Kiiminkijoki**			
			1999	1.8	n/a	
			2000	0.8	n/a	31
			2001	1.9	n/a	26
			2002	1.5	n/a	47
			2003	0.7	n/a	42
			2004	3.9	n/a	46
			2005	8.2	n/a	45
			2006	2.3	n/a	41
			2007	0.7	n/a	17
			2008	2.3	n/a	18
			2009	3.8	n/a	19
			2010	2	n/a	19
			2011			no sampling
			2012	6.6	n/a	2
			2013	3	n/a	20
			2014	1.8	n/a	12
			2015			no sampling
			2016			no sampling
			2017			no sampling
			2018	1.2	3.8*	15
			2019	3.2	n/a	14

table continues next page

* = adipose fin clipping enabled separation of wild-origin older parr from reared

n/a = reared parr, which are stocked, are not marked;

natural parr densities can be monitored only from 0+ parr

Table 3.2.2.1 continues…

Country	Assess-ment unit	Sub-div	River and year	Number of parr /100 m² 0+	>0+	Number of sampling sites
Finland	1	30	**Pyhäjoki**			
			1999	0.3	n/a	
			2000	0.2	n/a	23
			2001	0.9	n/a	18
			2002	1.9	n/a	20
			2003	0	n/a	22
			2004	0.2	n/a	13
			2005	0.7	n/a	16
			2006	0.2	n/a	17
			2007	0	n/a	13
			2008			no sampling
			2009	0.2	0	6
			2010	0	0.4	6
			2011	0	0	4
			2012-2019			no sampling
Russia	6	32	**Gladyshevka**			
			2001	0	0	2
			2002	0	0	2
			2003	0	0	3
			2004	6	0	2
			2005	15.6	4.1	3
			2006	7.7	6.2	2
			2007	3.1	3.7	4
			2008	0	2	1
			2009	0.9	0.3	1
			2010	1.2	2	4
			2011			no sampling
			2012			no sampling
			2013	3	3	3
			2014	2	3	3
			2015	24.3	9.2	4
			2016			no sampling
			2017	12.5	0	4
			2018			no sampling
			2019	51	4.6	4

table continues next page

Table 3.2.2.1 continues…

Contry	Assess-ment unit	Sub-div	River year	Number of parr/100 m² by age group 0+	>0+	Number of sampling sites
Lithuania	5	26	**Šventoji**			
			2000	1.9	0	6
			2001	0.25	0	6
			2002	2	0.1	6
			2003	0.1	0	6
			2004	0.62	0.28	6
			2005	0.5	0.46	4
			2006	3.15	1.35	4
			2007	4.8	0.1	4
			2008	5.8	0.3	5
			2009	6.1	1.4	5
			2010	0.94	0.84	5
			2011	6.3	2.3	5
			2012	4	1.5	5
			2013	4.8	0.8	5
			2014	5.32	0.08	5
			2015	8.23	2.7	5
			2016	3.12	1.7	5
			2017	0.54	0.1	5
			2018	3.4	1.4	5
			2019	10.73	0.9	6
Lithuania	5	26	**Siesartis**			
			2000	1.84	0	2
			2001	3.35	0.35	2
			2002	2.5	0	2
			2003	0.45	0	2
			2004	3.4	0	3
			2005	7.3	3	2
			2006	0.27	0.94	2
			2007	6.3	1.2	2
			2008	18.9	17.5	2
			2009	44.1	4	2
			2010	0.15	3.4	2
			2011	6.8	1.9	3
			2012	0.6	3.1	3
			2013	5	1.3	3
			2014	11.95	5.1	4
			2015	6.2	2.3	4
			2016	5.9	3.2	4
			2017	3.1	1.8	4
			2018	2.9	3.8	4
			2019	26.6	1.7	4
Lithuania	5	26	**Virinta**			
			2003	0.95	0	2
			2004	0.17	0	2
			2005	0.55	0.49	2
			2006	0.14	0	2
			2007	0	0	2
			2008	0	0	2
			2009	6.8	3.6	2
			2010			no sampling
			2011	13.7	0.38	2
			2012	0	0.5	2
			2013	2.4	0	2
			2014	5	0	2
			2015	1.5	0.9	2
			2016	3.7	1.0	2
			2017	0.35	0	2
			2018	6.3	1.9	2
			2019	1.4	0	2

table continues next page

Table 3.2.2.1 continues…

Contry	Assess-ment unit	Sub-div	River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Lithuania	5	26	**Širvinta**			
			2004	1	0	2
			2005	1	0	2
			2006	0	0	2
			2007	6.35	0.35	2
			2008	10.9	0	2
			2009	11.2	0	2
			2010			no sampling
			2011	4.7	0.3	2
			2012	0	0	2
			2013	0.8	0	2
			2014	2.7	0.15	2
			2015	1.6	0	1
			2016	1.6	0.4	1
			2017	4.5	0	2
			2018	5.3	0.4	1
			2019	0	0	1
Lithuania	5	26	**Vilnia**			
			2000	0	0	3
			2001	0.7	0	3
			2002	1.3	0	4
			2003	0	0	3
			2004	0.36	0.15	3
			2005	4.48	0.13	3
			2006	0.49	2.63	3
			2007	0.58	0	3
			2008	1.53	0.28	3
			2009	3.1	2.14	3
			2010	3.6	1	5
			2011	3.3	1.6	3
			2012	3.5	1	3
			2013	3.7	1.7	3
			2014	31.4	2.3	4
			2015	8.8	3.75	4
			2016	14.9	3.2	4
			2017	16.7	6.3	4
			2018	2.1	2.7	4
			2019	28.7	0.2	4
Lithuania	5	26	**Vokė**			
			2001	4.3	0	2
			2002	0.16	0	2
			2003	0	0	2
			2004	9.5	0	2
			2005	0.77	0	2
			2006	0	0.8	2
			2007	4.1	0	2
			2008	4.50	0	2
			2009	3.4	0.5	2
			2010			no sampling
			2011	3.8	0	2
			2012	5.2	0.8	2
			2013	3.4	0.7	2
			2014	9.5	3.8	2
			2015	2.2	1.45	2
			2016	1.6	2.85	2
			2017	6.8	1.7	2
			2018	0.5	6.7	2
			2019	11.0	3.0	2

table continues next page

Table 3.2.2.1 continues…

Contry	Assess-ment unit	Sub-div	River year	Number of parr/100 m^2 by age group 0+	>0+	Number of sampling sites
Lithuania	5	26	**B. Šventoji**			
			2003	1.12	0	8
			2004	2.52	0	8
			2005	0	0.22	9
			2006			no sampling
			2007	0.02	0	5
			2008	0.02	0	3
			2009	2.6	0	4
			2010	0.59	0	4
			2011	2.94	0.15	2
			2012	3	0	2
			2013	2.8	0.33	2
			2014	8	0.8	2
			2015	8.7	1.5	2
			2016	0.41	0	4
			2017	3.3	0.54	3
			2018	0.8	0.5	2
			2019	1.48	0.12	4
Lithuania	5	26	**Dubysa**			
			2003	2.12	0	9
			2004	0.75	0	9
			2005	1.47	0	8
			2006	0	0.06	9
			2007	0.02	0	8
			2008	0.53	0.09	10
			2009	0.79	0	7
			2010	2.79	0	5
			2011	0.52	0.29	3
			2012	1.1	0.5	2
			2013	3.7	1	3
			2014	9	0.3	8
			2015	5.1	0.8	7
			2016	0.22	0.53	10
			2017	10.2	0.74	4
			2018	5.23	2.18	6
			2019	11.04	2.56	7
Lithuania	5	26	**Minija**			
			2009	0	0.01	7
			2010	2.38	0	4
			2011	11.54	0.78	4
			2012	1.4	1.8	4
			2013	6.7	0	3
			2014	3.5	0.1	6
			2015	3.95	0.54	6
			2016	1.2	0.2	11
			2017	3.6	0.3	5
			2018	0.29	0.36	2
			2019	0.65	0.04	10

Table 3.3.1.1. Salmon smolt releases by country and assessment units in the Baltic Sea (x1000) in 1987–2019.

			Year																																
Assessment unit	**Country**	**Age**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Finland	2yr	1301	1703	1377	1106	1163	1273	1222	1120	1440	1394	1433	1528	1542	1679	1630	1541	1361	1541	1205	1439	1406	1340	1182	1165	1189	1155	1164	1135	1082	1063	1302	1265	1155
		3yr			21	5			0.3			1	1	1			1						1	1											
1 Total			1301	1703	1398	1111	1163	1273	1223	1120	1440	1395	1434	1529	1542	1679	1630	1541	1361	1541	1205	1439	1407	1340	1182	1165	1189	1155	1164	1135	1082	1063	1302	1265	1155
2	Sweden	1yr	292			8					22						5							84	98	150	195	194	207	252	320	404	378	270	265
		2yr	976	901	771	813	809	816	901	804	675	711	786	803	784	693	795	802	758	748	779	685	780	784	698	680	648	550	502	530	405	454	355	437	472
2 Total			1267	901	771	821	809	816	901	804	698	711	786	803	784	693	800	802	758	748	779	685	780	867	795	830	843	744	709	782	725	859	733	707	737
3	Finland	1yr	3							73														0.2	67	2									
		2yr	435	454	313	277	175	178	135	201	235	257	125	188	202	189	235	211	155	163	252	239	237	250	266	196	117	188	207	117	69	114	61	49	47
		3yr	19																			0.4													
	Sweden	1yr			10	12	11	41	10		103	43	69	43	38	35	47	84	162	96	273	268	391	564	628	688	711	847	795	818	869	887	860	822	645
		2yr	1026	983	1170	973	962	1024	1041	808	457	1011	1063	1072	864	1060	933	867	902	808	888	719	494	461	361	322	250	173	164	81	97	45	55	29	133
3 Total			1484	1437	1492	1261	1148	1242	1185	1083	794	1311	1257	1303	1104	1284	1215	1161	1218	1067	1414	1227	1122	1275	1322	1207	1078	1207	1166	1016	1034	1047	975	900	824
4	Denmark	1yr	62	60	46	60	13	64	80		70		103	30	35	72			14	13	16														
		2yr	8	10	10	12	11																												
	EU	1yr		25	107	60	109	40				7																							
		2yr		26	192	149	164	124	332	165	2	28																							
	Sweden	1yr	117	89	136	96	41	84	103	14	12	37	55	3		11		1				20							15	15	13	12	18	18	12
		2yr	129	113	18	58	69	25	33	68	3	4	9	2		1	9	5	5	6	7	8	31	8	17	20	11	9	3	3	3				
4 Total			317	323	509	435	407	337	548	246	87	76	167	35	35	84	9	7	19	19	23	28	31	8	17	20	11	9	18	18	16	12	18	18	12
5	Estonia	1yr			17	18	15	18	15																							11			
		2yr																														10	11		
	Poland	1yr		1						22	129	40	280	458	194	309	230	186	262	207	161	385	310	374	463	380	275	155	325	359	176	249	43	237	217
		2yr								2	107	77	30	80	175	60	24	86	53	58	69	79	98	30	32	41	31	11	55	12	12	10		1	
	Latvia	1yr	686	1015	1145	668	479	580	634	616	793	699	932	902	1100	1060	1069	867	961	777	566	814	868	944	752	756	394	649	737	738	675	614	678	569	787
		2yr	224	49	39	36	31	34	86	58	33	60	8	49	41	46		64	34	38	175	61	5	23	7										
	Lithuania	1yr													11				9	4	11	30			38		25	25	10	20	23	21	22	20	21
5 Total			910	1065	1201	722	525	632	735	698	1062	876	1250	1489	1521	1475	1324	1203	1317	1084	983	1371	1281	1371	1292	1177	724	839	1127	1128	886	914	753	827	1025
Assessment units 1-5 Total			**5278**	**5429**	**5371**	**4350**	**4052**	**4300**	**4592**	**3950**	**4081**	**4369**	**4893**	**5158**	**4986**	**5215**	**4977**	**4713**	**4673**	**4460**	**4403**	**4750**	**4621**	**4862**	**4608**	**4399**	**3845**	**3954**	**4184**	**4079**	**3743**	**3894**	**3780**	**3716**	**3752**
6	Estonia	1yr							22	33		30	18	52	36	69	129	101	86	82	96	125	80	122	125	77	64				32	22	37	80	34
		2yr		1									29	90	58	35	34	40	35	46	46	48	0	49	45	33	26	53	32	35	42	27	32	33	29
	Finland	1yr	156	26	23	30	67	26	120	66	63	45		15				65	80	58	84	13													
		2yr	429	415	372	363	349	315	190	198	284	346	222	253	326	362	400	338	266	275	325	276	222	337	266	271	146	218	199	150	79	99	103	145	183
		3yr	12																						3										
	Russia	1yr	85	113	81	100	102	13	128	78	124	102	174	85	165	77	103	136	70	271	233	247	278	270	230	238	129	315	466	427	352	450	377	373	662
		2yr	3	2	2	30			9	22	18	18	6	12	12	41	135	1	107	85	81	33	55	1	31		1		1	0.4					
6 Total			**686**	**556**	**478**	**524**	**518**	**354**	**470**	**398**	**489**	**542**	**449**	**507**	**597**	**584**	**801**	**681**	**644**	**817**	**865**	**742**	**635**	**778**	**700**	**617**	**366**	**586**	**697**	**613**	**505**	**598**	**549**	**631**	**908**
Grand Total			**5964**	**5986**	**5849**	**4874**	**4569**	**4654**	**5061**	**4347**	**4571**	**4911**	**5342**	**5665**	**5583**	**5799**	**5778**	**5394**	**5317**	**5277**	**5268**	**5492**	**5256**	**5639**	**5308**	**5016**	**4211**	**4540**	**4881**	**4692**	**4248**	**4492**	**4329**	**4347**	**4660**

Table 3.3.1.2. Releases of salmon eggs, alevin, fry and parr to the Baltic Sea rivers by assessment unit in 1995–2019.

Assessment unit	year	eyed egg	alevin	fry	1s parr	1yr parr	2s parr	2yr parr	fry	2s
1	1996	73	278	92	338	685	15			
	1997		1033	459	321	834	14			
	1998		687	198	690	582				
	1999		1054	25	532	923	15			
	2000		835	27	402	935				
	2001				98	1079				
	2002			19	145	775	5			
	2003					395	10			
	2004				63	266				
	2005		98		96	451	15	21		
	2006		330	11	14	896				
	2007		201	30	82	482				
	2008		89	220	19	489				
	2009		210			212				
	2010		354	1		172				
	2011	22	614			68				
	2012		556			64				
	2013		129		1	63	0.3			
	2015		296		10	67				
	2016					69				
	2017					50				
	2018		300			73				
	2019		455			33				
2	1996			362	415	117				
	1997			825	395	87				
	1998			969	394	190	3			
	1999			370	518	67	4			
	2000			489	477	71				
	2001			821	343	83				
	2002			259	334	127				
	2003			443	242	45				
	2004			200	155					
	2005			712	60					
	2006				80	36				
	2007				41	57				
	2017	300								
	2018	300		1		118				
	2019	20		146						
3	1996	255		614	414	43	61			
	1997	482	2	596	390	60	93			
	1998	691		468	359	99	184			
	1999	391		16	443	4	29			
	2000	516		158	239	30	34			
	2001	177		736	263		16			
	2002	74		810	161		17			
	2003			655	56	0	31			
	2004			503	6		7			
	2005			151	2	48	27			
	2006			295		18	4			
	2007			126	43	28	7			
	2008			210		101	4			
	2009			174	8	22	5			
	2010		74	215	5	15	5			
	2011	86		61	79	40				
	2012			573	116	60				
	2013				216	79				
	2014			22	155	444				
	2015				133	6				
	2016			77		31				
	2017			5		16				
	2018			20		17				
	2019	19		36		60				

Table 3.3.1.2. Continued.

4	1996			114	7	20	56			
	1997			159						
	1998				7		4			
	1999					3	1			
	2001			40			2			
	2002			88						
	2003			42						
	2005			70						
	2006			45						
	2007			69						
	2008			145						
	2012				20					
5	2001			100	96	14				
	2002			160	106	33				
	2003			109	515					
	2004			120	52	11	10			
	2005		420	199	224					
	2006		30	376	236	1				
	2007		200	418	125					
	2008		364	295	483	17				
	2009		240	863	81	56				
	2010		31	639	81	84				
	2011		50	866	441	25				
	2012		201	645	194	128				
	2013			522	381	16				
	2014			354	282	62				
	2015		40	495	218	2				
	2016		10	159	148	5				
	2017			247		61				
	2018			519	237					
	2019		35	649	196		13		5	
6	1996	449	20		15	124				
	1997		8		6	236				
	1998	514		50		166				
	1999		277			267				
	2000	267	51			233				
	2001		74			250				
	2002	20	102		640	272	13	5		
	2003	21	120	120	240	248	35			
	2004		294		229	208	3			
	2005	80	26		263	110				
	2006				197					
	2007		98		90	148	28			
	2008		6		355	50	40			
	2009	610			260	63	143			
	2010				560	41	138			
	2011	94			212	55				
	2012				199	70	75			
	2013			99	112	95	7	28		
	2014			98	22	15	24			
	2015			99	127	5	89	4		
	2016				86	18				
	2017	56			55	120	21			
	2018			75	62	110	9			
	2019	48		47	52	126	6			4

Table 3.3.3.1. Number of tagged hatchery-reared and wild salmon smolts released in assessment units 1, 2 or 3 and used in the salmon assessment (data not updated since 2012).

RELEASE YEAR	Reared salmon stocked in rivers without natural reproduction			Reared salmon stocked in rivers with natural reproduction			Wild salmon
	AU1	AU2	AU3	AU1	AU2	AU3	AU1
1987	29267	13258	23500	6900	1987	1994	629
1988	25179	13170	31366	4611	1989	2983	771
1989	11813	13157	36851	6428	2910	0	0
1990	9825	12824	31177	7467	3995	1996	0
1991	8960	13251	36655	7969	3990	1997	1000
1992	8920	12657	34275	5348	1996	1999	574
1993	7835	12656	34325	5968	1999	1991	979
1994	8077	12964	28717	5096	1997	2000	1129
1995	6988	12971	21877	6980	2000	0	0
1996	7967	13480	22429	6956	1000	1000	0
1997	6968	13403	23788	7981	1982	1997	0
1998	6929	13448	23547	5988	1974	994	1364
1999	7908	13445	23203	8925	2005	1996	2759
2000	7661	12018	26145	8484	2000	1000	3770
2001	7903	13498	16993	8412	2000	1000	4534
2002	7458	13992	18746	5969	2000	0	3148
2003	7233	13495	21485	8938	1997	1000	6299
2004	6946	12994	21987	6922	1981	1000	9604
2005	6968	13250	19478	9994	2000	1000	6607
2006	7933	13499	22755	10644	1650	1000	8034
2007	6982	7000	17804	10701	2000	1000	7069
2008	6998	7000	22047	9929	2000	1000	7105
2009	9924	7000	20000	4988	2000	1000	4177
2010	8566	7000	23145	6352	2000	1000	3772
2011	16924	7000	22985	2000	2000	0	6064
2012	15972	7000	18982	2205	2000	0	4993

Table 3.3.3.2. Number of Carlin-tagged salmon released into the Baltic Sea in 2019.

Country	24	25	26	27	28	29	30	31	32	Total
Denmark										0
Estonia										0
Finland								1,997		1,997
Sweden								5,000		5,000
Poland										0
Russia										0
Lithuania										0
Germany										0
Latvia										0
Total	0	0	0	0	0	0	0	6,997	0	6,997

Table 3.3.4.1. Releases of adipose fin-clipped salmon in the Baltic Sea and the number of adipose fin-clipped salmon registered in Latvian (subdivisions 26 and 28) offshore catches.

Year	Releases of adipose fin clipped salmon, Sub-divs. 24-32		Latvian offshore catches Sub-divs. 26 and 28	
	Parr	Smolt	Adipose fin clipped salmon in %	Sample N
1984			0.6	1,225
1985			1.0	1,170
1986			1.2	1,488
1987	43,149	69,000	0.6	1,345
1988	200,000	169,000	1.2	1,008
1989	353,000	154,000	1.5	1,046
1990	361,000	401,000	0.8	900
1991	273,000	319,000	1.4	937
1992	653,000	356,000	5.0	1,100
1993	498,000	288,000	7.8	900
1994	1,165,000	272,000	1.6	930
1995	567,470	291,061	2.0	855
1996	903,584	584,828	0.6	1,027
1997	1,626,652	585,630	4.4	1,200
1998	842,230	254,950	4.8	543
1999	1,004,266	625,747	4.4	1100
2000	1,284,100	890,774	7.2	971
2001	610,163	816,295	6.0	774
2002	536,800	733,191	2.5	883
2003		324,002	2.4	573
2004	10,000	648,563	3.2	621
2005	794,500	2,124,628	3.0	546
2006	258,714	1,753,543	2.4	250
2007	148224	2,126,906	0.0	100
2008	95,984	2,450,774	---	---
2009	72,731	2,325,750	---	---
2010	15,123	2,084,273	---	---
2011	127,496	2,341,228	---	---
2012	185,094	1,971,281	---	---
2013	13,200	1,768,083	---	---
2014	119,670	2,038,400	---	---
2015	142,361	2,690,095	---	---
2016	93,113	2,777,782	---	---
2017	166,364	3,728,054	---	---
2018	268,905	3,767,308	---	---
2019	89,800	3,743,215	---	---

Table 3.3.4.2. Adipose fin-clipped salmon released in the Baltic Sea area in 2019 (and clipped or unclipped tagged using other methods).

Country	Species	Stock	Age	Number parr	Number smolt	River	Sub-division	Other tagging
Estonia	salmon	Pärnu	2 s	12,700		Pärnu	28	
	salmon	Kunda	1 yr		19,800	Purtse	32	
	salmon	Kunda	1 yr	1,800		Purtse	32	
	salmon	Kunda	2 yr		5,200	Selja	32	500 T-bar
	salmon	Kunda	2 yr		5,500	Loobu	32	500 T-bar
	salmon	Kunda	1 yr		14,200	Valgejõgi	32	
	salmon	Kunda	2 yr		7,000	Valgejõgi	32	1000 T-bar
	salmon	Kunda	1 yr	8,900		Valgejõgi	32	
	salmon	Kunda	2 s	6,400		Valgejõgi	32	
	salmon	Kunda	2 yr		5,700	Jägala	32	500 T-bar
	salmon	Kunda	2 yr		5,300	Pirita	32	500 T-bar
Finland	salmon	Tornionjoki	2 yr		3,660	Aurajoki	29	
	salmon	Simojoki	2 yr		3,485	Eurajoki	30	
	salmon	Tornionjoki	2 yr		268,609	at sea	31	
	salmon	Tornionjoki	2 yr		3,700	Kokemäenjoki	30	
	salmon	Iijoki	2 yr		445,871	at sea	31	
	salmon	Iijoki	2 yr		30,000	Kiiminkijoki	31	
	salmon	Iijoki	2 yr		145,469	Iijoki	31	
	salmon	Iijoki	alevin			Iijoki	31	435 000 alizarin dye
	salmon	Oulujoki	2 yr		233,406	Oulujoki	31	
	salmon	Oulujoki	1 yr			Oulujoki	31	33 100 parr alizarin dye
	salmon	Oulujoki	2 yr		30,380	at sea	31	
	salmon	Neva	2 yr		9,971	Kiskonjoki	29	
	salmon	Neva	2 yr		77,630	Kymijoki	32	
	salmon	Neva	1 yr			Kymijoki	32	50 000 parr alizarin dye
	salmon	Neva	2 yr		10,003	Karjaanjoki	32	
	salmon	Neva	eyed egg			Karjaanjoki	32	48 000 alizarin dye
	salmon	Neva	2 yr		95,345	at sea	32	
	salmon	Neva	eyed egg			Kisko-Perniönki	32	9 500 alizarin dye
	salmon	Neva	2 yr		10,000	Kisko-Perniönki	32	
	salmon	Neva	eyed egg			Uskelanjoki	32	9 500 alizarin dye
Sweden	salmon	Luleälven	1 yr		131,809	Luleälven	31	
	salmon	Luleälven	2 yr		387,106	Luleälven	31	5000 Carlin
	salmon	Skellefteälven	1 yr		124,457	Skellefteälven	31	
	salmon	Skellefteälven	1 yr		6,255	Gideälven	30	
	salmon	Umeälven	1 yr		8,358	Umeälven	31	1000 PIT-tag
	salmon	Umeälven	2 yr		84,792	Umeälven	31	21000 PIT-tag
	salmon	Ångermanälven	1 yr	60,000		Ångermanälven	30	
	salmon	Ångermanälven	1 yr		54,588	Ångermanälven	30	
	salmon	Ångermanälven	2 yr		132,548	Ångermanälven	30	
	salmon	Indalsälven	1 yr		305,064	Indalsälven	30	
	salmon	Ljusnan	1 yr		117,580	Ljusnan	30	
	salmon	Dalälven	1 yr		161,238	Dalälven	30	2712 PIT-tag (12 of these with additional acoustic tag)
	salmon	Dalälven	1 yr		12,000	Stockholms ström	27	
Latvia	salmon	Daugava	1 yr		560,912	Daugava	28	
	salmon	Gauja	1 yr		194,884	Gauja	28	
	salmon	Daugava	1 yr		31,395	Lielā Jugla	28	
Total salmon				**77,100**	**3,743,215**			

Table 3.4.1.1. The M74 incidence (in %) as a proportion of M74 females (partial or total offspring M74 mortality) or the mean offspring M74 mortality (see annotation 2) of searun female spawners, belonging to populations of Baltic salmon, in hatching years 1985–2019. The data originate from hatcheries, laboratory monitoring or from the free thiamine concentration of unfertilized eggs (see annotation 3). Prognosis for 2020 is based on the free thiamine concentration in unfertilized eggs of autumn 2019 spawners, number of wiggling females (none in autumn 2019), and in Dalälven by forced development and earlier hatching in control groups held in warmer water.

River	SD	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Simojoki (2)	31		*7*	3	7	*1*	*14*	4	53	74	*53*	92	*86*	91	31	60	44	42	42	6	7	3	*18*	29	10	10	3	3	*0*	*0*	*0*	0	4	33	16		
Tornionjoki(2)	31				5	6	1	29	70	76	89	76			*25*	*61*	34	41	*62*	0	*0*		*27*	9	*10*	4	*10*		*0*	*0*					16	1	0
Kemijoki	31																						38	*54*	*25*	30	7	*6*								8	
Iijoki	31																									23								*41*			
Luleälven	31								58	66	62	50	52	38	6	34	21	29	37	4	4	1	18	21	10	16	34	2	2	1	2	2	11	25	20	6	
Skellefteälven	31								40	49	69	49	77	16	5	42	12	17	19	7	0	2	3	13	0	0	5	3	3	22	2	2	4	30	22	24	
Ume/Vindelälven	30	40	20	25	19	16	31	45	77	88	90	69	78	37	16	53	45	39	38	15	4	0	5	14	4	25	24	11	0	8	20	0	19	45	21	6	
Angermanälven	30								50	77	66	46	63	21	4	28	21	25	46	13	4	3	28	30	16	8	23	7	1	4	4	0	24		11	7	
Indalsälven	30	4	7	8	7	3	8	7	45	72	68	41	64	22	1	20	22	6	20	4	0	3	18	16	18	14	11	5	0	0	4	3	15	7		2	
Ljungan	30								64	*96*	*50*	56	28	29	10	25	10	0	55	0																	
Ljusnan	30							17	33	75	64	56	72	22	9	41	25	46	32	17	0	0	25	15	9	16	10	3	0	2	4	2	39	36	13	0	
Dalälven	30	28	8	9	20	11	9	21	79	85	56	55	57	38	17	33	20	33	37	13	4	7	15	18	7	24	18	4	0	3	13	7	34	58	25	2	4
Mörrumsan	25	47	49	65	46	58	72	65	55	90	*80*	63	*56*	23																							
Neva/Åland (2)	29									70	50																										
Neva/Kymijoki (2)	32								45	60-70		57	*40*	*79*	42	*42*	23		*43*	*11*	*6*	*6*	*0*	26													*0*
Mean River Simojoki and Tornionjoki			7	3	6	4	8	17	62	75	71	84	86	91	28	61	39	42	52	3	4	3	23	19	10	7	7	3	0	0	0	0	4	33	16	1	
Mean River Luleälven, Indalsälven, Dalälven		16	8	9	14	7	9	14	61	74	62	49	58	33	8	29	21	23	31	7	3	4	17	18	12	18	21	4	1	1	6	4	20	30	23	3	
Mean total		**30**	**18**	**22**	**17**	**16**	**23**	**27**	**56**	**77**	**66**	**59**	**61**	**38**	**15**	**40**	**25**	**28**	**39**	**8**	**3**	**3**	**18**	**22**	**11**	**15**	**15**	**5**	**1**	**4**	**6**	**2**	**19**	**34**	**18**	**6**	

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

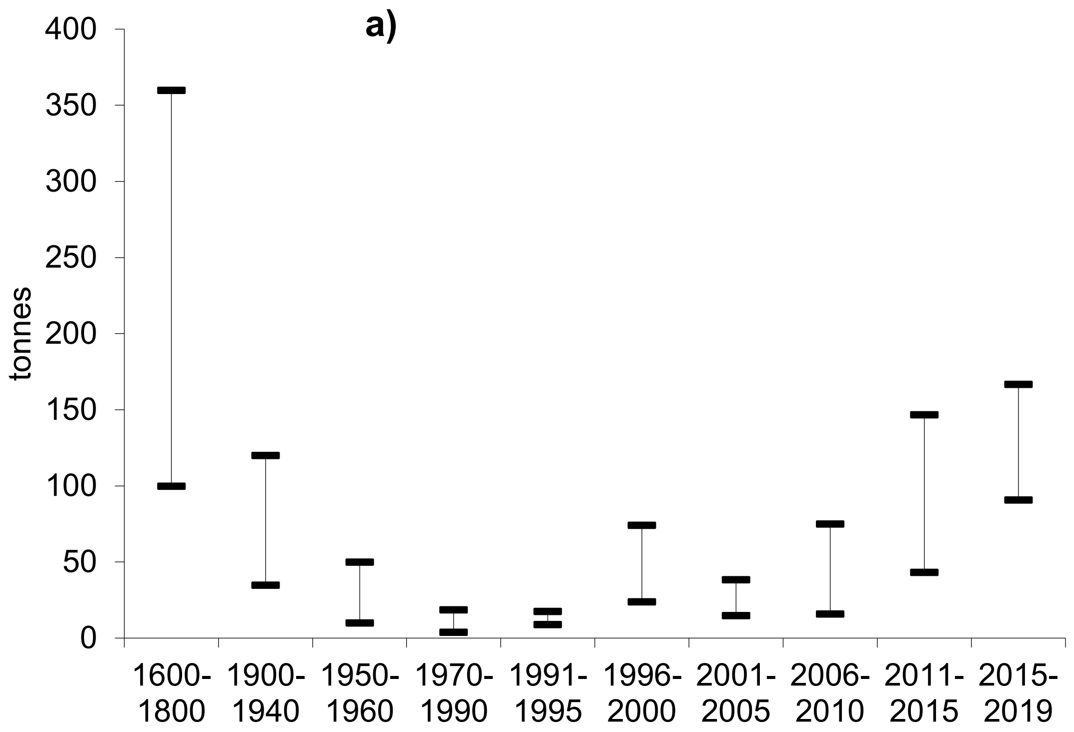
2) The estimates in the rivers Simojoki, Tornionjoki/Torne älv and Kymijoki are since 1992, 1994 and 1995, respectively, given as the proportion of females (%) with offspring affected by M74 and before that as the mean yolk-sac-fry mortality (%).

Table 3.4.1.2. Summary of M74 data for Atlantic salmon (*Salmo salar*) stocks of the Rivers Simojoki, Tornionjoki and Kemijoki or Iijoki (hatching years 1986–2019), indicating the total average yolk-sac fry mortality (YSFM, %) among offspring of sampled females, the percentage of females with offspring that display M74 symptoms (%) and the percentage of females with 100% mortality among offspring (%). Data from 2019 on is based on the concentration of free thiamine (THIAM) in unfertilized eggs and derived from the model by relating the THIAM concentrations with YSFMs from laboratory incubations in the spawning years 1994–2009 from the Finnish M74 monitoring data. Data from less than 20 females is given in italics. NA = not available.

	Total average YSFM (%)			Proportion of females with offspring affected by M74 (%)			Proportion of females without surviving offspring (%)		
	Simojoki	Tornionjoki	Kemijoki/Iijoki	Simojoki	Tornionjoki	Kemijoki/Iijoki	Simojoki	Tornionjoki	Kemijoki/Iijoki
1986	*7*	NA		NA	NA		NA	NA	
1987	3	NA		NA	NA		NA	NA	
1988	7	5		NA	NA		NA	NA	
1989	*1*	6		NA	NA		NA	NA	
1990	*14*	1		NA	NA		NA	NA	
1991	4	29		NA	NA		NA	NA	
1992	52	70		53	NA		47	NA	
1993	75	76		74	NA		74	NA	
1994	*55*	84		*53*	89		*53*	64	
1995	76	66		92	76		58	49	
1996	*67*	NA		*86*	NA		*50*	NA	
1997	71	NA		91	NA		50	NA	
1998	19	*26*		31	*25*		6	*19*	
1999	55	*62*		60	*61*		39	*56*	
2000	38	34		44	34		25	24	
2001	41	35		42	41		27	21	
2002	31	*61*		42	*62*		25	*54*	
2003	2	4		6	0		0	0	
2004	4	*2*		7	*0*		0	*0*	
2005	5	NA		3	NA		3	NA	
2006	*11*	*9*	25	*18*	*27*	38	*6*	*0*	19
2007	26	8	*40*	29	9	*54*	16	5	*31*
2008	14	*21*	*18*	10	*10*	*25*	7	*10*	*6*
2009	11	7	21	10	4	30	7	0	7
2010	10	14	8	3	10	7	0	3	4
2011	3	NA	*6*	3	NA	*6*	0	NA	*6*
2012	*2*	*1*	NA	*0*	*0*	NA	*0*	*0*	NA
2103	*4*	*5*	NA	*0*	*0*	NA	*0*	*0*	NA
2014	6	NA	NA	0	NA	NA	0	NA	NA
2015	2	NA	NA	0	NA	NA	0	NA	NA
2016	7	NA	NA	4	NA	NA	4	NA	NA
2017	19	NA	*34*	33	NA	*41*	18	NA	*29*
2018	28	8	NA	16	16	NA	8	5	NA
2019	NA	5	8	NA	1	5	NA	0	0

Table 3.4.1.3. Summary of M74 data for nine different Atlantic salmon stocks (hatching years 1985–2019), in terms of the number of females sampled with offspring affected by the M74 syndrome in comparison to the total number of females sampled from each stock.

	Luleälven		Skellelteälven		Ume/Vindel älven		Angermanälven		Indalsälven		Ljungan		Ljusnan		Dalälven		Mörrumsån	
	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total	M74	Total
1985	NA	NA	NA	NA	14	35	NA	NA	9	219	NA	NA	0	78	19	69	23	50
1986	NA	NA	NA	NA	16	82	NA	NA	18	251	NA	NA	0	49	4	49	24	50
1987	NA	NA	NA	NA	16	64	NA	NA	20	245	NA	NA	0	84	8	88	32	50
1988	NA	NA	NA	NA	12	64	NA	NA	15	202	NA	NA	0	75	16	79	23	50
1989	NA	NA	NA	NA	6	38	NA	NA	6	192	NA	NA	0	78	7	65	29	50
1990	NA	NA	NA	NA	18	59	NA	NA	15	198	NA	NA	0	86	4	45	39	55
1991	NA	NA	NA	NA	32	71	NA	NA	14	196	NA	NA	14	88	16	78	35	55
1992	161	279	16	40	55	71	78	157	85	190	14	22	29	89	50	63	33	60
1993	232	352	44	89	60	68	98	128	149	206	5	5	89	119	69	81	54	60
1994	269	435	54	78	146	164	52	79	148	208	6	12	105	163	70	126	4	5
1995	209	418	38	77	148	215	58	126	97	237	15	27	79	142	22	40	17	27
1996	202	392	54	70	68	87	36	57	107	167	6	22	92	128	102	178	10	18
1997	156	409	8	50	26	71	38	183	39	178	5	17	28	130	360	159	5	22
1998	22	389	2	48	6	37	3	81	2	155	2	20	7	82	14	83	NA	NA
1999	108	316	22	53	27	51	30	108	25	126	5	20	19	46	27	82	NA	NA
2000	67	320	7	57	27	60	29	136	27	125	1	10	29	114	36	131	NA	NA
2001	96	322	9	51	24	62	31	122	7	100	0	10	47	102	27	82	NA	NA
2002	119	300	8	42	20	53	56	122	25	123	6	11	23	60	56	150	NA	NA
2003	12	270	4	60	8	53	15	120	5	128	0	2	17	100	22	164	NA	NA
2004	10	270	0	59	2	56	4	114	0	125	NA	NA	0	47	5	112	NA	NA
2005	3	250	1	58	0	55	4	114	4	128	NA	NA	0	7	11	151	NA	NA
2006	40	228	1	40	2	39	19	67	18	98	NA	NA	15	60	25	132	NA	NA
2007	45	219	5	40	5	37	24	79	17	105	NA	NA	8	55	17	93	NA	NA
2008	22	212	0	40	2	50	13	80	19	106	NA	NA	7	81	8	108	NA	NA
2009	33	212	0	40	13	50	6	80	5	108	NA	NA	14	85	32	131	NA	NA
2010	78	226	2	40	9	38	17	74	13	120	NA	NA	9	90	24	136	NA	NA
2011	5	220	1	40	5	44	5	76	6	120	NA	NA	3	93	5	128	NA	NA
2012	5	260	1	40	0	50	1	80	0	120	NA	NA	0	92	0	111	NA	NA
2013	2	220	10	45	5	60	2	80	0	120	NA	NA	2	92	3	121	NA	NA
2014	4	220	1	50	12	60	3	80	5	125	NA	NA	4	92	13	103	NA	NA
2015	5	202	1	50	0	60	0	80	3	120	NA	NA	2	92	6	85	NA	NA
2016	21	184	2	50	7	36	19	78	18	120	NA	NA	36	92	33	98	NA	NA
2017	51	206	15	50	10	22	NA	NA	8	120	NA	NA	31	85	41	92	NA	NA
2018	36	180	11	50	3	14	2	19	NA	NA	NA	NA	7	53	20	97	NA	NA
2019	10	180	12	50	3	48	3	45	2	100	NA	NA	0	92	2	118	NA	NA



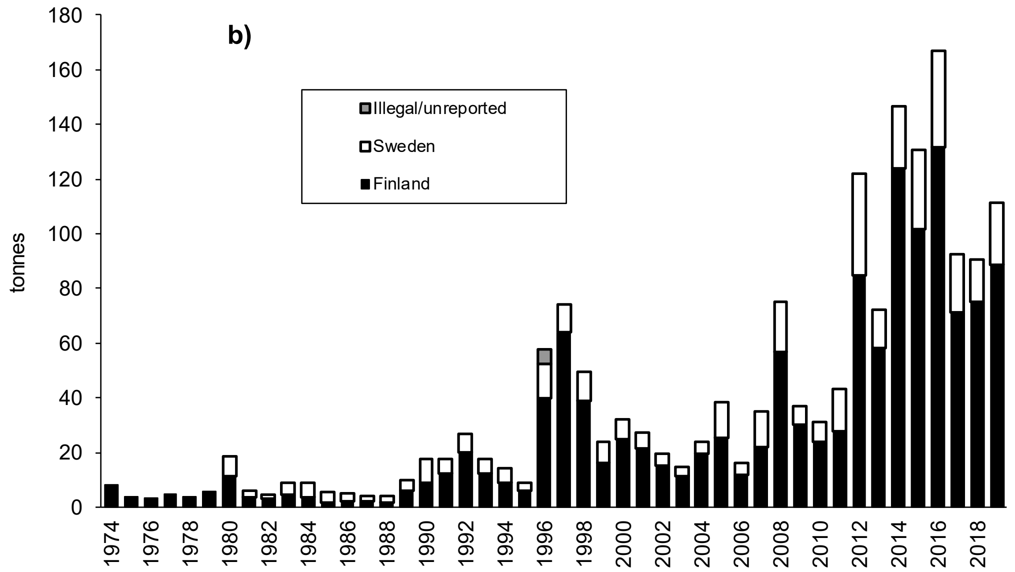


Figure 3.1.1.1. Total river catches in the River Tornionjoki (assessment unit 1). a) Comparison of the periods from 1600 to present (range of annual catches). b) from 1974 to present. Swedish catch estimates are provided from 1980 onwards.

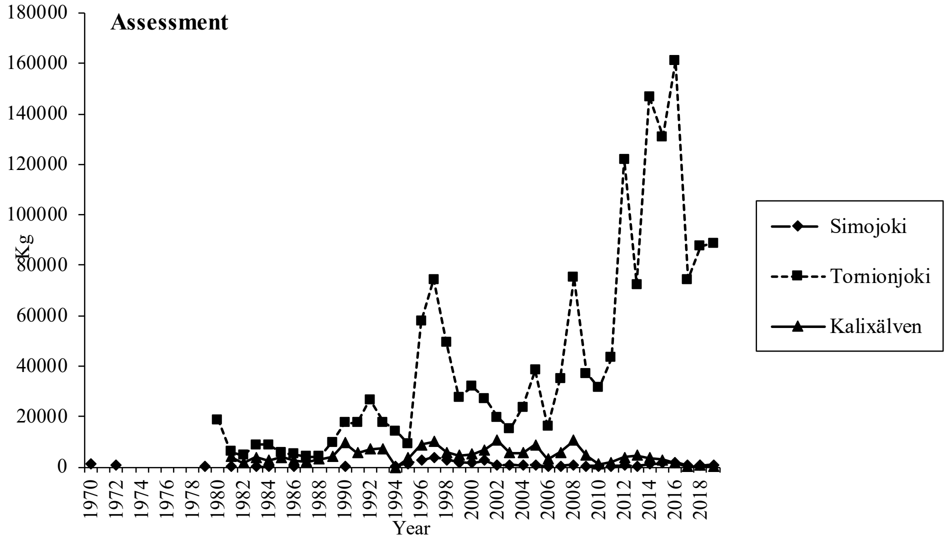


Figure 3.1.1.2 Salmon catch in the rivers Simojoki, Tornionjoki (finnish and swedish combined) and Kalixälven, Gulf of Bothnia, assessment unit 1, 1970-2019. Ban of salmon fishing 1994 in the river Kalixälven.

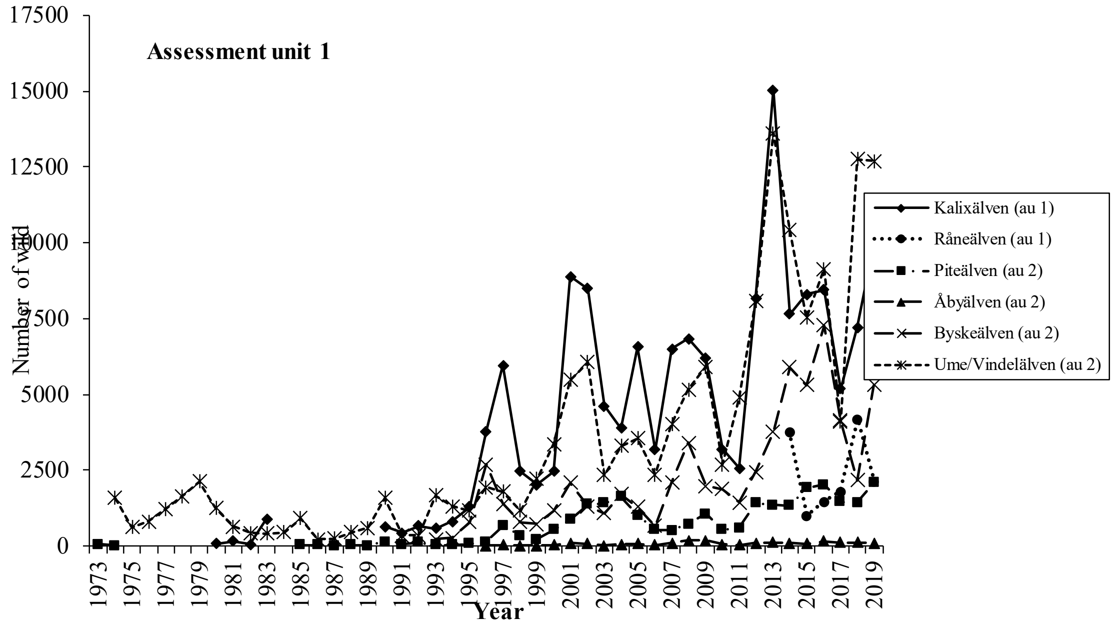


Figure 3.1.1.3. Total wild salmon run in fish way (ecosounder in Råneälven) in rivers in

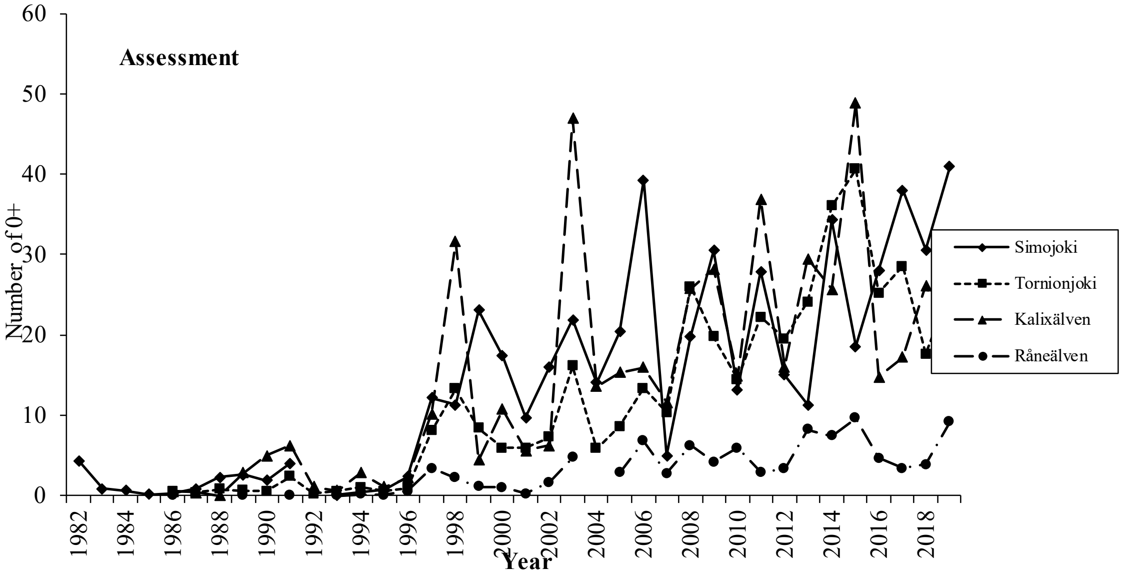


Figure 3.1.1.4 Densities of 0+ parr in rivers in Gulf of Bothnia (Sub-division 31), assessment unit 1, in 1982-2019.

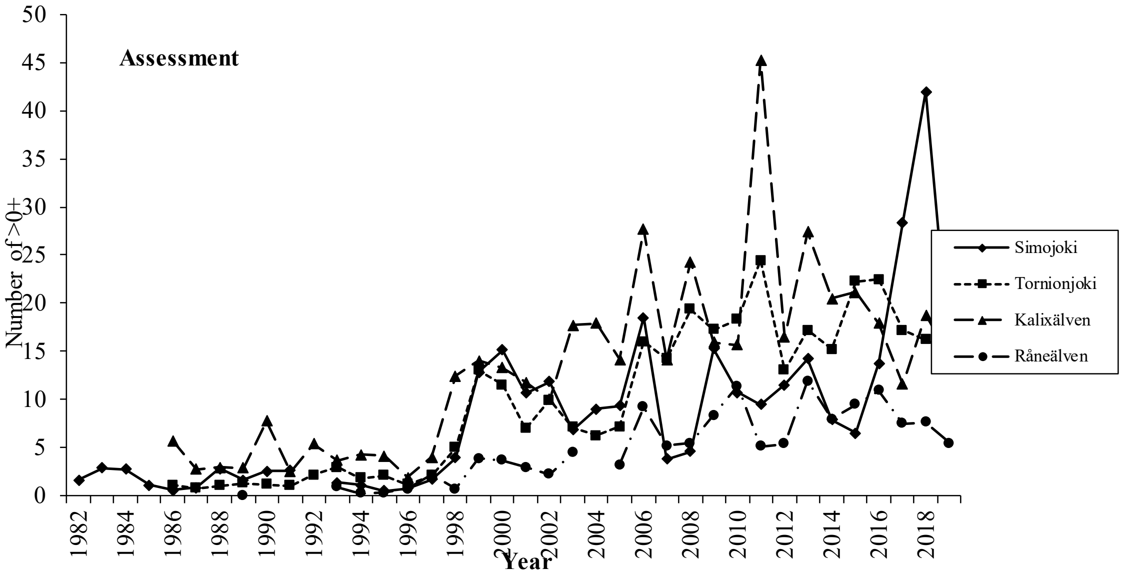


Figure 3.1.1.5 Densities of >0+ parr in rivers in Gulf of Bothnia (Sub-division 31), assessment unit 1, in 1982-2019.

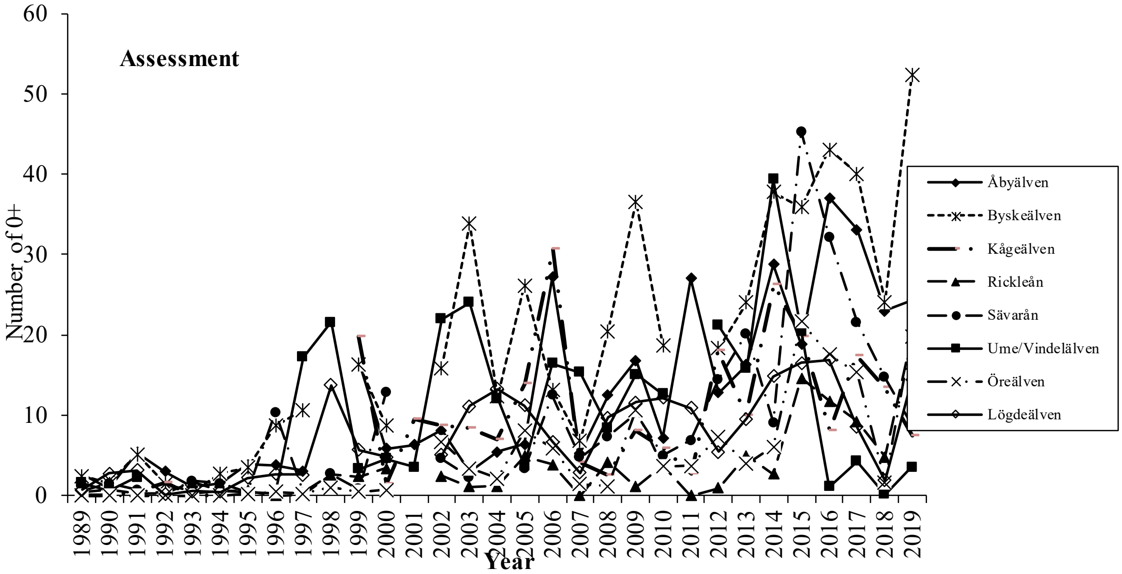


Figure 3.1.2.1 Densities of 0+ parr in rivers in Gulf of Bothnia (Sub-division 31), assessment unit 2, in 1989-2019.

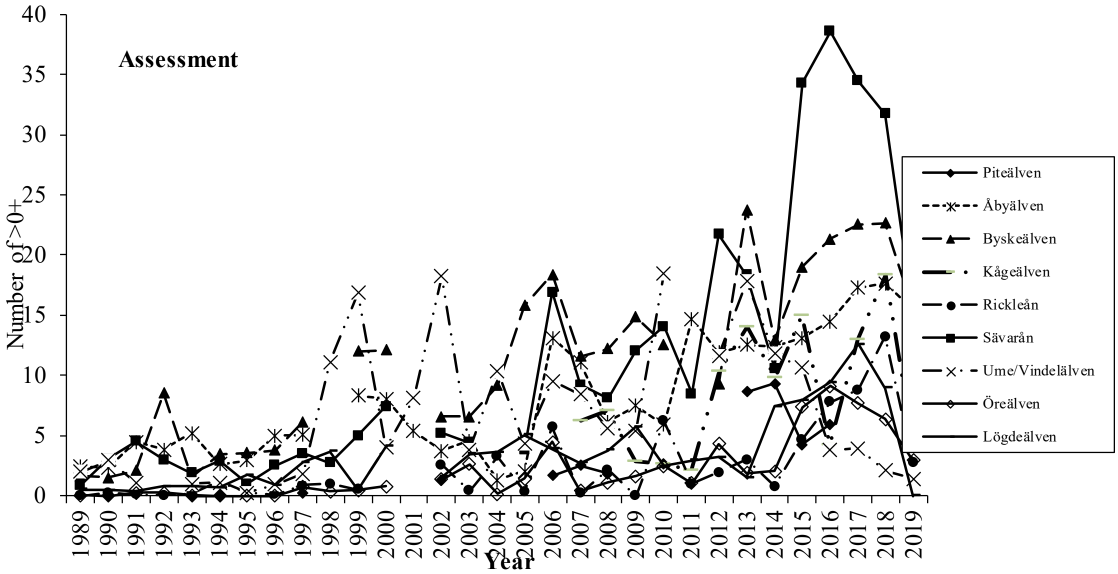


Figure 3.1.2.2 Densities of >0+ parr in riveres in Gulf of Bothnia (Sub-division 31), assessment unit 2, in 1989-2019.

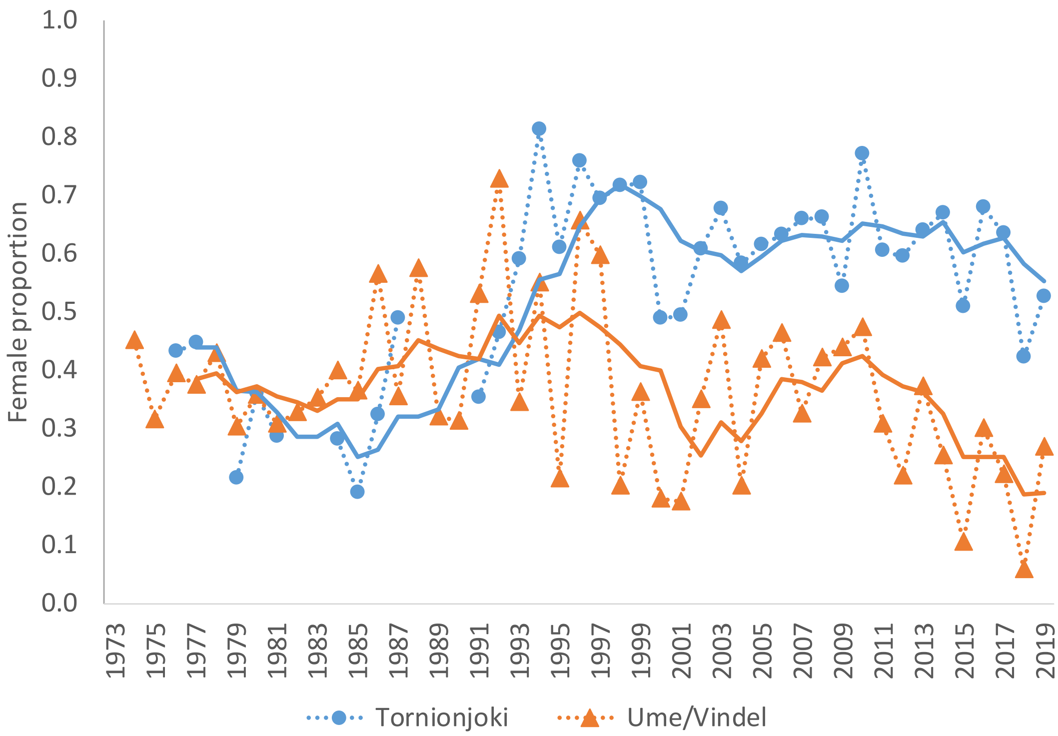


Figure 3.1.2.3. Observed female proportions in Tornionjoki (catch samples) and Ume/Vindelälven (fish ladder data) with moving five year averages.

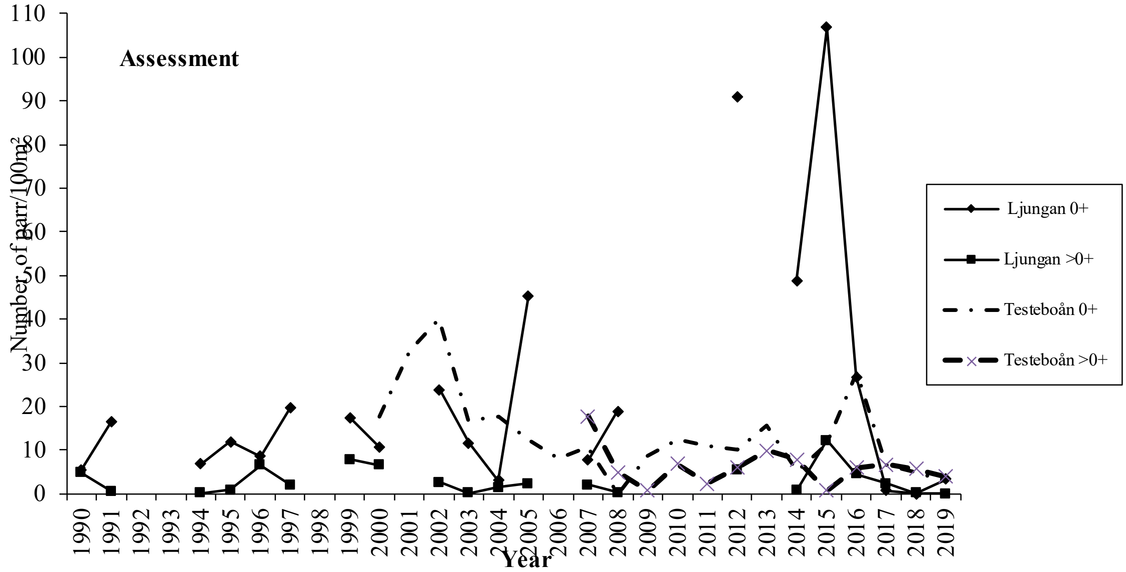


Figure 3.1.3.1 Densites of parr in Ljungan and Testeboån in the Gulf of Bothnia (Sub-division 30), assessment unit 3, in 1990-2019.

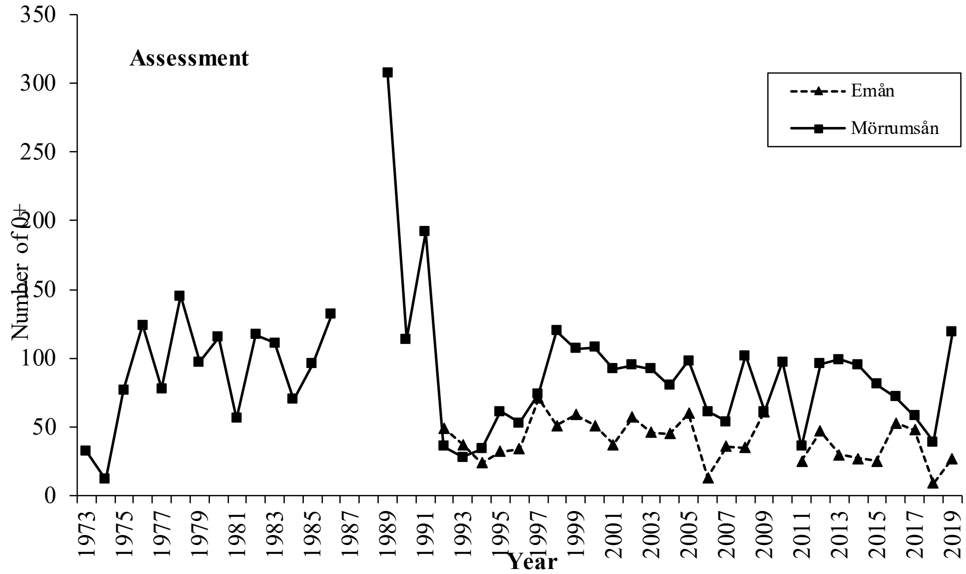


Figure 3.1.4.1 Densities of 0+ parr in rivers in the Main Basin (Sub-division 25-27), assessment unit 4, in 1973-2019.

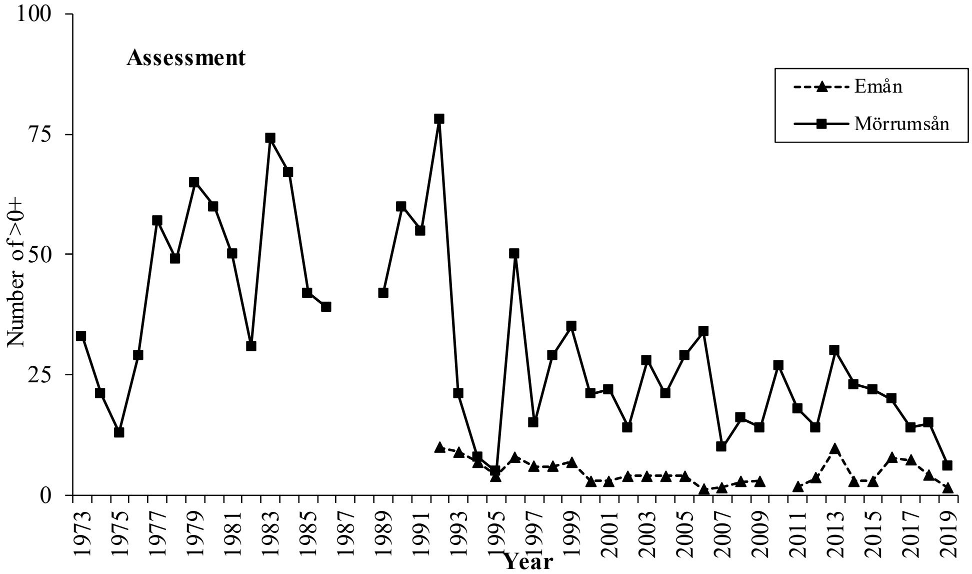


Figure 3.1.4.2. Densities of >0+ parr in rivers in the Main Basin (Sub-division 25-27), assessment unit 4, in 1973-2019.

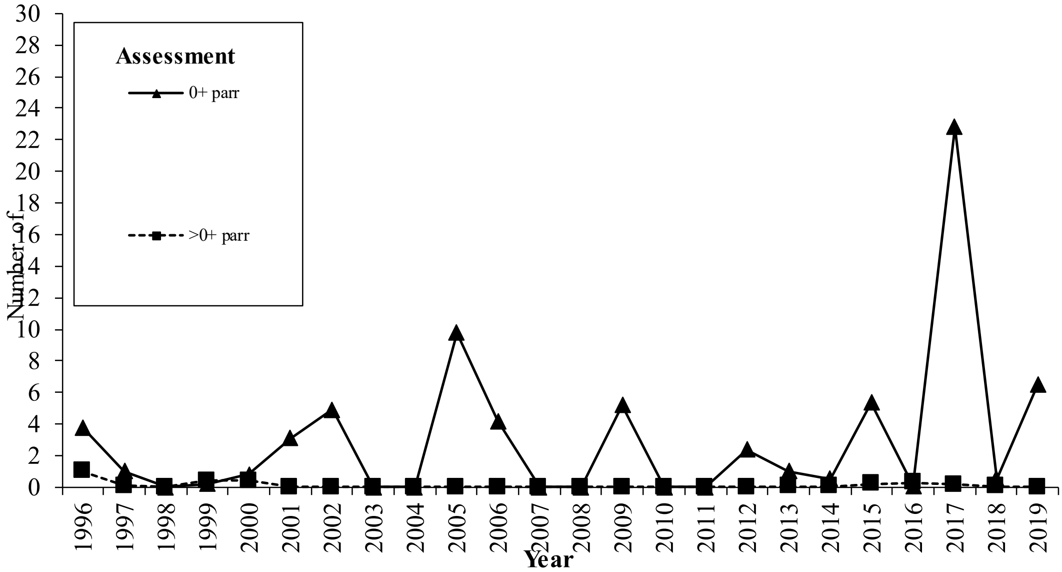


Figure 3.1.5.1 Densities of parr in the river **Pärnu** Main Basin (Sub-division 22-29) assessment unit 5, in 1996-2019

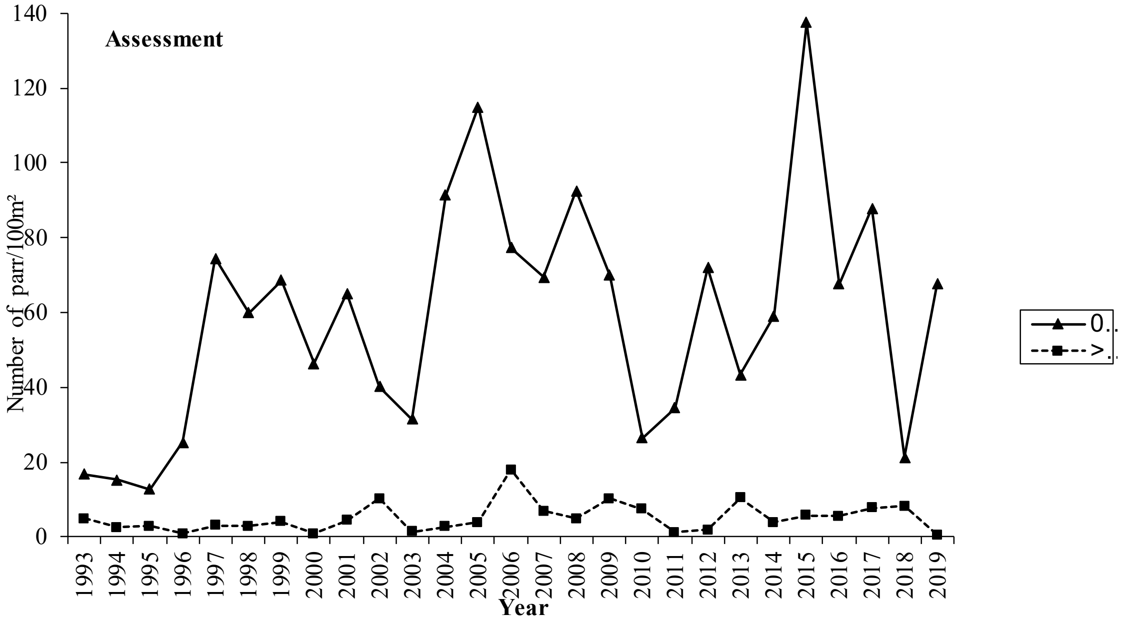


Figure 3.1.5.2. Densites of parr in the river Salaca, Main Basin (Sub-division 22-29) assessment unit 5, in 1993-2019.

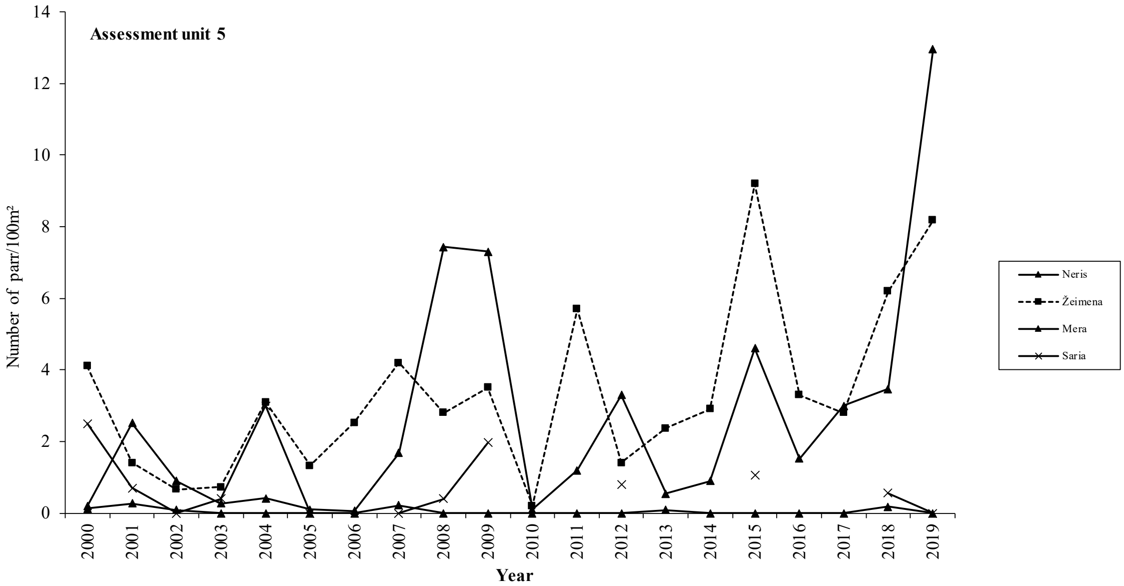


Figure 3.1.5.3. Densites of 0+ parr in Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2019.

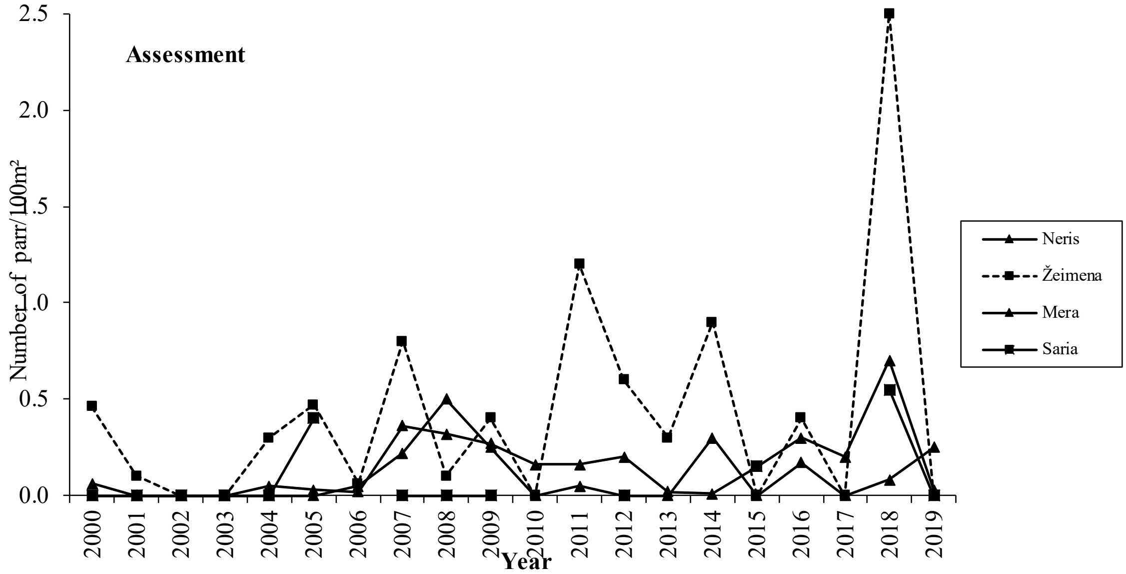


Figure 3.1.5.4 Densities of >0+parr in Lithuanian rivers in Main Basin (Sub-division 22-29) assessment unit 5, in 2000-2019.

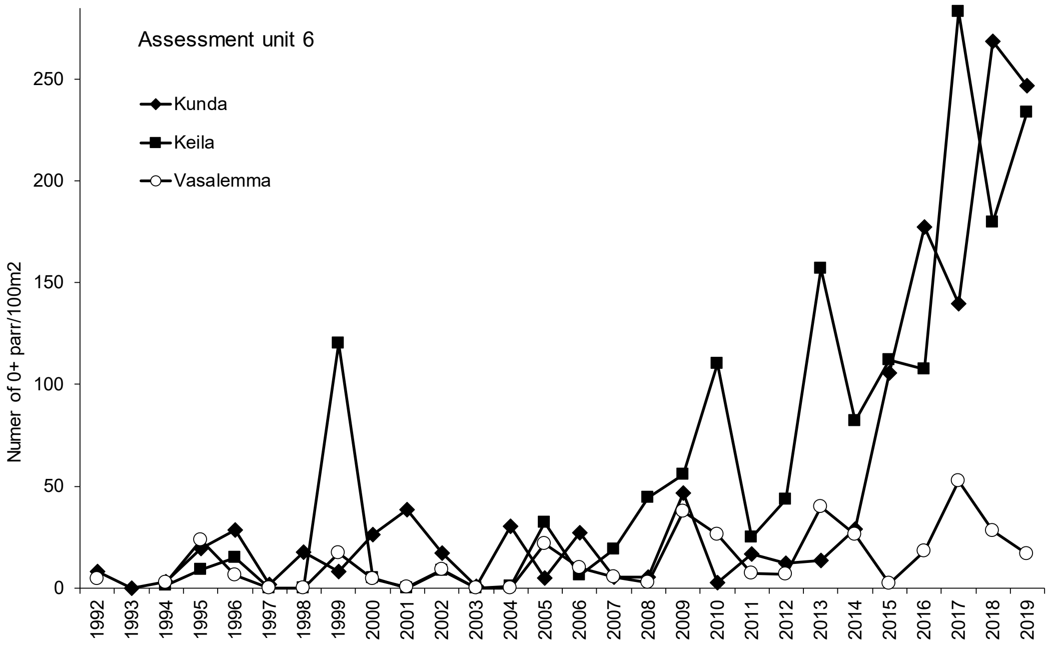


Figure 3.1.6.1. Densities of 0+ (one-summer old) salmon parr in the three wild Estonian salmon rivers

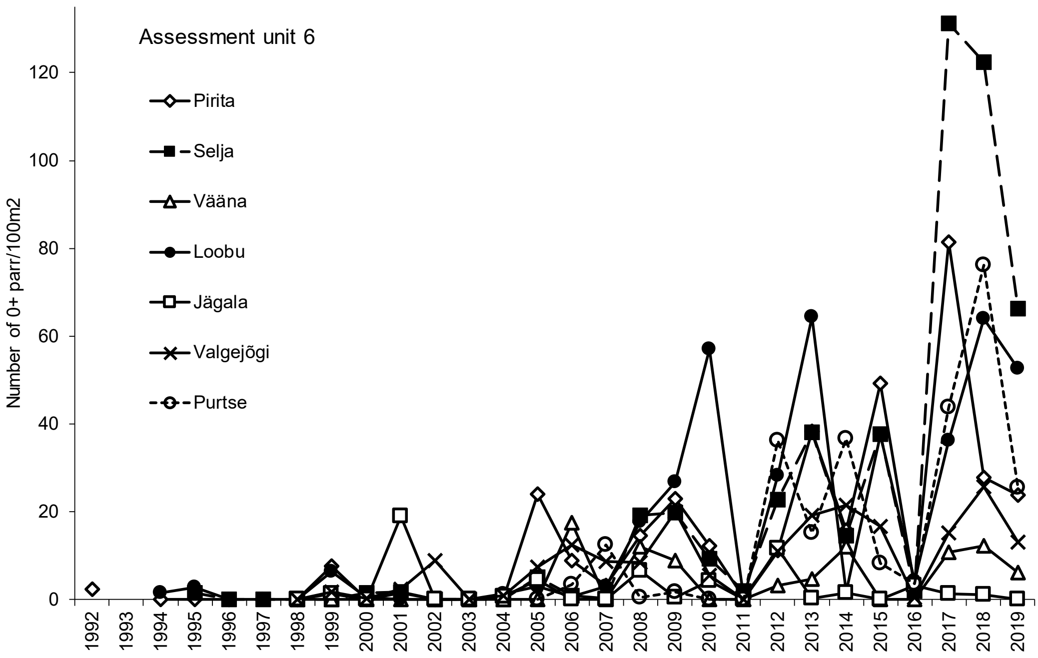


Figure 3.1.6.2. Densities of 0+ (one-summer old) salmon parr in seven Estonian salmon rivers were suportive

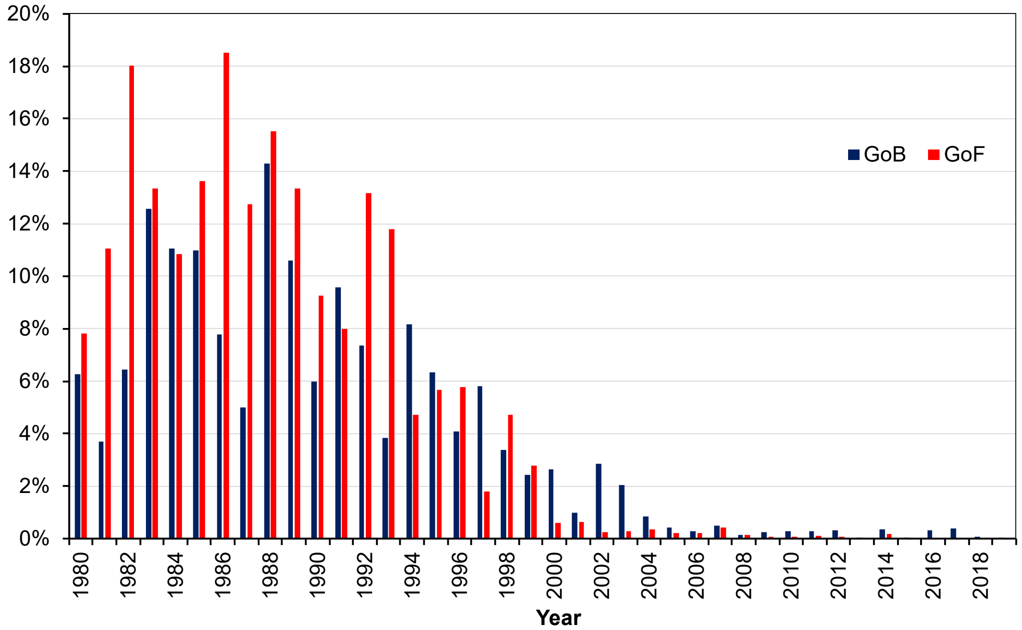


Figure 3.3.3.1. Return rates of Finnish Carlin tagged reared salmon released in Gulf of Bothnia and Gulf of Finland in 1980-2019 (updated in March 2020).

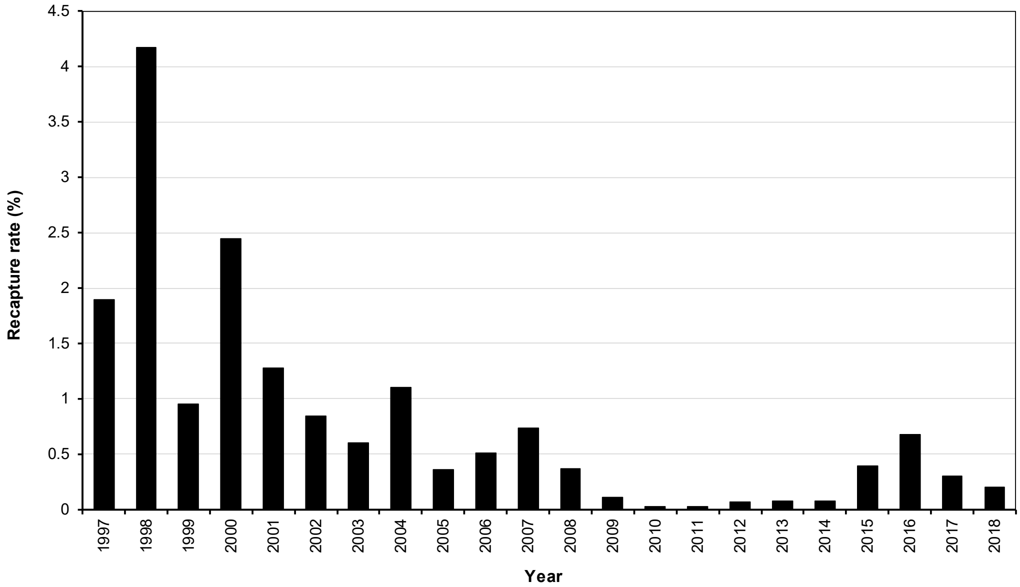


Figure 3.3.3.2. Recapture rate (%) of two-year-old Estonian Carlin tagged salmon in the Gulf of Finland. Carlin tagged from 1997-2014 and T-bar anchor tags since 2015 (updated in March 2020, no returns from 2019 cohort). Year on x-axis is a tagging year.

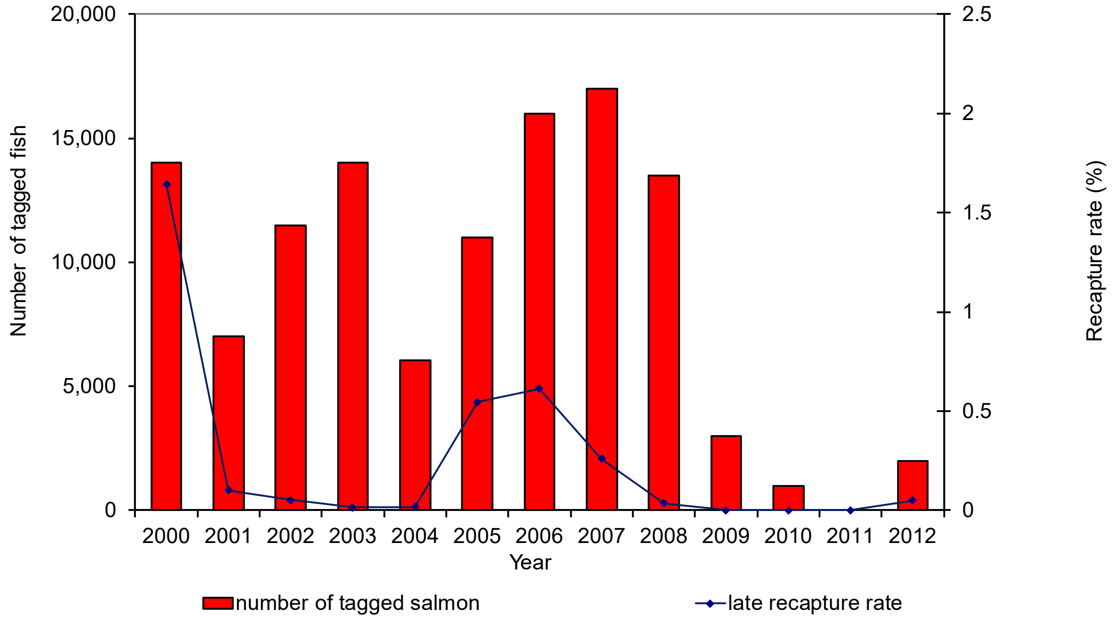


Figure 3.3.3.3. Number of Polish Carlin tagged salmon and return rate (%) for salmon in 2000-2012 (updated in March 2020; no tagging after 2012).

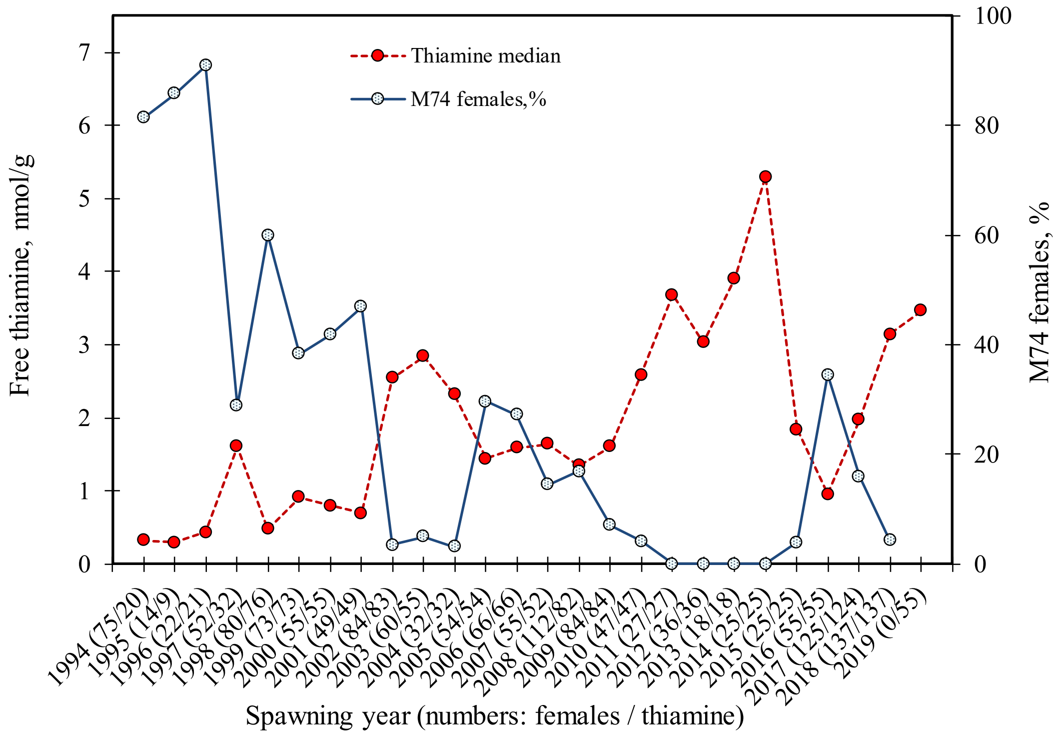


Figure 3.4.1.1. Relationship between the proportion of M74 females and the median concentration of free thiamine in unfertilized eggs of all M74-monitored salmon of the Rivers Simojoki, Torniojoki and Kemijoki (Vuorinen *et al.*, unpubl.).

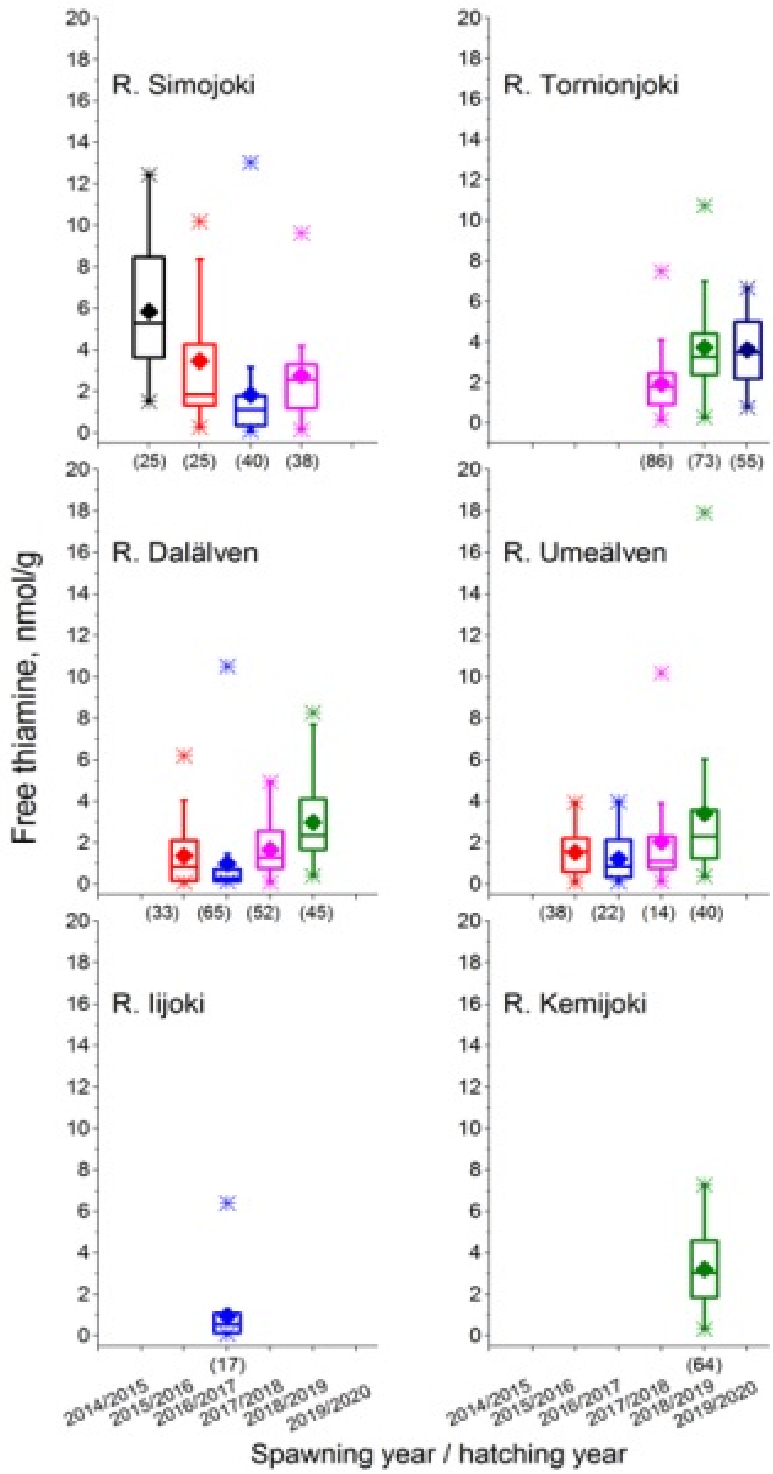


Figure 3.4.1.2. Concentration of free thiamine in the unfertilized eggs of salmon returned to the Rivers Simojoki, Tornionjoki, Dalälven, Ume/Vindelälven, Iijoki and Kemijoki in autumns 2014–2019. Data includes female wigglers in autumn 2016 (1 in R. Simojoki and 16 in Dalälven) and 2017 (1 in R. Tornionjoki), for which an estimated thiamine concentration (0.130 nmol/g) was set. Box depicts the range of 25–75%, horizontal line the median, diamond the mean, whiskers the confidence level of 5–95% and stars the minimum and maximum observations. The reproductive period (spawning year / hatching year) and the number of females (in parentheses) are indicated below the x-axis.

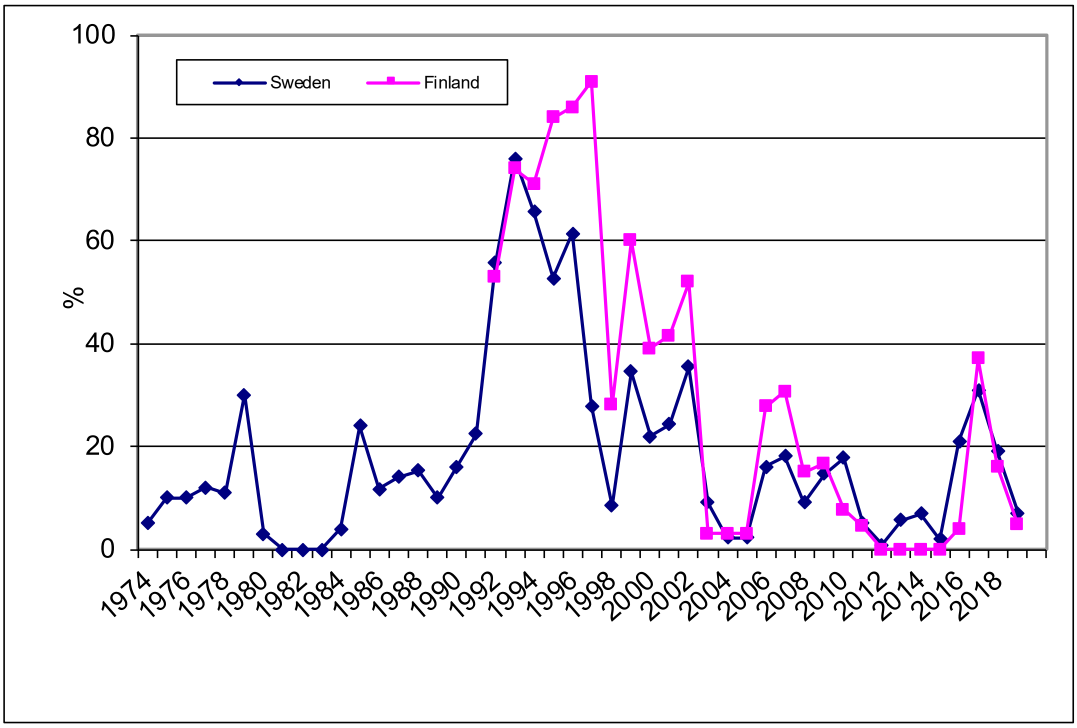


Figure 3.4.1.3. Proportion of M74 positive females in Swedish and Finnish hatcheries (hatching years are given below the x-axis).

4 Reference points and assessment of salmon

4.1 Introduction

In this section, development of salmon stocks and their fisheries as well as other information relevant for advising Baltic salmon fishing possibilities are summarized. Catch options for 2021 are also presented.

In WGBAST, an analytical assessment of the AU 1–4 salmon stocks has normally been carried out annually using the Full Life-History Model (FLHM) together with the newest data. These results of the historical development of stocks have then been used by a scenario tool (R script) to create stock projections under different assumptions about natural survival and harvesting (catch options). However, this year no updates were decided to be done in FLHM with the newest data. Instead, the last year's results of the FLHM serve as the starting point of scenarios. Therefore, no FLHM based updates are shown concerning the current stock status. The latest status updates are found in the last year's report (ICES, 2019).

In the lack of updated FLHM, WGBAST follows the approach used earlier in the 2016 and 2017 assessments (ICES, 2016; ICES, 2017). That is, the most recent (year 2019) data and results of stock monitoring are compared against the stock projection results, allowing for a qualitative evaluation of how well the predictions based on the last year's FLHM have become realised in 2019. This provides an indication of the feasibility to base advice with catch options for 2021 on the latest model run.

Section 4.2 gives a more detailed description of the methods used this year. Further methodological basis and details of the assessment model and stock projections are given in the Stock Annex (Annex 2).

Concerning the salmon stocks in AUs 5–6, their current status is evaluated against the reference points by the same procedure as before. This serves as an auxiliary information when the consequences of different catch options are considered.

4.2 Description of assessment (assessment units 1–4)

The full life-history model run from 2019 stock assessment is used as a basis for the current stock assessment, covering data until 2018. This model run is combined with new scenario runs in this year's stock assessment, including the most recent data (mainly from year 2019) on following issues:

- M74 (2018 spawning, 2019 hatching, see Section 4.3);
- Sea surface temperature (SST) up till March 2020;
- Reported fishing effort on longline and trapnet fisheries;
- For Ume/Vindel, the average proportion of MSW sex ratio passing the ladder in 2017–2019 is assumed for year 2019 and onwards.

In addition, the estimated catch of recreational trolling in 2019 is included as data in the scenarios, by transforming it into effort using corresponding longline CPUE. Recreational trolling is still dealt with in the model framework as a part of the longline fishery for computational simplicity.

Thus, compared to usual model framework with fully updated assessment, current methodology contains two interim years:

- 2019, for which data is updated on issues listed above, and for which some estimates can be compared with the observed data/submodel results (see Sections 4.3 and 4.4);
- 2020, which is treated as "normal" interim year (see Section 4.6).

Note that record high January–March SST in 2020 is giving reason to assume also high April SST for 2020 (Figure 4.2.1). This will induce high estimates on maturation rates for 2020 (see Section 4.6, Figure 4.6.3).

4.3 Submodel results

The **river model** (also called **hierarchical linear regression analysis)** has two versions, one of which is for the northern and the other for the southern rivers, see Stock Annex, Section C.1.5. When full assessment is carried out in FLHM, the river model provides input about smolt production as likelihood approximations (these are also sometimes called 'pseudo observations' in the literature, but for simplicity they are usually called 'smolt priors' in this report) into the life-cycle model, by analysing all the juvenile survey data from the rivers in AUs 1–4. For rivers in AUs 5–6, other methods are used to estimate smolt production (see Stock Annex, Section C.1.5 and ICES, 2017c).

Results of the river model indicate a substantial increase in smolt abundance in AU 1–2 rivers since the late 1990s (Table 4.3.1). In the years 2016–2018, smolt abundance was in its highest level in most of these rivers, but the abundance mostly turned to decrease for 2019–2020. Also for the years 2021–2022, the smolt abundance is generally predicted to be smaller than during 2016–2018. Simojoki is a an exception, because increasing parr densities have been observed in this river even in the latest field season, and therefore smolt abundance is predicted to substantially increase in this river also in the near future. In contrast, smolt abundance in Ume/Vindelälven is estimated have turned to an alarmingly steep decrease after 2017; the bottom in abundance for this river is predicted to take place in 2021, when the smolt abundance would be only about 10% of that of 2017. Also, the results of Sävarån indicate quite steep and continuous decrease of smolt abundance in near future. The long-term increase in smolt production in AU 3 (Ljungan and Testeboån) is less apparent than in the AU 1–2 rivers; nevertheless smolt abundance peaked in 2017–2018 also in this AU. However, no parr were observed in Ljungan during the 2018 electrofishing, therefore smolt abundance in this river is expected to collapse in 2020–2021. Also in Testeboån, the smolt abundance is decreasing.

For the rivers Tornionjoki, Simojoki, Ume/Vindelälven, Rickleån, Sävarån Lögdeälven, Testeboån, Emån and Mörrumsån the results of the river model are more informative than for the other rivers, because of the availability of smolt trapping data from one or several years. Also, smolt estimates of years without smolt trapping have become somewhat more precise in these rivers. Smolt trapping has been conducted only in one year in Lögdeälven and Emån, which increases the precision of smolt abundance mainly in that specific year.

A **model for M74 mortality** provides input about fry mortality due to M74 into the life-cycle model by analysing all data on incidence of M74 in the stocks (see Stock Annex, Section C.1.6). Figure 4.3.1 shows the estimates for M74 mortality (median and 95% probability interval); within the last ten years, the mortality has decreased until the spawning years 2015–2016 when it increased to the level of magnitude of 5–20%. The results from the 2018 spawning (Figure 4.3.1) and the predictions made for 2019 spawning (Section 3.4) indicate a return to the low level prevailing before 2015. In general, the percentage of females with offspring affected by M74 overestimates the M74 mortality, due to the fact that part of the offspring will die due to normal yolk-sac-fry mortality, unrelated to M74. Also, not all offspring necessarily die when affected by M74. Because of the decreasing trend in mortality among offspring of females affected by M74, the data on proportion of females affected by M74 especially overestimate M74 mortality in recent years. Data on the total average yolk-sac-fry mortality are much better at tracking the general trend but overestimate the actual M74 mortality, because these data do not distinguish between normal yolk-sac-fry mortality and yolk-sac-fry mortality caused by the M74 syndrome. Table 4.3.2 shows the actual values of the M74 mortality for the different salmon stocks. Figure 4.3.2 illustrates the probability that offspring of M74-affected females would die, which has been possible to calculate for Simojoki, Tornionjoki and an "unsampled salmon stock".

4.4 Recent trends in assessment unit 1–4 stocks and development of their fisheries

3.4.1 Stock abundance in 2019

Projections based on the FLHM (data up to 2018) indicate **smolt abundance** to slightly decrease in 2019 (and beyond) among the AU1–3 rivers (Figure 4.4.1.1). In AU4, smolt abundance is predicted to stay stable over the recent and near future years. The northern and southern rivers models (with data up to 2019), in turn, indicate a somewhat steeper decrease for 2019 (and 2020) than the predictions of FLHM. However, these differences in the predicted/estimated development for 2019 (and beyond) are very small and remain well within the probability intervals of the estimates in all cases. Similar annual differences between the FLHM and river model estimates can be seen also in the past, although estimates of those years are fed with the same data on juvenile production. Therefore, it can be concluded that the near-future projections about smolt production based on FLHM and data up to 2018 would not much change/benefit from inclusion of 2019 data.

Spawner counts are available from several AU 1–2 rivers (Table 3.1.1.2). An annual spawning run index was computed as the number of salmon counted in relation to in 2009, averaged across rivers and compared with an identically computed index for modelled median estimates from the base case scenario projection (FLHM with data up to 2018 with added 2019 data as listed in Section 4.2). Although the model tended to somewhat overestimate the 2019 spawning runs, this difference was considered as minor in relation to the large uncertainty surrounding the modelled spawning run index for this year (Figure 4.4.1.2).

3.4.2 Fisheries in 2019

The major change that took place in the Baltic Sea fisheries compared to the previous year was a strong decrease of Polish open sea fisheries in the southern Main Basin. The effort of Polish open sea longline fishery was 18%, and total reported salmon and sea trout catch was 6% in 2019 compared to in 2018. In 2010–2018 about 85% of the Polish reported open sea catch has been sea trout, which was suspected misreported actual salmon catch (ICES, WGBAST 2019). In Polish coastal fisheries in 2019, the total reported salmon and sea trout catch increased by factor 1.7, but the total combined catch in open sea and coast together was low, being about 40% compared to 2018.

The change in the Polish fishery was a result of the sea trout fishing ban in the open sea area, combined with problems for the fishery due to increased seal damages and stormy weathers (see Section 2.3.3).

Misreporting disappeared from the Polish open sea fisheries, but it is uncertain whether such occurs in coastal fisheries where the WGBAST doesn't have means to estimate potential misreporting. All in all, disappearance of misreporting substantially affected to proportions of different catch components in catch options (Table 4.6.1.1).

The substantial decrease in the Polish fishery, particularly the misreporting of salmon as sea trout, decreased the proportion of actual salmon catches taken in the southern Baltic Sea feeding areas. This correspondingly increased relatively the harvesting towards the spawning migrating salmon at coasts and rivers, and also decreased the total harvest rate. This change in the harvest rate of 2019 has been indirectly taken into account in scenarios via reported effort for 2019.

4.5 Status of the assessment unit 5–6 stocks

Smolt production in relation to PSPC in the **AU 5 stocks** shows a negative trend in almost every wild and mixed river (Figures 4.5.1 and 4.5.2). During the last decade, smolt production dropped from 50% or higher to below 50% of PSPC. Thereafter smolt production has stayed on this low level except for in 2015–2016, when a sudden temporal increase was observed in most rivers (Figure 4.5.1). In 2017 and in 2018, most AU 5 rivers were estimated to produce only about 10–30% of their PSPCs and they are therefore unlikely to have reached 50% target (given the associated uncertainties in estimation; Table 4.2.3.4). In river Pärnu the smolt production has shown small signs of improvement. The second river in AU 5 which shows limited positive development is Nemunas. This is a large watercourse with several tributaries, and many of them have been subject to long-term restoration efforts (habitat restorations, stocking, etc. see Sections 3.1.5 and 3.2.2). Observed smolt production in the Nemunas in relation to PSPC has remained far below 50% level of PSPC.

Rivers Salaca (AU 5) and Mörrumsån (AU 4) are both well-known salmon rivers with the most extensive and longest time-series of monitoring data in the Main Basin area (Sections 3.1.4 and 3.1.5). The developments of parr densities in these two rivers roughly resemble each other since the early 1990s; an increase in the densities from the early to the late 1990s and a subsequent decrease starting in the early 2000s. Smolt production in Salaca from 2017 to 2019 was mostly below 50% of PSPC. Prediction for Salaca smolt production in 2020 is to be just above 50% of PSPC.

Smolt production in the **AU 6 stocks** shows positive trends in most rivers but also a large interannual variation, especially in the smallest rivers (Figures 4.5.3 to 4.5.5). Among wild (Figure 4.5.3) and mixed (Figure 4.5.5) Estonian stocks the clearest positive trend exists in two of the wild ones (Keila and Kunda) which have reached 75% of their PCPCs. Smolt production in wild Vasalemma has also increased in recent years, however it has remained below 50% of PSPC (Figure 4.2.4.3). In 2018, the Vanaveski dam was opened and salmon got access to additional upstream spawning areas. Thefore, PSPC in Vasalemma is now estimated to be higher than in previous years. Despite of free access to all potential spawning areas, no salmon parr was found upstream from the Vanaveski dam. It remains to be seen how quickly salmon is able to recolonize the newly available areas.

In the small Estonian mixed stocks the smolt production was mostly low in 2017–2018, but increased in 2019 (Figure 4.2.4.4). It is predicted that smolt production in 2020 will be similar to 2019. Current PSPC in some of these rivers is severely limited by migration barriers, and parr densities show a lot of interannual variation in these small populations. PSPC in the mixed river Valgejõgi has increased since 2016 (from 1500 to 16 500 smolts) because salmon regained access to all potential historical spawning and rearing areas. Smolt production in relation to PSPC has remained far below 50%.

The Finnish mixed river Kymijoki shows a modest positive trend, although interannual variation is great. The smolt production has nevertheless remained below the 50% level in most years. In Russian river Luga, wild smolt production is stable but low, and it has remained below 10% of PSPC despite large-scale annual smolt releases using salmon of local origin (Figure 4.5.5).

4.6 Stock projections and catch options of Baltic salmon stocks in assessment units 1–4

The WG did not find any notable disagreement in stock development between the last year's FLHM based scenarios and the newest data (Section 4.4). Moreover, the 2019 situation in fisheries can be incorporated in the scenarios (Section 4.3). Therefore, it was concluded that catch options for the 2021 can be provided and their effects on later stock development evaluated without updating the FLHM.

Table 4.6.1 provides a summary of assumptions on which the stock projections are based. The basis has been kept as similar to the last full assessment (ICES, 2019) as feasible.

Fishing scenarios

The base case scenario (scenario 1) for future fishing (2021 and onwards) equals to the commercial catch advised by ICES for 2020, i.e. the median commercial removal would equal to 116 000 salmon. Scenarios 2 and 3 correspond to a 20% increase and 20% decrease from the scenario 1, respectively. Scenario 4 equals to the F=0.1 harvest rule, applied for total commercial removals. Scenario 5 illustrates stock development in case all fishing (both at sea and in rivers) was closed. Scenario 6 illustrates how recreational fishing alone would affect stock development. Scenario 7 represents a situation where recreational sea fisheries and river fisheries where absent, and only commercial sea fishery would be operational with a removal of 116 000 salmon. Finally, scenario 8 represents a 100% increase in commercial removal compared to scenario 1.

Similar to in previous years, fisheries in the interim year (2020) follow the scenarios, except for longline fishing during the first months of the year, which is estimated based on the effort observed during the corresponding months of 2019.

Scenarios were computed by searching an effort that results in a median catch that corresponds to the desired total sea catch (depending on the scenario) in the advice year (2021). For example, in scenario 1, the total sea catch (142 700 salmon) consists of total commercial sea catch (116 000 salmon) and total recreational sea catch (26 700 salmon). The recreational sea catch in 2021 is set constant in all but the scenarios 5 and 7 (which assume no recreational fishing). The recreational catch in 2021 consists of an estimated offshore trolling catch in 2019 (21 300 salmon) and reported recreational catches other than offshore trolling in 2019 (6550 salmon). Because the current model framework does not allow inclusion of recreational fisheries as a separate fishery, it is technically included as a part of offshore longline fishery.

Because the scenarios are technically defined in terms of future fishing effort, the predicted catches have probability distributions according to the estimated population abundance, age-specific catchabilities and assumed fishing effort. Scenarios 1–4, 7 and 8 assume the same fishing pattern in commercial fisheries (division of effort between fishing grounds) as realized in 2019. Figures 4.6.1a–b show the harvest rates prevailing in the scenarios 1–4.

In all scenarios, it is also assumed that the commercial removal reported under the TAC covers 83% of the total commercial sea fishing mortality, whereas 17% of this mortality consists of discards, misreported, and unreported commercial removals. This corresponds to the situation assessed to prevail in 2019 (Figure 4.6.1.9).

Survival parameters

In both the M74 and the post-smolt mortality (Mps) projections, an autoregressive model with one year lag (AR(1)) is fitted at the logit-scale with the historical estimates of the survival parameters. Mean values of the mean of the post-smolt survival over years 2014–2017 (14%), variance over the same time-series and the autocorrelation coefficient are taken from the historical analysis into the future projections. The method for M74 is similar, but the stable mean for the future is taken as the mean over the whole historical time-series (83%). In addition, the forward projection for Mps is started from 2017 to replace the highly uncertain model estimate of the last year of the historical model and the future uncertainty is adjusted to accommodate the range of historical variation in M74. The starting point of M74 projections is 2020. Time-series for Mps and M74 survival are illustrated in Figure 4.6.2.

Adult natural mortality (M) is assumed to stay constant in future, equalling the value estimated from the history. Different fisheries occur at different points in time and space, and many catch only maturing salmon, which has been subject to several months' natural mortality within a year. Thus, in order to increase comparability of abundances and catches, the abundances at sea have been calculated by letting M first to decrease the PFA (stock size at the beginning of year) of multi-sea-winter salmon for six months. Moreover, the stock size of grilse has been presented as the abundance after the period of post-smolt mortality and four months of adult natural mortality. This period is considered because the post-smolt mortality period ends in April, after which eight months of that calendar year remain during which grilse are large enough to be fished. Half of that period, i.e. four months, is considered to best represent the natural mortality that takes place before the fishing. Calculations for the F=0.1 scenario (Scenario 4) are also based on stock sizes which are first affected by M, as described above.

Maturation

Annual sea-age-specific maturation rates are given as the average level computed over the historical period, separately for wild and reared salmon. This projection starts from 2021, as the maturation rates of 2020 can be predicted based on sea surface temperature (SST) information from early 2020 (ICES, 2014, Annex 4). The time-series of maturation rates are presented in Figure 4.6.3.

It is important to note that because SST is estimated to be record high in 2020 (Figure 4.2.1), the maturation rates in 2020 are expected to be among the highest in the whole time-series. This results in abundant spawning runs predicted for 2020. Therefore, also the amount of salmon predicted to stay on the feeding ground for 2021 is less than it would be if maturation rates would be on average or low.

Releases of reared salmon

The number of released reared salmon per assessment unit is assumed to remain at the same level in future as in 2019 (Table 3.3.1).

3.6.1 Results

According to the projections, stock size on the feeding grounds (pre-fishery abundance, PFA) will be about 1.45 (0.56–3.50) million salmon (wild and reared, 1SW and MSW fish in total) in 2021 (Figure 4.6.1.1a–b). Of this amount, MSW salmon (i.e. fish which stay on the feeding area at least one and half years after smolting) will account for 0.61 (0.24–1.42) million salmon. These MSW fish will be fully recruited to both offshore and coastal fisheries in 2021. From the predicted amount of 1SW salmon (0.83 million, 0.22–2.27 million) at sea in spring 2021, a fraction (most likely 20–40%) is expected to mature and become recruited to coastal and river fisheries, while the rest of the 1SW salmon will stay on the feeding grounds and will not become recruited to the fisheries until next winter.

The abundance of wild salmon at sea has fluctuated without any apparent trend until 2010. During the 2010s the abundance has on average been higher than before, at or above one million (according to median values for 1SW and MSW wild salmon combined) (Figure 4.6.1.1a–b). Except for the high fishing scenario (8), the abundance of wild salmon is predicted to stay with high probability on this elevated level in the future.

The very high SST prevailing on the feeding ground in the early 2020 give rises to the predicted high maturations rate among salmon for 2020 (Figure 4.6.3). Because one of the simplifying assumptions of the modelled life cycle is that all salmon die after spawning, a lower maturation rate will increase the survival of the cohort to the next year compared to years with the same abundance but with average maturation. Similarly, a high maturation rate will decrease the abundance of MSW salmon in following years. Because of this feature, it is important to note that the predicted abundance may easily become over- or underestimated because of the (predicted) development of maturation rates.

In contrast to wild salmon, the abundance at sea of reared salmon strongly decreased from the mid-1990s to the late 2000s, mainly due to the decline in post-smolt survival. In some occasional years in the early 2010s, substantial amounts of reared salmon have been assessed to recruit to the fisheries (which may be an artefact due to the poor estimation of e.g. Mps in those years, ICES, 2019), but thereafter the abundance has stayed on a rather low level, and it is predicted to stay low also during the coming years. The combined wild and reared abundance (PFA) also declined substantially from mid-1990s until late 2000s, but thereafter the total abundance has increased and is (except in scenario 8) expected to stay on this elevated level in future (Figure 4.6.1.1a–b).

Table 4.6.1.1 shows the predicted total catch by scenario for year 2021, divided into the following components:

- commercial wanted sea catch, consisting of reported, unreported and misreported;
- commercial unwanted sea catch, consisting of discarded undersized and seal damaged salmon;
- recreational sea catch; and
- catch in the rivers.

The table also shows the predicted fishing mortality (separate F of commercial fishing and F of all sea fisheries) as well as the predicted number of spawners in 2021 for the given fishing scenarios.

The amount of unreporting, misreporting and discarding in 2021 is based on the expert evaluated share of those catch components compared to the reported catches in 2019 fisheries. In 2019, the wanted catch reported (commercial) accounted for about 83% from the corresponding estimated total commercial sea catch (i.e. total fishery related mortality). Unreporting, misreporting and discarding in 2019 are considered to take about 7%, 1% and 9% shares of the total commercial sea catch, respectively. The share of the total catch by its components for the period 1987–2019 is illustrated in Figure 4.6.1.9. It is important to keep in mind that future changes in either fishing pattern or in fisheries control may easily lead to changes in the share of catch caught under the quota regulation.

Within scenarios 1–4 the predictions indicate that the wanted catch reported (commercial) in year 2021 would be 85–127% (77 300–116 000 salmon) compared to the TAC of 2020 (Table 4.6.1.1). The corresponding total sea removal (including recreational fishing) would range from 119 500–165 900 salmon. The harvest rule of $F_{0.1}$ for commercial catch (scenario 4) results in a wanted catch reported of 115 000 salmon and an about 5% smaller spawning stock than under Scenario 1. The amount of spawners would be about 5% higher in Scenario 3 than in Scenario 1, and the zero fishing scenario indicates about 68% increase in the number of spawners compared to the scenario 1. The scenario 'recreational fishing only' (6) illustrates the magnitude of the current level of the recreational fishing which is predominantly angling in rivers and trolling at sea: recreational fishing alone would decrease the number of spawners by 24% compared to the zero fishing scenario. Figure 4.6.1.2 illustrates the longer term development of (reported) future catches given each scenario.

Figure 4.6.1.3a–e presents the river-specific annual probabilities to meet 75% of the PSPC under each scenario. Under the scenarios 1–4, different amount of fishing has small influence on the level but not on the trend of the probability of meeting 75% target over time. Scenarios with severely increased (8) or decreased fishing (5,6,7) diverge clearly. For Testeboån (AU3) the favourable performance in scenarios is in part due to the likely underestimation of its R0 (see Section 4.7). It is also noteworthy, that the status of Ume/Vindelälven is expected to decline even in the zero fishing scenario (5). The reason for this is the recent high mortality of spawners (especially females) entering the river (see Sections 3.1.2, 3.4.4 and 4.7).

As expected, changes in fishing have the smallest effect to those stocks that are close to their PSPC. Because the overall level of fishing effort is rather low in these scenarios compared to history, the examined range of fishing mortality within scenarios 1–4 only results in modest impacts on the chances of reaching the management objective. Table 4.6.1.2 compares the probabilities of reaching the 75% target around years 2025–2026, which are approximately one full generation ahead from now. Evidently, the probabilities are higher for effort scenarios with low exploitation, but differences between scenarios are small except for scenarios 5–7. Figure 4.6.1.4a–c illustrates by scenario the rate and the direction of change in smolt abundance in 2025/2026 compared to the smolt abundance in 2018. Future predictions about smolt abundance are naturally more uncertain than the estimated abundance in 2018. However, in those stocks that are close to their PSPC, also the predictions are rather certain, indicating that smolt abundance will stay close to PSPC in these rivers under different fishing scenarios.

Figures 4.6.1.5a–e show longer term predictions in the river-specific smolt and spawner abundances for three scenarios (1=removal which corresponds to ICES advice for 2019; 8=100% increase to ICES advice for 2019; and 5=zero fishing). The two most extreme scenarios, (5 and 8) illustrate the predicted effects of contrasting amounts of fishing.

4.7 Additional information affecting perception of stock status

This section focuses on auxiliary information of importance for a complete evaluation of the current stock status. In particular, we highlight information about diseases and other factors that may affect development in stock status, but which are not fully taken into consideration in the current modelling. Likewise, weaknesses in input data used in the assessment model might affect the precision of status evaluations, and in the worst case introduce biases. Such shortcomings in the current assessment model, when it comes to input data and ways of handling those, are also discussed under this section.

Many of the M74-fluctuations seen since the early 1990s have tended to last for some years before changing in direction (Figure 3.4.3). After a period with very low M74 abundance in 2011–2015, mortalities increased to higher levels in 2016–2018. In 2019, M74 related mortalities decreased considerably, and the latest thiamine analyses of eggs spawned in 2019 indicate that M74 mortality among offspring is predicted to decline to even lower levels in 2020. Despite the recent positive development, the future occurrence and development of M74 is difficult to predict, which introduces uncertainty in forecasts of the development of salmon stocks. The disease outbreaks reported in several rivers in recent years (Section 3.4.4) is also a concern for the future. In contrast to M74, the cause(s) of the disease is still unknown, and to accurately quantify the amount of affected or dead salmon in a river appears difficult, if at all possible.

The currently existing information indicates that health issues in Baltic salmon - such as M74 or diseases among spawners - only affect number of eggs deposited or hatched or the number of dispersing fry. That is, losses take place before the offspring reach stages with the highest density-dependent mortality. Therefore, a stock with high status is expected to show more resilience against various events that negatively affects early reproduction (i.e. from egg deposition to dispersal of fry), because these effects may partly be compensated by reduced density-dependent mortality among the offspring. In contrast, weaker populations are not expected to have similar 'buffers' against such losses.

Average salmon 0+ parr densities in many rivers decreased in 2017–2018 compared to the historically high densities observed around year 2015. In 2019, parr densities again increased in many rivers. Part of these fluctuations may be explained by generation effects, i.e. variation in year-class strength among spawners, but mortality due to M74 and/or other disease outbreaks could also be part of the explanation. Compared to other rivers, the recent negative development in parr densities in **Vindelälven** and **Ljungan** is exceptional, and those two rivers only showed minor improvements in 0+ parr densities in 2019**.** In **Vindelälven,** the average 0+ density dropped drastically, from ca. 40 parr/100 m^2 in 2015 to only one parr/100 m^2 in 2016, and has remained at very low levels since then even though a slight increase was observed in 2019 (Table 3.1.2.1). The decline likely reflects a combination of factors. In 2015, only 790 females were counted in the Norrfors fish ladder, which represented just 11% of the spawning run (18% among MSW salmon, if assuming 6% females among grilse). In 2016, the number of females counted was higher (2741), but a large proportion of the salmon passing the ladder had severe skin problems (fungus infections) and many died soon after having been counted. Female numbers again decreased to 908 in 2017 and 728 in 2018, which represented only 32% and 26%, respectively, among MSW salmon. There are no observations of such skewed sex ratios in the sea or at the river mouth of Umeälven, or in other rivers. Hence, the recent disease problems in Ume/Vindelälven seem to have prevented particularly females from reaching the spawning areas.

In 2019, the number of MSW salmon counted at Norrfors increased significantly and was the highest since the health problems started in the river. In total 3389 females, representing 33% of the MSW salmon, passed the counting site. Salmon still expressed symptoms of having health problems, but these were mainly observed during the early part of the migration period. It is possible that the higher number of ascending spawners observed in 2019 may reverse the current negative trend for Vindelälven, but such effects on the recruitment will not be possible to evaluate until autumn 2020 when data on reproductive success of these spawners will be available from electrofishing. In addition, the M74 situation has generally improved with low fry mortalities in 2019 and even lower predicted mortalities in 2020 (Table 3.4.1.1), which will also likely improve possibilities for recovery of this river stock.

Also in **Ljungan** average 0+ salmon densities in 2017 and 2018 were exceptionally low (<1 parr/100 m^2). There was a slight increase in 2019, but the abundance of 0+ parr is still very low compared to in preceding years (average density of 61 0+ salmon in 2014–2016; Table 3.1.3.1). Notably, the collapsed parr density in 2017 followed after a year with many dead salmon observed in the river, combined with a high expected level of M74-mortality. The very low parr densities in **Vindelälven** (2016–2019) and **Ljungan** (2017–2019) are expected to result in drastically reduced smolt production levels from 2019 and onwards. Effects of the reduced parr densities are expected to affect the estimated pre-fishery abundance of salmon from these two rivers from 2021 and onwards. Because of the alarming situation for the two rivers, local fishing restrictions, aimed at protecting ascending spawners in the river mouth area and during upstream migration, were enforced in 2019 and those restrictions will continue in 2020.

Two more rivers, **Öreälven** and **Lögdeälven**, showed very low levels of 0+ parr densities in 2018 (Table 3.1.2.1) and concern was raised that also these rivers may suffer from elevated levels of mortality among spawners and fry due to health problems. However, parr densities in 2019 increased to high levels in both rivers (in Lögdeälven the highest observed 0+ parr density in the time-series), indicating that the drop in parr abundance in 2018 was more likely a result of the extraordinary warm summer that year.

Testeboån was included in the FLHM for the first time last year. As described in ICES (2019), the PSPC posterior was heavily updated downwards, resulting in a seemingly too high status of this wild salmon river. Most likely, the results mirror a bias which may be overcome by inclusion of spawner count data from the river. This year, the FLHM was not updated with most recent data, which means that no updates of current stock status can be provided. Thus, the biased status for Testeboån is still present in stock projections presented in this report because the projections use results from last year's FLHM as a starting point of scenarios. The plan for 2021 is to include available spawner count data from Testeboån in the FLHM. Until then, status evaluations regarding Testeboån must be viewed with caution.

In last year's assessment, observations on spawner counts in **Piteälven** were used directly in the FLHM instead of using them to produce smolt production priors as earlier. The reason for this change was to avoid making assumptions about stock–recruitment parameters outside the model when converting from spawners to smolts. As a consequence of this change, estimates of spawner and smolt abundances as well as stock–recruit parameters were significantly updated (higher stock–recruit steepness, lower PSPC), resulting in changes in status evaluation as compared to the previous year's assessment. Based on fragmented additional data currently not used in the model, there is a concern that the updated status for Piteälven is biased upwards and should therefore be viewed with caution. The working group plan to evaluate the way Piteälven is handled in the FLHM and explore modelling options.

4.8 Conclusions

This year, the FLHM was not updated with the most recent data from 2019. Instead, projections use results from last year's FLHM as a starting point of scenarios. This procedure was justified because no notable disagreement in stock development was observed when comparing the last year's FLHM based scenarios (including data to 2018) and results from the river models which include also data from 2019 (Section 4.4). Moreover, the 2019 situation in fisheries could be incorporated in the scenarios, and it was therefore concluded that catch options for 2021 can be provided and their effects on later stock development evaluated without updating the FLHM.

For most rivers included in the FLHM (i.e. AU 1–4), the smolt production is expected to stay at relatively high levels in the coming years. Also, the pre-fishery abundance is expected to remain relatively unchanged in the near future, indicating possibilities for maintained exploitation levels during 2021. Results from the stock projections indicate that the current exploitation rate will result in either a maintained or positive trend in status for almost all AU 1–4 stocks (Section 4.6.1). However, there are a few exceptions. In particular, **Vindelälven** shows a clear negative trend because of disease problems (see below) under all fishing scenarios, also under the scenario with zero fishing. Also, **Ljungan** has been heavily affected by health problems in recent years which most likely will have negative effects on the development of this stock in the near future.

Projections indicate that changes in sea fishery removal of +/-20% have rather small effects on the expected status development of AU 1–4 stocks, further indicating that fishing mortality is currently at a fairly low level in comparison to other (natural) sources of mortality affecting the stock development. Obviously, probabilities to reach the smolt production targets are higher for scenarios with lower exploitation, but differences between scenarios are small except for the ones with a drastically reduced (‘zero fishing’, ‘recreational fishery only’ or ‘commercial fishery only’) or increased (‘100% increase to previous advice’) fishing.

Wild stocks in AU 6 have also shown a positive development in recent years, indicating that current exploitation level allows successive recovery of these stocks. There are, however, concerns for the development of several wild salmon stocks in almost all AUs. In particular, the majority of the AU 5 stocks have not responded positively to previous reductions in fisheries exploitation. These stocks are exploited in the Main Basin by offshore commercial and recreational fisheries and in rivers by angling. Many AU 5 stocks show a negative development in recent years and are far below a good state, indicating that current exploitation and natural mortality rates (at sea and/or in freshwater) do not allow for a recovery of these stocks (ICES, 2020). As detailed in Section 3, several environmental factors acting during the freshwater phase are also believed to affect development of these salmon stocks negatively.

Within the current management of Baltic salmon, there are no ‘rules’ or guidelines for how fast (within which time frames) weak salmon stocks should recover, or when a certain proportion of all stocks should have obtained their management goal. Therefore, under current conditions with only TAC regulated sea fisheries and many stocks with varying status, any catch advice for the mixed-stock fishery on Baltic salmon will be associated with some degree of subjective consideration of trade-offs. For some weak stocks, additional measures (on top of restrictions through the TAC system) also need to be implemented to increase number of spawners, for example by reducing fisheries on mixed-stocks in the Main Basin (to reduce the exploitation of weak AU 5 stocks) and on the spawning migration routes of weak stocks in areas where their share in catches becomes higher. Measures focused on the freshwater environment, such as work to improve river habitats and migration possibilities, and actions to reduce potential poaching, are also necessary because these problems appear to be larger among the southern than among the northern stocks. Thus, special actions directed to the weakest stocks which are not only fishery-related ones are likely required at any advised TAC level, especially in AU 5 but also for a few weak rivers in other AUs, to enable these stocks to recover.

M74-mortality was relatively high in 2016–2018, but new information show that the mortality decreased substantially in 2019 and the prognosis for 2020 is that the mortality will continue to decrease to the same low level as in 2011–2015 (see Section 3.4.1). Effects of the disease problems observed among spawers in recent years are difficult to predict (Section 4.7). If the health related problems should prevail or increase further this may result in decreased status, particularly among weaker stocks, as well as reduced fishing possibilities, and may easily counteract any positive effects of e.g. good post-smolt survival. The two Swedish rivers **Vindelälven** and **Ljungan** have been particularly affected by disease problems, and the recruitment of parr has collapsed (see Section 4.7). Increased number of MSW spawners in Vindelälven in 2019 is a positive sign, but its effect on recruitment difficult to evaluate until information about realized reproductive success among these spawners becomes available in autumn 2020. More restrictive regulations of fisheries were enforced locally in 2019 in both Vindelälven and Ljungan, to reduce exploitation rates on migrating spawners in these two rivers and in coastal areas outside the river mouths. These restrictive regulations will continue also in 2020. National and local management organizations of these two rivers should carefully monitor the development of the stocks and the effects of introduced regulations, and if necessary consider additional measures in the near future to increase number of spawners. Substantial disease problems (disease-affected and dead adults) have also been reported in **Mörrumsån** in recent years, but so far, the parr densities have not decreased as dramatically as in the two rivers described above.

Based on FLHM results from last year, several of the northern stocks are assessed to be close to or above the MSY-level, and the surplus produced by these stronger stocks could in theory be directed towards stock-specific fisheries. However, the current management system, with a single TAC for SD 22–31 that is set at a relatively low level (from a historical perspective) to safeguard weaker salmon stocks, prevents this surplus to be fully utilised by the commercial sea fishery. In a similar way, the surplus of reared salmon cannot be fully utilised today because reared salmon is also included in the same TAC with wild salmon.

Baltic salmon fisheries management could be developed to become more "stock-specific", by implementing more flexible systems for regulation of commercial fisheries with the aim of steering exploitation towards harvesting of reared salmon and stronger wild stocks. This could be done by implementing e.g. area-specific quotas and/or exclusion of certain single-stock fisheries from the quota system (such as fisheries in estuaries of rivers with reared stocks). In contrast, the increasing recreational trolling in Main Basin is a true mixed-stock fishery where stock-specific harvesting is not possible. Regulations that only allow landing of fin-clipped (reared) salmon, such as has been implemented in Sweden since 2013, may reduce fishing mortality of wild stocks by trolling if the post-release mortality is relatively low. A higher degree of stock-specific exploitation will also be necessary in the future, if different management objectives should be decided upon for individual stocks (e.g. to allow for a larger number of spawners than needed to fulfil the MSY-level in certain wild rivers). In a recent request from the European Commission, ICES was asked to evaluate parts of a new multi annual management plan draft for Baltic salmon. A response to the request, where alternative management systems and objectives are evaluated and discussed, can be found in ICES (2020).

4.9 Needs for improving the use and collection of data for assessment

Because requirements for data will always exceed available resources, preferences must be given. The identification and prioritisation of new data collection is of importance with respect to the European data collection framework (EU-MAP). Modifications to ongoing monitoring work should be based on end-user needs, particularly those related to ICES assessment.

Over the years, WGBAST has repeatedly highlighted and discussed various needs for data collection (e.g. ICES, 2014; 2015; 2016). For example, the need for genetic analysis to study stock composition in catch samples (MSA) has been reviewed (ICES, 2015), with suggestions provided regarding future studies. Comments have also been given to a comprehensive list of proposals for Baltic salmon data collection produced at an earlier ICES workshop in 2012 (ICES, 2016). Further, the need for at least one wild index river per assessment unit has been highlighted, with suggestions given on potential candidates in AUs 5–6. As a part of the last benchmark for Baltic salmon (WKBALTSalmon, ICES, 2017c) all different types of information needed as input for the Baltic salmon stock assessment (fisheries statistics, biological data, etc.) were reviewed with respect to needs, availability and quality. Data issues and questions listed in that benchmark report are rather extensive and prioritizations will thus be needed before decisions on data collection included in EU-MAP.

In brief, WKBALTSalmon highlighted the below data needs and development areas. WGBAST encourage Member States to include these elements into their national data collection programmes.

River data

Biological monitoring

- Expansion of networks for electrofishing sites, to cover also recently populated river stretches;
- Updates of size estimates for river-specific reproduction areas using standardised methodology;
- Inventories of habitat quality, particularly in 'weak' salmon rivers (i.e. those with low stock status);
- Compilation of stocking data on young life stages combined with information that enables estimation of survival for these releases until the smolt stage;
- Counting data of ascending spawners from additional rivers. Guidelines to assure comparability of such data should also be compiled. In rivers where counting is ongoing but data are yet not used in the assessment, additional information may be needed (e.g. from tagging studies).

River fisheries

- The amount and quality of catch statistics varies considerably between rivers and countries. There is a general need for improvement and harmonisation of methods used for data collection, including estimates of unreporting;
- River-specific salmon catches should be included in InterCatch (ICES database);
- Available effort data from river fisheries should be evaluated.

Sea fisheries data

- Misreporting of salmon as sea trout in the Polish fisheries may still be underestimated. For the Polish coastal fishery, no misreporting is accounted although it potentially may occur in significant amounts there too. Poland should provide representative data (covering all main gears) on proportions of sea trout and salmon in coastal catches to the working group to facilitate estimation of misreporting;
- Recreational trolling open sea catches have been estimated to be higher than previously recognised. Initiated work to improve methods and estimates should continue. Time-series of country specific catch estimates by three main fishing areas should be added into InterCatch;
- Also, estimates of other recreational salmon sea catches (i.e. from coastal fishing in Sweden and Finland) should be added into InterCatch;
- Unreporting of catches is challenging to estimate, and it is possible that higher than currently estimated unreporting takes place in some countries and fisheries. An expert elicitation covering all relevant fisheries is needed in order to update unreporting estimates. Also, discards (undersized and seal-damaged catch) may be substantially underestimated and studies on these (including post-release mortality following release of undersized salmon) are needed;
- Shortcomings in currently available fisheries data may cause bias in mortality estimates (F and M). At present, the possible magnitude of such bias, and consequently its potential impact on conclusions regarding stock status and catch advice, has not been evaluated. The present assessment model is assumed to estimate the magnitude of total mortality reasonably reliably. However, an exercise exploring extra uncertainties emerging from data deficiencies, currently not accounted for, and how these may influence the catch advices (both qualitatively and quantitatively) should be carried out.

Table 4.3.1. Estimates of wild smolt production (*1000) in Baltic salmon rivers updated with 2019 data. The estimates are based either on the river model (northern model for AU1–3 and southern model for AU3–4 rivers) or other methods considered appropriate by experts of these rivers (AU 5–6 rivers). For rivers in AU1–4, median values and the associated 90% probability intervals (PI) are presented. For most of the other rivers no measure of uncertainty is available. In earlier years, when full assessment was carried out, these time-series from AU1–4 rivers were used as input in the Full Life-History Model (see Section 4.2 and Stock Annex).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Method of estimation
Assessment unit 1																							
1 Tornionjoki	865	635	648	681	681	733	805	1130	1298	1430	1614	1688	1599	1442	1480	1786	1929	1872	1604	1460	1587	1526	1,2
90% PI	688-1090	535-750	513-823	541-862	546-840	570-952	624-1026	907-1422	1060-1591	1166-1743	1340-1950	1387-2048	1277-2001	1167-1781	1209-1818	1491-2139	1573-2354	1434-2493	1301-2008	1175-1819	1217-2166	917-2863	
2 Simojoki	46	49	48	32	22	32	28	40	23	31	37	27	37	39	33	30	34	45	33	63	59	50	1,2
90% PI	30-71	31-74	31-76	20-50	14-31	20-48	20-36	27-58	15-34	21-45	30-45	17-41	31-43	29-50	16-61	26-33	18-63	35-58	24-44	35-108	30-117	17-128	
3 Kalixälven	386	358	303	411	591	518	733	522	674	579	621	787	686	777	693	725	734	563	573	501	599	442	1
90% PI	122-1109	114-1024	95-865	127-1232	180-1826	166-1484	236-2147	170-1481	218-1939	188-1643	202-1761	249-2361	226-1946	254-2208	227-1981	238-2062	242-2076	184-1607	186-1622	160-1444	188-1818	115-1617	
4 Råneälven	27	22	15	21	36	34	40	45	40	49	60	51	49	50	55	65	77	70	52	44	60	70	1
90% PI	6-86	4-74	2-53	4-73	8-115	7-113	10-122	12-135	10-123	13-145	16-180	13-155	13-147	13-148	15-162	19-190	23-225	19-213	13-163	11-131	16-192	14-296	
Total assessment unit 1	**1352**	**1079**	**1037**	**1169**	**1349**	**1347**	**1633**	**1776**	**2069**	**2124**	**2375**	**2597**	**2418**	**2345**	**2305**	**2650**	**2832**	**2627**	**2315**	**2117**	**2386**	**2244**	
90% PI	**997-2105**	**798-1760**	**759-1620**	**823-2011**	**894-2599**	**920-2332**	**1072-3065**	**1309-2772**	**1509-3355**	**1605-3239**	**1813-3566**	**1919-4211**	**1791-3737**	**1700-3811**	**1708-3635**	**2018-4035**	**2146-4222**	**1943-3839**	**1752-3443**	**1608-3111**	**1739-3722**	**1385-4140**	
Assessment unit 2																							
5 Piteälven	34	26	16	18	20	19	24	23	23	24	20	22	25	26	26	27	25	27	26	26	25	26	5
90% PI	22-47	19-35	11-22	12-24	13-27	12-26	18-31	16-31	16-32	16-34	14-28	14-31	17-34	18-36	18-35	18-39	17-36	17-39	16-39	16-40	17-37	17-39	
6 Åbyälven	14	10	6	6	4	3	11	18	14	11	13	16	20	21	19	22	25	28	31	28	28	18	1
90% PI	2-50	1-38	0-26	0-26	0-21	0-18	1-45	3-62	2-50	1-40	2-48	3-56	4-67	4-69	4-63	4-75	5-81	6-93	7-99	6-88	6-92	2-75	
7 Byskeälven	90	73	64	64	90	103	136	113	101	108	120	132	114	139	119	153	171	195	201	173	231	144	1
90% PI	27-265	21-216	18-189	17-192	25-283	32-290	42-403	36-320	31-290	33-315	36-356	41-384	35-325	44-405	37-335	47-449	55-490	64-556	67-562	57-483	71-727	36-496	
Kågeälven								14	13	9	6	6	9	15	15	23	21	19	20	15	14	10	1
90% PI								1-57	1-54	1-42	0-31	0-29	1-40	2-62	2-62	4-87	3-79	3-77	3-78	2-60	1-60	0-53	
8 Rickleån	0.9	1.0	1.2	0.8	0.8	0.4	1.0	0.7	0.6	0.5	1.1	1.1	1.1	2.2	1.0	4.0	5.0	4.2	4.5	2.6	3.4	2.9	1,2
90% PI	0-8	0-9	0-10	0-8	0-8	0-5	0-8	0-7	0-6	0-6	0-9	0-9	0-8	1-2	0-8	3-5	3-7	0-20	0-20	0-15	0-20	0-23	
9 Sävarån	1.4	1.6	2.0	2.1	3.8	3.0	3.2	4.7	2.6	2.2	2.0	3.7	4.0	5.8	7.0	9.0	12.7	14.8	14.4	12.7	9.0	6.1	1,2
90% PI	0-8	0-9	0-10	0-10	3-4	2-3	2-4	3-6	1-5	1-3	1-3	0-14	2-6	1-19	1-22	2-26	4-34	4-38	4-37	3-34	2-27	1-23	
10 Ume/Vindelälven	171	139	141	118	171	169	138	125	142	156	186	274	229	164	167	214	223	142	73	35	24	44	1,2
90% PI	75-372	64-292	68-289	52-231	90-305	90-299	73-247	65-223	79-238	116-207	150-228	209-357	167-312	133-200	138-202	131-335	170-290	96-204	29-156	13-80	6-65	10-227	
11 Öreälven	1.6	2.0	2.8	4.2	3.7	4.0	5.4	4.9	4.6	4.6	7.0	6.5	6.5	5.6	5.4	8.6	15.1	16.5	15.8	8.5	11.3	8.9	1
90% PI	0-15	0-19	0-23	0-27	0-25	0-26	0-31	0-30	0-28	0-26	0-35	0-33	0-33	0-31	0-30	0-45	1-70	2-71	2-65	0-42	1-62	0-60	
12 Lögdeälven	3.4	2.9	2.4	2.6	3.3	4.3	5.0	4.8	4.3	4.7	5.2	6.4	7.2	6.7	7.8	6.0	13.4	15.7	14.6	11.3	13.6	12.9	1,2
90% PI	0-15	0-14	0-12	0-12	0-14	0-17	0-18	0-18	0-17	0-18	1-19	1-22	1-23	1-23	1-25	4-8	3-37	4-43	3-41	2-34	3-39	2-44	
Total assessment unit 2	**345**	**281**	**259**	**237**	**321**	**328**	**349**	**318**	**315**	**327**	**370**	**486**	**429**	**387**	**369**	**470**	**517**	**473**	**414**	**323**	**376**	**316**	
90% PI	**195-623**	**161-499**	**150-460**	**133-415**	**189-556**	**197-558**	**209-637**	**192-552**	**196-529**	**222-548**	**261-622**	**349-754**	**303-666**	**266-671**	**262-607**	**302-802**	**357-862**	**298-864**	**231-810**	**171-662**	**182-905**	**148-777**	
Assessment unit 3																							
13 Ljungan	1.4	0.9	0.5	0.4	0.5	0.4	1.0	0.8	0.2	0.5	0.4	0.3	0.5	0.9	0.5	1.6	3.1	1.7	0.3	0.0	0.0	0.1	1
90% PI	0-12	0-9	0-5	0-5	0-5	0-4	0-11	0-8	0-4	0-7	0-8	0-7	0-8	0-11	0-7	0-15	0-20	0-12	0-4	0-0	0-1	0-3	
14 Testeboån	0.9	1.1	1.4	1.6	2.0	2.6	2.8	3.1	0.8	1.4	1.8	2.2	2.8	3.2	1.9	1.9	2.9	3.2	2.1	1.3			1
90% PI	0-9	0-10	0-13	0-13	0-19	0-18	0-14	0-13	0-6	0-7	0-8	0-10	0-11	1-5	1-3	1-2	2-4	0-13	0-9	0-7			
Total assessment unit 3	**2.7**	**2.5**	**2.2**	**2.4**	**2.9**	**3.4**	**5.1**	**5.0**	**1.4**	**2.6**	**3.0**	**3.3**	**4.2**	**4.4**	**2.6**	**3.8**	**6.4**	**6.2**	**3.0**	**1.4**			1
90% PI	**0-26**	**0-25**	**0-25**	**0-24**	**0-31**	**0-30**	**0-27**	**1-22**	**0-12**	**0-17**	**0-16**	**0-17**	**0-19**	**1-16**	**0-10**	**0-17**	**1-23**	**1-25**	**0-15**	**0-10**			

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Method of estimation
Assessment unit 4																							
15 Emån	1	1	2	2	2	2	1	2	3	4	3	3	4	3	4	5	6	4	1	3			1
90% PI	0-6	0-8	0-10	0-11	0-11	0-10	0-7	1-3	0-17	0-21	0-18	0-15	0-20	0-16	0-20	0-22	0-25	0-20	0-9	0-17			
16 Mörrumsån	38	34	36	38	39	44	33	28	26	25	35	19	30	49	36	44	28	27	19	35			1,2
90% PI	15-104	13-90	12-102	15-99	16-102	17-121	13-85	11-74	8-86	10-72	15-95	8-46	17-72	25-116	16-93	24-106	14-71	11-70	6-56	10-114			
Total assessment unit 4	**38**	**34**	**36**	**38**	**39**	**44**	**33**	**28**	**26**	**25**	**35**	**19**	**30**	**49**	**36**	**44**	**28**	**27**	**19**	**35**			
90% PI	**15-104**	**13-90**	**12-102**	**15-99**	**16-102**	**17-121**	**13-85**	**11-74**	**8-86**	**10-72**	**15-95**	**8-46**	**17-72**	**25-116**	**16-93**	**24-106**	**14-71**	**11-70**	**6-56**	**10-114**			
Assessment unit 5																							
17 Pärnu	0.25	0.23	0.01	0.01	0.01	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0	0			3,4
18 Salaca	29.8	24.2	21.9	3.5	26.3	25.0	11.3	25.0	18.2	11.5	2.1	4.9	9.5	5.7	17.5	37.9	9.7	18.4	5.1	17.4			2
19 Vitrupe				0.0			0.6	0.0	0.5	0.0			0.2	0.1	0.6	2.1	0.0	0.1	0.1	0.0			4
20 Peterupe							0.0		0.0	0.0		0.2	0.0	0.0	1.8	0.0	0.0	0.0	0.3	0.0			4
21 Gauja				0.0	5.0	0.8	1.9	0.4	1.1	1.0	0.2	0.2	0.2	0.1	1.5	0.9	0.1	1.6	0.9	1.3			4
22 Daugava				0.0		0.0		0.0	0.0	0.0				0.0	0.0	0.0		0.0	0.0	0.0			4
23 Irbe															0.0	0.0	0.0	0.0	0.0	0.0			4
24 Venta				0.1	8.0	7.4	0.5	0.6	1.7	1.8	0.0	0.6	2.0	1.0	2.4	5.1	0.7	1.2	0.1	0.6			4
25 Saka							0.0	0.0	0.4	0.3	0.0			0.0	0.1	0.0	0.0	0.0	0.0	0.0			4
26 Uzava									0.1	0.0				0.0	0.1		0	0.0	0.0	0.0			4
27 Barta							0.0	0.0						0.0			0.0	0.0	0.0	0.0			4
28 Nemunas river basin	5	8	4	2	6	7	5	13	42	48	7	28	14	13	36	37	40	20	32	58			3,4
Total assessment unit 5	**35**	**32**	**26**	**6**	**45**	**40**	**19**	**39**	**64**	**62**	**9**	**34**	**26**	**20**	**60**	**83**	**52**	**42**	**39**	**77**			
Assessment unit 6																							
29 Kymijoki	12	13	20	13	6	24	41	20	12	11	25	26	9	29	16	37	78	23.3	7.8	66.0	43.5		4
30 Neva	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0			
31 Luga	2.5	8.0	7.2	2.0	2.6	7.8	7.0	3.0	4.0	6.7	4.3	6.3	5.0	6.6	7.0	5.3	2	6.0	6.0	8.8			2
±SE	2.4-2.6	7.7-8.3	6.9-7.5	1.9-2.1	2.0-35	5.1-16.5	4-10	1.9-4.1	2.8-6.1	4.8-8.6	2.7-5.9	1.9-4.1	3.2-6.8	4.3-8.9	4.6-9.4	2.9-7.7	1.9-2.1	3.2-8-4	3.2-8.4				
32 Purtse								0.1	2.6	2.2	0.4	1.1	0.0	4.3	3.1	2.1	1.3	0.9	4.0	3.6			4
33 Kunda	1.2	2.3	0.8	0.6	0.1	2.2	1.9	0.9	0.1	0.1	0.2	2.1	2.0	1.0	1.3	2.1	3.7	3.0	3.1	2.5			3
34 Selja	0.3	0.0	0.0	0.1	0.9	2.1	0.2	0.1	4.0	3.9	1.1	0.8	2.7	3.1	3.4	0.6	0.5	0.0	4.8	2.2			4
35 Loobu	0.7	0.3	0.1	2.4	4.2	7.8	1.7	0.0	0.1	10.5	4.5	3.5	2.7	3.5	11.6	0.8	2.0	0.6	7.1	6.7			4
36 Pirita	0.6	0.1	0.3	2.8	0.8	3.0	1.6	2.5	5.7	8.5	1.6	1.9	5.7	5.1	3.5	10.4	1.7	11.3	3.0	2.2			2,3
±SE						2.5-3.5	1.0-2.2	2.3-2.7	5.4-6.0	6.9-10.1	1.1-2.1	1.6-2.1	4.7-6.4	4.6-5.7	3.2-3.8	10-10.8	1.3-2.2	10.6-12	2.8-3.1				
37 Vasalemma	0.3	0.2	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.1	0.3	0.7	0.2	0.6	0.7	1.1	0 .1	0.7	1.5	1.0			4
38 Keila	1.3	0.4	0.1	0.0	0.0	0.7	2.0	0.7	1.1	6.3	3.0	6.0	1.0	8.3	12.0	4.4	6.3	6.6	10	5.7			4
39 Valgejõgi	0.1	0.1	0.0	0.0	0.4	0.3	0.3	0.7	0.5	0.6	0.8	0.4	0.1	0.4	0.5	0.7	0.2	0.4	0.4	0.4			4
40 Jägala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0			4
41 Vääna	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.6	0.2	0.1	0.0	0.2	0.3	0.2	0	0	0	0			4
Total assessment unit 6	**25**	**30**	**34**	**21**	**15**	**48**	**56**	**28**	**30**	**51**	**41**	**49**	**28**	**62**	**59**	**65**	**96**	**53**	**48**	**99**			

*) Electrofishing data from 2016 is not used at all in the R. Tornionjoki, which effectively prevents prediction of 2019 smolt production in this river (see Section 3.1.1 for details)

Method of estimation of current smolt production

1. Bayesian linear regression model, i.e. river model (separate models for northern and for southern rivers, see Stock Annex)
2. Sampling of smolts and estimate of total smolt run size.
3. Estimate of smolt run from parr production by relation developed in the same river.
4. Estimate of smolt run from parr production by relation developed in another river.
5. Results of 2019 run of Full Life History Model (FLHM).

Table 4.3.2. Median values and coefficients of variation of the estimated M74 mortality for different Atlantic salmon stocks (spawning years 1985–2018). The values in bold are based on observation data from hatchery or laboratory monitoring in the river and year concerned. Grey cells represent predictive estimates for years from which no monitoring data were available.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Simojoki	**9**	**3**	**5**	**3**	**11**	**4**	**43**	**64**	**50**	**64**	**52**	**54**	**8**	**44**	**25**	**27**	**23**
cv	0.61	0.87	0.63	0.96	0.51	0.72	0.17	0.14	0.17	0.10	0.16	0.14	0.30	0.11	0.21	0.23	0.22
Tornionjoki	11	9	**10**	**7**	**13**	**13**	**44**	**62**	**75**	**53**	**41**	**23**	**7**	**43**	**20**	**25**	**34**
cv	0.76	0.83	0.77	0.93	0.71	0.71	0.31	0.24	0.07	0.10	0.31	0.46	0.44	0.18	0.22	0.22	0.24
Kemijoki	11	9	10	7	12	13	43	61	60	42	42	24	4	31	18	19	23
cv	0.77	0.83	0.76	0.91	0.71	0.70	0.31	0.24	0.22	0.29	0.31	0.47	0.89	0.40	0.52	0.49	0.44
Iijoki	11	9	10	7	13	13	44	62	59	44	42	24	4	31	18	19	23
cv	0.76	0.81	0.79	0.88	0.71	0.70	0.31	0.24	0.22	0.29	0.31	0.47	0.85	0.40	0.52	0.51	0.44
Luleälven	11	9	10	7	12	13	**46**	**56**	**54**	**38**	**35**	**29**	**2**	**27**	**14**	**21**	**25**
cv	0.77	0.82	0.76	0.90	0.71	0.71	0.13	0.16	0.07	0.13	0.19	0.16	0.35	0.12	0.18	0.15	0.20
Skellefteälven	11	9	10	7	13	13	**35**	**44**	**60**	**37**	**51**	**14**	**2**	**33**	**9**	**13**	**14**
cv	0.76	0.85	0.78	0.93	0.71	0.69	0.20	0.18	0.10	0.17	0.20	0.31	0.62	0.18	0.33	0.29	0.32
Ume/Vindelälven	**16**	**18**	**14**	**11**	**24**	**28**	**60**	**73**	**77**	**51**	**52**	**27**	**6**	**41**	**28**	**26**	**24**
cv	0.24	0.31	0.27	0.44	0.25	0.39	0.14	0.16	0.07	0.13	0.19	0.21	0.44	0.15	0.20	0.19	0.26
Ångermanälven	11	9	10	7	13	13	**40**	**65**	**57**	**35**	**42**	**16**	**2**	**23**	**14**	**18**	**29**
cv	0.74	0.80	0.75	0.89	0.69	0.73	0.14	0.16	0.10	0.16	0.21	0.20	0.55	0.18	0.21	0.19	0.21
Indalsälven	**6**	**6**	**6**	**3**	**7**	**5**	**36**	**62**	**62**	**31**	**44**	**17**	**1**	**17**	**14**	**6**	**14**
cv	0.22	0.30	0.27	0.44	0.28	0.45	0.14	0.16	0.08	0.15	0.20	0.20	0.67	0.19	0.22	0.33	0.25
Ljungan	11	9	11	7	12	13	**48**	**69**	**50**	**42**	**25**	**22**	**4**	**24**	**12**	**10**	**29**
cv	0.75	0.81	0.76	0.92	0.71	0.73	0.19	0.20	0.19	0.19	0.30	0.33	0.62	0.29	0.47	0.56	0.30
Ljusnan	2	1	1	1	1	**11**	**28**	**63**	**56**	**42**	**48**	**16**	**3**	**33**	**17**	**31**	**24**
cv	0.82	0.89	0.84	1.04	0.79	0.44	0.18	0.16	0.09	0.14	0.20	0.21	0.45	0.18	0.21	0.16	0.24
Dalälven	**8**	**7**	**16**	**8**	**8**	**14**	**61**	**72**	**49**	**41**	**39**	**28**	**6**	**27**	**18**	**23**	**23**
cv	0.42	0.39	0.25	0.42	0.44	0.42	0.14	0.16	0.10	0.18	0.20	0.17	0.39	0.17	0.20	0.19	0.22
Mörrumsån	**36**	**43**	**33**	**40**	**52**	**38**	**44**	**74**	**63**	**46**	**39**	**19**	4	31	18	19	23
cv	0.17	0.25	0.20	0.28	0.20	0.39	0.16	0.16	0.17	0.18	0.25	0.33	0.87	0.40	0.52	0.50	0.44
Unsampled stock	11	9	11	7	12	13	44	62	59	43	42	24	4	31	17	19	24
cv	0.76	0.83	0.76	0.87	0.74	0.70	0.31	0.24	0.23	0.29	0.30	0.46	0.89	0.39	0.53	0.50	0.44

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Simojoki	**1**	**1**	**2**	**4**	**13**	**7**	**6**	**4**	**2**	**0**	**1**	**1**	**0**	**4**	**8**	**4**	**1**
cv	0.60	0.61	0.92	0.48	0.29	0.48	0.47	0.63	0.70	2.02	1.38	1.16	1.54	0.68	0.33	0.42	1.19
Tornionjoki	**0**	**0**	2	**5**	**6**	**7**	**3**	**7**	**4**	**0**	**0**	**3**	**1**	**10**	**12**	**3**	**1**
cv	1.05	1.46	1.33	0.50	0.48	0.63	0.63	0.48	1.00	1.95	1.48	1.12	1.38	0.74	0.62	0.36	0.61
Kemijoki	1	1	2	**10**	**21**	**13**	**14**	**6**	**3**	0	2	3	1	11	18	6	1
cv	1.07	1.44	1.29	0.32	0.29	0.41	0.30	0.54	0.70	2.01	1.35	1.11	1.44	0.71	0.46	0.44	0.57
Iijoki	1	1	2	5	11	8	**12**	9	4	0	2	3	1	10	**14**	**5**	**1**
cv	1.13	1.39	1.26	0.74	0.62	0.81	0.32	0.73	1.03	1.88	1.40	1.10	1.42	0.73	0.35	0.73	0.71
Luleälven	**1**	**1**	**1**	**5**	**10**	**7**	**9**	**21**	**1**	**1**	**1**	**1**	**1**	**7**	**12**	**3**	**0**
cv	0.62	0.44	0.64	0.41	0.24	0.25	0.22	0.20	0.43	0.60	0.77	0.61	0.57	0.39	0.46	0.52	1.22
Skellefteälven	**1**	**0**	**1**	**1**	**7**	**1**	**2**	**4**	**2**	**1**	**10**	**1**	**1**	**4**	**8**	**5**	**1**
cv	0.70	1.53	0.85	0.70	0.40	0.89	0.80	0.53	0.73	0.97	0.49	0.83	0.88	0.61	0.46	0.44	0.48
Ume/Vindelälven	**2**	**1**	**0**	**2**	**8**	**3**	**14**	**13**	**6**	**0**	**4**	**10**	**0**	**11**	**10**	**5**	**6**
cv	0.64	0.71	1.35	0.64	0.39	0.55	0.28	0.33	0.42	1.97	0.57	0.45	1.51	0.46	0.49	0.48	0.43
Ångermanälven	**2**	**1**	**2**	**7**	**14**	**11**	**5**	**13**	**4**	**1**	**1**	**2**	**0**	**14**	**14**	**5**	**2**
cv	0.60	0.59	0.59	0.41	0.26	0.27	0.39	0.27	0.41	1.00	0.76	0.63	1.60	0.40	0.49	0.57	0.63
Indalsälven	**1**	**0**	**2**	**5**	**8**	**12**	**3**	**7**	**3**	**0**	**0**	**2**	**1**	**9**	**12**	**5**	**1**
cv	0.71	1.52	0.59	0.42	0.30	0.24	0.42	0.30	0.40	1.87	1.47	0.55	0.66	0.40	0.62	0.75	1.19
Ljungan	**1**	1	2	5	11	8	8	9	4	0	2	3	1	10	12	5	1
cv	1.12	1.39	1.26	0.75	0.61	0.80	0.73	0.74	1.00	1.80	1.36	1.12	1.44	0.73	0.62	0.74	1.13
Ljusnan	**2**	**0**	**1**	**7**	**8**	**6**	**9**	**6**	**2**	**0**	**1**	**3**	**1**	**22**	**11**	**5**	**2**
cv	0.60	1.49	1.25	0.44	0.35	0.35	0.28	0.35	0.51	1.83	0.75	0.58	0.76	0.36	0.65	0.75	1.12
Dalälven	**2**	**1**	**4**	**5**	**9**	**5**	**13**	**11**	**2**	**0**	**1**	**7**	**4**	**19**	**12**	**5**	**1**
cv	0.59	0.52	0.46	0.43	0.29	0.34	0.21	0.25	0.43	2.09	0.67	0.44	0.54	0.36	0.63	0.73	1.18
Mörrumsån	1	1	2	5	11	7	8	9	4	0	2	4	1	10	12	5	1
cv	1.08	1.36	1.30	0.74	0.62	0.82	0.73	0.70	0.97	1.83	1.31	1.05	1.44	0.72	0.62	0.71	1.20
Unsampled stock	1	1	2	5	11	8	8	9	4	0	2	3	1	10	12	5	1
cv	1.08	1.37	1.27	0.74	0.60	0.81	0.73	0.73	0.99	1.84	1.38	1.07	1.51	0.73	0.61	0.76	1.14

Table 4.6.1. Key assumptions underlying the stock projections. The same post-smolt survival scenario and M74 scenario are assumed for all effort scenarios. Survival values represent the medians to which Mps and M74 are expected to return.

Scenario	Total commercial removal (dead catch) for year 2021
1	Removal that corresponds to ICES advice for fishing year 2020
2	20% increase to scenario 1
3	20% decrease to scenario 1
4	F0.1 approach (commercial removal)
5	zero fishing
6	recreational fishing only
7	No recreational fishing (no trolling, no river fishing). Commercial removal as in sc 1.
8	100% increase to scenario 1
	In all scenarios we assume that the commercial removal (wanted catch reported) covers 83% of the total commercial sea fishing mortality, whereas 17% of this mortality consists of discards, misreported and unreported. Recreational fisheries in 2021 are assumed to have a catch that corresponds to the average effort in these fisheries in 2017-2019 period, whereas in future years the effort component is the same for these fisheries but the catch varies according to abundance. (See text for details)

Post-smolt survival of wild salmon

Average survival between 2014-2017 (Figure 4.3.2.2)

Post-smolt survival of reared salmon

Same relative difference to wild salmon as on average in history

M74 survival

Historical median (Figure 4.3.2.2)

Releases

Same number of annual releases in the future as in 2019

Maturation

Age group specific maturation rates in 2020 are predicted using january-march 2020 SST data. For other years, average maturation rates over the time series are used, separately for wild and reared salmon. (Figure 4.3.2.3)

Ume/Vindelälven

Average proportion 2017-2019 for MSW sex ratio passing the ladder

Average proportions 2016-2018 (no. spawners passing ladder, extra mortality after ladder, these inputted to assessment 2019 full life history model)

Table 4.6.1.1. Estimates (in thousands of fish) of the total removal in the commercial fishery at sea by scenario, and the corresponding reported commercial catch in total and divided between these fisheries in 2021. Calculations about how the total catch is divided between reported commercial catch and discards/unreporting/misreporting are based on the

situation prevailed in 2019 (see text). The table shows also the predicted total number of spawners in 2021 (in thousands). All values refer to medians unless stated otherwise.

			Commercial catches (thousands of fish) at sea in SD 22-31 in 2021					
Scenario	Total commercial catch at sea	inst. F of comm. Catch	Wanted Catch Reported	(% of 2020 EU TAC)	Unwanted Catch (Dead+Alive) Undersized	Unwanted Catch (Dead+Alive) Seal damaged	Wanted Catch Unreported	Wanted Catch Misreported
1	116.0	0.08	96.6	106%	4.6	5.4	8.4	0.9
2	139.2	0.10	116.0	127%	5.5	6.5	10.1	1.1
3	92.8	0.07	77.3	85%	3.7	4.3	6.7	0.7
4	138.0	0.10	115.0	126%	5.5	6.4	10.0	1.1
5	0.0	0.00	0.0	0%	0.0	0.0	0.0	0.0
6	0.0	0.00	0.0	0%	0.0	0.0	0.0	0.0
7	116.0	0.08	96.6	106%	4.6	5.4	8.4	0.9
8	232.0	0.17	193.3	212%	9.2	10.8	16.9	1.8

Scenario	Total sea catch (comm. + recr.) 2021	inst. F of total catch at sea	Recreational catch at sea 2021	River catch 2021	Spawners 2021
1	142.7	0.10	26.7	53.9	148.6
2	165.9	0.12	26.7	50.6	140.8
3	119.5	0.09	26.7	56.9	156.5
4	164.7	0.12	26.7	50.8	141.2
5	0.0	0.00	0	0.0	249.8
6	26.7	0.02	26.7	69.5	189.7
7	116.0	0.08	0	0.0	197.1
8	258.7	0.20	26.70	37.8	107.9

Table 4.6.1.2. River-specific probabilities in different scenarios to meet 75% of PSPC in 2025/2026 (depending on the assessment unit) Probabilities higher than 70% are presented in green.

River	Year of comparison	Probability to meet 75% of PSPC — Scenario 1	2	3	4	5	6	7	8
Tornionjoki	2026	0.72	0.71	0.75	0.71	0.84	0.79	0.79	0.61
Simojoki	2026	0.48	0.45	0.51	0.45	0.72	0.60	0.62	0.31
Kalixälven	2026	0.83	0.81	0.84	0.81	0.88	0.86	0.87	0.76
Råneälven	2026	0.67	0.63	0.67	0.63	0.81	0.76	0.76	0.53
Piteälven	2026	0.87	0.84	0.85	0.84	0.88	0.87	0.88	0.82
Åbyälven	2026	0.70	0.70	0.73	0.70	0.82	0.76	0.77	0.63
Byskeälven	2026	0.76	0.79	0.81	0.79	0.85	0.81	0.82	0.73
Rickleån	2026	0.27	0.23	0.27	0.23	0.46	0.34	0.38	0.15
Sävarån	2026	0.35	0.33	0.37	0.33	0.55	0.42	0.45	0.24
Ume/Vindelälven	2026	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02
Öreälven	2026	0.30	0.26	0.29	0.26	0.47	0.37	0.39	0.19
Lögdeälven	2026	0.18	0.16	0.18	0.16	0.29	0.21	0.24	0.11
Ljungan	2026	0.47	0.43	0.46	0.43	0.60	0.52	0.55	0.36
Mörrumsån	2025	0.71	0.71	0.72	0.71	0.78	0.71	0.78	0.68
Emån	2025	0.08	0.07	0.08	0.07	0.14	0.09	0.13	0.05
Kågeälven	2026	0.52	0.51	0.54	0.51	0.68	0.59	0.63	0.43
Testeboån	2026	0.59	0.62	0.64	0.62	0.74	0.68	0.67	0.56

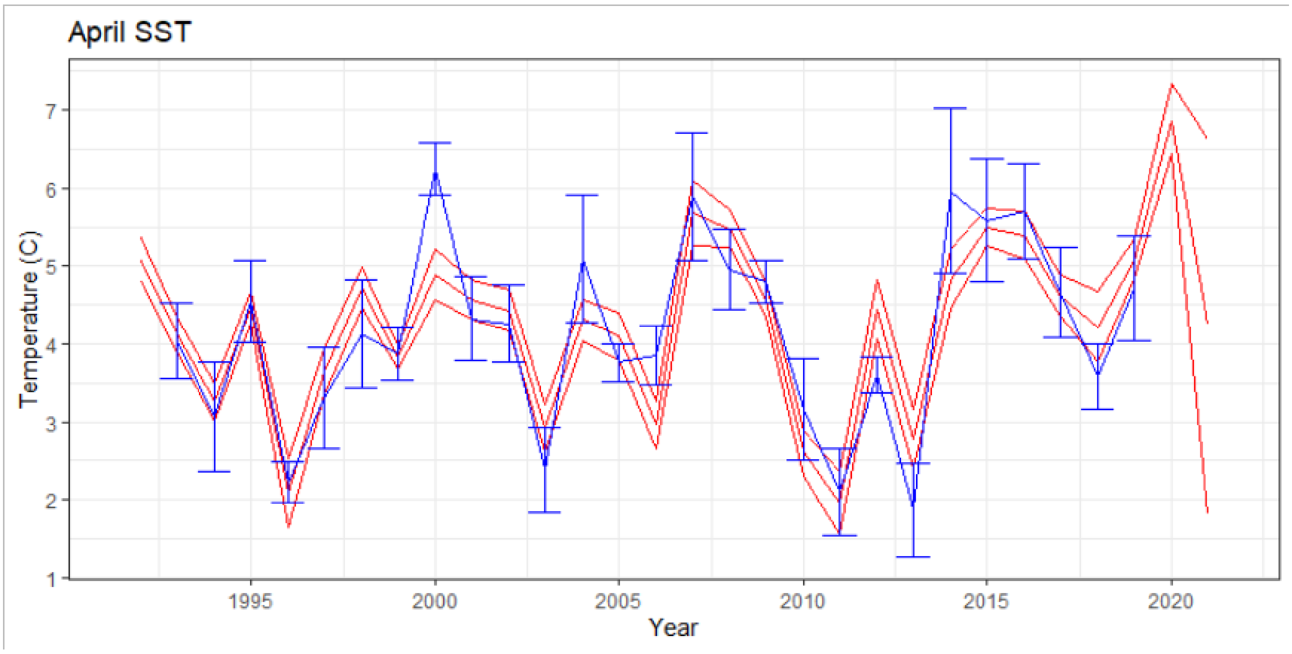


Figure 4.2.1. Estimated April sea surface temperatures (SST). Data on April SST from 8 stations is illustrated with blue bars and red lines show the estimated median and 90% probability intervals. Estimate for 2020 is based on observed January-March data, whereas 2021 estimate is predicted distribution based on the total time-series.

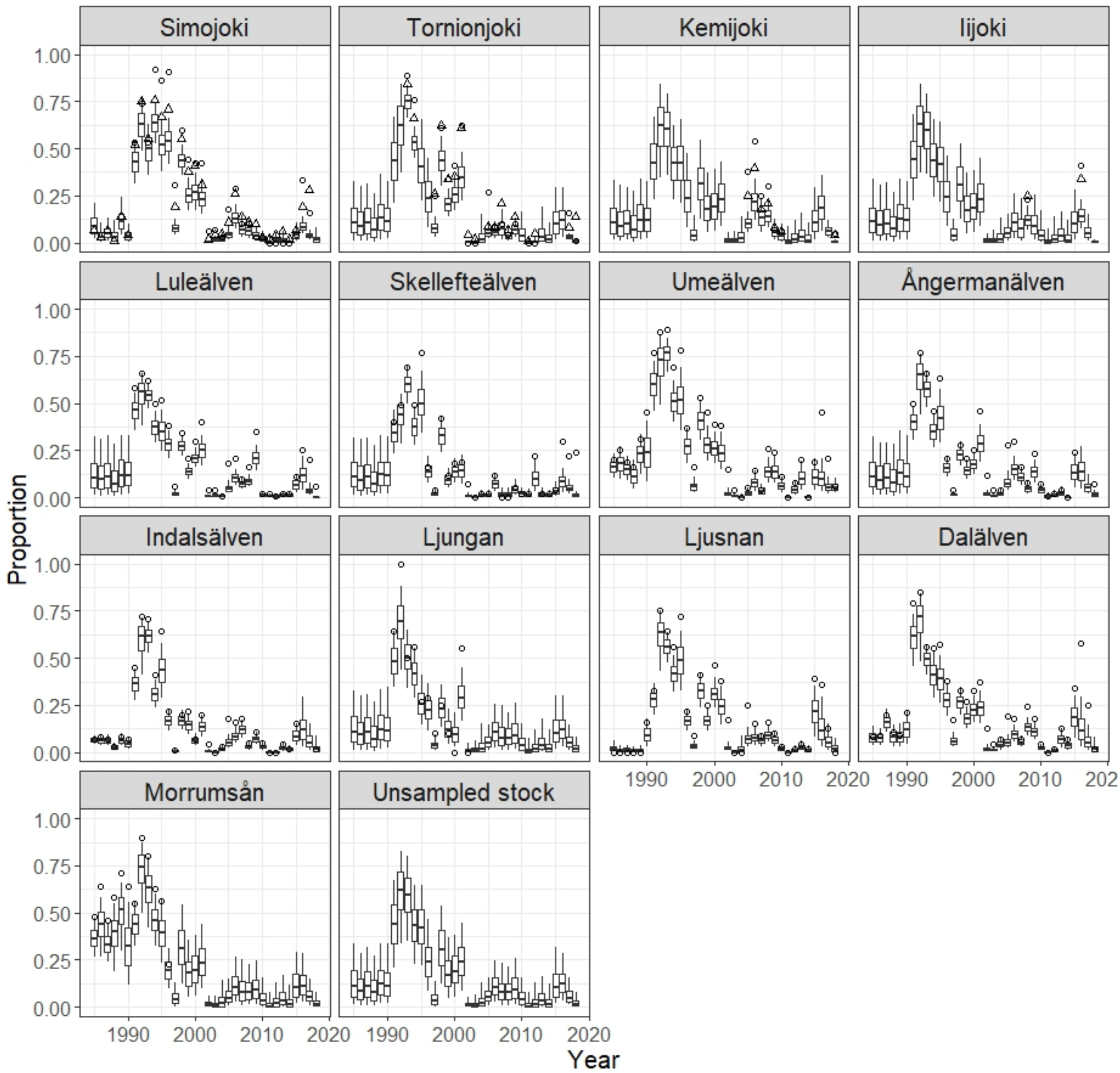


Figure 4.3.1. M74 mortality among Atlantic salmon stocks within the Baltic Sea by spawning year class in 1985–2018. Boxplots illustrate medians, 50% and 95% probability intervals of the estimated M74 mortality. Open circles illustrate the proportion of females with offspring affected by M74 and triangles the total average yolk-sac-fry mortality among offspring.

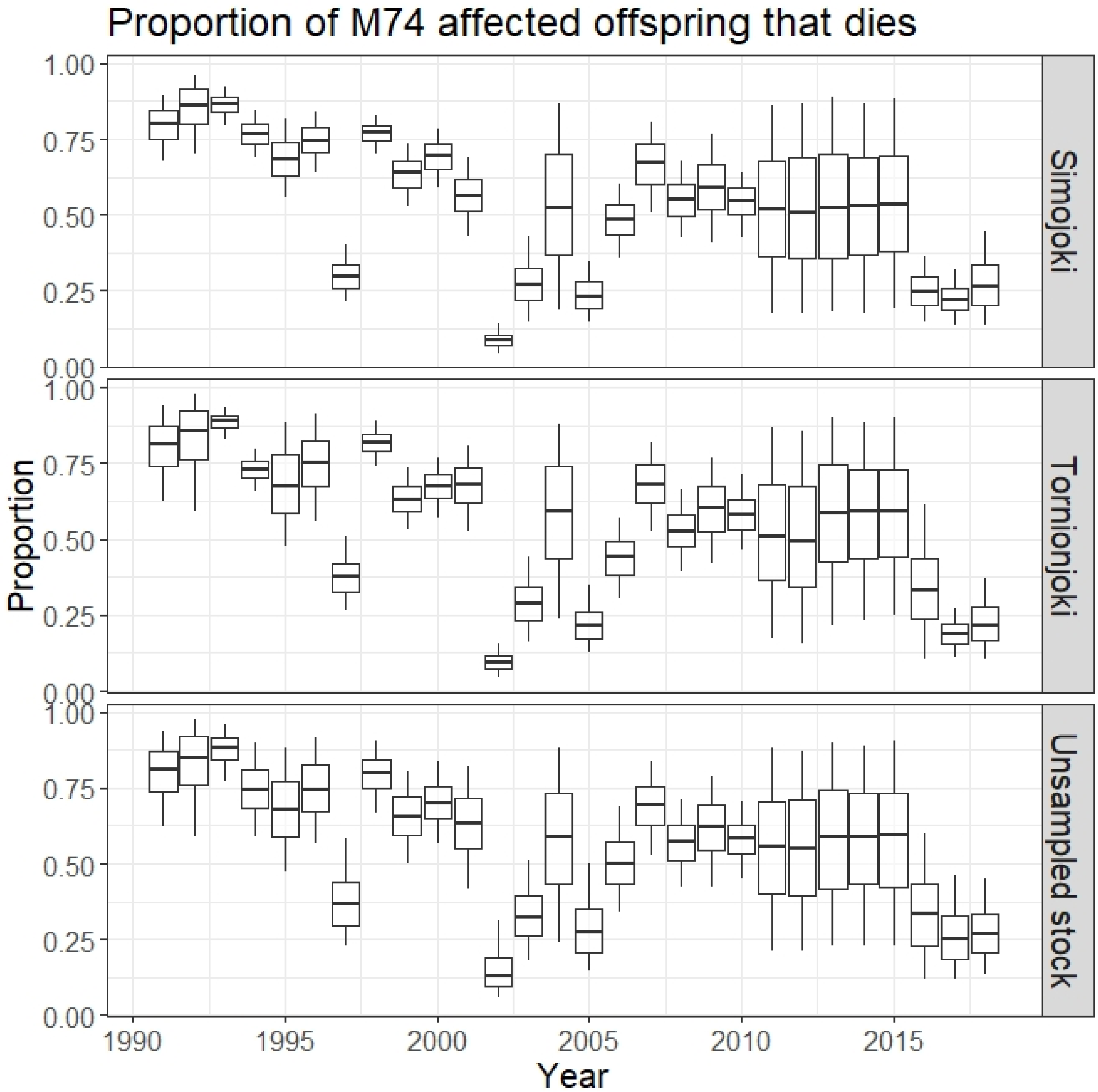


Figure 4.3.2. Estimated proportion of M74-affected offspring that die (i.e. mortality among those offspring that are from M74 affected females) by spawning year class in 1985–2018. Boxplots illustrate medians and 50% and 95% probability intervals.

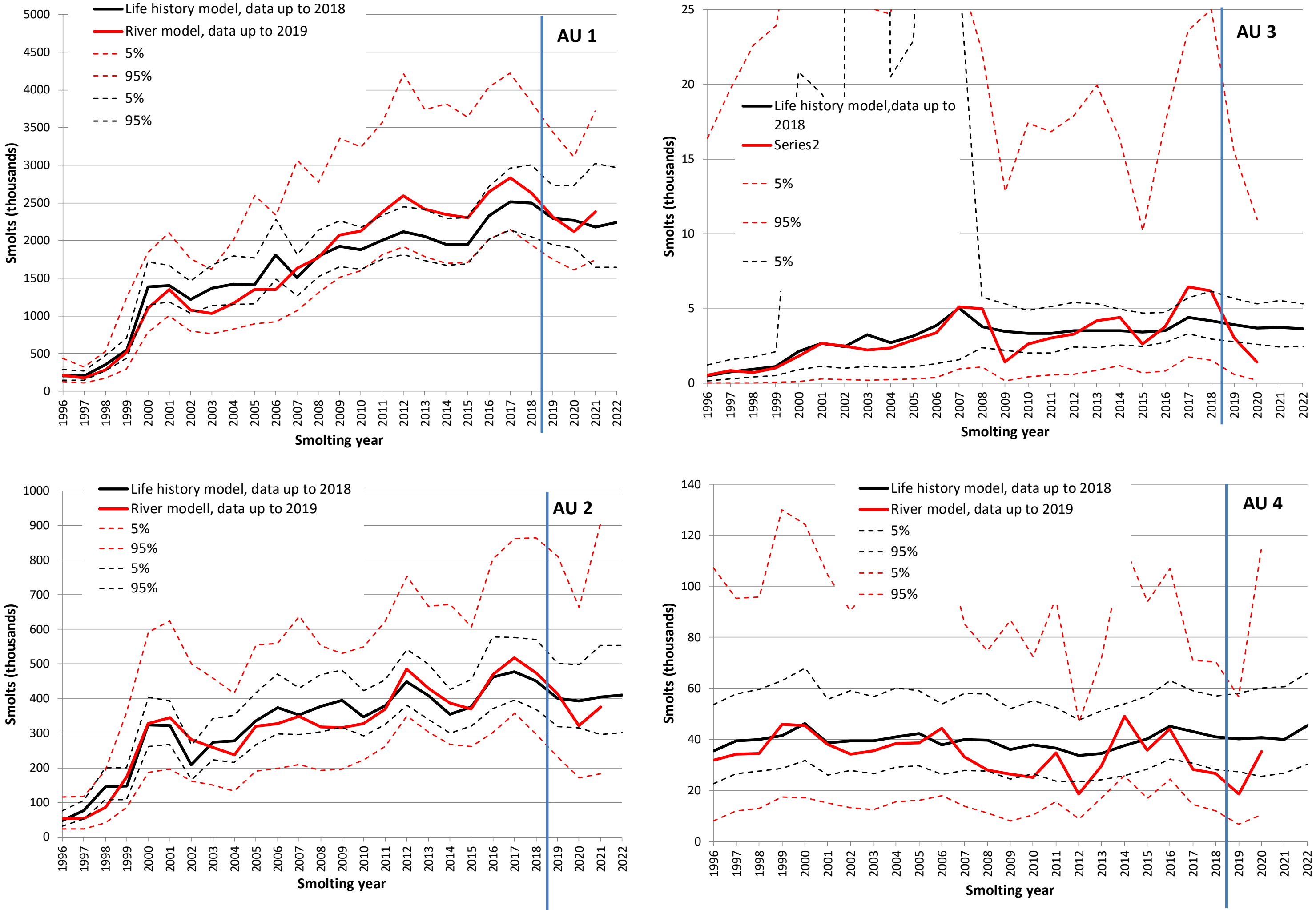


Figure 4.4.1. Development of total production of wild smolts in the AU 1-4 rivers, based on the last full assessment (FLHM, data up to 2018) and the river models updated with 2019 data (red lines, from Table 4.3.1). The blue vertical lines indicate the turning point in the time series, after which smolt abundance estimates based on the FLHM are predictions without data.

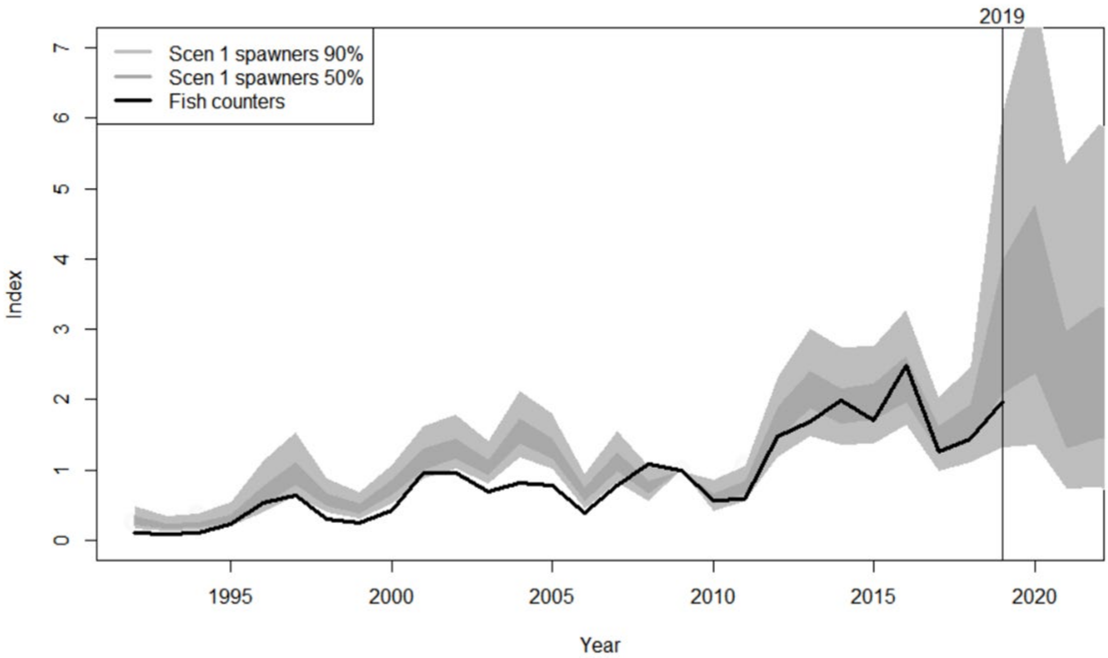
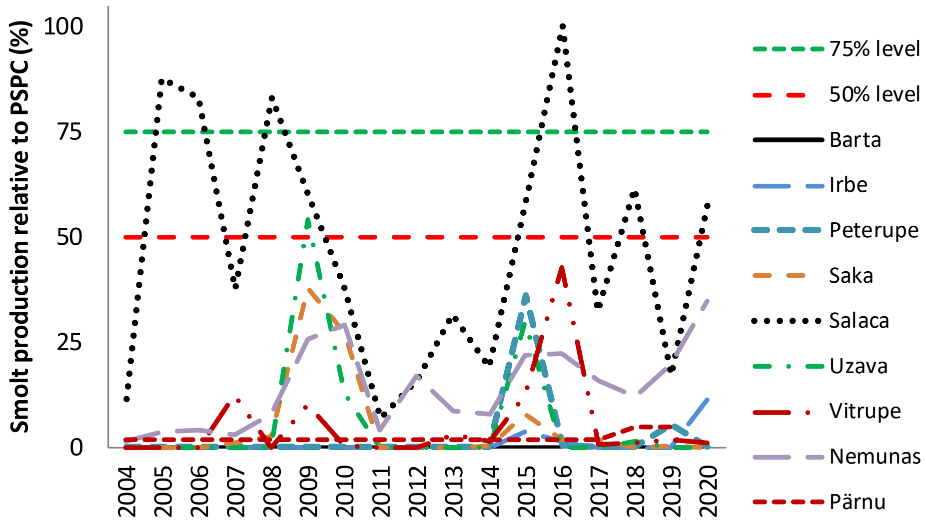


Figure 4.4.1.2. Black line: annual index showing average strength of spawning runs (data from fish counting) calculated as a relative proportion of ascending spawners in relation to 2009 in seven rivers (Tornio, Simo, Kalix, Pite, Åby, Byske and Ume/Vindel). Grey shaded areas: 50% and 90% probability limits for the corresponding index based on modelled spawner abundances in the same rivers. See text for details.

Figure 4.5.1. Wild smolt production level in relation to the potential in AU 5 wild salmon populations.



Year	
2005	77
2006	59
2007	40
2008	62
2009	44
2010	26
2011	24
2012	13
2013	17
2014	19
2015	24
2016	27
2017	24
2018	24
2019	25

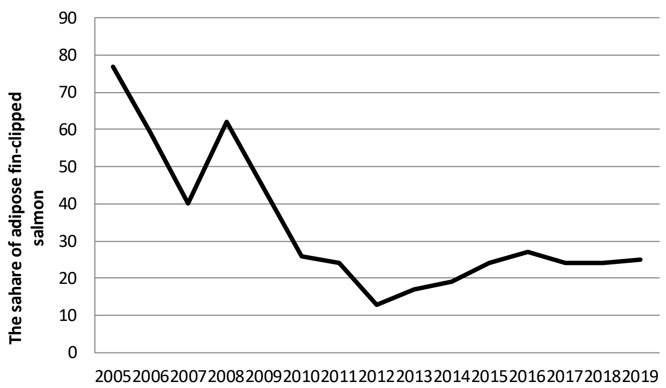


Figure 4.5.1.1 Share of adipose fin-clipped salmon caught on the southern coast of the Gulf of Finland

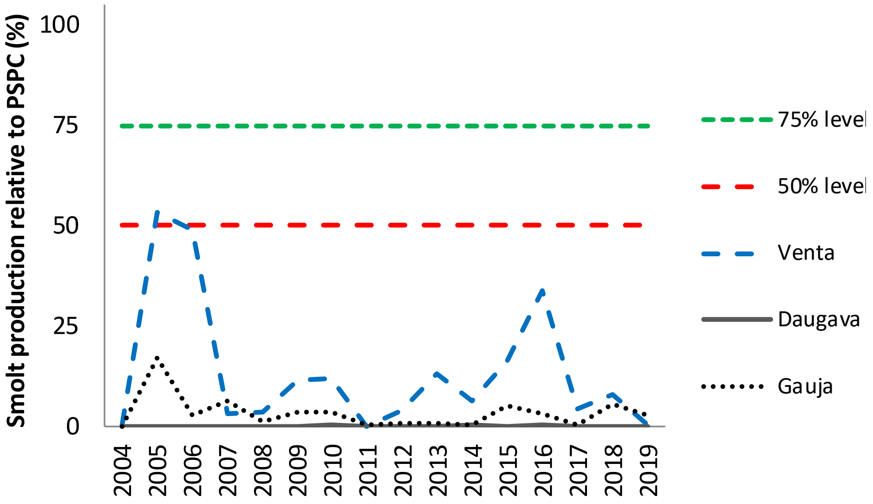


Figure 4.5.2. Wild smolt production level in relation to the potential in AU 5 mixed salmon populations.

Figure 4.5.3. Smolt production level in relation to the potential in **AU 6 wild salmon populations**. Note that the PSPC is calculated only to the accessible rearing habitat, areas above migration obstacles are excluded. In 2018 a dam was removed in r Vasalemma and the PSPC increased considerably. Therefore the actual smolt production in relation to PCPS is low despite the increase in actual smolt production from 2018 onwards.

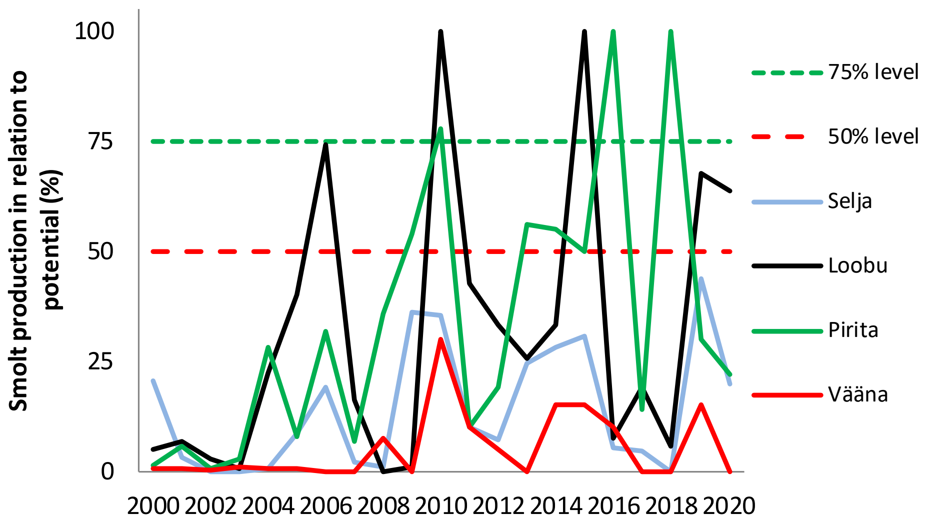


Figure 4.5.4. Smolt production level in relation to the potential in Estonian AU 6 mixed salmon populations. Note that the potential is calculated only up to the lowermost impassable migration obstacle and that many rivers have considerably higher total potential.

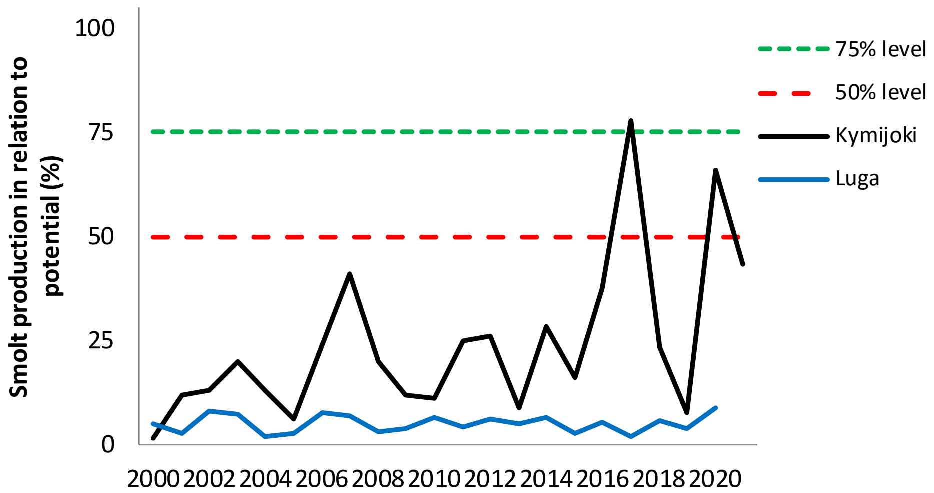


Figure 4.5.5. Wild smolt production level compared to potential in river Kymijoki (Finland) and in river Luga (Russia).

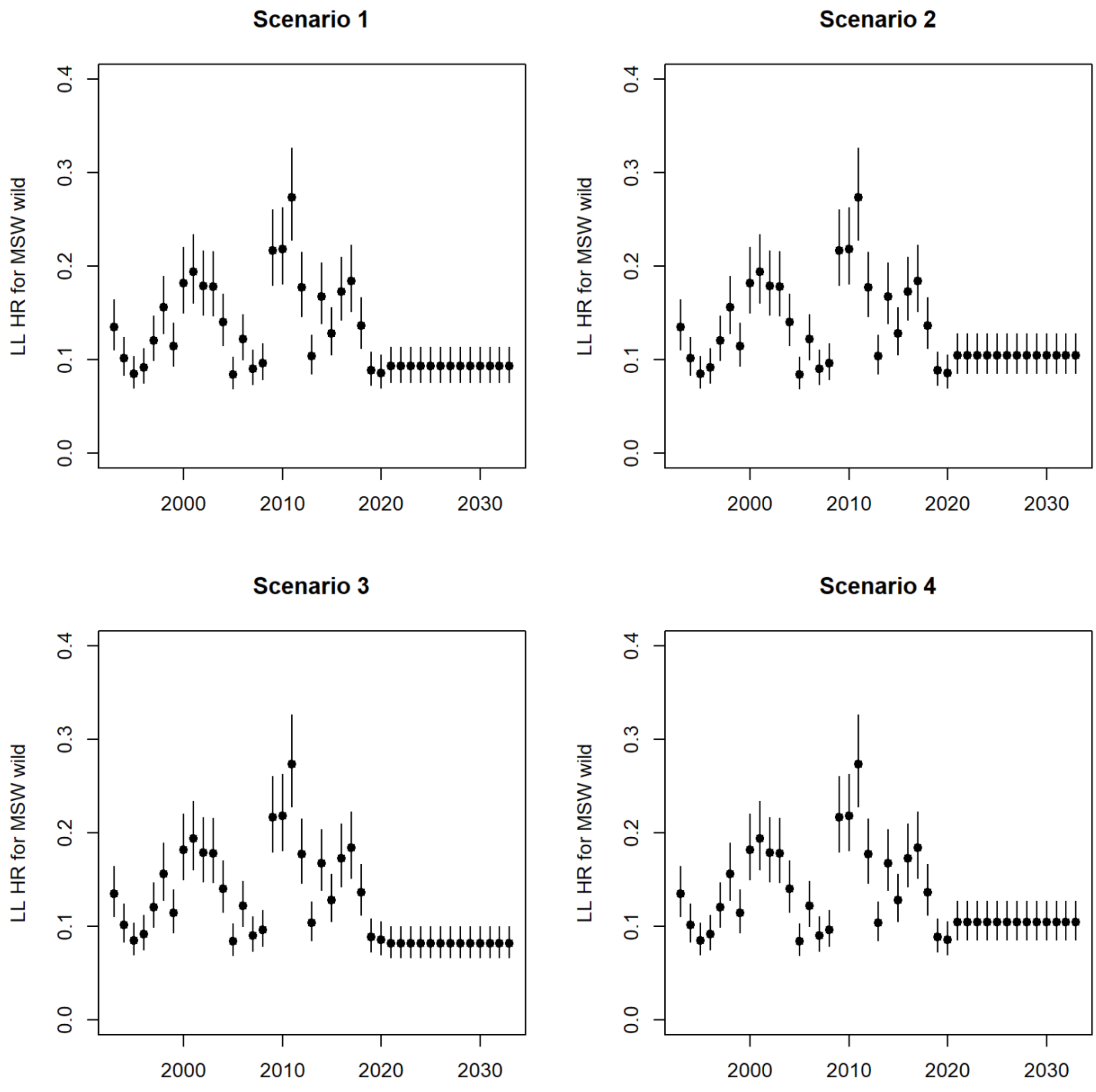


Figure 4.6.1a. Harvest rates (median values and 90% probability intervals) for wild multi-sea winter salmon in offshore longline fishery within scenarios 1–4.

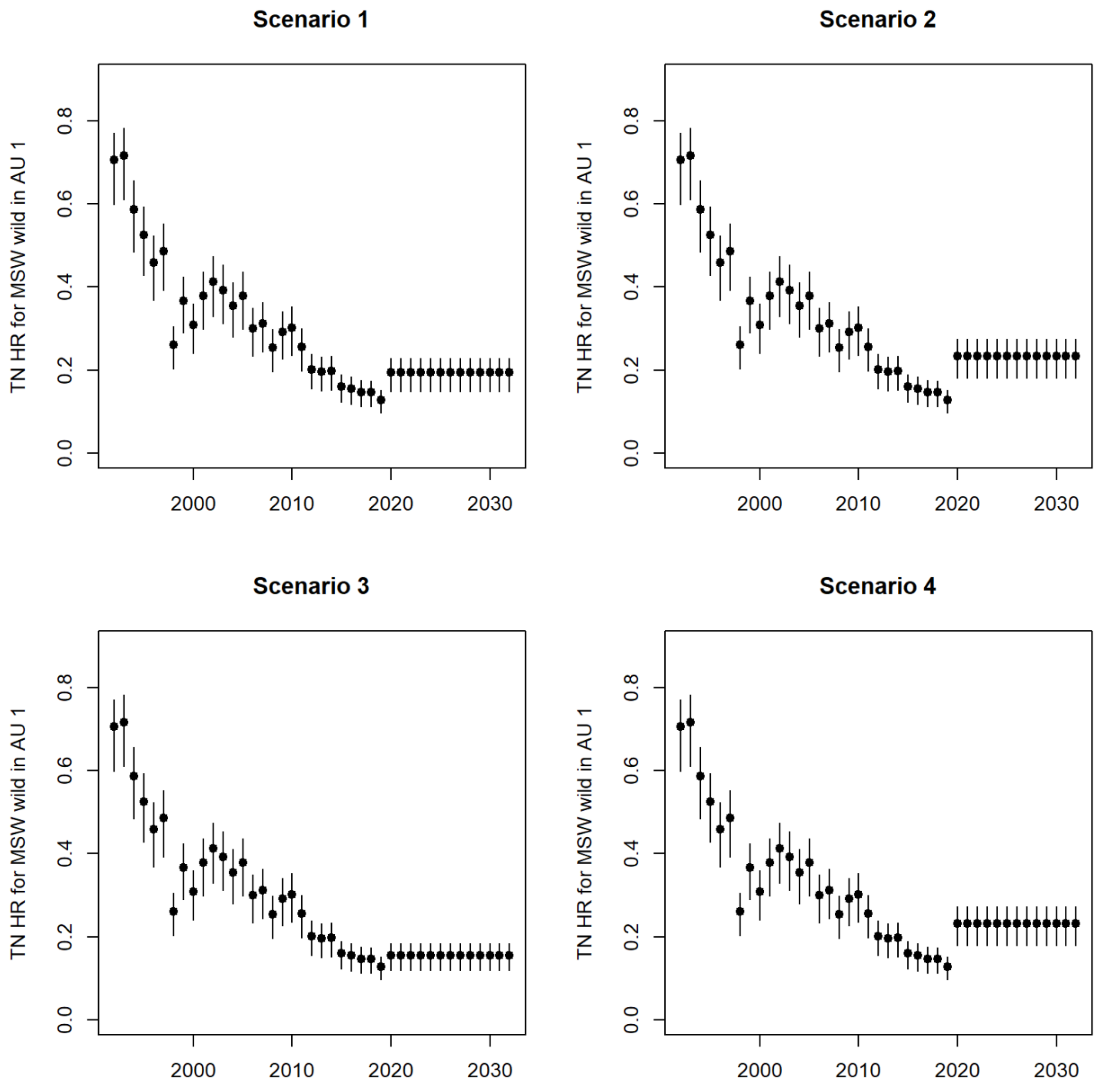


Figure 4.6.1b. Harvest rates (median values and 90% probability intervals) for wild multi-sea winter salmon in coastal trapnet fishery within scenarios 1–4.

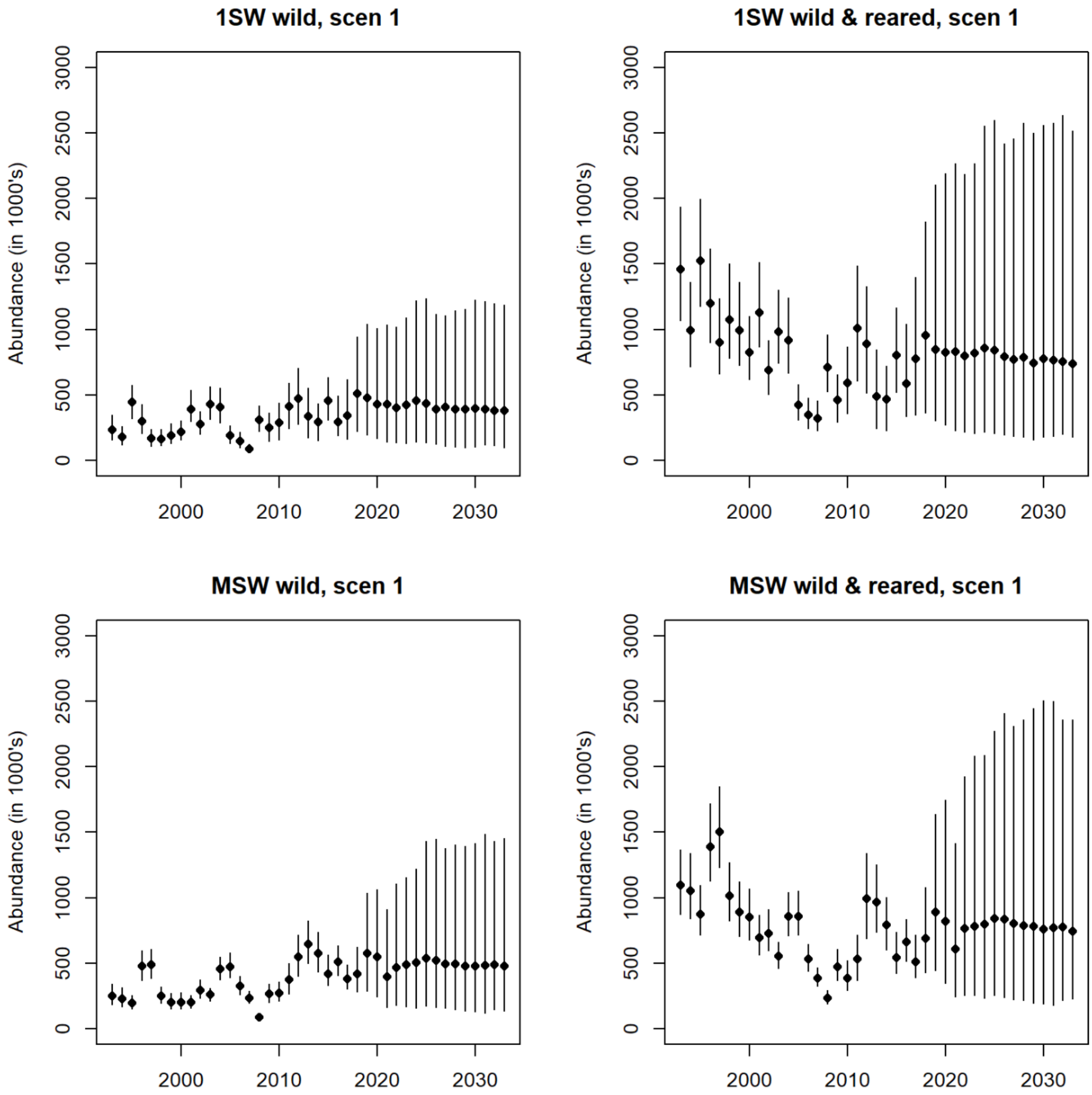


Figure 4.6.1.1a. Pre-fishery abundances of MSW and 1SW wild salmon and wild and reared salmon together based on scenario 1. PFA's reflect the abundance that is available to the fisheries. In case of MSW salmon natural mortality is taken into account until end of June of the fishing year and in case of post-smolts, until end of August (four months after post-smolt mortality phase). See text for details.

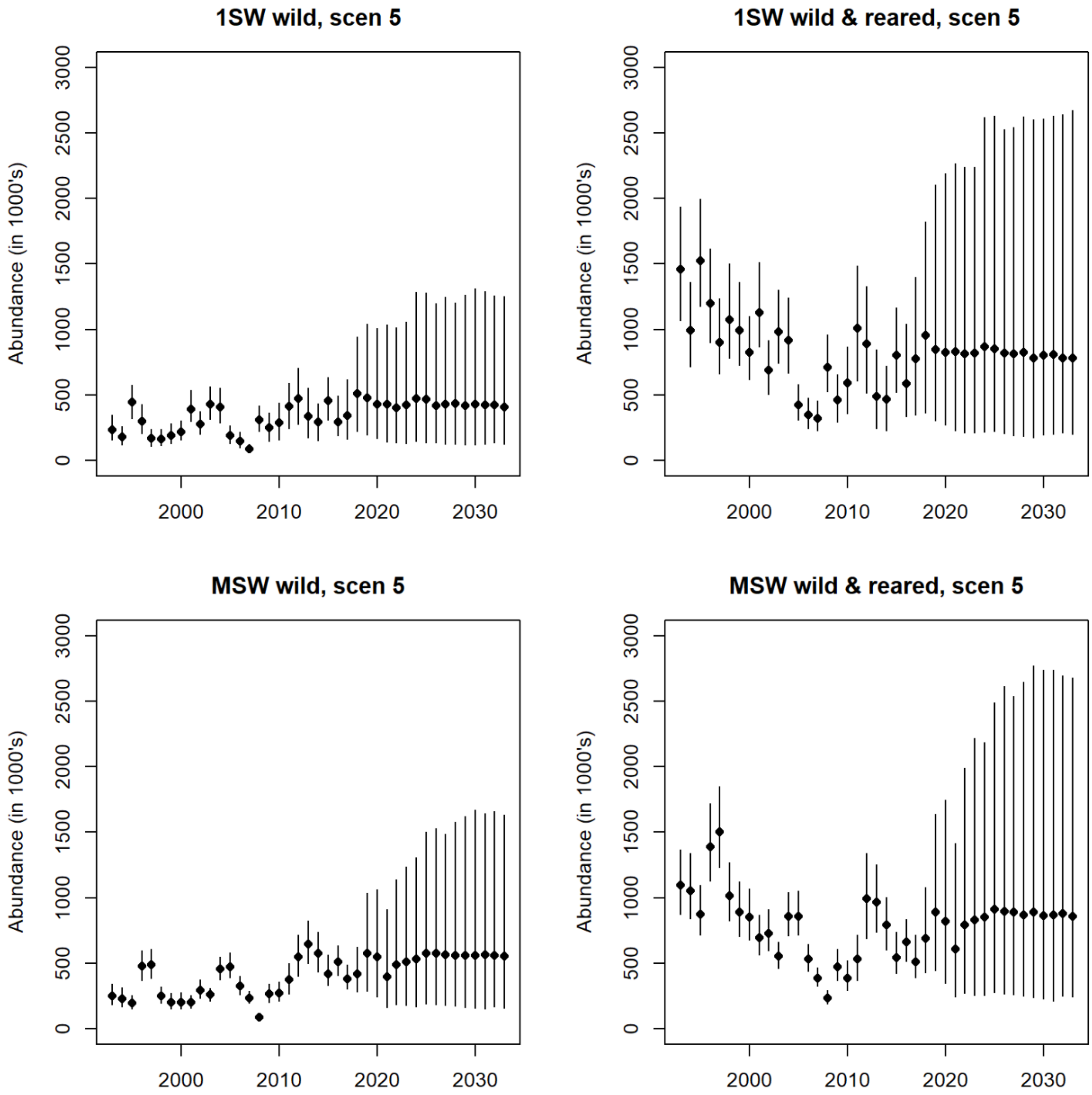


Figure 4.6.1.1b. Pre-fishery abundances of MSW and 1SW wild salmon and wild and reared salmon together based on scenario 5 (zero fishing). PFA's reflect the abundance that is available to the fisheries. In case of MSW salmon natural mortality is taken into account until end of June of the fishing year and in case of post-smolts, until end of August (four months after post-smolt mortality phase). See text for details.

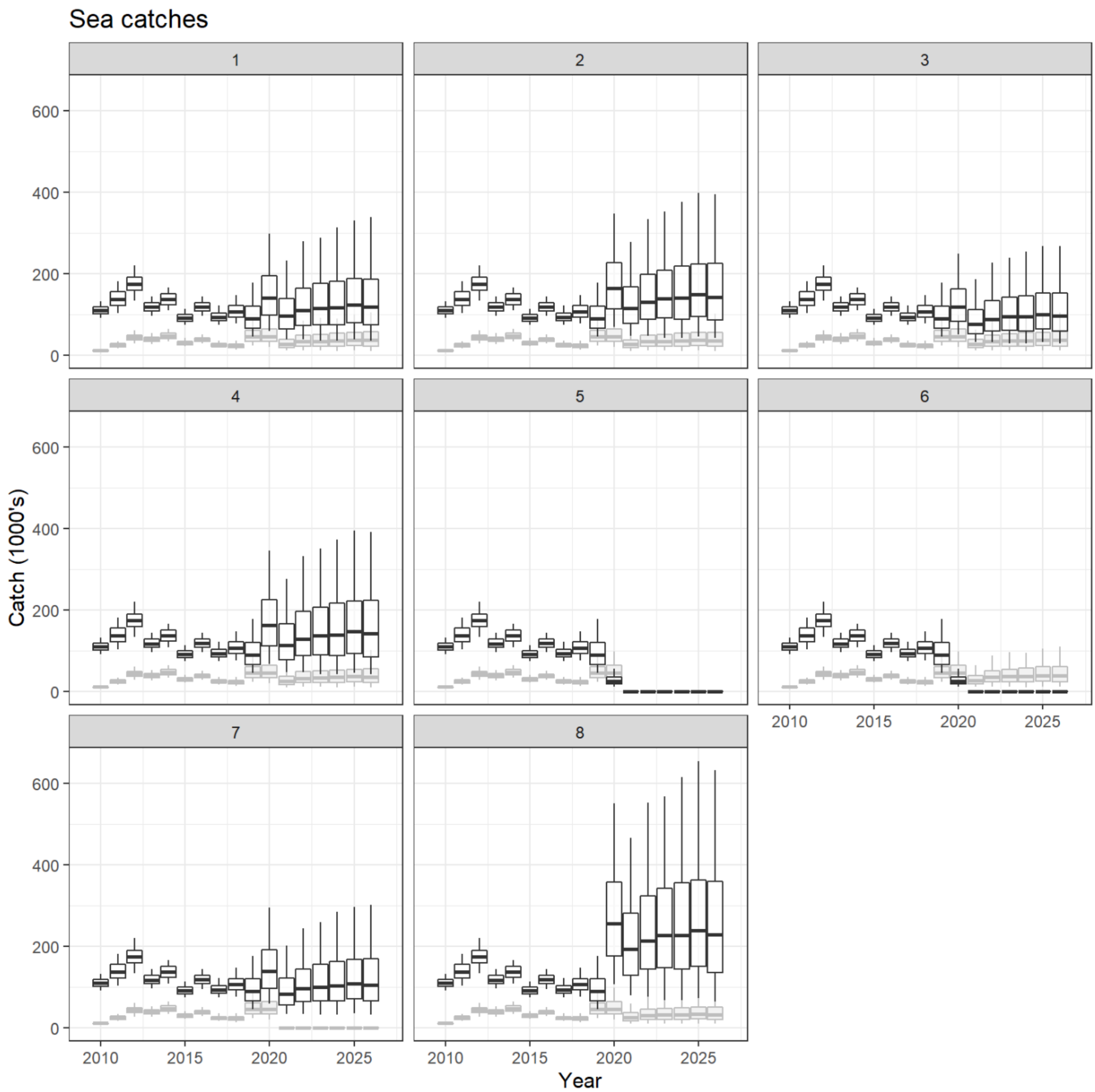


Figure 4.6.1.2. Estimates of reported commercial sea catches (all gears, black boxplots) and recreational sea catches (all gears, grey boxplots) based on scenarios 1–8.

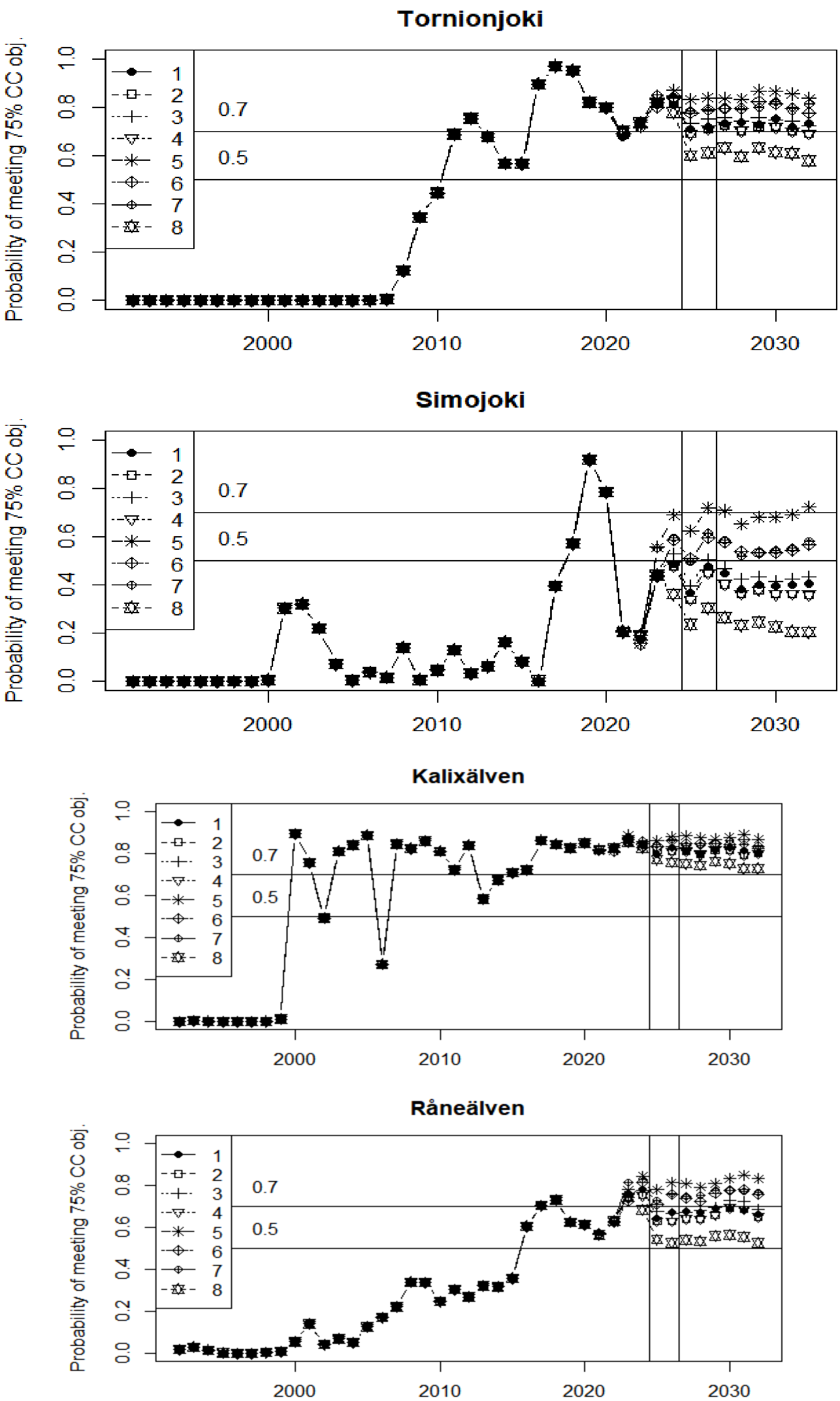


Figure 4.6.1.3a. Probabilities for different stocks to meet an objective of 75% of the potential smolt production capacity (PSPC) under scenarios 1–8. Fishing in 2021 affects mostly the years 2025–2026.

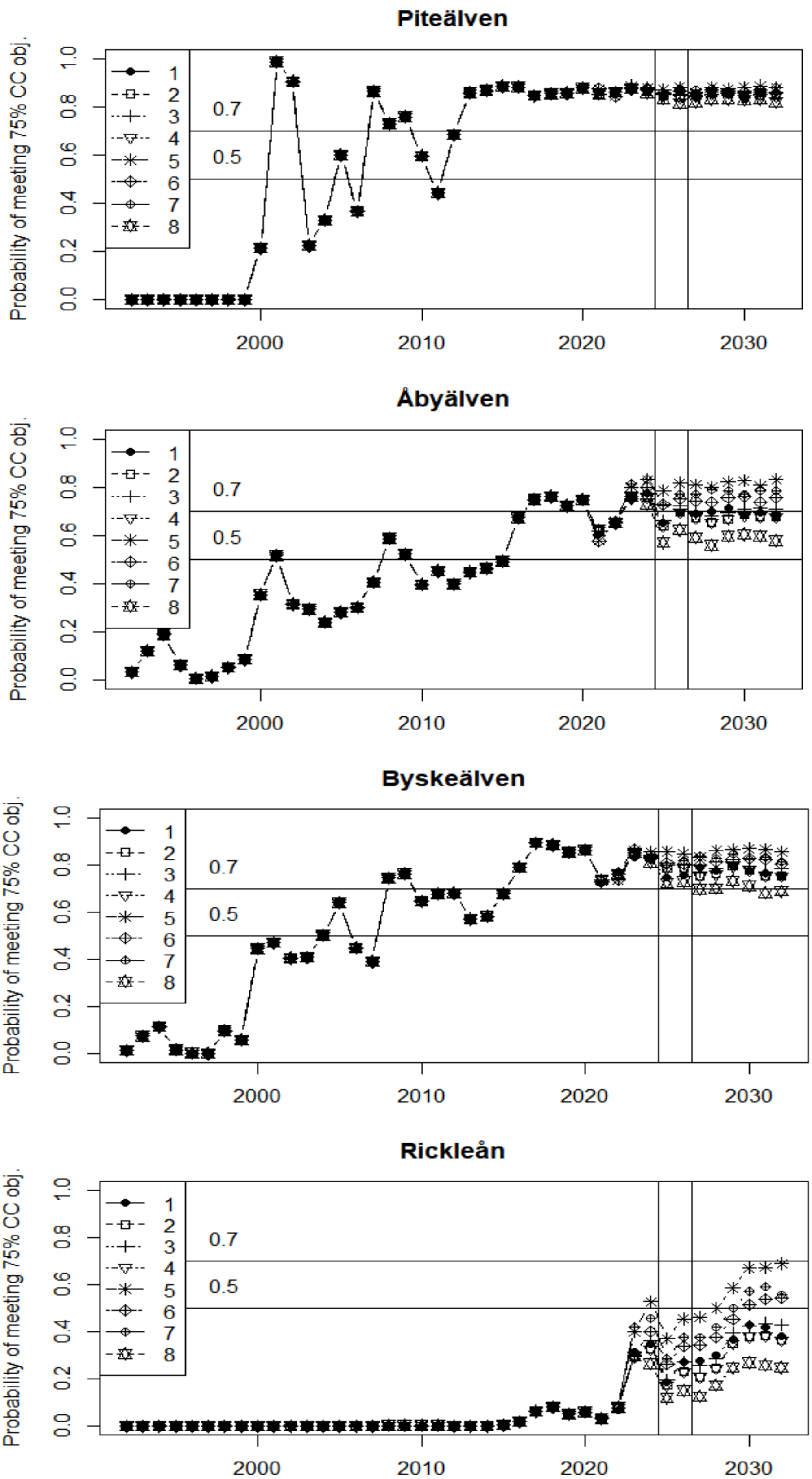


Figure 4.6.1.3b. Probabilities for different stocks to meet an objective of 75% of the potential smolt production capacity (PSPC) under scenarios 1–8. Fishing in 2021 affects mostly the years 2025–2026.

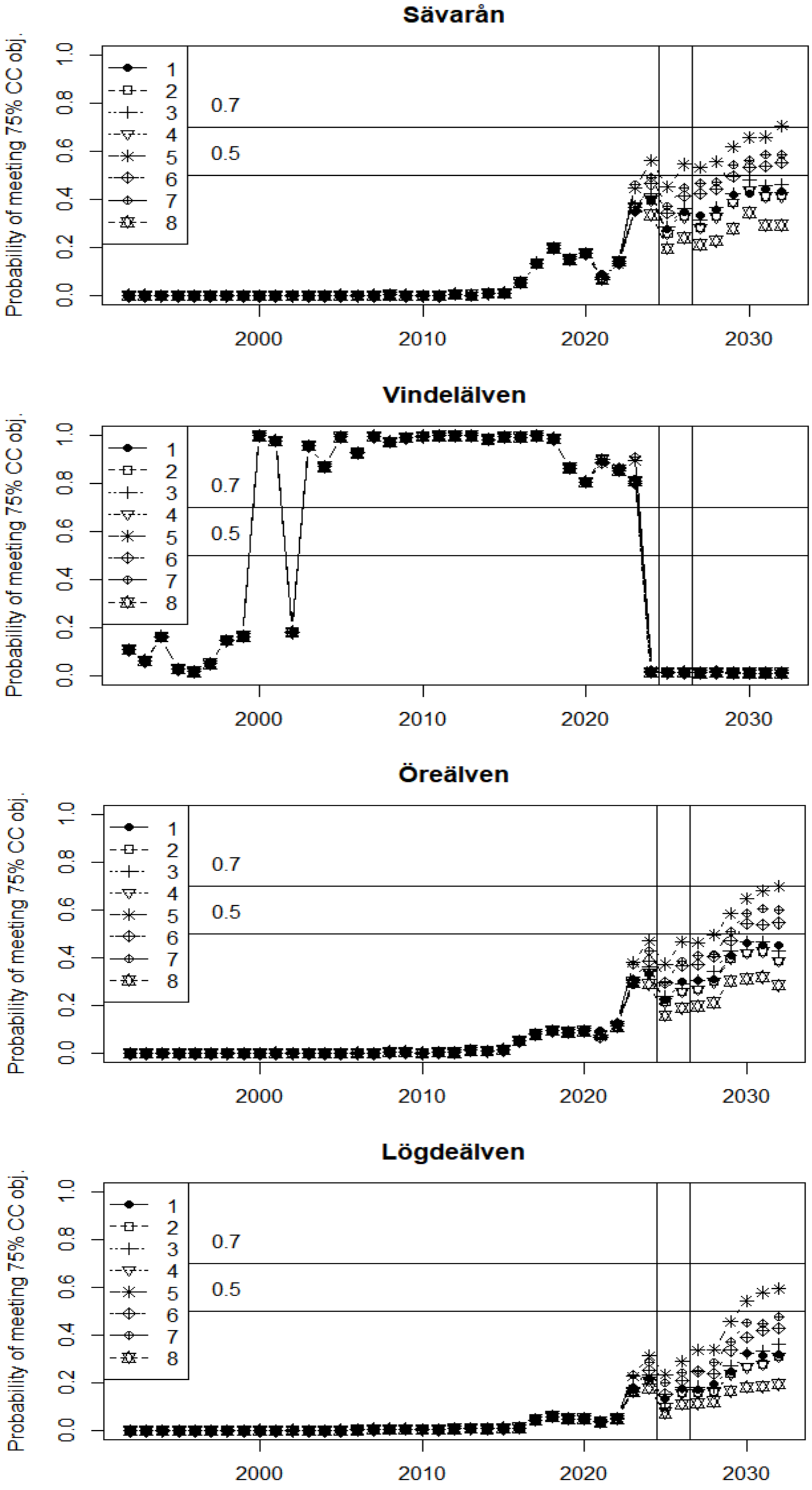


Figure 4.6.1.3c. Probabilities for different stocks to meet an objective of 75% of the potential smolt production capacity (PSPC) under scenarios 1–8. Fishing in 2021 affects mostly the years 2025–2026.

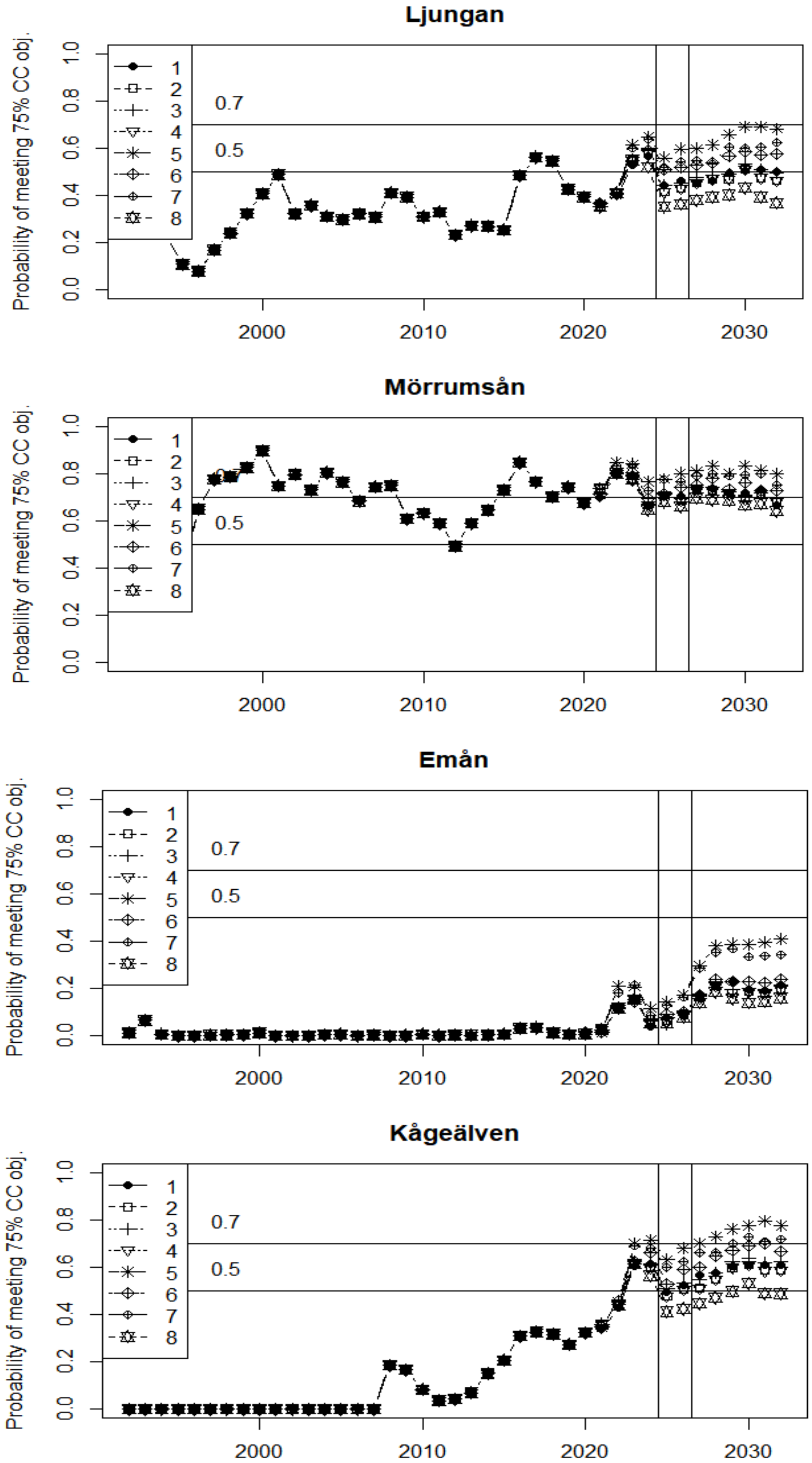


Figure 4.6.1.3d. Probabilities for different stocks to meet an objective of 75% of the potential smolt production capacity (PSPC) under scenarios 1–8. Fishing in 2021 affects mostly the years 2025–2026.

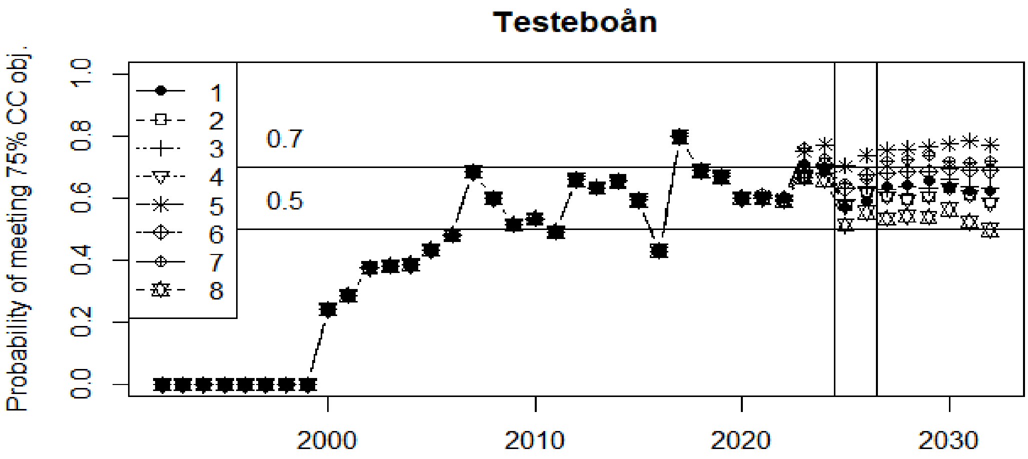


Figure 4.6.1.3e. Probabilities for different stocks to meet an objective of 75% of the potential smolt production capacity (PSPC) under scenarios 1–8. Fishing in 2021 affects mostly the years 2025–2026.

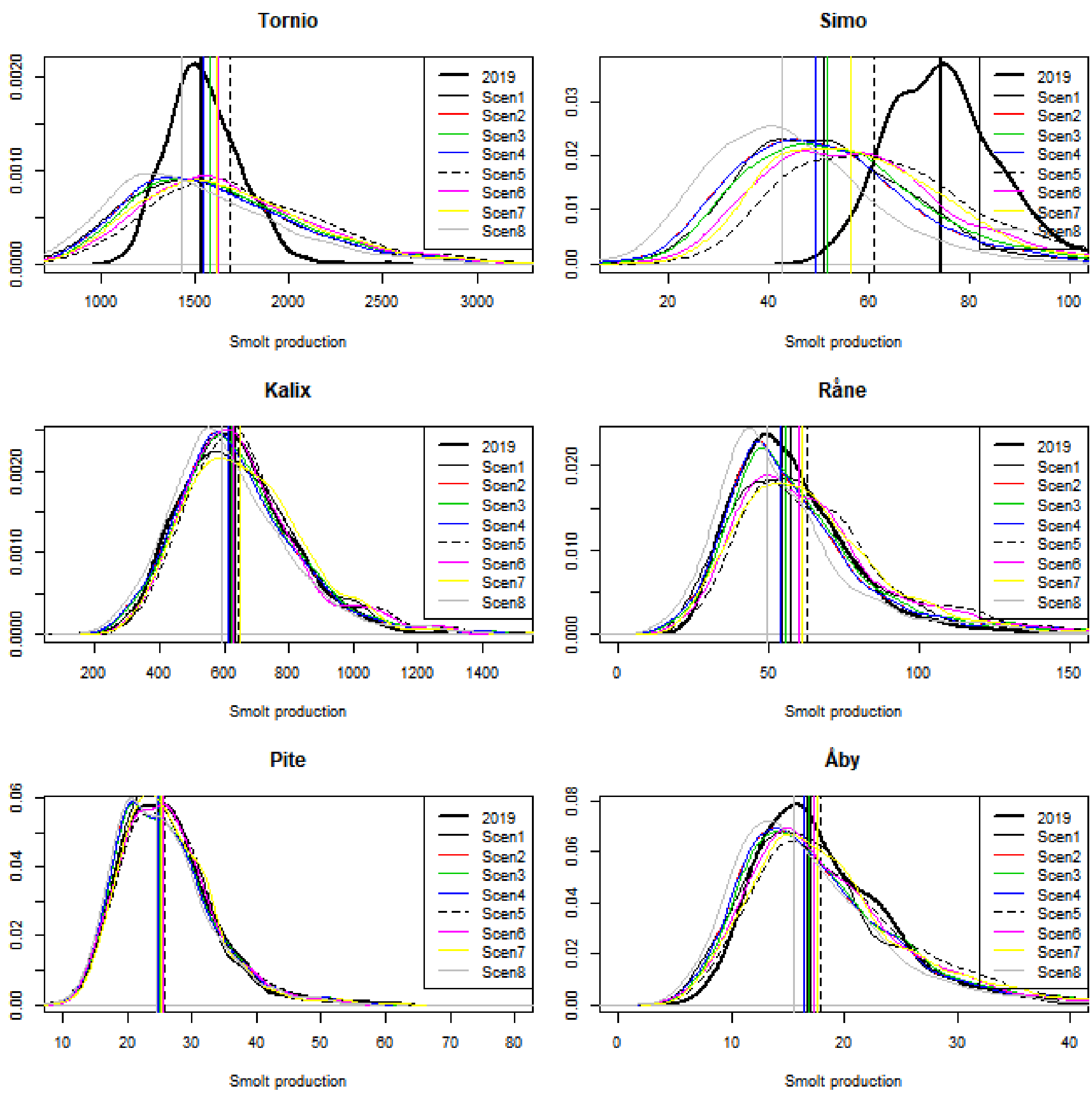


Figure 4.6.1.4.a. Predicted smolt production in 2026 (or 2025 for Emån and Mörrumsån) under fishing scenarios 1–8 (thin lines) compared to estimated production in 2018 (bold line). Vertical lines illustrate medians of the distributions.

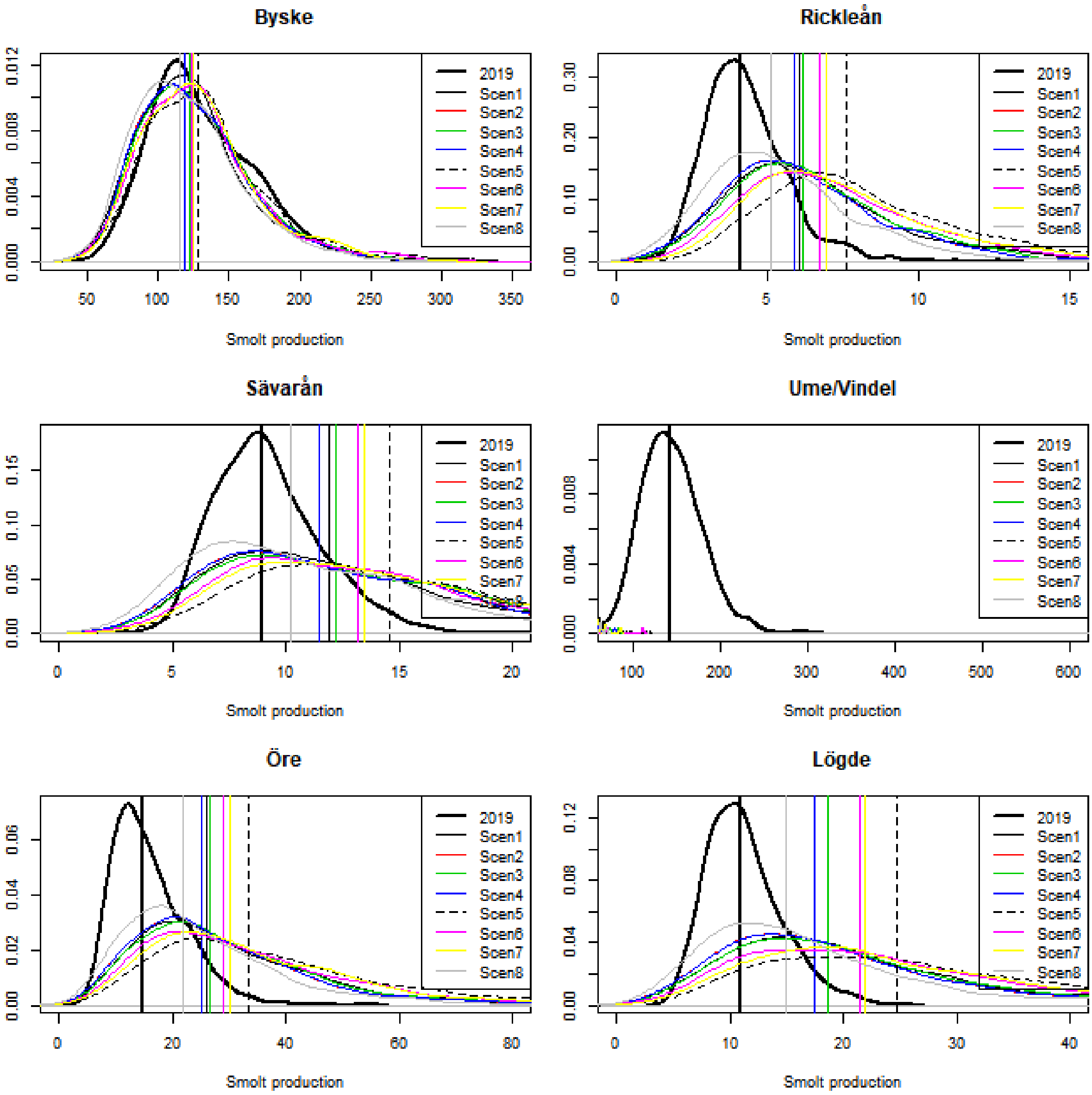


Figure 4.6.1.4.b. Predicted smolt production in 2026 (or 2025 for Emån and Mörrumsån) under fishing scenarios 1–8 (thin lines) compared to estimated production in 2018 (bold line). Vertical lines illustrate medians of the distributions.

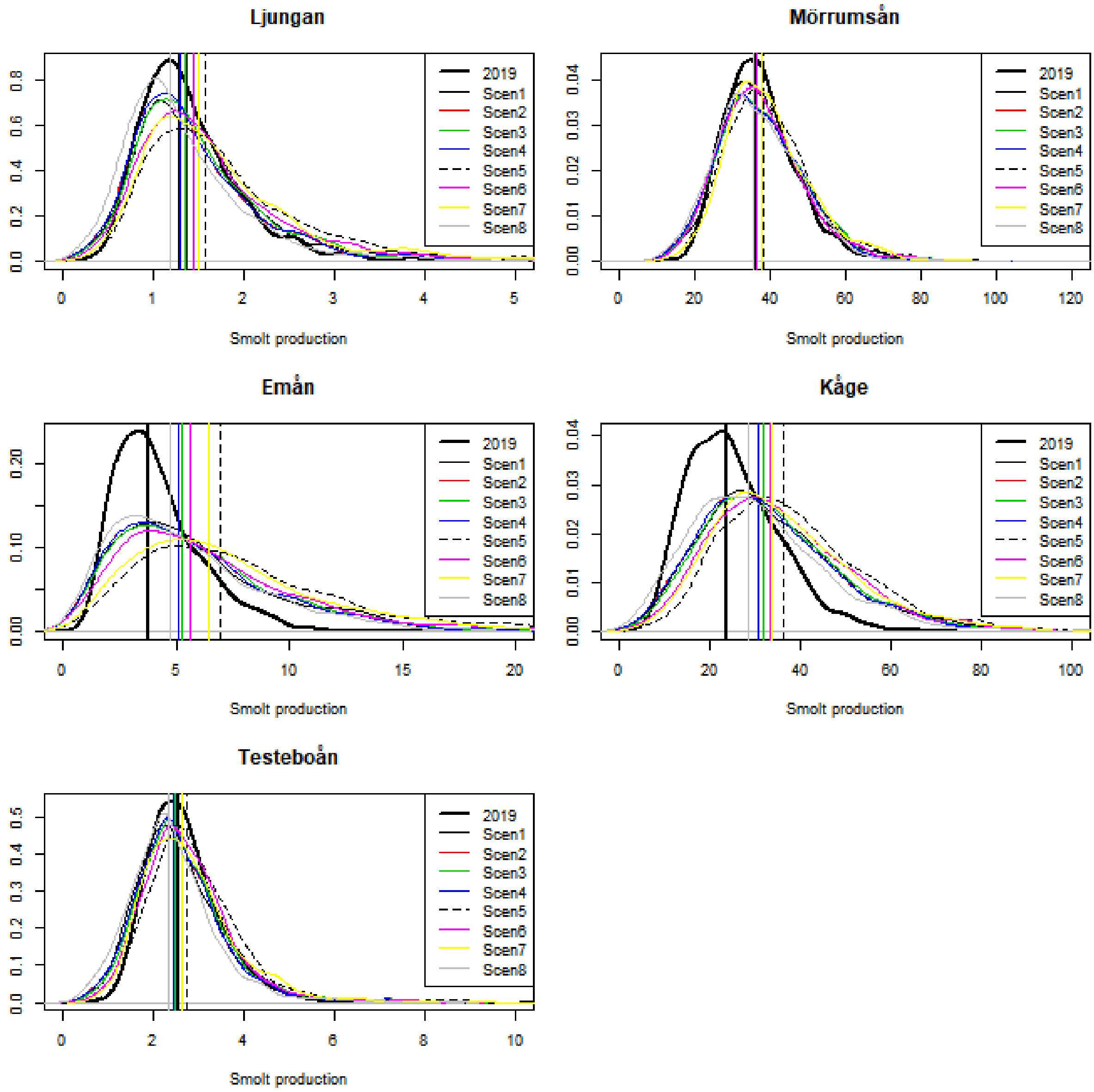


Figure 4.6.1.4.c. Predicted smolt production in 2026 (or 2025 for Emån and Mörrumsån) under fishing scenarios 1–8 (thin lines) compared to estimated production in 2018 (bold line). Vertical lines illustrate medians of the distributions.

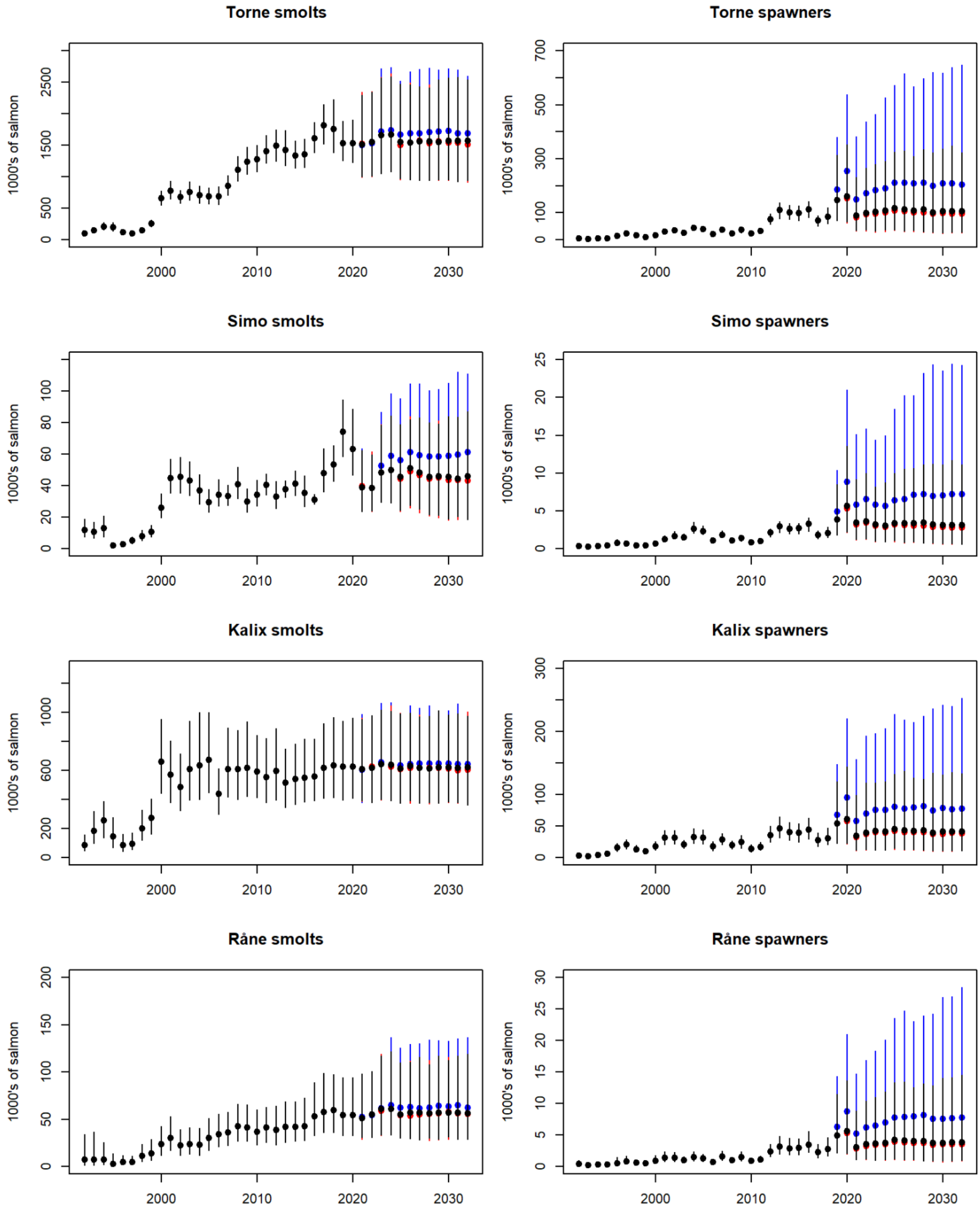


Figure 4.6.1.5a. Median values and 90% probability intervals for smolt and spawner abundances for rivers Tornionjoki, Simojoki, Kalixälven and Råneälven in scenarios 1 (black), 4 (red) and 5 (blue).

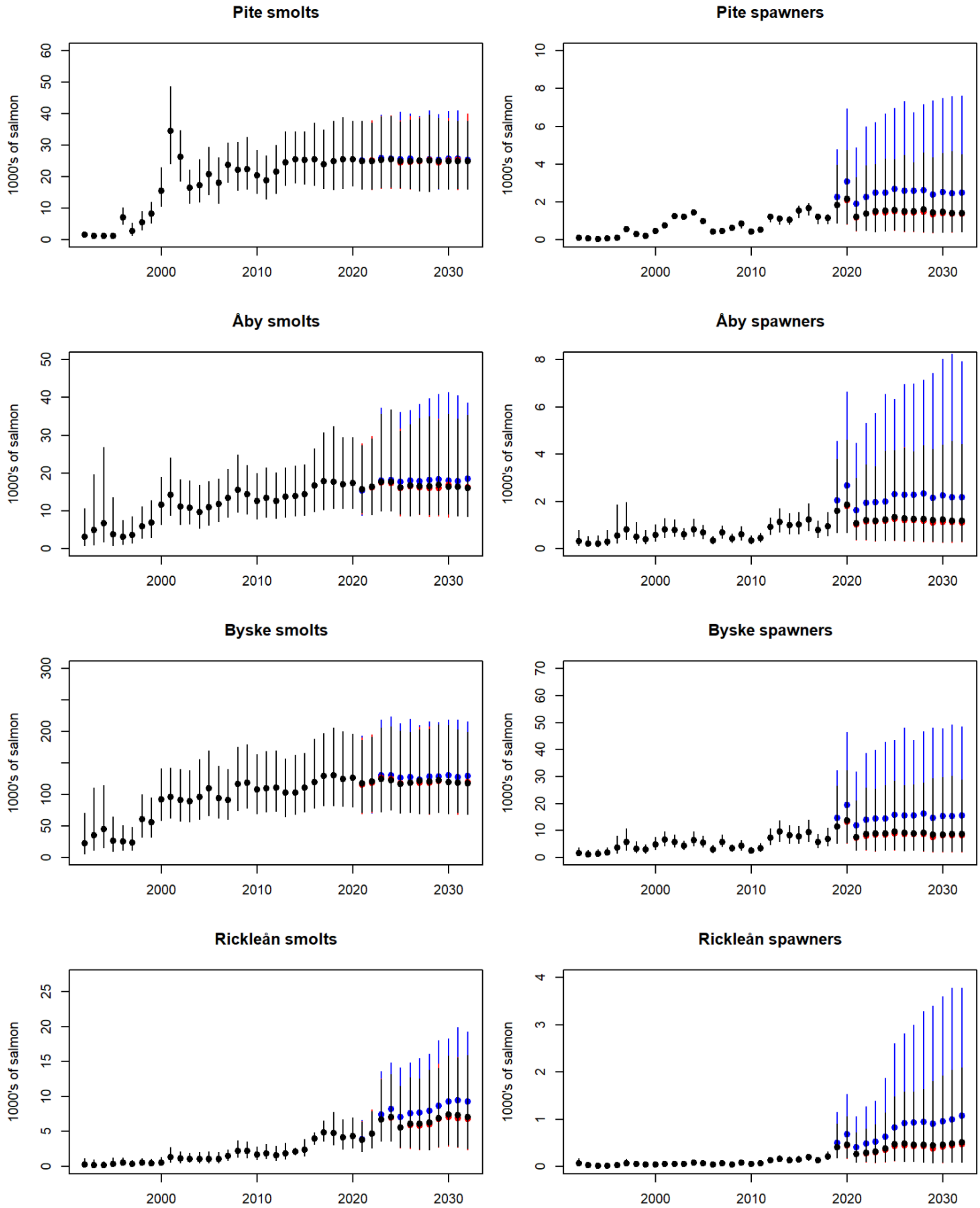


Figure 4.6.1.5b. Median values and 90% probability intervals for smolt and spawner abundances for rivers Piteälven, Åbyälven, Byskeälven and Rickleån in scenarios 1 (black), 4 (red) and 5 (blue).

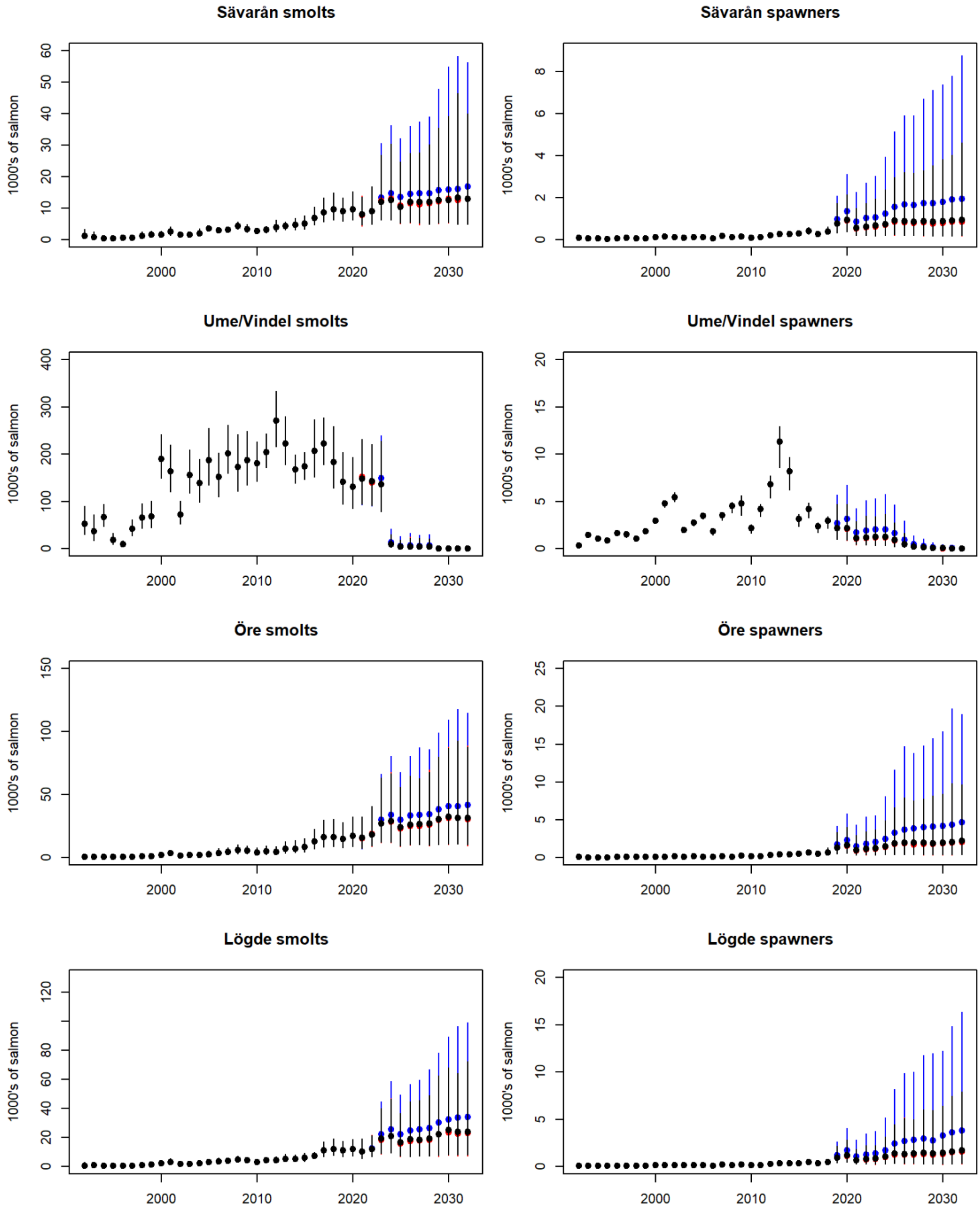


Figure 4.6.1.5c. Median values and 90% probability intervals for smolt and spawner abundances for rivers Sävarån, Ume/Vindelälven, Öreälven and Lögdeälven in scenarios 1 (black), 4 (red) and 5 (blue).

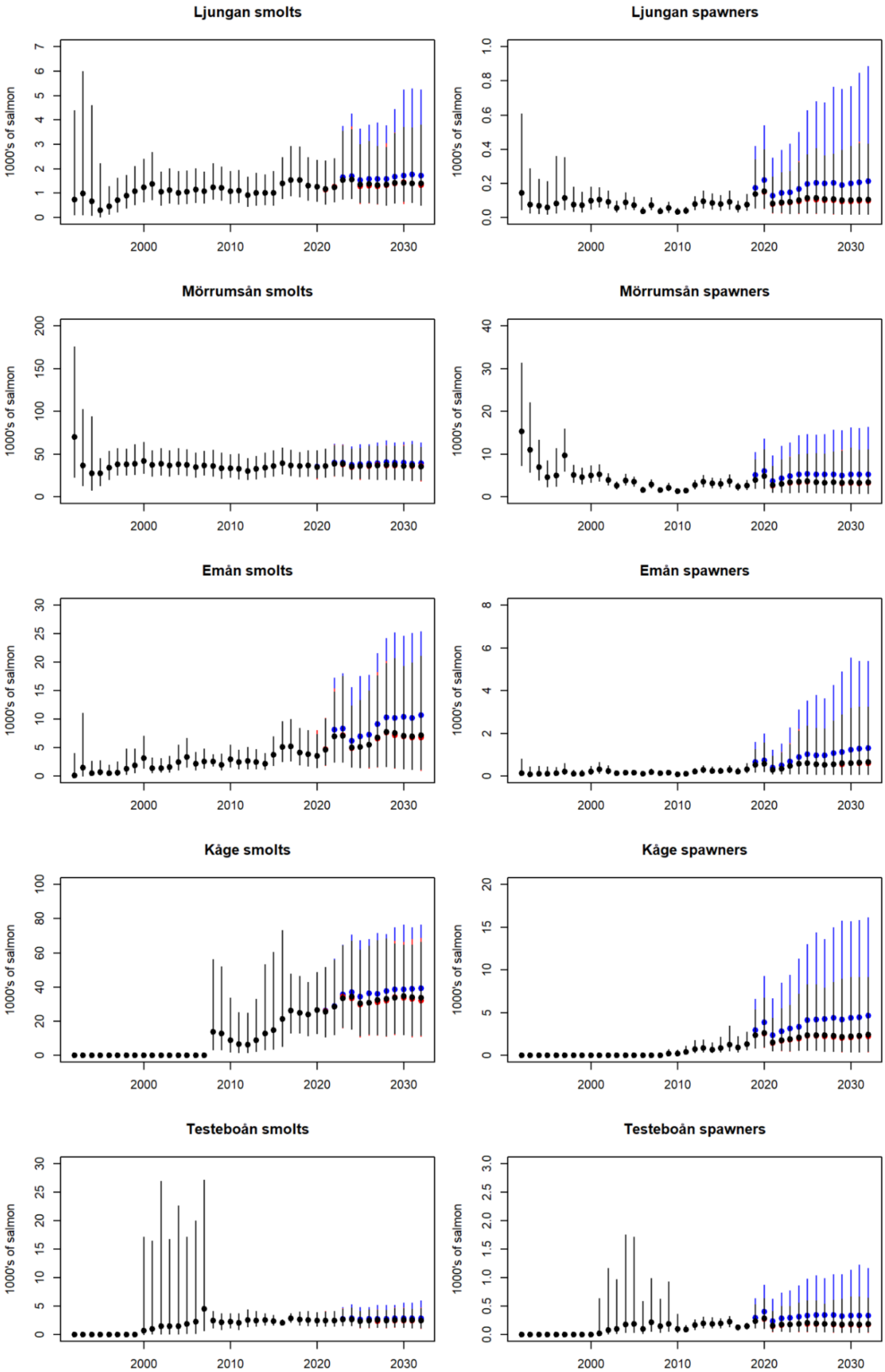


Figure 4.6.1.5d. Median values and 90% probability intervals for smolt and spawner abundances for rivers Ljungan, Mörrumsån, Emån and Kågeälven in scenarios 1 (black), 4 (red) and 5 (blue).

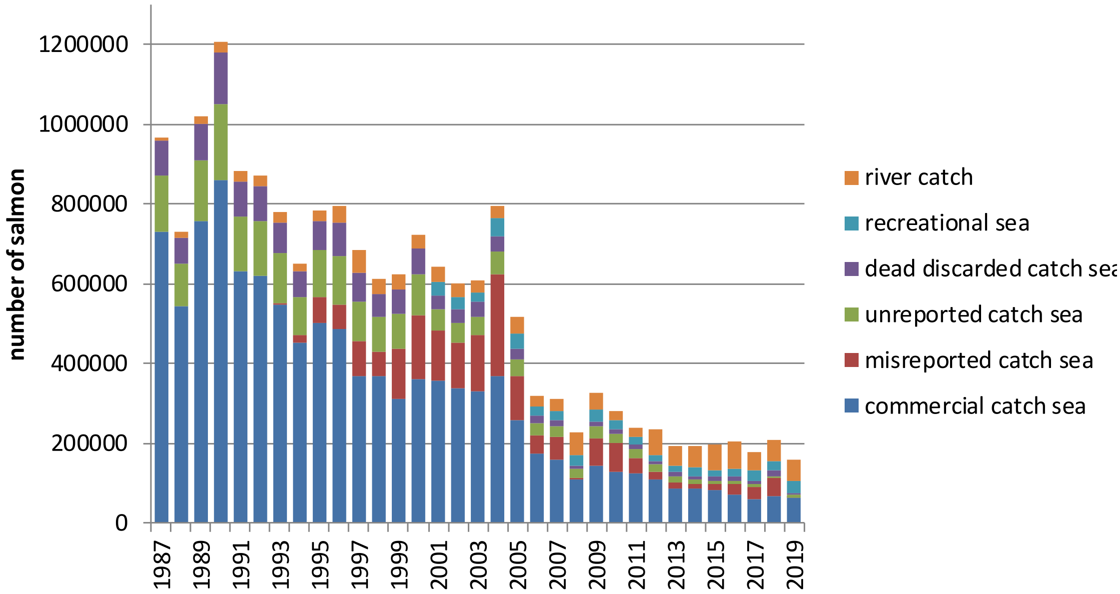


Figure 4.6.1.9. Share of commercial and recreational catches at sea, river catches (river catches include unreporting and also some commercial fishing), and discard/unreporting/misreporting of total sea catches in subdivisions 22-31 in years 1987-2019.

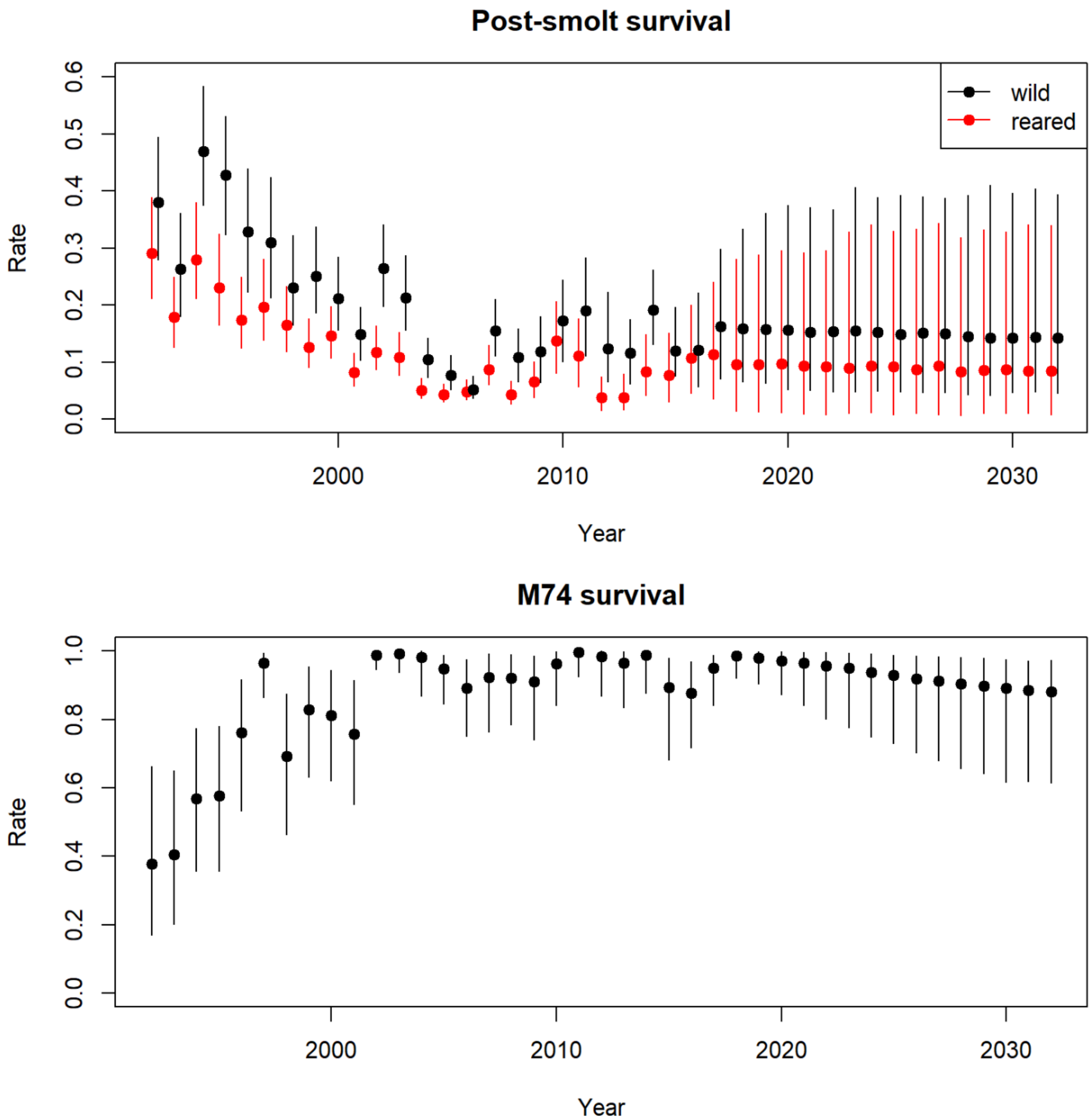


Figure 4.6.2. Median values and 90% probability intervals for post-smolt survival of wild and reared salmon and M74 survival assumed in all scenarios.

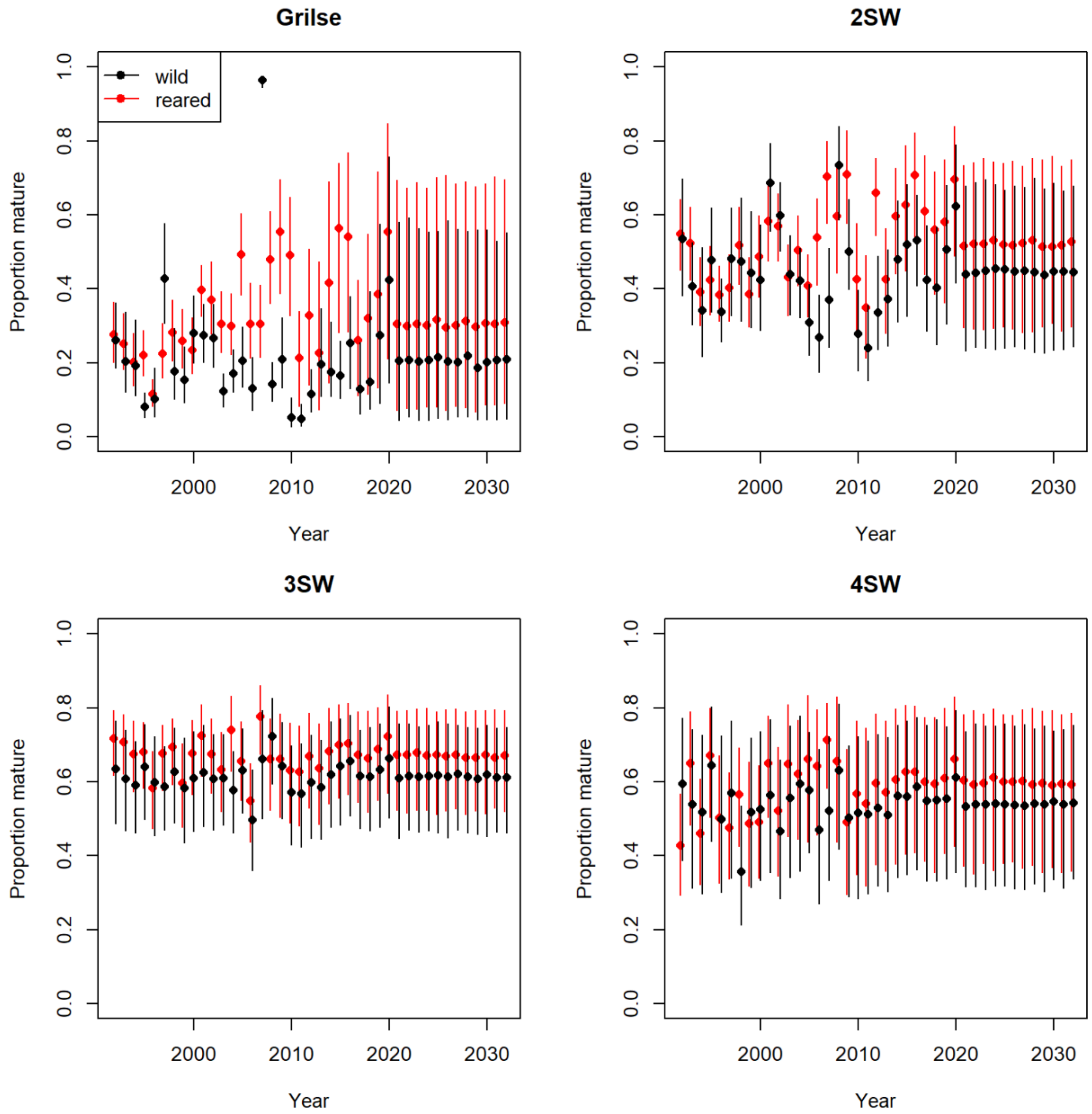


Figure 4.6.3. Median values and 90% probability intervals for annual proportions maturing per age group for wild and reared salmon in all scenarios.

5 Sea trout

Sea trout basically has the same life cycle as salmon. The most important difference is that most strains do not migrate as far as the salmon. Instead, they spend the time in sea in coastal waters where the majority of sea trout from a specific strain stay within a few hundred kilometres from their home river. Some specimens, however, migrate further and in some strains in the Southern Baltic most sea trout seem to migrate longer distances into the open sea. Sea trout spawn and live during the first period of life in smaller streams than salmon. In the Baltic Sea area, sea trout are found in a much larger number of streams than salmon. Many of these streams are in lowland areas that are often strongly influenced by human activity.

The assessment of sea trout populations in the Baltic is based on a model developed by the Study Group on Data Requirements and Assessment Needs for Baltic Sea Trout, SGBALANST (ICES, 2011), first implemented at the assessment in 2012 (ICES, 2012). For the evaluation of model results, other basic observations such as tagging data, spawners counts and catch statistics are also taken into account.

Below follows sections on sea trout catches, fisheries, and biological monitoring data followed by descriptions of assessment methods and results.

5.1 Baltic Sea trout catches

5.1.1 Commercial fisheries

Nominal commercial catches of sea trout in the Baltic Sea are presented in Table 5.1.1.1. The total catch decreased almost by half, from 312 tonnes in 2018 to 159 tonnes in 2019. A majority (77%) of this catch was caught in the Main Basin.

In the Main Basin, the catch decreased from 954 tonnes in 2002 to 236 tonnes in 2008. After two years (2009–2010) of somewhat higher catches, around 450 tonnes, the total commercial catch again fell, reaching a minimum of 145 tonnes in 2015. In 2016, the total Main Basin commercial catch again increased somewhat to 184 tonnes (where it remained in 2017) and in 2018, it increased further to 274 tonnes. In 2019, catches decreased here about 45% and reached only 123 tonnes. As in previous years, the majority of this catch was from the Polish fishery (71%).

The total nominal commercial catch of trout in the Gulf of Bothnia was 19 tonnes in 2019, which is similar to 2018 (22 tonnes) and below the ten year average catch (46 tonnes). All commercial catches in Gulf of Bothnia were from coastal fisheries.

In the Gulf of Finland, the total commercial sea trout catch in 2019 was 17 tonnes (Table 5.1.1.1), which is below the average for the last ten years (21 tonnes).

5.1.2 Recreational fisheries

Recreational sea trout catches (landed) in the Baltic Sea are presented in Table 5.1.2.1. In 2019, the total catch decreased to 318 tonnes, from 427 tonnes in 2018. However, the catch was lower than in 2016 when 743 tonnes were reported. Data from 2019 are underestimated, because Danish catches are only for the first half year (second part of the year not yet estimated) and will be updated in next year, like data from 2018.

Recreational river catches in 2019 were 35 tonnes, and were taken mainly in Swedish Gulf of Bothnia rivers. This is a smaller river catch than the ten years average (43 tonnes; Table 5.1.2.1).

Most of the recreational catch in the coastal zones of the Gulf of Bothnia and the Gulf of Finland was taken by Finnish fishermen (64 tonnes), similar to the last years.

Data on recreational coastal catches from the Main Basin in 2018 were available from Estonia, Latvia, Lithuania, Finland, Sweden and partially from Denmark and Germany (Table 5.1.2.1). From the last several years, results from questionnaires on Danish coastal recreational catches showed that; those catches increased from 224 tonnes in 2011 to 521 tonnes in 2014. Until 2016, they decreased to 323 tonnes, which constituted about 55% of the total Baltic Sea recreational catch of sea trout. In 2017–2019 this share is lower about 30–40%.

5.1.3 Total nominal catches

The highest combined commercial and recreational nominal catches, above 1300 tonnes, were taken in the early and late 1990s (Table 5.1.3.1). Since 2001 they have been decreasing to the level of 700–800 tonnes in recent years, and even 506 tonnes in 2017 (but without data on Danish recreational catches in 2017) (Tables 5.1.1.1 and 5.1.2.1 combined). In 2019, the combined catches reached 477 tonnes, however Danish data were only partial and covered only half of the year. Note that when taking estimated levels of misreporting of salmon as sea trout in the Polish sea fishery into account (Section 2.3.3), the overall reported commercial sea trout catches have been much too high. However in last year, according to new regulation in Polish fisheries, the level of misreported catch dropped almost to zero level. A column with yearly estimates of salmon catches misreported as sea trout (in weight) in the last ten years were added to Table 5.1.1.1.

5.1.4 Biological catch sampling

Strategies for biological sampling of sea trout and procedures are very similar to those for salmon (Annex 2, Section 2.5). In total, 1540 sea trout were sampled in 2019, similar to in 2018 (Table 5.1.4.1). Most samples were collected from Latvian (n=526) and Swedish (n=454) catches. In addition, 160 samples were collected from Estonian catches in the Gulf of Finland (SD 32), and 95 from Finnish catches in SD 29–32. Polish samples originated from river catches (n=126) in two rivers: Vistula and Rega and from the sea (n=62). Additionally 94 sea trout were sampled in Germany (Table 5.1.4.1).

5.2 Data collection and methods

5.2.1 Monitoring methods

Monitoring of sea trout populations is carried out in all Baltic Sea countries. The intensity and period during which monitoring has been going on varies (ICES, 2008c). Some countries started their monitoring in recent years, while very long dataseries exist for a few streams in others (ICES, 2008c). From 2016, a new European Union (EU) regulation (2016/1251) adopting a multiannual program for the collection, management and use of data in the fisheries and aquaculture, obligated EU countries to collect sea trout catch data.

Most monitoring of sea trout is carried out by surveying densities of trout parr in nursery streams by electrofishing. In Denmark, only a few sites in Baltic streams are monitored annually. In addition, a rolling scheme is used for electrofishing-monitoring of sea trout on the national level. Due to the large time lap between fishing separate rivers these are not directly useable for assessment, but the results are used as background information on the status of populations as such. In a couple of countries, sampling of parr densities are used to calculate smolt production by a relation of parr to smolt survival, either developed in the same stream or in some other

(ICES, 2008a). In most countries (but not in Denmark and Poland) electrofishing is supplemented with annual monitoring of smolt escapement by trapping and counting in one or more streams. In total, smolt production estimates exist for 12–13 rivers in the entire Baltic area, but the length of the time-series varies very much.

In only four streams/rivers (Mörrumsån, Åvaån, Testeboån in Sweden and Pirita in Estonia) both numbers of spawners and smolts are monitored. Adult counts are determined by trapping or recording of ascending sea trout using automatic counters. In two rivers (nine in Sweden, three in Poland, eight in Germany, one in Estonia and three in Finland) the numbers of spawners are monitored by automatic fish counters or video systems. In three rivers, the total run of salmonids is determined using echo-sounder systems. However, this technique does not allow strict discrimination between sea trout and salmon (or other fish species of similar size).

An indication of the spawning intensity can also be obtained by counting of redds. Such information is collected from a number of sea trout streams in Poland, Lithuania and Germany (ICES, 2008a). In a couple of streams in Denmark, the catch in sport fisheries has been used to estimate the development of the spawning run. Catch numbers are also available from some Swedish rivers. Tagging and marking are furthermore used as methods to obtain quantitative and qualitative information on trout populations (see below). Evaluation of sea trout status in rivers is done based on national expert opinions, as well as on factors influencing status. Such evaluations are updated irregularly.

5.2.2 Assessment of recreational sea trout fisheries

There is a highly developed recreational fishery targeting sea trout in many countries. Angling (rod-and-line fishing) accounts for the majority of the catches. The most common methods are spin and fly fishing from the shore or in rivers, and trolling with small boats at sea (see Annex 2 for a general description of the trolling fishery). The shore-based fishery along coasts and in rivers is highly diffuse and variable with strong local and regional variations depending on weather conditions and season. In the southern Baltic Sea, recreational fishing on sea trout takes places during the whole year with distinct activity peaks in spring and autumn. Fishing times vary between seasons, but most anglers fish a few hours around dawn and dusk. In winter and early spring, there is also an activity peak during noontime due to higher water temperatures. Some night fishing occurs in summer.

While the recreational catches of sea trout are largely dominated by rod-and-line fisheries, there are other types of fisheries carried out in some countries. To a smaller extent passive gears such as trapnets, gillnets or longlines are being used for catching sea trout in the Baltic Sea, either as a target species or as bycatch in other coastal recreational fisheries. Except for in northern Gulf of Bothnia, the catches from this type of fishing is estimated to be of minor importance in terms of impact on the stocks, i.e. removals.

Monitoring of the recreational fisheries is carried out in different ways. Below follows a description of methods and activities in the Baltic countries.

Since 2009, recreational catches of sea trout in Denmark have been estimated based on an interview-based recall survey, which is conducted by DTU Aqua in cooperation with Statistics Denmark. In addition, during spring 2017, a project on the recreational sea trout coastal rod-and-line fishery was carried out on the island Funen in SD 22. Two different approaches were applied: 1) on-site interviews (rowing creel) collected information on i.a. catch, release rates and effort, and 2) by aerial survey, information on effort was obtained. Furthermore, information on motivation and satisfaction was collected.

In Estonia, catch reporting has been mandatory since 2005. The data are reported to and stored in the Estonian Fisheries Information System (EFIS) for passive gears (gillnets, longlines) and salmon and sea trout rod-and-line fishing in rivers. The latest recreational fishery survey was carried out in 2016, based on a phone call approach.

Since 2002, the official catch estimates of the recreational sea trout fishery in Finland are based on a national recreational fisheries survey. Biannual surveys are conducted to estimate participation, fishing effort and catches of the recreational fishery (http://stat.luke.fi/en/recreational-fishing). A stratified sample of about 7500 household dwellings is contacted with response rates of around 40–45% after a maximum of three contacts. Afterwards, a telephone interview is done for a sample of the non-respondents. Harvested and released catch is measured separately by species. The latest estimate of recreational sea trout catch is for 2018 year and being 64 (CV>50%) tonnes. Due to methodical reasons, the catch estimate varies significantly between the recent and older surveys. Other information, however, does not indicate such a large variation in the true catches between the years. In the WGBAST catch data, the Finnish recreational catch estimates before the year 2002 is relative to the commercial catch by assumption that recreational catch constituted about 75% (derived from the tag return data) of the total catch (re-evaluation is considered). Since year 2002, the estimates have been based on the Finnish Recreational Fishing Survey results.

In Germany, a nationwide telephone-diary survey with quarterly follow-ups was conducted in 2014/2015, contacting 50 000 German households to collect representative data on catch and effort, and social, economic and demographic parameters for the German marine recreational fishery, covering also the recreational sea trout fishery. However, to collect more detailed information on the recreational sea trout fishery an additional pilot study (diary recall survey) was conducted. During this study, a bus route intercept survey was used to recruit diarists, collect biological samples (length, weight, scales, and tissue samples), and socio-economic data. Ongoing analyses aim to combine both studies to provide a full picture of the recreational sea trout fishery in Germany. Anecdotal information showed that recreational sea trout catches in freshwater are small and probably insignificant compared to marine catches. An update of the recreational sea trout catches is expected to be available in 2021. The results of the survey conducted in 2015 were considered to be a reliable level of recreational fishing and their result (151 tonnes) was also adopted for the years 2016–2019.

In Latvia, a first attempt to estimate total sea trout catches from angling was done in 2018 using Internet questionnaires. The main aim was to get a general information about angling places, gears and efforts. In a second part of the questionnaire, information about sea trout, salmon, cod and eel catches were collected. The total estimate received of sea trout caught in the recreational fishery was deemed highly unrealistic, amounting to 51 978 individuals (156 tons), and should not be used in further analyses. Sea trout angling from coast is not popular in Latvia due to an unfavourable coastline (most of the coast consists of sandy beaches, no islands or archipelagos) and ice coverage in winter. However, all landings in the Latvian "self-consumption fishery" are reported in logbooks. According to this logbook information landings of seatrout in 2018 were 1957 individuals. Additionally, according to official reports from the licensed fishery, 103 sea trout were caught. This estimate does not include angling in Daugava river (no licensing, because Daugava stock consists mainly from reared salmon and sea trout) or angling from the coast. In 2019 recreational coastal (1277), recreational offshore (10) and river angling (172) landed 1459 sea trout.

In Lithuania, recreational sea trout fishing is mainly conducted in rivers. Since 2015, recreational (anglers) sea trout catches are estimated by an online survey, a face-to-face interview survey, and individual interviews and catch reporting with diaries of selected anglers and experts. CPUE data (ind/person/day) is estimated from survey data, and combined with number of licences sold to anglers to calculate the total catch. In 2015, the online survey, face-to-face interview survey, and individual angler interviews were conducted, whereas in 2016 and 2017 only online surveys were carried out.

A pilot study in Poland initiated in 2017, relating to marine salmon and sea trout recreational fisheries, was continued in 2018. Trolling boats have been observed in ten harbours with particular focus on the Hel, Gdynia, Gdańsk Górki Zachodnie and Kołobrzeg harbors. A total of 136 trolling boats were inventoried in 2018. Number of active trolling boats varied between the autumn/winter (76–89) and spring (55–101) seasons with a higher number of trolling boats in spring. At this time, there is no reliable information on how CPUE (expressed as a number of fish per boat per day) depends on season and total number of trolling operations (boat-days) per year. Trolling catch estimates for 2018 yielded 2092 landed (retained) and 84 released salmon (below minimum landing size fish). More detailed data will be provided in 2020, and it is planned to update catch data for 2017–2019 based on obtained results.

A pilot study of estimation of Polish river recreational catches has begun in 2017 and was continued in 2018 and 2019. According to results for four rivers, Slupia, Rega, Ina and Parseta, average catch, based on catch records, in years 2013–2017 was 140, 274 , 295 sea trout, and 458 in the years 2017–2018 for Parsęta. Salmon average catches were very low and reached respectively in same years 7, 2, 1 salmon and 4 in Parseta. Results from on-site surveys performed in 2017–2019 show that the average catch per angler ranged from 0.9 sea trout (2016–2017) to 2.7 in (2018–2019). It was also observed that these values were higher for the Parsęta river compared to Słupia, Rega and Ina. In the analysed period, there were 17 to 40 fishing occasions per respondent. The vast majority of surveys were for local anglers. According to the questionnaire, half of the surveyed anglers prefer catch and release method. It has also been shown that periods of intensity of sea trout fishing can vary significantly between rivers. In the Ina River, the main fishing season is winter, while the rest of the fishing season is spread over time with peak just before spawning.

There are 8–10 rivers with similar intensity of sea trout/salmon fishing in Poland, so, taking into consideration underestimation of registers, recreational catch in Polish rivers can be roughly estimated for 40–80 specimens of salmon and 5–10 tons of sea trout yearly. As a result of pilot study a method for catches estimation on main sea trout rivers was proposed. The approach based on catch records corrected by results from *on site* surveys.

In Russia, sea trout is a protected species in the Baltic Sea, and recreational fishers are not allowed to target sea trout in the sea nor in rivers.

In Sweden, recreational fishery for sea trout is very popular. Since there is no commercial fishing specifically targeting the species, commercial catches are low and most catches are from recreational fisheries. A major part of the Swedish recreational catch is taken along the Baltic coast (>2400 km, including islands of Öland and Gotland), in particular by angling from shore or small boats, and from use of gillnets. Offshore recreational fisheries are in most cases done by trolling targeting salmon, with sea trout caught only occasionally. However, trolling closer to the coast targeting sea trout is starting to be popular in some areas. Swedish data on recreational sea trout river catches are almost only collected in larger salmon rivers, and therefore river catch statistics are far from complete. However, as mentioned, the largest proportion of the catch is assumed to be taken in coastal waters where no surveys specifically targeting sea trout are in place so far. Currently the best source for catch statistics comes from an annual national mail survey conducted by the Swedish Agency for Marine and Water Management (SWaM), the authority responsible for fisheries management. The survey is sent to about 17 000 randomly selected persons each year, and it collects statistics on different aspects of recreational fishing (catches, expenditures, fishing days, etc.) for all species. However, this survey can neither estimate trout catches with good precision nor on the geographic scale needed for effective management. To obtain catch statistics with better precision and finer geographic resolution, a specific survey programme needs to be developed.

5.2.3 Marking and tagging

The total number of fin-clipped sea trout released in 2019 in the Baltic Sea area was 1 341 288 smolts and 77 850 parr (Table 5.2.2.1). Fin-clipping of hatchery-reared smolts is mandatory in Sweden, Finland and Estonia. The largest number of fin-clipped smolts was released in Sweden (627 663) followed by Finland (479 400). All released sea trout smolts have been fin-clipped in the Gulf of Finland since 2014 and in the Gulf of Bothnia since 2016. In Latvia 325 742 smolts were fin-clipped and released in Subdivision 28. Fin-clipping was not performed in Poland in 2019, and there was also no stocking of fin-clipped sea trout smolts in Denmark, Germany, Russia, Estonia or Lithuania. In 2019, the total number of Carlin tagged sea trout was only 2467, half of the amount in the year before. Most of the tagged trout were released in subdivisions 28 and 30–32 (Table 5.2.2.1). In addition, 4028 sea trout were tagged with T-bar (T-Anch) tags, mostly in Latvia and released in the Brasla River (4000). In addition, 28 tagged adults and kelts (post-spawners) were released in Poland (SD 25) (Table 5.2.2.1). The number of sea trout marked with passive integrated transponders (PIT) increases every year. In last year 15 467 sea trout were tagged internally; the majority was tagged by Poland and Sweden as reared smolts and released in the Vistula River (6000) in Subdivision 26 and into the Parseta River (1000 smolts and 443 adults, SD 25). In subdivisions 31 and 30, smolts tagged with PITs were stocked in rivers Umeälven (6000) and Dalälven (2000) (Table 5.2.2.1). In Finland 511 300 eyed egg and fry of sea trout were marked with Alizarin Red Staining solution and released in subdivisions 29–31 (Table 5.2.2.1).

5.3 Assessment of recruitment status

5.3.1 Methods

Recruitment status

The SGBALANST (ICES, 2008c; 2009b) screened available data on sea trout populations around the Baltic Sea, and proposed an assessment method (ICES, 2011). The basic method, theory and development is fully described in ICES (2011; 2012), and the slightly adjusted method applied since the assessment in 2012 is briefly summarized below, together with modifications applied in the present assessment.

Through screening of data availability, (ICES, 2008a; 2009a; 2011) it was found that only abundance of trout from electrofishing were available from all countries. Together with habitat data, trout densities are collected annually from specific sites every year in most countries. However, at the time of the screening, the number of sites was highly variable and mostly sparse in many parts of the Baltic. From a few countries, directly useable data were not available, either because there was no electrofishing programme at all, or because the information collected was not sufficiently detailed. It was also found that only little and scattered information existed on other life stages (sea migration, abundance of spawners, smolt production and survival). Likewise, information on human influence, such as sea and river catches (especially recreational ones), was sparse.

An assessment model using electrofishing data together with habitat information collected at the same sites was proposed focusing on *recruitment status* as the basic assessment tool (reference point). Recruitment status was defined as the *observed recruitment* (observed densities) relative to the *potential maximal recruitment* (maximal densities that could be expected under the given habitat conditions, i.e. the predicted densities, see below) of the individual sea trout populations.

Due to the significant climatic (e.g. temperature and precipitation) and geological differences found across the Baltic area, as well as the huge variation in stream sizes, the model proposed is constructed to take variables quantifying such differences into account. Differences in habitat qualities (suitability for trout) influence trout parr abundance, given that stock status is below carrying capacity and spawning success is not limited by environmental factors such as migration obstacles downstream to monitored sites.

To allow comparison of trout abundances between sites with different habitat quality, a submodel was used, i.e. the **Trout Habitat Score (THS)**. THS is calculated by first assigning values (scores) for the following relevant (and available) habitat parameters for 0+ trout: *average/dominating depth, water velocity, dominating substrate, stream wetted width, slope* (where available) and *shade*. Scores assigned range between 0 for sites with poor conditions and 2 for best conditions (assessed from suitability curves and in part by expert estimates; see details in ICES, 2011). THS is then calculated by addition of score values resulting in a total score that can vary between 0 (very poor conditions) and 12 (10 if *slope* is omitted) for sites with very good habitat conditions. Finally, the THS values obtained were grouped in four **Habitat Classes** ranging between 0 (poorest) and 3 (best (ICES, 2011).

The potential maximum recruitment for sites with a given habitat quality used in this year's assessment was the same as in 2015 (ICES, 2015). In calculations, observed parr abundance was transformed using Log10 (x+1) to minimize variation and improve fit to a normal distribution.

Predicted maximum densities were determined by a multiple linear regression analysis based on select sites displaying expected "optimal densities" (see Section 5.6.2. in ICES, 2015). The analysis found the variables *log (width), average annual air temperature, latitude, longitude and THS* to be significant in determining optimal densities of 0+ trout (r^2=0.5, Anova; $F_{2,254}$=51.8, p<0.001) according to the following relation:

1. Log10 (*0+optimal density*) = 0.963 - (0.906**logwidth*) + (0.045**airtemp*) - (0.037**longitude*) + (0.027**latitude*) + (*THS**0.033).

This multiple regression relation 1) was used for calculating the potential maximal densities at the individual fishing occasions, with current **Recruitment Status** 2) calculated as:

2. Recruitment status = (Observed density / Predicted maximal density) * 100.

Note that for two reasons, it is possible that single observed densities can sometimes by higher than the predicted mean, resulting in a recruitment status somewhat above 100%. First, as described above, predicted maximal densities are calculated using multiple regression based on observations that show variation around the mean. The maximum values used to assess status thus represent average densities across several sites with a given habitat quality score (THS), and individual observations may occasionally exceed the predicted (average) maximum. Second, the calculation of predicted maximal densities have not been updated since the construction of the present model in 2015, taking more recent observations into account.

Mean recruitment status was calculated for each Assessment Area (see below and Figure 5.3.2.1), each ICES subdivision (SD) and by SD and country combined. Recruitment status was calculated separately for 2019 and for the three last years (2017–2019). Assessment Areas were defined according to the below table:

Assessment area	SD
Gulf of Bothnia (GoB)	30–31
Gulf of Finland (GoF)	32
Western Baltic Sea (West)	27 & 29
Eastern Baltic Sea (East)	26 & 28
Southern Baltic Sea (South)	22–25

Concern has been raised regarding the applicability of the assessment model in the northern parts of the Baltic (which was developed using data from the more southern parts, i.e. latitude <60). Therefore, a new model approach for establishing reference values for trout 0+ from electrofishing surveys being developed within WGTRUTTA (not yet published) was here applied to calculation of recruitment status for sites north of 60° and compared to the present assessment model.

The WGTRUTTA model applies a regression (a random forest model) to describe the relationships between expected trout density at a site and available explanatory variables (e.g. latitude, distance from sea, trout habitat score, stream width and size of watershed). The expected 0+ density is estimated by identifying the point (i.e., breakpoint from a using a linear plateau model) where the cumulative distribution curve levels off. The breakpoint is used as an index for recruitment level (0+ densities) at carrying capacity, and can be calculated either for individual sites/rivers (if time-series are available) or for predefined spatial groups.

The new model for the northern Baltic region was constructed using 64 sites with >8 years of data (time-series), and used to predict reference values and calculate status for all sites in the area (for sites with and without time-series).

Recruitment trends

An indicator of **Recruitment Trend** was calculated as the bivariate correlation between annual recruitment status (see above) and sampling year (ICES, 2012), illustrated using the slope from a linear regression with 95% CI. Recruitment over time was assessed for the last five year period (2015–2019) in order to illustrate the most recent development in change of status. Only sites where a calculated status was available for all years in the last five year period were used when trends were calculated (Figure 5.3.2.2).

Both recruitment status and trend were calculated as average values for each of the following units of analysis: **Assessment Area**, **ICES** s**ubdivision** (SDs) and, where more countries have streams in one SD, for **individual countries**.

For a final assessment, the results from the above status and trend analyses were combined with additional information gathered, most markedly from fisheries and count of spawners (where available).

5.3.2 Data availability for status assessment

Information on densities of 0+ trout from 598 fishing occasions in 2019, at sites with good or intermediate water quality and without stocking, was available for calculation of recruitment status. For the trend analysis, 259 sites that had been fished continuously in the latest five years period (2015–2019) were included (Table 5.3.2.1).

The geographical distribution of fishing occasions used for evaluation of status is shown in Figure 5.3.2.1, whereas the corresponding distribution of sites for trend analysis is shown in Figure 5.3.2.2. Some new sites, previously not available electrofishing data have been included in the assessment over time. In the same way, some sites fished in 2018 were not sampled in 2019.

5.4 Data presentation

5.4.1 Trout in Gulf of Bothnia (SD 30 and 31)

Sea trout populations are found in a total of 67 Gulf of Bothnia rivers, of which 32 have wild and 35 have mixed populations (Tables 5.4.1.1 and 5.4.2.1).

The status of sea trout populations in Swedish rivers is in general considered to be uncertain. Populations are affected by human activities influencing freshwater habitats, mostly through overexploitation, damming, dredging, pollution and siltation of rivers (Table 5.4.1.2).

Average 0+ parr densities for Swedish and Finnish rivers in the area are presented in Figure 5.4.1.1. For Sweden, the densities presented in this figure are mainly from sites chosen for salmon monitoring in larger rivers, and in many cases, trout is thus absent or found in low densities. The average densities dropped after 2005, from 8–16 to 1–4 0+ parr per 100 m^2, and they have remained at this low level (Figure 5.4.1.1). The SD 30–31 electrofishing results from Finland include three rivers (Lestijoki, Isojoki, and some tributaries of Tornionjoki). Densities of 0+ parr have remained low in Lestijoki, but increased after a few years drop in Isojoki and in some Tornionjoki tributaries (Figure 5.4.1.1).

Sea trout smolt runs (trapped and estimated) in the period 2002–2019 are presented in Table 5.4.1.3. In river Tornionjoki (SD 31) smolt trapping during the whole migration period for sea trout has only been possible in some years, because the trout smolt run is earlier than for salmon, and in most years the trout smolt run is already ongoing when river conditions allow start smolt-trapping; the five annual estimates available for Tornionjoki range from about 11 000 to 23 000 sea trout smolts with maximum amount in 2019 (Table 5.4.1.3). In the two smaller SD 31 rivers, Sävarån and Rickleån, where trapping ended in 2013 and 2017, yearly production estimates have varied from ca. 200–2100 and 300–600 smolts, respectively. A screw trap has started in Isojoki (SD 30) in 2019 and a number of smolts was estimated to 7300 (Table 5.4.1.3).

The number of sea trout spawners recorded by fish counters is low in most larger 'salmon rivers' in Sweden (Figure 5.4.1.2). The average number of sea trout counted in River Kalixälven increased somewhat after 2006, from about 100 to about 200 with a maximum of 300 in 2013, 2014 and 2016, In River Byskeälven, the number decreased after 2005, from approximately 100 sea trout to very low levels (ca. 25 sea trout per year). In 2015–2016 the run again increasing in almost 300 fish followed by a decrease to 50 in 2018. From 2001, the annual number of ascending sea trout in River Vindelälven has varied within the range 25–150. However, the number increased considerably in 2015 to more than 500 fish, followed by a decrease to 200 fish in 2016 and 2017 and a new increase in 2018 to more than 400. In contrast, River Piteälven has showed a positive trend that has lasted since the beginning of the century, with 1600 sea trout spawners recorded in 2017, followed by a small decrease in 2018. In all these rivers, increase of number of entering trout was observed in 2019 (Figure 5.4.1.2).

Catches of wild sea trout in SD 30–31 have declined considerably over a long time period, possibly indicating large overall reductions in population sizes. Although catches since 2013 do not reflect actual runs, because of implemented restrictions (size and catch limits, in R. Torne a complete ban on harvest of sea trout, etc.) catches declined considerably after the late 1970s and have remained low until present. As an example, the catch in River Kalixälven dropped to zero in 2017

(Figure 5.4.1.3). In 2019, the overall catch of wild sea trout from sport fishing in Swedish SD 31 after some years with decreasing trend, increased. Catch in SD 30 increased too (Figure 5.4.1.4).

Returns from Carlin tagged sea trout have showed a rapid decrease since the 1990s, and after 2003, the average return rate has been below 1% (Figure 5.4.1.5). For trout tagged in Gulf of Bothnia rivers, a large and increasing proportion of the recaptures, often a majority, are caught already as post-smolts during their first year in sea. Sea trout are mainly bycatch in whitefish fisheries with gillnets and fykenets. Based on tagging data, the proportion of fish caught as undersized fish during the first sea year has been fluctuating around 50% in the last decades (Figure 5.4.1.6), and the proportional distribution of recaptures in different fishing gears has been relatively stable (Figure 5.4.1.7).

According to tagging results, the survival rate of released smolts is at present lower than the long-term average. Furthermore, tagging data show that Finnish sea trout migrate partly to the Swedish side of the Gulf of Bothnia (ICES, 2009a), whereas Swedish sea trout have been caught at the Finnish coast. There is no more recent information available.

A Bayesian mark–recapture analysis based on tagging data (Whitlock *et al*., 2017) has recently been conducted for reared sea trout in two Finnish rivers in SD 30 and 31 (Isojoki and Lestijoki, 1987–2011). The results of this study indicate substantial fishing mortality for sea trout aged three years and older from both stocks, but particularly in the case of Isojoki (Figure 5.4.1.8). Annual total fishing mortality rate estimates ranged from 1 to 3 in most years for sea trout aged 3 and older in both rivers, corresponding to harvest rates between 0.63 and 0.95. Total fishing mortality for the Isojoki stock showed a decreasing pattern over time, while the temporal pattern was fairly stable for Lestijoki sea trout. Fishing mortality was considerably higher for sea trout of age 3 compared with fish of age 2 in both stocks (Figure 5.4.1.8). A decreasing pattern of survival in the first year at sea was also estimated (results not shown). Sustained high rates of fishing mortality have likely contributed to the poor status and limited reproduction of wild sea trout stocks in the Isojoki and Lestijoki rivers (Whitlock *et al*., 2017).

5.4.2 Trout in Gulf of Finland (SD 32)

The number of streams with sea trout in Gulf of Finland was partly updated in 2018. It is now estimated that there are 100 rivers and brooks with sea trout in this region; out of these 92 have wild stocks, the rest are supported by releases (Tables 5.4.1.1 and 5.4.2.1). The situation for populations is uncertain in 36 rivers and very poor in 20 (with current smolt production below 5% of the potential).

In Estonia, sea trout populations are found in 39 rivers and brooks in the Gulf of Finland region, of which 38 have wild populations (Table 5.4.1.1). Electrofishing data from Estonian rivers show densities of up to 140 0+ parr per 100 m^2 in the 1980s. In more recent years, densities have in general been below 40 0+ parr per 100 m^2 (Figure 5.4.2.1). Estonian rivers with higher smolt production are situated in the central part of the north coast. Smolt runs in River Pirita during the period 2006–2019 have varied between around 100 and 4000, and after a three years of high amounts dropped to around 600 in 2019 (Table 5.4.1.3). The number of spawners recorded by a fish counter in this river has varied between 26 and 125 fish during 2014–2019 (Figure 5.4.2.2).

Parr densities for sea trout in the Finnish rivers in the Gulf of Finland have been highly variable, with densities varying between 0 and 82 0+ parr per 100 m^2 in the period 2001–2019, as shown in Figure 5.4.2.1.

The recapture rate of Carlin tagged sea trout in Gulf of Finland shows a continued decreasing trend for more than 20 years; in recent years, it has been close to zero (Figure 5.4.1.5). Tagging results have shown that in Finnish catches in general, about 5–10% of the tag recoveries are from

Estonia and some also from Russia. These migration patterns have been confirmed in a genetic mixed-stock analysis (Koljonen *et al*., 2014).

In Russia, wild sea trout populations are found in at least 48 rivers and brooks, including main tributaries (Tables 5.4.1.1 and 5.4.2.1). A majority of these populations are situated in rivers or streams along the Russian northern Gulf of Finland coast, but the rivers with highest smolt production are located along the south coast. In most recent years, average 0+ parr densities have in general been below ten individuals per 100 m^2 (Figure 5.4.2.1) with very high variations in some tributaries of River Luga.

The smolt run in River Luga during the period 2002–2014 varied between 2000 and 8000 wild trout smolts (Table 5.4.1.3). After increasing to a record level of 11 600 smolts in 2015, almost three times higher than the average for the total monitoring period (ca. 4000 smolts), it again decreased to 3600 in 2019. Total production in the Russian part of Gulf of Finland has been estimated to about 15 000–20 000 smolts per year. Genetic studies have shown that 6–9% of the sea trout caught along the southern Finnish coast was of Russian origin (Koljonen *et al*., 2014).

5.4.3 Trout in Main Basin (SD 22–29)

In the Main Basin, when including tributaries in larger water systems (Odra, Vistula and Nemunas), there are 396 rivers and streams with sea trout populations, out of which 321 are wild (Tables 5.4.1.1 and 5.4.2.1). However, these figures do not include Germany; the actual number of German sea trout streams/rivers has not yet been evaluated, although it has been estimated that it could be close to 90.

In Sweden, 207 sea trout rivers are found in the entire Main Basin. Out of these, 200 have wild sea trout populations whereas seven are supported by releases. In Denmark, 139 out of 173 trout rivers are wild, with a majority classified as being in good condition. In Poland, the number of populations was revised in 2018; sea trout are found in 26 rivers (whereof 12 in SD 26), mainly in Pomeranian rivers (eleven) but also in the Vistula (six) and Odra (six) systems (including the main rivers). All Polish sea trout populations but two are mixed due to supplemental stocking since many years. There are three Russian sea trout rivers flowing into the Main Basin (in the Kaliningrad Oblast). All are wild and their status is uncertain. In Lithuania, sea trout are found in 19 rivers, whereof eight belong to the Nemunas drainage basin. In eight Lithuanian rivers, there are wild populations, while the rest are supported by releases. In Latvia, sea trout populations are found in 28 rivers, about half of them wild. In Estonia, sea trout occurs in 36 rivers and brooks discharging into the Main Basin. All of them are small with wild populations.

The situation for sea trout populations in the Main Basin based on expert evaluation was partially revised in 2018, and it was found to be uncertain in 222 rivers with wild populations. Status of 25 populations (wild and mixed, including tributaries in large systems) are considered as poor with an estimated production <5% of the potential (Table 5.4.1.1 and 5.4.2.1), mainly due to habitat degradation, dam buildings and overexploitation (Tables 5.4.1.2 and 5.4.3.1).

Main Basin East (SD 26 and 28)

In Latvia, average densities of 0+ parr have varied from 3–16 per 100 m^2 with increase during the last three years (Figure 5.4.3.1). In Salaca estimated smolt numbers from smolt-trapping have varied between 2500 and 19 000 in the period 2002–2016. In 2017 and 2018, it dropped to below 6000 and in 2019 even to around 3000 (Table 5.4.1.3). Estimated smolt production in 2018 for all Latvian rivers combined was about 20 600 smolts, far below the last five-year average which was around 50 000.

In Lithuania, average parr densities for 0+ trout have varied from five to 14 individuals per 100 m^2 (Figure 5.4.3.1). The estimated total natural smolt production in 2019 was 62 800, much more than in 2018.

In Poland, average densities of 0+ parr in SD 26 rivers have been generally high but variable, with densities of up to more than 90 individuals per 100 m^2 in some years. After four years (2013–2016) with high (70–90) and stable densities, the average 0+ density dropped to level of 30–50 lately (Figure 5.4.3.1). Number of adult sea trout migrating upstream recorded by an electronic counter (VAKI) in a fish-pass at the Wloclawek dam in Vistula River decreased from 1554 in 2015 to only 173 in 2017 and stay on a low level till 2019 (Figure 5.4.2.2).

Main Basin West (SD 27 and 29)

Average 0+ parr densities in western Estonian rivers (SD 29) have increased during the 20th century, from close to zero to almost 50 per 100 m^2 in 2018; they are monitored every second year (Figure 5.4.3.2). In Swedish river Emån, the average parr density decreased from above 40 to close to 0 in 1990s and has been varying between one and 15 in 20th century. Nominal (landed) river catches of sea trout in Emån are presented in Figure 5.4.1.4. The sport fishing harvest of sea trout in Emån has been declining, and in 2019, it was only nine fish. However, since catch and release is not included, this does not give a correct picture of the total catch.

Main Basin South (SD 22-25)

Average parr densities in southern Swedish river Mörrumsån have been seven in average since the mid-1990s, although it increased to 20 in 2017 and dropped to four in 2019 (Figure 5.4.3.4). Results from smolt trapping shows that the production in the upper half of the river (the smolt trap is located approximately 11 km from the outlet) has varied between 2100 and 10 200 smolts during the last ten years, with the smallest number seen in 2019 (Table 5.4.1.3). Number of spawners recorded in River Mörrumsån has been decreasing since 2012, when it was more than 1000; only 118 fish were counted in 2018, although the counter was not operated during the whole season and didn’t work also in 2019 (Figure 5.4.2.2). The sport fishing harvest of sea trout has declined markedly in the past decade; in 2019, it was 33 fish (Figure 5.4.1.4). However, since catch and release is not included, this does not give a correct picture of the total catch in Mörrumsån.

The total number of wild sea trout smolts produced in Danish rivers (SD 22–25) is at present estimated to around 493 000 per year. In most previous years, electrofishing data from Danish streams have showed average parr densities between 50 and 200 0+ per 100 m^2, after few years’ decrease increased in 2019 back to almost 100 (Figure 5.4.3.4). Annual smolt migration in one stream on the Island of Bornholm (Læså, length 17 km, productive area 2.46 ha) was on average 6300 individuals in the period 2007–2013; however, with very high variation among years (1687–16 138), probably due to varying water levels (Table 5.4.1.3). Smolt-trapping in Læså has not continued after 2013.

Information on densities of 0+ trout from 598 fishing occasions in 2019, at sites with good or intermediate water quality and without stocking, was available for calculation of recruitment status. For the trend analysis, 259 sites that had been fished continuously in the latest five year period (2015–2019) were included (Table 5.3.2.1).

The average parr abundance in Germany has been decreasing from 68 in 2014 to 16 in 2018 and even four in 2019 (Figure 5.4.3.4), but the set of electrofished sites has been changed in every year. Spawners numbers in 2019 have been collected by video counting in six German streams in SD 22 and 24 with wild populations. In four streams there were no or only a few fish. In Peezer Bach (SD 24) number of spawners was around 400, close to the last few years, and in Hellbach (SD 22) almost 1400, much more than in 2018 but close to years 2016 and 2017 (Figure 5.4.2.2).

Since spawning season 2011, an increasing number of fungal infected sea trout have been reported from the Trave River, the largest Baltic Sea discharging river in German Schleswig-Holstein. As a consequence, project-based research (2017–2019) on the health status of sea trout in the Trave has been launched.

Average densities of 0+ parr on spawning sites in Polish rivers in SD 25 have shown a decreasing trend, from 114 in 2004 to 32 in 2018 and 2019 (Figure 5.4.3.4). Spawning runs have been monitored by fish counting in the Slupia River since 2006 and till 2013 was varying between 3500 and 7500 fish, then dropped below 400 in 2017 and increased in two last year to around 2000 in 2019 (Figure 5.4.2.2). Severe disease problems have occurred in all Polish Pomeranian sea trout rivers since 2007. The affected sea trout display UDN-like skin damages followed by fungal infections, high mortality and lack of kelts. In 2019, it was observed in most of rivers, also between fresh, silver fish entering river in a spring.

In summary, parr densities in southwestern Baltic rivers (SD 22–25) demonstrate a decreasing trend during the last three years. Notably, the observed numbers of spawners in some southern Baltic rivers are higher than in larger northern ones, even if some of these southern rivers are very small. In most rivers with spawner counts, the time-series (number of years) still do not allow evaluations of long-term trends. However, in almost all monitored rivers spawner counts in 2019 were better than in 2018 (Figure 5.4.2.2).

5.5 Recruitment status and trends

Results from the updated analyses of recruitment status and trends for sea trout in rivers and streams around the Baltic Sea are shown in Figures 5.5.1 to 5.5.6.

5.5.1 Recruitment status

In the **Gulf of Bothnia** assessment area (SD 30–31) the recruitment status is on average just approx. 60% (Figures 5.5.1 to 5.5.3). Status in SD 31 is slightly better in Finland compared to in Sweden (Figure 5.5.3), but the difference is not significant. The drop in status is also illustrated when comparing status for just 2019 with the three-year average (2017–2019). The reduction could be caused by a reduction in the number of sites available for assessment.

In the **Gulf of Finland** assessment area (SD 32) the overall status is good (Figure 5.5.1). While the level is about the same in Estonia and Finland, status is considerably lower in Russia compared to last year. The change is in part due to a change in sites with available information from this country (Figure 5.5.3).

In assessment area **East** (SD 26 and 28; Figure 5.3.2.1) the overall status is relatively low (just under approximately 60%) but a bit higher in 2019 compared to the three-year average. The level was much higher in SD 28 compared to SD 26. (Figures 5.5.1 to 5.5.2). In SD 26, the low status is due to a large number of sites with low status in Lithuania, while status in Polish rivers is considerably better. In SD 28 status is approximately equal in the Latvia and Sweden (however with just one site in this SD) and slightly higher in Estonia three countries with streams in this SD (Estonia, Latvia, Sweden).

In assessment area **West** (SD 27 and 29; Figure 5.3.2.1) only Swedish sites were available this year (Figures 5.5.2 and 5.5.3). In this area, status is estimated as reasonably good.

In assessment area **South** (SD 22–25; Figure 5.3.2.1) overall status is low, however with large variations between both subdivisions and countries. Status is highest in SD 25, due to generally good status in Poland. In SD 24, the overall low status is mainly due to low status in Germany. In SD 23 (where only Swedish sites are available) status is good, after being low in last year's assessment. In SD 22, status was low in Germany and good in the two Danish sites in this area (Figure 5.5.3).

Recruitment status for year 2019 compared to an average computed for the three-year period 2017–2019 shows differences in some assessment units, indicating interannual variation. But in most comparisons, the overall situation has been relatively stable within the short time period (Figures 5.5.1 to 5.5.3).

5.5.1.1 Evaluation of assessment model in Northern rivers

The comparison of the presently used model the difference was not statistically significant when the sites where pooled into ICES areas within countries (FI SD 30: t=0.26, df=20, p=0.80; FI SD 31: t=0.06, df=28, p=0.93, FI SD 32: t=0.46, df=34, p=0.55, SE SD 30: t=0.26, df=28, p=0.80, SE SD 31: t=0.12, df=18, p=0.83). However it is planned to further develop and explore this approach.

5.5.2 Recruitment trends

The trend in the development of recruitment status on sites being fished throughout the latest five years has been negative in all assessment areas, although with confidence intervals including values larger than zero in all areas (Figure 5.5.4).

In assessment area South, where the status for 2019 was considerably lower compared to the previous three years (Figure 5.5.1), the trend (calculated from sites being fished continuously for the last five years) was considerably less negative. This was also the case in both SD 22 and 24.

The strongest negative trends were observed in assessment area West, followed by Gulf of Bothnia, more specifically in SD 31, mostly due to a negative trend on Finnish sites (Figures 5.5.4–5.5.6).

On the level of individual countries by subdivision, a significantly negative trend was observed in Latvia. Positive trend estimates were obtained only in a few countries, most markedly in Poland SD 26 (Figure 5.5.6).

5.6 Reared smolt production

Total number of reared sea trout smolts released 2019 in the Baltic Sea (SD 22–32) was 2 747 000, which is less than in last year (3 356 000) and the last ten year average. Out of this total, 1 766 000 smolts were released into the Main Basin, 875 000 into the Gulf of Bothnia and 106 000 into the Gulf of Finland (Table 5.6.1).

- In Finland, trout smolt production is mainly based on reared brood stocks supplemented by spawners caught in rivers. In the past ten years, the average number of smolts released has been 776 000. In 2019, the number of smolts was 539 000, whereof 74% were stocked into the Gulf of Bothnia and 9% into the Gulf of Finland.
- In Sweden, the number of trout smolts stocked in 2019 was 647 000, close to the average level in the last few years. A majority of the Swedish smolts were released into Gulf of Bothnia (73%).
- Estonia has stopped all sea trout releases in 2018.
- In Poland, juvenile fish are reared from spawners caught in each Pomeranian river separately but increasing part of the Vistula stocking is of reared brood stock origin. A total of 946 000 smolts were released into Polish rivers in 2019, below the ten years average of 1 107 000.
- Denmark released 322 000 smolts in 2019, much less than in 2018.

- Latvia released 220 000 smolts in 2019, less than in 2018 (309 000) but close to the last ten year average (234 000).
- Lithuania released 11 000 smolts in 2019, one-third of releases in the last few years
- Russia released 55 000 smolts in 2019 into the Gulf of Finland, less than in 2018.
- The German released 7000 smolts, half of amounts in a few last years.

In addition to direct smolt releases, trout are also released as eggs, alevins, fry and parr (Table 5.6.2). The estimated number of smolts originating from these releases of younger life stages over time ('smolt equivalents', calculated as described in Table 5.6.2) is presented in Table 5.6.3. In 2019, the estimated smolt number expected from releases of younger life stages in previous years was around 245 000, mainly in Main Basin rivers. The prediction for 2020 is approximately 153 000 smolts for the whole Baltic, of which 119 000 will migrate into the Main Basin. Total number of smolt equivalents from enhancement releases in 2019 was higher than from releases in 2018, but less than in the very beginning of the 20th century (Table 5.6.3).

5.7 Recent management changes and additional information

5.7.1 Management changes

According to the Council Regulation (EU) 2018/1628 of 30 October 2018 fixing for 2019 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2018/120 as regards certain fishing opportunities in other waters most of the sea trout in the Baltic Sea is exploited in coastal areas and therefore, it was prohibited to fish for sea trout beyond four nautical miles and to limit bycatches of sea trout to 3% of the combined catch of sea trout and salmon in order to contribute to preventing misreporting of salmon catches as sea trout catches. That regulation in combination with unfavourable weather conditions and increasing seal damage, affected with serious changes in Polish fisheries. The offshore fisheries (both catch and effort) was reduced and the issue of misreporting salmon as a sea trout dropped.

Additionally in Sweden, from 1 September 2019, new fishing regulations were introduced in SD 30 to improve the situation for coastal fish populations in this area. These regulations include a ban for fishing with nets in areas with less than 3 meters depth between 1 September and 10 June, a complete net ban between 15 October and 30 November, increase of the minimum size for sea trout from 40 to 50 cm, and a daily bag limit of one wild sea trout when fishing with sport fishing equipment or fykenets.

5.7.2 Additional information

Measures of stocking efficiency have been conducted in Poland, involving genetic parental assignment techniques. As target rivers Vistula and two Pomeranian rivers were chosen. In 2018, several hundreds of sea trout, returning to the Vistula River for reproduction, were collected and genotyped. Molecular analyses (microsatellite loci) of sea trout returning to the rivers in 2018 were used to identify descendants of fish used for artificial spawning in 2013. The genotypic parental database of spawners from 2013 included approximately 2000 brood stock fish. Genotyped farmed fish used for artificial spawning in 2013 were also a main part of the parental group in subsequent years (2014, 2015 and 2016). Analysis of parenthood, performed for fish caught in 2018 in the Vistula, indicated that 25–30% of the analysed fish originated from the brood stock spawners in 2013. In 2019, several hundreds of sea trout, returning to the Rega for reproduction, were collected and genotyped. The genotypic parental database of spawners from 2016 was composed of 429 fish used for artificial spawning in the Rega River that year. Analysis of parenthood, performed for fish caught in 2019 in the Rega, indicated that 25–30% of fish originated from the 2016 artificial spawners database (depends from computation method - exact or probability).

Trout parr otolith core strontium/calcium (Sr:Ca) ratios have been used to determine whether parr has an anadromous or resident maternal parent The study was carried out in some Estonian and Finnish short, coastal streams (ICES, 2018a).

In 2014/2015, a national probability-based telephone-diary survey was conducted aimed at providing information on the marine recreational fishery in Germany, covering also sea trout. To collect more detailed information on the recreational sea trout fishery, an additional pilot study (diary recall survey) was conducted. During this study, a bus route intercept survey was used to recruit diarists, collect biological samples (length, weight, scales, and tissue samples), and socio-economic data. The ongoing analyses aim to combine both these studies to provide a full picture of the recreational sea trout fishery in Germany. The majority of research activities was, and still is, short- or medium-term projects, mostly funded on federal state authority level or externally through angling licence funds.

For the assessment in the coming years, there is concern about data availability from Schleswig-Holstein (S-H), Germany. In S-H, information has in recent years been provided from a time-limited project. The working group was informed that this project is likely to be discontinued, resulting in a regrettable lack of information on sea trout in western Germany. In contrast, it is very positive that a new initiative should be able to provide information in future years for sea trout in Mecklenburg-Vorpommern, Germany.

5.8 Assessment result

While a positive development has been observed in more recent years (2015–2017) in many sea trout populations around most of the Baltic Sea, a general slight decline in status was observed in both 2018 and 2019. The decline is reflected both in reductions in status in many areas, and in general a negative trend in status over the past five years. The negative trend appears stronger than what is displayed in the change of status. This is likely due to the fact that more sites (and to some extent, also different sites) are available for status analysis, than are for the trend analysis. The overall final conclusion is that the change in status does not raise concern.

In spite of the overall improvement in recent years, populations in some areas are still considered to be fragile, and many uncertainties remain.

Sea trout in **Gulf of Bothnia** (SD 30 and 31) should still be considered vulnerable, and it is recommended to further reduce the fishing mortality in the fishery targeting other species, and to maintain the present restrictions. Spawner counts show a continued increase, especially in the river Pite, where it is believed to be partly a result of habitat improvements, whereas increases are modest in other rivers. However, absolute spawner numbers are still low considering the size of these northern rivers. Knowledge on parr densities is still quite limited, but in general, they seem to have improved slightly during later years compared to earlier. However, in Swedish rivers in the latest three years average densities has diminished. Overall, the recruitment status in 2019 was low in SD 31 but better in SD 30, and trends on sites electrofished during the last five years were neutral in Sweden and negative in Finland.

Sea catches were still dominated by young trout, mostly caught in bottom gillnets, although a larger part of all catches in recent years were from angling.

The restrictions in the Swedish sea fishery (gillnetting ban in shallow waters), which has now been in effect for a number of years, and a more recent complete ban of harvest of wild (not fin-clipped) sea trout in Finnish waters, is expected to contribute to a positive future development in the Gulf of Bothnia. However, the continued fishery for other species (e.g. whitefish) with fine meshed gillnets that also catch post-smolts and young sea trout is still problematic and can be expected to either limit the level of wild sea trout populations in the area, or at least delay their recovery.

The relatively high recruitment status for sea trout in Finnish SD 30 is currently based on data from only one river (Isojoki). The expert opinion, based on local knowledge, is that the assessment model currently overestimates the actual status in Isojoki. Similar opinions have also been expressed regarding Swedish Gulf of Bothnia populations.

In the **Gulf of Finland**, a positive development has been observed in Estonia, where trout populations in general seem to be in a good shape, however with a relatively low, only slightly increasing smolt run in the Pirita.

In Russia, recruitment status was approximately on the same level as in previous years. In Luga, the smolt number in 2019 was low compared to 2018, and the level of production is still very low taking the size of the river into consideration. The reason is most likely that most subpopulations in the tributaries are much below their potential levels. In Russia, illegal catch of sea trout may be one reason for the continued poor status for the populations in this area.

Recent catch restrictions for wild sea trout in Finland are expected to improve the sea survival of trout for all countries in the Gulf of Finland area. It is recommended to continue with the present management restrictions in both Finland and Estonia.

In the **Western Main Basin** (assessment area West, SD 27 and 29), data for calculation of recruitment status were only available from Sweden. In spite of low 2018 parr densities in Emån, likely due to a warm summer with low water levels, the overall recruitment status in Sweden (SD 27) declined in 2019.

In the **Eastern Main Basin** (assessment area East, SD 26 and 28) both parr densities and status are rather good in Estonia, and presently the situation does not raise concern.

In Latvia, both status and average densities increased in 2019. The increase in status is related to a low level in 2018, where streams in the western part were negatively affected by high temperatures. In spite of the negative trend the situation does not raise serious concern.

However in the eastern part of the country, populations are in some places limited by lack of suitable spawning places, in part because of siltation and overgrowth of the spawning gravel. The smolt run in Latvian river Salaca has in recent years been variable, but without signs of any significant change. Many of the sea trout streams in Latvia are highly affected by beaver activities which reduces migration opportunities. Beaver dams often also reduces water-covered habitats downstream and it can be especially devastating for smaller streams particularly in years with high temperatures.

In Lithuania (SD 26) both average densities and recruitment status are low, and the five-year trend in recruitment status is negative. Densities and status was lower in the eastern part of this country, compared to in the western part. It is believed that elevated summer temperature is the main reason for this longitudinal difference. Smolt counts are low in most rivers with trapping but higher in 2019 compared to earlier years. A possible reason for the low recruitment status is believed to be low water flows during the spawning period in recent years. In addition, it is uncertain if there are sufficient spawning possibilities in all areas. The recruitment status could also be influenced by the long distance to the sea from most spawning areas.

In Eastern Poland (SD 26), the five-year trend is positive and both densities and status are good. The situation does not raise concern in the smaller SD 26 rivers. In the river Vistula, however, in spite of heavy stocking, the number of spawners has been dramatically reduced in the last few years (Dębowski, 2018).

In the **Southern Baltic Sea** (SD 22, 23, 24 and 25) the overall recruitment status in 2019 was on approximately the same level as in 2018. Danish sea trout populations are subject to a considerable (mainly) recreational fishery, especially in the sea. In the streams, spawning possibilities are in many places still insufficient, in spite of significant restoration works in recent years. However, presently the situation does not raise concern.

No information was available from Schleswig-Holstein in Germany, where status in previous years was assessed as relatively good.

In western Poland (SD 25) recruitment status is on average unchanged, and presently it does not raise concern. The continuous decrease in count of spawners in river Slupia, is believed to be related to the cessation of stocking of smolts some years ago, and problems with intensive UDN in several years (which concerns other Pomeranian rivers also).

In Sweden (SD 25) status in the streams included is on average low, and with a negative trend. In the River Mörrum the number of smolts counted (upper part of the river only) has decreased during the last few years, being lower than what could be expected considering the size of the river.

In SD 23, only Swedish sites are available for assessment, showing on average low status. The negative trend mainly reflects high recruitment status in 2014 together with a low recruitment status in 2018 (zero catches at two of six sites, of which one was reported to be affected by draught).

5.8.1 Future development of model and data improvement

In 2017, the ICES Working Group WGTRUTTA (Working Group with the Aim to Develop Assessment Models and Establish Biological Reference Points for Sea Trout (anadromous *Salmo trutta*) Populations) was established. In 2020, the group applied for a three-year continuation, and for EU-funding to connect graduate students to the network (Innovative training network ITN). The group has gathered and summarized available sea trout data and information on life history (created a database and publications), and examined S–R relationships and modelling options. One modelling approach that has been evaluated is similar to the one currently employed in WGBAST, and based on electrofishing data. Reference points for expected fry density is estimated using breakpoints in cumulative distribution of 0+ trout, and used as a proxy for 'reference' 0+ density under the different THS scores and classes. It is expected that the outcome from this work can be used in future as a basis for development of the current sea trout assessment.

The new recruitment model it is not yet ready for replacing the one currently used in the Baltic, but is used here to evaluate the accuracy of the assessment results for the northern areas. The new model will be further adjusted to the WGBAST data (i.e. determine an appropriate set of available habitat descriptors, and determine whether status should be assessed using one single model or with region- or group-specific models). Additional site-specific information that are already available for the models includes a.o. distance to sea and catchment area.

5.8.2 Compatibility of the EU-MAP with the data needs for WGBAST

A better geographical data coverage than hitherto is still needed, with a sufficient number of electrofishing sites from typical trout streams. In spite of inclusion of several new sites in the northern areas, it is still considered relevant to have more sites in the northern parts of the Baltic, preferably with good geographic coverage. This is relevant both for the actual assessment as such, and in order to evaluate how well the application of the assessment model work in these areas. Also, in the southwest Baltic (Denmark) there is currently a lack of sites being collected annually.

The concept of the current assessment model builds on a comparison of observed densities with estimated maximum densities at sites with good conditions, no migration obstacles and no or low impact from fishing. This is largely depending on expert judgment. If an array of trout index-rivers, with counts of both smolt and returning adults, was established, it would be possible to express recruitment as a proportion of maximum density, but also as a proportion of stock biomass and smolt production (thereby provide data for any future life-history models; such work has been initiated in WGTRUTTA). Furthermore, if knowledge on the total river production area with known habitat quality (Group Trout Habitat Score), calculated total population of fry and estimates (in index rivers count) of total smolt production were available, this would provide a basis for further model development.

5.9 Recommendations

- Total population size of 0+ and older parr, as well as estimated total production of smolt should be calculated for rivers where data are available. Especially important are values for index rivers.
- Total production area available for sea trout should be provided for streams where data are available. If possible, the areas should be divided into habitat quality classes.
- Sufficient data coverage of sea trout parr densities from typical trout streams should be collected in all countries. Continued (annual) sampling from these sites for longer time periods is required.
- Sea trout index-rivers should be established to fulfil assessment requirements with respect to geographical coverage and data collection needs.
- Data on recreational sea trout catches should be consistently collected, taking into account the potentially high impact of recreational fisheries on sea trout stocks and the lack of these data in several countries.

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Table 5.1.1.1. Nominal commercial catches (in tonnes round fresh weight) of sea trout in the Baltic Sea (2001–2019). S=Sea, C=Coast and R=River.

Year	Main Basin																	Total	Gulf of Bothnia				Total	Gulf of Finland				Total	Grand	Estimated
	Denmark	Estonia	Finland		Germany	Latvia			Lithuania			Poland			Sweden			Main	Finland		Sweden		Gulf of	Estonia	Finland		Russia	Gulf of	Total	misreported
	S	C	S	C	S C	S	C	R	S	C	R	S	C	R	S	C	R	Basin	S	C	C	R	Bothnia	C	S	C	R	Finland		catch*
2001	54	2	5	14	10	1	11	0	0	2	0	486	219	11	23	2	3	844	2	54	16	44	115	8	0	17		25	984	
2002	35	5	2	8	12	0	13	0	0	2	0	539	272	53	11	2	0	954	0	49	25		74	11	0	11		23	1051	
2003	40	2	1	4	9	1	5	0	0	0	0	583	169	32	8	3	0	858	0	41	21	0	62	7	0	7		14	934	
2004	46	3	1	5	12	0	7	0	0	1	0	606	122	36	9	3	0	851	1	39	21	0	61	7	0	7		14	926	
2005	14	4	1	7	14	0	7	1	0	1	0	480	86	20	5	3	0	644	0	46	24	0	70	6	0	11		18	732	
2006	44	10	1	10	12	0	7	0	0	1	0	414	98	17	6	2	0	623	1	40	20	0	61	9	0	13		23	707	
2007	26	4	2	8	9	0	8	0	0	1	0	354	133	39	6	3	0	592	0	45	15	0	61	13	0	12		26	678	
2008	18	4	1	11	13	0	8	0	0	2	0	34	90	48	4	3	0	236	0	47	19	0	67	8	0	18		26	328	
2009	12	7	1	8	4	0	10	0	0	2	0	259	103	26	3	3	0	439	0	46	17	1	64	11	0	17		28	530	266
2010	8	5	0	6	3	0	5	0	0	2	0	343	81	30	2	3	0	489	0	37	20	1	58	11	0	10		22	568	299
2011	6	5	0	5	3	0	0	6	0	2	0	139	65	39	1	2	0	275	0	33	18	1	53	12	0	10		22	350	148
2012	11	8	0	5	18	0	4	1	0	3	0	37	74	26	0	3	0	191	0	41	18	2	61	14	0	16	0	29	281	70
2013	4	7	0	6	14	0	5	1	0	11	0	43	44	8	0	3	0	148	0	29	14	1	44	12	0	9	0	21	212	60
2014	10	5	0	6	14	0	5	1	0	5	0	21	72	28	0	3	0	170	0	22	11	0	33	10	0	7	0	17	220	54
2015	8	5	0	4	14	0	4	0	0	6	0	13	83	7	0	2	0	145	0	16	13	1	30	11	0	6	0	17	192	66
2016	1	6	0	3	12	0	5	0	0	4	0	62	86	3	0	2	0	184	0	18	10	0	29	14	0	6	0	20	232	104
2017	6	5	0	3	9	0	4	0	0	1	0	111	41	1	0	3	0	184	0	16	9	16	41	13	0	6	0	19	244	128
2018	3	7	0	1	10	0	6	1	0	0	7	179	55	3	0	2	0	274	0	13	9	0	22	10	0	6	0	16	312	170
2019	3	6	0	2	10	0	4	1	0	8	0	3	82	3	0	1	0	123	0	12	7	0	19	11	0	6	0	17	159	2

*calculated from number of misreported salmon, substracted from total catch.

Table 5.1.2.1. Nominal landed recreational catch (in tonnes round fresh weight) of sea trout in the Baltic Sea (2001–2019). S=Sea, C=Coast and R=River. N.a. data not available.

	Main Basin									Total	Gulf of Bothnia			Total	Gulf of Finland		Total	Whole of the Baltic	Grand
	Denmark	Estonia	Finland	Germany	Latvia		Lithuania	Poland	Sweden	Main	Finland	Sweden		Gulf of	Estonia	Finland	Gulf of	Finland	Total
Year	C+R	C	R	C	C	R	O+R	R	R	Basin	R	C	R	Bothnia	C+R	R	Finland	C	
2001	n.a.	n.a.	0.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.0	7.0	n.a.	n.a.	7.0	0.0	3.0	3.0	324.0	334.0
2002	n.a.	n.a.	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	2.8	3.0	6.5	0.0	38.4	44.9	0.0	2.6	2.6	116.0	166.5
2003	n.a.	n.a.	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	3.6	3.8	11.1	0.0	31.5	42.6	0.0	1.6	1.6	116.0	164.0
2004	n.a.	n.a.	0.5	n.a.	n.a.	n.a.	n.a.	n.a.	2.6	3.1	10.6	0.0	28.2	38.8	0.0	2.1	2.1	80.0	123.9
2005	n.a.	n.a.	0.5	n.a.	n.a.	n.a.	n.a.	n.a.	1.5	2.0	10.6	0.0	30.9	41.5	0.0	2.7	2.7	80.0	126.2
2006	n.a.	n.a.	0.1	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.4	5.3	0.0	32.5	37.8	0.0	3.3	3.3	187.0	229.4
2007	n.a.	n.a.	0.3	n.a.	n.a.	n.a.	n.a.	n.a.	1.3	1.6	8.2	0.0	31.5	39.6	0.0	3.1	3.1	187.0	231.3
2008	n.a.	n.a.	0.2	n.a.	n.a.	n.a.	n.a.	n.a.	2.6	2.7	8.9	0.0	39.7	48.6	0.0	2.3	2.3	163.0	216.6
2009	n.a.	n.a.	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	2.3	2.7	10.6	0.0	45.8	56.4	0.0	5.5	5.5	163.0	227.6
2010	346.0	n.a.	0.4	n.a.	0.0	0.1	n.a.	1.6	3.3	351.3	7.3	0.0	39.1	46.4	0.0	1.2	1.2	56.0	454.9
2011	224.0	n.a.	0.4	n.a.	0.0	0.0	n.a.	1.7	2.2	228.3	7.5	1.7	39.3	48.5	0.0	2.2	2.2	56.0	335.0
2012	260.0	n.a.	0.3	n.a.	0.0	0.0	n.a.	2.4	2.2	264.9	10.6	2.5	38.9	51.9	0.0	3.8	3.8	109.0	429.6
2013	301.0	1.4	0.2	n.a.	3.0	0.0	n.a.	n.a.	1.3	306.9	10.6	1.5	46.2	58.3	3.3	3.8	7.1	109.0	481.3
2014	521.0	1.5	0.3	n.a.	3.8	0.0	n.a.	n.a.	0.7	527.3	5.2	1.4	43.0	49.6	3.1	2.2	5.3	71.0	653.3
2015	395.7	1.7	0.3	151.1	2.9	0.0	n.a.	n.a.	0.6	552.3	1.7	0.0	27.6	29.3	4.6	1.0	5.6	71.0	658.2
2016	323.1	2.3	0.2	151.1	5.0	0.1	n.a.	n.a.	0.4	482.3	1.8	0.0	21.7	23.6	4.9	0.5	5.4	232.0	743.2
2017	202.7	1.9	0.3	151.1	3.7	0.0	n.a.	n.a.	0.1	359.8	3.9	0.0	15.5	19.4	4.3	0.3	4.6	232.0	615.8
2018	178.5	0.0	0.0	151.1	7.7	0.0	n.a.	n.a.	0.0	337.3	3.0	0.0	15.5	18.5	6.4	0.7	7.0	64.0	426.9
2019	60.1	3.0	0.0	151.1	0.0	0.5	5.5	n.a.	0.2	220.5	2.6	0.0	26.0	28.6	4.8	0.3	5.1	64.0	318.2

Table 5.1.3.1. Nominal catches (commercial + recreational; in tonnes round fresh weight) of sea trout in the Baltic Sea in years 1979–2000. Commercial and recreational catches after year 2000 are presented in Tables 5.1.1.1 and 5.1.2.1. S=Sea, C=Coast and R=River.

Year	Main Basin																Total	Gulf of Bothnia						Total	Gulf of Finland				Total	Grand
	Denmark[1,4]	Estonia	Finland[2]			Germany[4]	Latvia		Lithuania		Poland			Sweden[4]			Main	Finland[2]			Sweden			Gulf of	Estonia	Finland[2]			Gulf of	Total
	S + C	C	S	S + C	R	C	S + C	R	C	R	S[9]	S + C	R	S[6]	C[6]	R	Basin	S	C	R	S[6]	C[6]	R	Bothnia	C	S	C	R	Finland	
1979	3	na		10		na	na		na		na	81[3]	24	na	na	3	121		6	na	na	na	na	6	na		73	0	73	200
1980	3	na		11		na	na		na		na	48[3]	26	na	na	3	91		87	na	na	na	na	87	na		75	0	75	253
1981	6	na		51		na	5		na		na	45[3]	21	na	na	3	131		131	na	na	na	na	131	2		128	0	130	392
1982	17	na		52		1	13		na		na	80	31	na	na	3	197		134	na	na	na	na	134	4		140	0	144	475
1983	19	na		50		na	14		na		na	108	25	na	na	3	219		134	na	na	na	na	134	3		148	0	151	504
1984	29	na		66		na	9		na		na	155	30	na	na	5	294		110	na	na	na	na	110	2		211	0	213	617
1985	40	na		62		na	9		na		na	140	26	na	na	13	290		103	na	na	na	na	103	3		203	0	206	599
1986	18	na		53		na	8		na		na	91	49	7	9	8	243		118	na	1	24	na	143	2		178	0	180	566
1987	31	na		66		na	2		na		na	163	37	6	9	5	319		123	na	1	26	na	150	na		184	0	184	653
1988	28	na		99		na	8		na		na	137	33	7	12	7	331		196	na	na	44	42	282	3		287	0	290	903
1989	39	na		156		18	10		na		na	149	35	30	17	6	460		215	na	1	78	37	331	3		295	0	298	1,089
1990	48[3]	na		189		21	7		na		na	388	100	15	15	10	793		318	na	na	71	43	432	4		334	0	338	1,563
1991	48[3]	1		185		7	6		na		na	272	37	26	24	7	613		349	na	na	60	54	463	2		295	0	297	1,373
1992	27[3]	1		173		na	6		na		na	221	60	103	26	1	618		350	na	na	71	48	469	8		314	0	322	1,409
1993	59[3]	1		386		14	17		na		na	202	70	125	21	2	897		160	na	na	47	43	250	14		704[7]	0	718	1,865
1994	33[8,3]	2		384		15[8]	18		+		na	152	70	76	16	3	769		124	na	na	24	42	190	6		642	0	648	1,607
1995	69[8,3]	1		226		13	13		3		na	187	75	44	5	11	647		162	na	na	33	32	227	5		114	0	119	993
1996	71[8,3]	2		76		6	10		2		na	150	90	93	2	9	511		151	25	na	20	42	238	14		78	3	95	844
1997	53[8,3]	2		44		+	7		2		na	200	80	72	7	7	474		156	12	na	16	54	238	8		82	3	93	805
1998	60	8		103		4	7		na		208	184	76	88	3	6	747		192	12	0	9	39	252	6		150	3	159	1,158
1999	110[8,3]	2		84		9	10		1		384	126	116	51	2	3	898		248	12	0	18	41	319	8		93	3	104	1,321
2000	58	4		64		9	14		1		443	299	70	42	4	3	1,011		197	12	0	14	36	259	10		56	3	69	1,339

[1]Additional sea trout catches are included in the salmon statistics for Denmark until 1982 (table 3.1.2).

[2]Finnish catches include about 70 % non-commercial catches in 1979 - 1995, 50 % in 1996-1997, 75% in 2000-2001.

[3]Rainbow trout included.

[4]Sea trout are also caught in the Western Baltic in Sub-divisions 22 and 23 by Denmark, Germany and Sweden.

[5] Preliminary data.

[6]Catches reported by licensed fishermen and from 1985 also catches in trapnets used by nonlicensed fishermen.

[7]Finnish catches include about 85 % non-commercial catches in 1993.

[8]ICES Sub-div. 22 and 24.

[9]Catches in 1979-1997 included sea and coastal catches,since 1998 costal (C) and sea (S) catches are registered separately

na=Data not available

\+ Catch less than 1 tonne.

Table 5.1.4.1. Biological sea trout samples collected in 2019.

				Number of sampled fish by subdivision					
Country	Month (number)	Fisheries	Gear	22–28	29	30	31	32	Total
Estonia	1–12	Coastal	Gillnet					160	160
Finland	4–9	Coastal	All gears		2	18	48	27	95
Latvia	11	Coastal, River	Gillnet, trapnet	526					526
Lithuania	1-12	Coastal	All gears	23					23
Poland	1–12	Coastal, River	Gillnets, electrofishing	188					188
Germany	1-12	Coastal	Rod, nets	94					94
Sweden	6–9	River	All gears	33		244	177		454
Total									1540

Table 5.2.2.1. Adipose fin-clipped and tagged sea trout released in the Baltic Sea area in 2019.

Country	Sub-division	River	Age	Number			Tagging	Other Methods			
				fry	parr	smolt	Carlin	T-bar Anch	PIT	ARS (1)	CAL (2)
Poland	25	Leba	spawner					28			
Poland	25	Parseta	spawner						433		
Poland	25	Parseta	1yr						1,000		
Sweden	25	Lyckebyån	1yr			1,000					
Poland	26	Vistula	2yr						6,000		
Sweden	27	Stockholm various places	1yr			132,550	467				
Sweden	27	Nyköpingsån	1yr			14,000					
Sweden	27	Nyköpingsån	2yr			7,000					
Latvia	28	Venta	1yr			48,373					
Latvia	28	Gauja	1yr			41,400					
Latvia	28	Gauja	2yr			10,540					
Latvia	28	Daugava	1yr			90,155					
Latvia	28	Daugava	2yr			10,680					
Latvia	28	Salaca	2yr			11,510					
Latvia	28	Brasla	1yr			6,867		4,000			
Finland	29	Kisko-Perniönki	2yr			10,000					
Finland	29	Kisko-Perniönki	eyed egg							9,500	
Finland	29	Uskelanjoki	eyed egg							9,500	
Finland	29	Aurajoki	2yr			3,700					
Finland	29	at sea	2yr			27,200					
Finland	30	at sea	2yr			10,600					
Finland	30	Oravaistenjoki	2yr			800					
Finland	30	Lapväärtinjoki	2yr			14,200					
Finland	30	Karvianjoki	2yr			4,200					
Finland	30	Kokemäenjoki	eyed egg							28,400	
Finland	30	Kokemäenjoki	2yr			19,600					
Finland	30	Eurajoki	2yr			4,000					
Finland	30	Lapinjoki	1yr parr							3,000	
Sweden	30	Gideälven	1yr			8,199					
Sweden	30	Ångermanälven	2yr			58,505					
Sweden	30	Indalsälven	1yr			72,866					
Sweden	30	Ljungan	1yr parr		18,569						
Sweden	30	Ljungan	2yr parr		523						
Sweden	30	Ljungan	1yr			6,190					
Sweden	30	Ljungan	2yr			3,695					
Sweden	30	Ljusnan	1yr parr		2,264						
Sweden	30	Ljusnan	1yr			21,162					
Sweden	30	Ljusnan	2yr			41,166					
Sweden	30	Gavleån	2yr			200					
Sweden	30	Dalälven	1yr			22,676					
Sweden	30	Dalälven	2yr			56,249			2,040		
Finland	31	Perhojoki	2yr			7,400					
Finland	31	Perhojoki	alevin							6,300	
Finland	31	Lestijoki	2yr			20,100					
Finland	31	Lestijoki	fry							68,100	
Finland	31	Kalajoki	fry							2,000	
Finland	31	Siikajoki	2yr			1,200					
Finland	31	Oulujoki	2yr			76,900					
Finland	31	Oulujoki	1yr parr		24,900						
Finland	31	Kiiminkijoki	1yr parr		20,000						
Finland	31	Iijoki	2yr			76,000					
Finland	31	Iijoki	alevin							190,000	
Finland	31	Kemijoki	2yr			78,400					
Finland	31	Kemijoki	2yr parr		600						
Finland	31	Tornionjoki	2yr			2,100					
Finland	31	at sea	2yr			85,000					
Finland	31	Kruunupyynjoki	2yr			300					
Sweden	31	Luleälven	1yr			47,124					
Sweden	31	Luleälven	2yr			86,748	2,000				
Sweden	31	Skellefteälven	1yr			24,987					
Sweden	31	Ume/Vindelälven	1yr			11,519			1,000		
Sweden	31	Ume/Vindelälven	2yr			12,827			1,000		
Sweden	31	Ume/Vindelälven	1yr parr		9,994				3,994		
Finland	32	Summajoki	2yr			1,400					
Finland	32	Kymijoki	2yr			7,800					
Finland	32	Taasianjoki	eyed egg							36,100	
Finland	32	Koskenkylänjoki	eyed egg							39,600	
Finland	32	Ilolanjoki	eyed egg							25,300	
Finland	32	Porvoonjoki	1yr parr		1,000						
Finland	32	Porvoonjoki	eyed egg							37,400	
Finland	32	Mäntsäläjoki	eyed egg							41,800	
Finland	32	Loviisanjoki	eyed egg							14,300	
Finland	32	at sea	2yr			42,200					
Total sea trout				**-**	**77,850**	**1,341,288**	**2,467**	**4,028**	**15,467**	**511,300**	**-**

(1) ARS = Alizarin Red Staining, *single marked, released as fry, (2) CAL = calcein dye

Table 5.3.2.1. Number of fishing occasions/sites in 2019 available for assessment of trout recruitment status, distributed on ICES subdivisions (SD), and number of sites available for trend analysis (sites fishes all years 2015–2019).

	Number fishing occasions	
ICES SD	**Recruitment**	**Trend**
22	153	2
23	7	7
24	127	3
25	31	25
26	101	88
27	5	4
28	62	8
29	1	1
30	27	20
31	27	23
32	53	44
Total	**598**	**215**

Table 5.4.1.1. Status of wild and mixed sea trout populations. Partial update in 2019.

Area	Country	Potential smolt production (x1000)	Smolt production (% of potential production)									
			<5 %		5-50 %		> 50 %		Uncertain		Total	
			wild	mixed	wild	mixed	wild	mixed	wild	mixed	wild	mixed
Gulf of Bothnia	Finland	< 1									0	0
		1-10	1	3	1						2	3
		11-100*			1						1	0
		> 100									0	0
		Uncertain									0	0
	Total		1	3	2	0	0	0	0	0	3	3
	Sweden	< 1									0	0
		1-10									0	0
		11-100									0	0
		> 100									0	0
		Uncertain							25	26	25	26
	Total		0	0	0	0	0	0	25	26	25	26
Total			1	3	2	0	0	0	25	26	28	29
Gulf of Finland	Estonia	< 1	1		2		4		12		19	0
		1-10			6	1	11				17	1
		11-100					2				2	0
		> 100									0	0
		Uncertain									0	0
	Total		1	0	8	1	17	0	12	0	38	1
	Finland**	< 1	1	1							1	1
		1-10	2	2	5	0					7	2
		11-100				2					0	2
		> 100									0	0
		Uncertain									0	0
	Total		3	3	5	2	0	0	0	0	8	5
	Russia	< 1	1		3		2		2		8	0
		1-10	7		2				2		11	0
		11-100*	1	1	1						2	1
		> 100									0	0
		Uncertain							19		19	0
	Total		9	1	6	0	2	0	23	0	40	1
Total			13	4	19	3	19	0	35	0	86	7
Main Basin	Denmark	< 1	2	5	17	3	80	2			99	10
		1-10		1	5	9	34	9			39	19
		11-100			1	1		4			1	5
		> 100									0	0
		Uncertain									0	0
	Total		2	6	23	13	114	15	0	0	139	34
	Finland	< 1									0	0
		1-10									0	0
		11-100	1								1	0
		> 100									0	0
		Uncertain									0	0
	Total		1	0	0	0	0	0	0	0	1	0
	Estonia	< 1	7		4		12		5		28	0
		1-10	1		4		3				8	0
		11-100									0	0
		> 100									0	0
		Uncertain									0	0
	Total		8	0	8	0	15	0	5	0	36	0
	Latvia	< 1							6		6	0
		1-10							8	5	8	5
		11-100			1					1	1	1
		> 100									0	0
		Uncertain								7	0	7
	Total		0	0	1	0	0	0	14	13	15	13
	Lithuania	< 1			2	2	1	1			3	3
		1-10				1	1	1			1	2
		11-100				1	1				1	1
		> 100*									0	0
		Uncertain									0	0
	Total		0	0	2	4	3	2	0	0	5	6
	Poland	< 1				3	1			1	1	4
		1-10			1			1			1	1
		11-100		3		4		1			0	8
		> 100		1							0	1
		Uncertain									0	0
	Total		0	4	1	7	1	2	0	1	2	14
	Russia	< 1									0	0
		1-10									0	0
		11-100									0	0
		> 100									0	0
		Uncertain							3		3	0
	Total		0	0	0	0	0	0	3	0	3	0
	Sweden	< 1									0	0
		1-10									0	0
		11-100									0	0
		> 100									0	0
		Uncertain							200	7	200	7
	Total		0	0	0	0	0	0	200	7	200	7
Total			11	10	35	24	133	19	222	21	401	74
Grand total			25	17	56	27	152	19	282	47	515	110

* includes data from large river systems

** in 7 wild rivers it is not known if releases are carried out

Table 5.4.1.2. Factors influencing status of sea trout populations. Partial update in 2019.

Area	Country	Potential smolt production	Number of populations					
			Over exploitation	Habitat degradation	Dam building	Pollution	Other	Uncertain
Gulf of Bothnia*	Finland	< 1	0	0	0	0	0	0
		1-10	5	5	4	1	0	0
		11-100	1	1	0	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		6	6	4	1	0	0
Total			6	6	4	1	0	0
Gulf of Finland	Finland	< 1	2	2	1	0	0	0
		1-10	9	9	7	0	0	0
		11-100	2	2	1	1	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		13	13	9	1	0	0
	Russia	< 1	5	5	0	4	0	0
		1-10	11	9	2	7	0	0
		11-100	3	3	1	3	0	0
		> 100	0	0	0	0	0	0
		Uncertain	11	11	3	8	0	0
	Total		30	28	6	22	0	0
	Estonia	< 1	1	5	0	0	0	0
		1-10	6	3	1	4	0	0
		11-100	0	0	0	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		7	8	1	4	0	0
Total			50	49	16	27	0	0
Main Basin*	Finland	< 1	0	0	0	0	0	0
		1-10	0	0	0	0	2	0
		11-100	1	1	1	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		1	1	1	0	2	0
	Estonia	< 1	29	29	0	0	0	0
		1-10	6	6	1	0	0	0
		11-100	0	0	0	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		35	35	1	0	0	0
	Latvia	< 1	0	1	0	0	0	0
		1-10	5	3	3	0	2	0
		11-100	0	0	1	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		5	4	4	0	2	0
	Lithuania	< 1	0	0	0	0	0	0
		1-10	0	4	5	2	0	0
		11-100	0	1	2	1	0	0
		> 100	0	1	1	1	1	0
		Uncertain	0	0	0	0	0	0
	Total		0	6	8	4	1	0
	Poland	< 1	0	4	3	1	1	0
		1-10	0	1	2	0	0	0
		11-100	5	3	8	1	1	0
		> 100	1	1	1	1	1	0
		Uncertain	0	0	0	0	0	0
	Total		6	9	14	3	3	0
	Russia	< 1	0	0	0	0	0	0
		1-10	0	0	0	0	0	0
		11-100	0	0	0	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	3	2	0	2	0	0
	Total		3	2	0	2	0	0
	Denmark	< 1	0	51	62	0	0	0
		1-10	0	39	35	0	0	0
		11-100	0	0	0	0	0	0
		> 100	0	0	0	0	0	0
		Uncertain	0	0	0	0	0	0
	Total		0	90	97	0	0	0
Total			50	147	125	9	8	0
Grand total			106	202	145	37	8	0

* data from Sweden were unavailable

Table 5.4.1.3. Sea trout smolt estimates for the period 2002–2019.

SD	**24**	**25**	**26**	**26**	**26**	**26**	**28**	**28**	**30**	**31**	**31**	**31**	**32**	**32**	**32**	**32**
Country	DK	SE	LT	LT	LT	LT	LV	LV	FIN	SE	SE	FIN	RU	RU	EE	EE
River name	Læså	Mörrum	R. Mera	R. Mera	R. Siesartis	R. Siesartis	R. Salaca	R. Salaca	R. Isojoki	Sävarån	Rickleån	Tornionjoki	Luga	Luga	Pirita	Pirita
Method	1	2	5	6	5	6	3	4	14	7	8	9	10	11	12	13
2002			12				13100						8200			
2003			11				11000						2500			
2004			11				2500					12510	2500			
2005			0		5		7700						5000			
2006	4543		3		8		10400			510		12640	2800			
2007	2481		32		104		15200			10851			5000			
2008	16138		170		95		15800			2124		10810	2500		884	772
2009	1687	6995	11		163		16900			1848			6900		2138	1945
2010	2920	3526	3		73		19400			1232			3300		2301	2198
2011	8409	5086	584	n.d.	243	n.d.	4900			637		19420	3100		832	153
2012	8702	5517	606	33	576	40	11400			231			2000		766	740
2013	5326	10220	422	0	186	2	9600			1600			2100		1769	1429
2014	n.d.	6867	344	98	559	6	3100	265		n.d.	348	n.d.	6200	190	260	227
2015	n.d.	3612	0	226		23	12100	712		n.d.	n.d.	n.d.	11600		1020	687
2016	n.d.	5298	768	306	537	95	17500	1369		n.d.	604	17350	2600		3830	3771

SD	24	25	26	26	26	26	28	28	30	31	31	31	32	32	32	32
Country	DK	SE	LT	LT	LT	LT	LV	LV	FIN	SE	SE	FIN	RU	RU	EE	EE
River name	Læså	Mörrum	R. Mera	R. Mera	R. Siesartis	R. Siesartis	R. Salaca	R. Salaca	R. Isojoki	Sävarån	Rickleån	Tornionjoki	Luga	Luga	Pirita	Pirita
Method	1	2	5	6	5	6	3	4	14	7	8	9	10	11	12	13
2017	n.d.	3461	1866	91	676	8	5400	540		n.d.	470	n.d.	3500		2241	1410
2018	n.d.	3173	n.d.	n.d.	0	n.d.	5999	594		n.d.	n.d.	n.d.	5800		3346	3783
2019	n.d.	2126	n.d.	n.d.	n.d.	n.d.	3158	302	7300	n.d.	n.d.	23 270	3600		684	554

n.d.= no data.

1) based on smolt trap - directly counted number of smolts, varying efficiency over years due to water level (probability level data available).

2) Median values of Bayesian estimates are only for the upper part of the river!

3) estimated smolt output on the base of counted smolts and mean trap efficiency (2014=8.5%; 2015=5.9%; 2016=9.5)

4) directly counted number of smolts during trapping season

5) estimated output derived by electrofishing data. (assumed survival probabilities to smolts: 0+ --> 40%; >0+ --> 60%).

6) counted number of individuals smolts in trap. Assumed trap efficiency almost 100%

7) "simple" Peterson estimates - trap moved to river Ricklean in Year 2014

8) Trap located close to river mouth, so this is the total estimated production.

9) estimated smolt output. Trap efficiency in 2016 from efficiency for salmon smolt.

10) estimated number of smolt output based on results of floating trap-netting- 2.9% in 2016, due to high water only part of migration period covered.

11) directly counted number of smolts in trap.

12) Original estimates based on smolt trapping.

13) Estimates based on a Bayesian model *) due to high water level counts individual numbers presumably too low.

14) Partial smolt trapping (screwtrap) and mark-recapture experiments.

Table 5.4.2.1. Status of wild and mixed sea trout populations in large river systems.

Country	River (Area)	Potential smolt production (x1000)	Smolt production (% of potential production)									
			<5 %		5-50 %		> 50 %		Uncertain		Total	
			wild	mixed	wild	mixed	wild	mixed	wild	mixed	wild	mixed
Lithuania	Nemunas	< 1				2	1	1			1	3
	(Main	1-10					1	1			1	1
	Basin)	11-100				1	1				1	1
		> 100									0	0
		Uncertain									0	0
Total			0	0	0	3	3	2	0	0	3	5
Poland	Odra	< 1									0	0
	(Main	1-10				3					0	3
	Basin)	11-100		1		1					0	2
		> 100									0	0
		Uncertain									0	0
Total			0	1	0	4	0	0	0	0	0	5
Poland	Vistula	< 1									0	0
	(Main	1-10								1	0	1
	Basin)	11-100		3		1					0	4
		> 100									0	0
		Uncertain									0	0
Total			0	3	0	1	0	0	0	1	0	5
Russia	Luga	< 1	1		1						2	0
	(Gulf of	1-10	1		1						2	0
	Finland)	11-100	1			1					1	1
		> 100									0	0
		Uncertain							1		1	0
Total			3	0	2	1	0	0	1	0	6	1
Finland	Tornion-	< 1	1		1						2	0
	joki	1-10		5	1						1	5
	(Gulf of	11-100		1	1						1	1
	Bothnia)	> 100									0	0
		Uncertain									0	0
Total			1	6	3	0	0	0	0	0	4	6

Table 5.6.1. Sea trout smolt releases (x1000) into the Baltic Sea by country and subdivision in 1988–2019. Note that project based fisheries enhancement releases included.

			year																															
	country	age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Main Basin 22-29	DE	1yr																					14	14	14	13		14	15	14	15	14.8		7
		2yr																									15							
	DK	1yr	5	1	4	4	4	19	17	177	177	177	196	196	19	751	634	614	562	562	398	387	387	365	261	281	272	272	333	313	930	591	550	322
		2yr															30	30	30	30	21	9	9	2	2	2	2	2						
	EE	1yr	50	5		5																	3											
		2yr			5	6	10	10	16	28	30	32	30	32	30	32	30	23	25	2	21	20	17	21	26	21	1	5						
	FI	1yr			11				1	0		4		26		28	1		15		35	52	45	52	18	115		40	5	30	14		15	
		2yr		129	169	165	123	103	171	144	181	153	182	168	258	197	131	134	244	303	164	187	218	136	113	121	76	107	123	93	97	103	92	87
		3yr		35	16	0		26	1	8	0	13	17	25	35	34	24	9	16	16	15		8	14	4									
	LT	1yr						5	5	4	4	10											23	58	45		11	10	23	29	32	32	31	11
		2yr								3														1										
	LV	1yr	1	1	6	26	44	26	24	20	1	1	7	25		114	160	170		74	91	113	63	50	153	236	270	161	115	98	308	224	296	187
		2yr	1	4	6	7	5	2					11	29		2	10	67		116	177	112	132	65					8	69			13	33
	PL	1yr	51	85	102	2	148	140	266	483	298	492	330	138	151	211	30	16	46	322	455	188	358	434	267	132	174	243	289	328	311	546	1024	431
		2yr	857	847	498	248	376	845	523	642	821	1028	1001	924	845	733	739	804	765	843	968	1261	1021	834	1060	936	981	1046	888	619	620	651	8	515
	SE	1yr	13	9	8	19	41	18	6		4	23	19	90	7	10	108	10	116	11	131	15	76	180	129	170	118	138	207	156	183	156	144	156
		2yr	32	51	78	61	44	46	84	90	60	95	87	76	100	93	40	48	103	44	36	63	78	31	31	27	35	20	20	30	17	33	40	17
Main Basin Total			1010	1167	903	544	795	1239	1114	1600	1576	2029	1880	1730	1445	2204	1935	1925	1921	2322	2513	2406	2453	2255	2123	2052	1955	2058	2026	1779	2527	2351	2214	1766
Gulf of Bothnia 30-31	FI	1yr			9							7		1		5						33						125						
		2yr		358	579	700	716	527	525	510	663	639	483	540	462	478	503	451	305	358	477	541	608	676	426	519	472	503	493	473	405	417	458	401
		3yr		99	30	5	18	39	15	1	28	12	49	10	34	75	28	11	15	6	27	9	27	20	4	4	8	3		1	1	1	1	
	SE	1yr			19	7				6			1										40	61	55	110	197	181	219	239	253	221	221	215
		2yr	445	392	406	406	413	376	460	642	554	429	407	372	405	424	380	428	361	413	569	530	410	428	400	420	395	311	293	230	190	276	236	259
Gulf of Bothnia Total			445	848	1042	1118	1147	942	1001	1159	1244	1087	939	923	901	982	911	890	681	776	1072	1113	1086	1184	885	1052	1071	1123	1005	943	849	915	915	875
Gulf of Finland 32	EE	2yr																14	6	8	9	12	10	6	6	15	13	8	5	6	3	2.5		
	FI	1yr		5		22			4	5	15	12	13	5		38		4				11												
		2yr		191	260	249	306	312	284	342	128	228	277	386	355	372	367	290	281	190	279	247	316	291	213	239	216	242	173	132	194	178	143	51
		3yr					24	6		1	33	92	40	7	24	18	6	16														276	0	
	RU	1yr																4	3		13	95	25	10	3	7	64	44	74	36	88	81.9	84	55
		2yr																1		0								1						
Gulf of Finland Total				197	261	270	330	318	287	348	177	331	331	398	380	427	373	329	291	198	301	364	352	308	222	260	292	294	252	173	285	538	227	106
Grand Total			1455	2212	2205	1932	2272	2499	2402	3106	2997	3447	3150	3050	2726	3613	3219	3144	2893	3296	3886	3883	3890	3747	3230	2702	3318	3475	3283	2895	3660	3804	3356	2747

Table 5.6.2. Release of sea trout eggs, alevins, fry and parr into Baltic rivers in 2019. The number of smolts is added to Table 5.6.3 as enhancement.

Region	Egg	Alevin	Fry	Parr				Smolt			
				1- s old	1- y old	2- s old	3-s old	2020	2021	2022	Total
Sub-divs. 22-29	(1)	(1)	(4)	(6)	(9)	(10)	(10)				
Denmark	-	-	2,800	7,500	-	-	-	-	534	-	534
Estonia	-	-	-	-	-	-	-	-	-	-	-
Finland	-	-	-	-	600	74,000	-	11,172	-	-	11,172
Germany	-	-	650,000	-	-	-	-	-	19,500	-	19,500
Latvia	-	-	-	-	-	-	-	-	-	-	-
Poland	-	1,944,300	3,321,430	27,500	-	-	-	-	120,736	-	120,736
Sweden	-	-	61,500	-	-	-	-	-	1,845	-	1,845
Lituania	-	-	151,000	-	-	-	-	-	4,530	-	4,530
Total	-	1,944,300	4,186,730	35,000	600	74,000	-	11,172	147,145	-	158,317
Sub-divs. 30-31	(2)	(3)	(5)	(7)	(8)	(8)	(10)				
Finland	60,600	196,300	70,100	-	49,300	23,200	-	-	8,700	4,650	13,350
Sweden	451,000	-	-	9,994	28,833	523	-	-	3,523	2,855	6,377
Total	511,600	196,300	70,100	9,994	78,133	23,723	-	-	12,223	7,504	19,727
Sub-div. 32	(1)	(1)	(4)	(6)	(9)	(10)	(10)				-
Estonia	-	-	-	-	-	-	-	-	-	-	-
Finland	229,600	22,500	-	1,000	11,600	-	-	1,392	2,581	-	3,973
Russia	-	-	-	-	-	-	-	-	-	-	-
Total	229,600	22,500	-	1,000	11,600	-	-	1,392	2,581	-	3,973
Grand total Sub-divs. 24-32	741,200	2,163,100	4,256,830	45,994	90,333	97,723	-	12,564	161,949	7,504	182,017

Table 5.6.3. Estimated number of sea trout smolts originating from eggs, alevins, fry and parr releases in 2000–2019.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sub-divs. 22-29																							
Denmark	30,858	25,555	45,759	7,912	17,790	17,508	13,695	13,695	13,704	12,540	12,540	10,737	9,177	9,606	9,240	9,246	9,519	518	518	518	453	534	-
Estonia	-	-	2,100	1,200	400	1,110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Finland	440	22,670	33,965	19,550	18,735	160	-	-	-	11,445	13,815	10,350	8,100	14,375	16,260	17,787	14,349	18,313	16,141	15,990	12,264	-	-
Germany	25,500	24,900	61,200	72,240	27,240	36,900	32,550	38,400	29,640	29,910	40,800	34,500	29,400	34,650	32,700	32,580	31,860	35,874	29,550	24,129	5,250	19,500	-
Latvia	13,815	8,644	11,007	960	5,340	15,227	6,462	3,189	19,015	6,840	17,664	30,595	5,987	15,300	28,913	7,787	11,621	6,000	6,828	-	8,400	-	-
Poland	167,496	148,500	84,240	68,400	91,000	63,236	77,690	61,459	107,686	84,901	108,422	114,982	95,939	103,756	130,787	133,965	120,012	143,635	127,479	167,504	87,693	120,736	-
Sweden	13,129	39,333	42,690	5,320	29,335	2,055	27,700	4,425	1,623	2,210	898	-	2,385	1,737	2,940	3,258	1,368	1,380	2,379	2,346	2,373	1,845	-
Lituania	-	-	-	-	1,670	2,400	4,350	7,440	18,180	12,990	8,040	6,750	5,370	10,935	8,580	6,300	4,560	4,680	3,840	6,120	2,820	4,530	-
Total	251,238	269,602	280,961	175,582	191,510	138,596	162,447	128,608	189,847	160,836	202,179	207,914	156,358	190,359	229,420	210,924	193,289	210,400	173,268	216,607	119,253	147,145	-
Sub-divs. 30-31																							
Finland	54,268	80,662	26,523	42,828	36,670	1,890	31,362	11,787	22,704	29,892	32,550	46,753	39,285	25,881	22,595	18,782	12,878	12,879	21,328	16,284	15,761	11,295	4,650
Sweden	84,237	78,440	43,614	24,092	22,921	36,170	20,207	22,756	24,561	16,690	16,497	12,811	13,026	5,456	21,906	9,073	25,850	12,996	17,203	11,003	14,220	7,902	2,855
Total	138,505	159,102	70,137	66,920	59,591	38,060	51,569	34,543	47,265	46,582	49,047	59,564	52,311	31,337	44,501	27,855	38,728	25,875	38,531	27,287	29,981	19,197	7,504
Sub-div. 32																							
Estonia	-	-	-	2,412	2,532	4,407	2,100	420	-	-	1,536	2,098	6,552	9,486	3,519	840	1,020	618	-	-	-	-	-
Finland	20,910	5,500	2,049	419	340	3,429	345	11,574	8,997	4,353	5,919	5,233	291	1,747	1,632	1,050	7,716	2,409	2,722	1,384	4,529	2,581	-
Russia	3,882	3,630	7,800	200	1,630	1,281	6,690	3,924	-	312	9,381	126	3,441	1,746	3	2,910	-	-	-	-	-	-	-
Total	24,792	9,130	9,849	3,031	4,502	9,117	9,135	15,918	8,997	4,665	16,836	7,457	10,284	12,979	5,154	4,800	8,736	3,027	754	1,384	4,529	2,581	-
Grand total																							
Sub-divs.	414,535	392,476	360,947	245,533	255,603	185,773	223,151	179,069	246,108	212,083	268,061	274,935	218,953	234,675	279,075	243,578	240,753	239,301	212,554	245,278	153,762	168,923	7,504

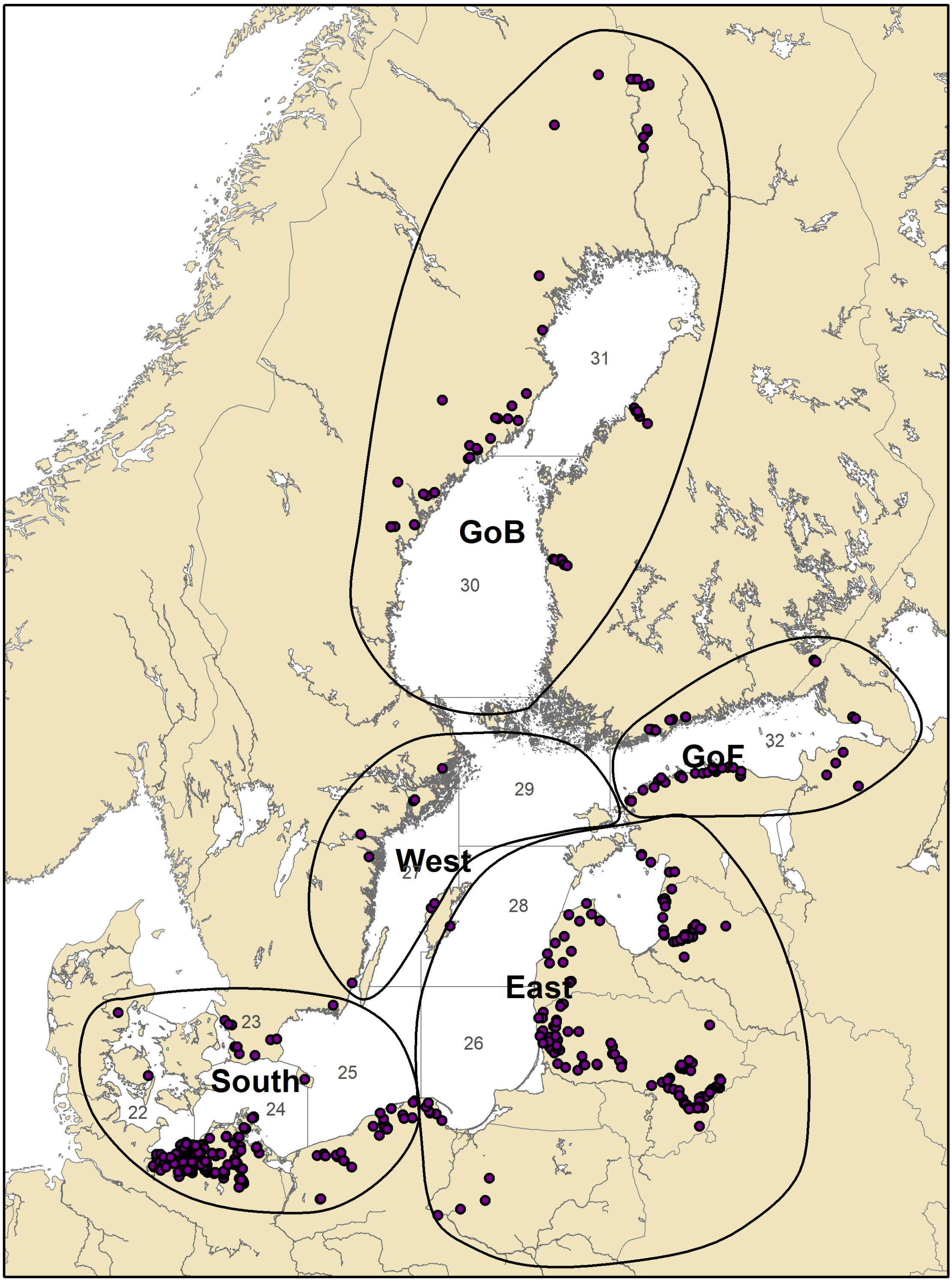

Figure 5.3.2.1. Electrofishing sites in subdivisions 22–32 used for assessment of sea trout recruitment status.

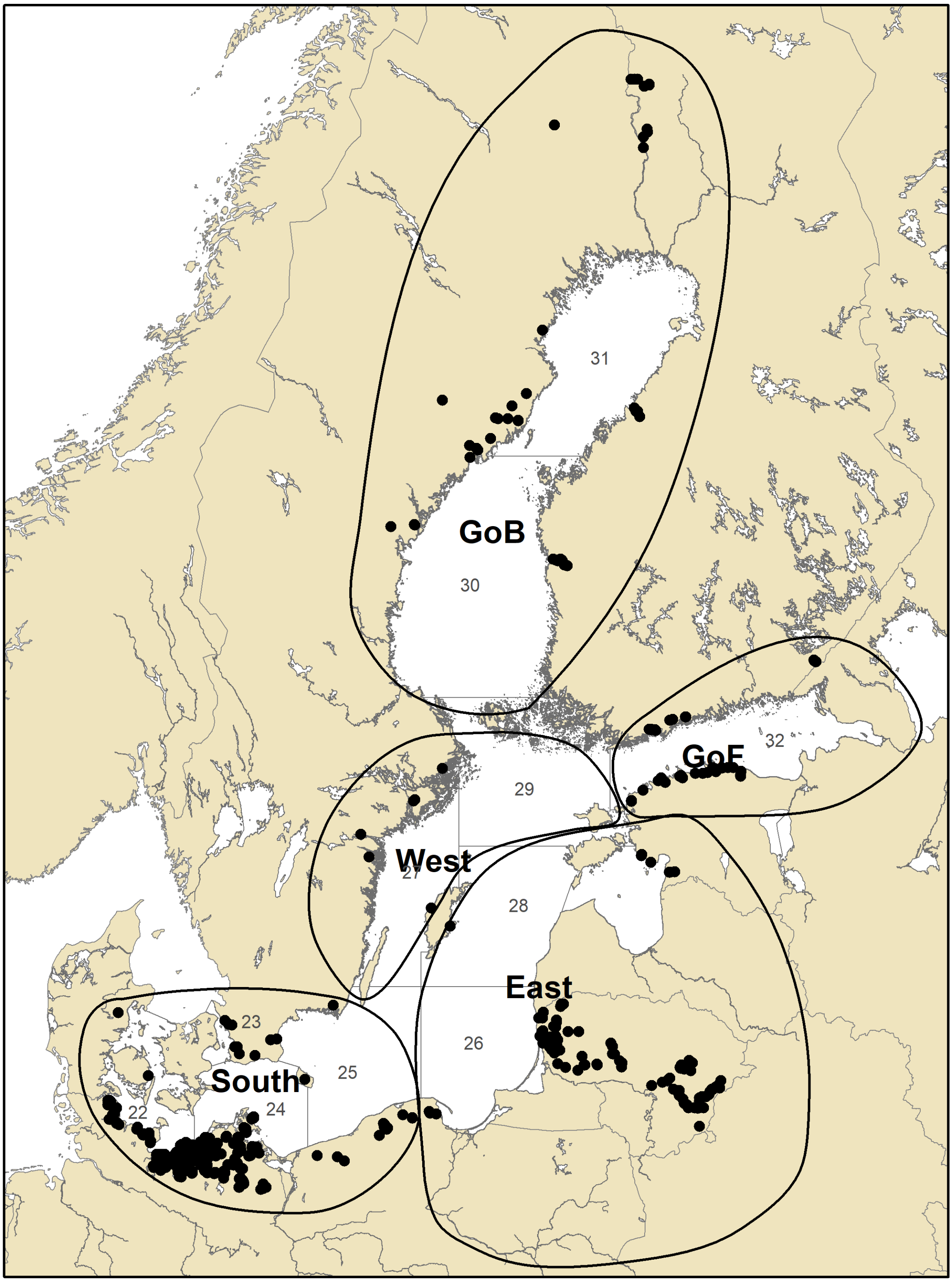

Figure 5.3.2.2. Electrofishing sites in subdivisions 22–32 used for trend analysis of sea trout recruitment status.

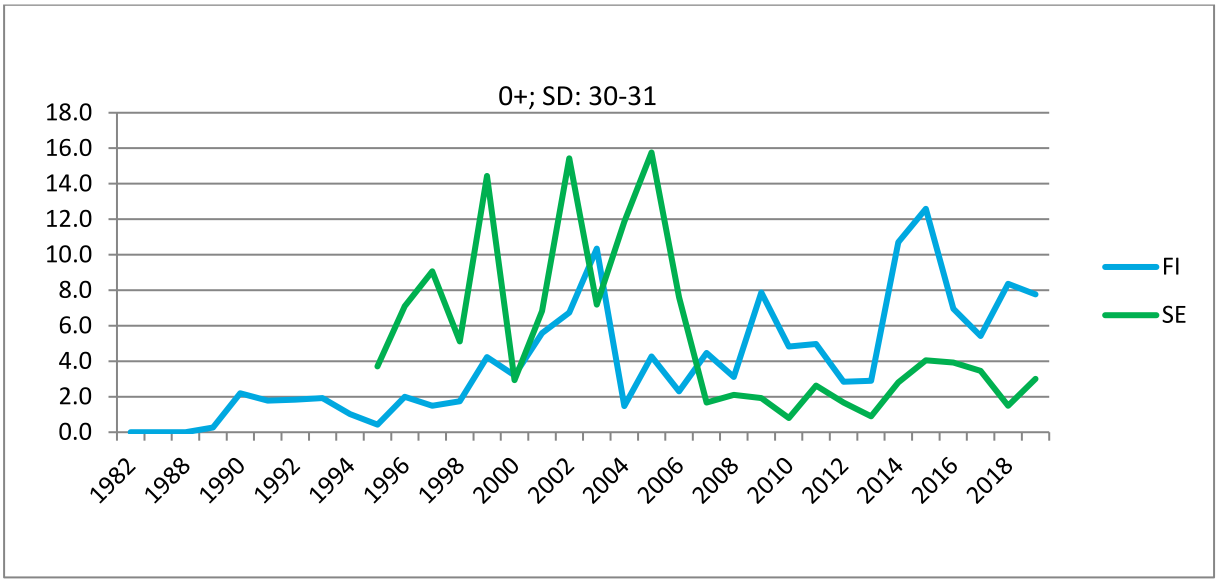

Figure 5.4.1.1. Average densities of 0+ trout in Finnish (FI) and Swedish (SE) rivers in ICES SD 30–31.

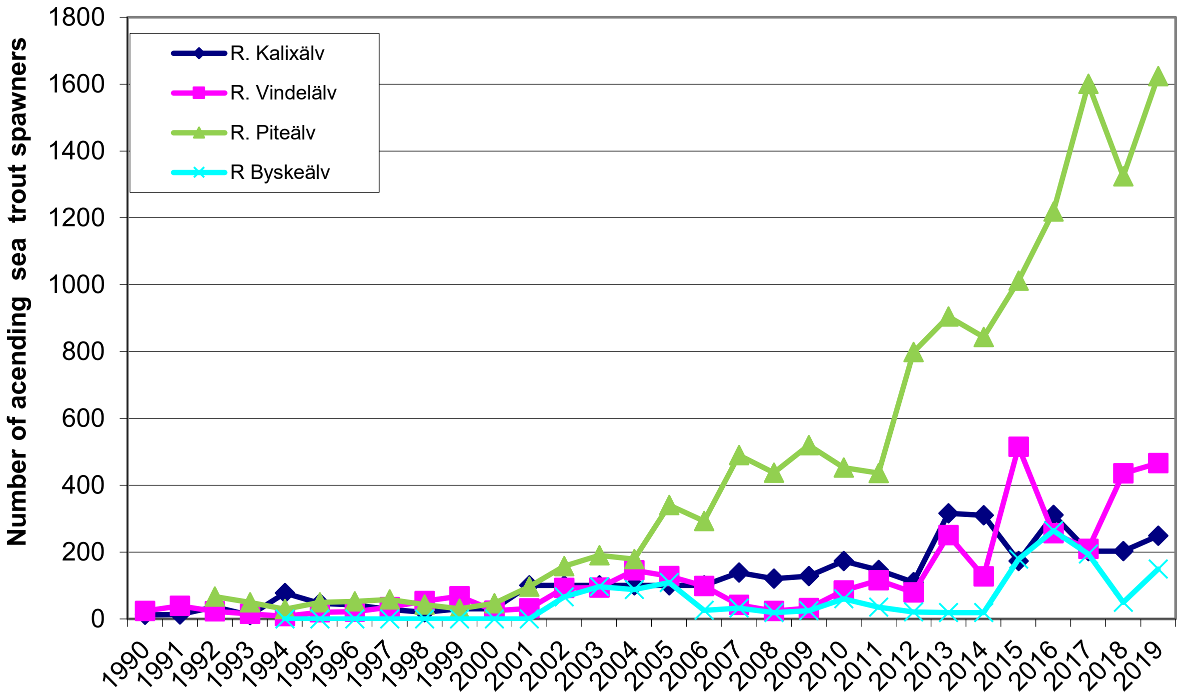

Figure 5.4.1.2. Number of ascending sea trout spawners from fish counters in four Swedish rivers debouching in the Bothnian Bay.

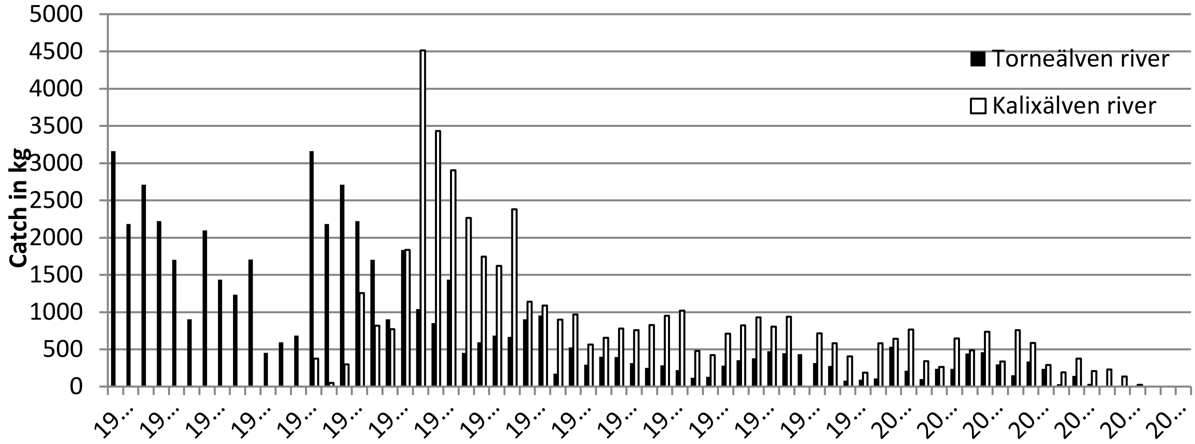

Figure 5.4.1.3. Swedish sea trout catches (landed, in kilos) in rivers Kalixälven and Torneälven (SD 31). Note that since 2013 there is a ban for landing of sea trout in Torneälven (updated for WGBAST 2020).

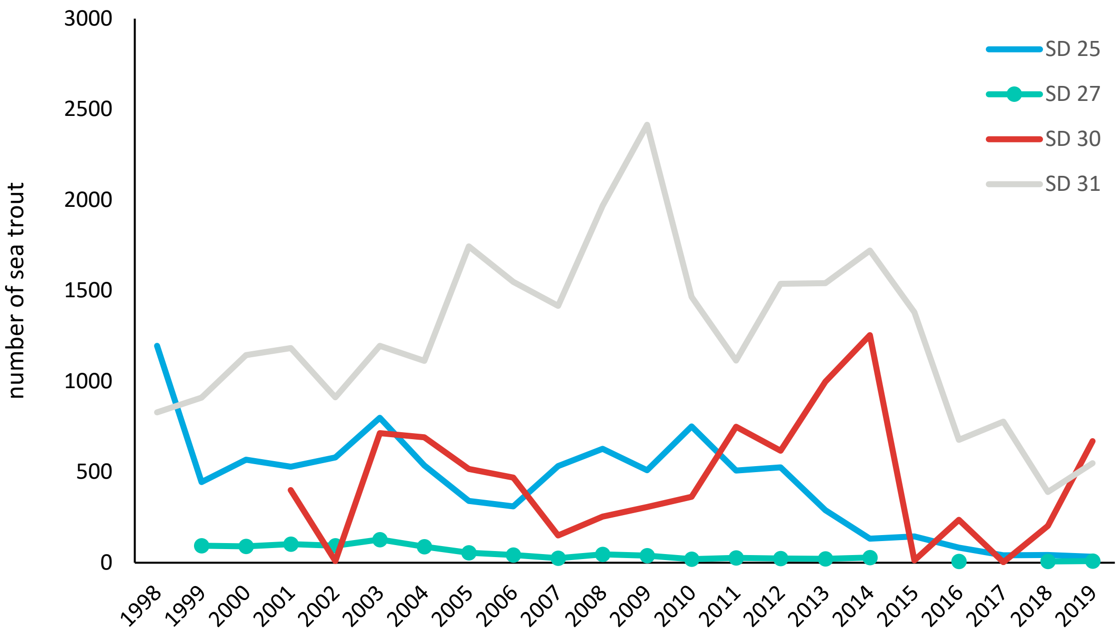

Figure 5.4.1.4. Nominal catches (in numbers) of sea trout in Swedish wild rivers (ICES SD 25, 27, 30 and 31). Only landed catches are included (no catch and release).

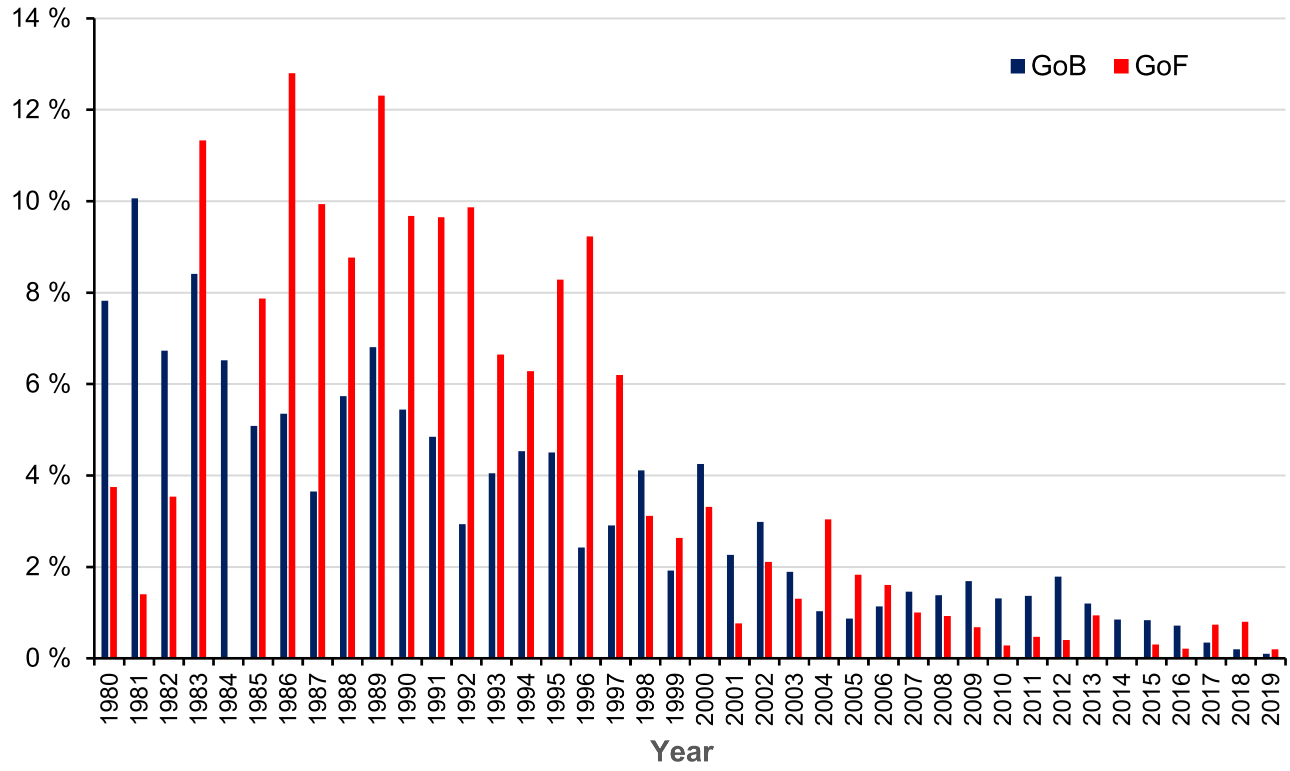

Figure 5.4.1.5. Return rates of Carlin tagged sea trout released in Gulf of Bothnia and Gulf of Finland in 1980–2018 (updated in March 2020).

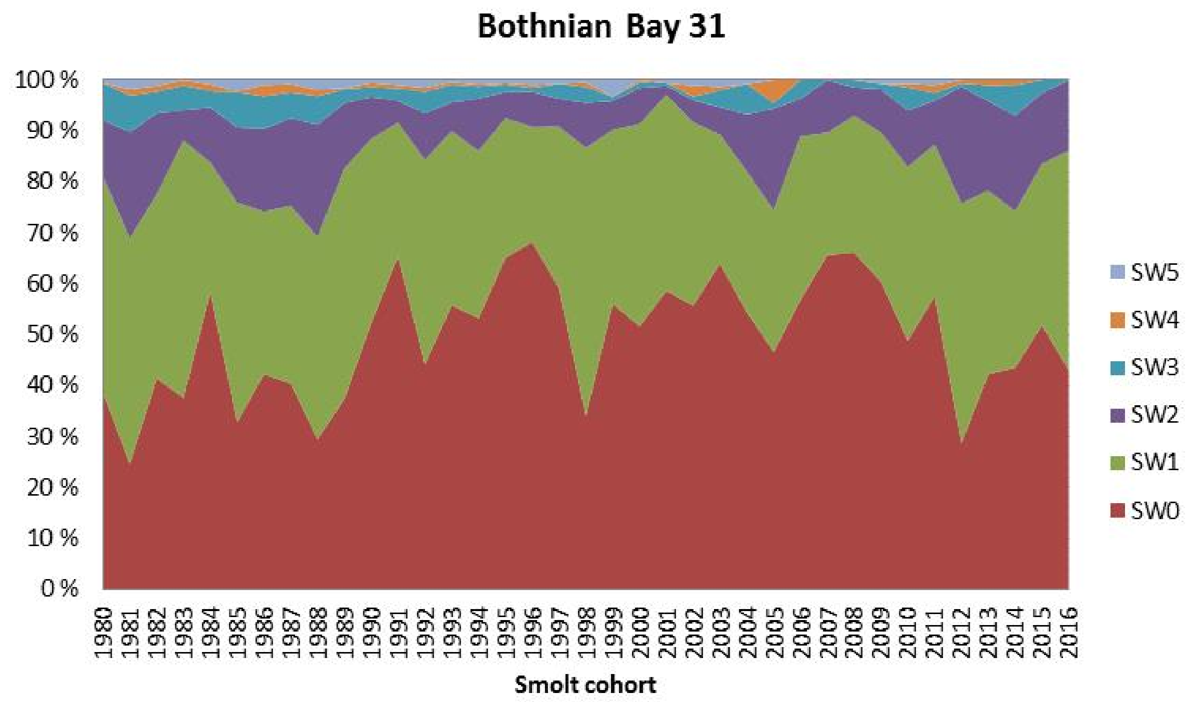

Figure 5.4.1.6. Age distribution of recaptured Carlin-tagged sea trout released in the Bothnian Bay (Subdivision 31) area in Finland, 1980–2016 (not updated for WGBAST 2020).

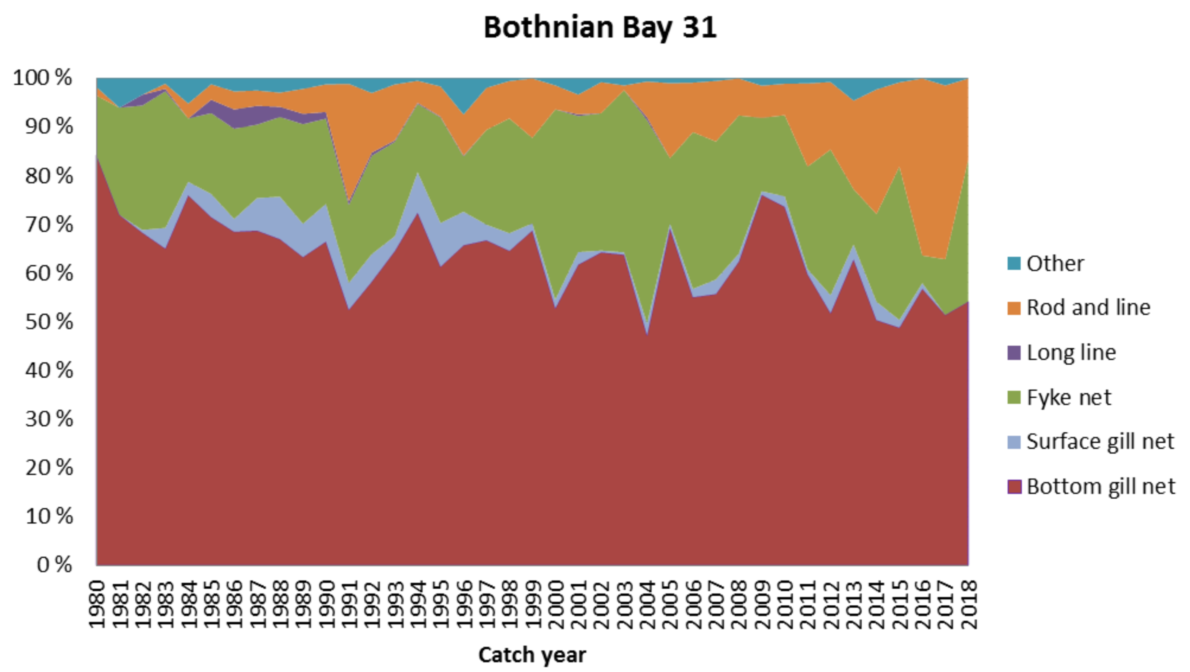

Figure 5.4.1.7. Distribution of fishing gear in recaptures of recaptured Carlin-tagged sea trout caught in the Bothnian Bay (Subdivision 31) area in Finland in 1980–2018. (not updated for WGBAST 2020).

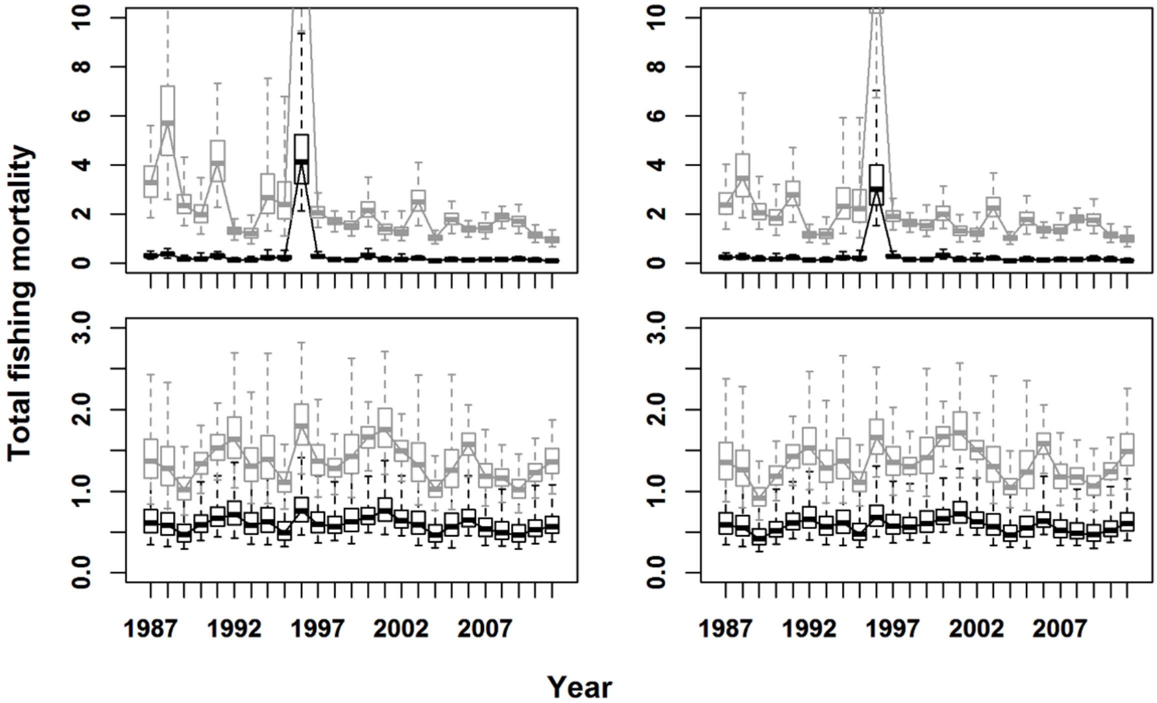

Figure 5.4.1.8. Posterior estimates of total annual instantaneous fishing mortality (F, summed over gear types/fleets) for sea trout from the Isojoki (top panels) and Lestijoki (lower panels) stocks with a time-invariant recreational tag reporting rate (left-hand panels) and time varying recreational tag reporting rate (right-hand panels). Survival from fishing =exp(-F) and harvest rate=1-exp(-F). Black boxes, age 2; grey boxes, ages 3+. The horizontal line in the center of each box denotes the median, the ends of the box denote the interquartile range and the whiskers extend to the 2.5th and 97.5th percentiles.

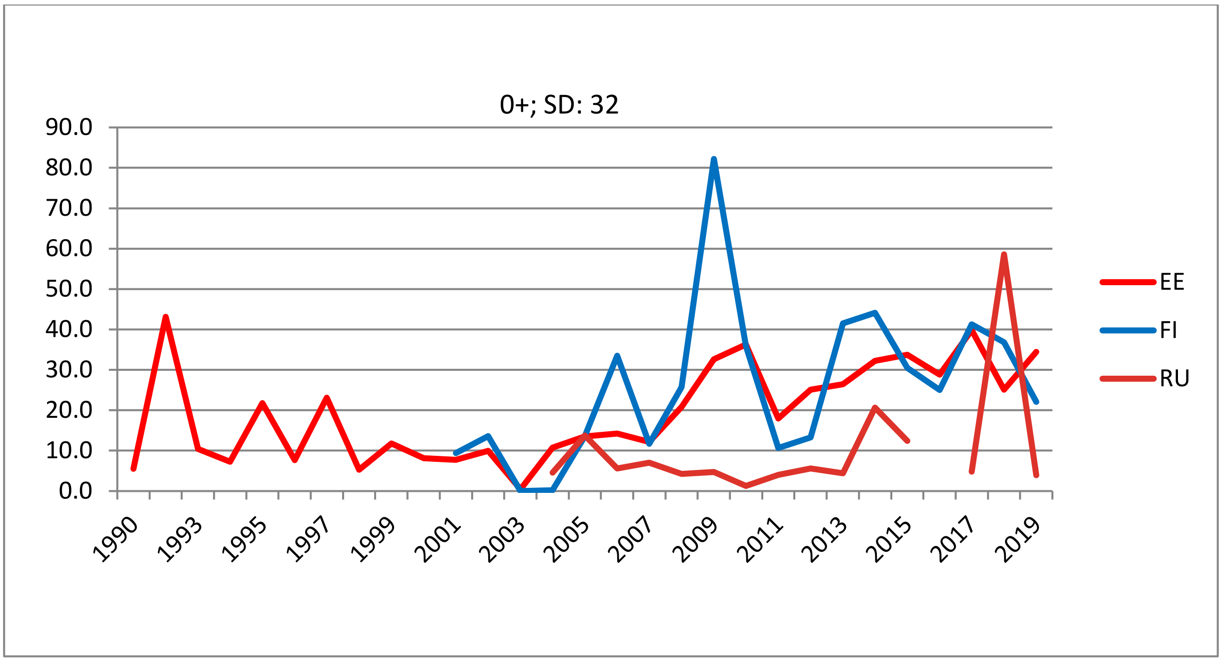

Figure 5.4.2.1. Average densities of 0+ trout in Estonian (EE), Finnish (FI) and Russian (RU) rivers in the Gulf of Finland (ICES SD 32).

Figure 5.4.2.2. Video monitoring based on spawners counts in German small river systems, partially updated for WGBAST 2020 (SD 22 and 24). Vaki counter numbers from Polish rivers (SD 25 and 26), Morrum SD 25 (in 2019 counter not operated) and Estonian Pirita River SD 32.

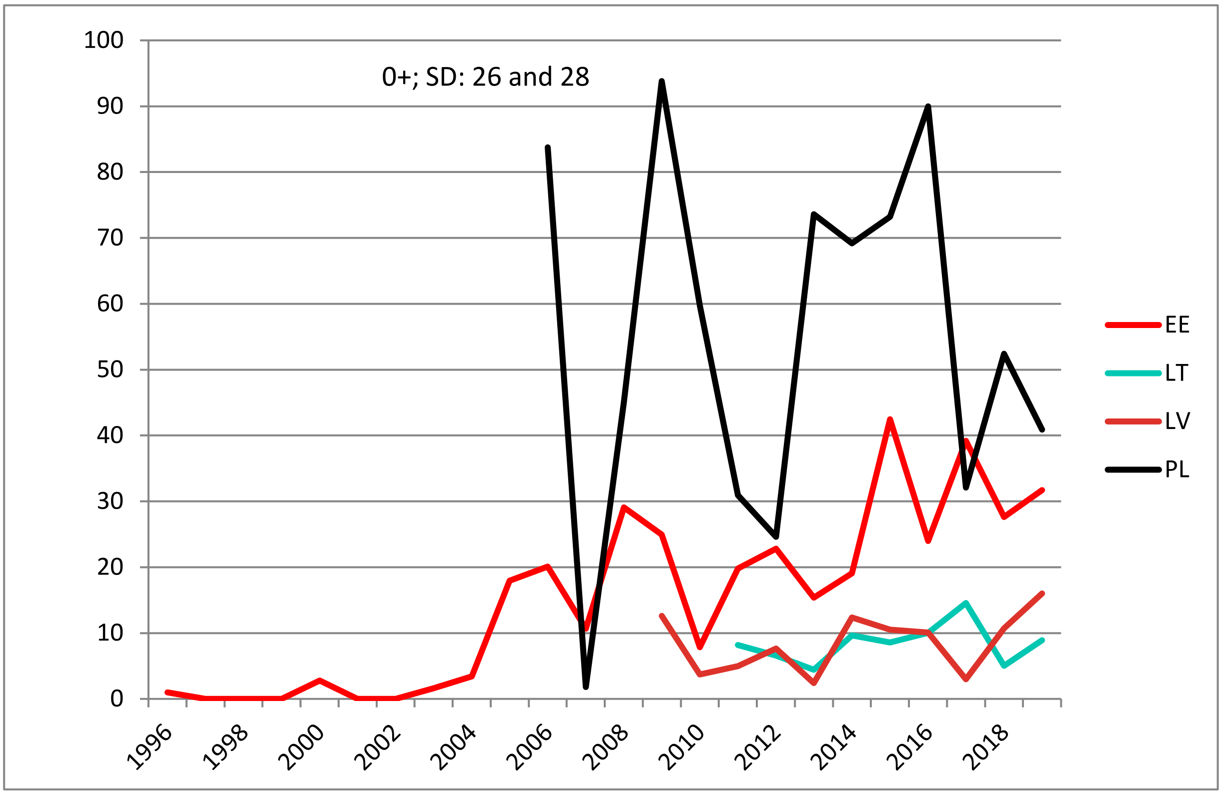

Figure 5.4.3.1. Average densities of 0+ trout in Estonian (EE), Lithuanian (LT), Latvian (LV) and Polish (PL) rivers in ICES SD 26 and 28.

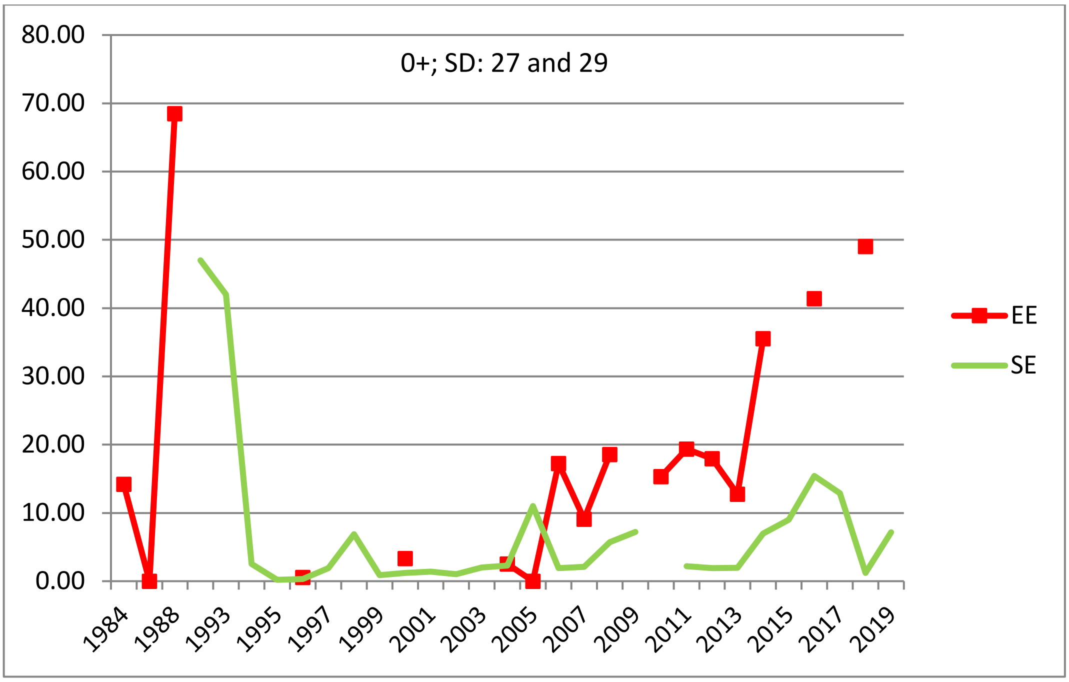

Figure 5.4.3.2. Average densities of 0+ trout in Estonian (EE) and Swedish (SE) rivers in ICES SD 27 and 29.

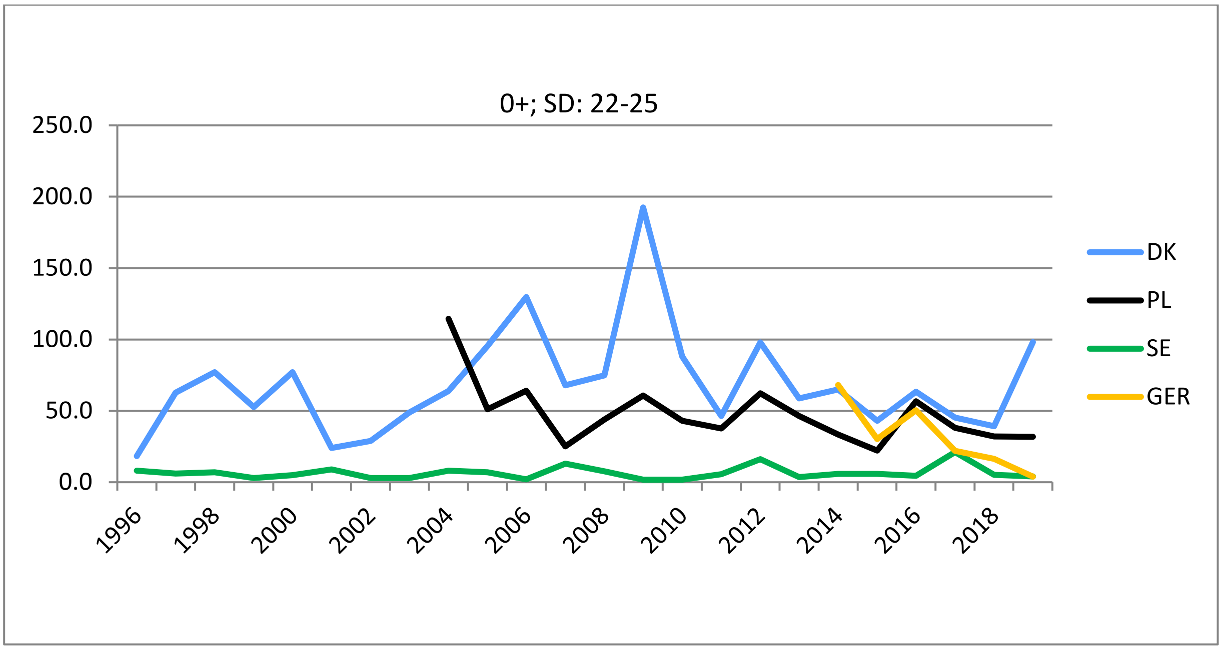

Figure 5.4.3.4. Average densities of 0+ trout in Danish (DK), Polish (PL), Swedish (SE) and German (GER) rivers in ICES SD 22–25.

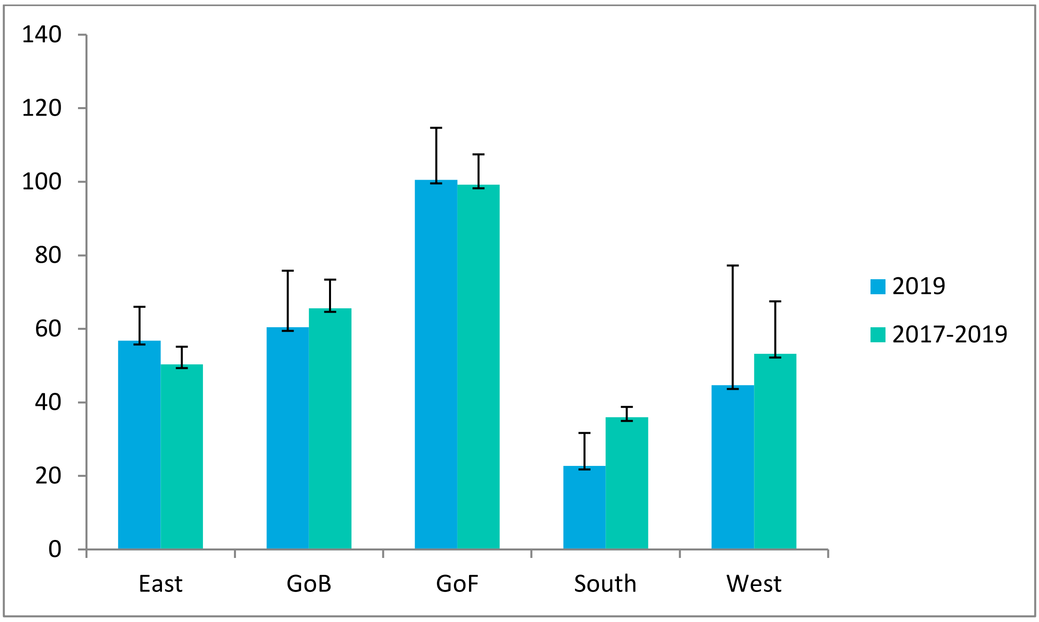

Figure 5.5.1. Recruitment status for 0+ trout by Assessment Area Division (95% CL, only positive value displayed) in 2018 and the last three years (2017–2019).

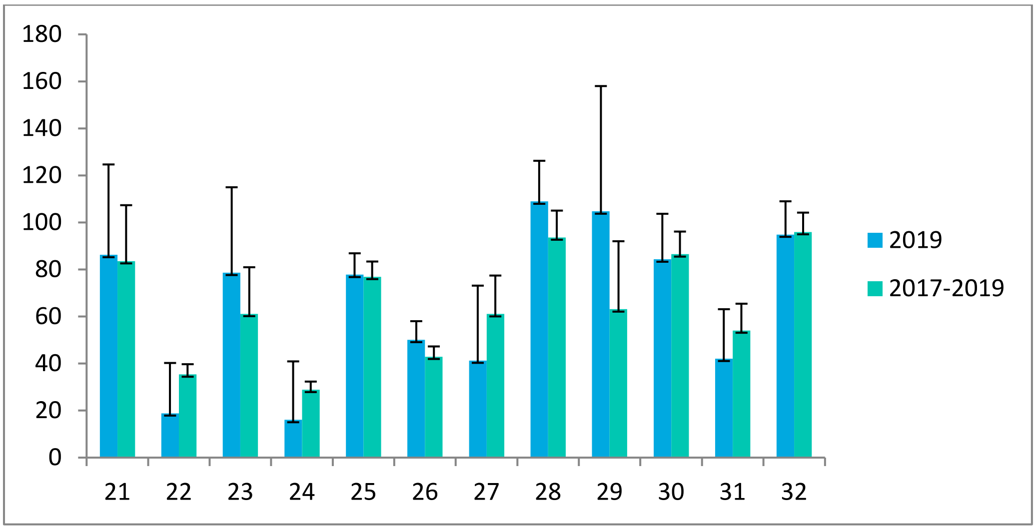

Figure 5.5.2. Recruitment status for 0+ trout by ICES SD (95% CL, only positive value displayed) in 2019 and the last three years (2017–2019).

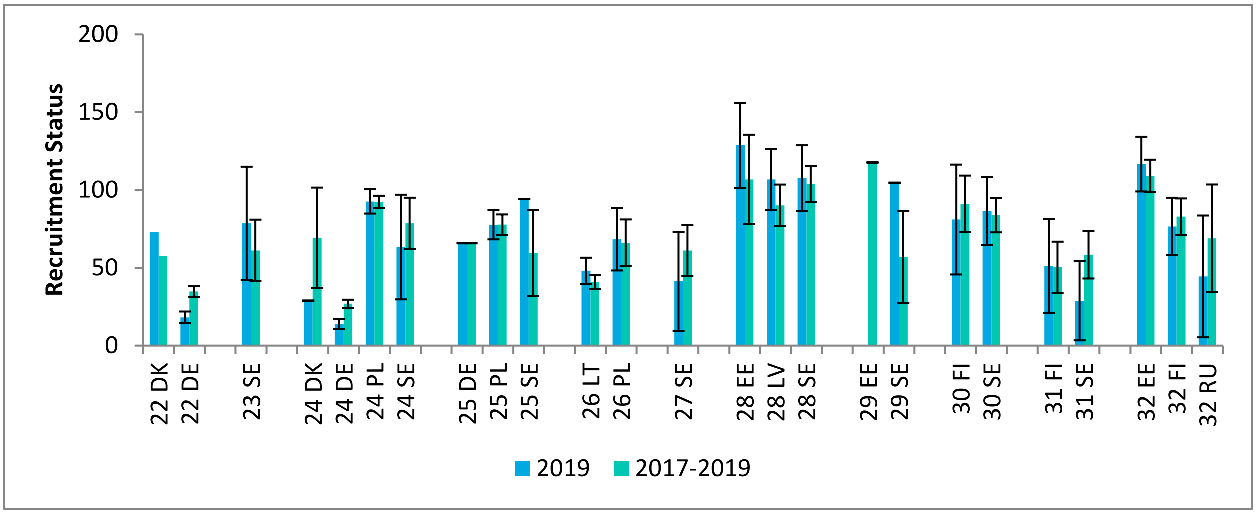

Figure 5.5.3. Recruitment status for 0+ trout by ICES SD and individual countries within SD (95% CL, only positive value displayed) in 2018 and the last three years (2016–2018). There are no CL bars year 2018 for 24 DK, PL and SE (n=1), and no data for 29 EE.

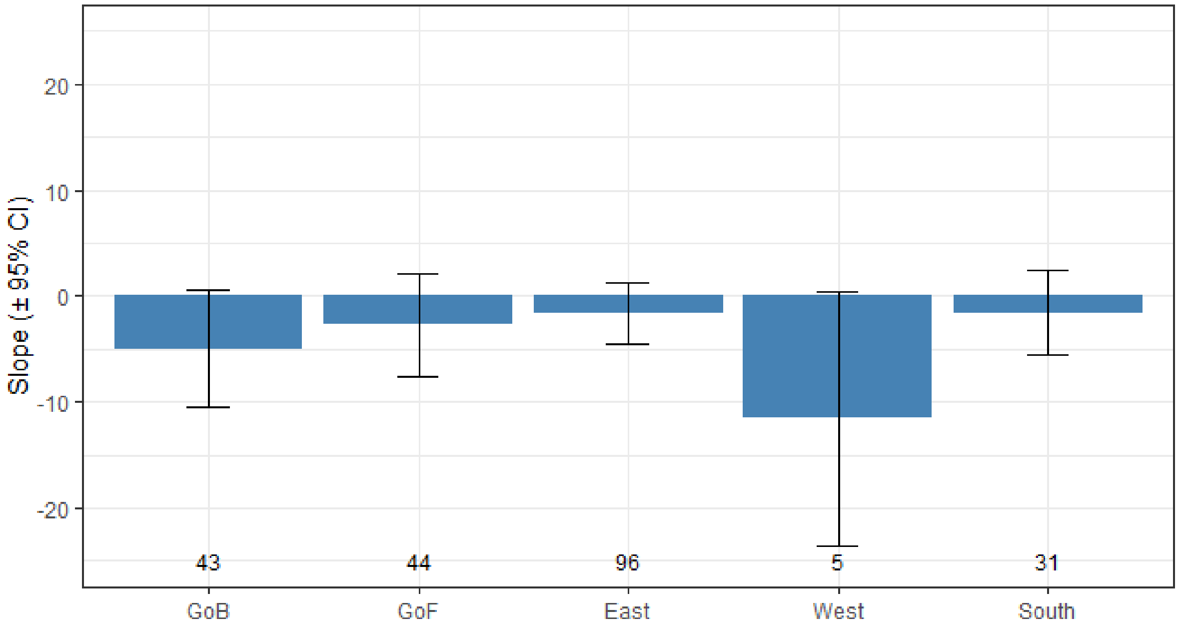

Figure 5.5.4. Trend (linear regression slope with 95% CI) in 0+ trout recruitment status in the last five years by Assessment Area Division (number of sites is denoted above the x-axis). Note that trends are calculated by assessment area and not by individual sites.

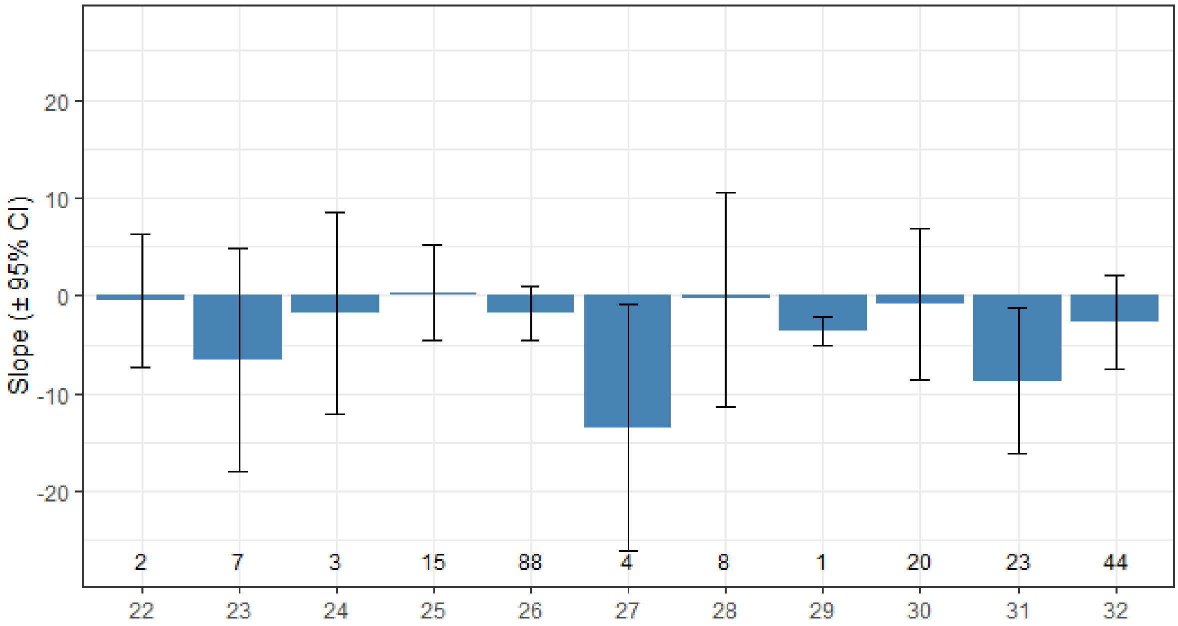

Figure 5.5.5. Trend (linear regression slope with 95% CI) in 0+ trout recruitment status in the last five years by ICES SD (number of sites is denoted above the x-axis). Note that trends are calculated by ICES SD and not by individual sites.

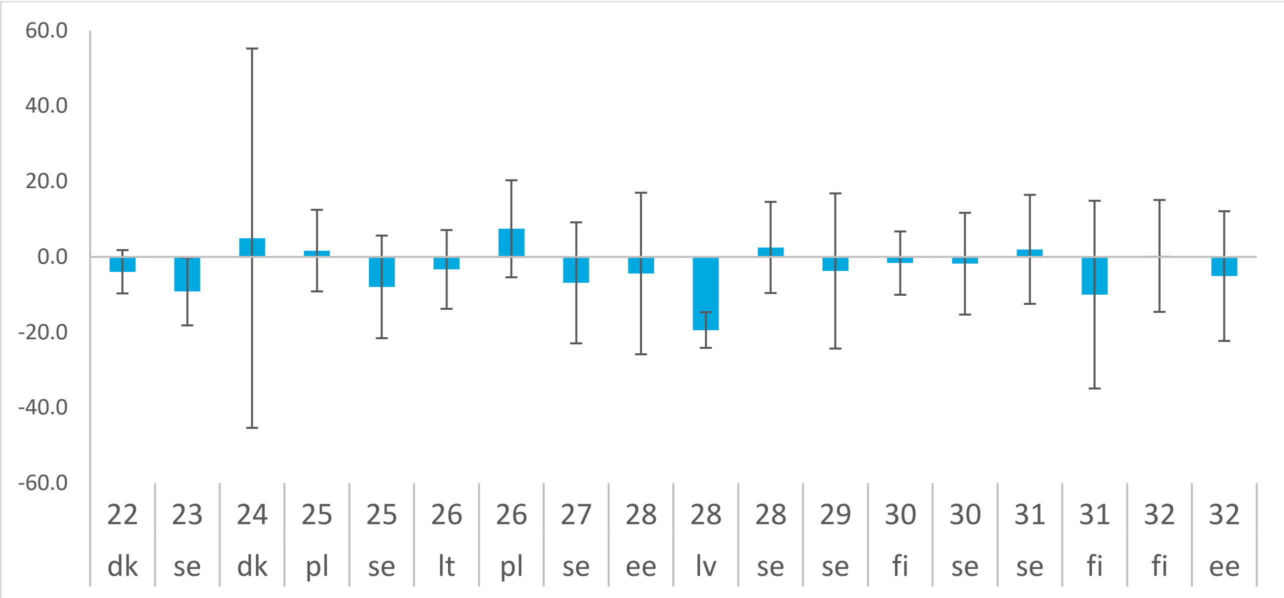

Figure 5.5.6. Trend (linear regression slope with 95% CI) in 0+ trout recruitment status in the last five years by ICES SD and individual countries (number of sites is denoted above the x-axis). Note that trends are calculated by ICES SD and country and not by individual sites.

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Annex 1: List of participants

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Annex 2: Resolution

This resolution was approved 1 October 2019

2019/2/FRSG06 The **Baltic Salmon and Trout Assessment Working Group** (WGBAST), chaired by Martin Kesler*, Estonia, will meet by correspondence 31 March–8 April 2020 to:

a) Address relevant points in the Generic ToRs for Regional and Species Working Groups;

Material and data relevant for the meeting must be available to the group on the dates specified in the 2020 ICES data call. WGBAST will report by 15 April 2020 for the attention of ACOM.

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group.

Due to the COVID-19 disruption that started early 2020, ACOM drafted a "spring 2020 approach" for recurring fishing opportunities advice. The generic Terms of Reference have been adjusted as described in the letter to ICES chairs below.

Chairs of Expert Groups

Our Ref: C.4.e/MDC/mo 13 March 2020

Subject: **Spring 2020 approach to advice production**

Dear Expert Group Chair,

I am writing this letter to keep you up to date about the approach of ACOM to the COVID-19 disruption. Many of our institutes now have travel bans and/or working from home policies. ACOM has developed a "spring 2020 approach" to this year's spring advice season. This letter covers the recurrent fishing opportunities advice. Any special request processes and non-fisheries advice will be dealt with separately. The expert groups effected are listed in Annex 1.

ACOM is encouraging all expert groups to keep working, and stick broadly to the time line, but clearly this needs to be through virtual meetings. ICES secretariat will support your efforts and make WebEx available. They will also produce a broad training document on WebEx. We know that the use of virtual meetings will result in an increased burden on the Chairs and members of the expert groups, therefore we have made changes to the generic terms of reference (see Annex 2 below) categorizing them as high, medium and low priority for this year's work. We also suggest that the expert group works virtually through smaller subgroups, and only hold larger virtual meetings when necessary.

The requesters of advice have been informed that there will be disruption/change to the delivery of advice for the spring 2020 season.

ACOM will also change the way that ICES gives advice for the spring 2020 season. There will be three types of advice:

- **Standard advice** sheet (the advice sheet following the January 2020 guidelines)
- **Abbreviated advice** sheet (a shortened advice sheet)
- **Rollover advice** (the same advice as in 2019)

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The choice of which type of advice to apply to a stock is based on criteria determined by ACOM:

a. **Standard advice** - stocks with 2020 benchmarked methods
b. **Abbreviated advice** – most stocks, including management plan and MSY advice stocks, and some Cat 3 stocks. The abbreviated advice will contain the advice of the headline advice, catch scenario tables, plots and automated tables (last years' advice will be added as an annex to each sheet). The guidance for abbreviated advice is being written now and you should receive it in a few days.
c. **Rollover advice** – same as 2019 advice. This will be provided for stocks in the following categories:
    - zero TAC has been advised in recent years and no change likely,
    - category 3 or greater roll over advice, except if due to be reviewed in 2020
    - long lived stable stocks, with no strong trends in dynamics in recent years
    - some non-standard stocks (e.g. North Atlantic salmon)

We need to consult both you and the requesters of advice about which type of advice to apply to each stock. Today the ACOM criteria are being used by the secretariat to allocate advice types to stocks. This is the first version. We would like you to consider this list and comment if you think that the allocation needs changing. Please remember that the abbreviated advice is being developed to help your processes and also the ACOM processes during the disruption. The list of allocated advice type for each stock will hopefully be sent to you today or Monday. Please reply with your comments by 19th March so that we can start the dialogue with requesters. ACOM hopes that we could have a definitive list by 25th March. (This is too late for HAWG, so we suggest that HAWG use the list compiled in cooperation with Secretariat expecting requesters of advice to agree).

ACOM is recommending that for North Sea stocks with re-opening of advice in the autumn, the stock assessments be carried out in the spring but not the forecasts (postponed until early autumn). The advice would be delivered in the autumn of 2020.

You will shortly receive the first version of the **list of advice types allocated to stocks** and the **guidelines for abbreviated advice**. Please respond by 19th March with your comments on the first version of the list.
Your professional officer has been briefed about these changes. The changes are designed to reduce both expert group and ACOM workload. Lotte, your professional officer, the ACOM leadership and the FRSG Chair are available for further explanation.

Best regards

Mark

Mark Dickey-Collas
ACOM Chair

Annex 1. Expert groups associated with 2020 spring advice season

Herring Assessment Working Group for the Area South of 62°N
Working Group on North Atlantic Salmon*
Assessment Working Group on Baltic Salmon and Trout*
Baltic Fisheries Assessment Working Group
Arctic Fisheries Working Group
Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak
North-Western Working Group
Working Group on the Biology and Assessment of Deep-sea Fisheries Resources
Working Group for the Bay of Biscay and the Iberian Waters Ecoregion
Working Group for the Celtic Seas Ecoregion
Working Group on Southern Horse Mackerel, Anchovy, and Sardine
Working Group on Elasmobranch Fishes

* These groups already have different approaches.

Annex 2. Spring 2020 adapted generic terms of reference. [Agreed by ACOM 12 March 2020]

In light of the disruptions caused by COVID-19 in 2020, the generic terms of reference for the FRSG stock assessment groups have been re-prioritised. This applies to expert groups that feed into the spring advice season process[1]. ACOM is encouraging expert groups to use virtual meetings (e.g. WebEx) and subgroups to deliver the high priority terms of reference. See letter from the ACOM Chair to expert groups.

High Priority for spring 2020 advice season

c) Conduct an assessment on the stock(s) to be addressed in 2020 using the method (analytical, forecast or trends indicators) as described in the stock annex and produce a brief report of the work carried out regarding the stock, summarising where the item is relevant. **Check the list of the stocks to be done in detail and those to roll over**.
   i) Input data and examination of data quality;
   ii) Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;
   iii) For relevant stocks (i.e., all stocks with catches in the NEAFC Regulatory Area) estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2019.
   v) The developments in spawning stock biomass, total stock biomass, fishing mortality, catches (wanted and unwanted landings and discards) using the method described in the stock annex;
   vi) The state of the stocks against relevant reference points;
   vii) Catch scenarios for next year(s) for the stocks for which ICES has been requested to provide advice on fishing opportunities;
   viii) Historical and analytical performance of the assessment and catch options with a succinct description of quality issues with these. For the analytical performance of category 1 and 2 age-structured assessment, report the mean Mohn's rho (assessment retrospective (bias) analysis) values for R, SSB and F. The WG report should include a plot of this retrospective analysis. The values should be calculated in accordance with the "Guidance for completing ToR viii) of the Generic ToRs for Regional and Species Working Groups - Retrospective bias in assessment" and reported using the ICES application for this purpose.

d) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines. Check list to confirm whether the stock requires a concise advice sheet or a traditional advice sheet.

f) Prepare the data calls for the next year update assessment and for planned data evaluation workshops;

j) Audit all data and methods used to produce stock assessments and projections.

[1] These do not apply to Assessment Working Group on Baltic Salmon and Trout and Working Group on North Atlantic Salmon.

Medium Priority for spring 2020 advice season

a) Consider and comment on Ecosystem and Fisheries overviews where available;

b) For the aim of providing input for the Fisheries Overviews, consider and comment for the fisheries relevant to the working group on:
   i) descriptions of ecosystem impacts of fisheries
   ii) descriptions of developments and recent changes to the fisheries
   iii) mixed fisheries considerations, and
   iv) emerging issues of relevance for the management of the fisheries;

e) Review progress on benchmark processes of relevance to the Expert Group; High for application;

Low Priority for spring 2020 advice season

c iv) Estimate MSY proxy reference points for the category 3 and 4 stocks

g) Identify research needs of relevance for the work of the Expert Group.

h) Review and update information regarding operational issues and research priorities and the Fisheries Resources Steering Group SharePoint site.

i) Take 15 minutes, and fill a line in the audit spread sheet 'Monitor and alert for changes in ecosystem/fisheries productivity'; for stocks with less information that do not fit into this approach (e.g. higher categories >3) briefly note in the report where and how productivity, species interactions, habitat and distributional changes, including those related to climate-change, have been considered in the advice. ACOM would encourage expert groups to carry out this term of reference later in the year through a webex.

Annex 3: Stock Annex for Salmon (*Salmo salar*) in subdivisions 22–31 (Main Basin and Gulf of Bothnia) and Subdivision 32 (Gulf of Finland)

The table below provides an overview of the WGBAST Stock Annex. Stock Annexes for other stocks are available on the ICES website Library under the Publication Type "Stock Annexes". Use the search facility to find a particular Stock Annex, refining your search in the left-hand column to include the *year*, *ecoregion*, *species*, and *acronym* of the relevant ICES expert group.

Stock ID	Stock name	Last up-dated	Link
Sal-2431+sal-32	Salmon (*Salmo salar*) in subdivisions 22–31 (Main Basin and Gulf of Bothnia) and subdivision 32 (Gulf of Finland)	April 2020	Baltic Salmon

Annex 4: Recommendations

The Working Group recommends following actions in order to fulfil the shortcomings in the present data and knowledge regarding the Baltic Sea salmon and sea trout to further improve the stock assessment and also, potentially support the management of Baltic salmon and sea trout.

Recommendation	Adressed to
1. Catch estimates of recreational salmon and sea trout fisheries are uncertain, incomplete or totally missing for several countries. Studies and methods to estimate these catches are needed.	ICES Baltic Sea member states, RCG Baltic Sea (DSG), ICES WGRFS
2. Issues related to salmon sampling: In Sweden and Finland, in the coastal trapnet fishery, salmon are released back to sea during part of fishing season because of quota fulfillment or fishing regulations. Reported and non-reported amounts of these discarded salmon and their survival rate should be evaluated. Counting of ascending adults should be performed in all salmon index rivers. Quality of data on amounts and areal distribution of seal damaged salmon and other dead discards by fisheries should be evaluated and improved in countries where these data are found to be defective.	ICES Baltic Sea member states, RCG Baltic Sea (DSG), ICES PGDATA
3. Issues related to sea trout samplig: Total population size of 0+ and older parr, as well as estimated total production of smolt should be calculated for rivers where data are available. Especially important are values for index rivers. If possible the areas should be divided into habitat quality classes. Total production area available for sea trout should be provided for streams where data are available. Sufficient data coverage of sea trout parr densities from typical trout streams is needed from all countries. Continuing sampling for longer time-series is required for assessment. Sea trout index rivers should be established to fullfil assessment requirements with respect to geographical coverage and data collection needs.	ICES Baltic Sea member states, RCG Baltic Sea (DSG), ICES PGDATA
4. Data on proportions of sea trout and salmon in catches should be provided to the working group to facilitate estimation of the development of misreporting. Poland should provide catch composition data from coastal and offshore fisheries (as defined in the EU regulation) covering all main gears.	Sweden, Finland, Latvia, Poland, Germany ICES WGPDMO

Annex 5: Smolts and PSPC per AU for HELCOM salmon indicator

Table A5. The medians of total smolt production and potential smolt production capacity (PSPC) within assessment units 1–6 (AU1–2 combined) for the HELCOM salmon core indicator. In AU1–4 estimates are based on the analytical assessment whereas in AU5–AU6, smolt production estimates are derived from parr densities with country-specific unharmonised mortality parameter values, and PSPS estimates are based on the expert evaluation. Smolt production estimates for AU1–4 are based on assessment run in 2019. For AU5–6 estimates are updated in 2020.

	Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AU1-2	Smolts	460	326	283	290	233	306	447	589	408	255	276	502	700	1714	1725	1437	1643
	Q5	237	188	184	203	179	223	330	459	297	192	216	407	573	1459	1507	1247	1405
	Q95	1247	656	464	416	309	416	601	755	554	342	355	639	863	2055	2012	1686	1958
	PSPC	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973
	Q5	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622
	Q95	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371
AU3	Smolts	0.8	0.6	0.7	1.0	1.3	0.7	1.0	0.6	0.3	0.5	0.8	0.9	1.1	2.1	2.7	2.5	3.2
	Q5	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.1	0.3	0.4	0.5	0.9	1.1	1.0	1.1
	Q95	7.2	8.2	5.7	6.9	7.5	4.7	6.2	4.6	2.3	1.2	1.6	1.7	2.1	20.8	19.3	16.7	494.0
	PSPC	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
	Q5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Q95	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
AU4	Smolts	15.9	15.0	51.7	64.6	58.0	71.5	40.0	25.7	29.9	35.4	39.4	39.9	41.6	46.1	38.8	39.5	39.5
	Q5	3.2	3.0	16.6	19.8	21.8	25.4	15.4	8.3	14.6	22.6	26.5	27.5	28.6	31.8	25.9	28.0	26.7
	Q95	82.9	76.3	167.7	211.6	159.3	233.6	108.3	88.6	47.2	53.7	57.8	59.7	63.1	67.9	55.8	59.2	56.8
	PSPC	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8
	Q5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5
	Q95	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
AU5	Smolts															35.0	32.5	25.9
	PSPC															301	301	301
AU6	Smolts														19.9	25.0	30.3	34.5
	PSPC														273	273	273	273

	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
AU1-2	Smolts	1703	1752	2184	1872	2173	2325	2230	2384	2576	2466	2308	2330	2800	2993	2955	2691	2668	2511
	Q5	1414	1482	1849	1614	1889	2031	1974	2121	2264	2122	2039	2071	2461	2619	2489	2331	2271	2001
	Q95	2090	2115	2666	2179	2552	2690	2535	2734	2910	2834	2659	2699	3212	3454	3496	3152	3149	3287
	PSPC	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973
	Q5	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622	2622
	Q95	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371	3371
AU3	Smolts	2.7	3.2	3.9	5.0	3.8	3.5	3.3	3.4	3.5	3.5	3.5	3.4	3.5	4.4	4.2	3.9	3.7	3.5
	Q5	1.0	1.1	1.3	1.6	2.4	2.2	2.0	2.0	2.4	2.4	2.6	2.5	2.7	3.3	3.0	2.8	2.6	2.4
	Q95	20.5	22.9	57.5	27.2	5.8	5.3	4.9	5.1	5.4	5.3	4.9	4.7	4.7	5.7	6.2	5.7	5.3	5.2
	PSPC	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
	Q5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Q95	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
AU4	Smolts	41.2	42.4	37.9	40.1	39.7	36.2	37.9	36.5	33.7	34.5	37.7	40.2	45.2	43.0	41.0	40.1	39.3	40.2
	Q5	29.1	29.6	26.2	27.8	27.5	24.4	26.7	23.8	23.5	24.1	25.7	28.3	32.4	30.8	28.1	27.4	27.0	27.4
	Q95	60.2	59.2	53.9	58.2	57.9	52.1	55.1	52.6	47.7	51.4	54.0	57.0	62.9	59.1	57.2	58.0	56.9	57.4
	PSPC	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8
	Q5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5
	Q95	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
AU5	Smolts	5.9	45.3	39.8	19.3	39.0	64.1	62.4	8.9	33.9	25.8	19.8	59.9	82.8	52.1	42.4	38.7	77.1	
	PSPC	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	
AU6	Smolts	20.9	15.0	48.0	55.9	28.1	30.3	50.5	41.4	48.9	28.4	62.1	59.4	64.7	95.7	52.8	48.0	99.1	
	PSPC	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	