Annex 3: Technical Minutes

Review of the Report of the Baltic Salmon and Trout Working Group (WGBAST)

April 21-23, 2008

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General Comments:

A problem was found after the meeting of the Working Group with respect to the salmon assessment and the use of the software program WinBugs. The issue was most likely the result of a typographical error in the code, which resulted in the model being fitted only to the catches of 1992-1997 but not to the rest of the catch data.

The above misspecification of the model results in a number of tables and figures being affected. For instance (to name a few): Figures 5.3.8.2, 5.3.9.3, 5.3.9.5 and Table 5.3.9.4 are particularly relevant.

Because of the importance of these results on the advice, it was agreed after the Working Group meeting that the model would be rerun and that the Review Group, which was scheduled to meet by correspondence from April 21-23, 2008, would reconvene with the Advice Drafting Group during their meeting in Copenhagen, from April 28-May 1, 2008.

The WG has applied a state of the art approach to their efforts to model and assess Baltic salmon resources.

Contents:

The Technical Minutes from both last and this year should be included on the WG Report.

Executive Summary:

First paragraph: The WG is unable to provide catch predictions or TAC advice.

Low post-smolt survival - Results from runs of the corrected model were presented to the review group and these updated results showed higher estimates of the post-smolt survival for the last two years than observed in the previous analyses. This indicates a break in the previously reported declining trend. The conclusion about a declining post-smolt survival has received much attention in the WGBAST analyses in this year's report, and the report covers an attempt to verify and find reasons to the decline.

Section 2: Salmon fisheries data

Section 2.7 Proportion of wild salmon in genetic studies and scale readings of catch samples.

This is a promising method which should be further developed and included in future monitoring and assessments. For instance, the sampling for genetic analyses and results from the scale reading analyses could be combined so as to obtain a better resolution of stock composition. Stock estimates can be improved using this method if data on genetics (proportions of total sea+coastal catch for each river-stock) are combined with true counts of returns to a few major home rivers. Mark-recapture estimation can be used for this purpose and it also allows for population estimates of rivers without counting devices. Adding a sub-model, to the assessment model, based on genetics in mixed stock fishery to estimate the return stocks is expected to improve both the accuracy and the precision of the existing assessment model. There still seems to be some uncertainties in determining the stock origin by the genetics. Method improvement to remove existing uncertainties in the stock separation is recommended. In addition, there will be a need to design a specific sampling strategy to ensure maximum use of the genetic data.

Section 2.9.3. Tag reporting rate

Reporting rate is a critical parameter if voluntarily reported tags will be used in an assessment to calibrate population size or to estimate stock contribution to catches. This section reviews a number of issues with tag return rates, some of which are particularly worrisome for the use of tagging data in the assessment. There is an expectation that tags will be underreported, but as long as the characteristics of the under-reporting stay the same, the tag returns are useful. The WG report has evidence that tag reporting rates have changed in recent years, perhaps reflecting the deteriorating conditions of the stocks and concern on the part of fishers that further restrictive management measures may ensue. There have also been experiments with enhanced tag rewards, these experiments can yield useful data on the level of tag reporting, but they also have the effect of changing reporting pattern by bringing the issue of reporting to the fore. It was also reported that tag reporting rates differ by region. The WG needs to take an objective look at where tagging are still useful in a quantitative context. Also, the WG could look at the sampling initiative carried out in 2003 in that context.

Due to the problems with declining returns of tags, and worries about changes in the reporting rate, it might be worth considering transferring at least parts of the tagging resources to improve and extend the index river sampling. Data from these rivers will be valuable in combination with the genetics in future assessment. The working group also recognizes the need to consider alternative sampling methods to the Carlin-tagging (Annex 2 of the report).

Section 3: River data on salmon populations

Section 3.2 Wild salmon populations in Main Basin and Gulf of Bothnia

Monitoring of parr densities are carried out by standardized electrofishing surveys. The method is carried out in a similar way in all assessment units.

- The need to extrapolate these data to the entire rives has received attention both in WGBAST and in WGNAS. The hierarchical regression model developed and validated for Torniojoki seems promising. The way the sampling sites were originally selected (e.g. in prime habitats only), and still remains so in most cases, is not according to standard statistical procedure which can affect (bias) the results as noted in the report. It might be worth taking a closer look at the sampling design to see if improvements can be done. There are a number of issues that should be considered, e.g. how to account for variation in flow between years? and how informative or representative is data from the shallow shore sections compared to the deeper parts which are difficult or impossible to electrofish?

3.2.1 Rivers in the assessment

Spawning runs and their composition

The problem with the migration success to the fish ladder in Ume/Vindelälven is recognized in the report. At the present the success rate is not accounted for in the assessment model. At the present, there seems to be some problems with the model allocating too much smolt to the Ume/Vindelälven. The RG recommend that available measures on the success rate for the Ume/Vindelälven is used as input to the assessment model and that the observed returns that passes the fish ladder in Umeälven is given more weight in the analyses. Data on success rates are available for the years 1995-1997 and 1999-2005. Data from 1996 is available from the Swedish Board of Fisheries, and data from 1995, 1997, and 1999-2005 is available from VFM at SLU in Umeå.

Figure 3.2.1.1. Clarify that the graph shows the range of annuals landings for the period.

Section 4: Present management measures and other factors influencing salmon fishery

General aspect - The RG have some concerns about the genetic consequences of the bottleneck that should have occurred in at least some wild and reared salmon populations due to the high mortalities caused by M74 in the first half of the 1990s. If genetic baseline data are available from the period prior to, or during, the M74 event it should be of importance to compare with the genetic diversity of todays populations.

Section 4.1. Is the minimum size designed to achieve spawning of some proportion of the population, what is the goal of this measure? Perhaps stating the management action that these measures were intended to achieve would be useful.

Section 4.1.2. This section provides some speculation on the effect of the international management measures, but it is not clear what the strategy is to determine whether the measures are working and how they may be working in respect to all the measures on a national scale. Is there any assessment of the efficacy of these different management regulations and how they relate to the overall measures for the basin described in section 4.1? If not, such an assessment is encouraged.

Section 4.3.3. Why are these data being reviewed? If it is because by-catch and predation mortality is going to be included in any modeling exercise, please explain this and evaluate the quality of the data and how it may be applied?

Section 4.3.4. Why is the price of salmon being tracked? Is this a factor in the amount of effort being applied in the salmon fishery? If so, please include how these will be used in the assessment.

Section 4.4.3 Methods (Analyses of the post-smolt survival)

As suggested above and noted by the WG further analyses should be performed to clarify the variation over time in the post-smolt survival. It is especially important to find the reasons to the sudden declines in the survival during some years.

The analysis in the WGBAST 2008 report uses data on wild salmon from the river Vindelälven and Kalixälven and also by using the entire assessment model. The underlying data for these analyses are associated with uncertainties since the actual smolt productions from the majority of rivers are not measured by means of sampling programs, and there are no sampling of smolt to measure smolt production in the rivers Umeälven and Kalixälven. Smolt estimates from these rivers originate from less precise electrofishing surveys. Another issue that might influence these analyses is the declining reporting rate of tag-recaptures. These reports on tag-recaptures are essential for reliable estimates of sea mortality and stock size estimates. The estimates of the post-smolt survival are therefore sensitive to changes in the reporting rate. Since the alarms on reduced post-smolt survival have been a major concern, it should be important to try other approaches to estimate the post-smolt survival. Members of the review group here provide some suggestions of a particular data set that should be useful for a complementary analysis that might either strengthen the previous conclusions or shed some new light onto the temporal variation of the post-smolt survival in the Baltic. There is at least one data set from the Baltic with known number smolt as well as returns. This data set deals exclusively with hatchery reared smolt from the river Umeälven. It need to be noted that there is one type of uncertainty in this data set and that is the success rate of returns from the river mouth to the fish ladder. This success rate has been measured for a number of years (1995/30 ind., 1997, 1999 and 2001-2005, 500 ind./year). These success rates should also be important to include in the Bayesian model in order to improve the smolt-return relationship.

One way of identifying the reason to the low post-smolt survival could be to use separate datasets from different regions (e.g. Umeälven, Dalälven, Gulf of Finland) in order to investigate if the phenomenon is large-scale or restricted to certain areas.

A second survival series based on juvenile censuses in freshwater and river returns was presented, these data do not agree with the tagging data very well. They only seem to agree in suggesting the most recent few years have had poor survival, the time course of the survival rates for the 1990s into the 2000s are very different between the two datasets. The lack of coherence in the depiction of survival rates is troubling and need to be investigated in future assessments.

Section 4.4.4

Why are beta values reported in table 4.4.2? If the WG is evaluating potential linear predictors, reporting the correlation coefficients would make more sense. The table notes that the betas were not corrected for multiple tests. Multiple tests may not be an issue; if a correlation emerges, it should only be used if there is a reasonable mechanistic hypothesis that can be attached to the variable. So, pragmatically casting a wide net over reasonable potential; predictors are not a multiple test issue. What is an issue is time series autocorrelations. Time series comparison will have varying degrees of autocorrelation. To account for this autocorrelation in correlation analyses (Pearson product-moment correlation) the effective degrees of freedoms of each test could be obtained through the procedure suggested by Pyper and Peterman (1998). The effective degree of freedom (N^*) of a correlation between two time series, in notation series *X* and *Y*, was estimated by:

$$\frac{1}{N^*} \approx \frac{1}{N} + \frac{2}{N}\sum_{j=1}^{N/5}\frac{(N-j)}{N}\rho_{xx}(j)\rho_{yy}(j)$$

Where *N* is the sample size and $\rho_{xx}(j)$ and $\rho_{yy}(j)$ are the autocorrelations of *X* and *Y* at lag *j*. Following Garrett and Petrie (1981) we took the autocorrelation at lag *j* of the cross-products of standardized time series of *X* and *Y*. The probability associated with a correlation coefficient is designated as p and as p^* for a test with degrees of freedom based on N^*.

Earlier it was indicated that explanatory variables would be tested against the survival time series and a pre-whitened series to account for trends in CPUE. The WG does not indicate which survival series it tested. Are the beta for tests with raw survival rates or the adjusted rates? Also, it would be troubling to see that betas are not consistent across rows indicating that the indices that are suppose to be representing the same survival rate, are not coherent with their relationship to predictor variables.

Section 5: Main Basin and Gulf of Bothnia

Section 5.1 Introduction

Posterior distributions obtained from the analysis of one data set can be used as prior distributions in the analysis of another data set. True but care must be taken to have these data set independent from each other.

Figure 5.3.1.3 missing.

Section 5.3.3.2 Methodology

The variable *smoltification age* does not aim to reflect a distribution for the smoltification age, i.e. the percentage of parr that smoltify at each age, but the modal smoltification age and uncertainty connected with it.

> – It is not clear to the RG how flexible the smoltification age distribution is over time in the model for a particular river. There is some concern that variation in the age distribution of the smoltification, as well as the return age-distribution, could have a major influence on the population dynamics.

Section 5.3.5 Hierarchical linear regression analysis to estimate wild smolt production of different salmon stocks

This model requires time series of parr abundance indices for all rivers considered, and time series of smolt abundance estimates for as many rivers as possible. More specifically, the annual number of sampling sites electrofished and the corresponding estimated density of age 0+, 1+ and >1+ parr are needed.

> - These data requirements differ somewhat from what is available, at least in the Swedish electrofishing. How important is the 1+ separation? If it is

important, then there is a need to have an overview of the electrofishing protocols in the different countries.

Section 5.3.5.3 Results

Data from Sävarån is also available for 2007, and the sampling for 2008 is about to start. Also, *Figure 5.3.9.2* is missing.

- *Figures 5.3.6.1 and 5.3.6.2 are missing.*
- *Tables 5.3.7.1 and 5.3.7.2 are missing.*
- *Tables 5.3.9.1, 2, 3 and 4 are missing together with figure 5.3.9.9.*
- *Section 5.4.1.1 Model reliability and the plausibility of future stock predictions.*
- *Tables 5.4.2.1, and 5.4.2.2 are missing.*

The WG should stay alert to climate scale changes occurring in the Baltic and NE Atlantic affect the physical habitat and the nature of biological food webs of consequence to Atlantic salmon. A related question is whether or not to include environmental variables in the model.

Section 5.6.1 General conclusions

The results of new analysis using the full range of catch data were tabled during the course of the Review Group meeting. These results are presented in Annex to these Technical Minutes (annex 1). While the results led to a better fit of the model to the catch data, the results for the Ume/Vindelalven river suggest that model allocate too many fish to that river, thereby preventing the attribution of salmon to other rivers. This was seen as the result of the current design of the model which puts little constraint in the production capacity estimation for that river and the special treatment of that river in the model. This was seen as a key concern with the current formulation of the model. Accordingly, the Review Group advised against using the river specific estimates in the advice. Instead, a roll-up by Unit should be used. Concerns were expressed with the compilation of results for Unit 2, which did not include the estimates for the Ume/Vindelalven river (thereby masking the problem with the estimation of smolt production for these rivers).

Section 5.6.2 Short term perspectives.

References to Tables 5.4.2.1 and 5.4.2.2 which are missing (same as above).

Section 6: Salmon in the Gulf of Finland

- Figures 6.3.3.2 and 6.3.3.3 are missing.
- Section 6.6. Figure 8.1.2.1 is missing or misidentified.

Section 7: Sea trout

This part of the report is descriptive, not based on models. The information available is limited and insufficient for analytical approaches but informative.

The RG notes the proposal for a Study Group on Sea Trout Assessment as a follow up to SGBALANST and the proposal will be put forward to be dealt with in the ICES planning process.

Section 8: Data and information needs for assessment

Note the high priority accorded to the following: It has high priority to establish one index river in each Assessment Unit for both salmon and sea trout. The collection of data concerning parr densities, smolt counts and number of spawners has high priority in these rivers… etc.

Note suggestion of the WG: It would be timely to start discussion concerning other tagging systems that could replace current large scale Carlin tagging. The WG suggests that a more comprehensive plan be considered during the WG meeting in 2009.

ICES also notes the nine Recommendations of the WG as per Annex 2.

Additional references

Garrett, C., and Petrie, B. 1981. Dynamical aspects of the flow through the Strait of Belle Isle. Journal of Physical Oceanography, 11: 376–393.

Pyper, B. J., and Peterman, R. M. 1998. Comparison of methods to account for autocorrelation in correlation analyses of fish data. Canadian Journal of Fisheries and Aquatic Sciences 55: 2127-2140.

Annex 1. Main results of the revised model runs made available to the Review Group.

The revised model run resulted in changes in the most of tables and figures in Chapter 5 in WG report. Below has been presented some of the updated tables and figures which had a central role in the evaluation of the stock status and in the compilation of the catch advice.

Table 5.3.9.2 Posterior probability distributions for the smolt production capacity (* 1000) in different Baltic salmon rivers. The posterior distributions are described in terms of their mode or most likely value, the 95% probability interval (PI), the method on how the posterior probability distribution has been obtained.
These estimates serve as reference points to evaluate the status of the stock
This table also shows the mode as estimated by last years stock assessment and how much the estimated mode has changed compared to last year.

		Smolt production capacity (thousand)				Method of	Last year´s	% change
		Mode	Median	Mean	95% PI	estimation		
Assessment unit 1								
1	Tornionjoki	1153	1217	1268	838-2002	1	840	37 %
2	Simojoki	43	60	69	33-160	1	79	-46 %
3	Kalixälven	638	794	899	401-2057	1	730	-13 %
4	Råneälven	28	58	80	24-283	1	45	-38 %
Total assessment unit 1		2100	2230	2323	1537-3662		1684	25 %
Assessment unit 2								
5	Piteälven	7	33	43	18-99	1	32	-79 %
6	Åbyälven	12	15	17	7-36	1	21	-41 %
7	Byskeälven	118	148	169	78-372	1	170	-30 %
8	Rickleån	9	13	12	0-29	1	3	194 %
9	Sävarån	4	6	8	2-18	1	4	2 %
10	Ume/Vindelälven	592	1279	1886	74-6674	1	90	558 %
11	Öreälven	13	20	23	4-71	1	20	-36 %
12	Lögdeälven	15	23	30	7-89	1	20	-29 %
Total assessment unit 2		237	283	307	173-592		386	-39 %
Assessment unit 3								
13	Ljungan	1	2	5	0-23	1	1	-22 %
Total assessment unit 3		1	2	5	0-23		1	-22 %
Assessment unit 4								
14	Emån	15	15	15	11-20	1	15	1 %
15	Mörrumsån	84	85	87	65-115	1	79	6 %
Total assessment unit 4		99	100	102	81-133		95	5 %
Assessment unit 5								
16	Pärnu	3.5	3.7	3.9	2-6	2	3.5	-1 %
17	Salaca	30	30	30	26-35	3	30	0 %
18	Vitrupe	4	4	4	3-7	3	4	-6 %
19	Peterupe	4	5	5	3-9	3	5	-11 %
20	Gauja	25	27	28	16-46	3	28	-12 %
21	Daugava	9	10	10	6-17	3	10	-7 %
22	Irbe	5	5	5	3-8	3	4	22 %
23	Venta	14	15	16	10-24	3	15	-4 %
24	Saka	7	8	8	5-14	3	8	-8 %
25	Uzava	4	4	4	3-7	3	4	-7 %
26	Barta	4	4	4	3-7	3	4	-6 %
27	Nemunas river basin	150	161	166	96-264	3	150	0 %
Total assessment unit 5		273	280	285	213-386		279	-2 %
Total assessment units 1-5		**2537**	**2698**	**2821**	1748-4568		**2636**	-4 %

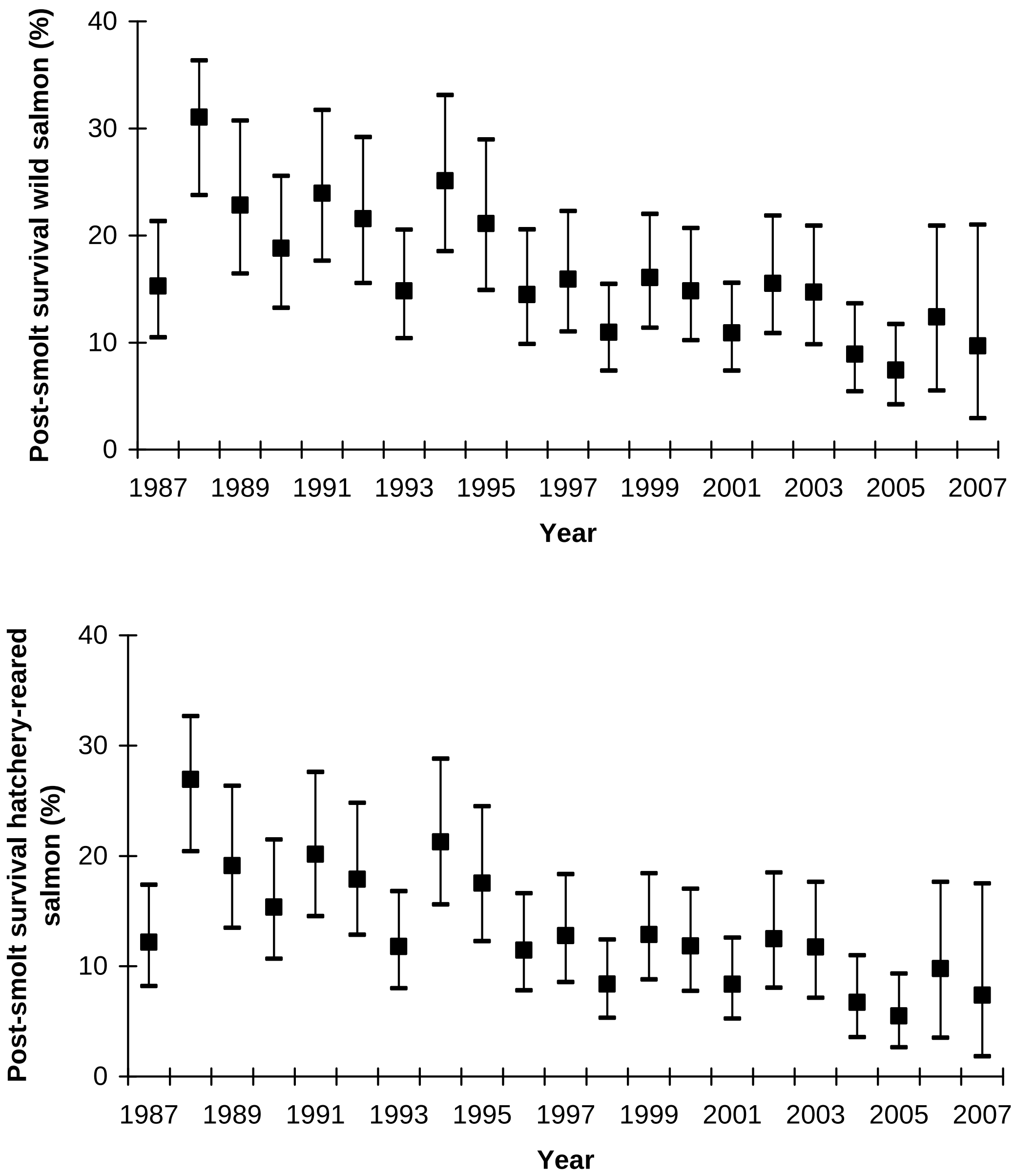

Figure 5.3.8.2 Post-smolt survival for wild and hatchery-reared salmon

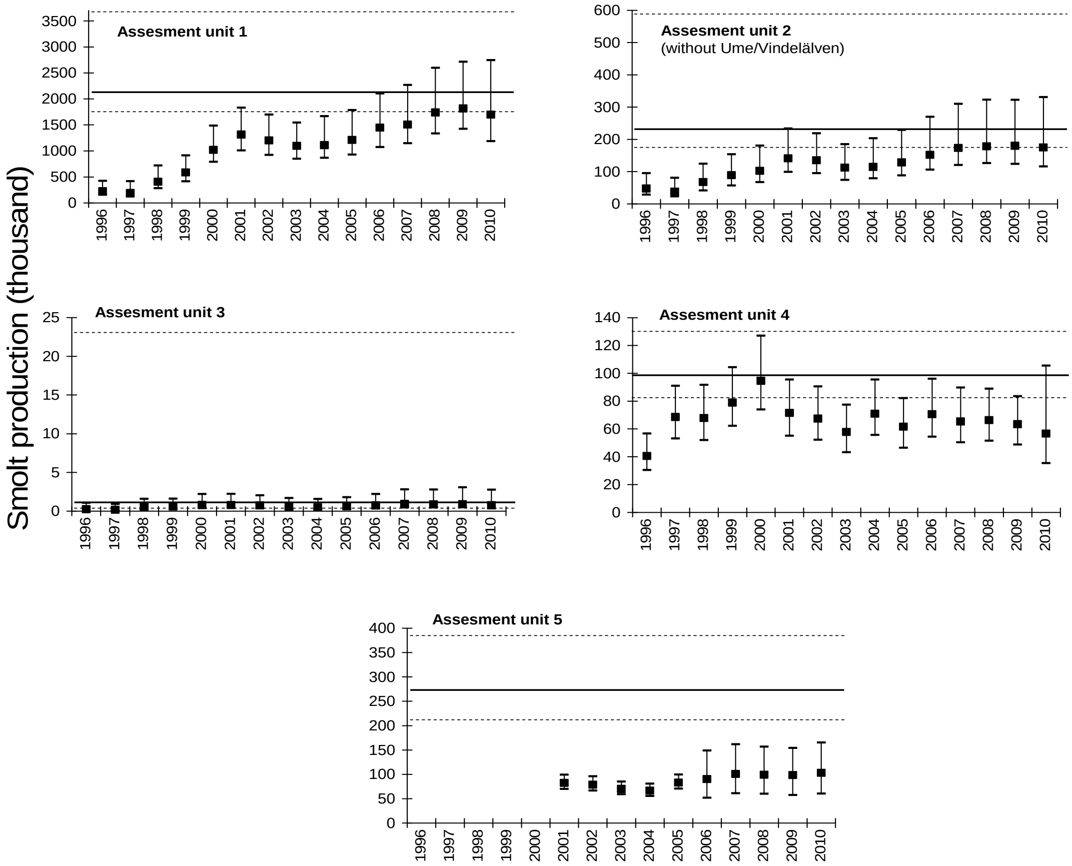

Figure 5.3.9.3 Posterior probability distribution (mode and 95 % PI) of the total smolt production within units 1-5. The horisontai solid lines illustrate the mode of the potential production capacity and dashed line 95 % PI.

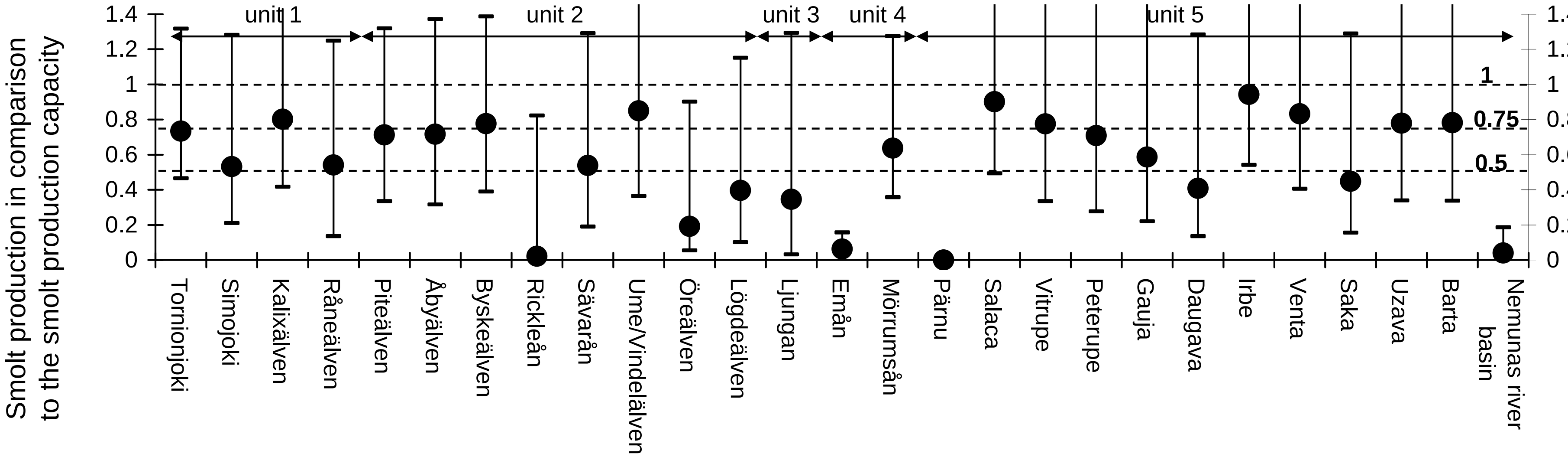

Figure 5.3.9.5 Smolt production in 2010 in comparison to the natural smolt production capacity for the Gulf of Bothnia and Main Basin stocks (mode and 95 % PI).

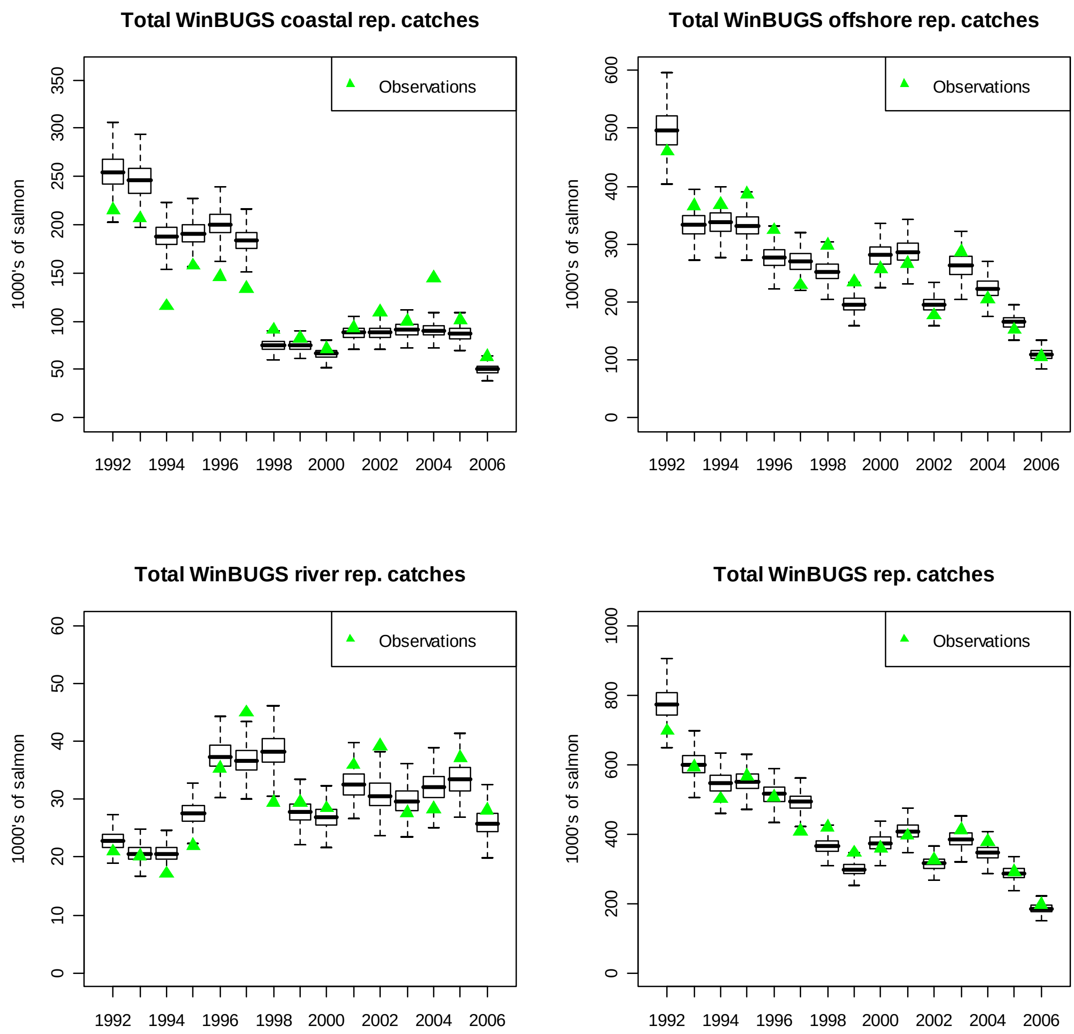

Figure 5.4.1.1 Estimated catches versus observed catches in coast, offshore, river and total.

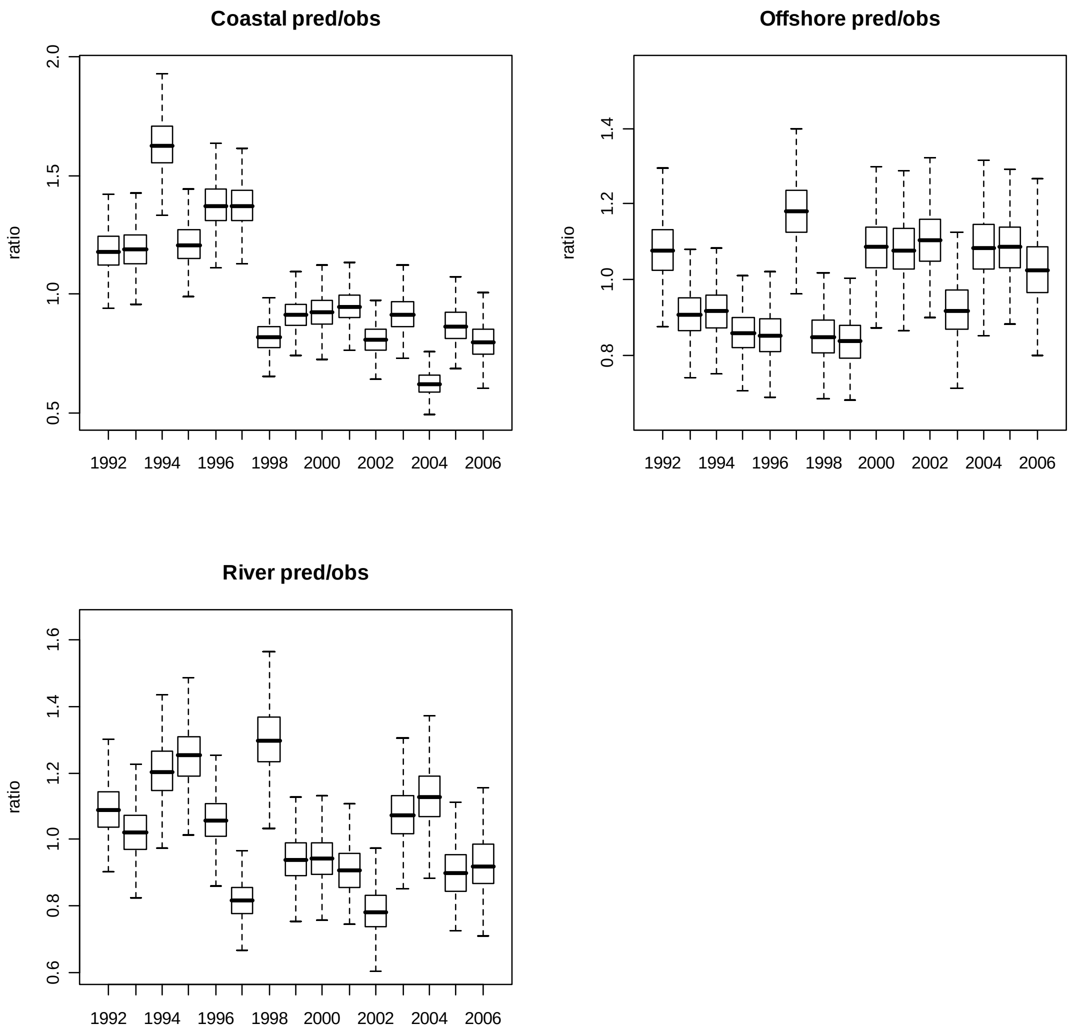

Figure 5.4.1.2 The ratio of predicted to observed values.

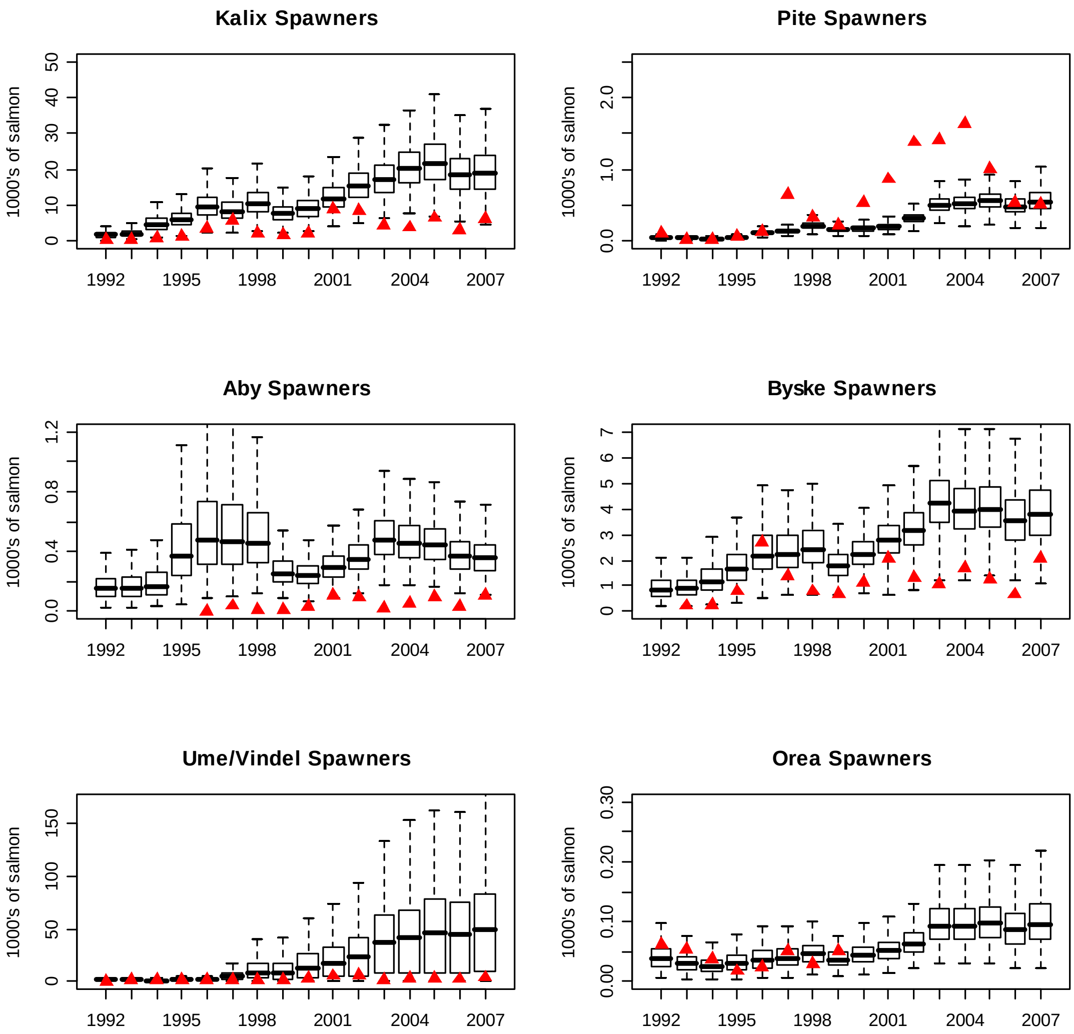

Figure 5.4.1.3 Predicted number of spawners versus observed number of spawners in fish ladders.

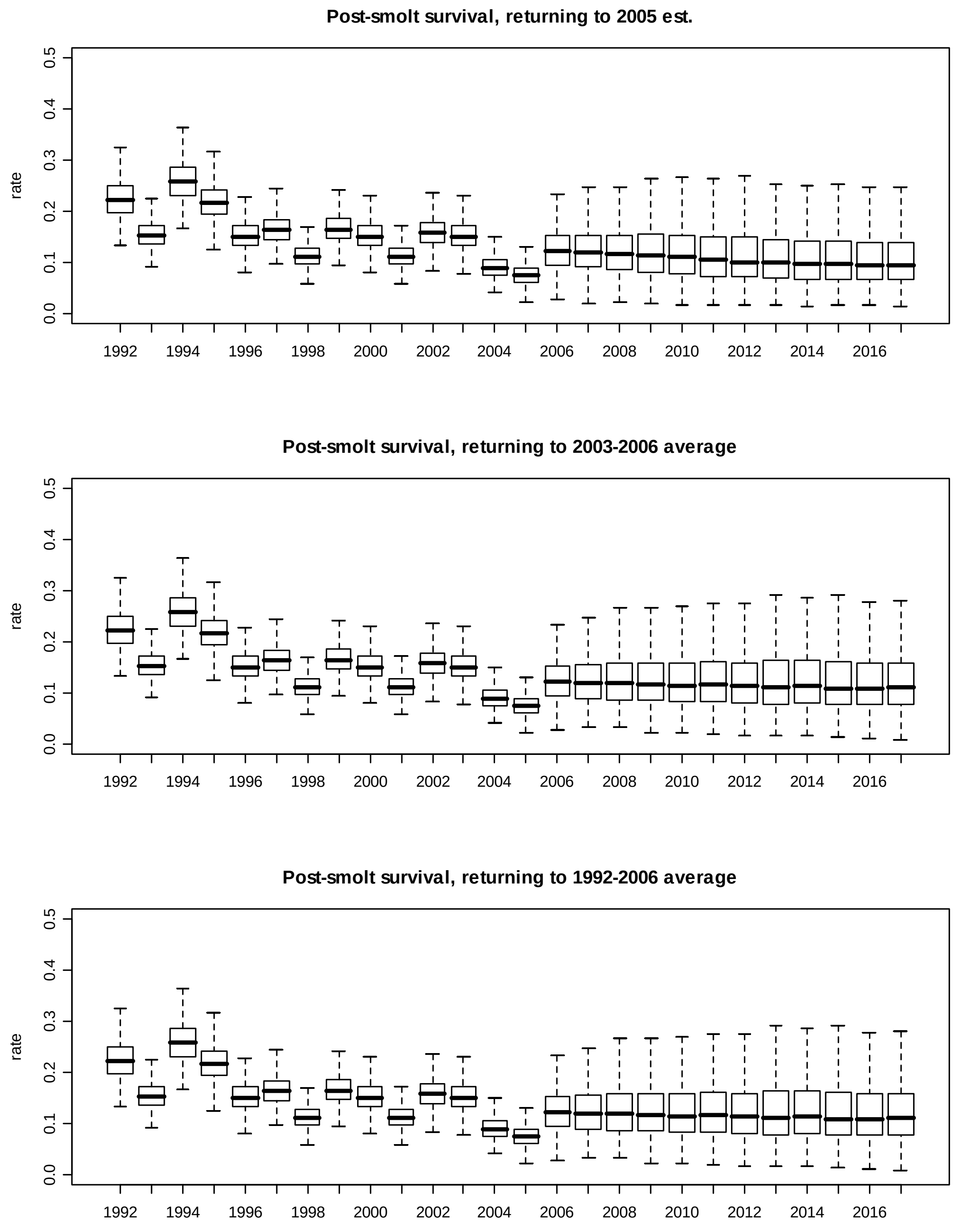

Figure 5.4.2.3 Box plot illustration of post-smolt survival rates of the three scenarios.

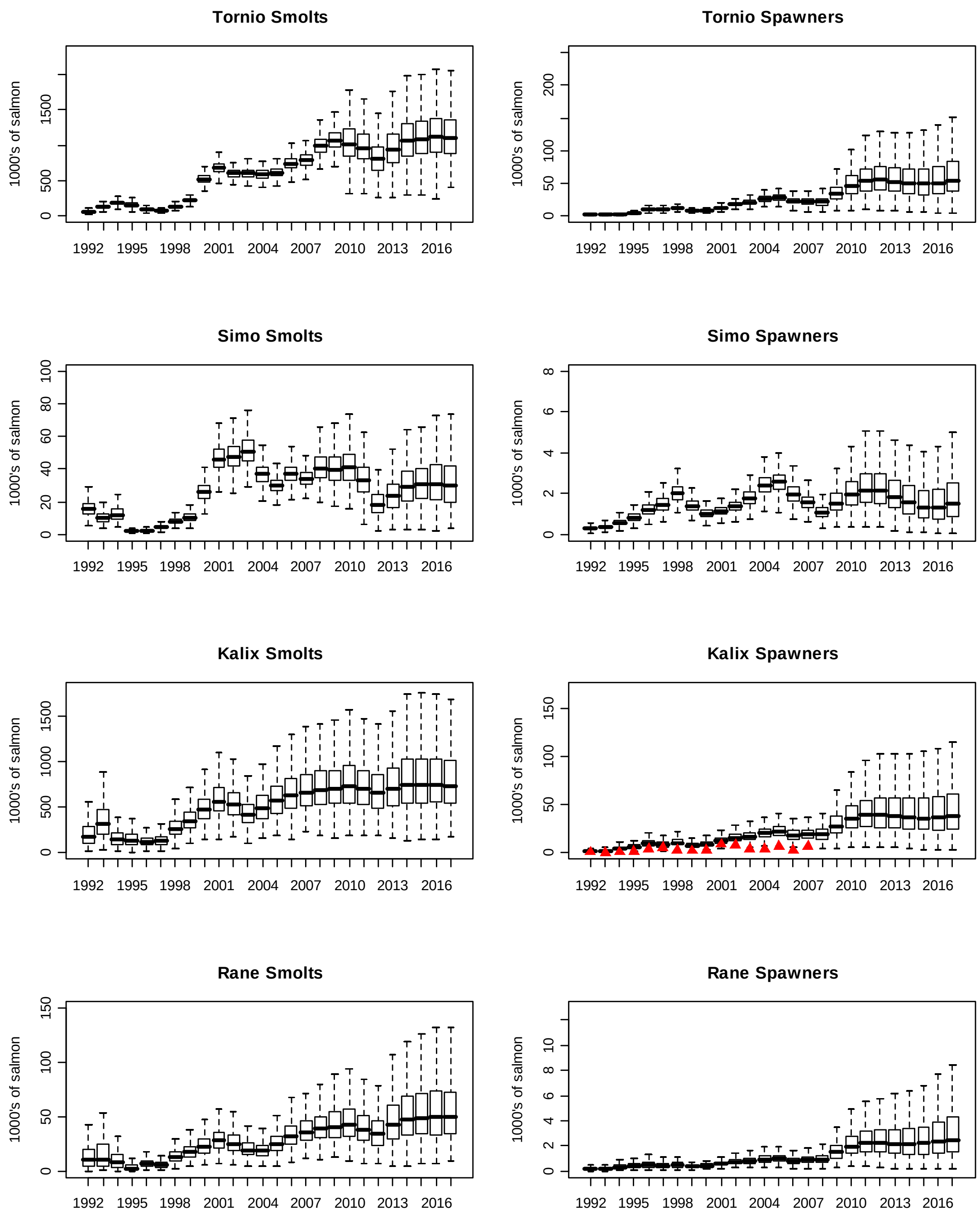

Figure 5.4.3.1 a) Uncertainty and expected values regarding smolts and spawners abundance. The Triangles show the number of spawners observed in the fish ladder.

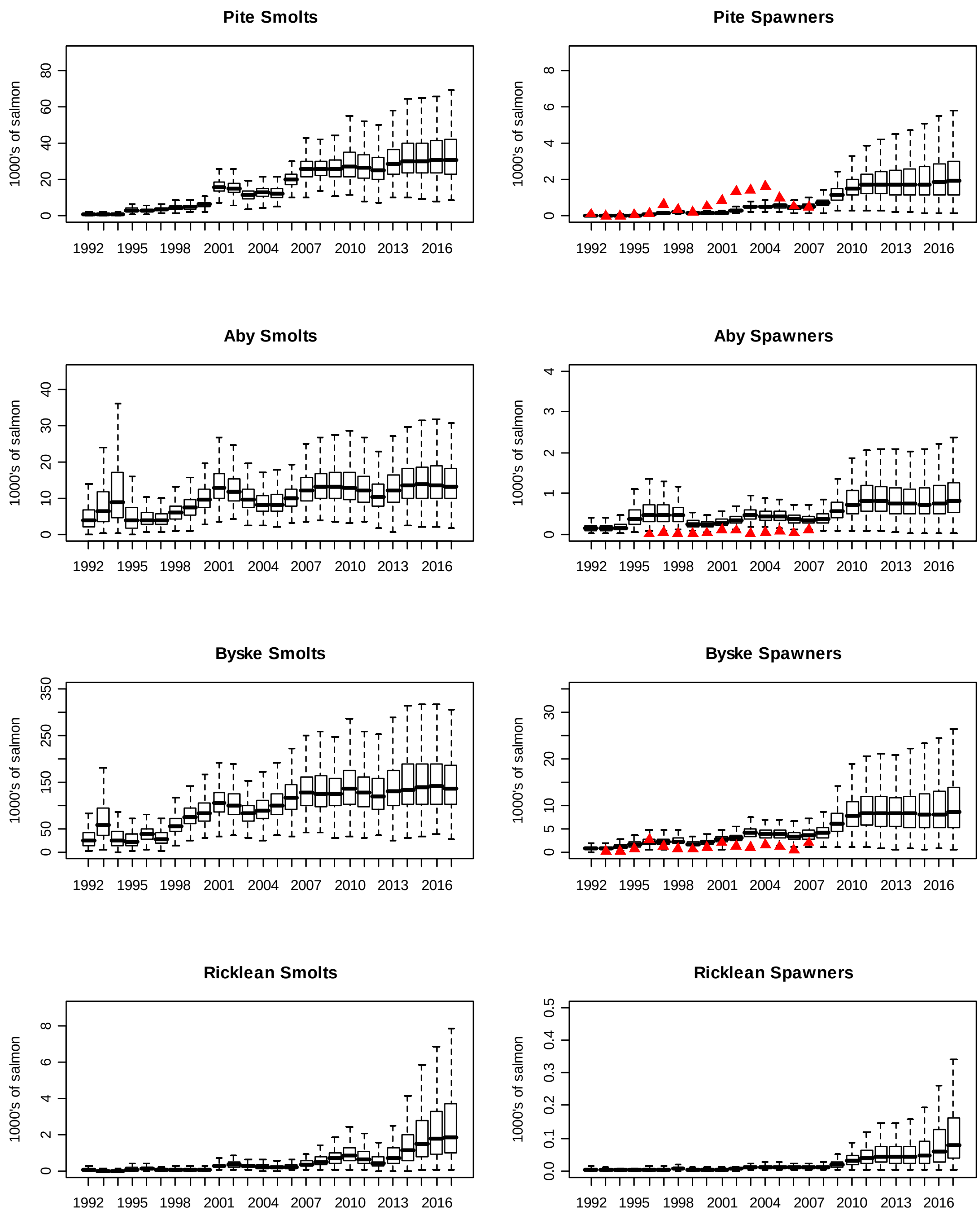

Figure 5.4.3.1 b) Uncertainty and expected values regarding smolts and spawners abundance. The Triangles show the number of spawners observed in the fish ladder.

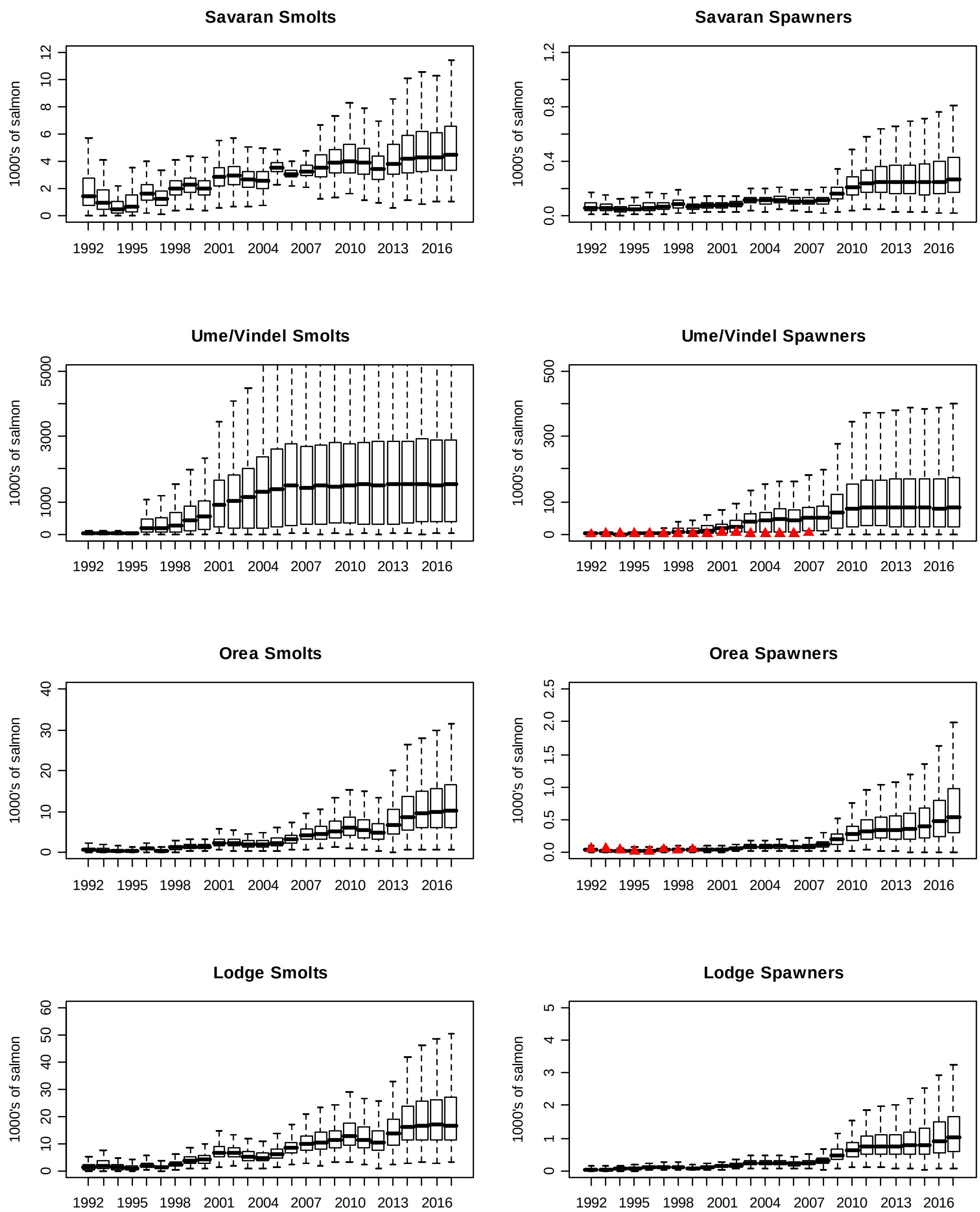

Figure 5.4.3.1 c) Uncertainty and expected values regarding smolts and spawners abundance. The Triangles show the number of spawners observed in the fish ladder.

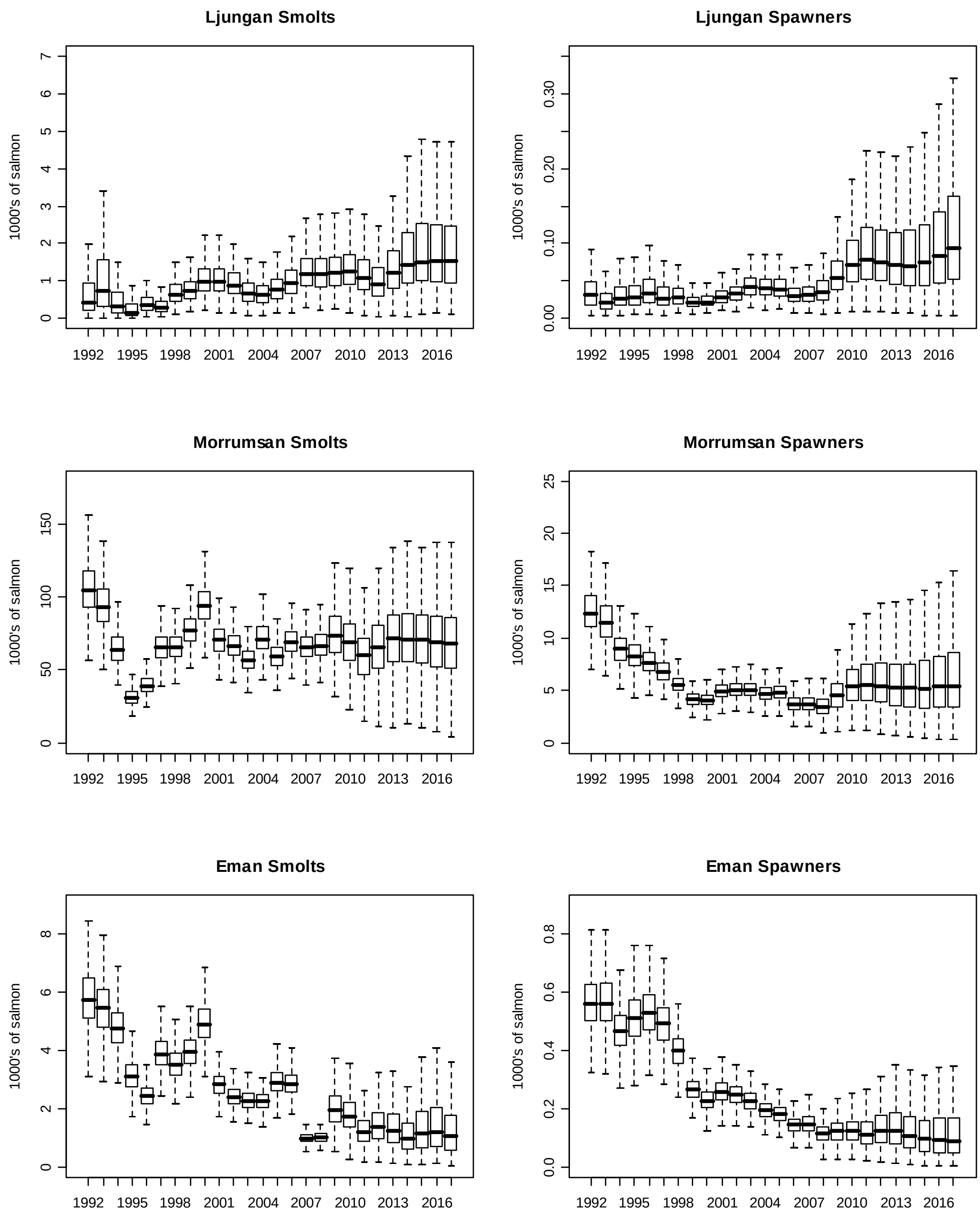

Figure 5.4.3.1 d) Uncertainty and expected values regarding smolts and spawners abundance. The Triangles show the number of spawners observed in the fish ladder.

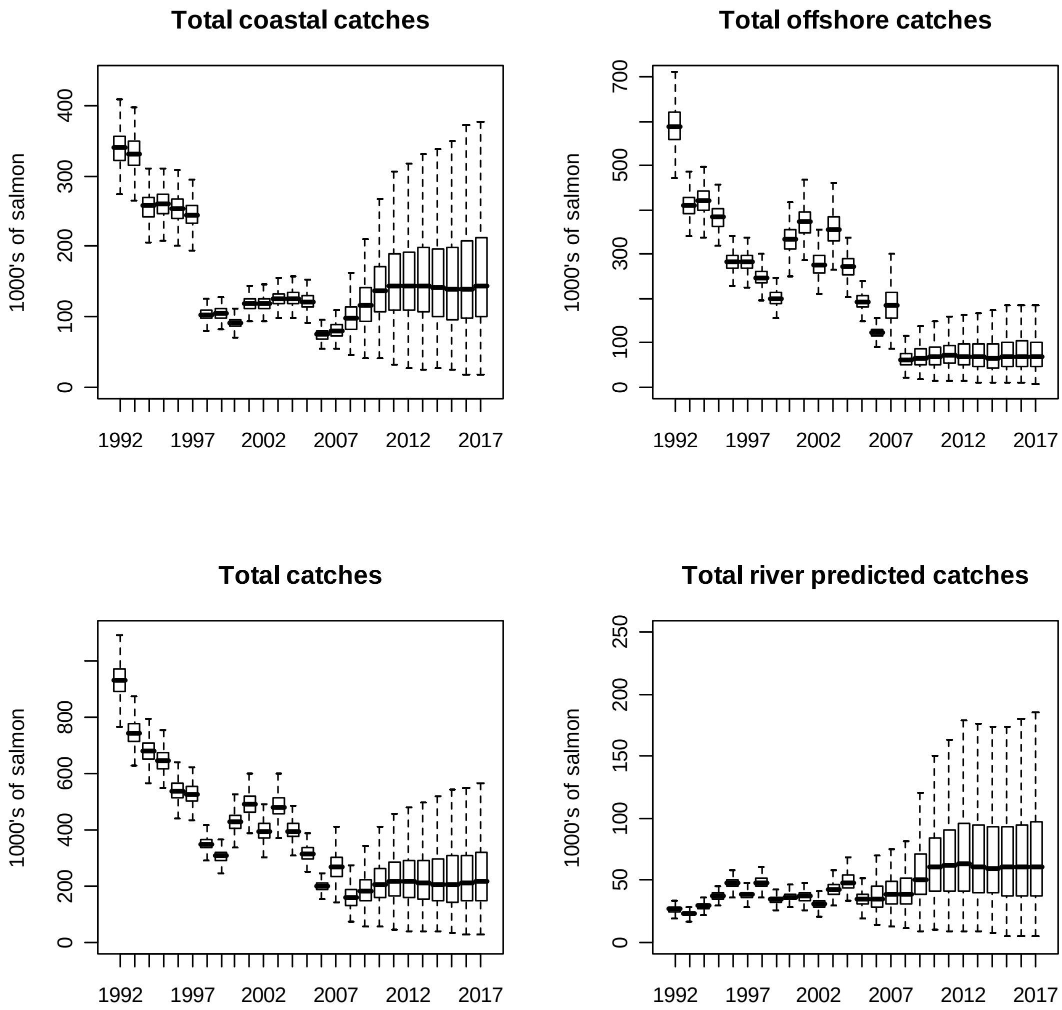

Figure 5.4.3.2 Uncertainty and expected values for the cathes assuming expert beliefs about the future level of effort.