

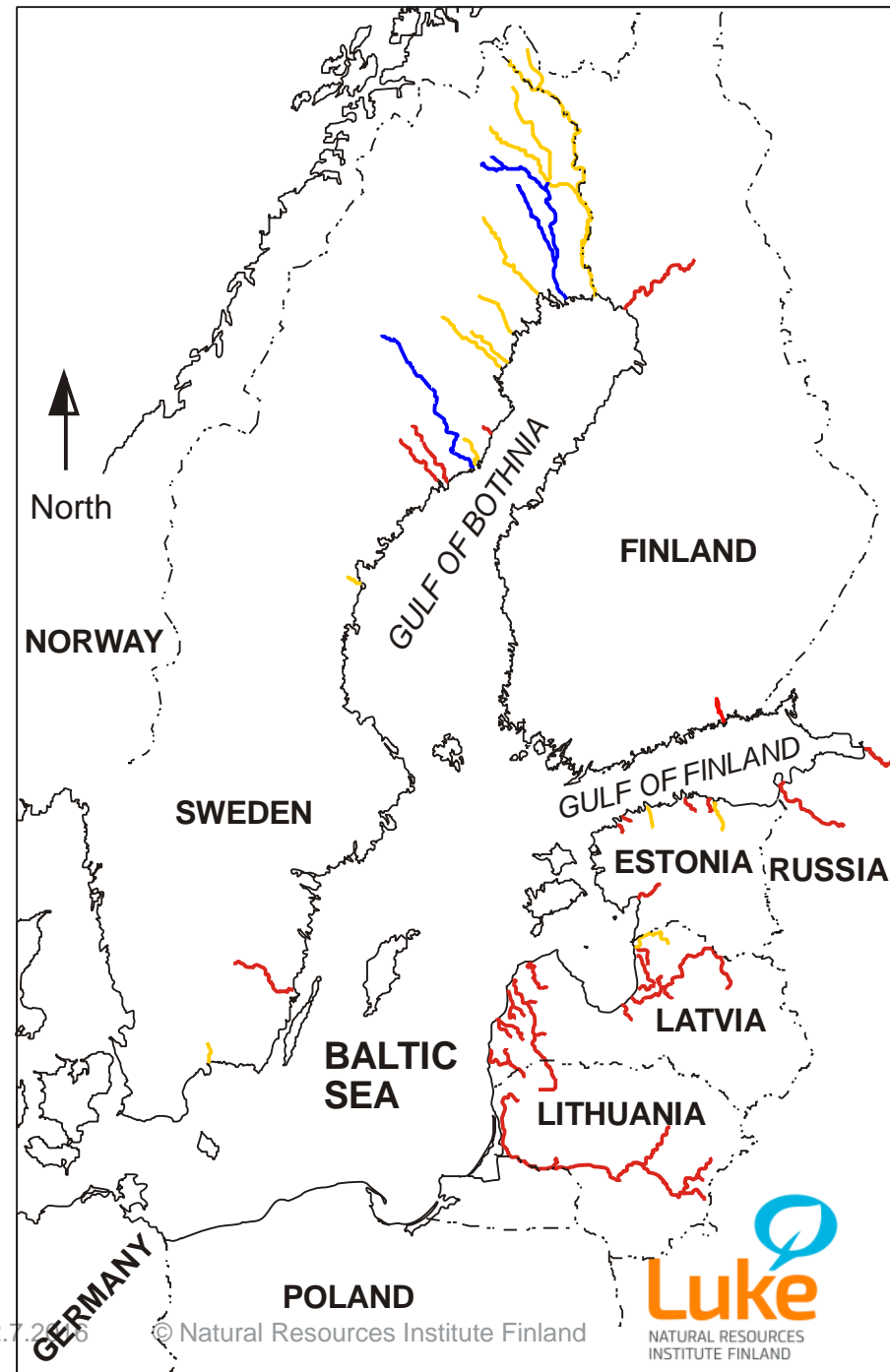
How can fish based indicators be used in assessing the status of salmon stocks in the Baltic Sea area?

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Baltic salmon at present

- Natural reproduction takes place in 40 rivers (historically there were about 80 rivers)
- The potential smolt production capacity of wild Baltic rivers salmon rivers is about 4.4 million smolts
- Present smolt production is about 3.5 million smolts
- Smolt releases are about 4.2 million smolts (mostly to compensate the lost natural reproduction due to building of hydro power stations)
- Positive development in wild stock status
- Total catch about 1 million kilos, 40 % from the recreational fishery



Management framework

- EU Common Fisheries Policy (CPF) aims for a sustainable fishing and the MSY based approach is accepted there
- Consequently the International Council for the Exploration of the Sea (ICES) follows the MSY criterion in it's advisory process
- Environmental indicators and criteria for a good ecological status (GES) are under development in implementation of the European marine framework directive. Indicator of the Baltic salmon is part of this framework.
- -> aim in strengthening the present Baltic salmon stocks to a MSY level i.e. to a good ecological status
- Gradual reduction of smolt release programs are discussed

Salmon indicator - Description

- The status of the Baltic salmon stocks is evaluated by comparing the estimated **smolt production** with an estimated **potential smolt production capacity** (PSPC) by river.
- Linkage to the **number of spawners** ascending the rivers and hence to the fishing pressure at sea and in river.
- The indicator also reflects the state of the ecosystem as smolt production is dependent on river connectivity (effect of dams) and the quality of spawning habitats.
- In other words – Stock status is evaluated in terms of smolt production but management focuses on the number of spawners

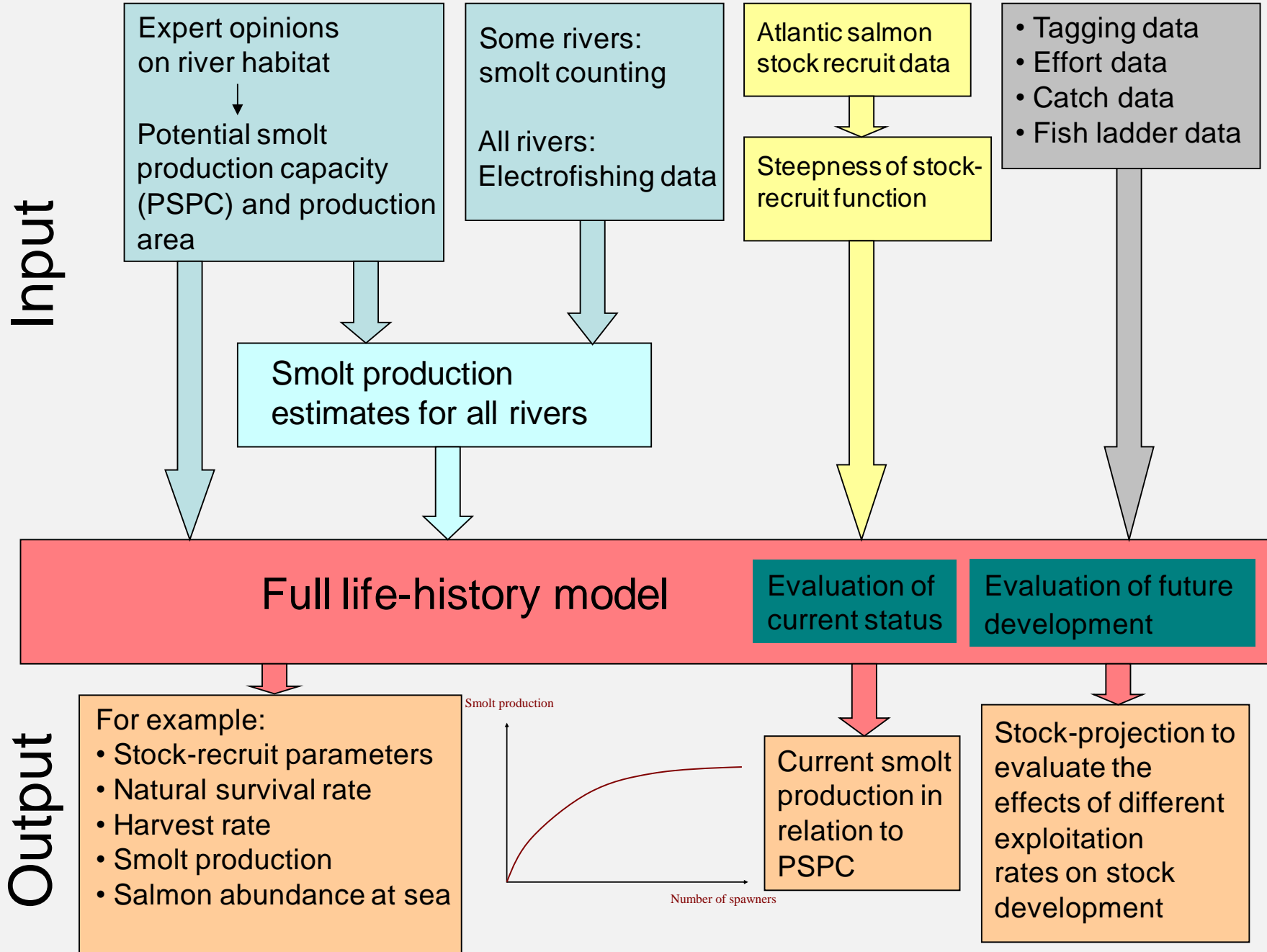
Data in the assessment of stock status

- Parr density data from all salmon rivers
- Counting of out migrating smolts
- Counting of returning adult spawners
- Fisheries data (effort, catch, tag recoveries, catch samples)
- 39 rivers with natural salmon production
- 3 index rivers at the moment, another 4 coming



Data collection and analysis

- Data is collected in all Baltic Sea coastal countries (EU countries work under the EU MAP)
- Data is compiled annually by the ICES Working Group on Baltic Salmon and Sea Trout (WGBAST). ICES updates the river specific PSPC, smolt production and consequently the stock status. In addition ICES estimates post smolt mortality, number of spawners and harvest rates.
- Smolt production estimated by a ICES full history model for 17 rivers
- Smolt production estimates by expert evaluation for 22 rivers



Criterion for GES

- Stock size at MSY in terms of smolt production
- Varies between the stocks and is 60-80 % of PSPC
- Stock specific estimates are in form of probability distributions expressing the uncertainty associated to the estimated stock status -> what is the acceptable degree of uncertainty?

GES value and uncertainty in estimates

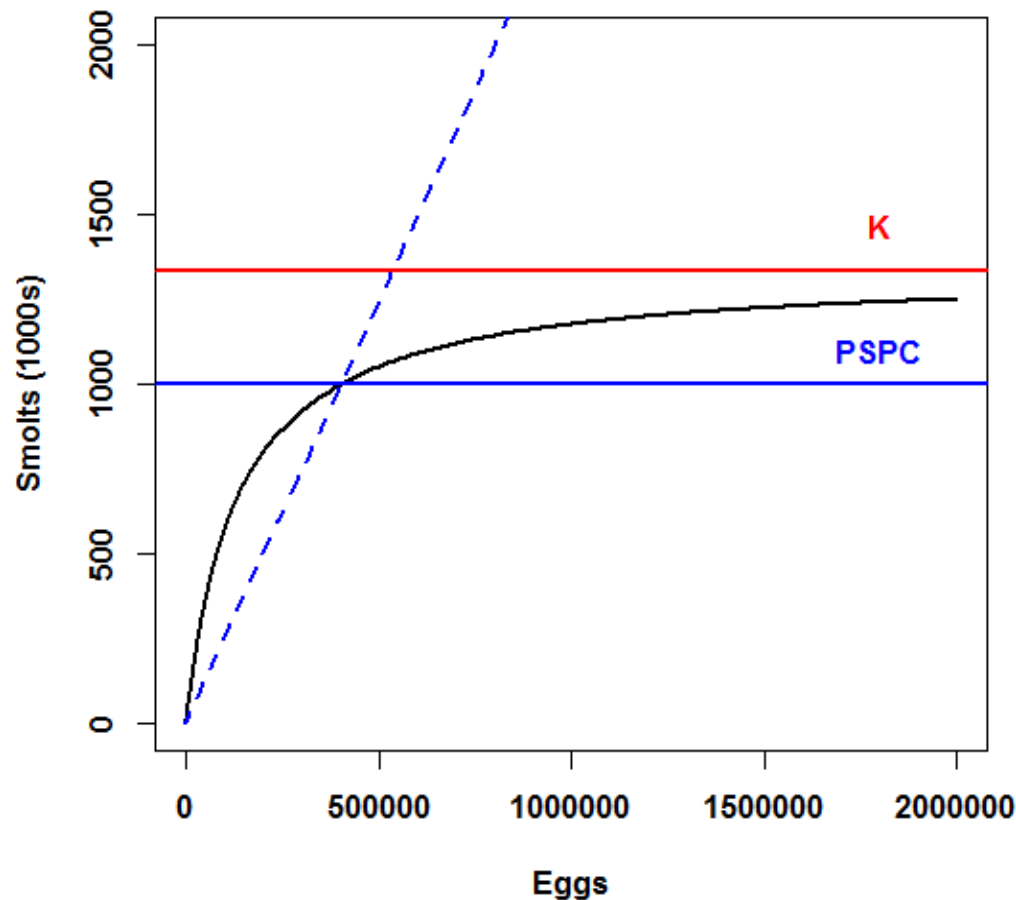
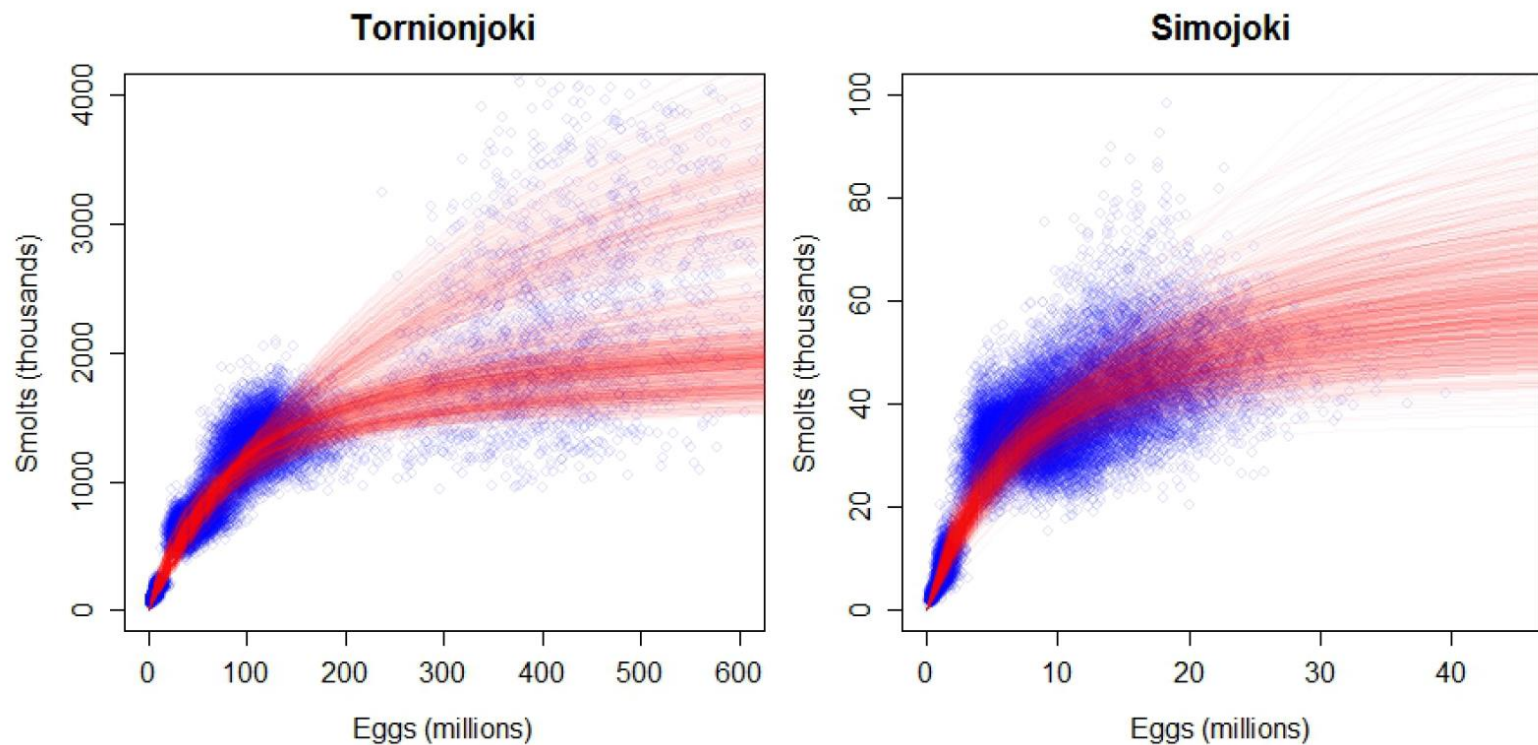


Figure. Beverton–Holt stock–recruitment curve (solid black line) with replacement line (dashed blue line), potential smolt production capacity with 0 fishing mortality, PSPC0 (i.e. R_0 , solid blue line) and carrying capacity, K (solid red line) indicated (ICES WGBAST 2016).

Uncertainty in smolt production estimates and in potential smolt production estimates



Summary

- Data collection well established
- Analytical assessment for 17 stocks
- Expert evaluation plays important role
- GES boundary well defined (stock size at MSY). Updates for stock specific estimates on smolt production at MSY coming soon.
- Agreement needed on target stock size (common proxy or stocks specific)
- Agreement needed on how the uncertainty will be dealt with in the evaluation of target stock size

References

- <http://www.helcom.fi/baltic-sea-trends/indicators/abundance-of-salmon-spawners-and-smolt>
- <http://ices.dk/community/groups/Pages/WGBAST.aspx>

Thank you!