Sufficiency of measures analysis to support the HELCOM Baltic Sea Action Plan update

HELCOM ACTION project
HELCOM Secretariat
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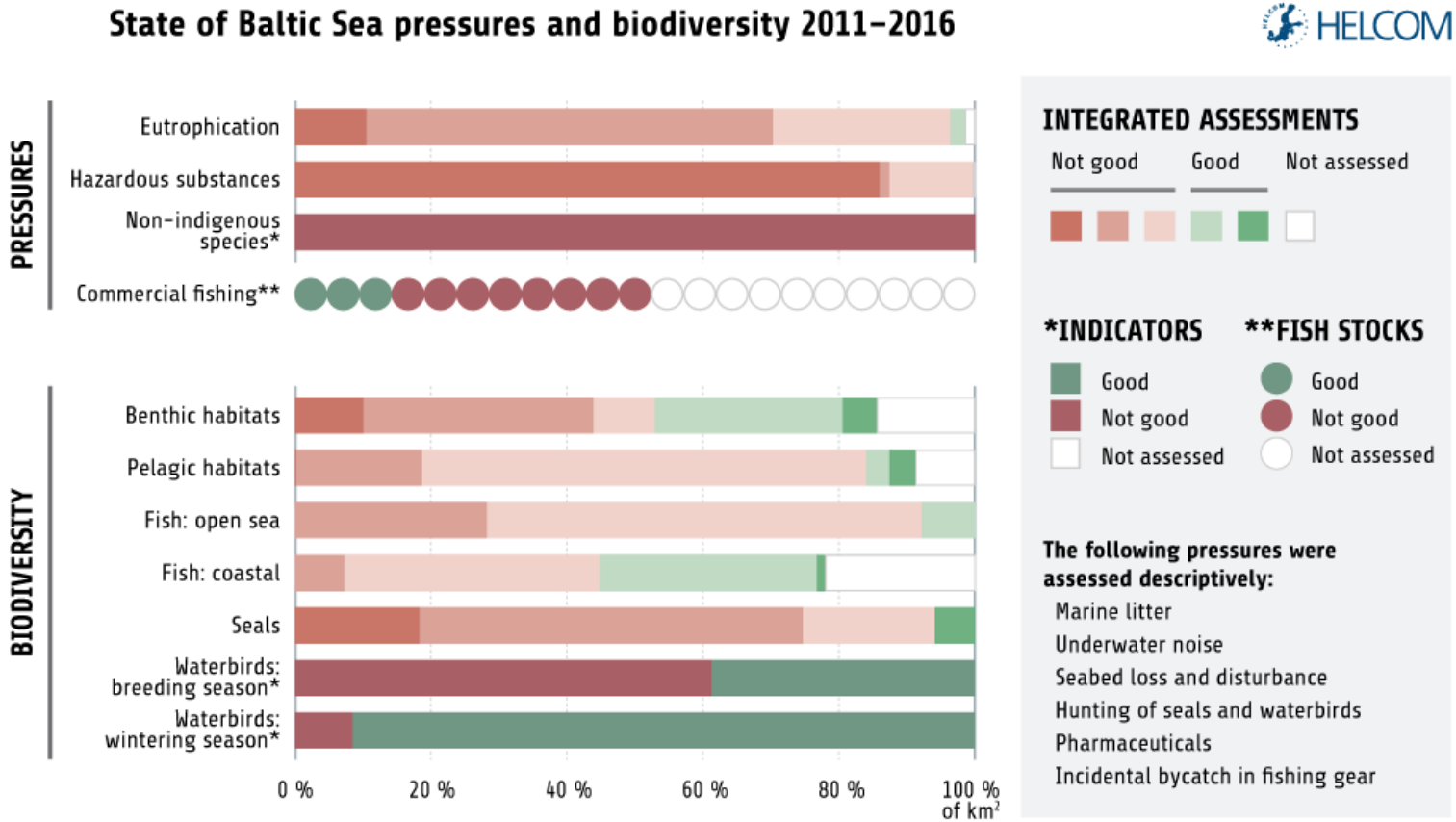
HELCOM

Overview of the SOM analysis

Baltic Sea: current state



Summary of the assessment of pressures and status for the Baltic Sea showing the proportion of area covered by different assessment status categories (based on square kilometres). For commercial fishing, the summary shows status of fish stocks. Integrated assessment results (eutrophication, hazardous substances, benthic habitats, pelagic habitats, fish, and seals) are shown in five categories. Assessment results based on indicators (commercial fishing, non-indigenous species, and waterbirds) are shown in two status categories.

Update of the Baltic Sea Action Plan

Key guiding documents:

- HELCOM 2018 Ministerial Declaration:
  - as a first priority, **achieve already agreed actions** with renewed efforts to make progress towards the goals of the current BSAP by 2021,
  - in addition, **address new issues**, on the basis of the commitments made in this Declaration and further deliberations during the BSAP updating process,
  - the updated BSAP should include **actions necessary for managing human activities** in such a way that the current HELCOM strategic goals can be achieved,
  - the updated BSAP will at least **maintain the ambition level of agreed actions and objectives**.
- Strategic plan for the BSAP update
- Work plan for the BSAP update

Analysis of sufficiency of measures (SOM)

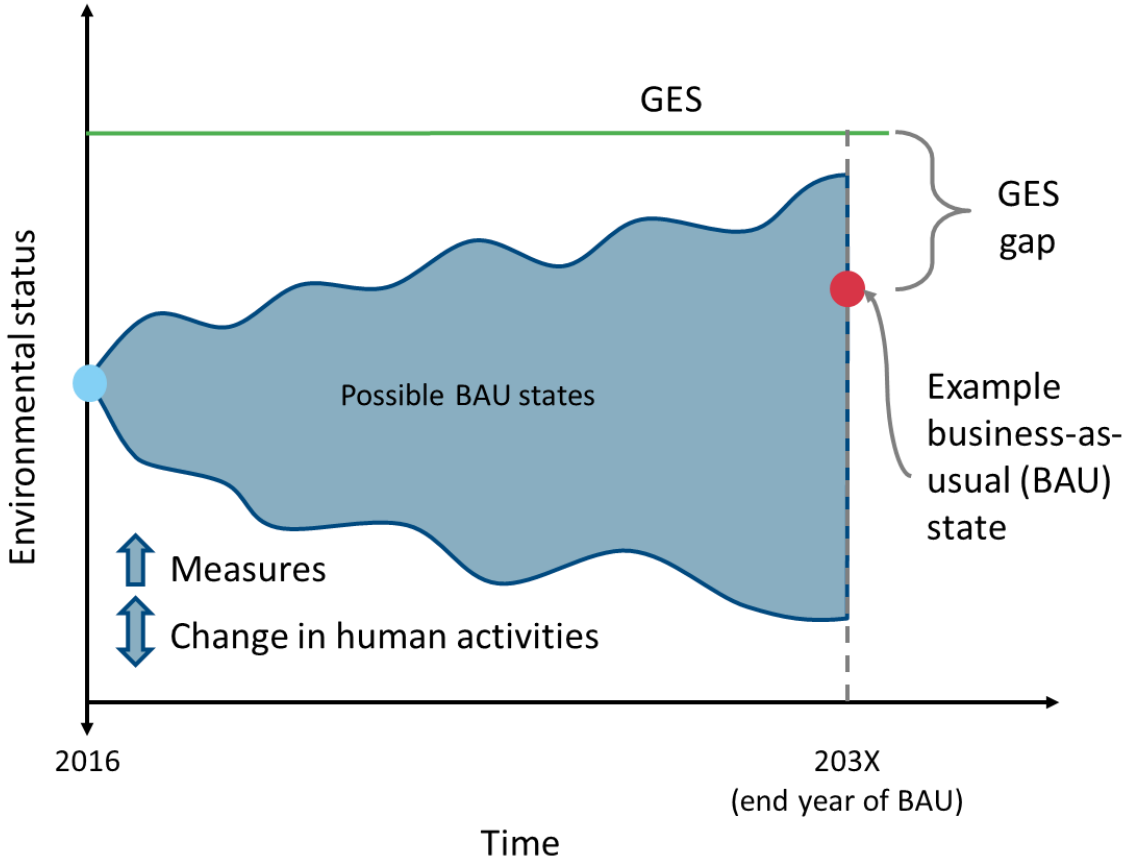
(activity 2.5 of strategic plan, SOM Platform, ACTION project, Working Groups, now-end of 2020)

- Agreed as an activity in the Strategic Plan for the BSAP update
- To be carried out by the HELCOM SOM Platform and HELCOM ACTION project
- Overall SOM approach endorsed by HOD 56-2019 and amended and supported by SOM Platform meetings 1-2019 and 2-2019

Features of the SOM analysis

- Supports the BSAP update by
  - assessing how far we are from achieving good status (GES) with existing measures
  - providing information for identifying the need for potential new measures
- First time SOM assessment is done in this extent in the Baltic Sea region or elsewhere
- Combines natural and social sciences approaches
- Same approach applied across all topics to ensure comparability and coherence (birds, mammals, fish, benthic habitats, hazardous substances, marine litter, underwater noise, non-indigenous species, input of nutrients)

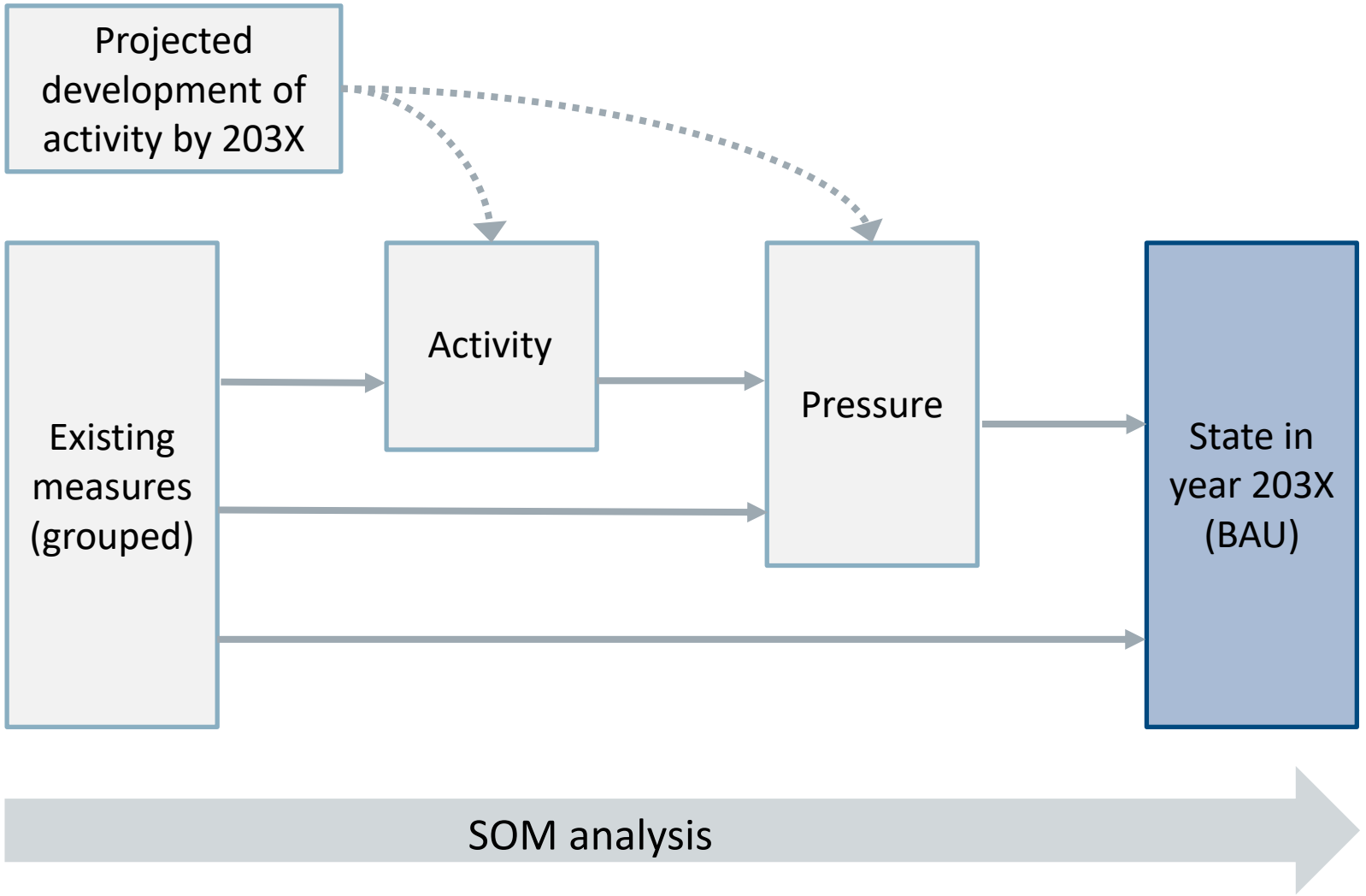
Assessing the business-as-usual (BAU) state for the SOM analysis



BAU state = status of the marine environment at a specific future year given measures in existing policies, their implementation status, natural time lags and possible development of human activities over time

Comparison of BAU and GES => whether existing measures are sufficient

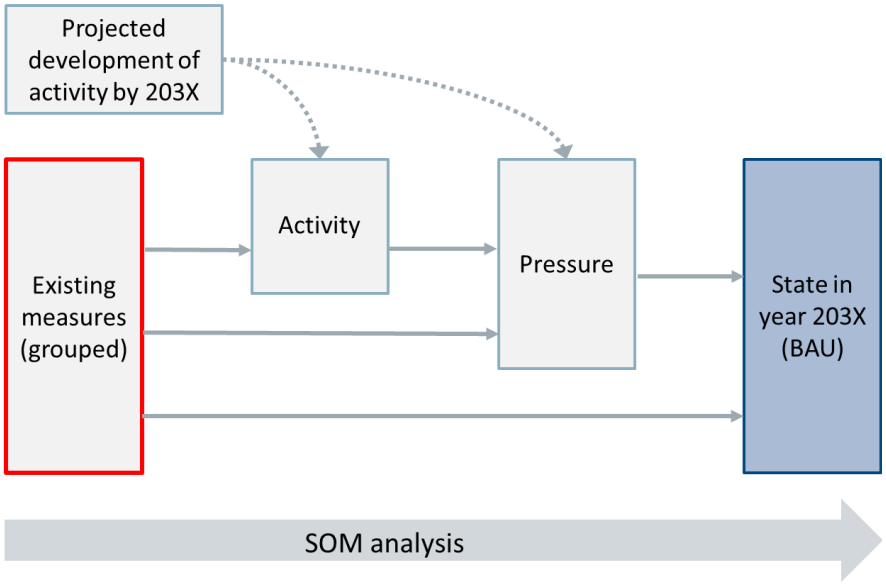
Components of the SOM analysis



Steps in the SOM analysis

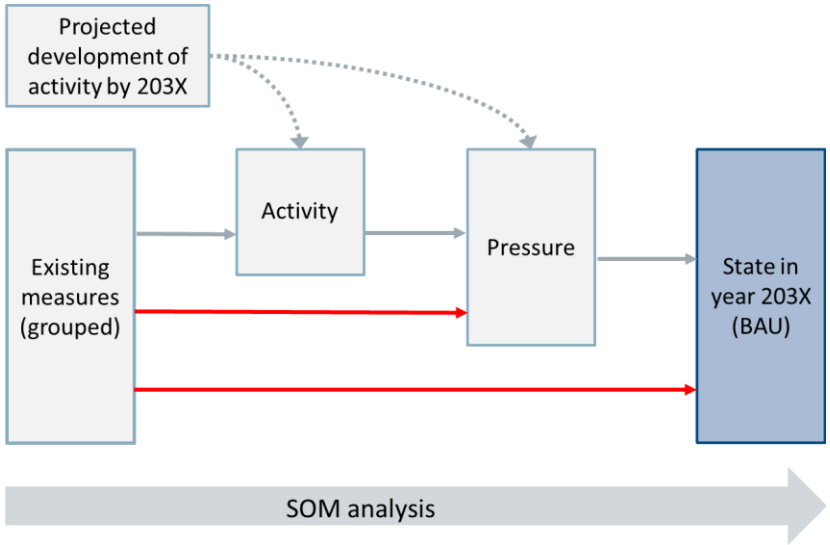
1. Existing measures
2. Identifying main pathways for pressures using activity-pressure-linkages
3. Estimation of effects of measures
4. Projected development of human activities/pressures
5. Linking reduced pressures with state components
6. Comparison of BAU and GES and sufficiency of measures
7. Time lags in measure-pressure and pressure-state links and state recovery

Existing measures



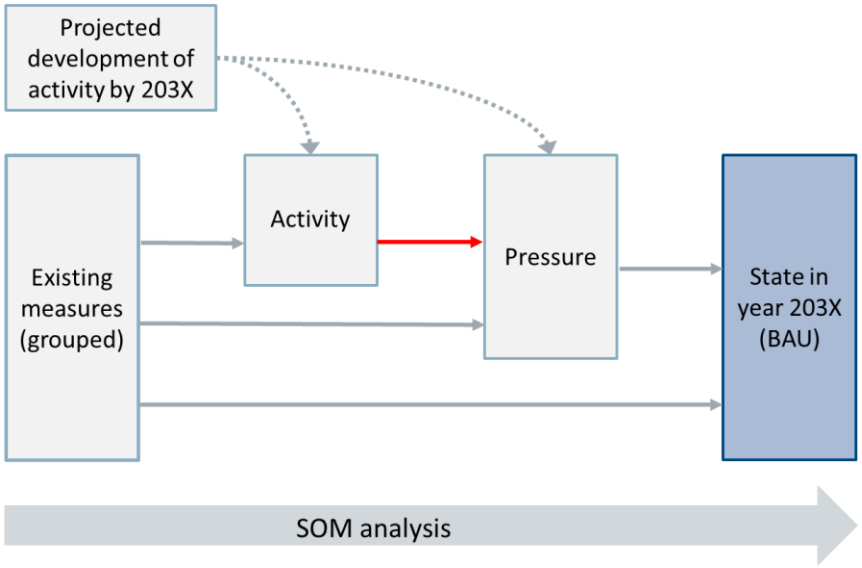
- Measures in existing relevant policies, e.g. current BSAP, MSFD
- Implemented, ongoing and planned in the time frame of BAU
- Grouped to general measure types to reduce the number of measures and improve the feasibility of the analysis

Effectiveness of measures



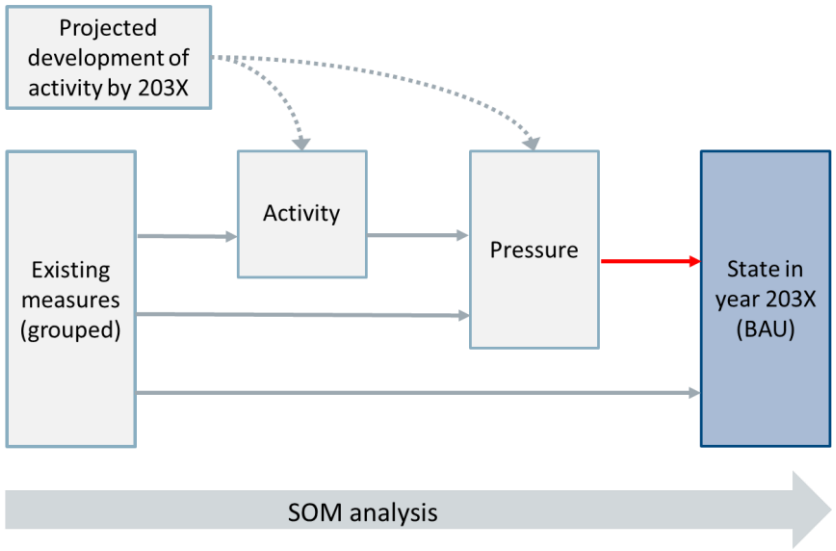
- Reduction in a specific pressure from a specific activity from implementing a generalized measure
- Assessed as a percent (%) change
- Restoration measures
- Based on expert elicitation and existing literature and models

Activity – pressure link



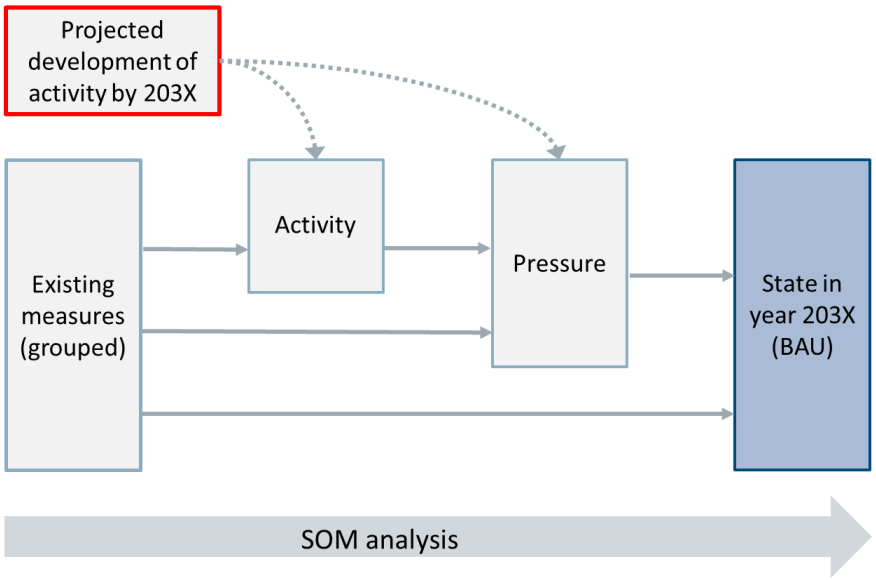
- Contribution (%) of activities to pressures
- Mainly based on expert surveys
- Loss and disturbance to the seabed
  - Approach used in HOLAS II
  - Links percent contribution of activities to the two physical disturbance pressures
- Input of nutrients: data from ACTION WP4

Linking pressures with state components



- Links between pressures and state components
- Depending on the existence of GES threshold:
  - Required pressure reduction (in %) to reach or maintain GES
  - Required pressure reduction (in %) to achieve a specific change in the state component
- Mainly based on expert elicitation

Development of human activities



- Changes in human activities over time
- Two alternative assumptions: 1) no change, 2) most likely change in activities
- Analysis limited to predominant activities
- National and regional data sources
- Qualitative information translated into percentages

Main components in SOM analysis using expert elicitation

1. Linking activities to pressures
2. Effects of measures on pressures
3. Linking pressures with state components

- Information from scientific literature and expert elicitation to allow for comprehensive inclusion of measures, pressures and state components

Expert SOM workshops and surveys

- Five SOM topic workshops in fall 2019
  - Mammals, birds, hazardous substances, fish, benthic habitats
  - Effectiveness of measures and pressure-state links
  - Aim to test and discuss the surveys and gather comments and feedback for finalizing them
- Expert surveys
  - Implemented online in December - January
  - Respondents: nominated experts

Timeline for 2020

- Survey and literature data collection completed in January 2020
- Data analyses and model runs in January-February
- Results and draft report presented to SOM Platform 3-2020 at the end of March

Use of expert survey responses in the SOM analysis

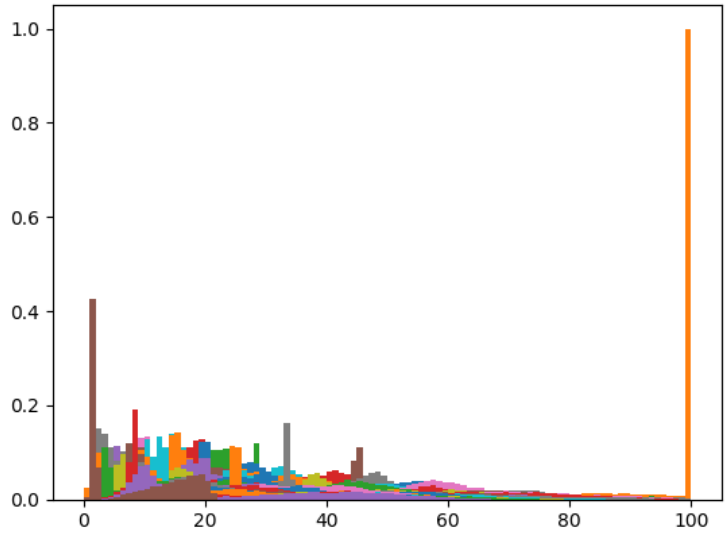
Survey responses

- Survey responses can be used to formulate three point estimates
- Minimum, maximum and most likely asked directly for contribution of activities to pressures and effect of reducing pressures on state
- Effectiveness and certainty of that effectiveness used to form three point estimates of the effectiveness of measures

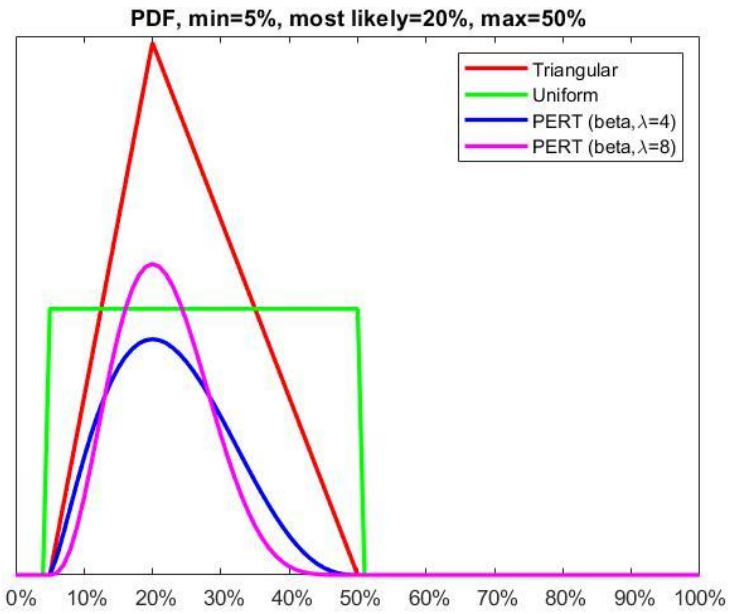
From survey responses to probability distributions

- Each three point expert estimate can be turned into a probability distribution
- Sets of point values drawn from these expert-specific distributions can be pooled over experts (pooling approach)
- Aggregate distributions can be defined based on these pooled values

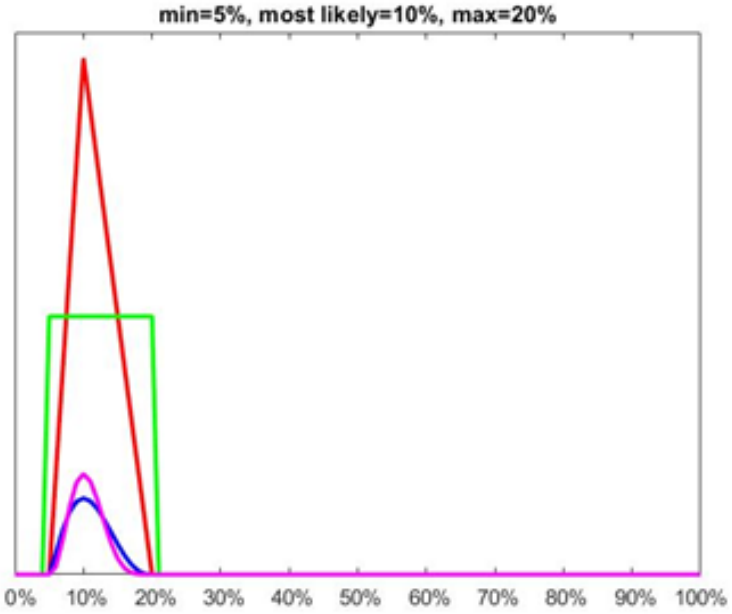
Example:
Distributions of the effectiveness of several measure types
(made-up data)



Alternative distributional assumptions are possible



Example: Contribution of an activity to a pressure



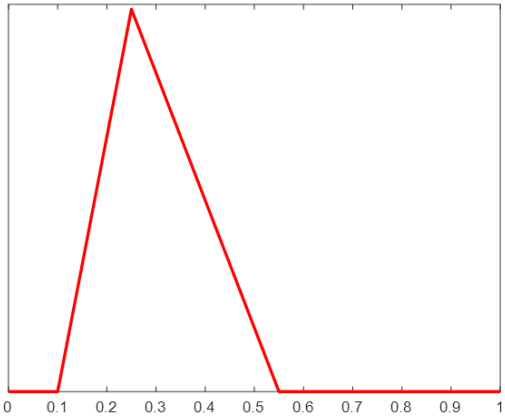
Example: Pressure reduction from a measure type

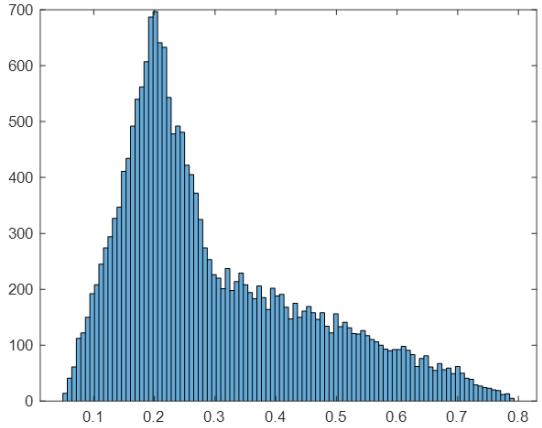
Different assumptions on the type of probability distribution can be made

- Beta distribution: values close to the most likely value are more likely
- Uniform distribution: all values from minimum to maximum are equally probable

Example on three point estimates of two respondents

Estimates	Minimum	Most likely	Maximum
Expert 1	15%	30%	80%
Expert 2	5%	20%	30%





- Left: distribution based on the averages of the three point estimates of two experts
- Right: a discrete distribution aggregated from **pooled** values (pooling approach)
- Aggregated distributions of pooled values account better for the uncertainties and extreme values given by all respondents

Effectiveness of measures

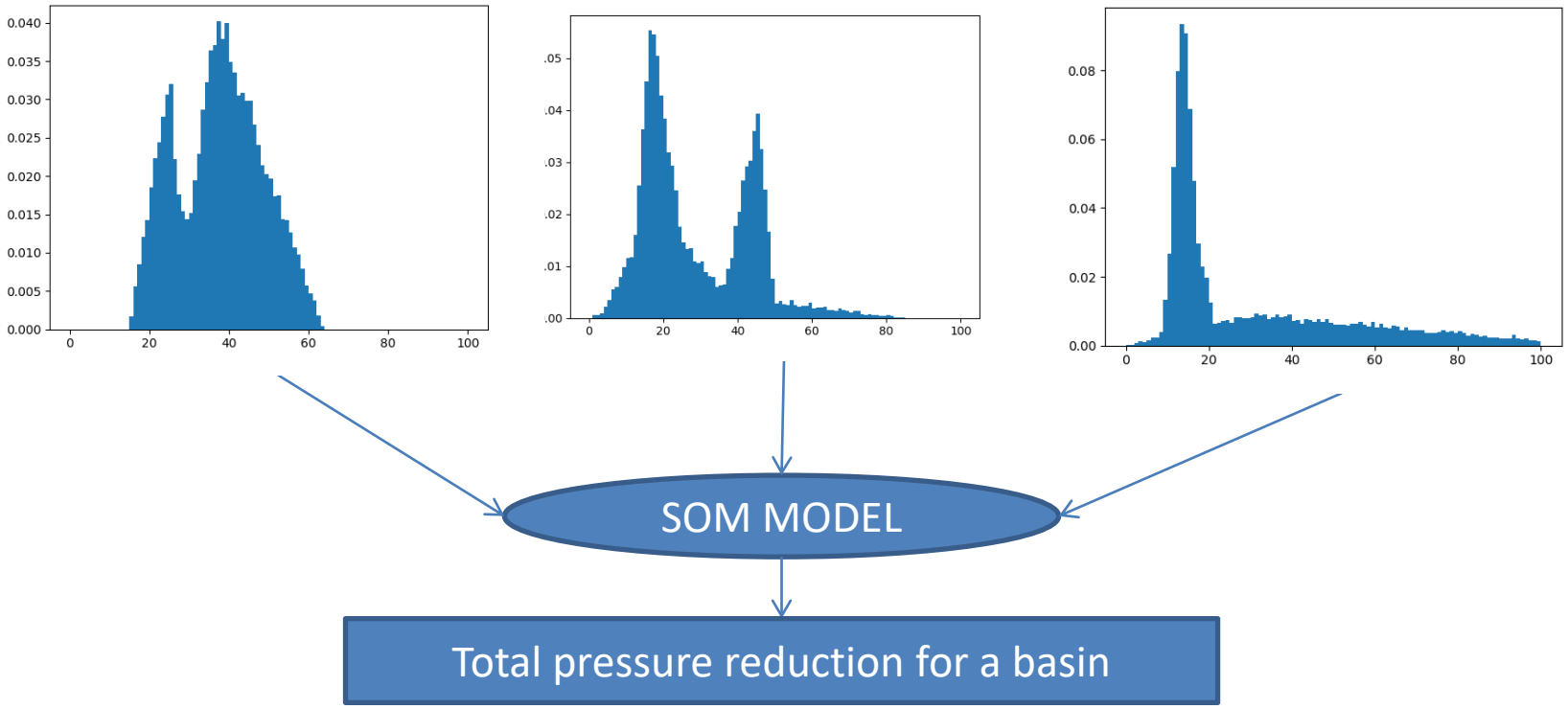
Measure type pressure reductions (%)

- Based on relative effectiveness of measure types, certainty of the effectiveness and expected effectiveness of the most effective measure type (%)
- Effectiveness responses used to assess most likely effectiveness
- Certainty responses used to assess minimum and maximum effectiveness

Activity-specific measure type pressure reductions (%)

- Three point estimates of activity-pressure contributions (min, max, most likely, %), three point estimates of measure type pressure reductions (%)

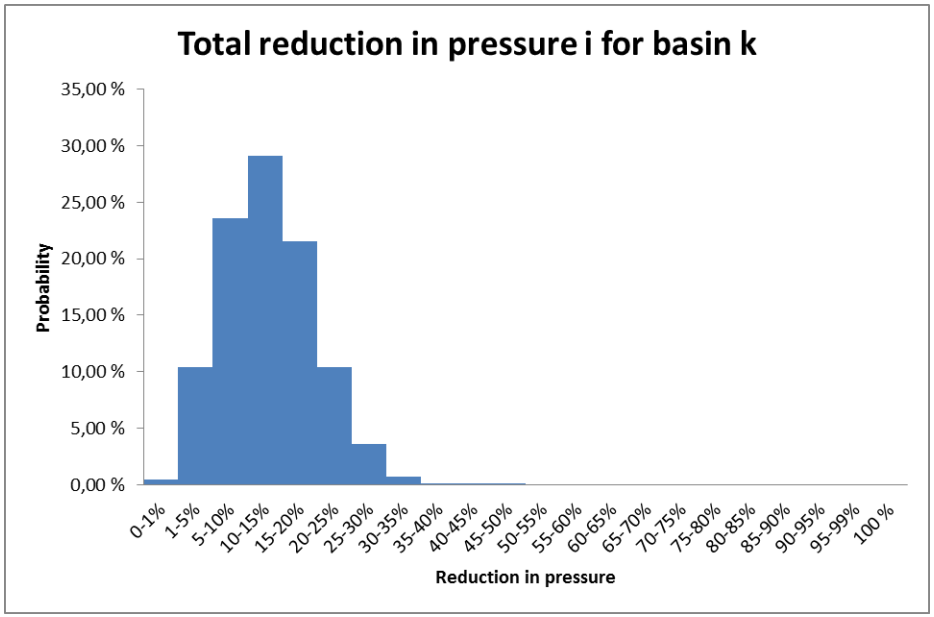
Effectiveness of measures: simulation



- Data is randomly drawn from distributions that represent pooled activity-pressure contributions and pooled pressure reductions from measure types
- A large number of values is drawn from each distribution (Monte Carlo simulation)

Effectiveness of measures: Model results - pressure reduction

- Result: Total reduction in pressure (%) presented as a probability distribution
- Expected reduction in pressure (%) can be estimated
- Possible to assess the likelihood that reduction in pressure is less than some percent and that pressure reduction is between some percent values



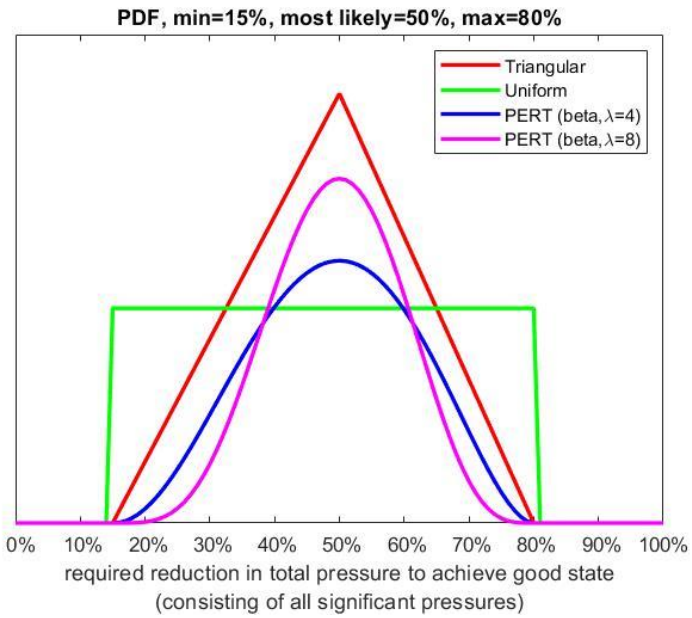
Pressure-state linkages

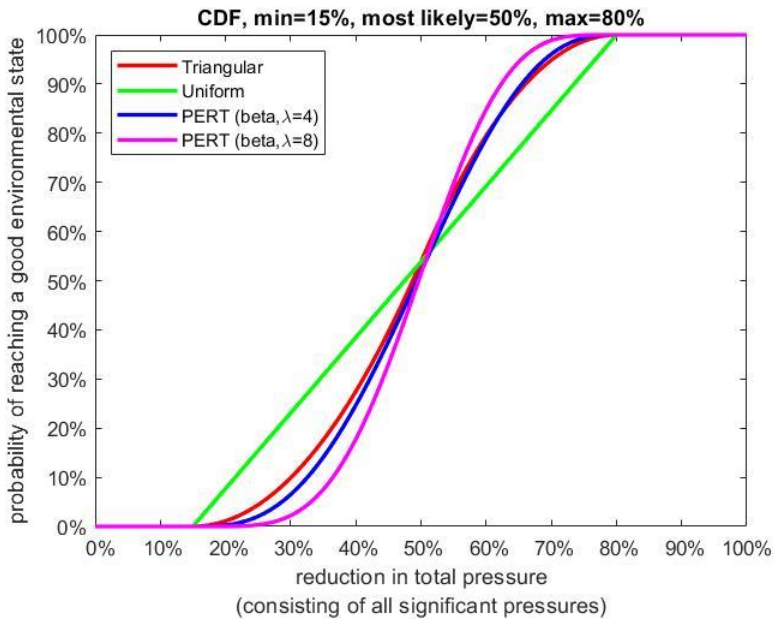
- Three point estimates can be defined based on survey responses (min, max, most likely)
- Two alternatives
  - GES threshold exists
  - No GES threshold

Pressure-state: GES threshold

- Pressure reduction - good environmental status cumulative distribution
  - based on three point estimates for state variables with known GES thresholds
  - defines the probability of reaching GES given a reduction in total pressure affecting the state variable

Probability of achieving GES





- Cumulative probability of achieving GES: defined from the probability distribution of required reduction in total pressure to achieve GES
- Results are used to assess what is the probability that GES is achieved given the pressure reduction - good state cumulative distribution functions

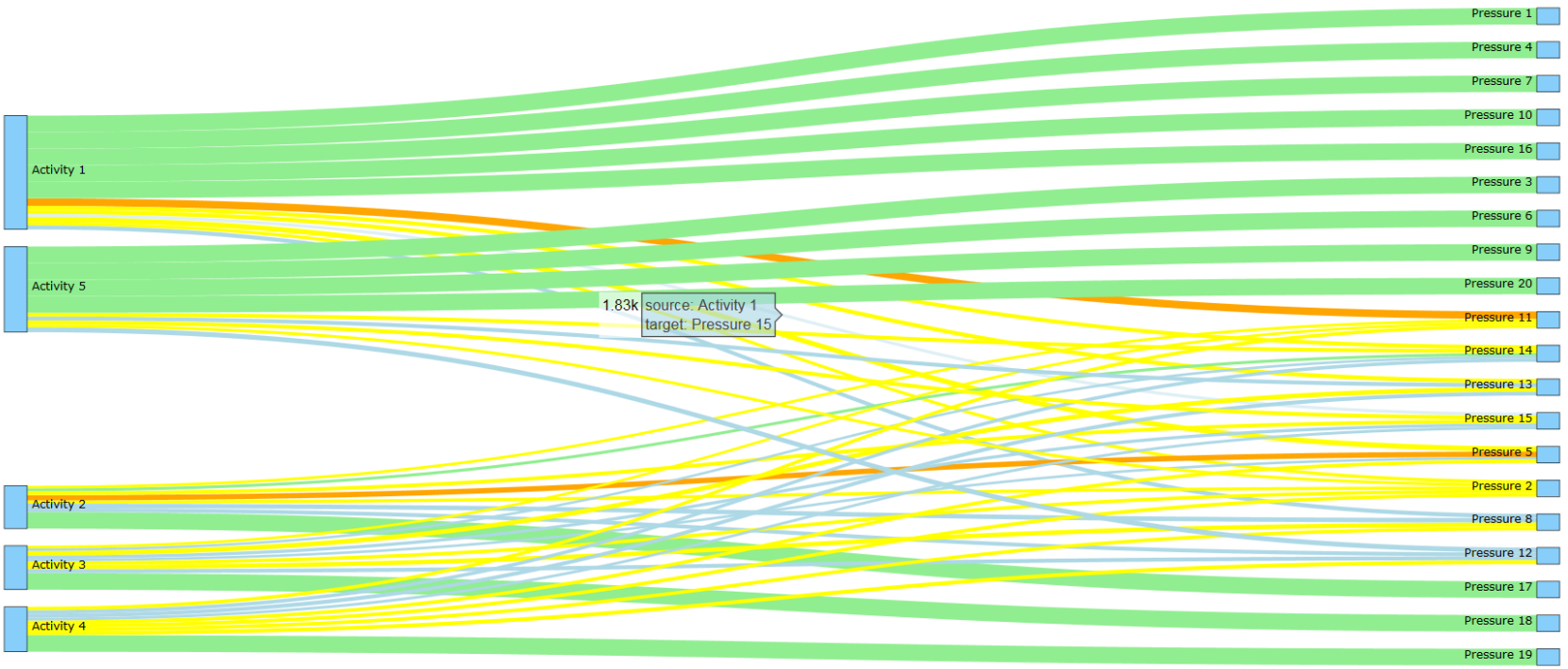
Pressure-state: no GES threshold

- Probability to achieve GES cannot be assessed for state components without a GES threshold
- Probability of achieving specific state improvements (%) from reduction in pressures
- Probability distribution and cumulative distribution of reduction in total pressure required for state improvements

Interpretation of the results

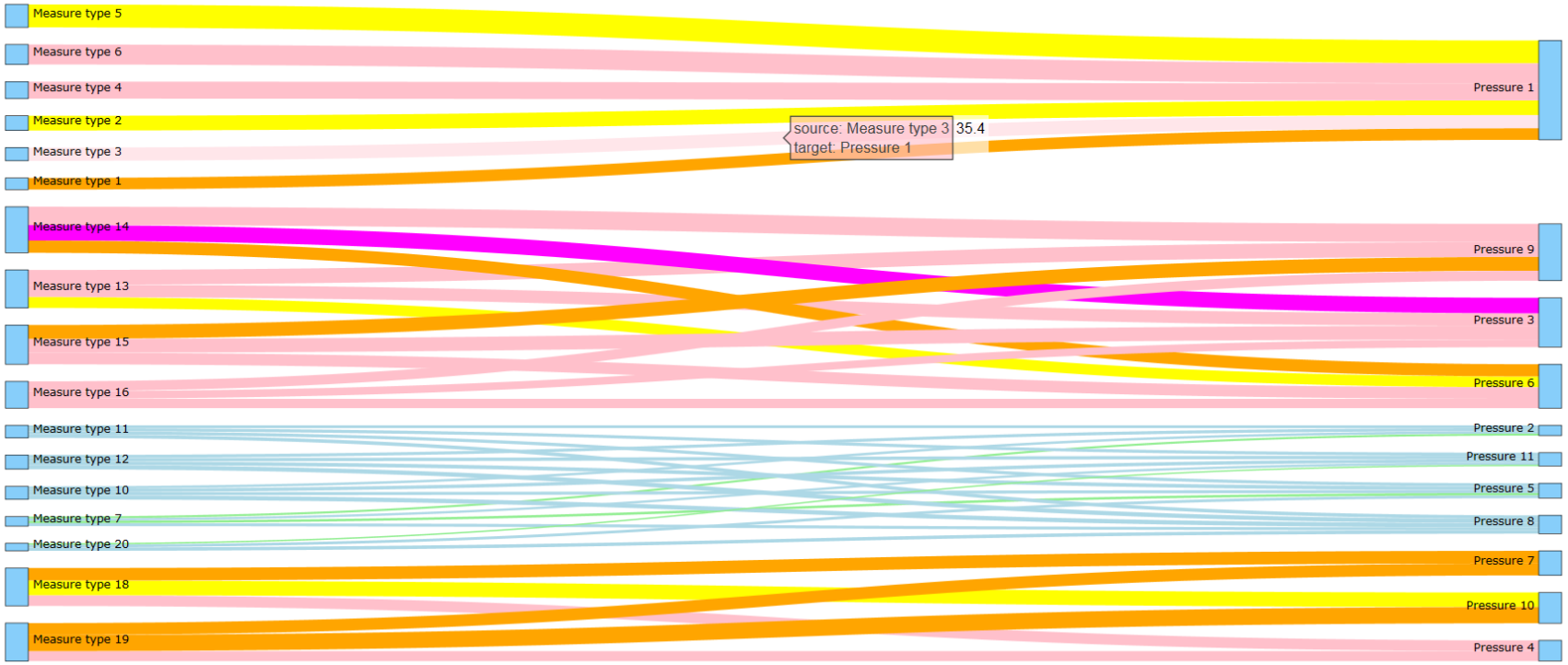
- Numeric results of the model can be transformed to more descriptive categorical values (e.g. low, medium, high)
- Final results on the total reduction of pressure or achieving GES should be interpreted in the context of the model, relative to the other results
- Additional results, e.g. on the effectiveness of measure types in reducing pressures and summaries of the activity-pressure contributions
  - Can be used to interpret the final results and to identify what type of new measures are needed

Results example: Summary of activity-pressure contributions



Colors and thickness of lines can be used to present magnitude and uncertainty

Results example: The effects of measure types on reducing pressures (note: not based on real data)



Colors and thickness of lines can be used to present magnitude and uncertainty

More information

Website with SOM materials

Document on SOM approach for SOM Platform 2-2019

Document on use of survey results in the SOM model for SOM Platform 2-2019