

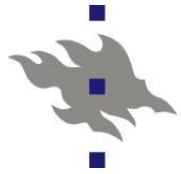


HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

IBAM: Integrated Bayesian risk analysis of ecosystem management in the Gulf of Finland

Coordinator:

Professor Sakari Kuikka, Fisheries and Environmental Management Group (FEM), Department of Biological and Environmental Sciences, University of Helsinki

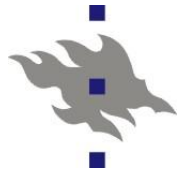


Aim is to create a model that...

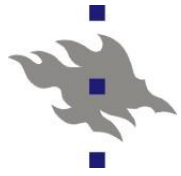
- Integrates several risk factors in the Gulf of Finland:
 - fisheries
 - eutrophication
 - oil spills
 - dioxin risks related to the consumption of herring
 - climate change

- includes uncertainty estimates

- can be used to rank decision options

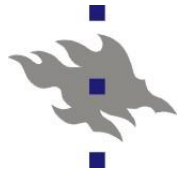


IBAM: consortium



Team

- Fisheries and Environmental Management Group at the University of Helsinki
- Environmental Geoinformatics Group, Helsinki University of Technology (TKK), Finland
- Estonian Marine Institute, University of Tartu, Estonia
- The Finnish Environment Institute, Finland
- Blekinge Institute of Technology, Sweden



TEAM: Joined research project

- OILECO – oil spill risk analysis
- PRONE – risk methodology in fisheries
- POORFISH – management in data poor cases
- EVAHER – dioxin risk analysis
- EVAGULF – risk analysis on eutrophication
- JAKFISH – interactive risk modelling with stakeholders



- IBAM – integrated risk analysis

Funding

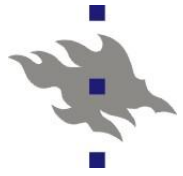
Interreg
6th framework
- ” -
UHel, HERC
Interreg
7th framework

BONUS !

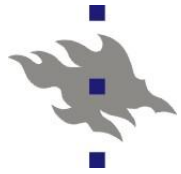


Total budget (excluding *in kind* contributions)

	2009	2010	2011	Sum
Personnel costs:	217478	215478	216128	649084
Person months:	54	54	56	164
Consumables:	3900	3900	3900	11700
Travel costs:	17600	17575	17000	52175
Equipment:	3500	0	0	3500
Other costs:	3300	2300	4700	10300
Subtotals:	245778	239253	241728	726759
Overhead:	43209	41825	41518	126552
Subcontracts:	12500	7500	0	20000
Total costs:	301487	288578	283246	873311

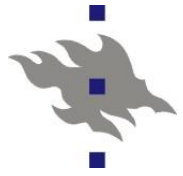


IBAM: framework and approaches



Important themes are:

- **Integration of risks:** What happens when a species/population is threatened by several risks at the same time?
- **Evaluation of management:** Would integrated management of all sea-related pressures (oil transport, fishing, nutrient loading...) bring benefits compared to the current situation?
- **Accounting for uncertainties** in every step of the management process: stochasticity of natural processes, lack of knowledge about natural responses, uncertainty in human responses to management (Bayesian modelling)



Risk ?

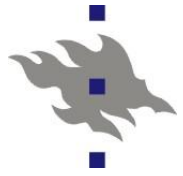
- Risk has usually two definitions:

- 1) probability of something bad happening (e.g. probability of stock collapse)

- 2) risk = probability * value of the utility function.

- Risk includes also the subjective valuations of good and bad !

- **Probabilistic models** are required to complete this type of analysis.

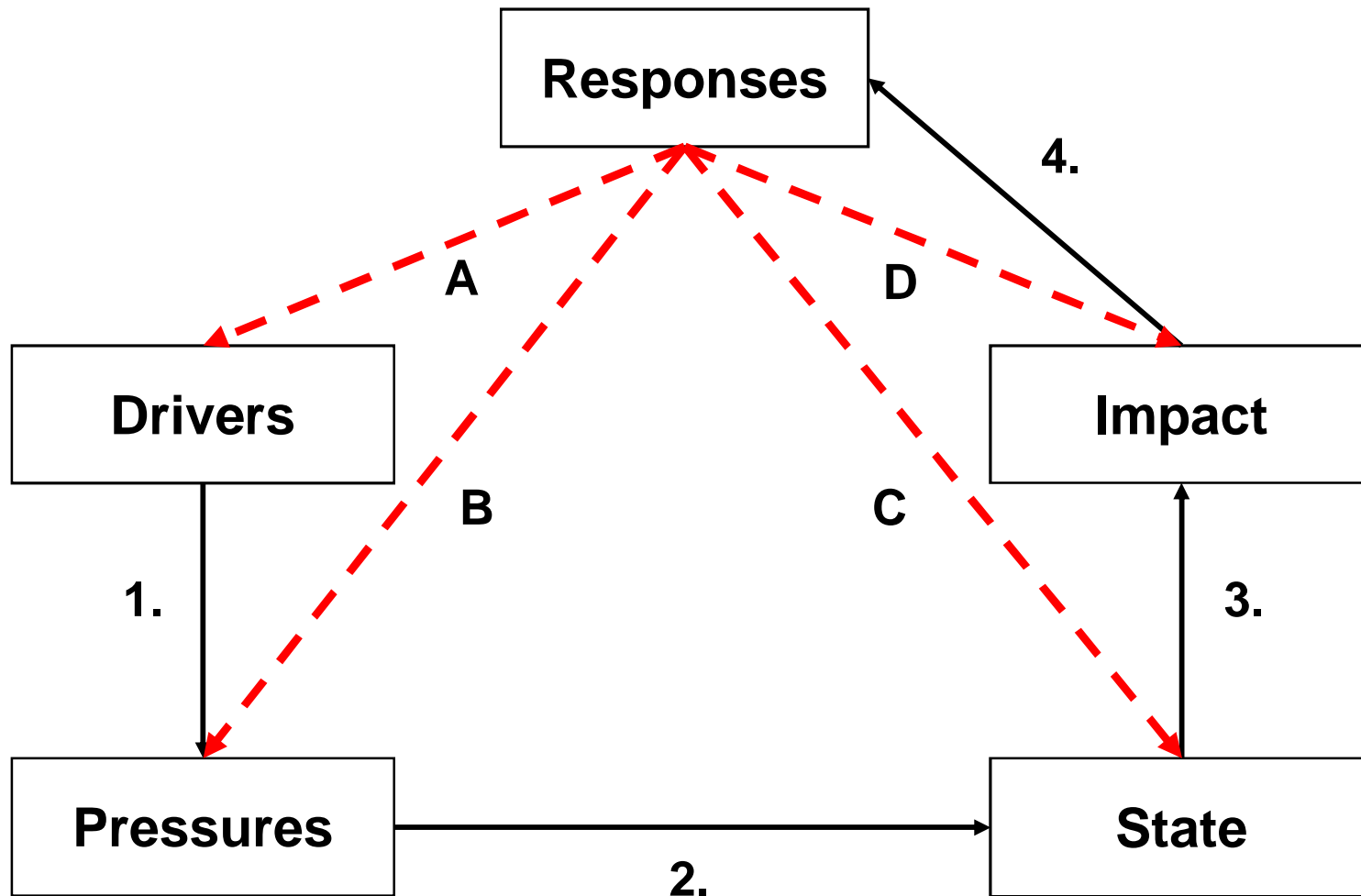


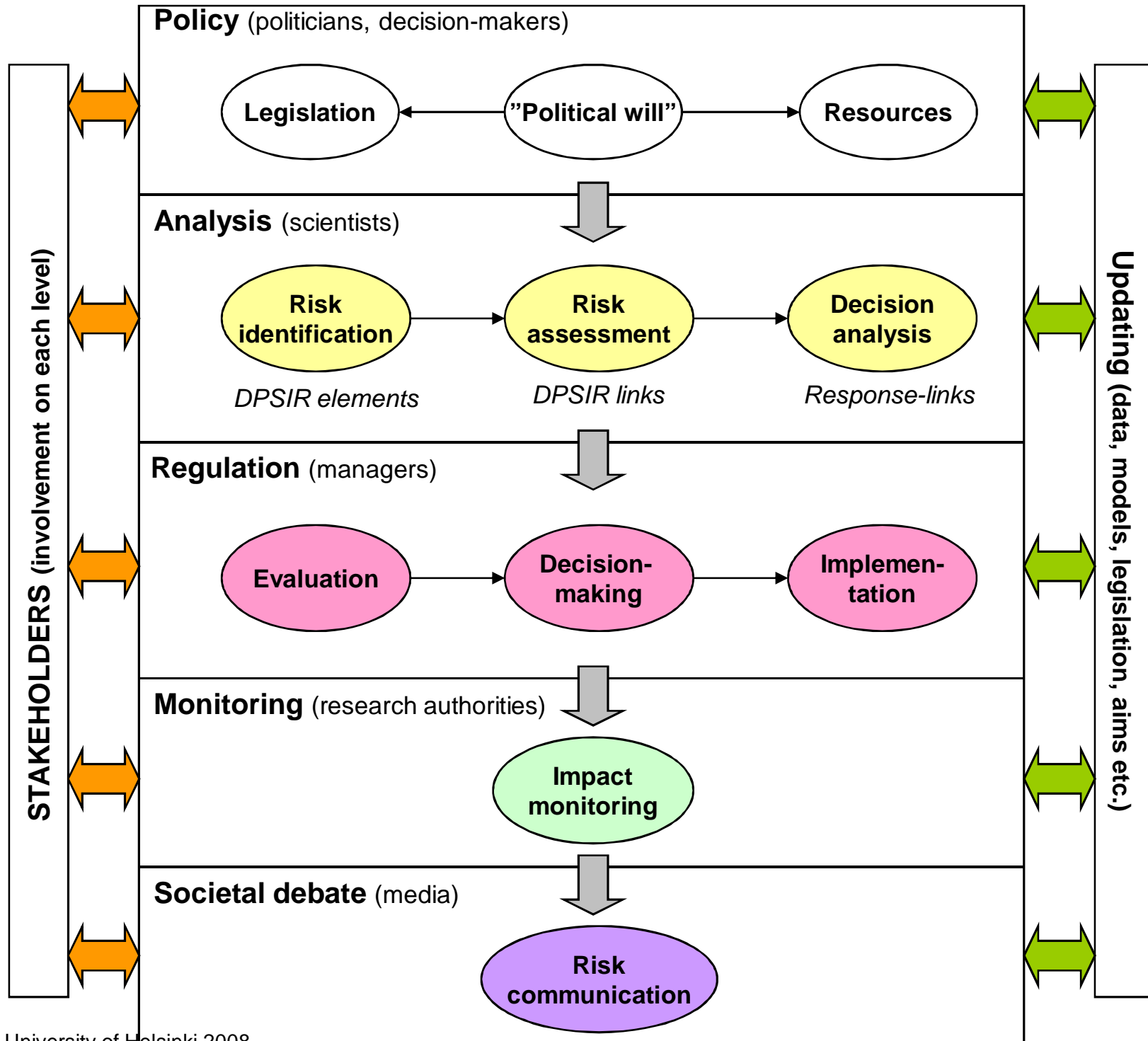
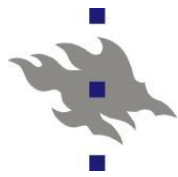
PRONE project: application of risk framework to fisheries

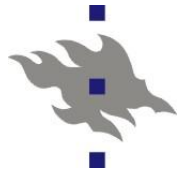
- Risk definition
- Risk assessment
- Risk management
- Risk communication: is it possible?



DPSIR => framework for decision analysis







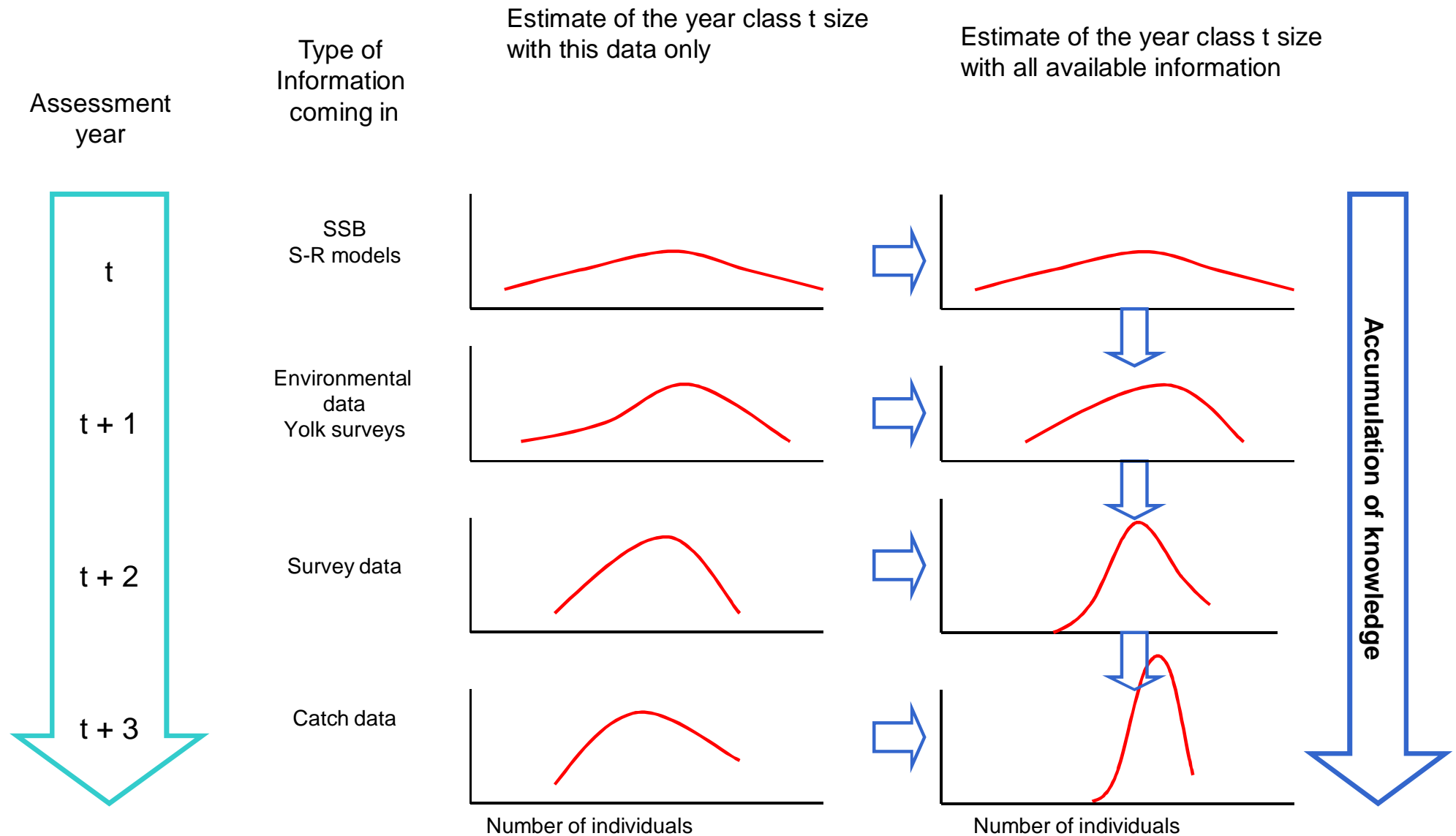
Uncertainty

Rowe (1994):

- Temporal uncertainty: future and past states
- Structural uncertainty (uncertainty due to complexity, related to control)
- Metrical uncertainty (uncertainty in measurements, e.g. how representative they are)
- **Translational uncertainty (uncertainty in explaining uncertain results)**

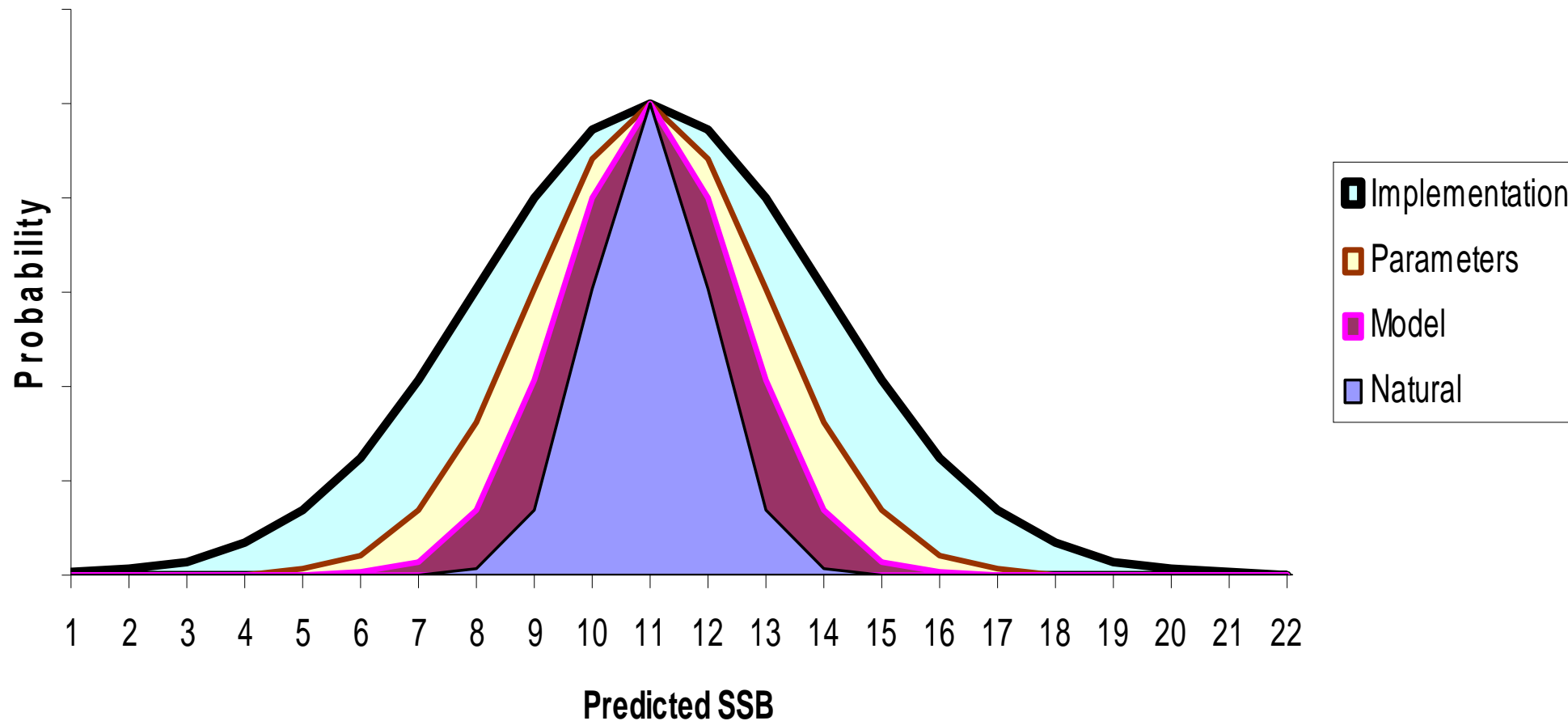


Bayes – inference: learning from several models





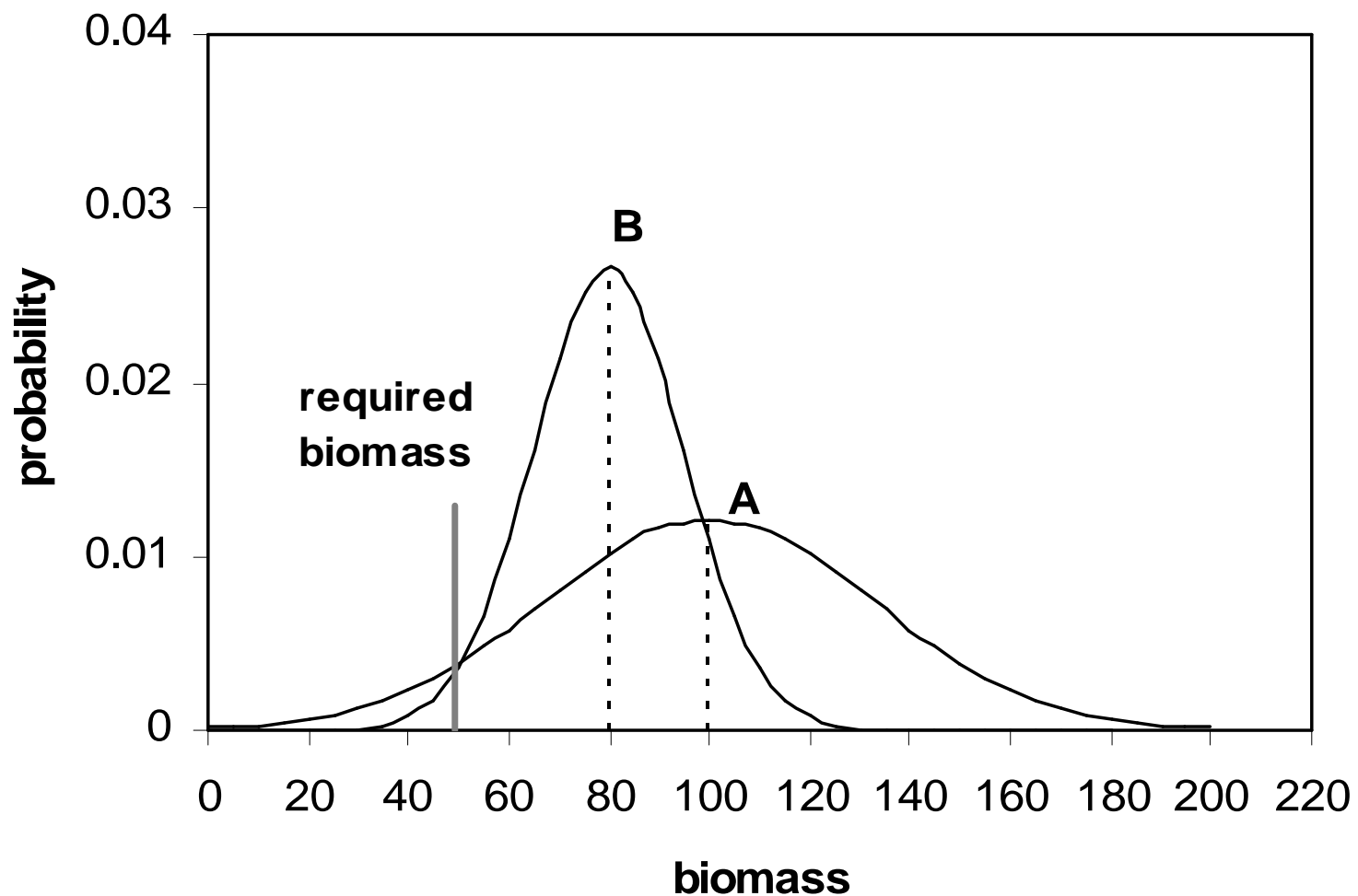
Risk assessment: Sources of uncertainty

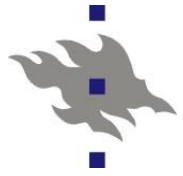


By Samu Mäntyniemi, FEM



Risk management: actions



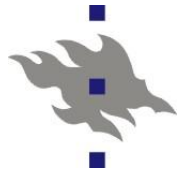


IBAM: tasks and related earlier projects



Task 1: Geographical analysis of the spread of the common reed (*Phragmites australis*) in the Gulf of Finland

- Model the historical and future development of the reed community in the Finnish coast (map application)
- Complex ecological phenomenon
- Ecological effects: birds, fish, insects, plants
- Biodiversity effects
- Recreational value
- Conservation status



Task 2: Herring fisheries analysis

- Contribution of environmental effects (eutrophication, warming) and fishing on the collapse of the GoF herring stock
- Effect of oil spills (unknown frequency and magnitude)
- Setting up Bayesian quota for herring fisheries
 - Optimisation between total effort and total catch
 - Biological and economic aims



Task 3: Development of an integrative environmental decision support system (DSS)

- Integrating the various risk factors into one model
 - Climate change, eutrophication, oil spills, fishing

- Policy analysis

- Ecological and economic consequences

- Examined species include
 - Key species: Reed, Bladder wrack, Common eider
 - Endangered species
 - Economically important species: Baltic herring, common reed



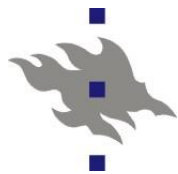
Related projects 1/3 (Interreg; ended)

■ OILECO (2005 – 2007)

- Integrating ecological values in the oil combating decisions
- Vulnerability of species & functional groups;
- Mapping the most vulnerable species

■ EVAGULF (2006 – 2007)

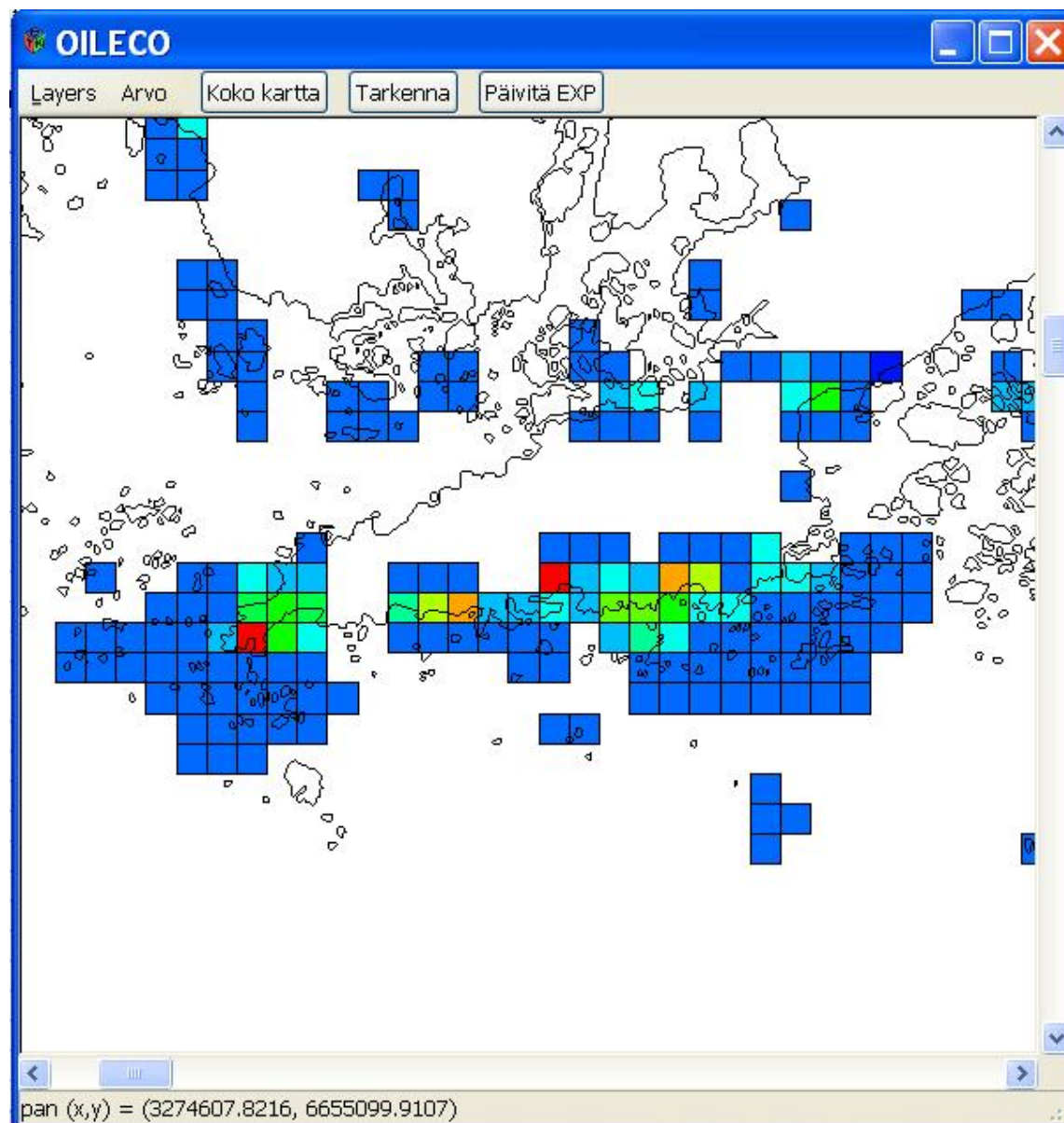
- Eutrophication-related risks in the ecosystem in the GoF
- Decision-support tool: likely effects of policies
- Protection of biodiversity: national actions / international coordination?



OILECO: Software Map interface

Menu:

- Resolution (200/1000m)
- Month
- Oil type (light/medium)
- Wind speed and direction
(inserted)
- **Criteria for the valuation**
 - 1 Conservation value
 - 2 Recovery potential
 - 3 Booming efficiency
 - 4 OILECO index (1-3)
 - 5 **Number of vulnerable species**





OILECO: Example of submodel: oil spills

Skenaario 1

oil type	
0.00	light_oil
0.00	medium_oil
100.00	heavy_oil

recovery of gulls	
0.30	> 80%
11.40	50-80%
22.69	20-50%
65.61	< 20%

time of the year	
0.00	spring
100.00	summer
0.00	autumn

proportion of oiled co...	
0.00	< 7 %
0.00	7-15 %
0.00	15-44 %
0.00	44-88 %
100.00	> 88 %

Skenaario 2

oil type	
0.00	light_oil
100.00	medium_oil
0.00	heavy_oil

recovery of gulls	
87.02	> 80%
12.43	50-80%
0.56	20-50%
1.55E-5	< 20%

time of the year	
100.00	spring
0.00	summer
0.00	autumn

proportion of oiled co...	
0.00	< 7 %
100.00	7-15 %
0.00	15-44 %
0.00	44-88 %
0.00	> 88 %

Type of oil
(light / medium / heavy)

Recovery of sea-gulls
(% populaatiosta 10 vuodessa)

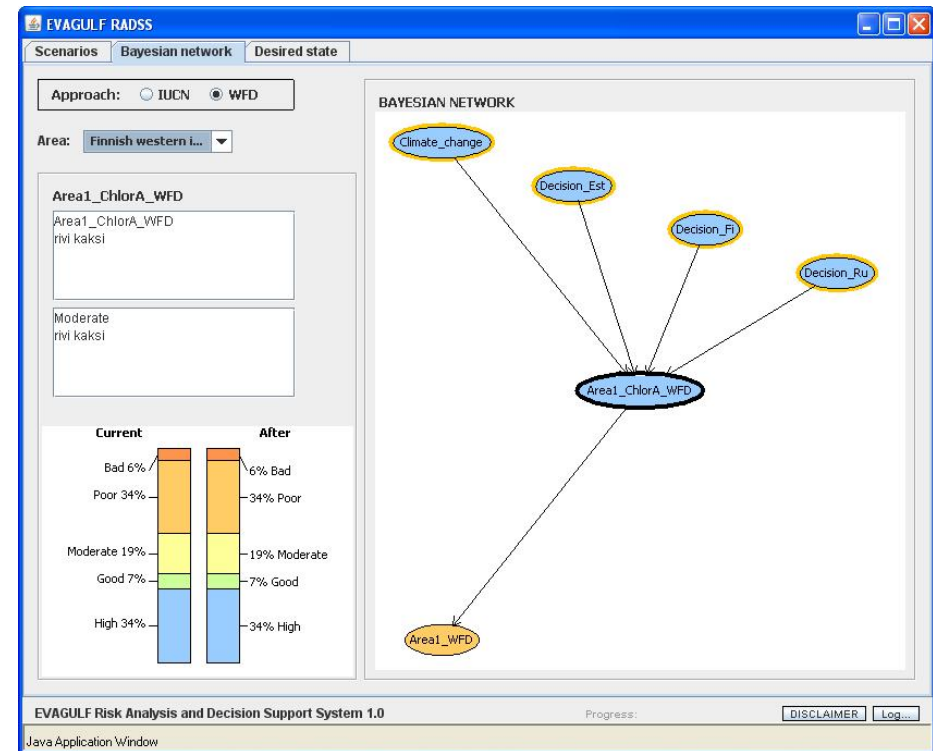
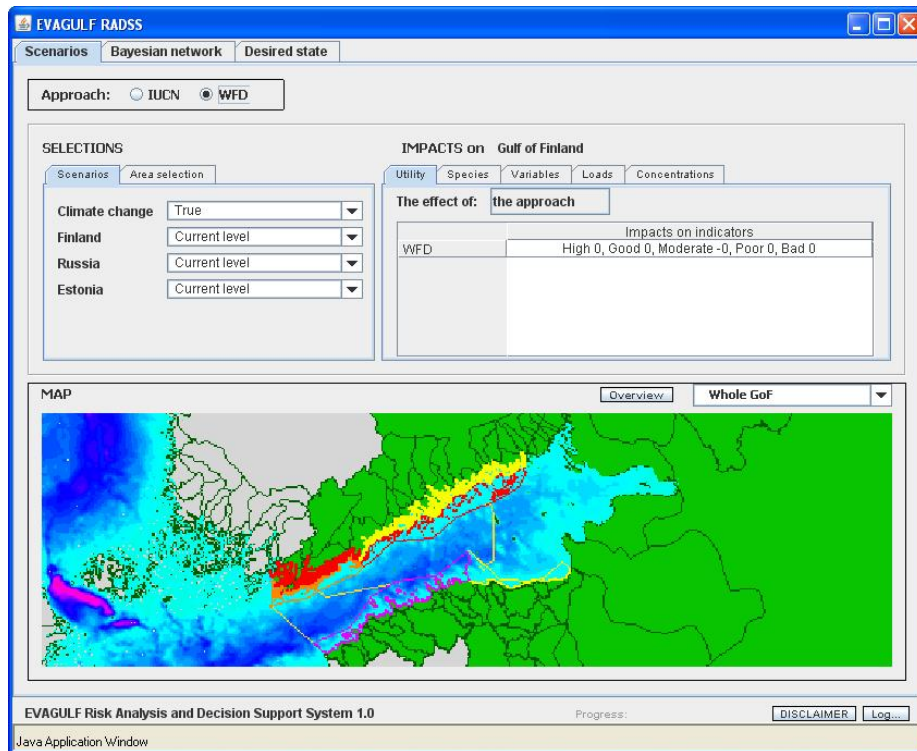
Time of the year
(spring / summer / autumn)

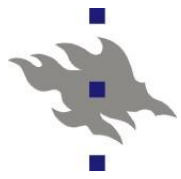
Proportion of oiled shoreline
(%)



EVAGULF: WEB models

- Example: www.evagulf.fi
- Main page
 - Select the area, evaluation approach, scenario and unit and disseminate the changes compared to the current situation:
 - Total utility / risk
 - Status of the species
 - State of the key environmental variables
 - Total load

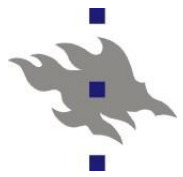




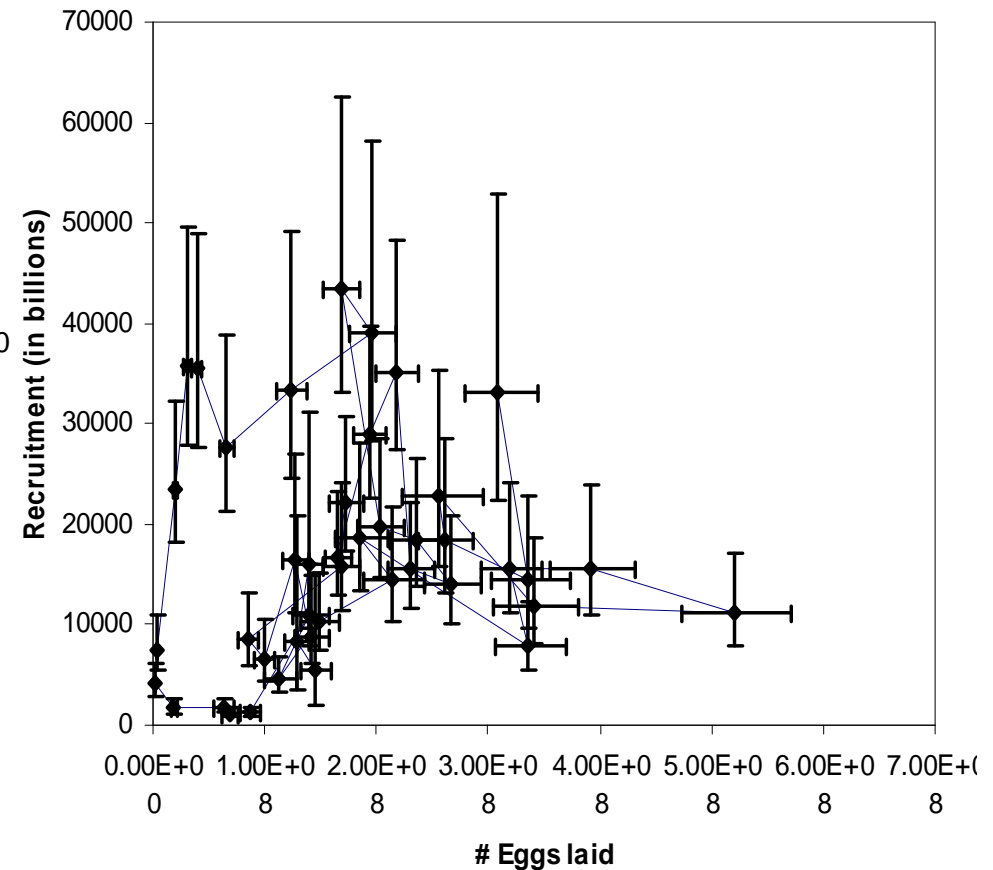
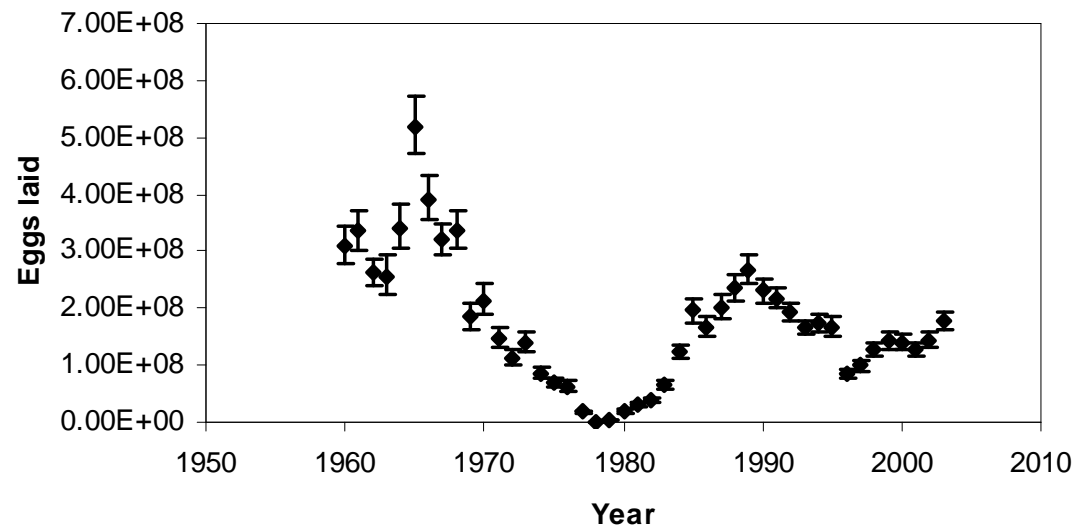
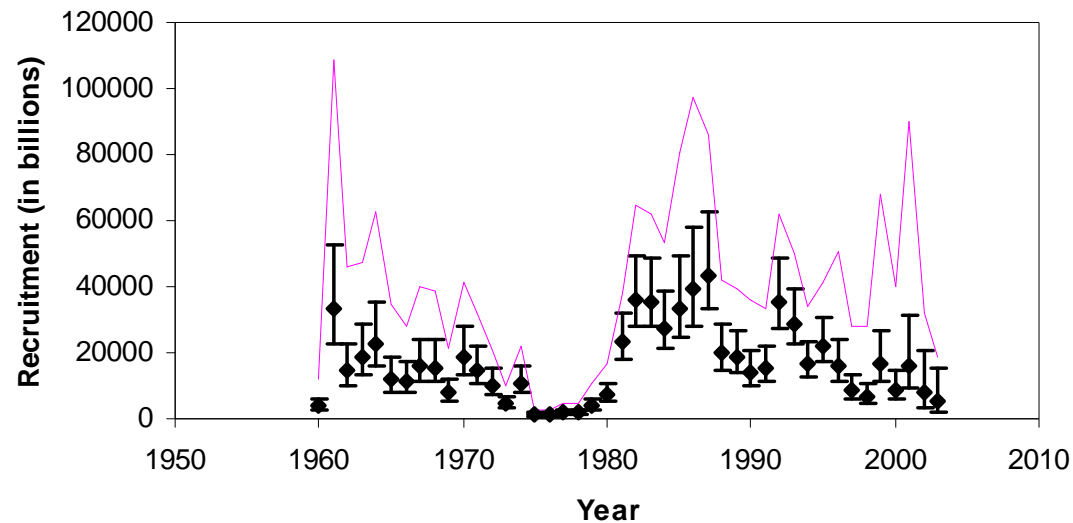
Related projects 2/3 (EU framework; ended)

- POORFISH (2005 – 2008)
 - Developing probabilistic methodology for data-poor situations
 - Effective use of published results, expert knowledge, etc.

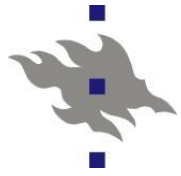
- PRONE (2006 – 2008)
 - Developing risk analysis methodology for European fisheries
 - Estimating the value of new information



PRONE: Probabilistic herring estimates



(Samu Mäntyniemi, FEM)



Related projects 3/3 (Ongoing)

- EVAHER (2006 – 2009)
 - Dioxine risk in the human consumption of Baltic herring

- JAKFISH (2008 – 2011)
 - Stakeholder involvement and commitment in fisheries
 - Multi-objective nature of management

- SAFGOF (2008 – 2010)
 - Maritime traffic and its ecological consequences in the GoF
 - Direct effects, risk of accident

- ECOBAYES (2009-2012)
 - PhD project: education of a Bayesian bioeconomist



Multicriteria decision model: utility function

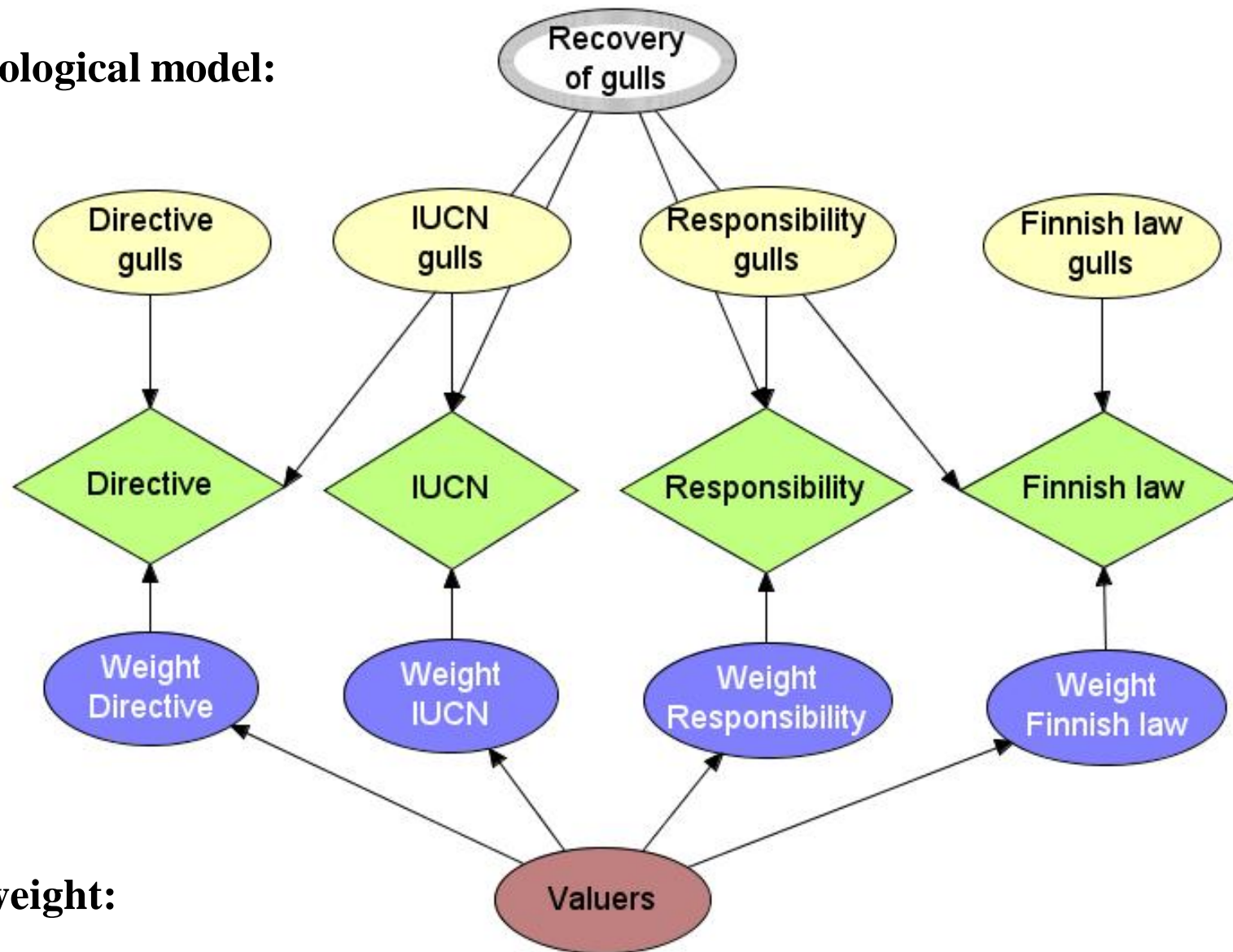
Result from a biological model:

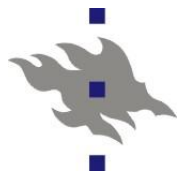
Criteria:

Weighted utility

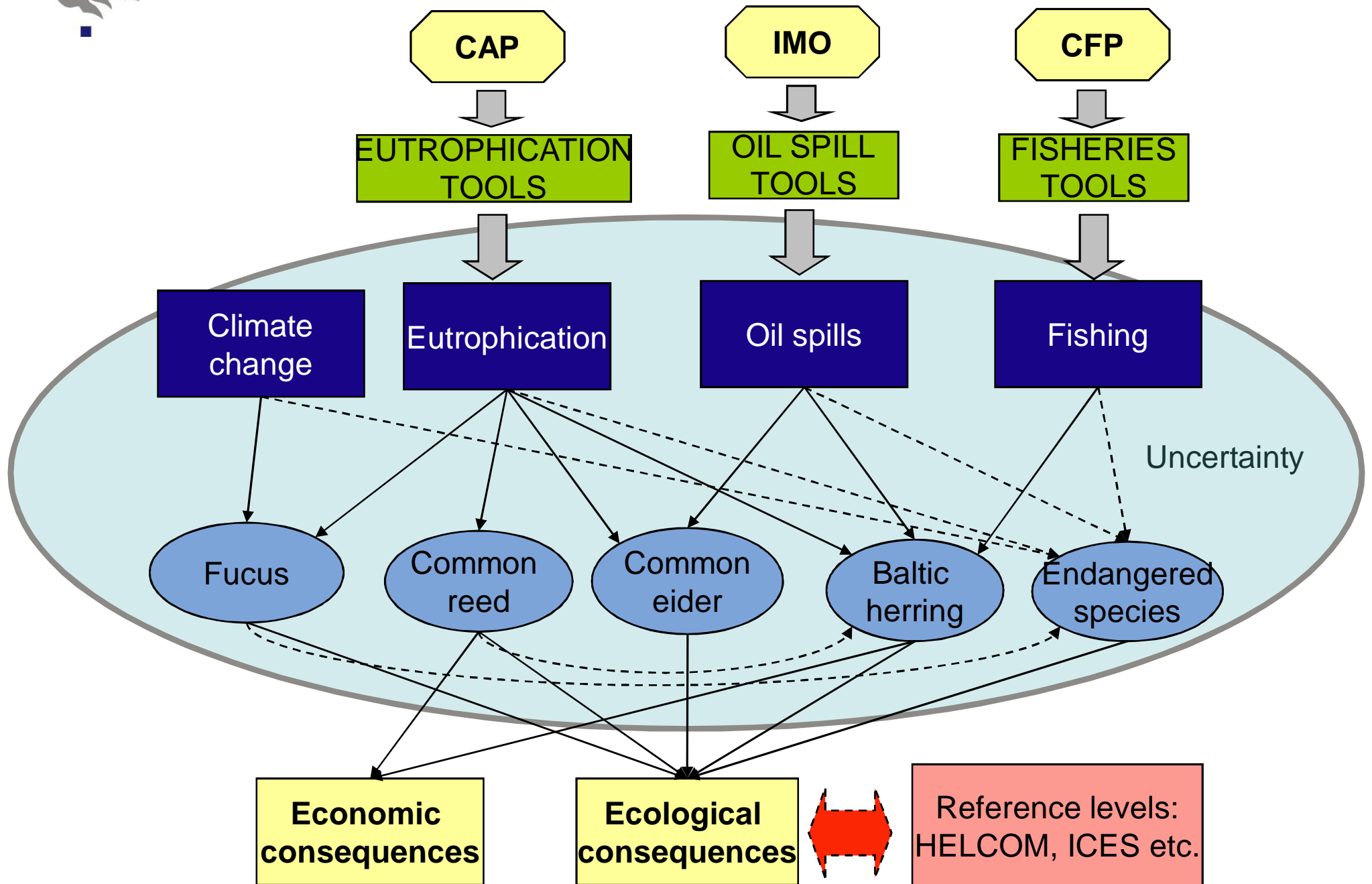
Weights

Persons giving weight:





IBAM: final product

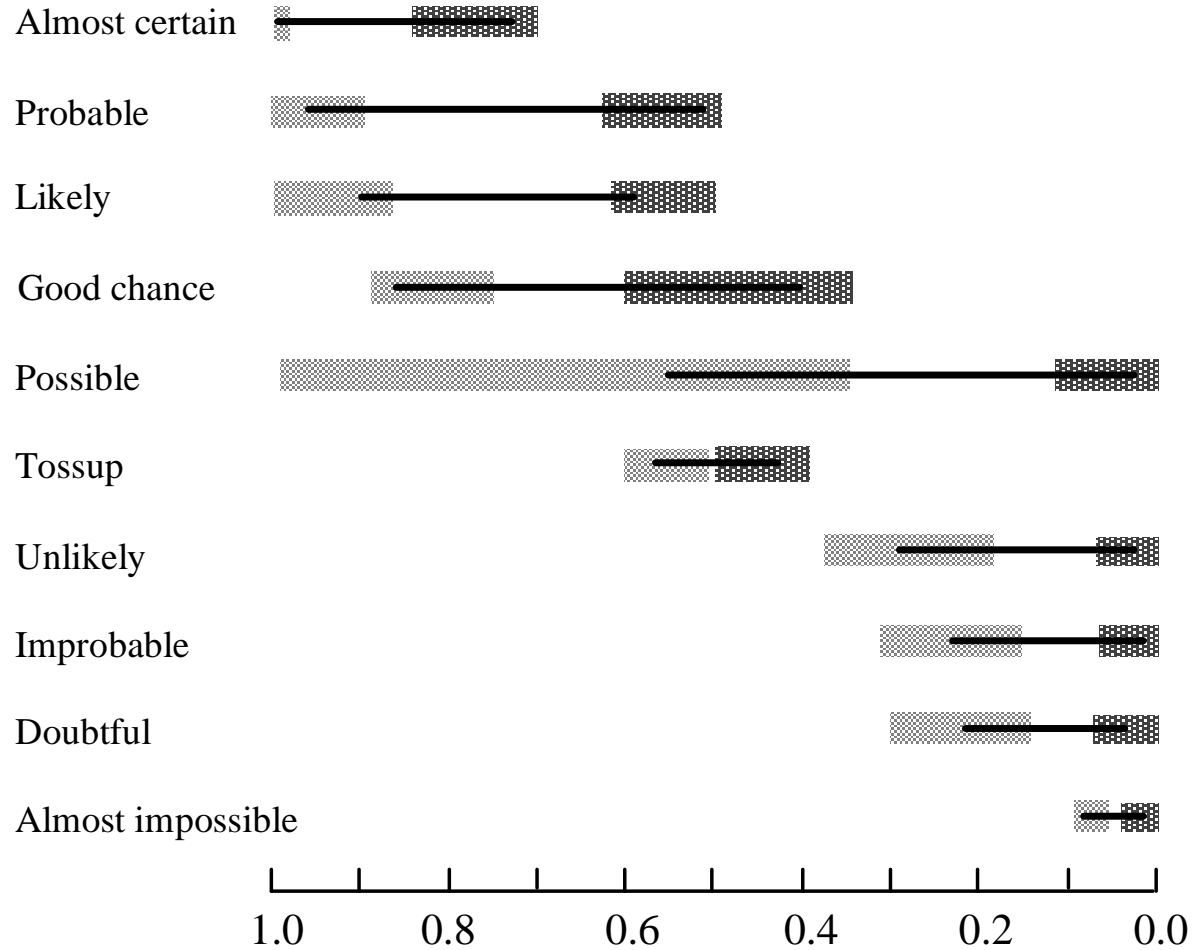
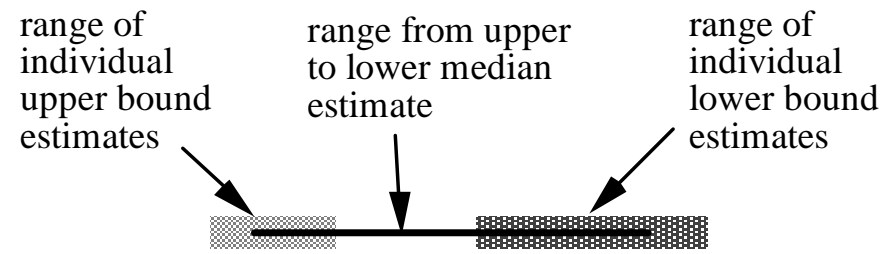


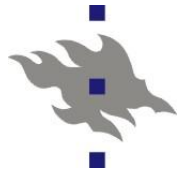


You are
now experts
in risk
communication:

Is successful
risk
communication
possible?

Qualitative description of uncertainty used





IBAM: future

- Input from all existing main models
- Input from all main large data sets
- Input from published papers
- Input from experts
- = need for a **large** consortium in IBAM II 😊