A balanced participatory process to advance towards a legitimized Ecosystem-Based Management in complex Social and Ecological Systems

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and Marcos Llope

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A UN Ocean Decade Event
#MSEAS2024
Marine Socio-Ecological Systems Symposium

CSIC
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Mouth of Gualdalquivir estuary
(Sanlucar de Barrameda)

Gualdalquivir estuary through Seville


Gualdalquivir estuary Turbidity

Nursery for comercial species

Mining activities

Shipping activities

Agriculture activities. Rice fields


Waste water Treatment

Illegal activities. Fishing

Illegal activities. Drug traficking

SNAPQUIVIR

Science for Nature and People to achieve Ecosystem-Based Management in the Guadalquivir estuary–Gulf of Cadiz

period:
01/09/2021 – 31/08/2025

team:

- Marcos Llope (IEO)
- Alfredo García de Vinuesa (IEO)
- Marina Delgado (IEO)
- Fernando Ramos (IEO)
- Marián Torres (IEO)
- Eli Muñoz (IEO)
- David Florido (US)
- Reme Cabrera-Castro (UCA)
- César Vilas (IFAPA)

SAB

- Örjan Bodin (SRC)
- Debbi Pedreschi (MI)
- Phil Levin (WU-NOAA)

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Overall goal

The main objective of SNAPQUIVIR is to create a framework for analysis and decision-making support to achieve ecologically and socially balanced management using co-created social analysis and modeling techniques for the Guadalquivir estuary-Gulf of Cádiz socio-ecosystem.

ICES EBM

SNAPQUIVIR

Project structure and main tools

WP.1 social-scoping

Development of the framework of the analysis

Social Network Analysis

WP.2 stakeholders wk

Participatory modelling and scenarios

Conceptual modelling

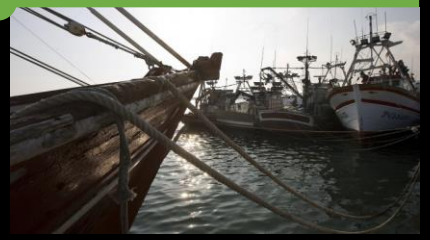
WP.3 model

Management strategy evaluation (MSE)

Bayesian Belief Networks

Social Network Analysis | 11 sectors

fishing



salt production

energy

Stakeholders
Total: 55

agriculture

aquaculture

mining

research

conservation

navigation

surveillance

goverment

Ayuntamiento de Coria del Río

Social Network Analysis | Interviews

Personal interviews

Relationship
Trust
Power dynamics
Management goals

Social Network Analysis | Key stakeholders

Centrality measures address the question: "Who are the key or central actors in this network?". We have used specific measures such as **degree, betweenness, and closeness**.

Key

Non-key

Social Network Analysis | Cohesion

Cohesion measures: Union or close relationship between actors. Specifically, we have used density, defined as the number of links in a simple network, expressed as a proportion of the maximum possible number of links.

Sectors	Fish.	Aquac.	Agric.	Ship.	Min.	NGO.	Res.	Town.	Gover.	Ener.	Surv.
Fish.	**57,39**	34,52	1,587	23,81	24,6	26,23	29,37	21,56	33,63	0	34,92
Aquac.	22,75	**86,11**	25,93	37,04	24,69	40,33	47,74	24,07	58,33	22,22	0
Agric.	14,55	54,32	**88,89**	62,96	14,81	28,81	38,68	40,12	77,78	62,96	55,56
Ship.	28,57	20,37	48,15	**100**	20,37	32,1	56,17	42,59	36,11	47,22	33,33
Min.	7,937	17,28	0	35,19	**32,41**	32,3	31,69	14,2	31,48	37,04	18,52
NGO.	25,93	34,16	16,05	22,84	24,07	**45,29**	36,74	31,69	29,48	30,25	11,11
Res.	43,52	62,96	31,89	65,43	36,01	53,57	**80,25**	57,35	70,06	69,75	62,96
Town.	37,5	55,25	31,48	59,26	24,07	50	44,03	**55**	78,7	72,22	66,67
Gover.	48,02	68,06	69,44	55,56	58,33	50	68,98	65,74	**96,3**	72,22	66,67
Ener.	33,33	37,04	37,04	88,89	37,04	34,57	48,15	56,48	55,56	**100**	55,56
Surv.	57,54	79,63	55,56	66,67	44,44	68,52	56,79	76,85	100	55,56	**100**

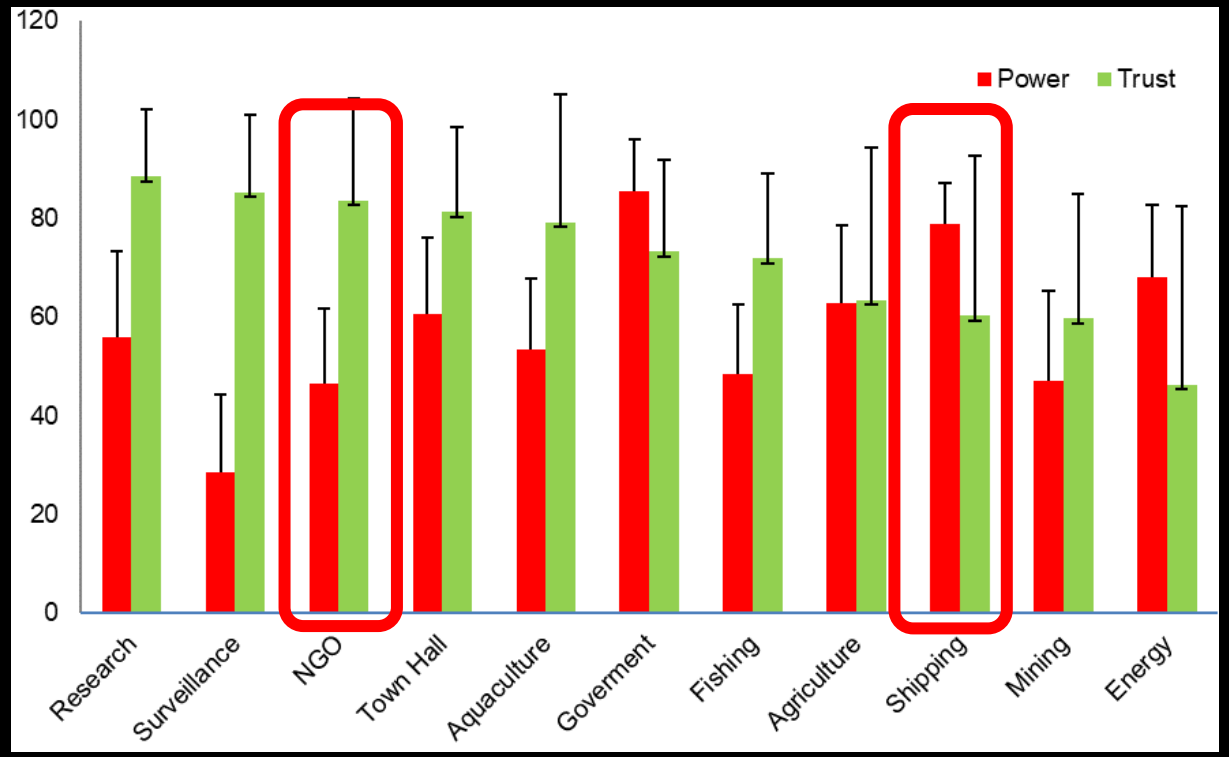
Density relationship expressed like percentage by sector

Social Network Analysis | Power and trust

Other characteristics:

1) Power: Power is measured based on the actors' opinions regarding their capacity to influence the management of other actors.

2) Trust: We measure trust by calculating how many actors support the management objectives of the other actors.



Power and trust in percentage by sector

Social Network Analysis | Management goals

What are the main management objectives of the actors?

Illegal fishing

Water pollution

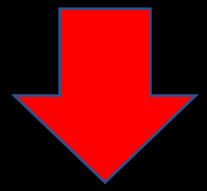
Drug traficking

Alien species

Social Network Analysis | Management goals

Summarizing the results of the social network analysis

Key actors (centrality measures)
Social cohesion (density)
Trust among actors
What are their power dynamics?
What are their management objectives?



We have used the information extracted from the social network analysis to construct a participatory process with the aim of addressing the socio-ecosystem towards Ecosystem-Based Management.

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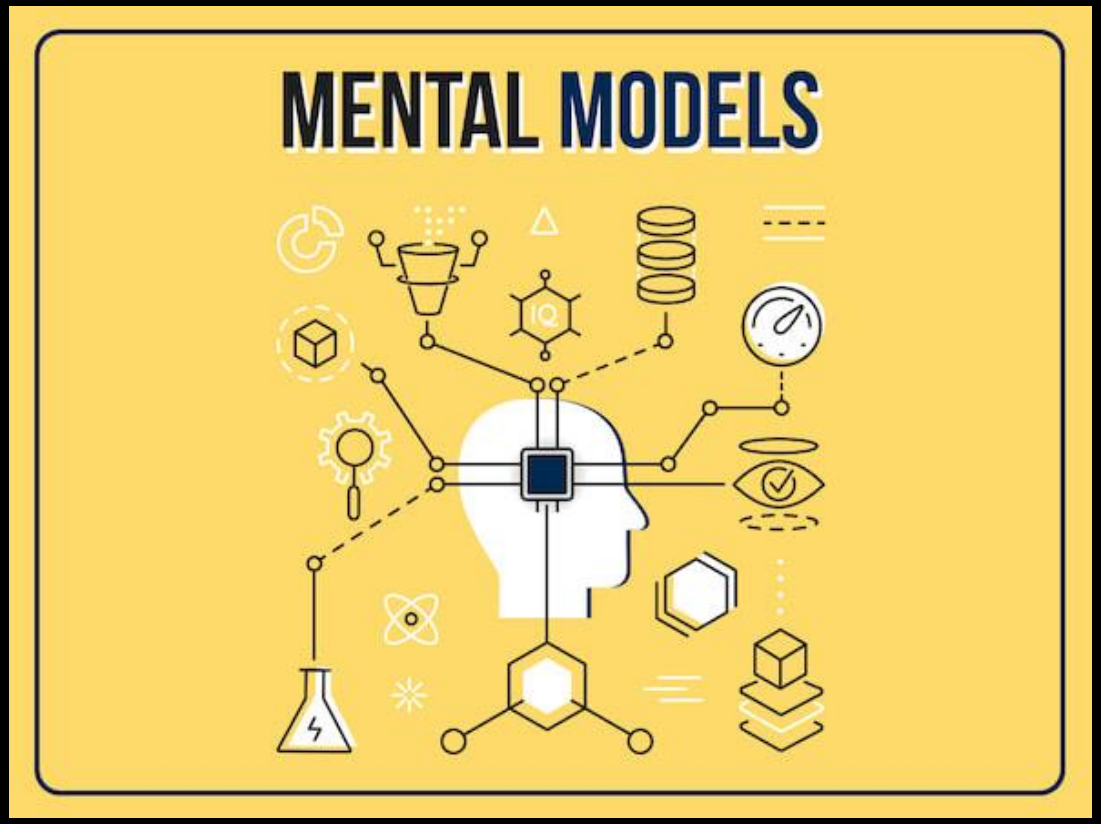
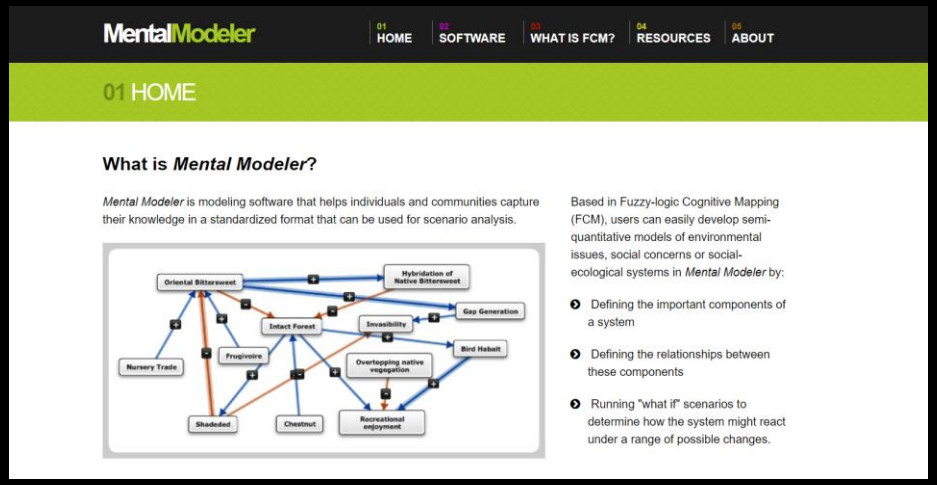
Conceptual modelling | Mental model

A mental model is a representation of a situation that supports understanding, reasoning, and prediction. Mental models allow reasoning about situations not directly experienced, enabling people to mentally simulate the behavior of a system.



Software: mental modeler



Conceptual modelling | Workshops

Fishing

Water uses

Shipping

SNAPQUIVIR workshop focused on fishing in Sanlucar de Barrameda

Conceptual modelling | Workshops

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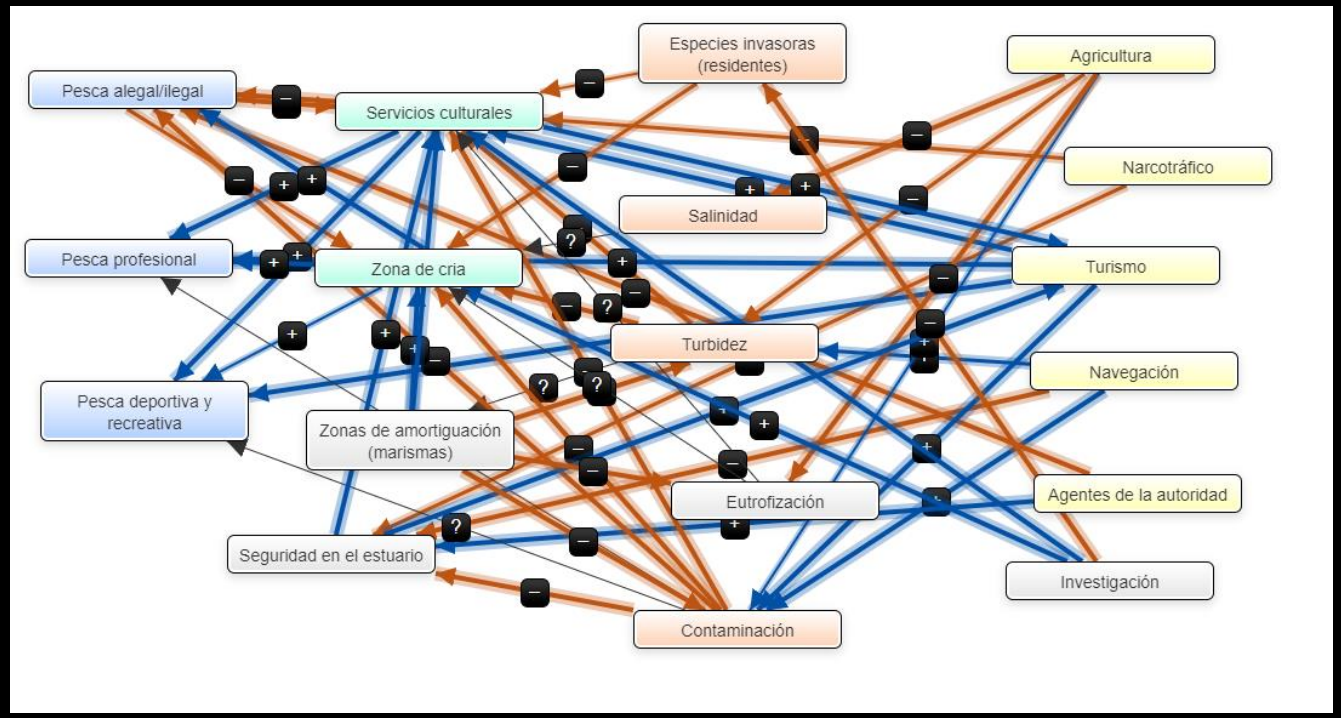

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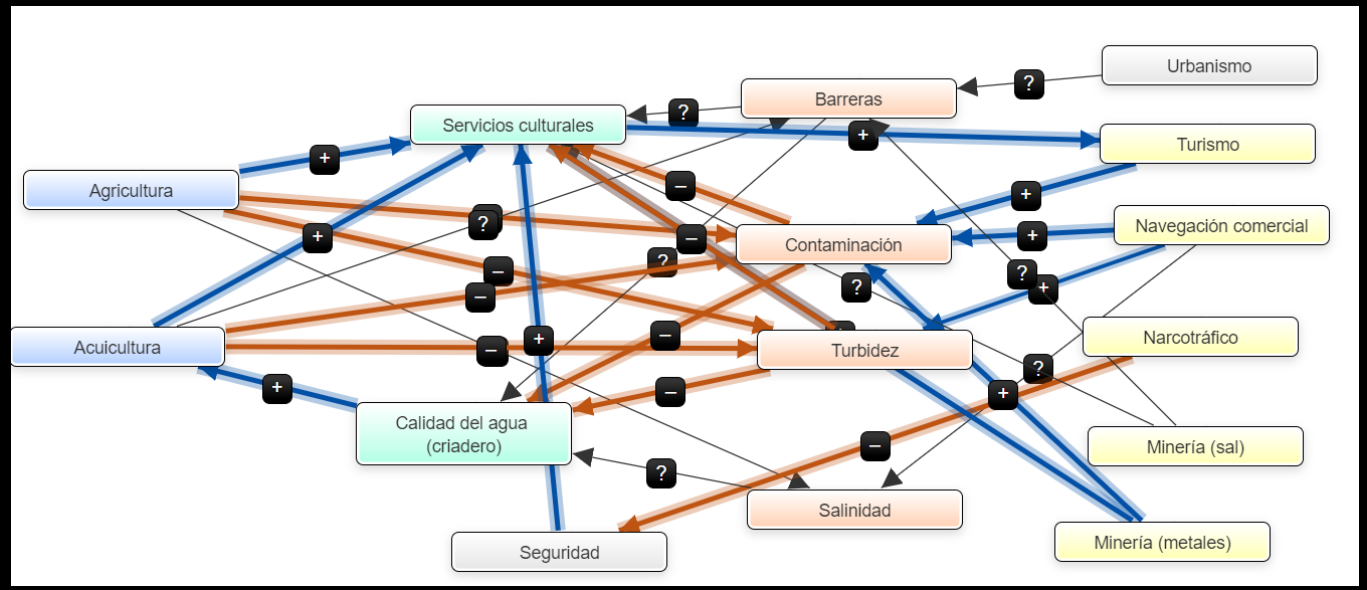

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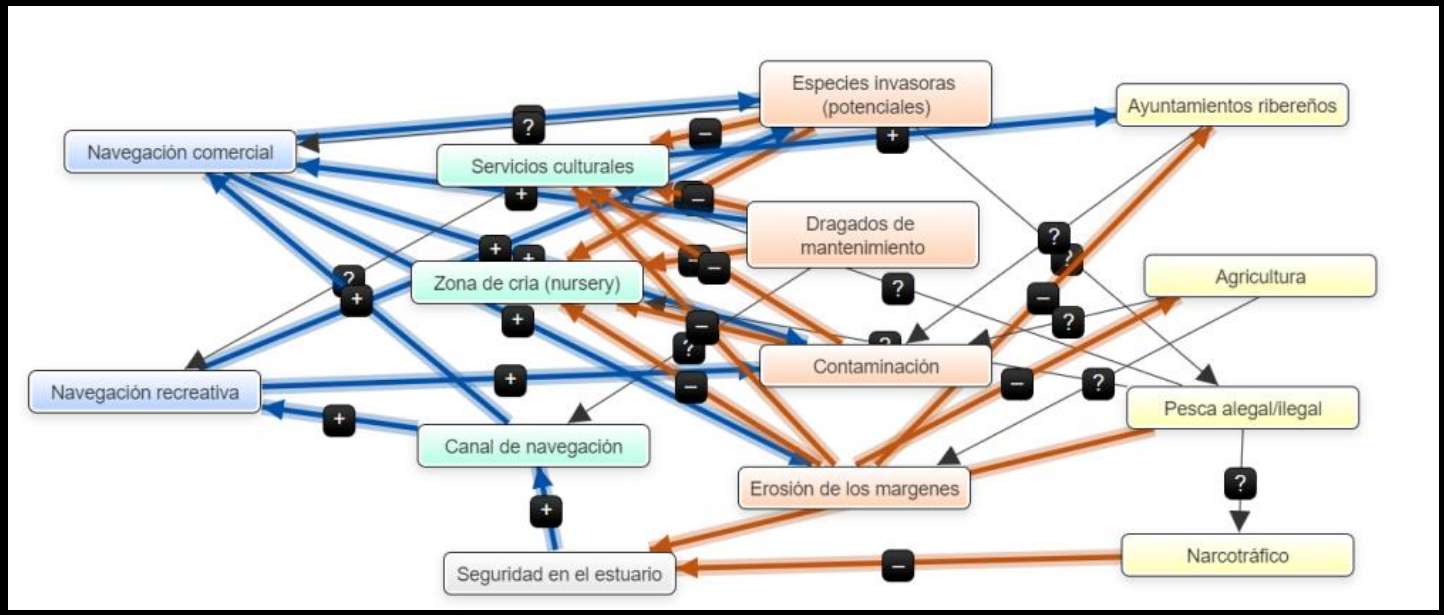
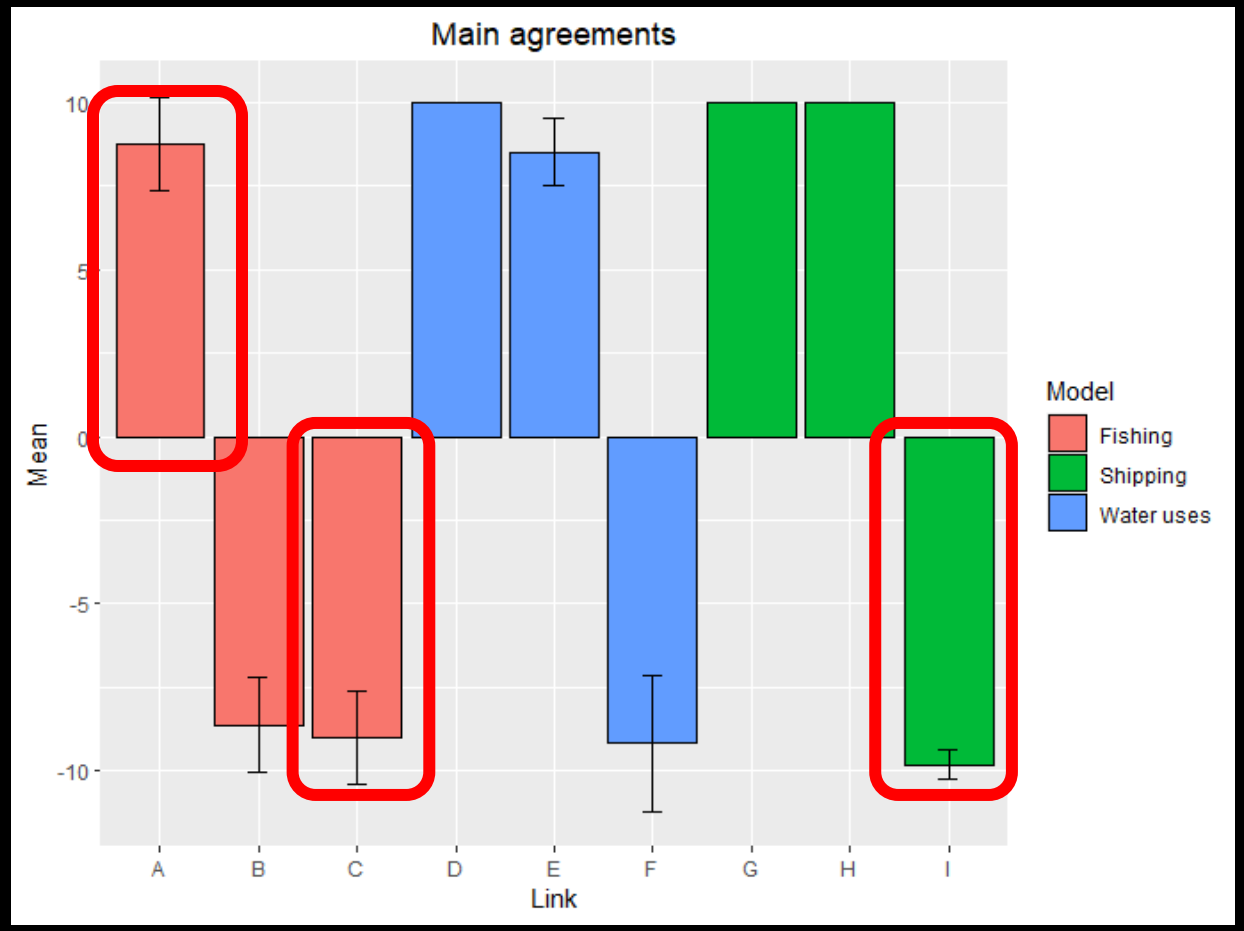


Conceptual modelling | Workshops

Main agreements. The three most important agreements among the actors regarding the relationship between nodes (links) are represented using mean and standard deviation for each model.

Correspondence of the X-axis (links):

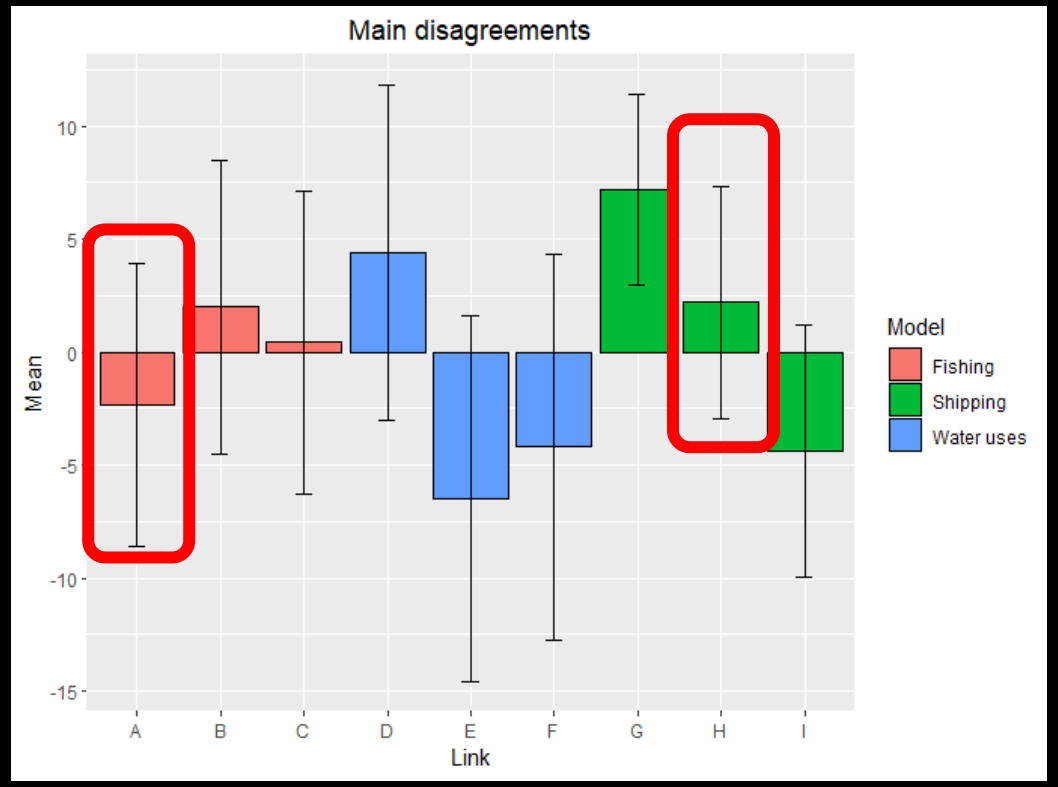
A: Surveillance to safety
B: Illegal fishing to nursery
C: Pollution to professional fishing
D: Water quality to aquaculture
E: Aquaculture to barrier creation
F: Pollution to water quality
G: Navigation channel to commercial navigation
H: Maintenance dredging to navigation channel
I: Illegal fishing to nursery



Conceptual modelling | Workshops

Main disagreements. The three most significant disagreements among stakeholders regarding the relationship between nodes (links) are represented using the **mean and standard deviation** for each model.

Correspondence of the X-axis (links):
A: Salinity to agriculture
B: Invasive species (residents) to research
C: Buffer zones (salt marshes) to turbidity
D: Agriculture to pollution
E: Drug trafficking to security
F: Barriers to water quality
G: Navigation channel to recreational navigation
H: Maintenance dredging to cultural services
I: Margin erosion to breeding



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Bayesian Belief Networks

Bayesian Belief Network | What and why?

Bayesian Networks (BBNs) represent system components with probabilistic relationships, aiding in problem decomposition for interdisciplinary issues. BBNs are commonly used to support decision-making in complex systems.

- Integrating **multiple** system components and management issues.
- Allowing for the study of **trade-offs**.
- Using different **types of information** (e.g., sampling data or expert knowledge) in model parameterization.
- Producing an **assessment of different risks**, where uncertainties are expressed as probabilities.
- Can be constructed and updated **iteratively** as new information becomes available.

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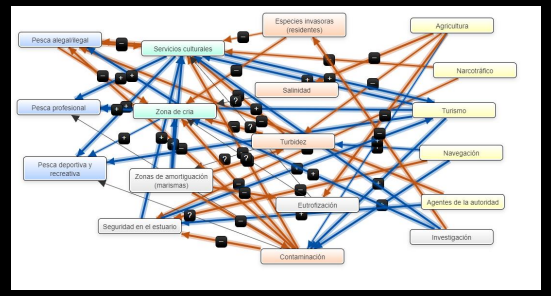
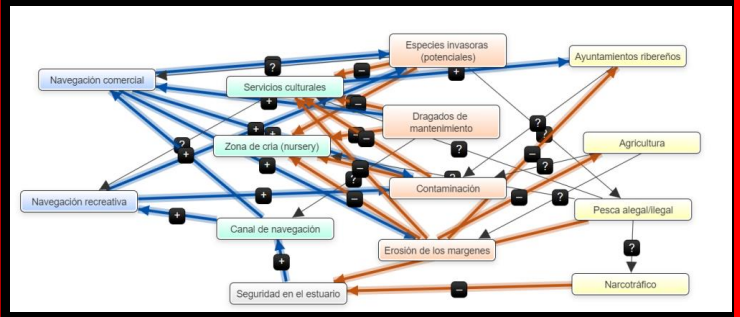
Bayesian Belief Network | Strawman

Partial models (conceptuals)

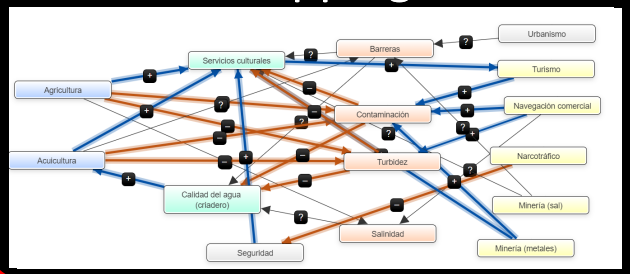
Water uses



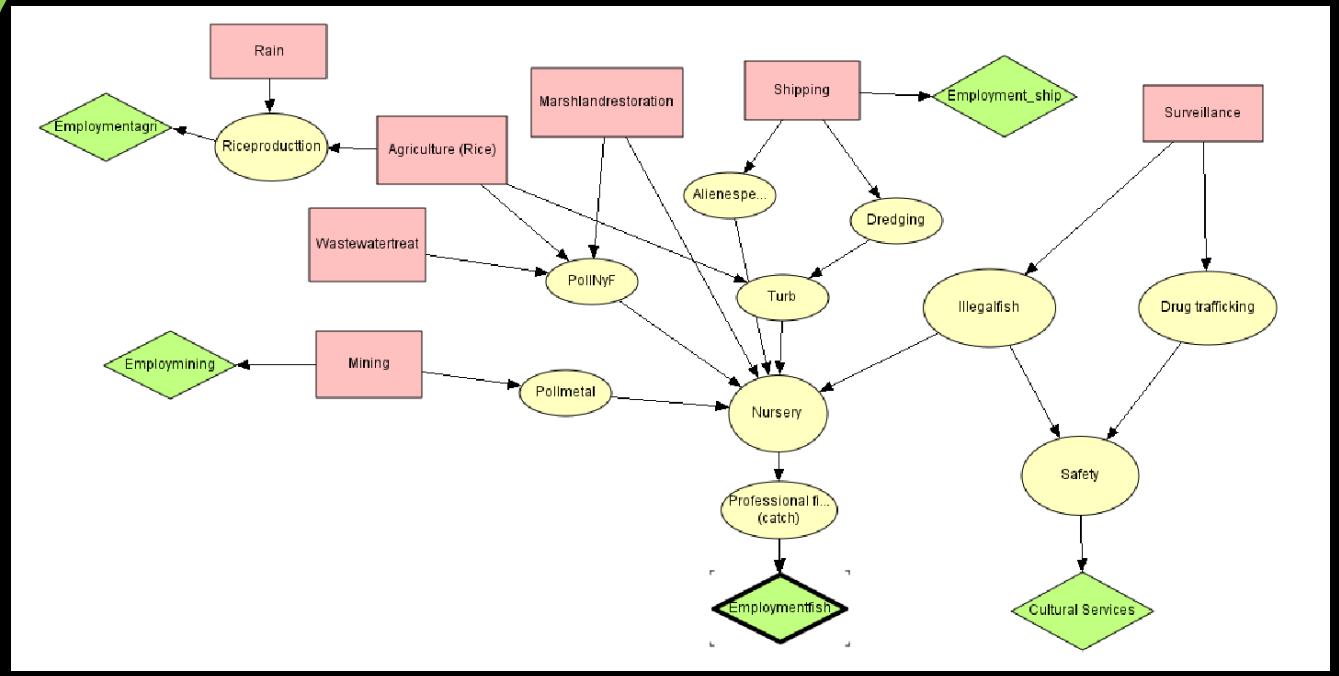
Fishing



Shipping

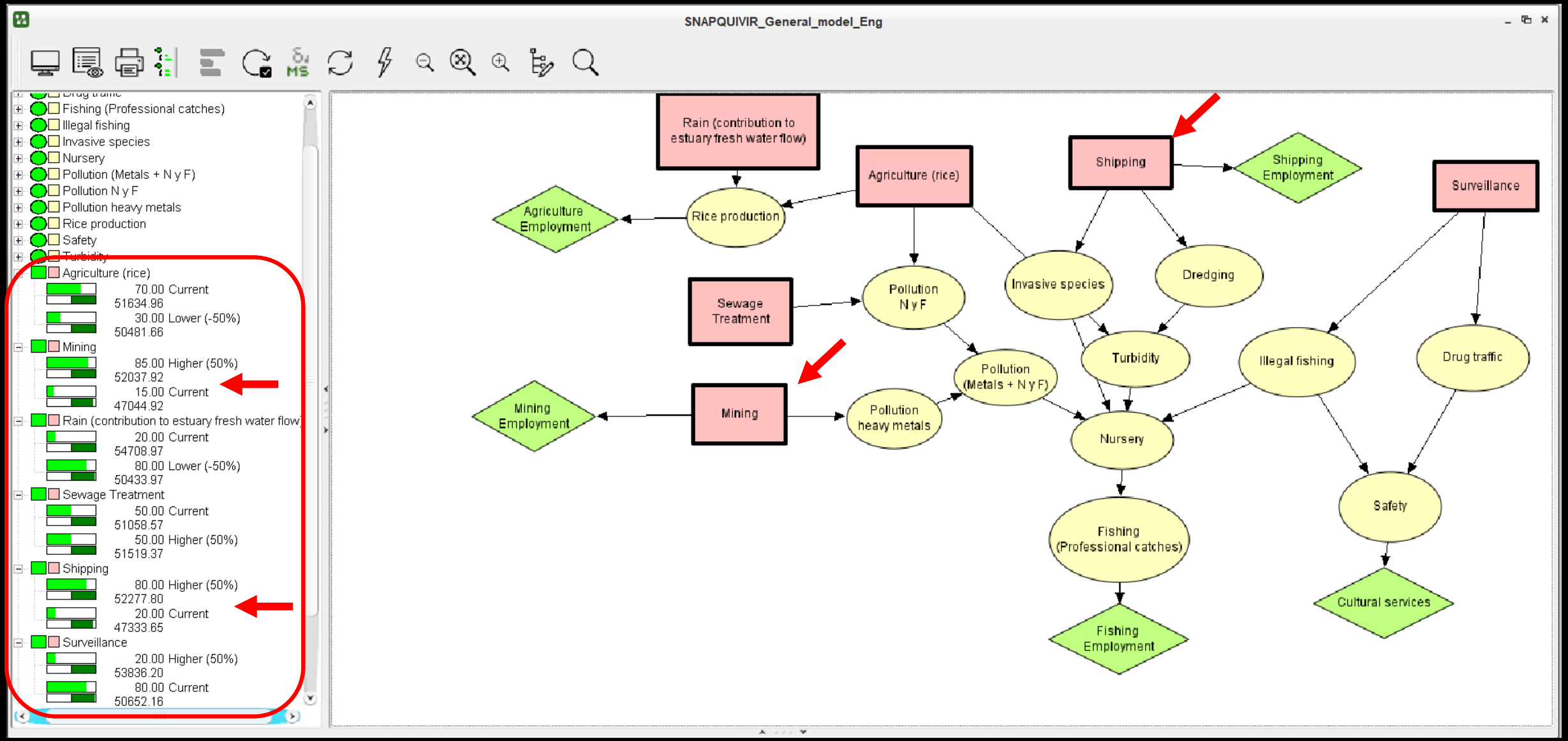


General model (Bayesian)

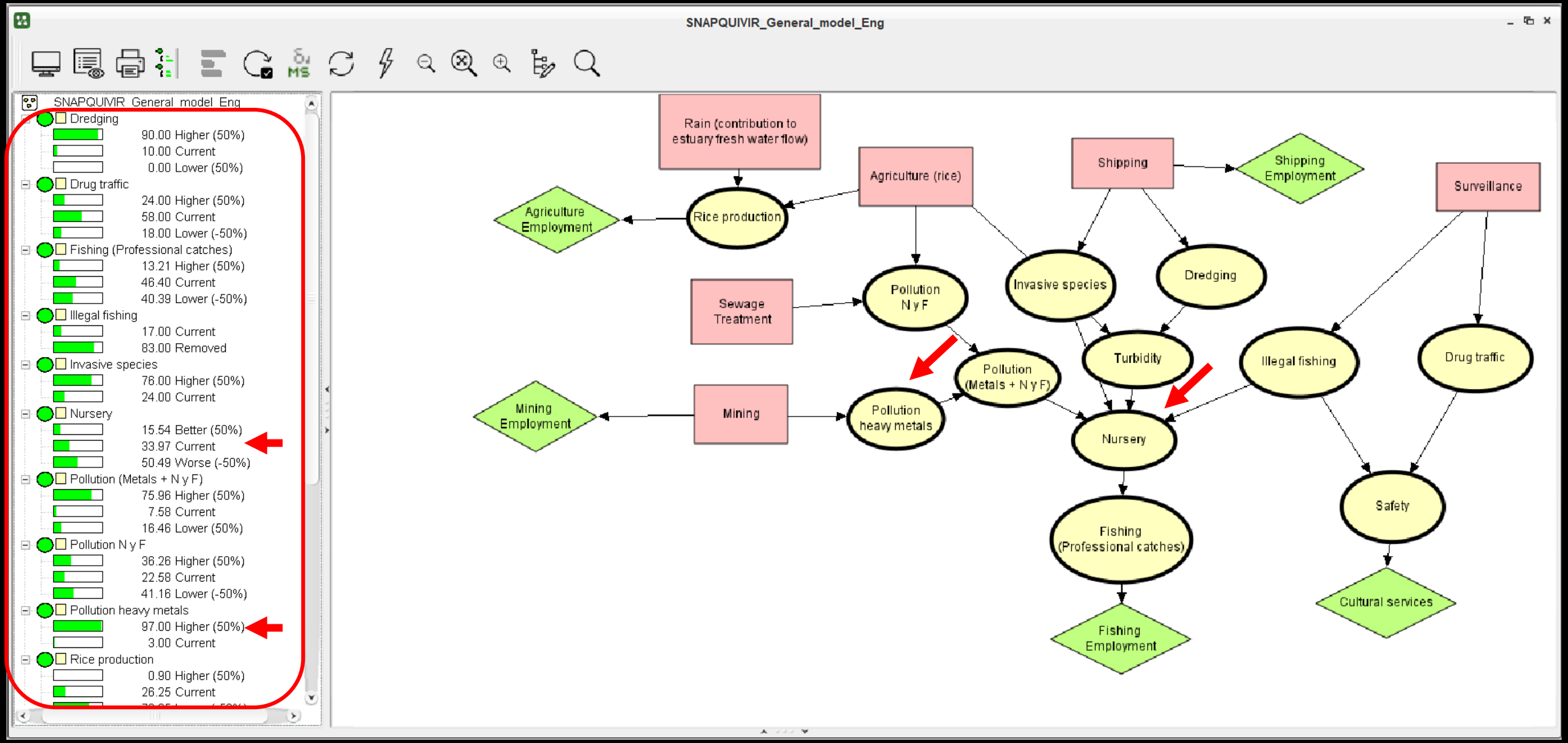


Temporal framework (5 years)

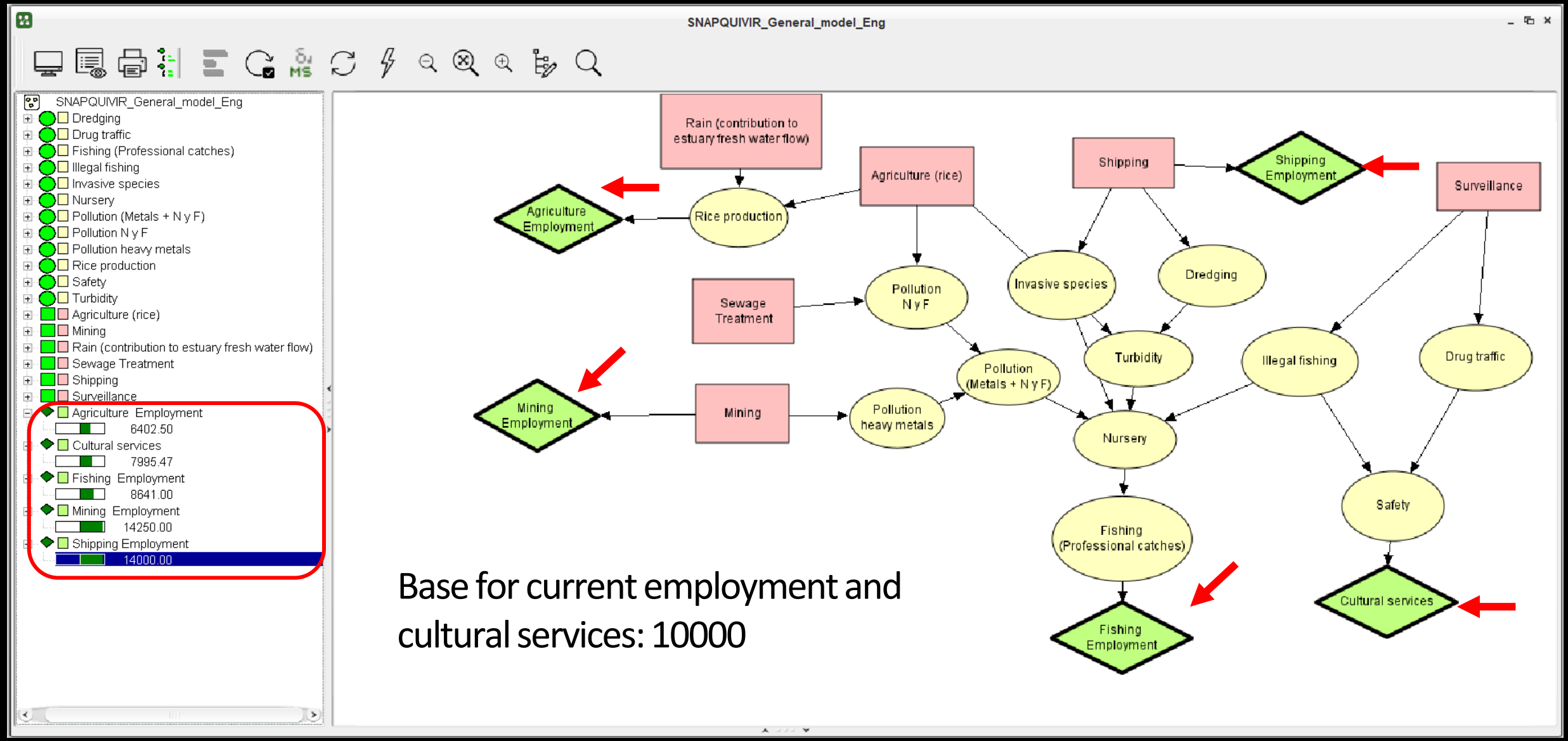
Bayesian Belief Network | Co-creation



Bayesian Belief Network | Co-creation



Bayesian Belief Network | Co-creation



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Thank you for your attention

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