



**eMSP
NBSR**

Emerging Ecosystem-based
Maritime Spatial Planning
Topics in the North and Baltic
Sea Regions



**Co-funded by
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MSP for GES – indicator review

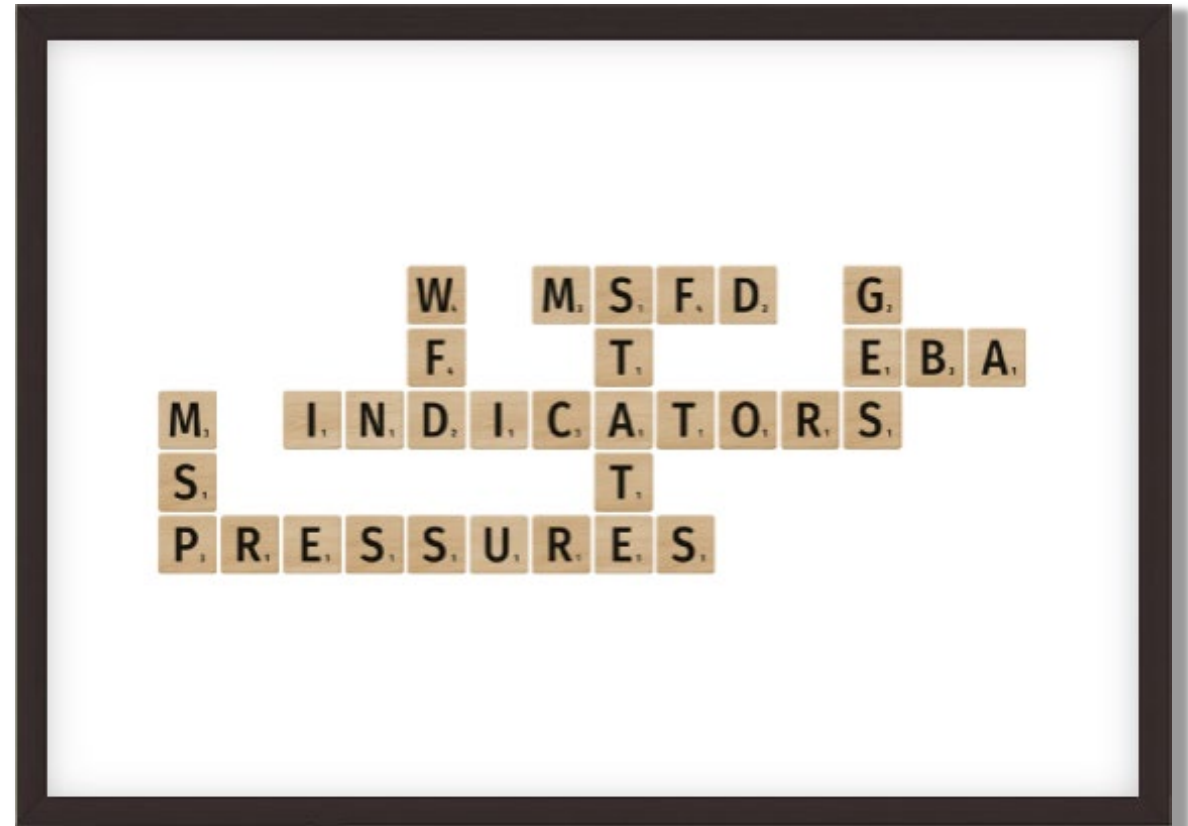
June 13th, 2023

Ville Karvinen (Syke)



Points of focus

- To investigate which indicators are related to pressures that MSP can influence
- To review the current sets of indicators by collecting and distilling background information on them, issues affecting the indicators and assessing whether MSP can affect those issues
- To examine whether the current indicators are sufficient for use in evaluating MSP contribution in GES





MSP for GES – indicator review

Working hypothesis:

An indicator measuring a pressure or describing a state affected by an activity within the scope of MSP can be used in evaluating MSP effects on GES, if sufficient data in both spatial and temporal scales exist.

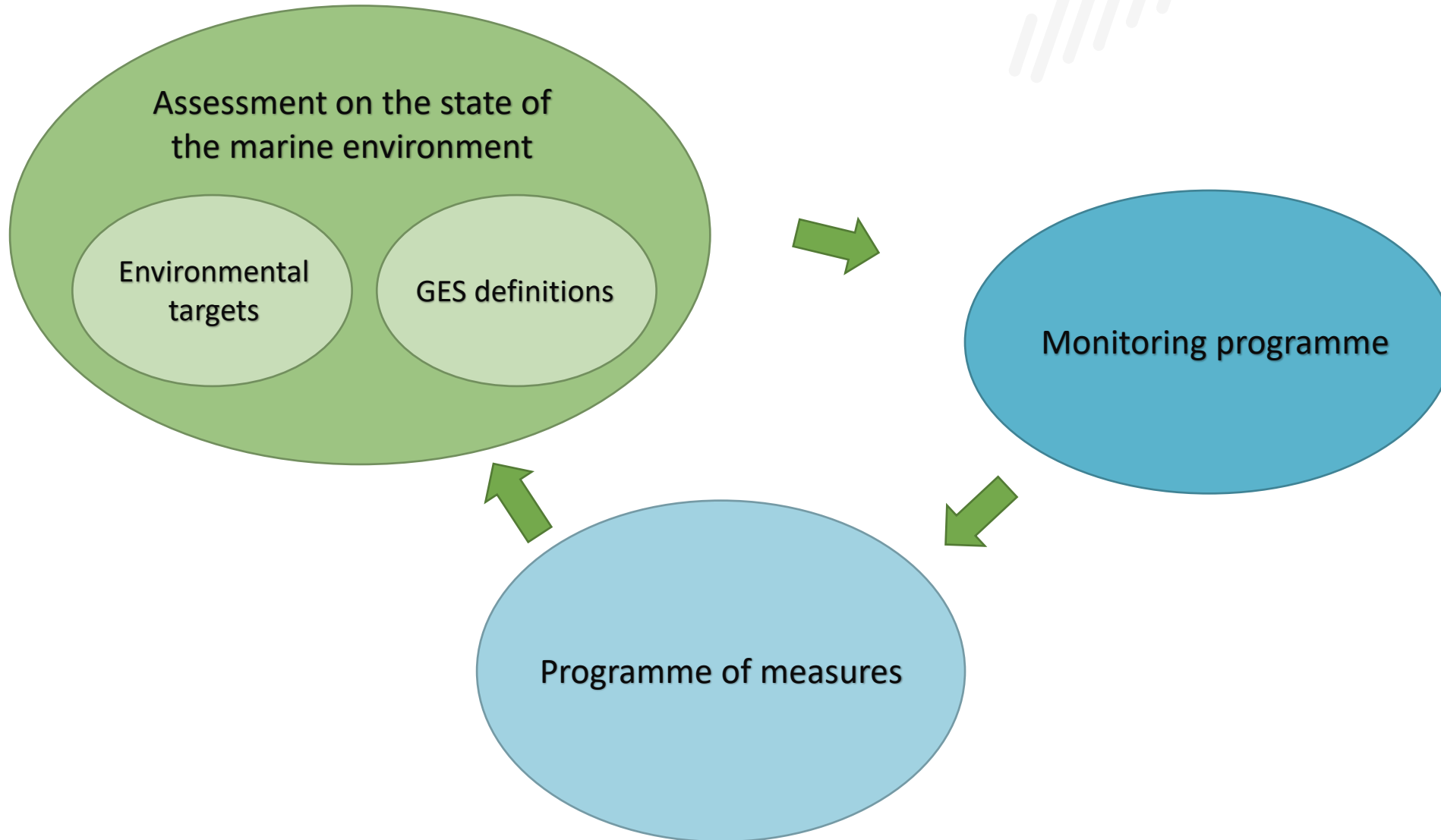
Pressures and State in MSFD

Qualitative descriptors for determining good environmental status in the MSFD (EU, 2008). The right column classifies the descriptors according to presence of corresponding pressure or state criteria/attributes within the descriptor (following the DPSIR framework).

MSFD descriptor	Short name	Classification
Biological diversity	D1	State
Non-indigenous species	D2	Pressure/state
Commercially exploited fish and shellfish	D3	Pressure/state
Marine food webs	D4	State
Human-induced eutrophication	D5	Pressure/state
Sea floor integrity	D6	Pressure/state
Hydrographical conditions	D7	Pressure/state
Concentrations of contaminants	D8	Pressure
Contaminants in fish and other seafood	D9	Pressure
Marine litter	D10	Pressure
Energy, including underwater noise	D11	Pressure

- *Pressure* has an impact on the marine environment (direct causal effect)
- *State* is the condition or quality of the marine environment

MSFD management cycle



Indicator types in MSFD (Finland)

Pressure

- 23 indicators

Example

- Nutrient loads into Baltic Sea

State

- 96 indicators

Example

- *Nutrient concentrations in water*

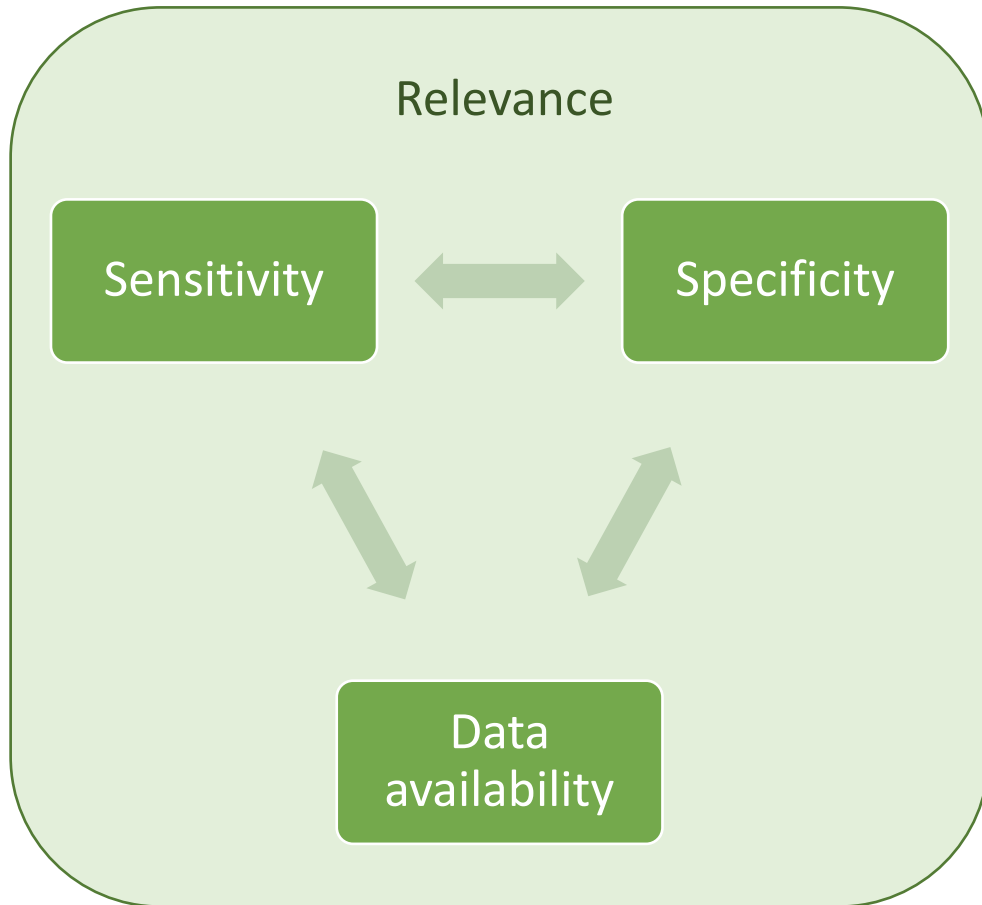
Environmental target

- 29 indicators

Example

- *Trend of nutrient loads*

Assessing MSFD indicators for MSP



- Does the indicator capture an aspect of GES that can be affected by MSP?
- Is the indicator sensitive enough to detect changes in the parameter that may be caused by MSP activities?
- Can the indicator be used to differentiate between natural and anthropogenic changes to the parameter?
- Is the indicator specific enough to distinguish between the effects of MSP activities and other factors that may affect the parameter?
- Are there long-term and high-quality data available for the indicator?
- Are the data available at the appropriate spatial and temporal scales for assessing the effects of MSP on GES?
- Are there any gaps in the data that would limit the ability to use the indicator for assessing the effects of MSP on GES?

Assessing relevance to MSP

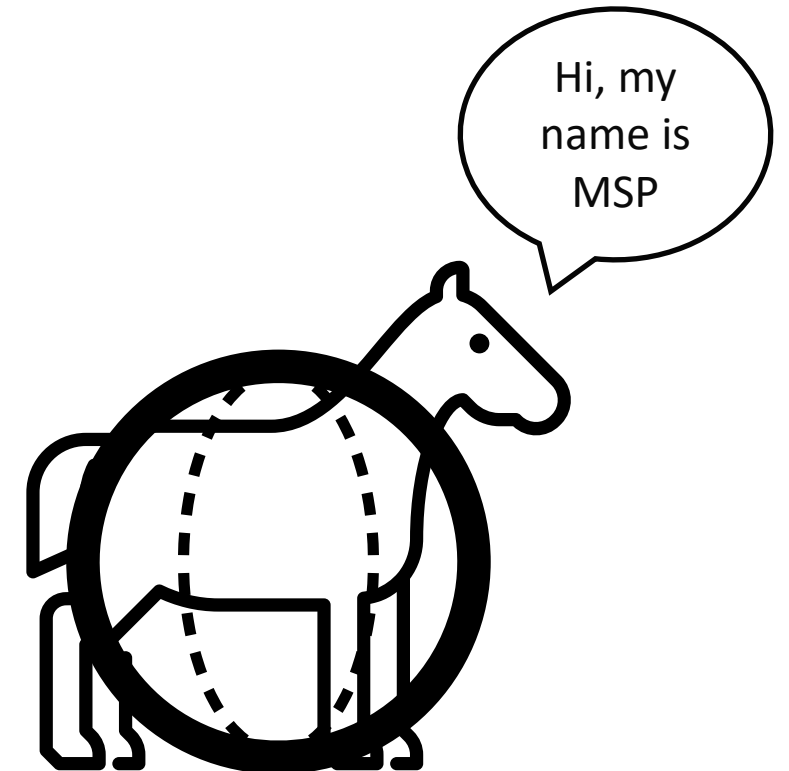
How to define if an activity can be regulated by MSP?

Challenges:

- Legal status of MSP varies between countries
- EU sectoral policies coordinate activities such as fishing etc.

Simplification needed for this assessment

- *If it's in MSP, it's relevant.*



Activities - Sea uses - Pressures

	A	B	C	D	E	F
1	Theme	Activity	Specification of activity	Sea use code	Sea use name	Pressure
2	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Change of seabed substrate or morphology (~ physical loss)
3	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Disturbance or damage to seabed
4	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Changes to hydrological conditions
5	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of sound / Ambient underwater noise
6	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of hazardous substances (synthetic substances, non-synthetic substances, radionuclides)
7	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of litter (solid waste matter, including micro-size litter)
8	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of nutrients
9	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of organic matter
10	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Disturbance of species / visual, presence, boating, recreational activities, above-water noise
11	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of genetically modified species and translocation of indigenous species
12	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input of microbial pathogens
13	Cultivation of living resources	Aquaculture (marine)	Finfish mariculture (Aquaculture)	aquaculture-fish	Aquaculture (fish)	Input or spread of non-indigenous species
14	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Change of seabed substrate or morphology (~ physical loss)
15	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Disturbance or damage to seabed
16	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Changes to hydrological conditions
17	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of sound / Ambient underwater noise
18	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of hazardous substances (synthetic substances, non-synthetic substances, radionuclides)
19	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of litter (solid waste matter, including micro-size litter)
20	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of nutrients
21	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of organic matter
22	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Disturbance of species / visual, presence, boating, recreational activities, above-water noise
23	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Extraction of, or mortality/injury to, species, including target and non-targeted catches (by commercial
24	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of genetically modified species and translocation of indigenous species
25	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input of microbial pathogens
26	Cultivation of living resources	Aquaculture (marine)	Shellfish mariculture	aquaculture-mussel	Aquaculture (mussel)	Input or spread of non-indigenous species
27	Cultivation of living resources	Agriculture	Animal pastures, crop farming			Changes to hydrological conditions
28	Cultivation of living resources	Agriculture	Animal pastures, crop farming			Input of nutrients
29	Cultivation of living resources	Forestry				Input of hazardous substances (synthetic substances, non-synthetic substances, radionuclides)
30	Cultivation of living resources	Forestry				Input of nutrients
31	Production of energy	Renewable energy genera	Wind energy production: operation	ow installations-owf	Offshore wind farm	Change of seabed substrate or morphology (~ physical loss)
32	Production of energy	Renewable energy genera	Wind energy production: operation	ow installations-owf	Offshore wind farm	Disturbance or damage to seabed
33	Production of energy	Renewable energy genera	Wind energy production: operation	ow installations-owf	Offshore wind farm	Changes to hydrological conditions
34	Production of energy	Renewable energy genera	Wind energy production: operation	ow installations-owf	Offshore wind farm	Input of sound / Ambient underwater noise


TAPAS Human Activities – Pressures Matrix

MATRIX BETWEEN HUMAN ACTIVITIES AND PRESSURES

This matrix visualizes linkages between human activities and pressures affecting the Baltic marine environment.

Human activities occurring in the Baltic Sea are shown on the left whereas the pressures are on the top bar.

Both human activities and pressures are categorized under broader themes adopted from the proposed revision of MSFD Annex III.

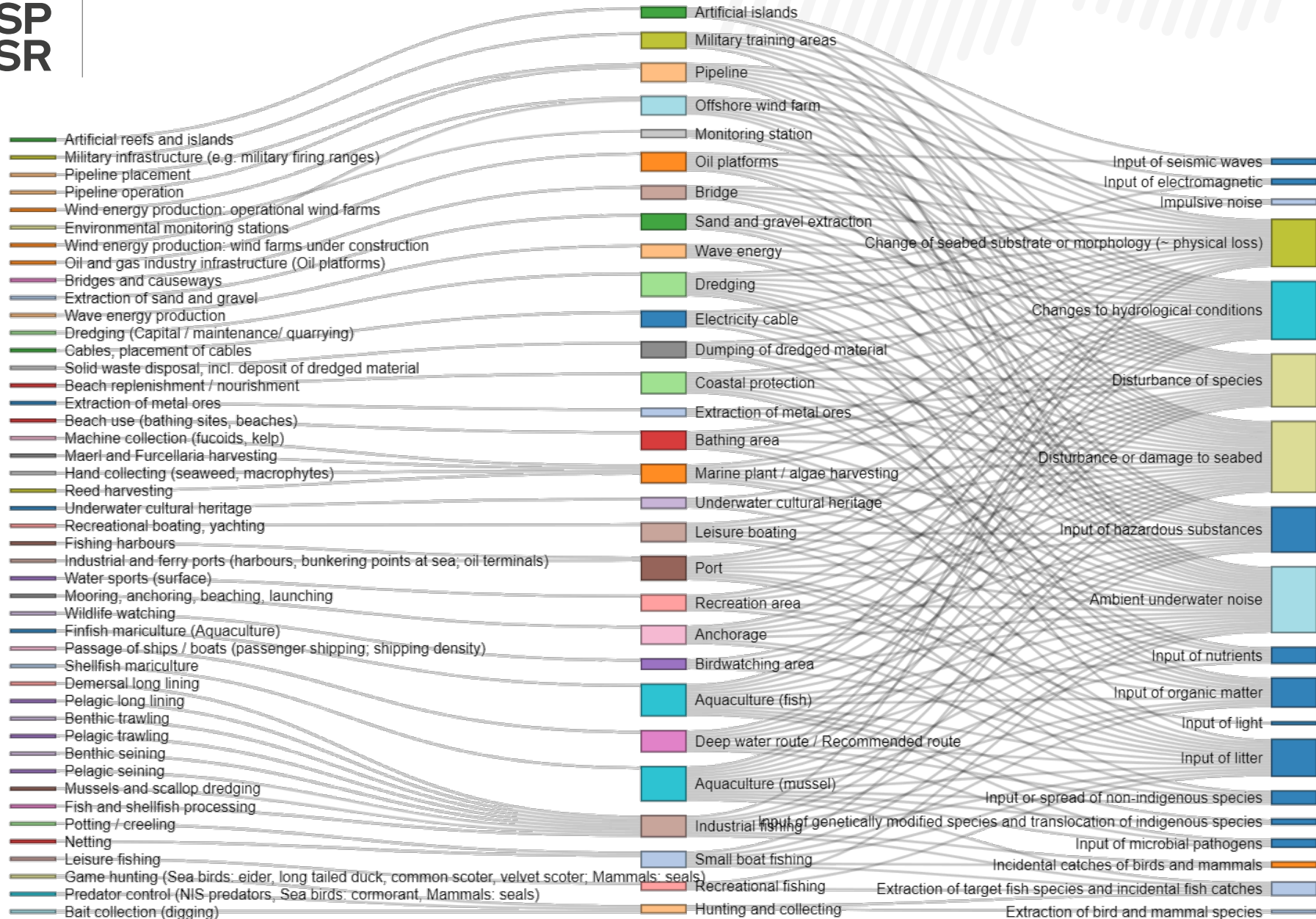


Themes of activities		Pressure themes															
		Physical			Energy						Substances				Other		
Activities		Change of seabed substrate or morphology (physical loss)	Disturbance or damage to seabed	Changes to hydrological conditions	Input of sound		Input of other forms of energy				Input of hazardous substances (synthetic substances, non-including)	Input of litter (solid waste matter, including)	Input of nutrients	Input of organic matter	Disturbance of species		Extraction of, or removal of, including target and non-target species
Specification of activities					Ambient underwater noise	Impulsive noise	Input of electromagnetic fields	Input of seismic waves	Input of light	Input of heat					visual, presence, boating, recreational activities, above-water noise	Other (e.g. barriers, collision)	Extraction of target fish species and incidental fish catches
Cultivation of living resources	Aquaculture – marine	Finfish mariculture (Aquaculture)															
		Shellfish mariculture															
		Aquaculture – fresh water															
		Agriculture	animal pastures, crop farming														
Production of energy	Forestry																
	Renewable energy generation	Wind energy production: operational wind farms															
		Wind energy production: wind farms under construction															
		Tidal barrages															
		Wave energy production															
	Non-renewable energy generation	Fossil fuel energy production															
Nuclear energy production																	
Transmission of electricity and communications	Cables, placement of cables																
	Pottinal creelina																

Sea uses



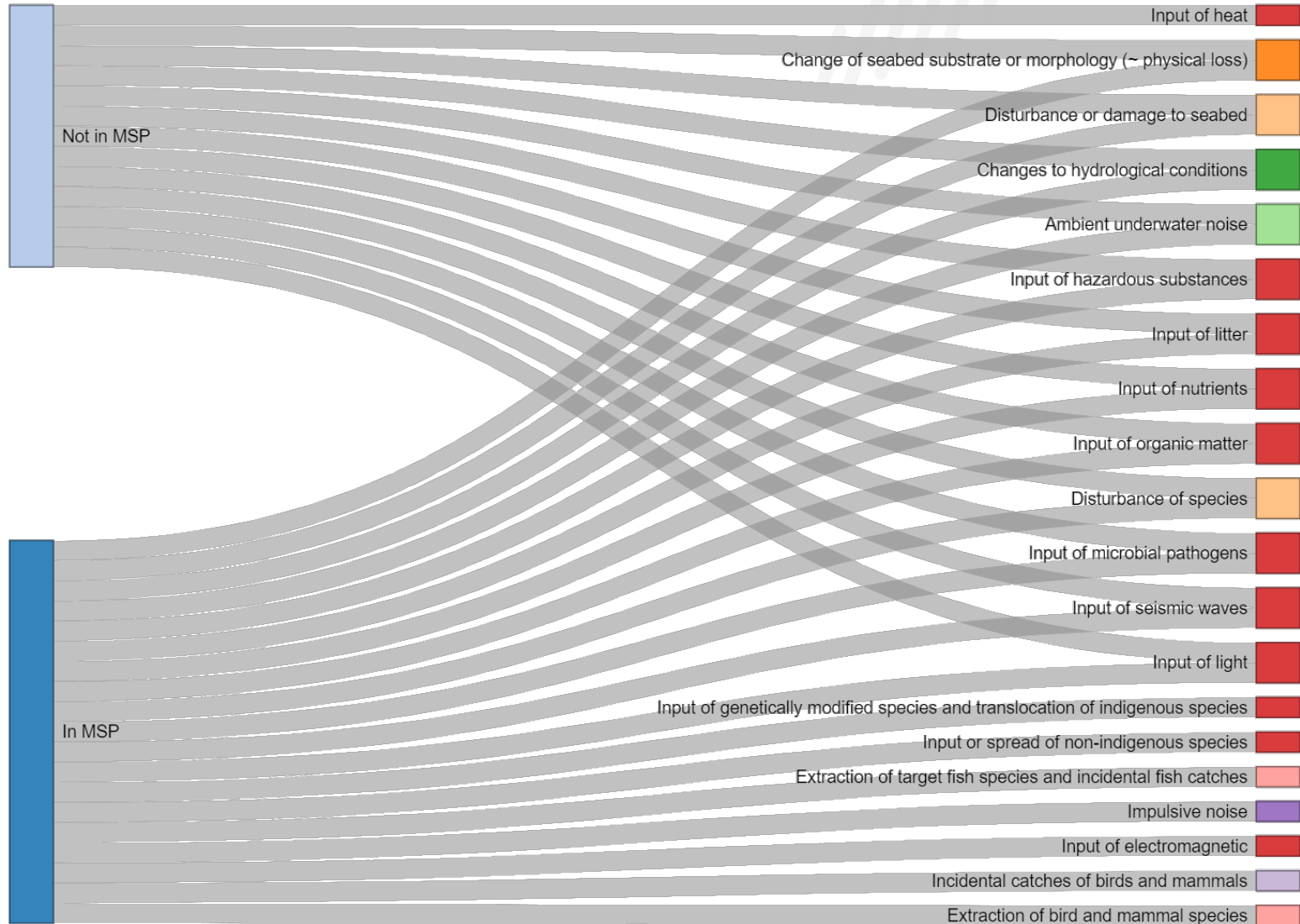
Activities (in MSP)



Pressures

Activities to pressures

Sea uses

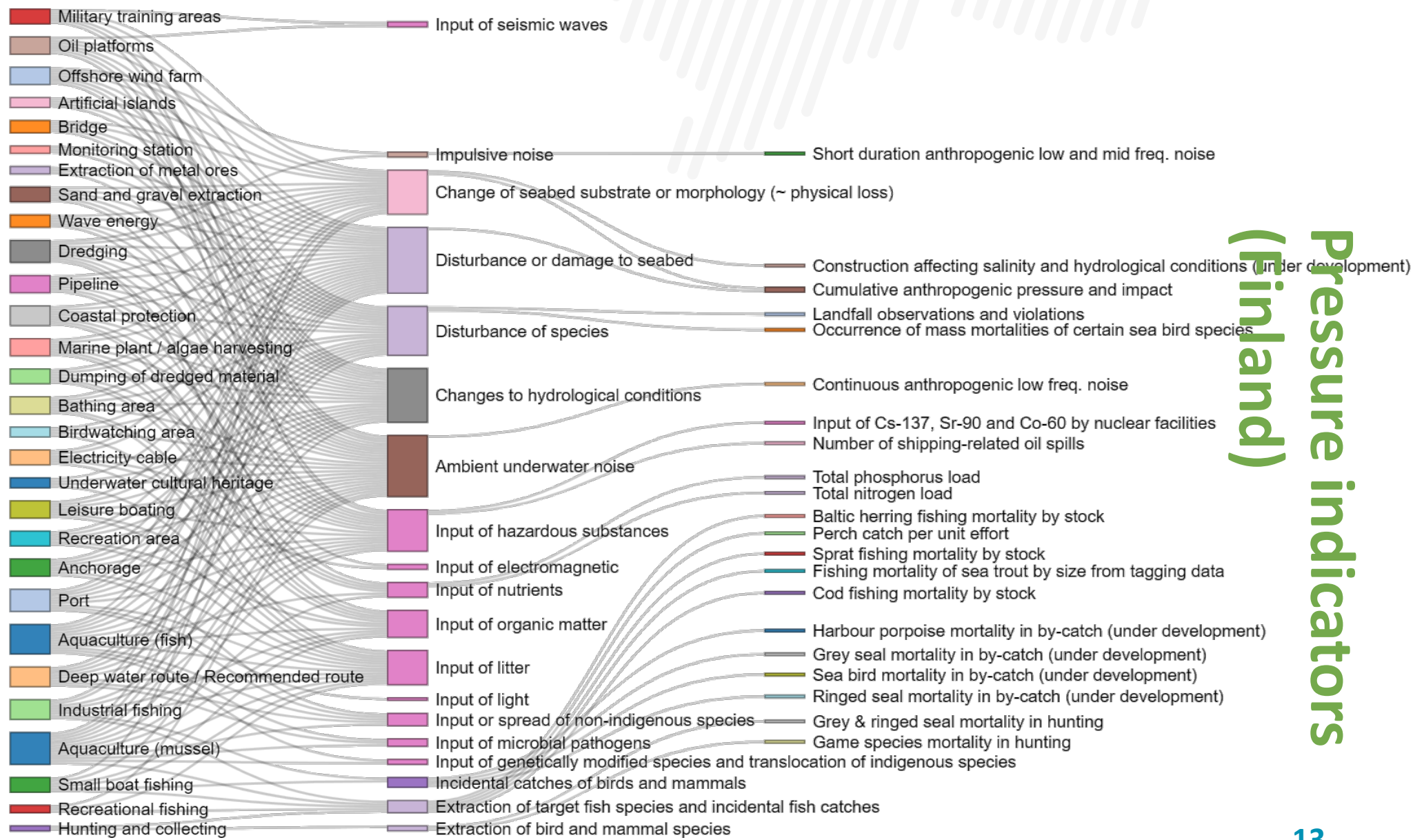


Pressures

Pressures



Sea uses

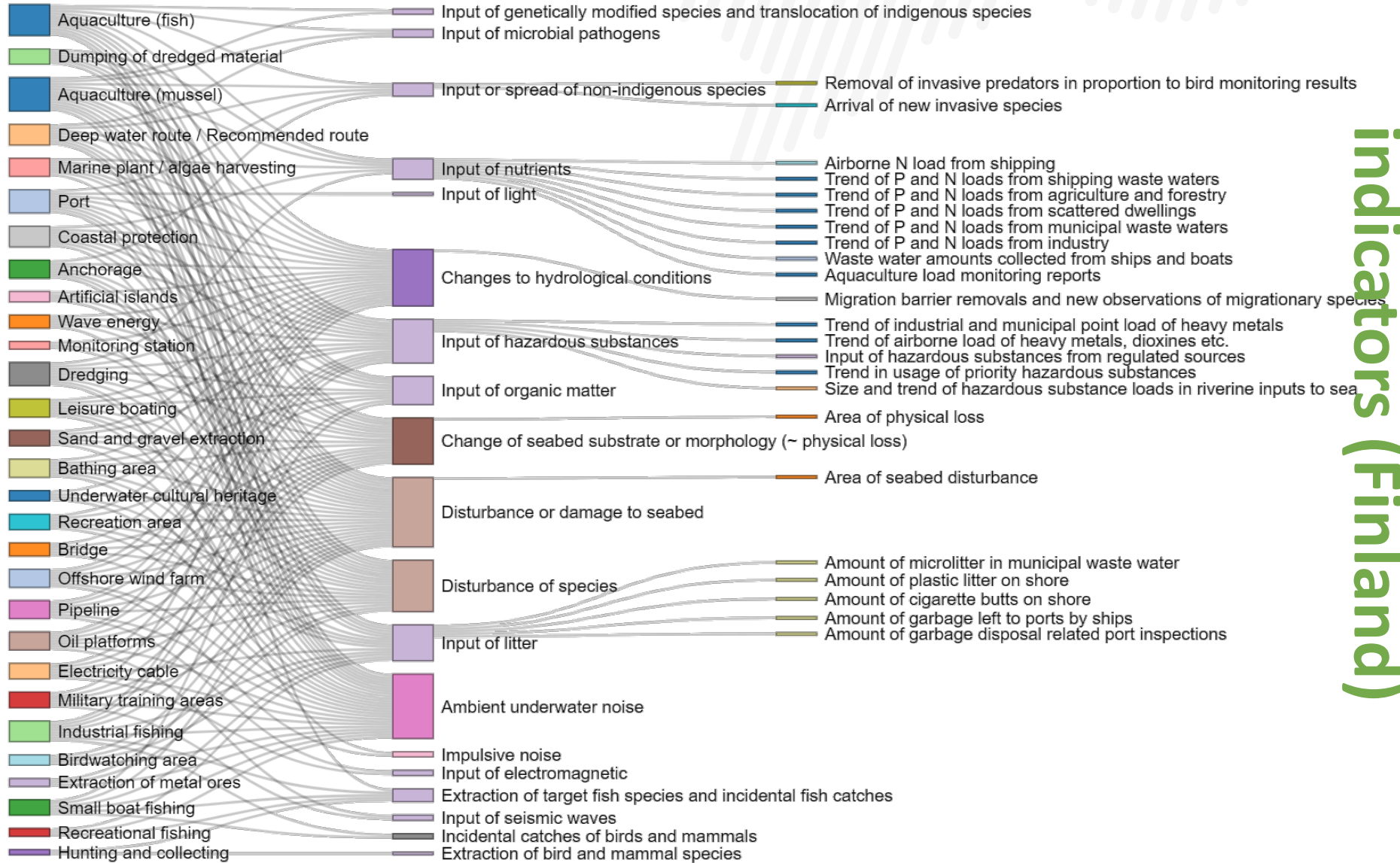


Pressure indicators (Finland)

Pressures



Sea uses



Environmental target
indicators (Finland)

How to connect state indicators to pressures?

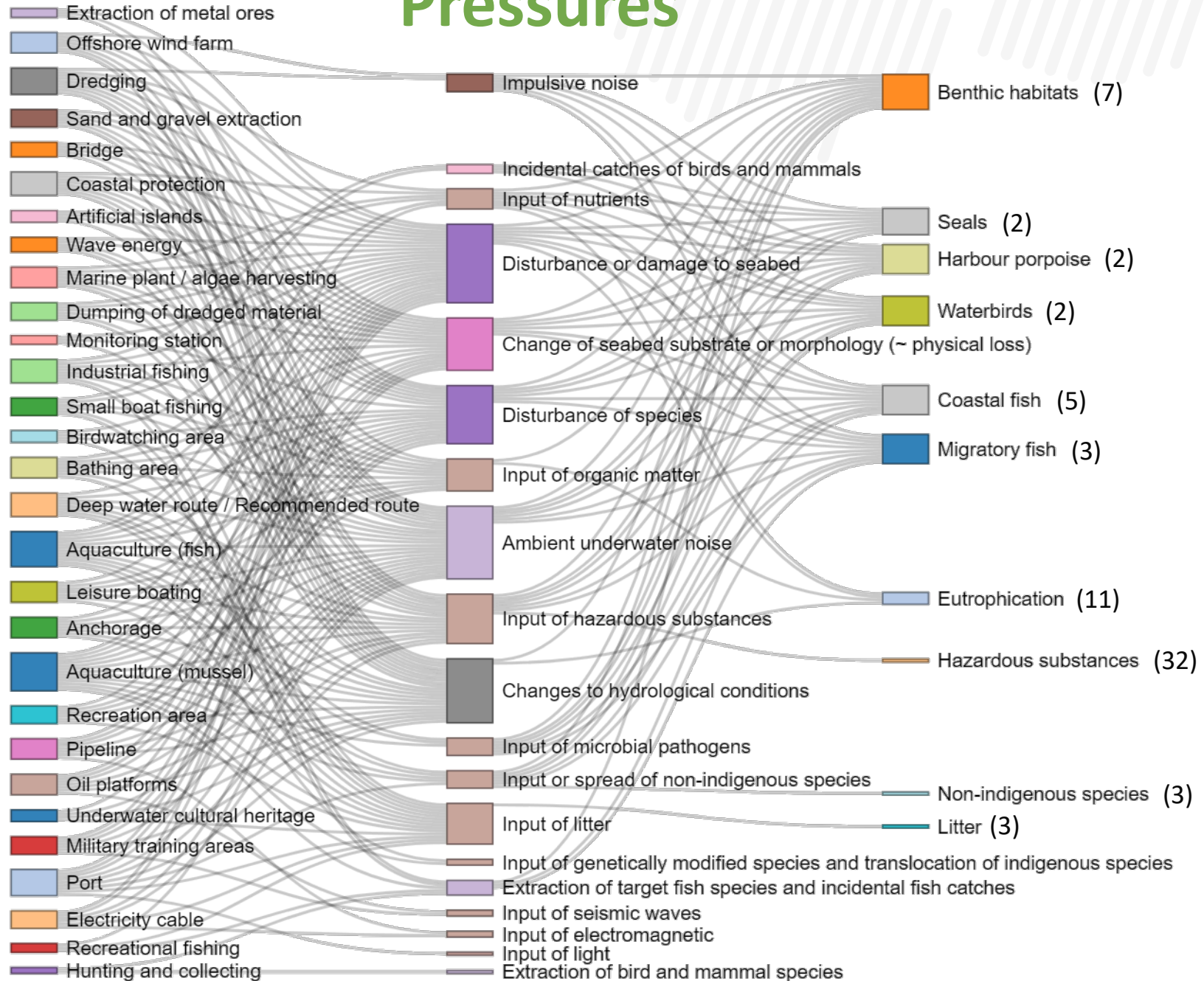


Table C1. Sensitivity scores used in the cumulative effect assessment. The scores are median values of all the expert responses. See Chapter 4.1 and Appendix C text for description.

	Circalittoral coarse sediment	Circalittoral mixed sediment	Circalittoral mud	Circalittoral rock and biogenic reef	Circalittoral sand	Infralittoral coarse sediment	Infralittoral mixed sediment	Infralittoral mud	Infralittoral rock and biogenic reef	Infralittoral sand	Offshore circalittoral coarse sediment	Offshore circalittoral mixed sediment	Offshore circalittoral mud	Offshore circalittoral rock and biogenic reef	Offshore circalittoral sand	Bathyal	Abyssal	Small toothed cetaceans	Deep diving toothed cetaceans	Baleen whales	Seals	Turtles	Breeding birds	Fish	Saltmarshes	Seagrasses	Cold-water corals and other coralligenous formations	Seamounts	Coastal water column habitat	Offshore water column habitat		
BALTIC SEA																																
Introductions of non-indigenous species	3	3	2,63	3	2,75	3	3	3	3	2,63	2,75	2,5	2,25	3	2,5			1			1,5		2	2	2,13	2,88	3,75	2,5	3	3		
Input of microbial pathogens	3	3	3	2	2,5	2	2,5	2,5	2	2,5	2,5	2,5	2,5	2,5	2,5			4			3,5		3,5	4	2	2	2	1,5	2,5	2,5		
Disturbance of species due to human presence	1	1	1	1,5	1	2	2	2	2	2	0	0	0	1	0			3			3,13		4	2	2,75	2	1,5	0	2	0		
Extraction of species by commercial fishing	1	1	1	2	1	2	2	2	2	2	1	1	1	2	1			2			2		2	4,63	0	1,5	2	4	3	3		
Bycatch by pelagic towed gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			3			2		2,5	4	0	0	1	2	3	3		
Bycatch by bottom touching mobile gear	3,5	3,5	3	3	3,5	2	2	3	3	3	4	4	4	3	4			1			1		1	4	0	2	2,5	3,5	1	1		
Physical loss of seabed	5	5	5	5	5	5	5	5	5	5	4,75	4,75	4,5	5	4,75			2			1,5		1	3	5	5	5	4,5	1	1,13		
Physical disturbance to seabed	3,25	3	4	4	4	3	3	4	4	4	3,13	3	4	4	3,5			1			1		1	3	4	4	3,5	3,5	2	0		
Changes to hydrological conditions	2	2	2	2	2	2,38	2,38	2,38	3	2,13	2	2	2	2	2			0,5			1		1	2,75	3	3,5	2,5	1	2	3		
Inputs of nutrients	3	3	3	3,13	3	3,63	3	3,13	4	3,63	3	3	3	3	3			1,5			1,5		2	3	4	4,88	3	2	4	4		
Input of organic matter	3	3	3	3	3	4	4	3	4	3	2,5	2,5	2,5	3	2,5			1			1		2	2	2	3	3	1,5	4	2,5		
Input of hazardous substances	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3			4			4		4	4	3	3	2,5	2,5	2,5	2,5		
Input of continuous anthropogenic sound	0,5	0,5	0,5	0,5	0,75	0,88	0,88	0,88	0,75	0,88	0	0	0	0	0			4			3,38		3	3	0,75	0,5	1	0	1	0		
Input of impulsive anthropogenic sound	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,75	0,88	0,75	0,75	0,75	0,75	0,75			4,88			4		4	3	0,75	0,63	1	0	1,75	2		
Global change	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	4	3,5	3	3	3	3	3			2			3		2	3	3,5	3	3	2,5	4	4		

Pressures

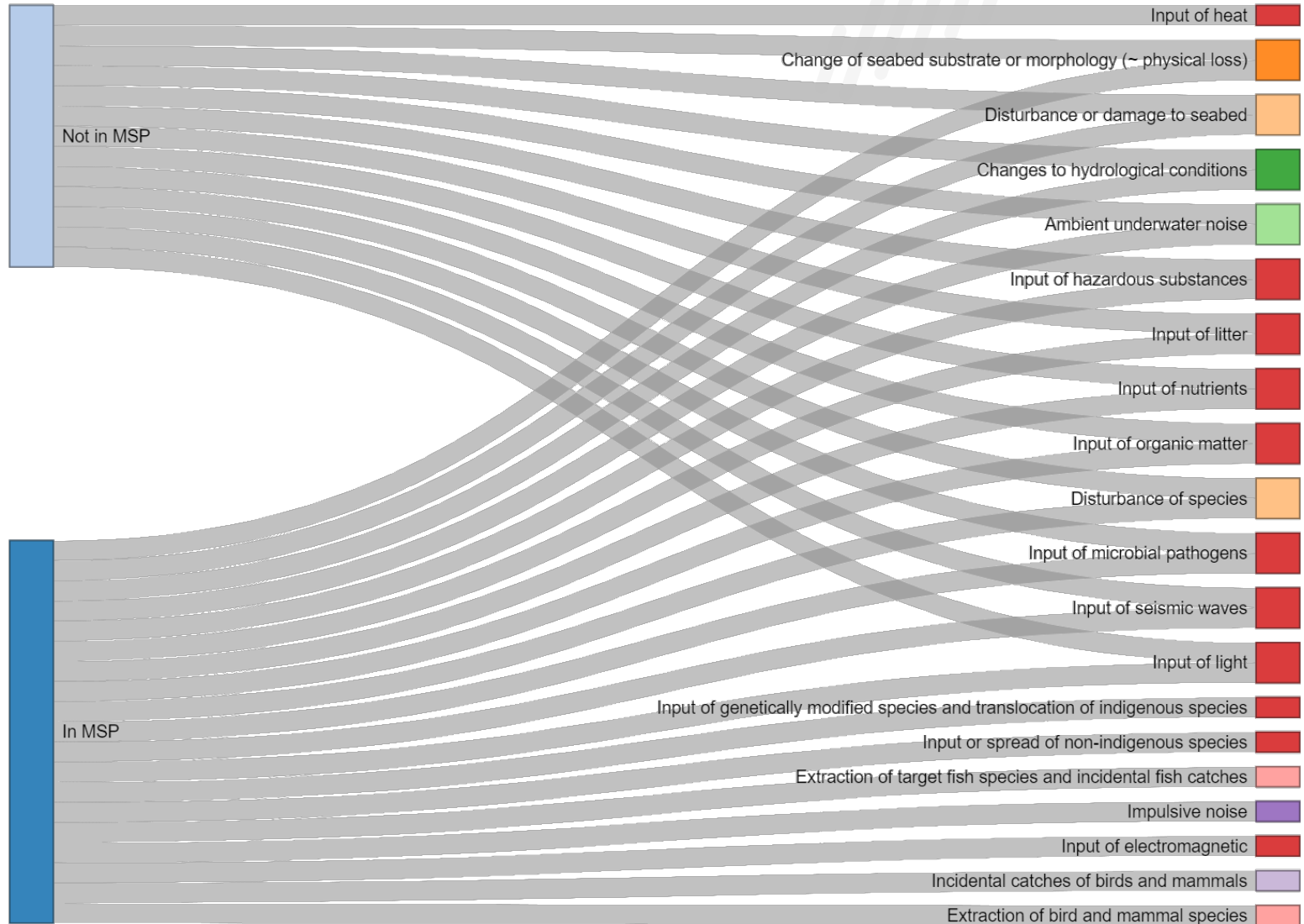
Sea uses



State indicators by topic (Finland)

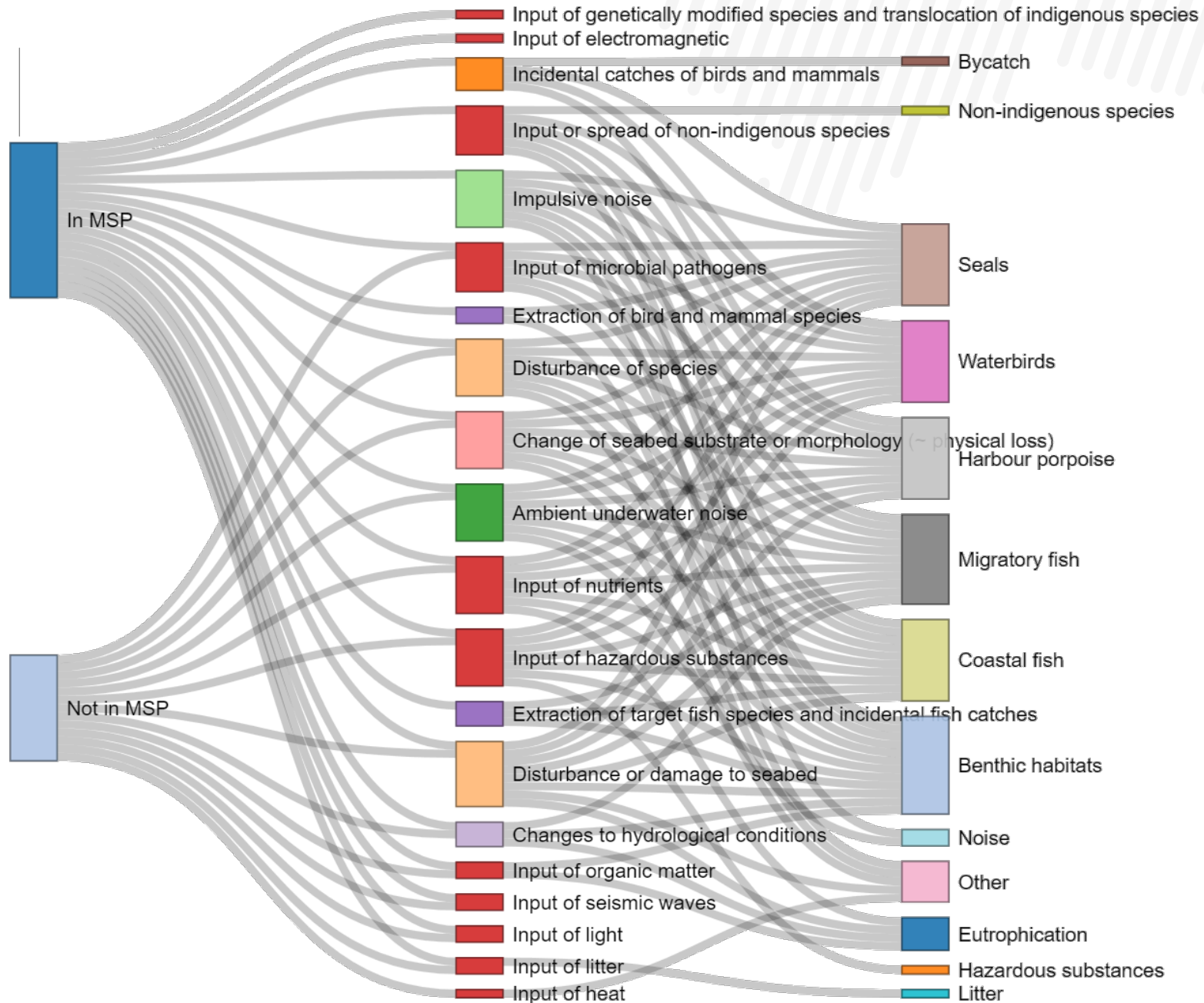
How to assess specificity?

Sea uses



Pressures

Sea uses



Gaps?

Preliminary conclusions

- Plenty of indicators, specificity will probably be a problem
 - ..which makes sensitivity and data availability even more important
- Any MSP contribution to GES analysis should focus on expected change
 - Is the MSP just writing down the status quo or proposing changes?
 - What specifically could be expected to change if the plan has direct effects?
 - ..and what unexpected changes could there be.

Continuing with..

- Complete the pressure-oriented relevance review for Finland & Sweden & HELCOM indicators
- Do a simplified specificity analysis on indicators
- Assess sensitivity by comparing information on spatial scales & data availability



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Thank you!

Any ideas on how to develop this concept are welcome.

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