Vulnerability and spatial competition: The case of fisheries and offshore wind projects

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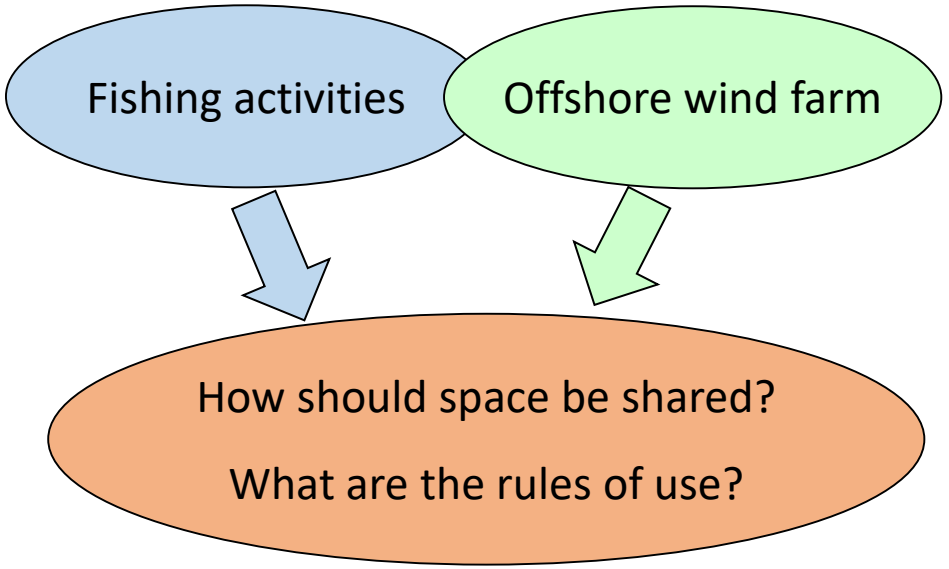
Introduction

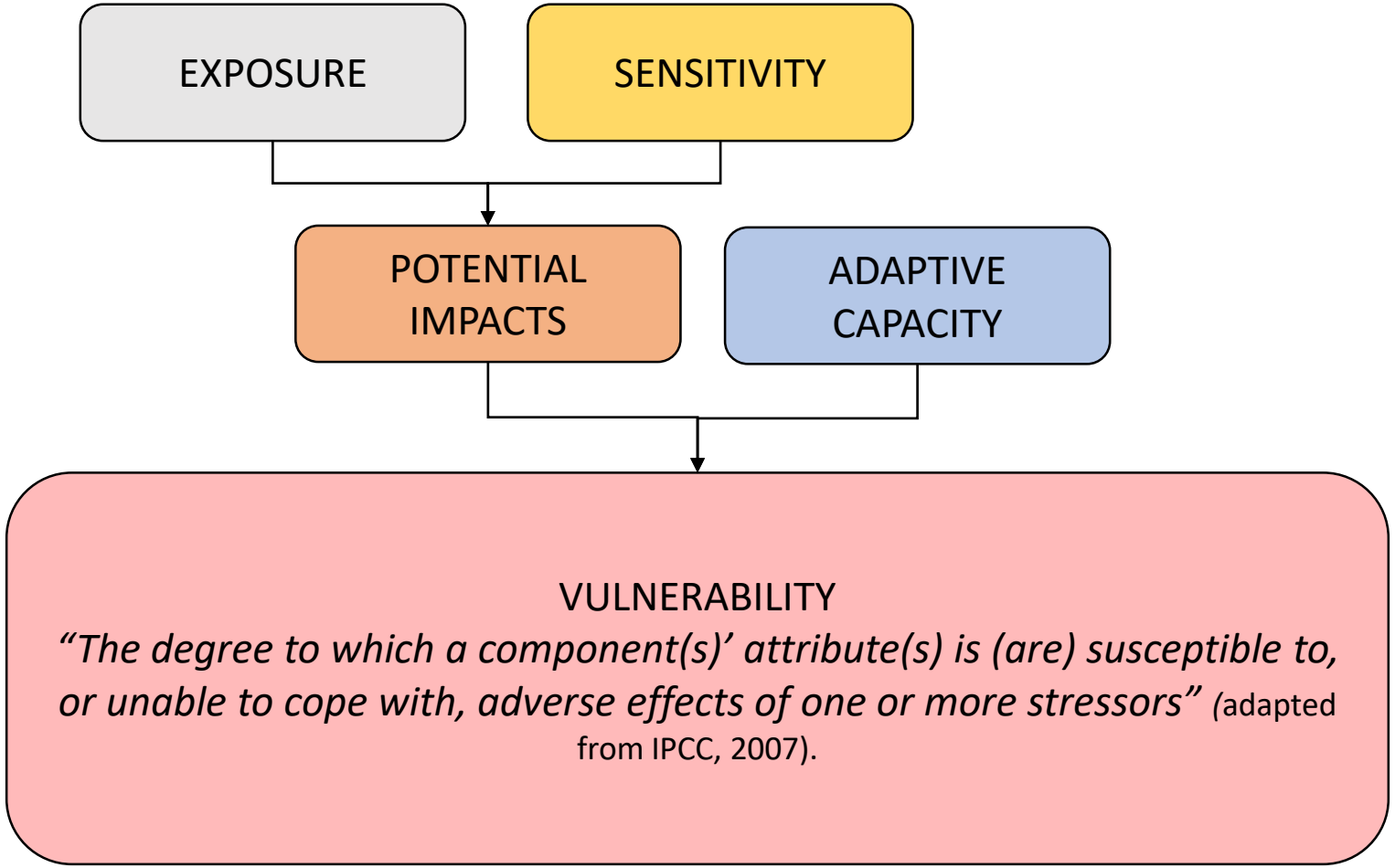
- Increase of offshore wind farm projects (Alexander et al. 2013)
- Pressure on the fisheries activities as an effect on :
  - Fisheries based livelihood (Islam et al. 2014)
  - Well-being on the fishers (Bush et al. 2011)

- Issue:

  Cohabitation between the traditional activity of exploiting living marine resources and the development of the offshore wind energy industry (spatial competition).



Use of vulnerability to understand the interaction between human and the system with the use of 3 dimensions

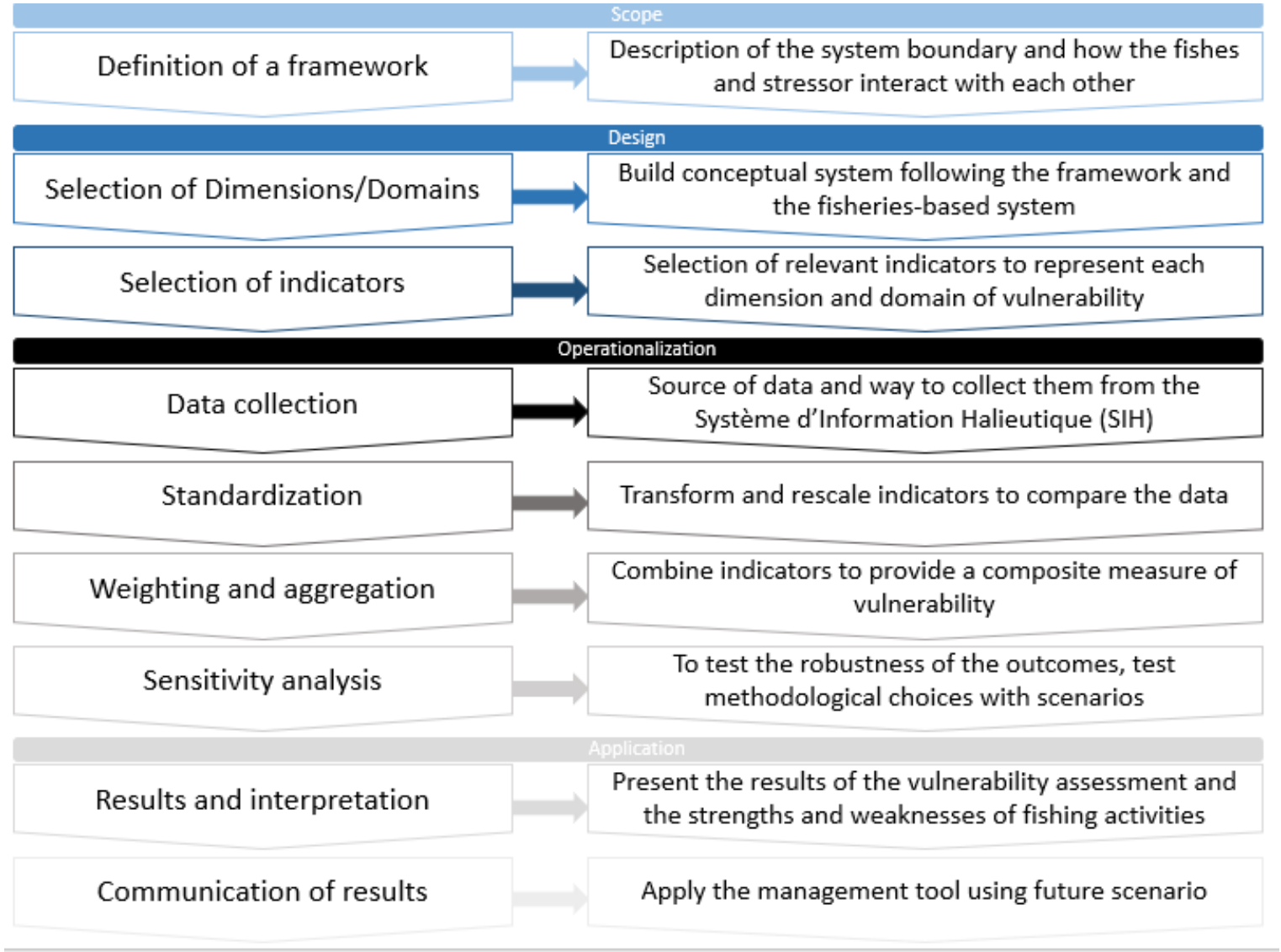


Aims

- Adapt the vulnerability method to the case of spatial pressure between offshore wind park and fishing activities (with identification of key pressure)
- Measure the vulnerability of professional fishing communities threatened by spatial competition from an offshore wind farm project
- Identify the groups of fishers most vulnerable to the establishment of a park and how to produce vulnerability-based management

Material and Methods

- Vulnerability assessment using a composite index method (based on OECD, 2008)



Scope

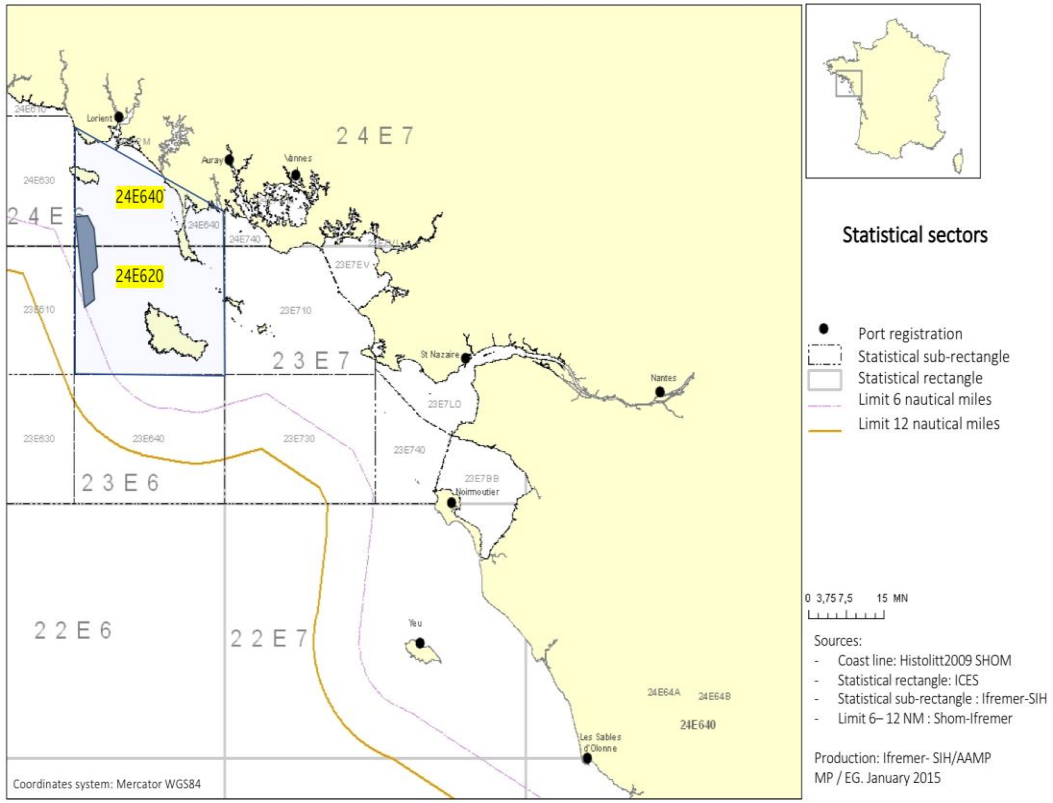
Definition of a framework → Description of the system boundary and how the fishes and stressor interact with each other

- Study case on a pilot farm off the coast of Groix and Belle-Ile (France)

Characteristic of the study area:

- 14.3km²,
- 22 km from the coast,
- sandy-muddy area,
- depth between 55 and 70 m.

A prototype floating wind turbine in the test phase © Ifremer-Eolink - O. Dugornay



Scope

Definition of a framework → Description of the system boundary and how the fishes and stressor interact with each other

- 3 different groups of fishing activities:

Fleets present in the impacted area in 2018.

		Size of vessels	
		< 12 m	≥ 12 m
Fishing Technique	Lines, traps, nets	Fleet 1 18 vessels (35%)	N/A[a] 2 vessels
	Trawls, dredges, seines	Fleet 2[b] 21 vessels (40%)	Fleet 3 13 vessels (25%)

Design

Selection of Dimensions/Domains → Build conceptual system following the framework and the fisheries-based system

Domains

Dimensions

EXPOSURE

Nature and degree to which a component is in contact with, or subject to, a stressor

(IPCC 2007, Kasperson et al. 2005, Adger 2006, Gallopín 2006)

SENSITIVITY

Conditions determining the degree to which a component is directly or indirectly altered or modified in the short term by stressor exposure

(modified from IPCC 2001, 2007, Bousquet et al. 2015).

ADAPTIVE CAPACITY

Latent ability to implement effective responses to changes by minimizing, coping with, or recovering from the potential impacts of a stressor

(Whitney et al. 2017, Cinner et al. 2018).

POTENTIAL IMPACTS

VULNERABILITY

Design

Selection of indicators → Selection of relevant indicators to represent each dimension and domain of vulnerability

Data collection → Source of data and way to collect them from the Système d'Information Halieutique (SIH)

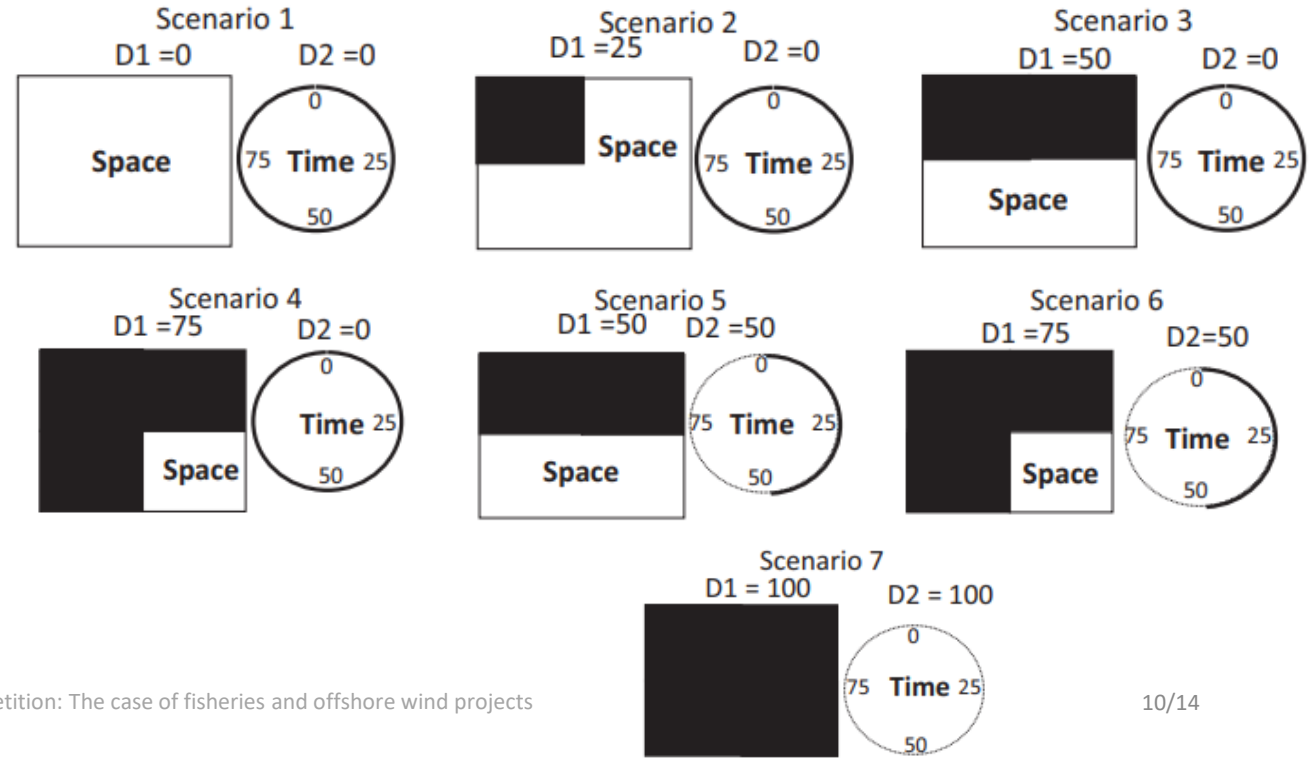
Dimensions	Domains	Nb	Indicators
EXPOSURE	Direct Spatial	I1	Proportion of area accessible to fishing vessel. (in %)
	Direct Temporal	I2	Proportion of the temporal closure accessible to fishing vessel. (in %)
SENSITIVITY	Environment dependence	I3	Number of species caught in the future wind farm area divided by the total number of species caught in a year. (in %)
	Cultural dependence	I4	Frequentation rate of the area by the number of months of activity declared. (in %)
		I5	Number of years the fishing vessel operated in the area between 2011 and 2020 (in years)
	Economic dependence	I6	Annual sales (turnover) made from the area divided by the annual total turnover. (in %)
ADAPTATIVE CAPACITY	Physical capital	I7	Age of the vessels (years)
		I8	Combination of length, engine power and tonnage, transformed into a logarithm (for simplicity of values).
	Human capital	I9	Age of the boat owner (in years)
		I10	Crew size (fishers/boat)
	Natural capital	I11	Number of species caught in a year in general (all area included) (in species/years)
		I12	Number of métiers declared in a year in general (in métiers/years)
	Social capital	I13	Number of vessels from the same fleet per harbour (in vessels/harbour)
	Economic capital	I14	General annual turnover divided by the indicator boat characteristics (D6). (in euros)

Table: Final composite index with major dimensions, domains and indicators developed in the case of the implementation of an offshore floating wind farm in France

Operationalization

Standardization	Transform and rescale indicators to compare the data
Weighting and aggregation	Combine indicators to provide a composite measure of vulnerability
Sensitivity analysis	To test the robustness of the outcomes, test methodological choices with scenarios

- Standardization using min-max method
- Equal weight
- Use of min max standardization
- Additive and multiplicative aggregation (to test sensitivity)
- Test of scenario (to test sensitivity)



Application

Results and interpretation → Present the results of the vulnerability assessment and the strengths and weaknesses of fishing activities

Table 4
Vulnerability score with exposure, sensitivity, and adaptive capacity per fleet in additive and multiplicative forms – scenario 1 (D1 = 0, D2 = 0).

	Fleet 1		Fleet 2		Fleet 3	
Scores	Additive	Multiplicative	Additive	Multiplicative	Additive	Multiplicative
Vulnerability (between 0 and 1)	0.80	0.70	0.66	0.61	0.58	0.63
Exposure	1	1	1	1	1	1
Sensitivity	0.73	0.99	0.35	0.75	0.38	0.88
Adaptive capacity	0.34	0.89	0.37	0.91	0.64	1

- Coastal feet using passive gears is the most vulnerable
- Coastal fleet using active gears is less economically dependent (and therefore less vulnerable) than coastal feet using passive gears .
- The vulnerability of the fleet 3 (large vessels using active gears) is relatively low, indicating a low economic dependence on the area and occasional frequentation (the floating wind turbine site is located within the coastal strip), and therefore less sensitivity

Application

Results and interpretation

Present the results of the vulnerability assessment and the strengths and weaknesses of fishing activities

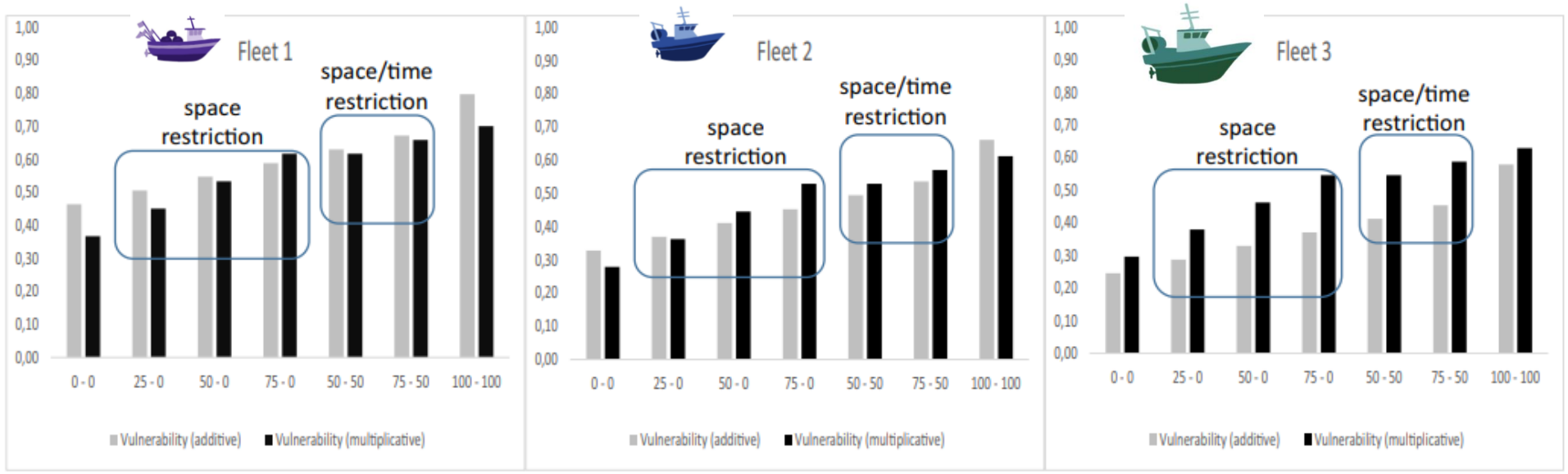


Fig. 4. Vulnerability score under different scenarios using two aggregation method.

- Using additive or multiplicative aggregation keeps fleet 1 with the higher vulnerability score.
- The multiplicative form reduce the difference of score between fleet 2 and 3

Application

Results and interpretation → Present the results of the vulnerability assessment and the strengths and weaknesses of fishing activities

→ Advantages of the method

- Can be adapted at local scale
- Low cost of implementation (if data available)
- Possibility to add indicators relating to non-market values
- Objective of reducing negotiation costs/facilitating dialogue between stakeholders.

→ Limitations of the method

- Must be finely adapted to the case study (definition of areas and indicators)
- The choice of variables must be transparent
- Tools to assist consultation (not a space optimization model)

Thank you for listening

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