Ecological, Socioeconomic and Institutional Resilience to shifting fish stocks

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Outline

- Motivation
- Goals
- Methods
- Results
- Final remarks

Motivation

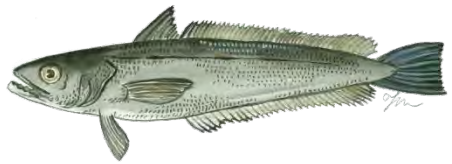
- The problem of shifting stocks
  - EU shifting stocks (ICES, 2017, Poloczanska et al., 2016)
- The need for fisheries Resilience
  - Resilience factors for a fishery (Ojea et al., 2017)
- Lack of operationalized examples of fisheries resilience (Leith et al., 2014, exception is Van Putten, 2013 and focusses on economic resilience)

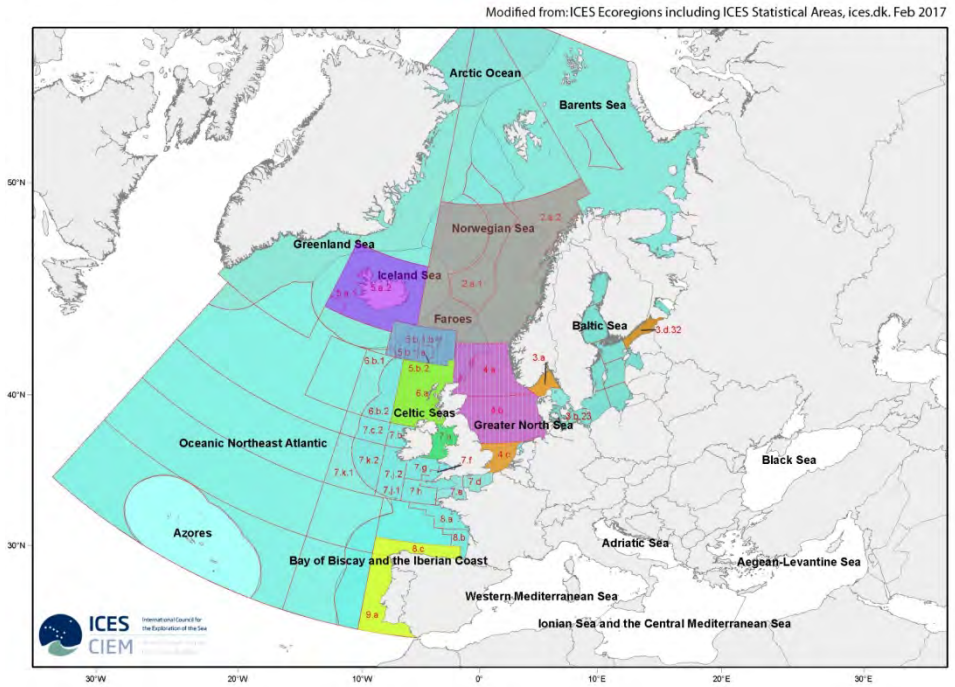
Goals

- Identify potential resilience factors for fisheries affected by the shifting stocks problem
- Understand the institutional, socioeconomic and ecological dimensions of resilience in fisheries

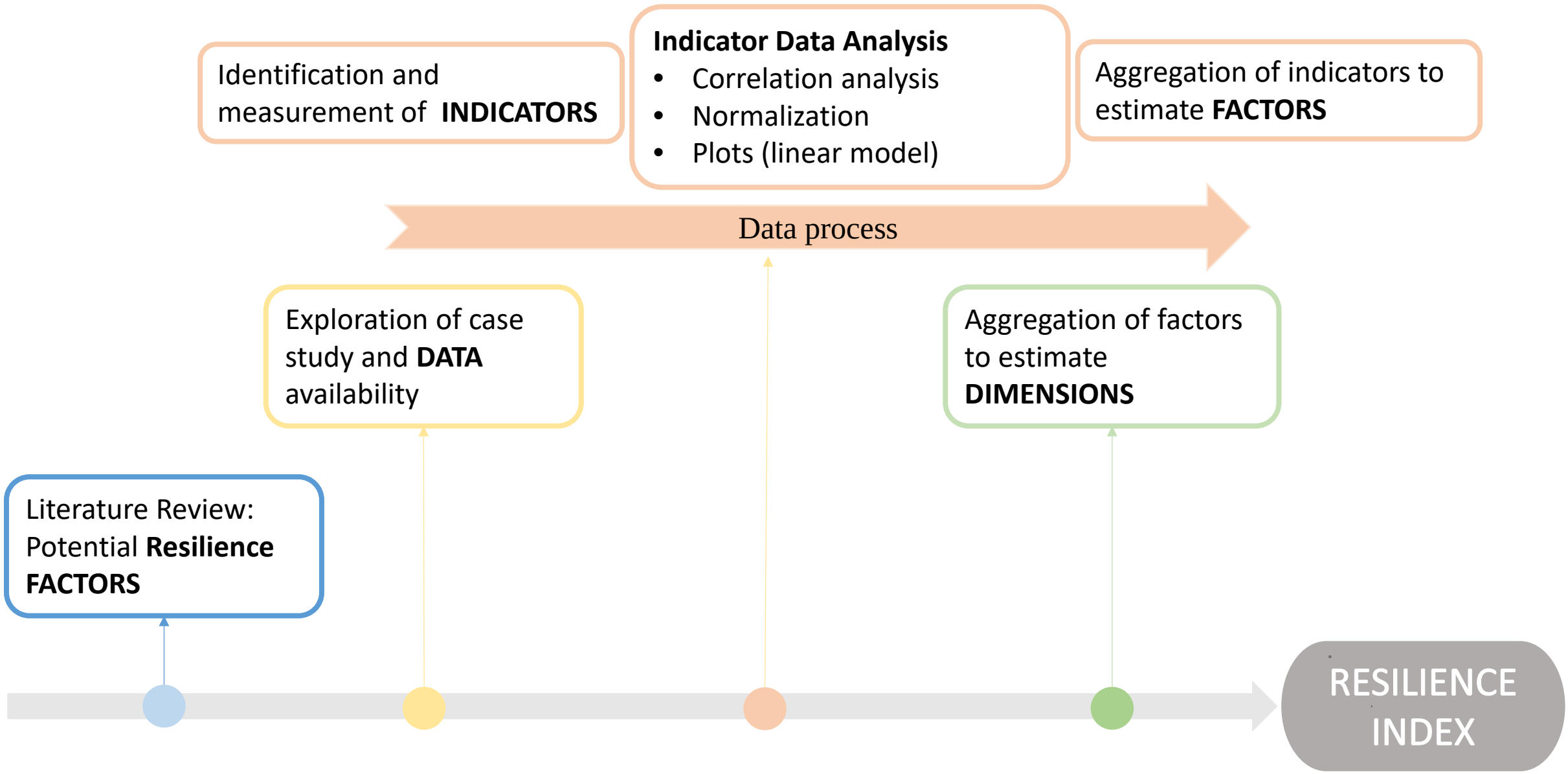
Case Study

- EU- ICES areas
- Two commercial species:
  - Atlantic cod (*Gadus morhua*)
  - European hake (*Merluccius merluccius*)





Methods


Identification and measurement of **INDICATORS**
Indicator Data Analysis
• Correlation analysis
• Normalization
• Plots (linear model)
Aggregation of indicators to estimate **FACTORS**
Data process
Exploration of case study and **DATA** availability
Aggregation of factors to estimate **DIMENSIONS**
Literature Review: Potential **Resilience FACTORS**
RESILIENCE INDEX

Methods - Potential factors for resilience

ECOLOGICAL Factors

FACTOR	REFERENCES
Potential Distribution Area	King, 2008
Abundance Trend	Gutiérrez et al., 2011
Temperature Range of species	Cheung et al., 2013
Age diverse target population	Ojea et al., 2017
Overexploitation	Sanpedro et al., 2016 Murawski, 2000
Recovery Time	Neubauer er al., 2013
Gear Restrictions	Cinner et al., 2009

SOCIOECONOMIC Factors

FACTOR	REFERENCES
Gear Diversity	Murawski, 2000
Fleet Mobility	Van Putten et al., 2013
Livelihood diversification	Ojea et al., 2017
Fleet Diversification (species)	Gutiérrez et al., 2011
Catch Dependency	Gutiérrez et al., 2011
Adaptive Management	Ojea et al., 2017 Murawski, 2000

INSTITUTIONAL Factors

FACTOR	REFERENCES
Co-management	Van Putten et al., 2013 Gutiérrez et al., 2011
Property Rights	Ojea et al., 2017 Andersen et al., 2009 Leith et al., 2014
Multi-level Governance	Ojea et al., 2017
Quotas	Gutiérrez et al., 2011
Institutional strength	Gutiérrez et al., 2011

Information from 38 scientific papers

Methods - Ecological Data

Stock assessments RAM Legacy data

CODCOASTNOR

CODNEAR

CODFAPL

CODICE

CODBA2532

CODKAT

CODIS

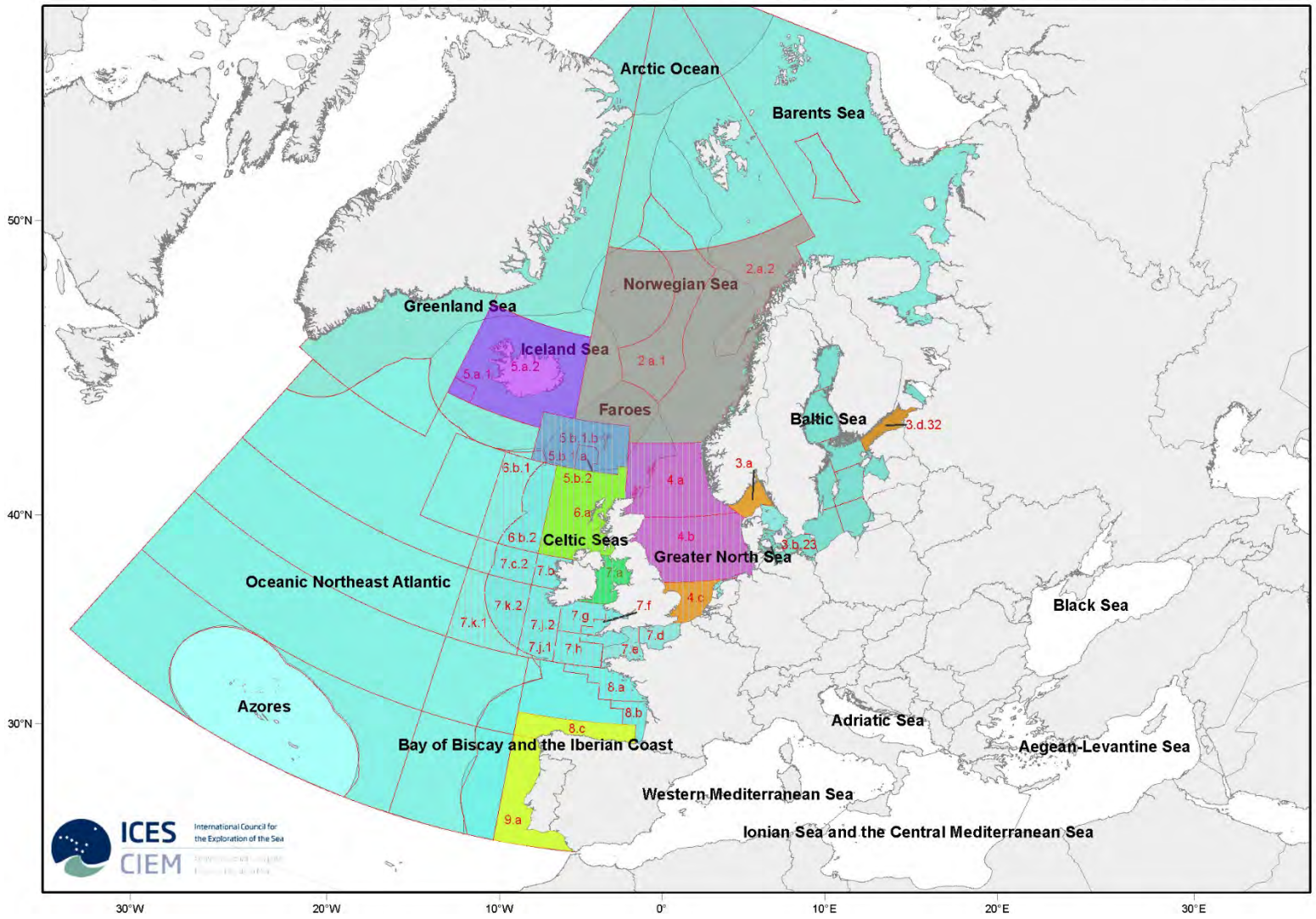
CODVIa

CODNS

HAKENRTN

HAKESOTH

Modified from: ICES Ecoregions including ICES Statistical Areas, ices.dk. Feb 2017



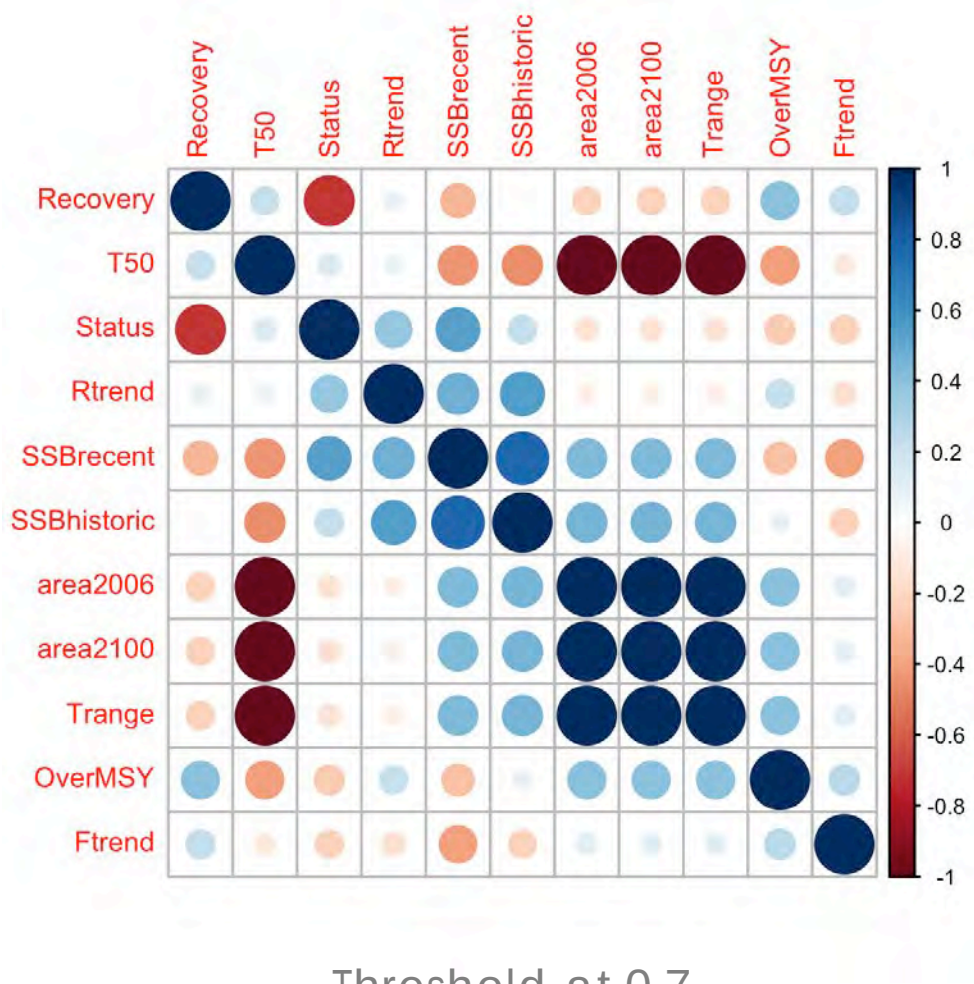
Methods - Ecological Data

STOCK	BE	DK	DE	EE	IE	ES	FR	LV	LT	NL	PL	PT	FI	SE
HAKENRTN	X	X	X	-	-	X	X	-	-	X	-	X	-	X
HAKESOTH	-	-	-	-	-	X	X	-	-	-	-	X	-	-
CODCOASTNOR	-	X	X	X	X	X	X	-	-	-	X	X	-	-
CODNEAR	-	X	X	X	X	X	X	-	-	-	X	X	-	-
CODFAPL	-	-	X	-	-	-	-	-	-	-	-	-	-	-
CODICE	-	-	X	-	-	-	-	-	-	-	-	-	-	-
CODBA2532	-	X	X	X	-	-	-	X	X	-	X	-	X	X
CODKAT	-	X	X	-	-	-	X	-	-	X	-	X	-	X
CODIS	X	-	-	-	X	-	X	-	-	-	-	-	-	-
CODVIa	-	-	X	-	X	-	X	-	-	-	-	-	-	-
CODNS	-	-	-	-	-	-	X	-	-	-	-	-	-	-

Methods - Ecological Data

Ecological resilience

FACTOR	INDICATOR
AREA	Area2006 Area2100
ABUNDANCE	SSB historic SSB recent F trend (mortality) R trend (recruitment)
TEMPERATURE	T^a range T^a 50
AGE TARGET POPULATION	NA
OVEREXPLOITATION	Status B_{limit}/F_{limit} Distance to MSY
RECOVERY	Recovery time
Gear restrictions	NA



Threshold at 0.7

Methods - Ecological Data

Ecological resilience

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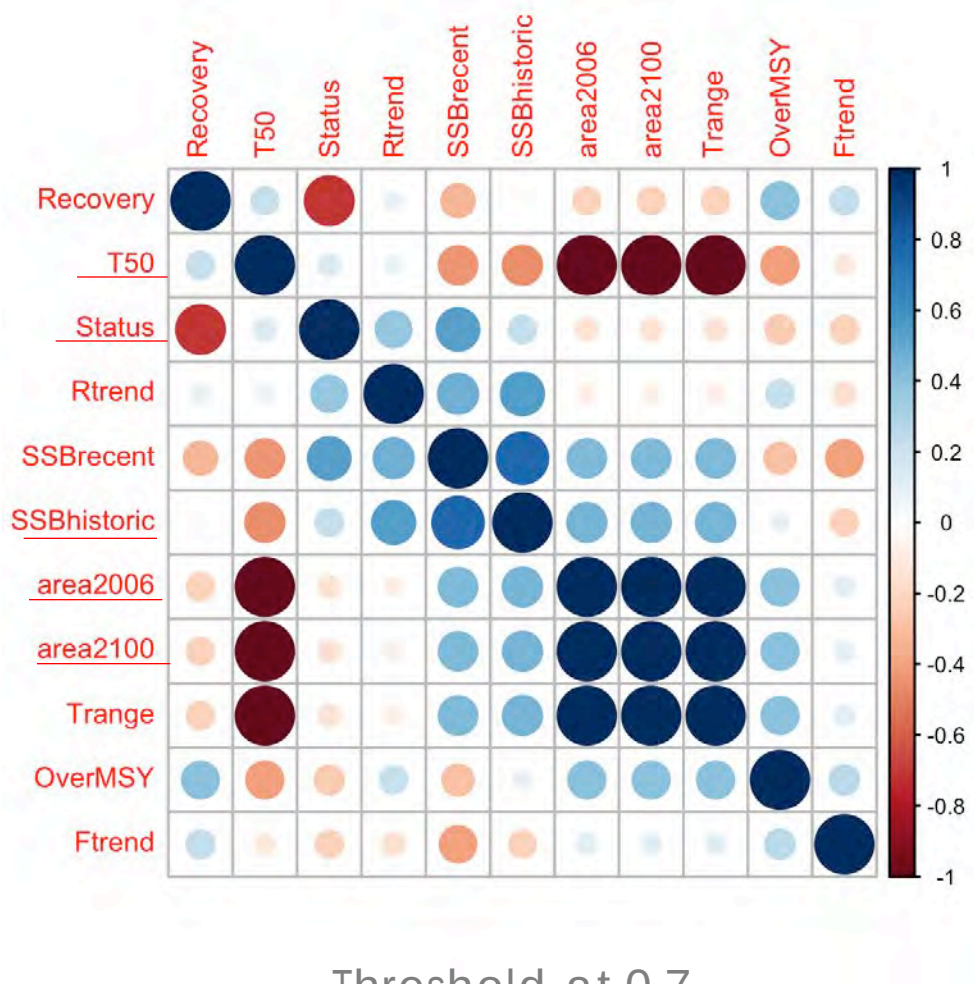
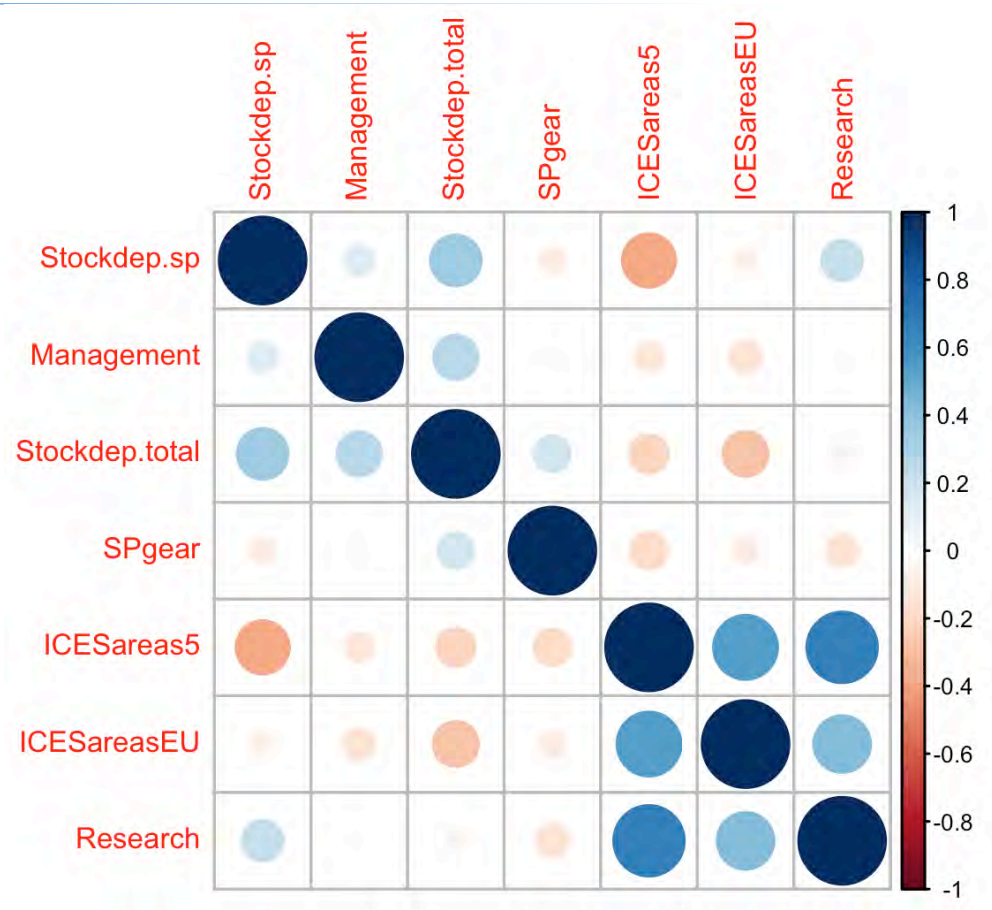


Threshold at 0.7

Methods – Socioeconomic Data

Socioeconomic resilience

FACTOR	INDICATOR
GEAR.DIVERSITY	NA
FLEET.MOBILITY	ICESareas5 ICESareasUE
LIVELIHOOD.DIVERSITY	NA
FLEET.DIVERSITY	NA
ADAPTIVE.MNG	Research Management
CATCH.DEPENDENCY	Stockdep.sp Stockdeo.total



Threshold at 0.7

Methods – Socioeconomic Data

Socioeconomic resilience

FACTOR	INDICATOR
GEAR.DIVERSITY	NA
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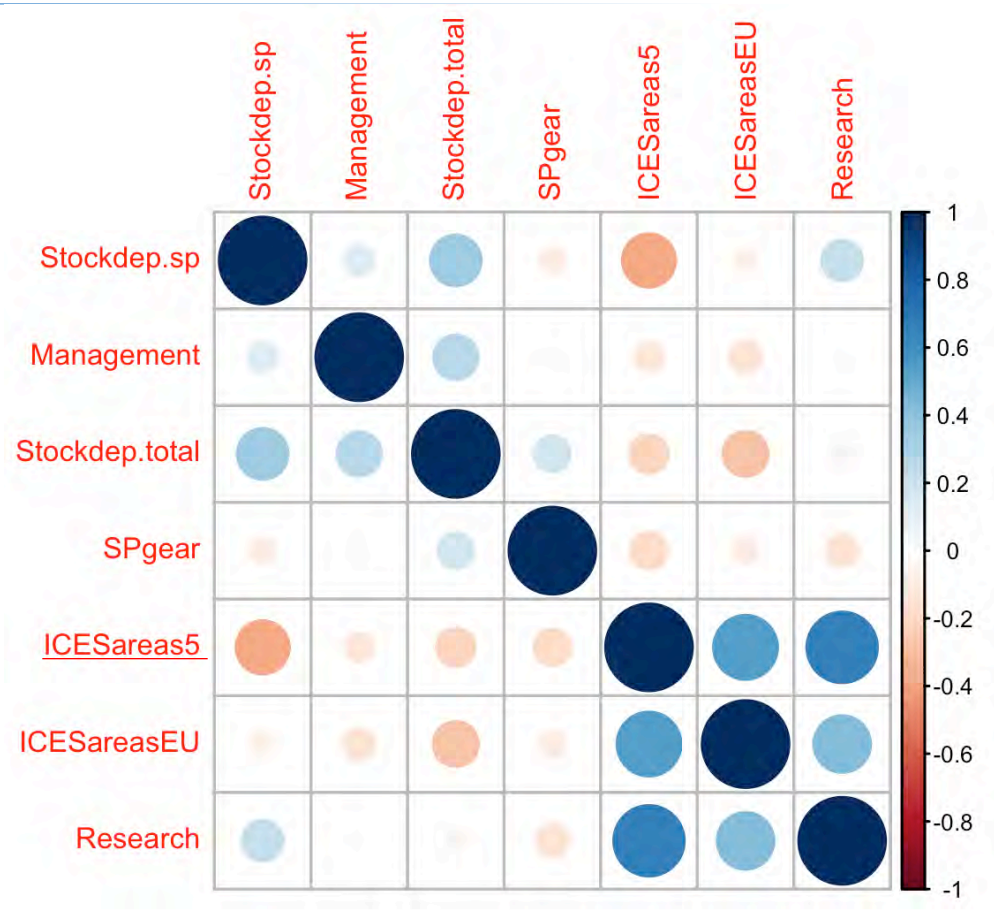
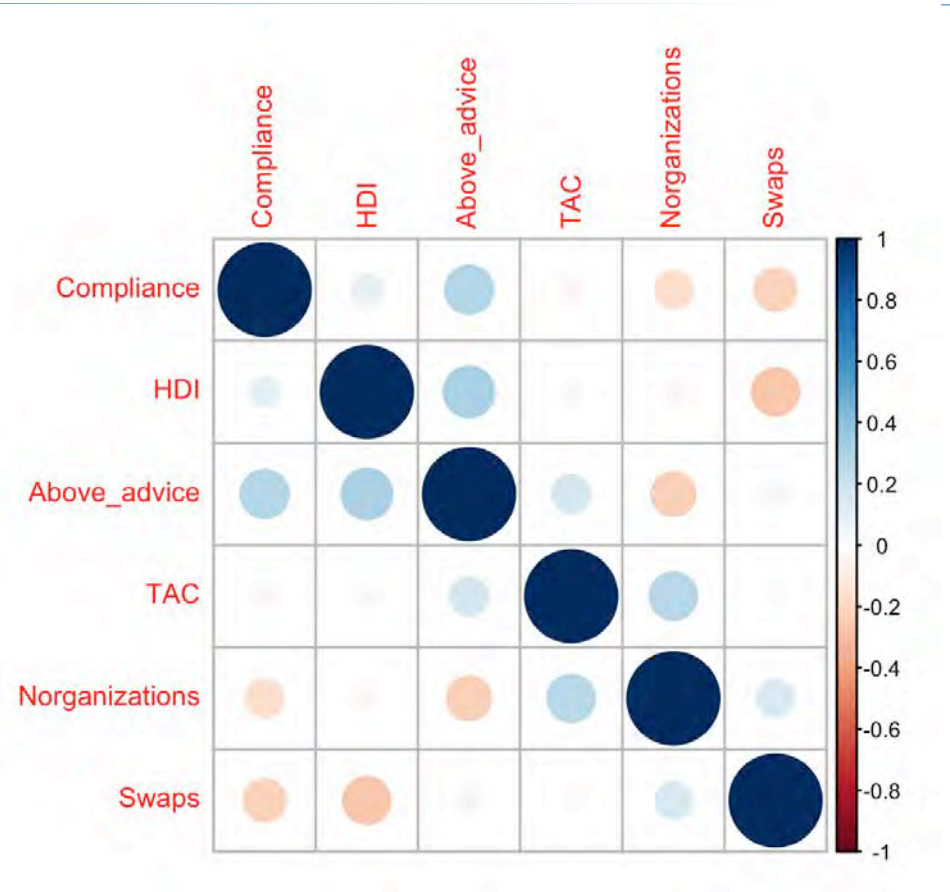


Threshold at 0.7

Methodology. Final resilience factors

Institutional resilience

FACTOR	INDICATOR
CO.MANAGEMENT	Nº of Producer Organizations
PROPERTY.RIGHTS	Swaps
MULTI-LEVEL GOVERNANCE	NA
QUOTAS	Above TAC excess
INST. STRENGTH	Compliance index



Threshold at 0.7

Methodology. Final composite index

Ecological Resilience

Abundance (+)

Temperature range (+)

Overexploitation (-)

Recovery time (-)

Socioeconomic Resilience

Fleet mobility (+)

Adaptive management (+)

Catch dependency (-)

Institutional Resilience

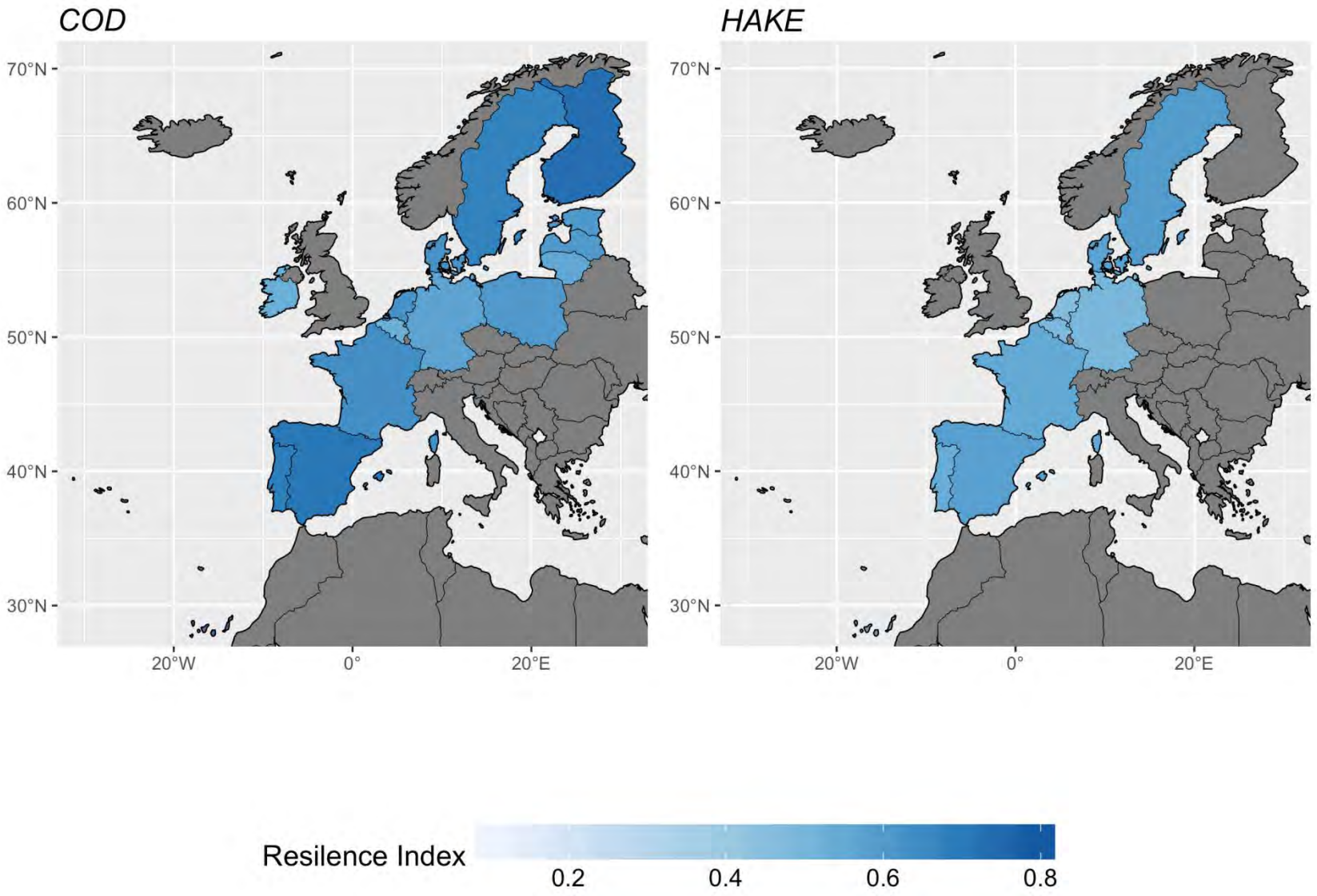
Co-management (+)

Property-rights (+)

Quota excess (-)

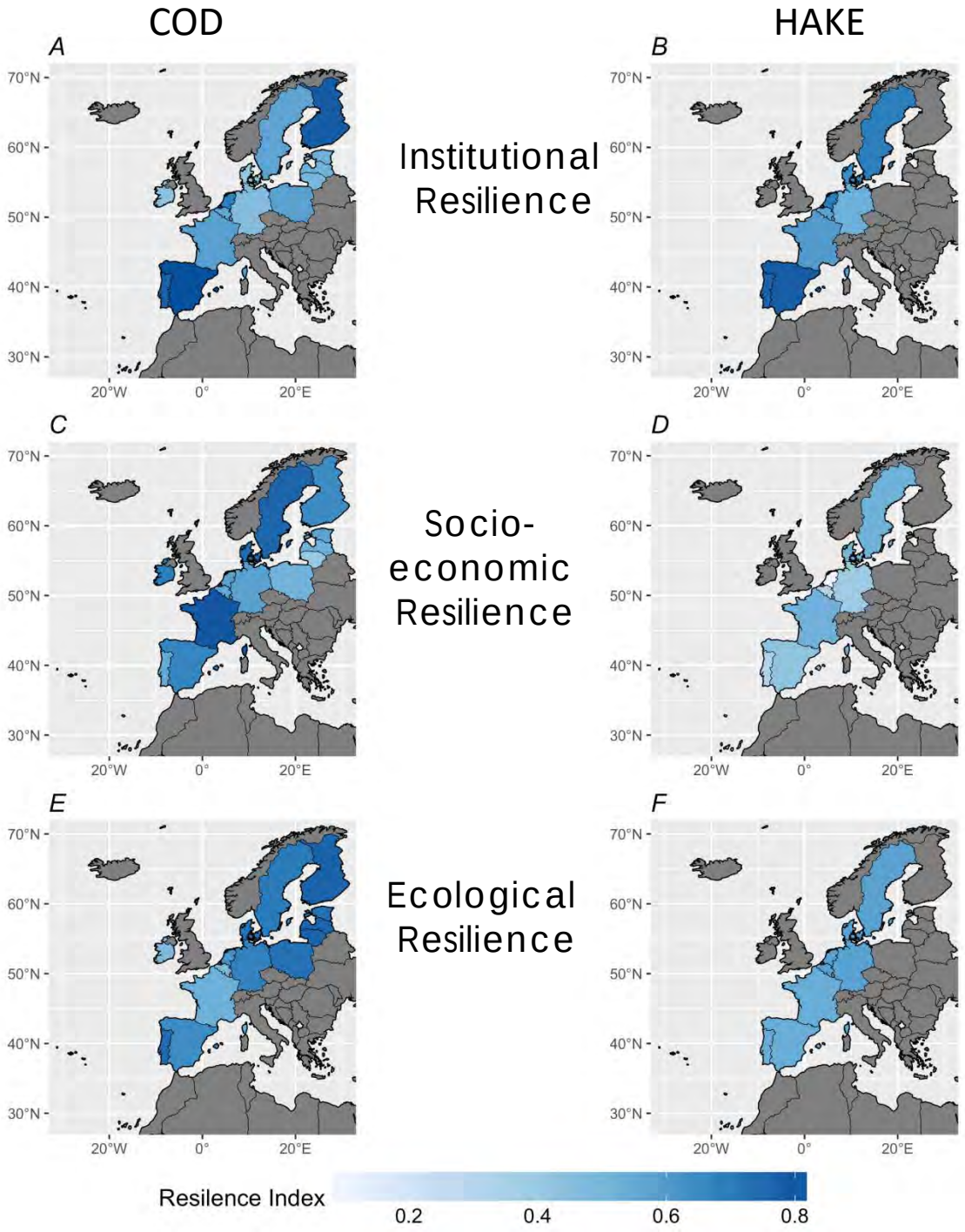
Institutional strength (+)

Results – Resilience index

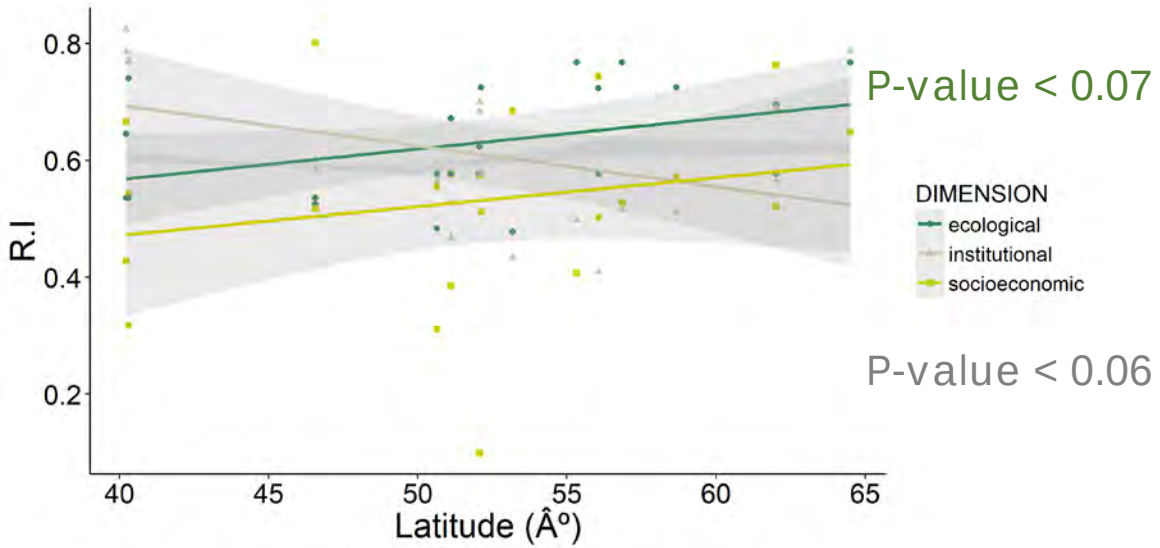


Results – dimensions

- Cod fisheries have higher resilience than hake
- Differences happen in socioeconomic resilience (greater catch dependency in hake)
- And in ecological resilience (lower abundance and status in hake)

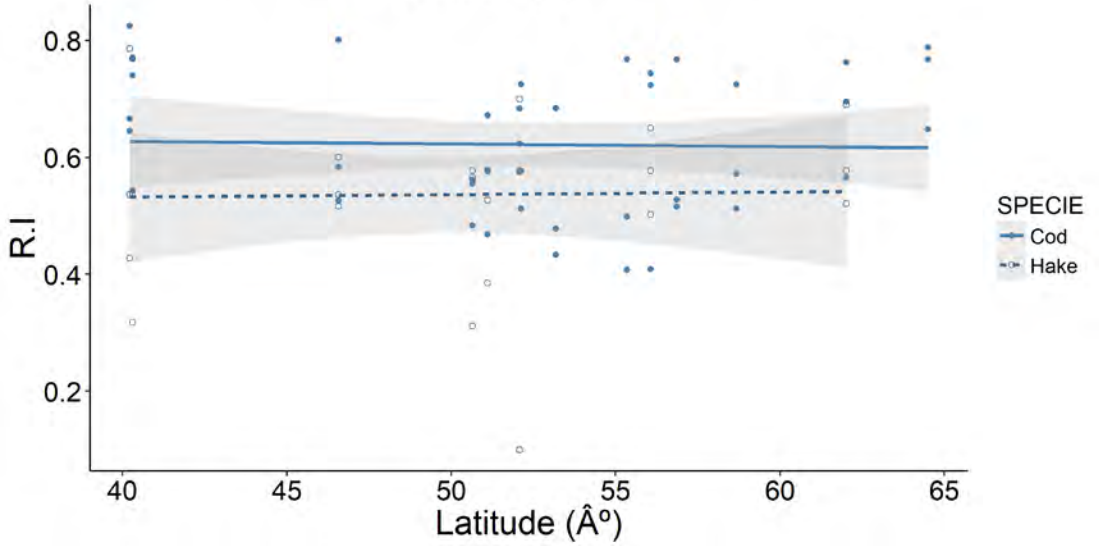


Results – latitude



P-value < 0.07

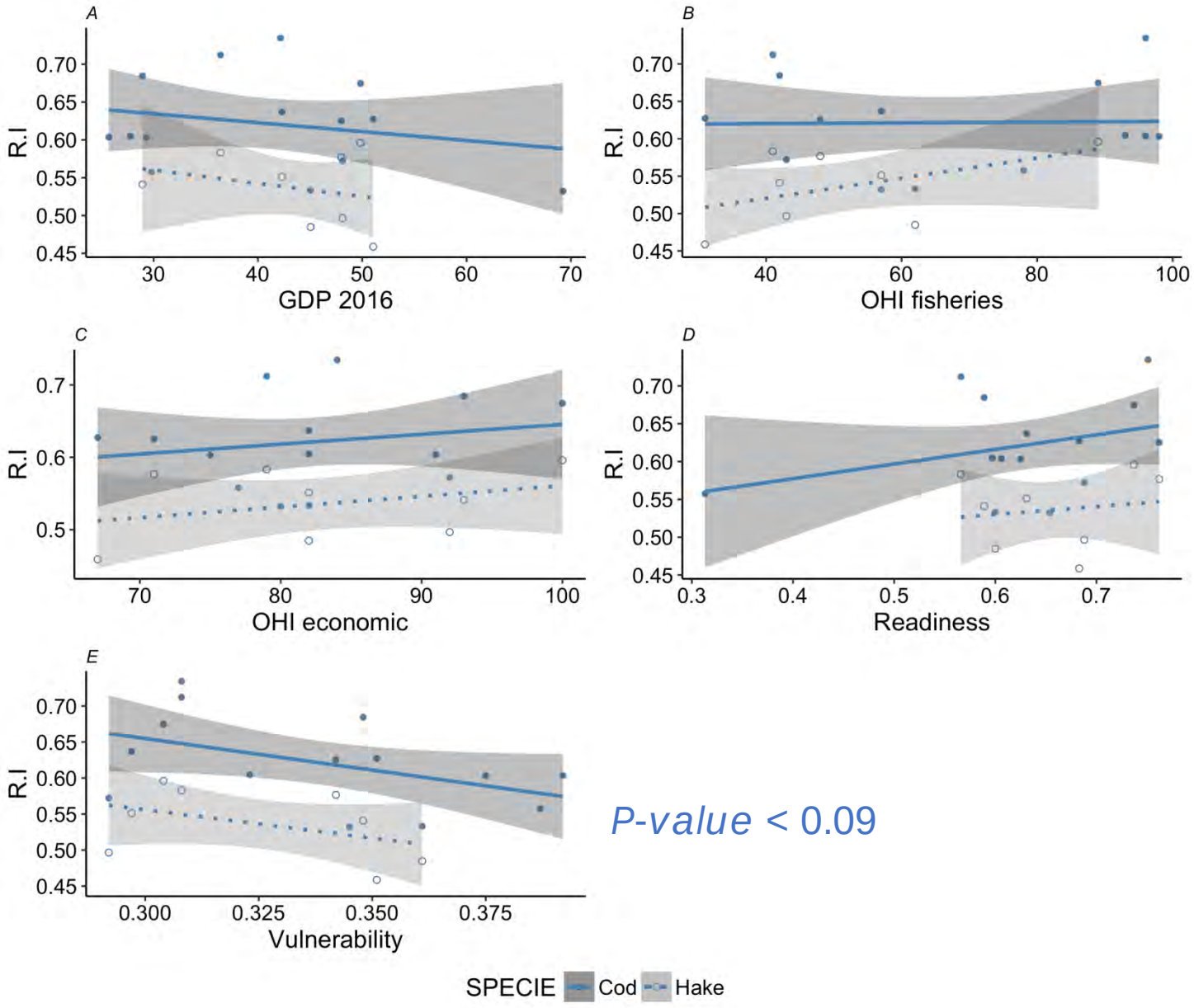
P-value < 0.06



- Higher latitudes are associated with higher ecological resilience and lower institutional resilience

- No latitude effect with the composite index

Results – Other indices



P-value < 0.09

- Expected direction with other indices
- Resilience index – vulnerability significant for cod
- More significant relationships per dimension

Final Remarks

- Operationalization of resilience in commercial fisheries for three dimensions
- Applied to species with shifting stocks in EU countries
- Ecological resilience increases towards the north, while institutional resilience is higher for southern countries
- Importance of looking at the institutional settings
- Importance of institutional and management data on a per stock basis to improve the analysis
- Potential to assess resilience in other shifting species

Thank you

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