Funded by the European Union's Horizon Europe programme under grant agreement No.101058956.

The MarineSABRES project: Using a Simple Social Ecological Systems approach in analysing Arctic pelagic fisheries

Dr Catherine Chambers and Gemma Smith

Acknowledgements to: Dr Emma Verling, Dr Roula Kyriazi, Anna Heiða Ólafsdóttir, Bjarki Þ. Elvarsson, Sandra Rybicki, Pamela J. Woods, Mirjam Carlsdóttir Olsen, Unn Laksá, Dr Amanda Gregory, Prof. Jonathan Atkins, Prof. Michael Elliott, and the Marine SABRES Project

Structure of the talk

1. MarineSABRES overview - Catherine
2. Simple SES theory and background - Gemma
3. Arctic Demonstration Area - Catherine

MARINE SABRES

Systems **A**pproaches for **B**iodiversity **R**esilience and **E**cosystem **S**ustainability

Overarching Aim:

"To conserve and protect biodiversity by integrating Sustainable Ecosystems and a Resilient Blue Economy"

AIM and MISSION

Overarching Aim:

"To conserve and protect biodiversity by integrating Sustainable Ecosystems and a Resilient Blue Economy"

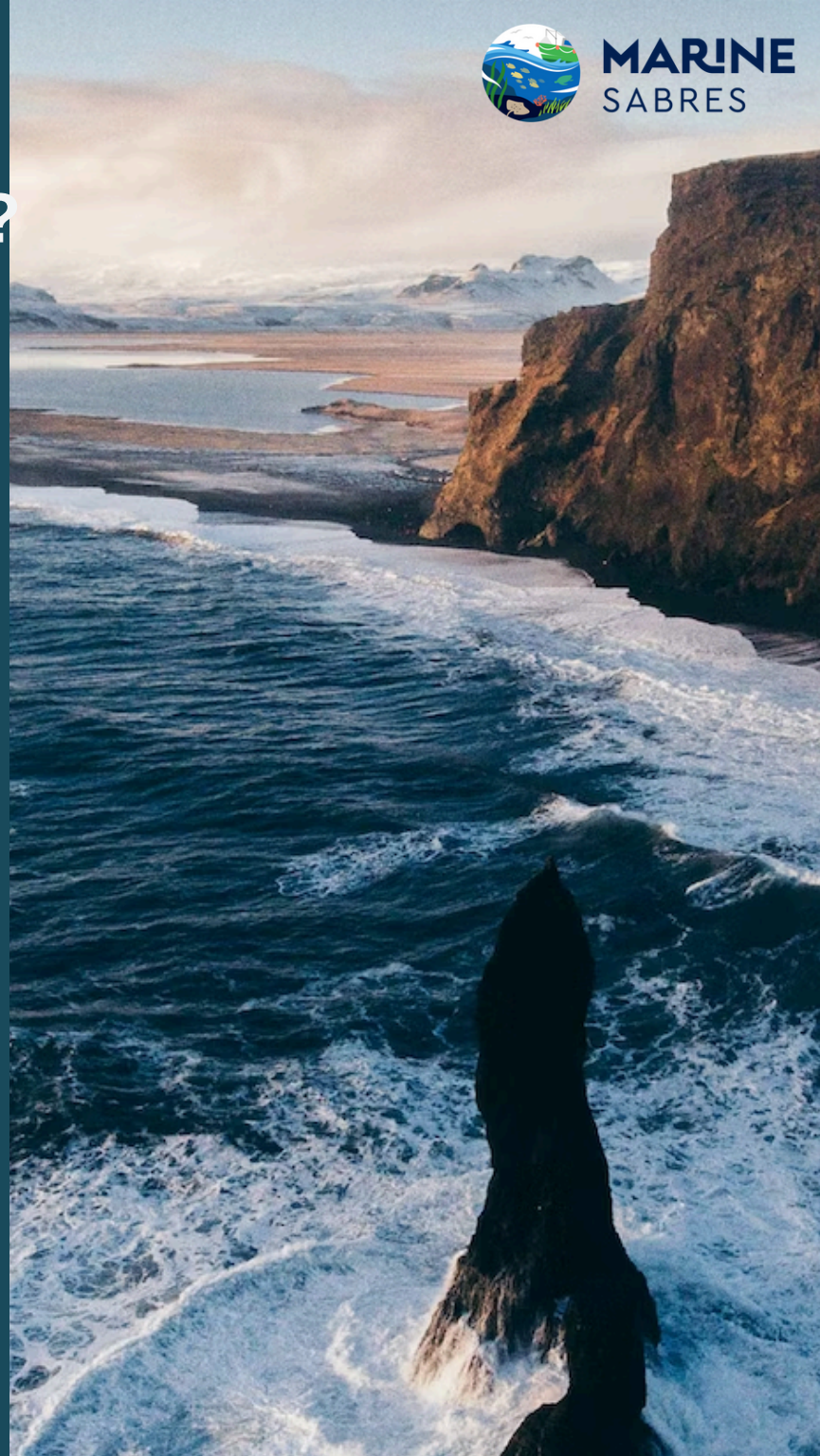
"….bringing stakeholders together from government, policy, business and coastal management, with marine scientists to co-design a Simple Social-Ecological System (SES). This Simple SES is designed to improve uptake of Ecosystem-Based Management (EBM) and strengthen interventions and measures for the protection and conservation of coastal and marine areas, their biodiversity and Ecosystem Services (ES)….."

WHAT WILL THE PROJECT DO?

PHASE 1: Specification and development of a Simple SES

PHASE 2: Application, testing and demonstration of the Simple SES

PHASE 3: Refinement of the Simple SES

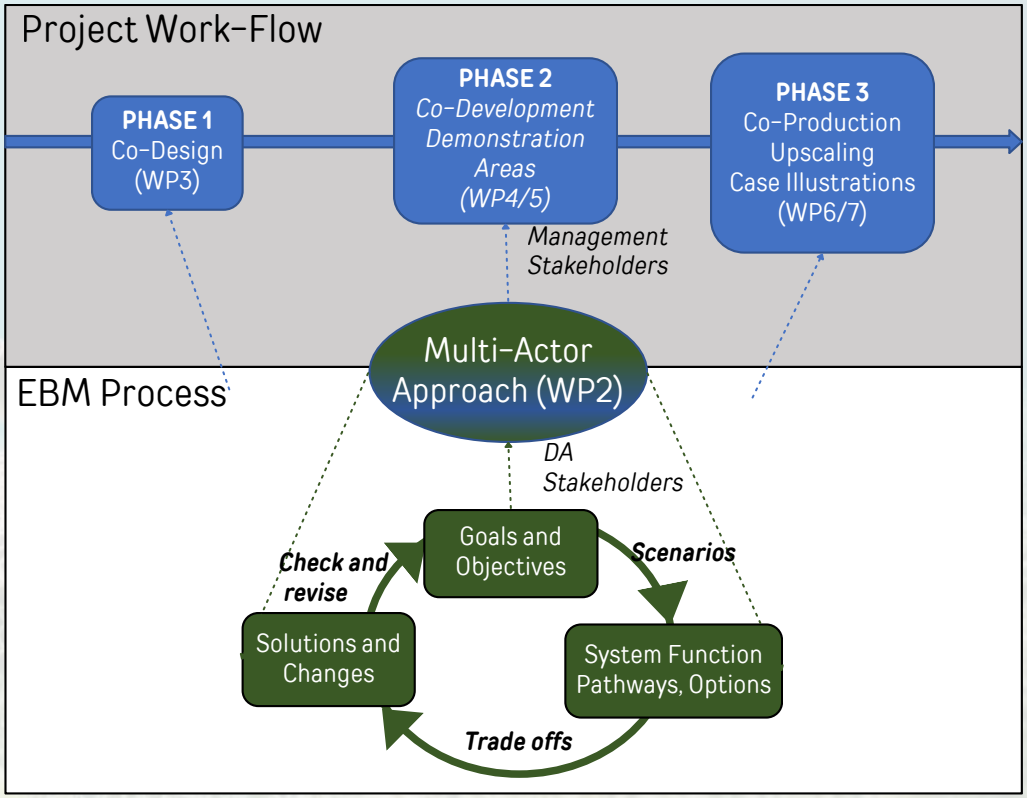


WHAT WILL THE PROJECT DO?

PHASE 1: Specification and development of a Simple SES
This provides the structure and interrelationships between sub-systems of the SES and identifies methods for the collection of the data and information to populate them. The specification will be determined by stakeholders (WP2) and designed by experts in each subsystem (WP3).

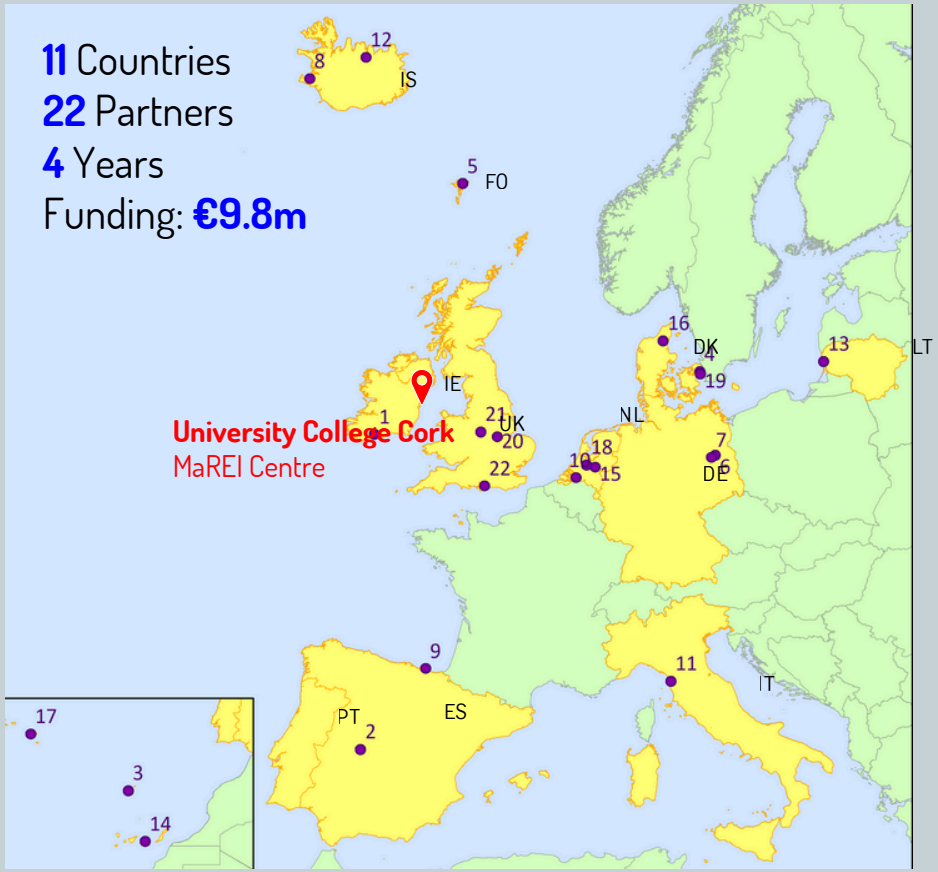
PHASE 2: Application, testing and demonstration of the Simple SES
through the process of EBM and implementation of concrete conservation interventions in **three Demonstration Areas** (WP4). Identification and costing of scenarios for development in the DAs (WP5)

PHASE 3: Refinement of the Simple SES
Packaging of the tools and guidance to populate the Simple SES into an open access Decision Support System (DSS). Upscaling of EBM process through illustration of transfer to other locations (WP6). Dissemination and exploitation of the Simple SES and its applications (WP7)



WHO and WHERE

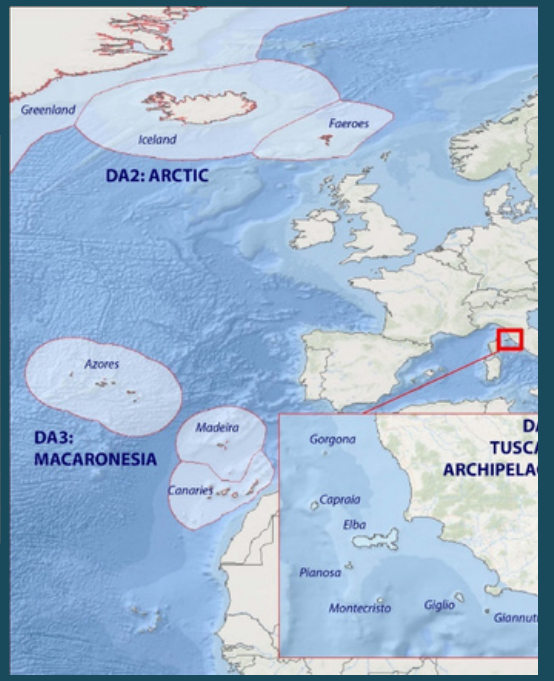
11 Countries
22 Partners
4 Years
Funding: **€9.8m**



3 Demonstration Areas (DAs):

Tuscan Archipelago,
Arctic North - East Atlantic
Macaronesia

Partners	
1. UCC (Coordinator)	12. SAI
2. Lifewatch ERIC	13. KU
3. ARDITI	14. ULPGC
4. DTU	15. WR
5. Blue Resource	16. AAU
6. ECOLOGIC	17. Uac
7. IASS	18. NIOZ
8. MFRI	19. WWF Denmark
9. AZTI	20. CEFAS
10. HuFoSS	21. IECS
11. UNIPI	22. UoP

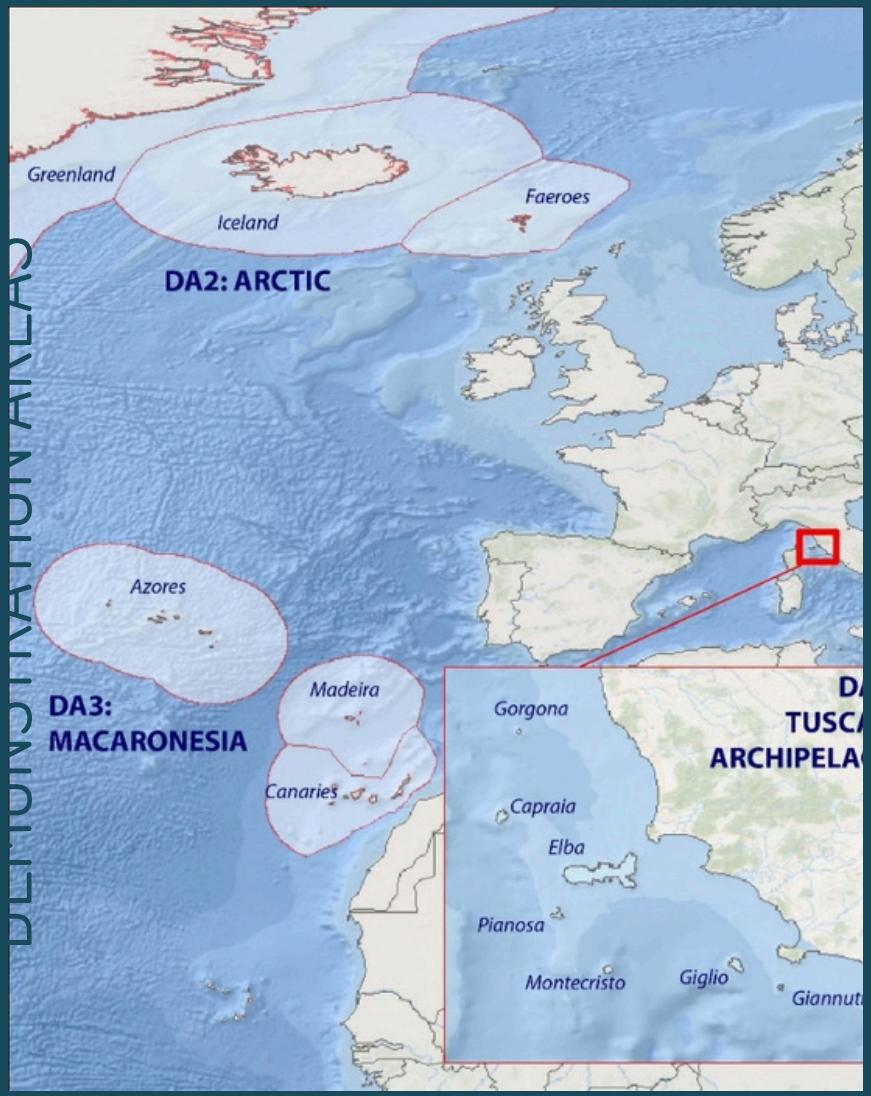


DEMONSTRATION AREAS – WHERE?

DA 1: The Tuscan Archipelago
Territories: Italy (IT)

DA 2: The Arctic North-East Atlantic
Territories: Iceland (IS), Greenland (DK), Faroes (DK)

DA 3: Macaronesia
Territories: Azores (PT), Madeira (PT), Canaries (ES)



Funded by the European Union's Horizon Europe programme under grant agreement No.101058956.

Simple Social-Ecological Systems

Underpinning theory and approach

Gemma Smith

Acknowledgements to: Prof Mike Elliott, Dr Amanda Gregory, Prof Jon Atkins.

Human aspects within the system, e.g. fishing, tourism, and policies

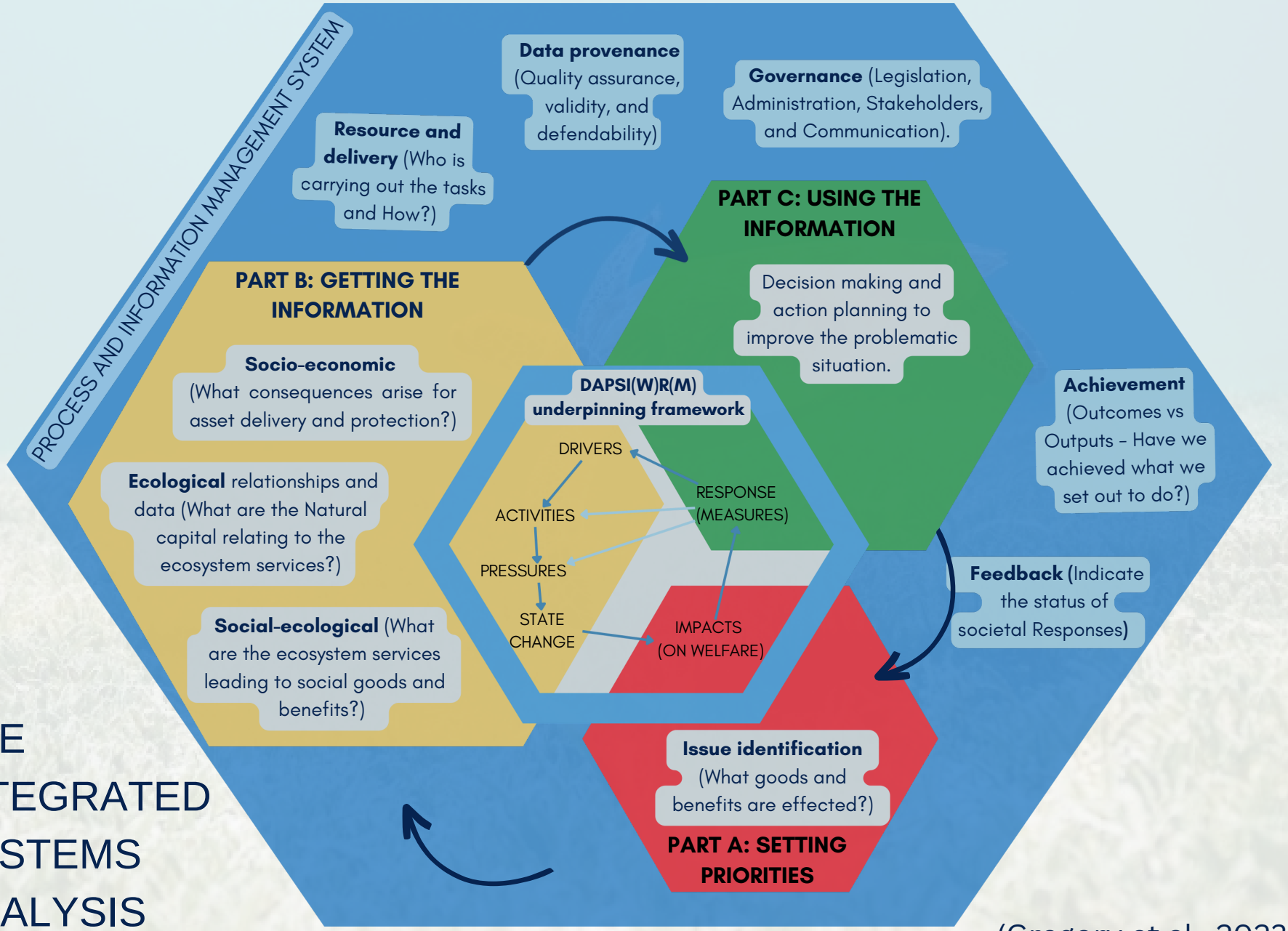
The scope of focus where the different aspects interact, e.g. an ecosystem or a specific area

SIMPLE SOCIAL-ECOLOGICAL SYSTEM

The minimum complexity necessary to make informed decisions

Natural aspects within the system, e.g. habitats, species, and marine functions.

THE INTEGRATED SYSTEMS ANALYSIS

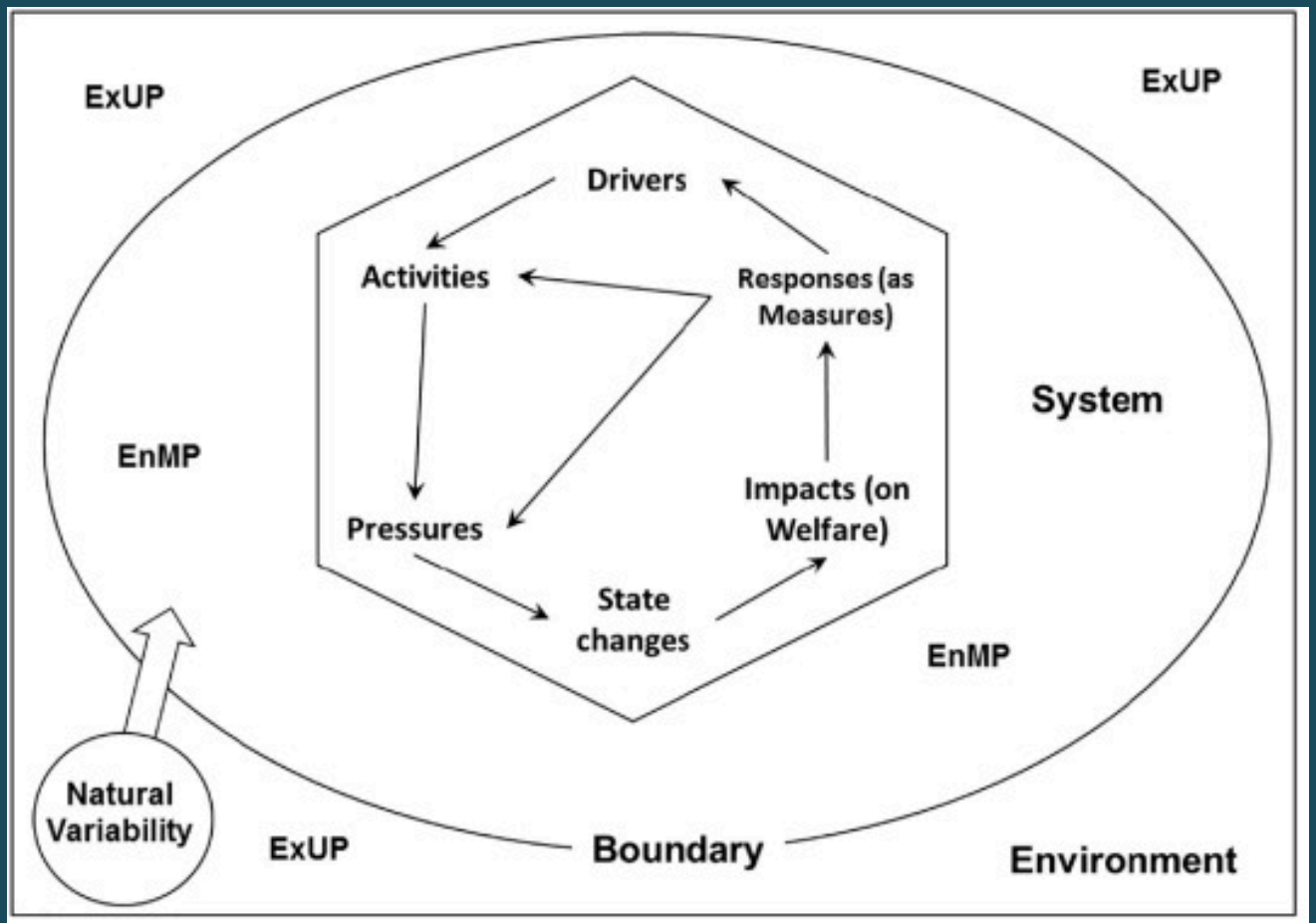


(Gregory et al., 2023)

Foundations for the investigation: **The PIMS System**

- The overarching Process and Information System (PIMS) operationalises the concepts of ‘good management’
- Project and resource management
- Stakeholders and communication
- Data provenance and management

DAPSI(W)R(M)

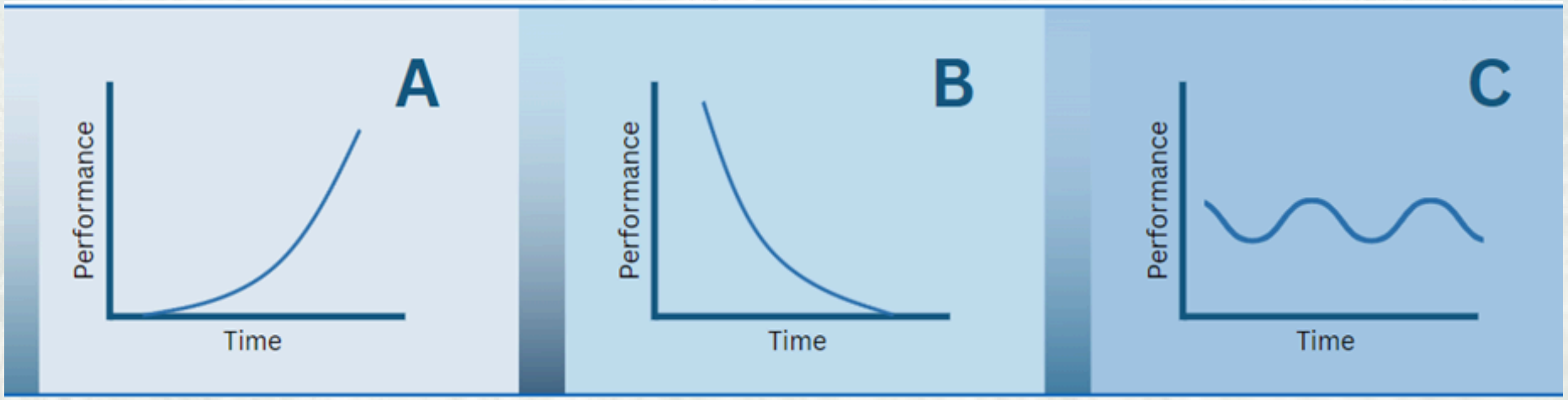


Key: ExUP = Exogenic Unmanaged Pressures; EnMP = Endogenic Managed Pressures (see text for explanation)

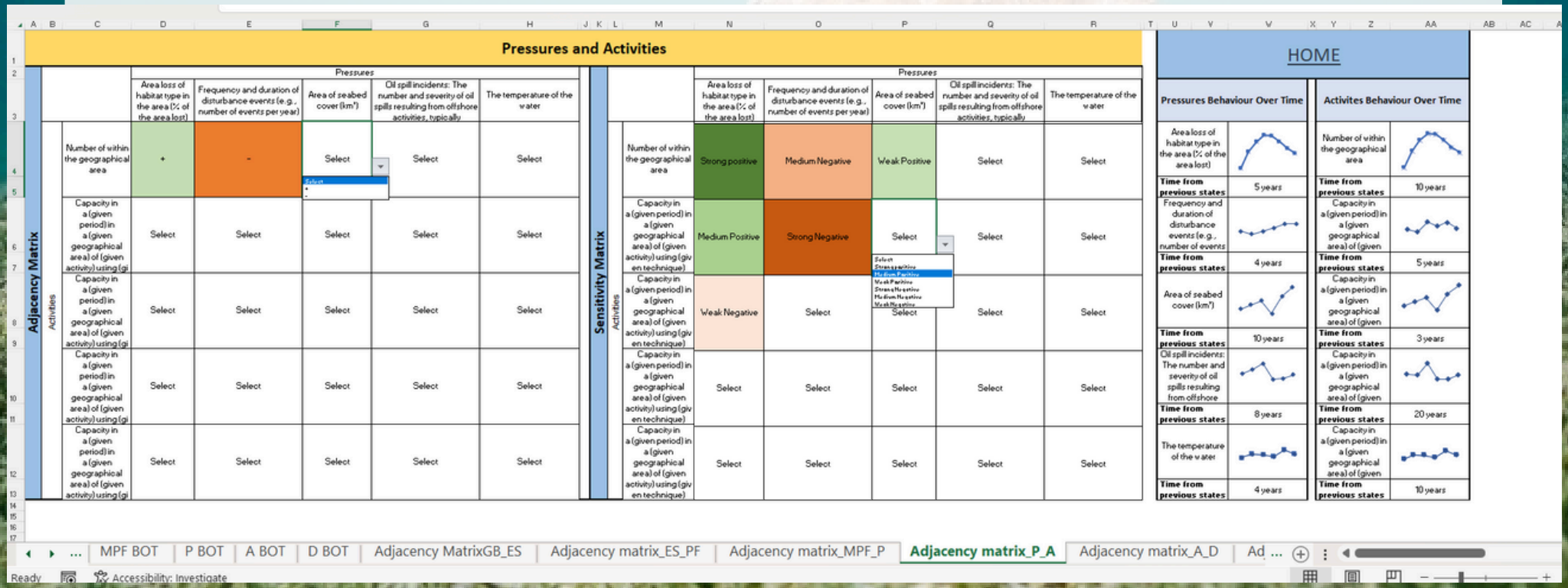
(Elliott et al., 2017)

Behaviour Over Time Graphs

The BOTs can be used to connect past observed behaviour with future behaviour in a way that offers insight into underlying causal structures.



Adjacency Matrices



Pressures and Activities

Adjacency Matrix

Activities	Pressures: Area loss of habitat type in the area (% of the area lost)	Frequency and duration of disturbance events (e.g., number of events per year)	Area of seabed cover (km²)	Oil spill incidents: The number and severity of oil spills resulting from offshore activities, typically	The temperature of the water
Number of within the geographical area	+	-	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (gi	Select	Select	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (gi	Select	Select	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (gi	Select	Select	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (gi	Select	Select	Select	Select	Select

Sensitivity Matrix

Activities	Pressures: Area loss of habitat type in the area (% of the area lost)	Frequency and duration of disturbance events (e.g., number of events per year)	Area of seabed cover (km²)	Oil spill incidents: The number and severity of oil spills resulting from offshore activities, typically	The temperature of the water
Number of within the geographical area	Strong positive	Medium Negative	Weak Positive	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (giv en technique)	Medium Positive	Strong Negative	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (giv en technique)	Weak Negative	Select	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (giv en technique)	Select	Select	Select	Select	Select
Capacity in a (given period) in a (given geographical area) of (given activity) using (giv en technique)	Select	Select	Select	Select	Select

HOME

Pressures Behaviour Over Time		Activites Behaviour Over Time	
Area loss of habitat type in the area (% of the area lost)		Number of within the geographical area	
Time from previous states	5 years	Time from previous states	10 years
Frequency and duration of disturbance events (e.g., number of events		Capacity in a (given period) in a (given geographical area) of (given	
Time from previous states	4 years	Time from previous states	5 years
Area of seabed cover (km²)		Capacity in a (given period) in a (given geographical area) of (given	
Time from previous states	10 years	Time from previous states	3 years
Oil spill incidents: The number and severity of oil spills resulting from offshore		Capacity in a (given period) in a (given geographical area) of (given	
Time from previous states	8 years	Time from previous states	20 years
The temperature of the water		Capacity in a (given period) in a (given geographical area) of (given	
Time from previous states	4 years	Time from previous states	10 years

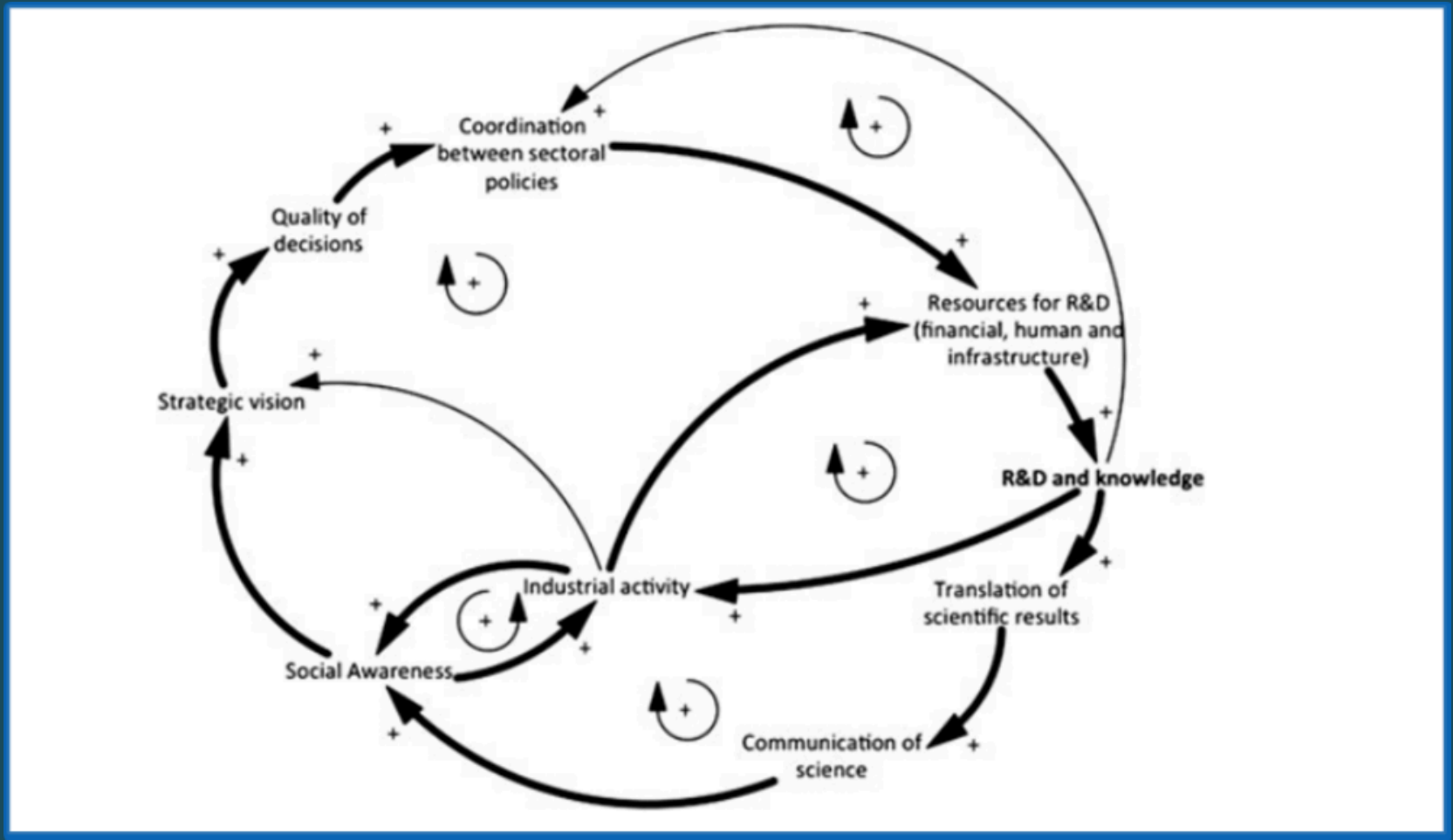
MPF BOT | P BOT | A BOT | D BOT | Adjacency MatrixGB_ES | Adjacency matrix_ES_PF | Adjacency matrix_MPF_P | **Adjacency matrix_P_A** | Adjacency matrix_A_D | Ad ...

Ready | Accessibility: Investigate

Causal loop diagrams

- Qualitative modelling tool
- Analysis of how the system behaves as a whole
- Identification of Leverage points

Causal loop diagrams



Causal Loop Diagram for issue of 'R&D awareness and dissemination of ocean-related activities (Videira, 2012).

OVERVIEW OF THE ISA ANALYSIS

PIM System

This is a management system where we account for provenance in all social and ecological elements of the system.

DAPSI(W)R(M)

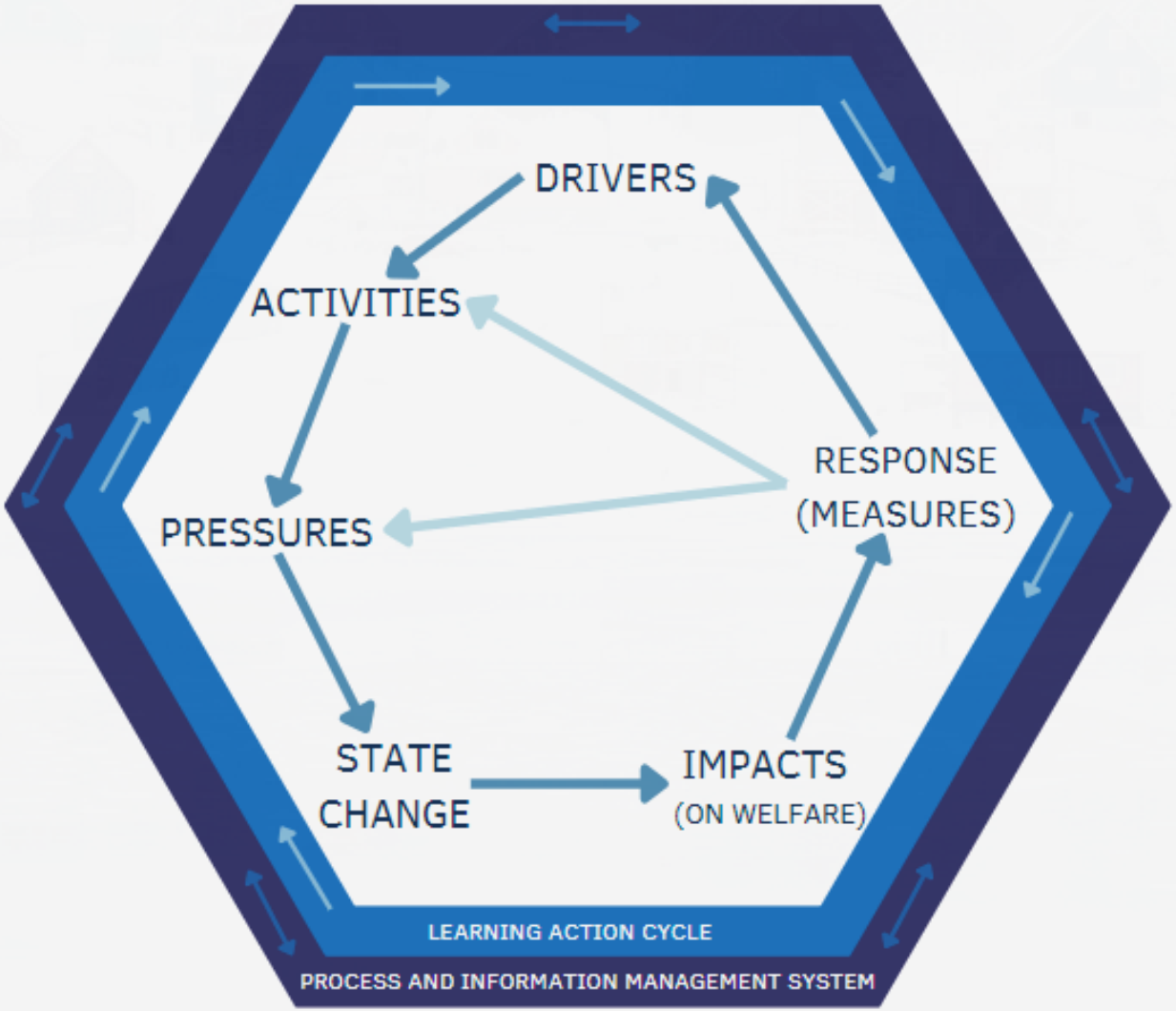
We use a problem structuring framework to define SES elements and understand their causal structures.

CLD and BOT

Qualitative systems tools such as Causal loop diagrams and Behaviour Over Time graphs complement the data driven approach.

Learning and action

In operationalisation, we look to promote a continuous and meaningful learning and action cycle throughout the process.



"Everything should be made as simple as possible, but not simpler."

- Albert Einstein

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Elliott M. D. Burdon, J.P. Atkins, A. Borja, R. Cormier, V.N. de Jonge, R.K. Turner. (2017)"And DPSIR begat DAPSI(W)R(M)!" - A unifying framework for marine environmental management, Marine Pollution Bulletin, http://dx.doi.org/10.1016/j.marpolbul.2017.03.049

Gregory, A.J., Atkins, J.P., Smith, G., Elliott, M. (2023). Simple Social-Ecological Systems Guidance, Deliverable 3.1. Marine SABRES, European Union's Horizon Europe research and innovation programme under grant agreement no. 101058956. and the UKRI Project Number 10050525

Videira, N., Lopes, R., Antunes, P., Santos, R., & Casanova, J. L. (2012). Mapping maritime sustainability issues with stakeholder groups. Systems Research and Behavioural Science, 29(6), 596-619. doi:10.1002/sres.2141

Funded by the European Union's Horizon Europe programme under grant agreement No.101058956.

Arctic Pelagic Fisheries

Preliminary project findings

Catherine Chambers

Acknowledgements to: Prof Mike Elliott, Dr Amanda Gregory, Prof Jon Atkins.

Arctic DA - Overview

- **Countries** involved: Faroe Islands, Iceland, Greenland
- **Main focus: Pelagic fisheries**
  - Northeast Atlantic mackerel
  - Blue whiting
  - Herring

- **Background**
  - Fisheries are important economic sector for capture, processing, marketing, employment
  - Interconnection and vertical integration of economic structures between countries

Blue whiting

(*Micromesistius poutassou*)

Norwegian spring-spawning herring

(*Clupea harengus*)

Northeast Atlantic mackerel

(*Scomber scombrus*)

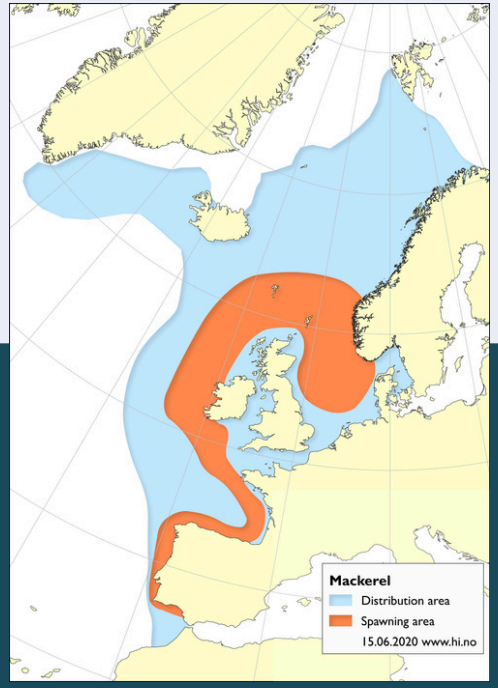
Impact: Distribution changes

Widely distributed stocks

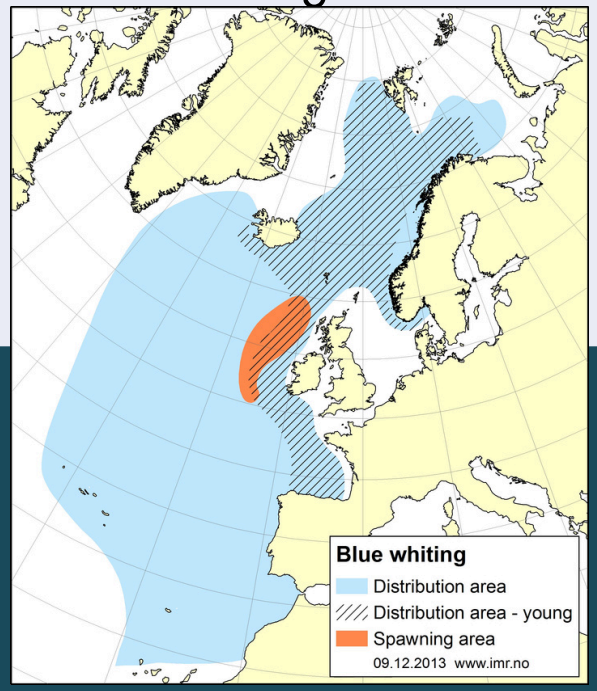
- **cross many Exclusive Economic Zone (EEZ) boundaries as well as high seas**
- **also called a straddling and transboundary stock**

The Three Fish Stocks: distribution

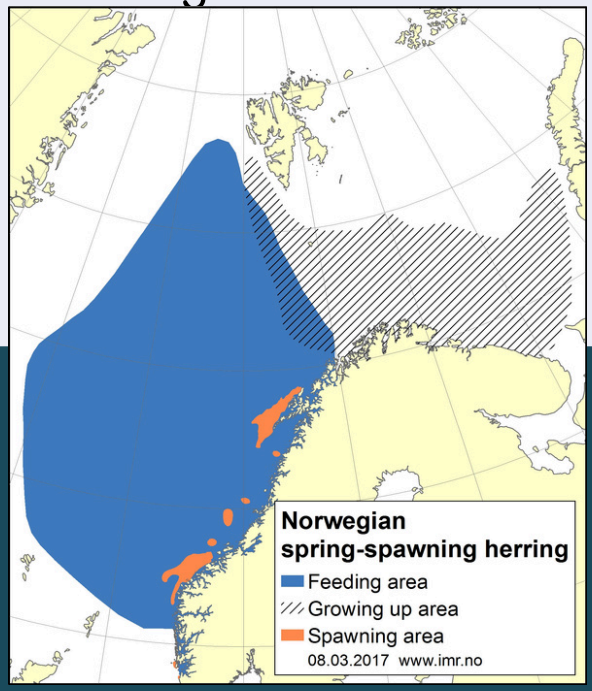
Mackerel



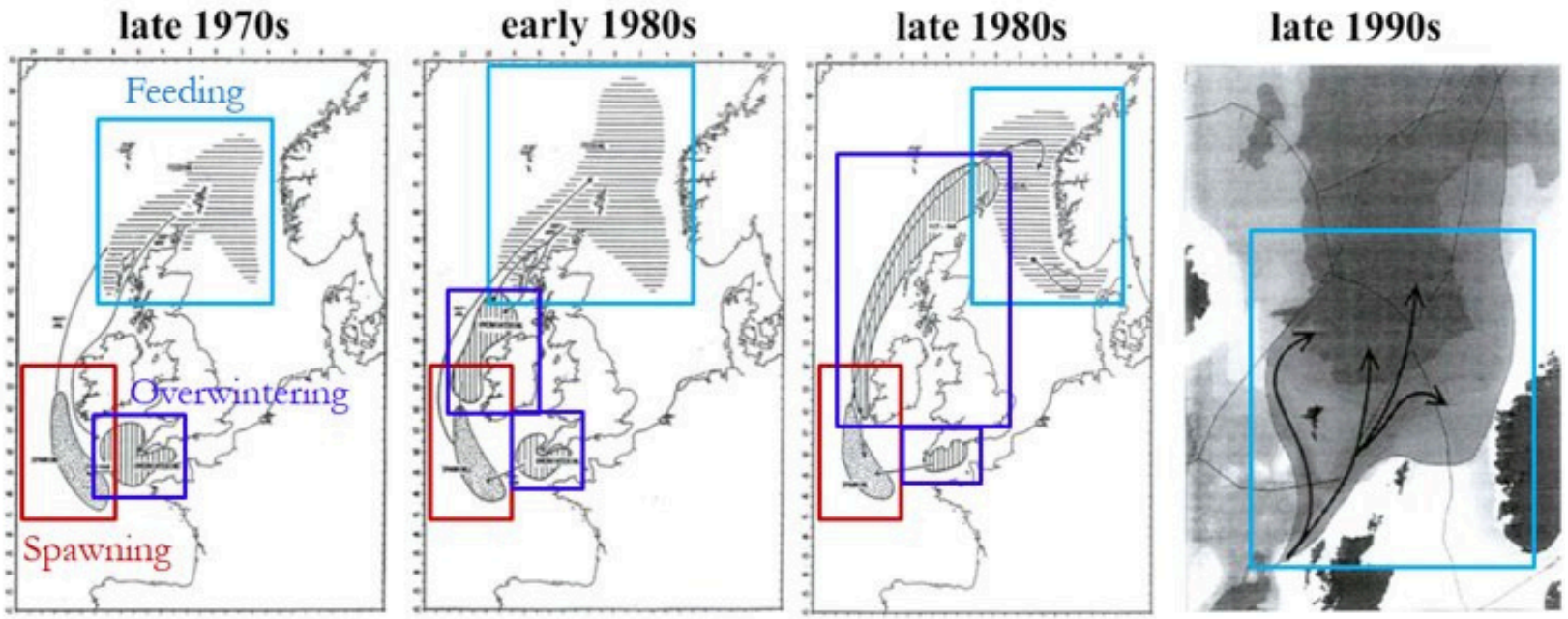
Blue whiting



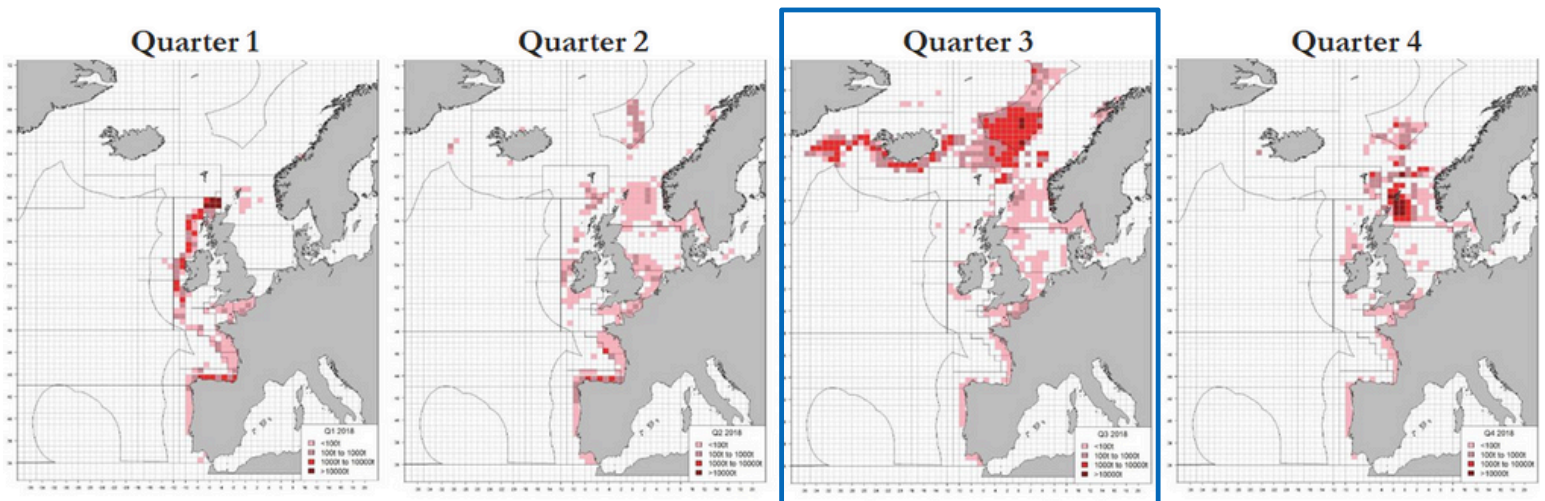
Herring



Northeast Atlantic mackerel

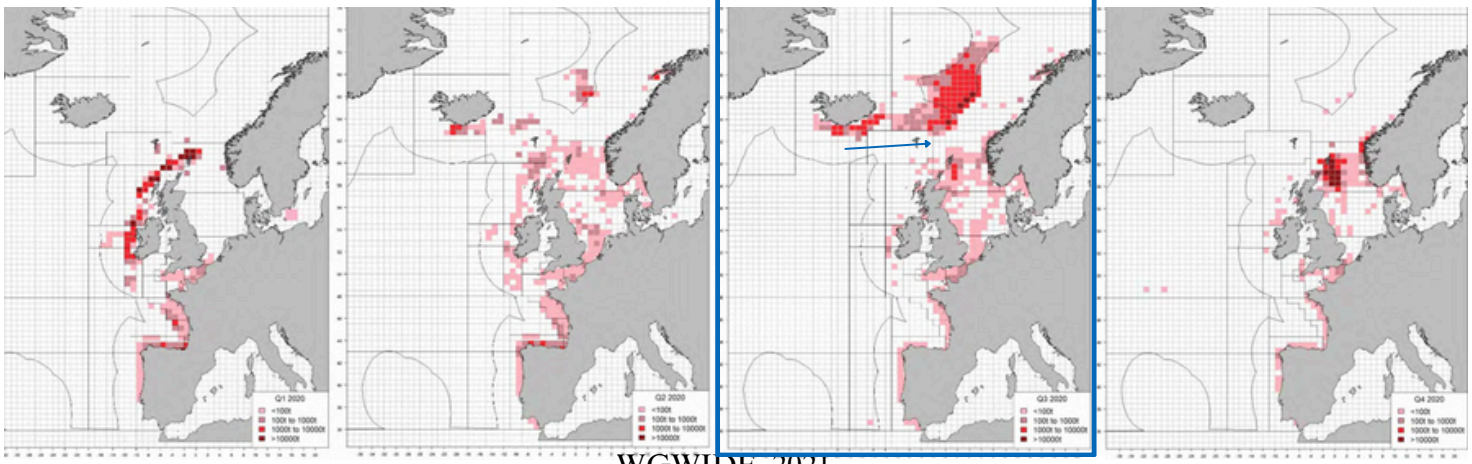


ICES, 1990; Belikov et al., 1998; Iversen, 2002



Catch 2018
- < 100t
- 100t - 1000t
- 1000t - 10000t
- > 10000t

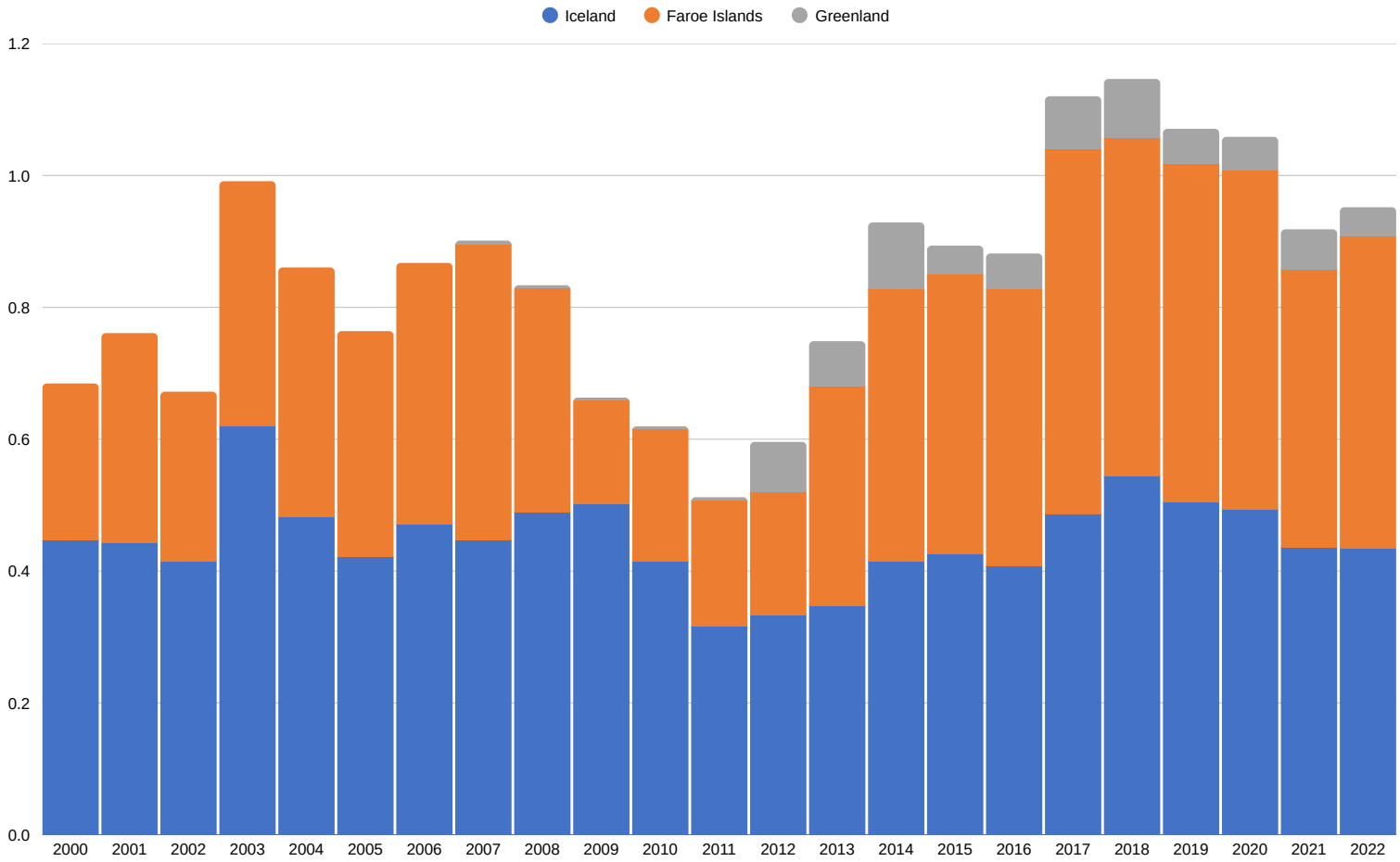
ICES, 2019



Catch 2020
- < 100t
- 100t - 1000t
- 1000t - 10000t
- > 10000t

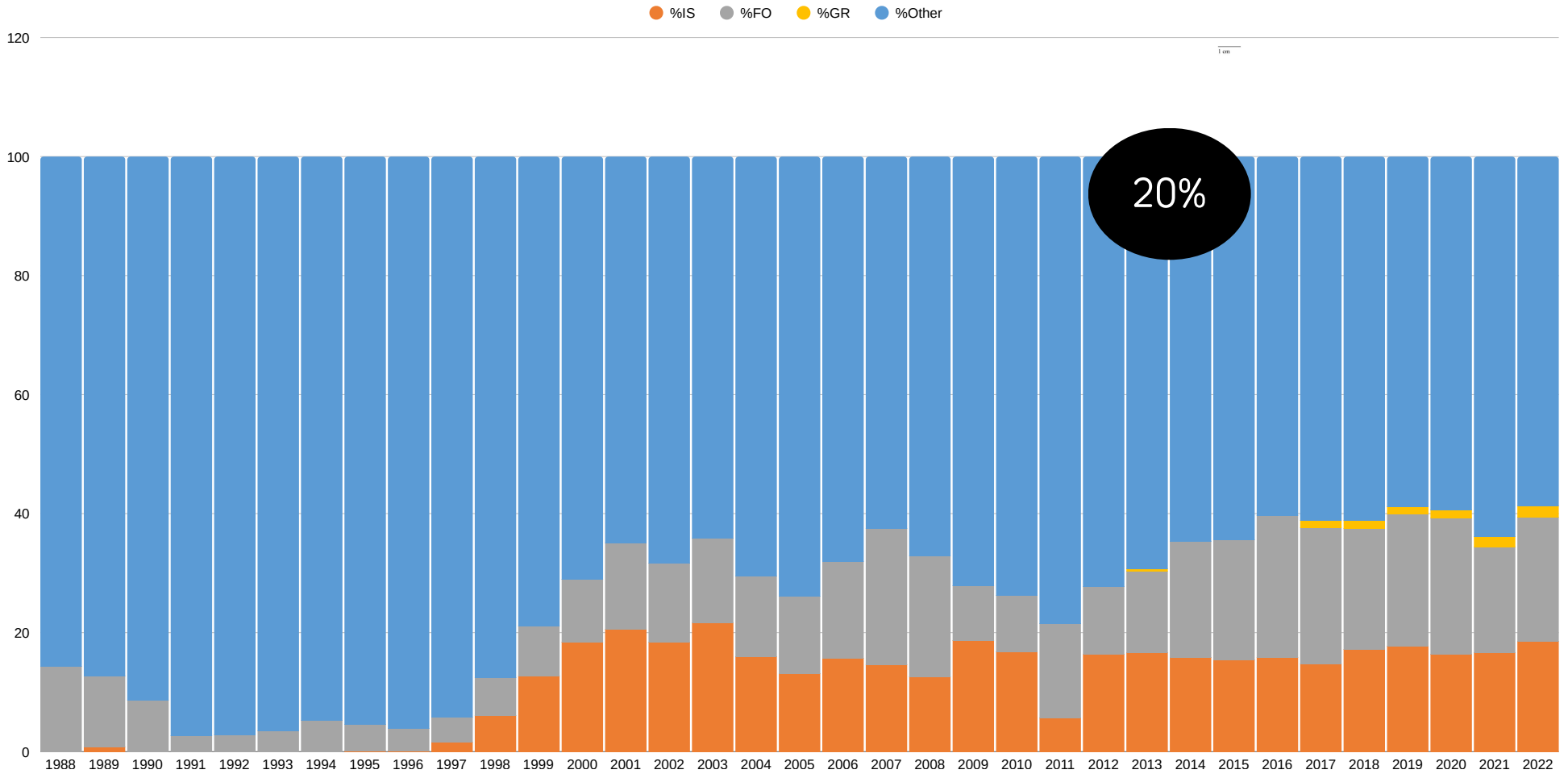
WGWIDE, 2021

The Fishery: blue whiting, herring and mackerel catch per country

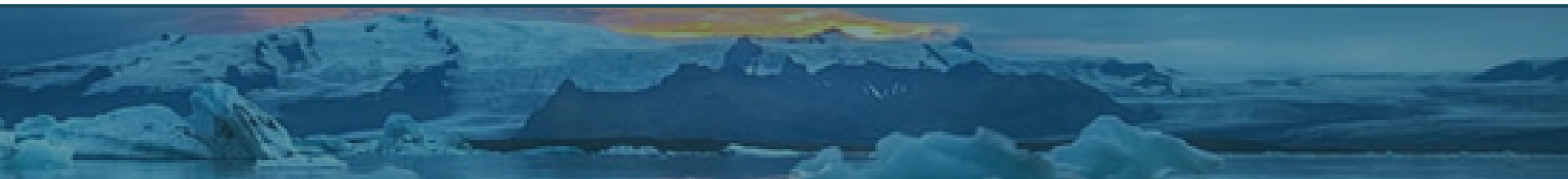


https://doi.org/10.17895/ices.pub.24025482.v1

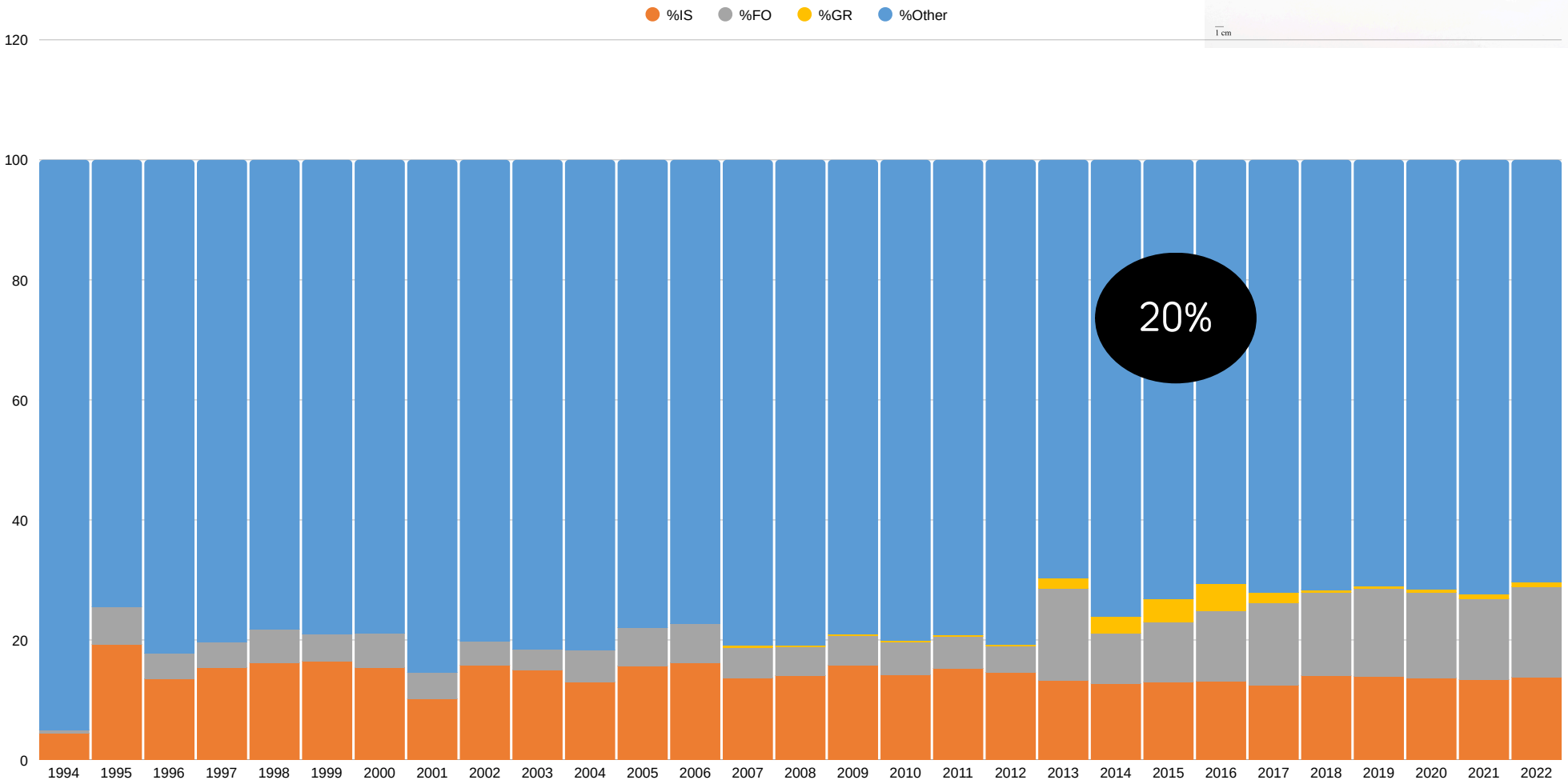
Blue whiting: the fishery 1988-2022

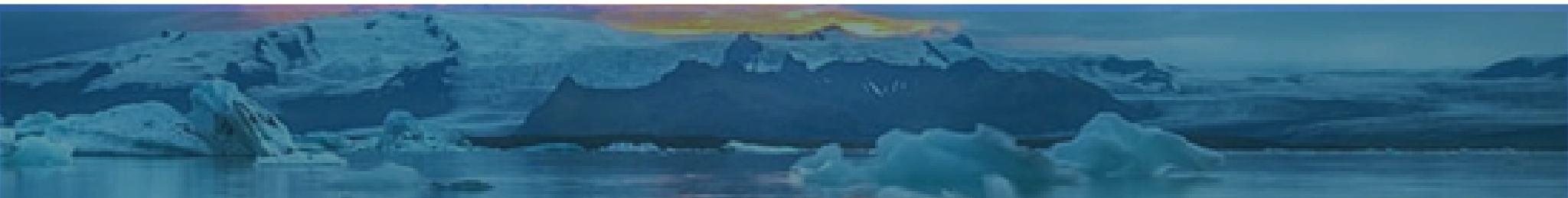


Mackerel: the fishery 2000-2022



Herring: the fishery 1988-2022



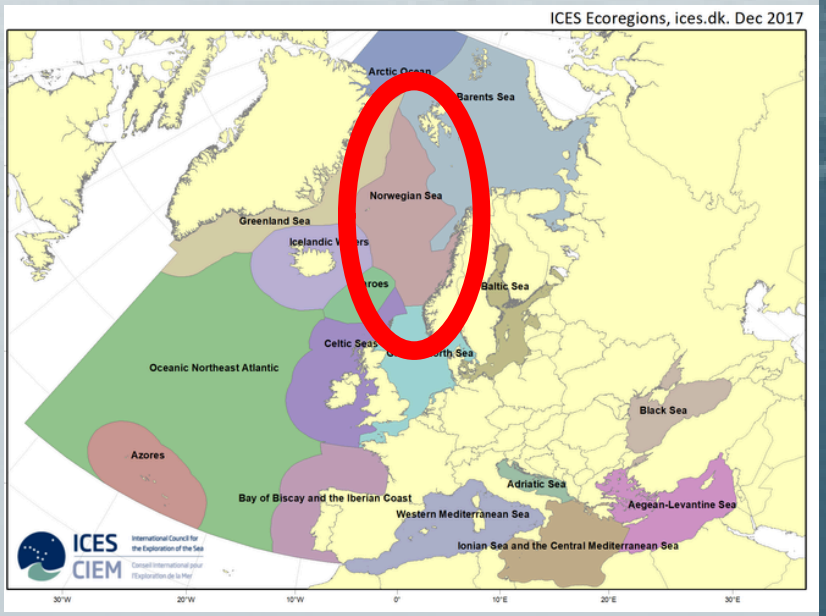


ICES Working Groups on Integrated Ecosystem Assessment per Ecoregion

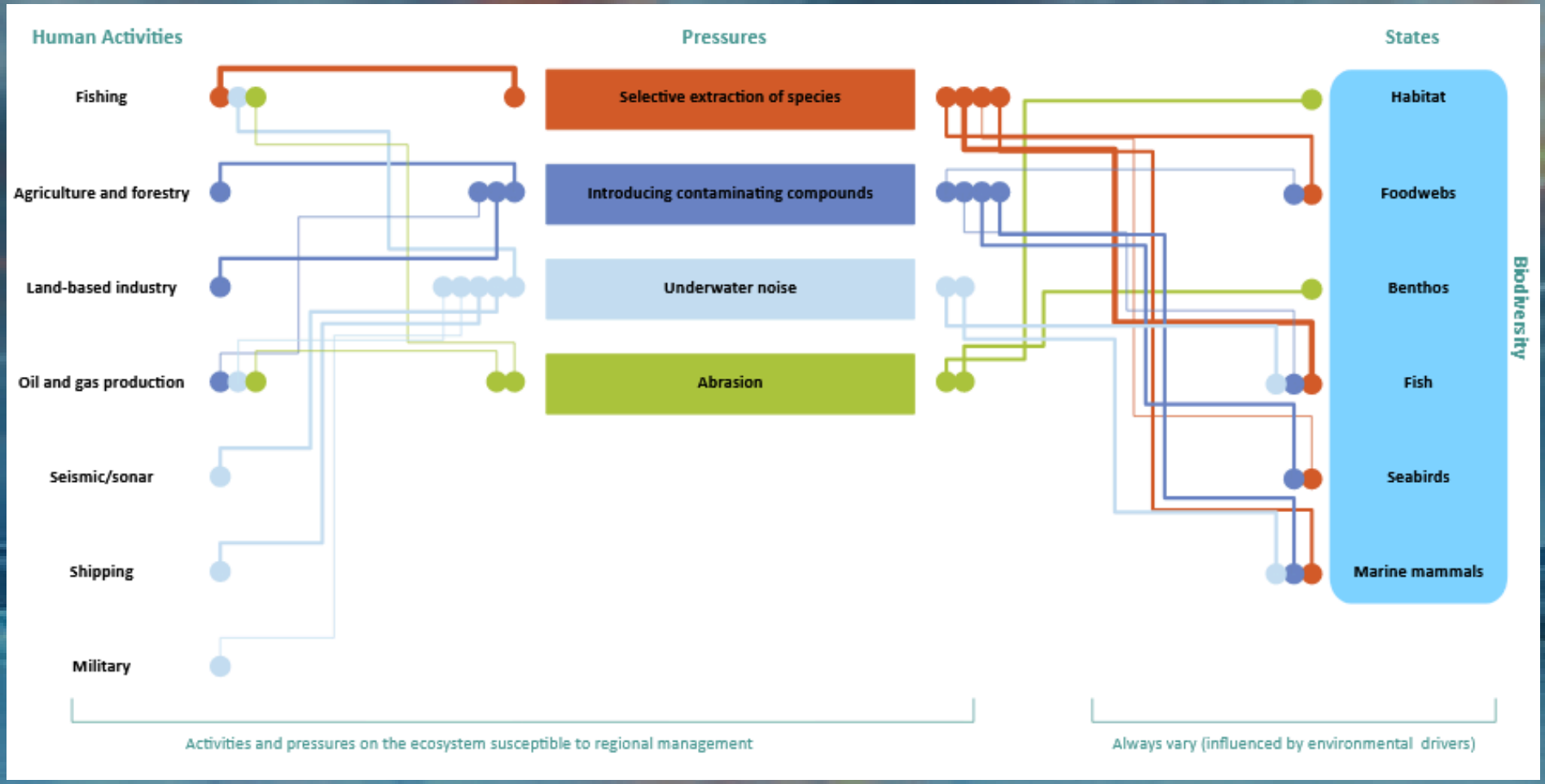
"Our Ecosystem Overviews use risk-based methods to identify the main human pressures and explain how these affect key ecosystem components in each ICES ecoregion"
"They provide information on trends in the ecosystem in recent years. They perform a crucial role, giving the context for ecosystem-based management"

<u>Working Group on the Integrated Assessments of the Norwegian Sea:</u>

- focuses on the 3 pelagic stocks
- produce the Ecosystem Overview (ICES advice)
- ToR: "Preform integrated assessment of the pelagic ecosystem in the Norwegian Sea and develop a framework for identifying important signals for management"
- ToR: "Annually review and revise the ecosystem status summary to report trends and recent changes"
- ToR: Stakeholder interactions FO-IS-NO.



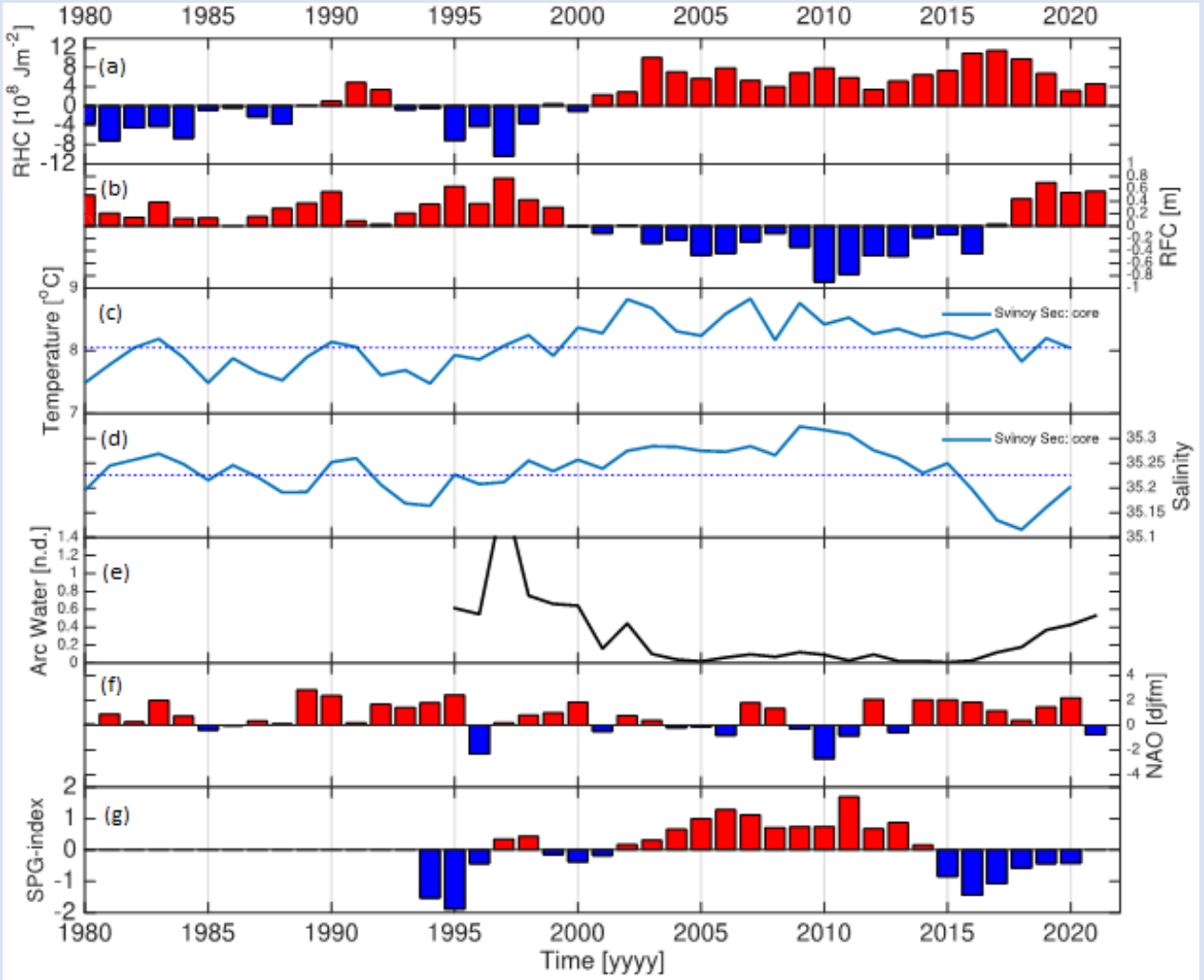
WGINOR: Ecosystem Overview & Human activities – Pressures - States



https://doi.org/10.17895/ices.advice.21731726.v1

WGINOR: ANNUAL INTEGRATED ECOSYSTEM ASSESSMENT

OCEAN CLIMATE



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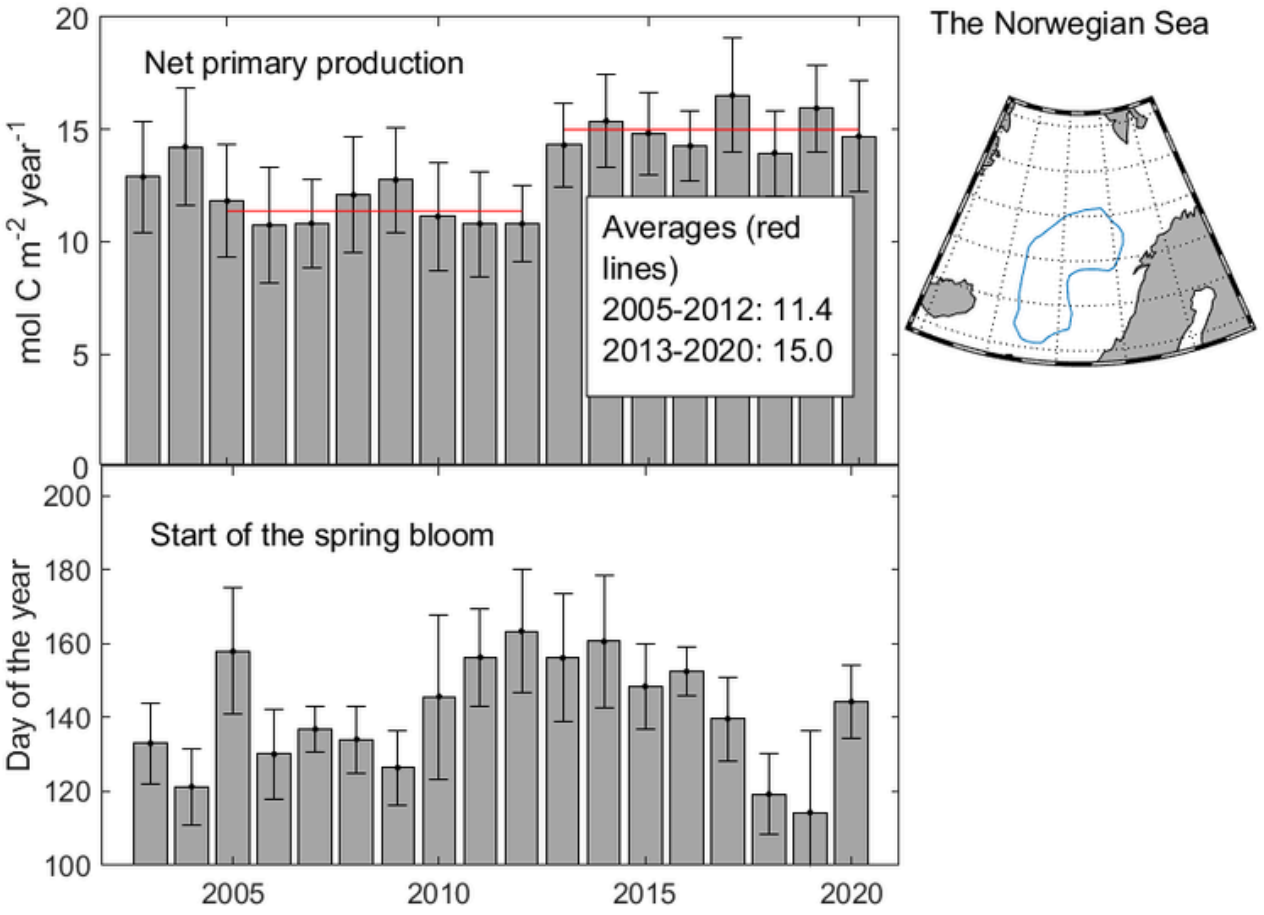
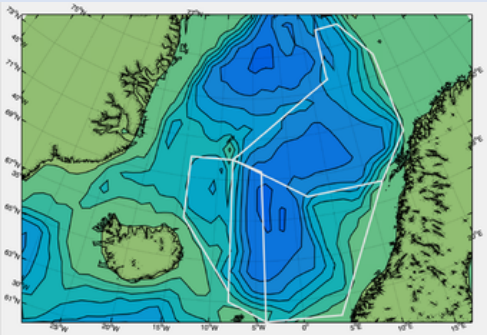
WGINOR: ANNUAL INTEGRATED ECOSYSTEM ASSESSMENT

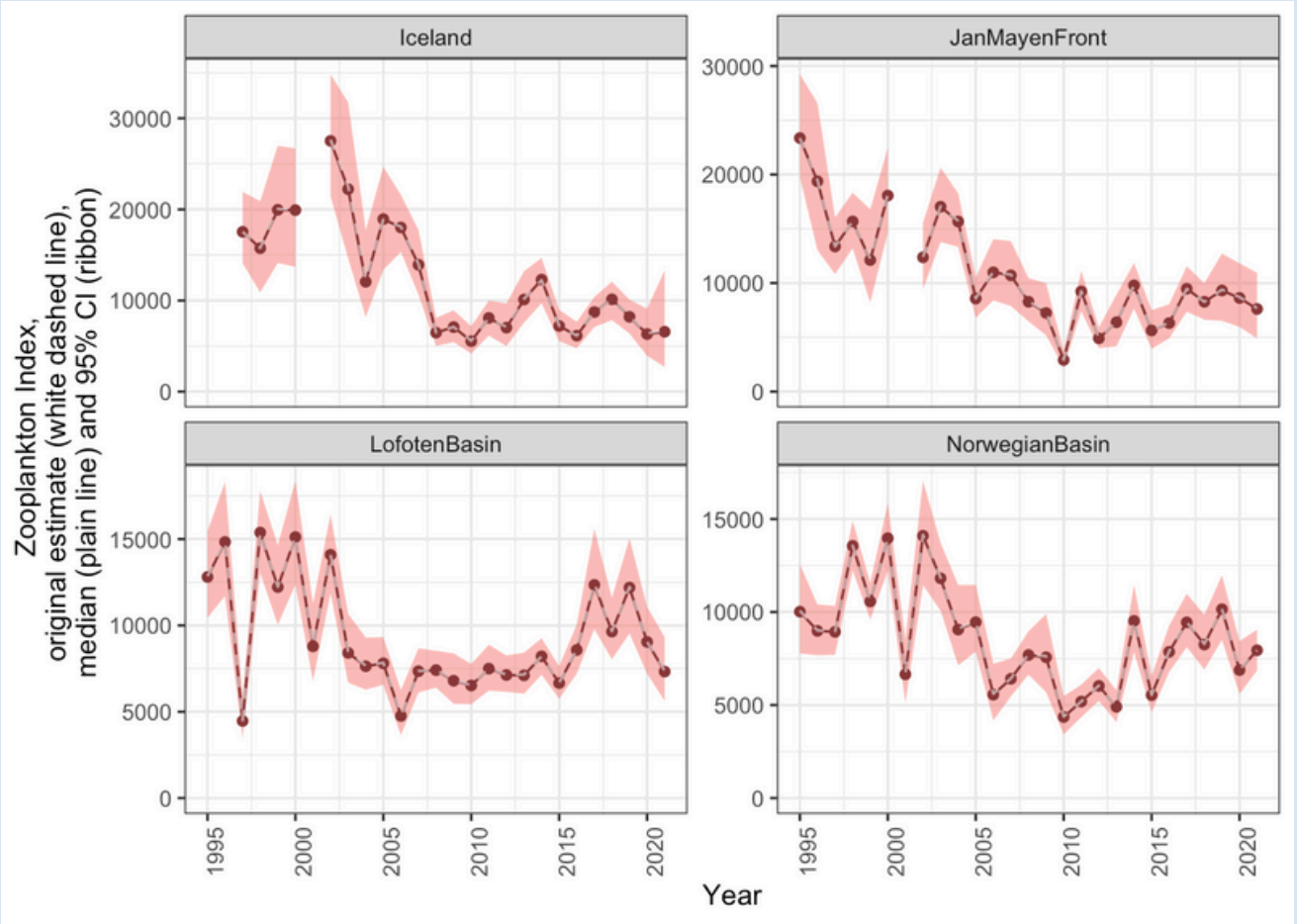
PRIMARY PRODUCTION



ANNUAL INTEGRATED ECOSYSTEM ASSESSMENT

ZOOPLANKTON





PRESSURES

Climate change adaptation

Climate change mitigation

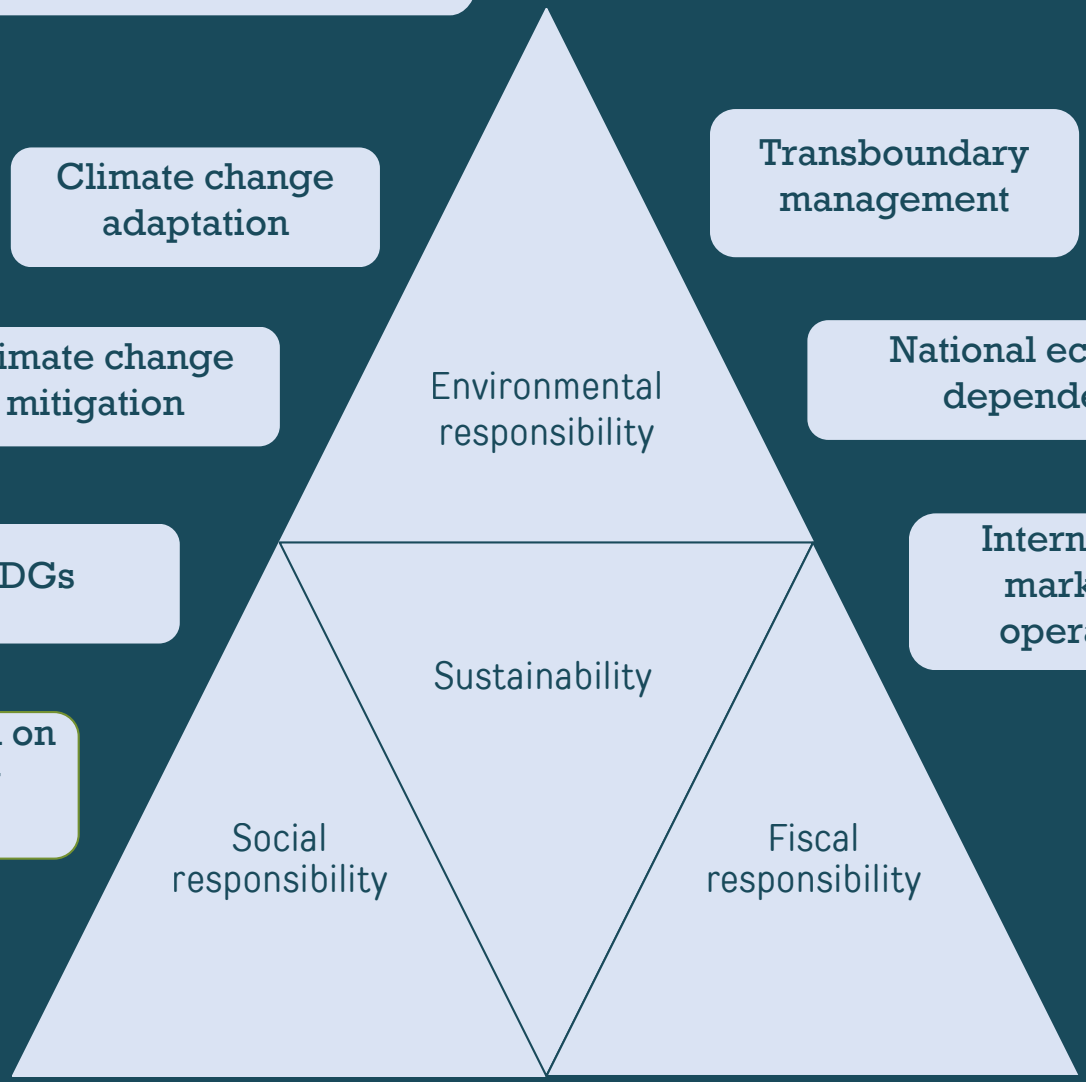
UN SDGs

UN Convention on Biodiversity (30x30)

Transboundary management

National economic dependency

International markets & operations



Main goals

- Identify effects of climate change on ecosystem state
- Dynamic feedback loops of human systems
- Capacity to respond to changes

Topics of interest to stakeholders

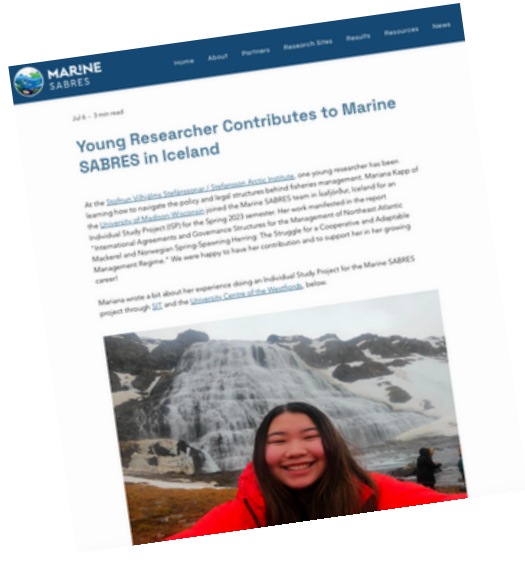
- International agreement on quota allocation
- Product innovation
- Shift in species distribution
- Inclusion and transparency
- Carbon footprint
- Circular economy initiatives
- Biodiversity and species interactions

Topics to be considered

- Can transboundary management solutions be linked to climate change mitigation?
- Is social and environmental sustainability driven by stewardship or market opportunities in upper leadership?
- Adaptation planning:
  - What happens if the fish leave?
  - How would the industry implement 30x30?


Interested in creating opportunities and innovative solutions to challenges in pelagic marine industries?
Join the Marine SABRES project as a stakeholder within the Arctic Northeast Atlantic research site!
Learn more
What's in it for me?
Help create a vision for the future of Icelandic pelagic industries
Opportunities to publicly but anonymously communicate your opinions on needs for research or governmental support of industry
Opportunities to confidentially convey opinions and ideas regarding government regulation of the marine pelagic ecosystem
The potential for networking and cooperation among other stakeholders
Who we need
Industry employees and executives over the entire supply chain, community members, academics, scientists, government employees, and anyone else generally concerned about the pelagic ecosystem and human dependency on it
What we need from you
Two confidential one-hour interviews, one in autumn 2023 and one in 2024 In 2025, one additional confidential interview or participation in a stakeholder workshop
Scan the QR Code
to learn more about our research in the Arctic-Northeast Atlantic
@MarineSABRES
Contact Us
Dr. Catherine Chambers
Coordinator of Icelandic stakeholders, Marine SABRES project
Email: cat@uw.is
Phone: +354 450 3048
Website: www.uw.is


International Agreements and Governance Structures for the Management of Northeast Atlantic Mackerel and Norwegian Spring-Spawning Herring
By: Mariana Kapp

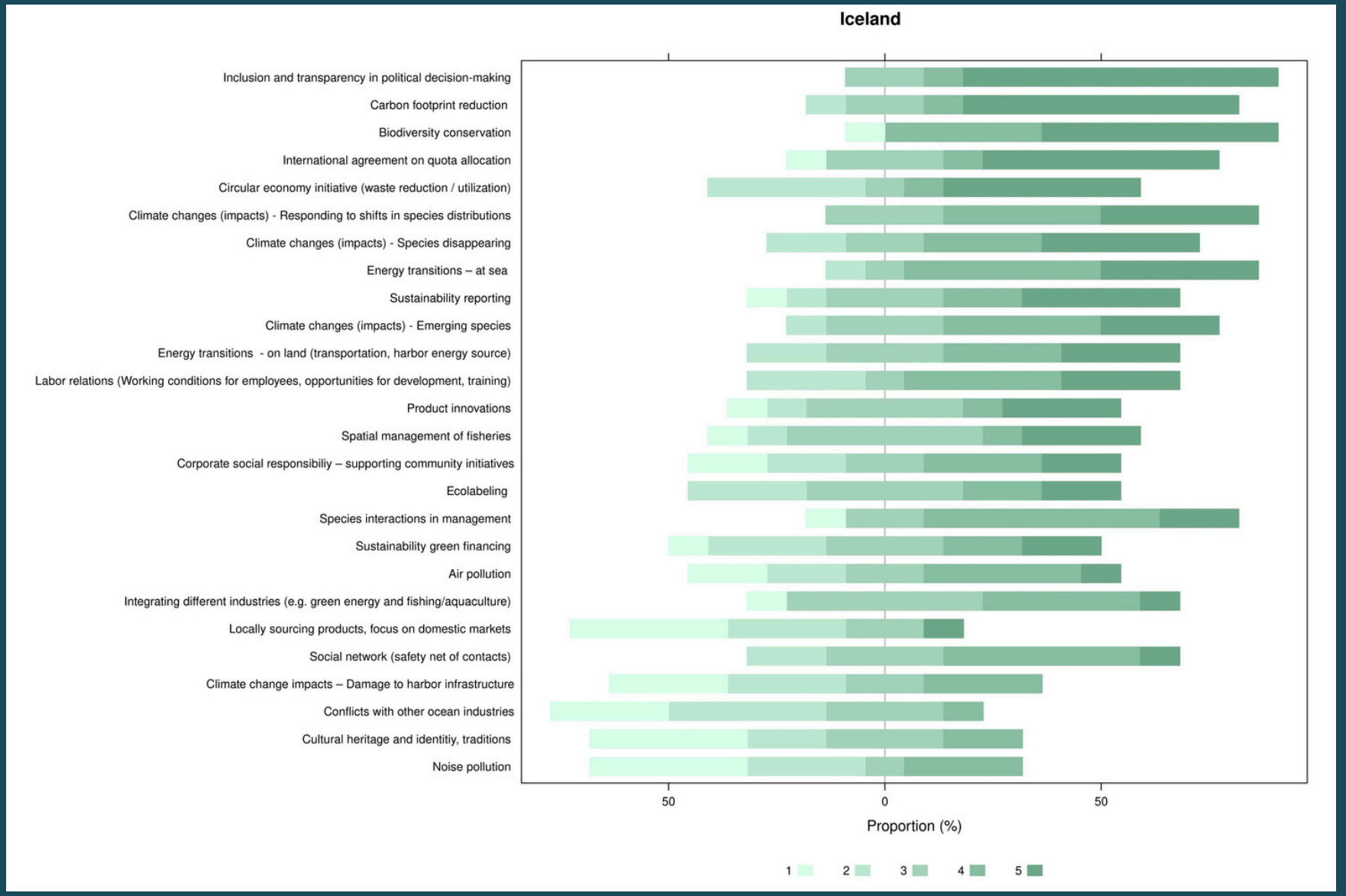

MARINE SABRES
Young Researcher Contributes to Marine SABRES in Iceland

Stakeholder mapping

Methods

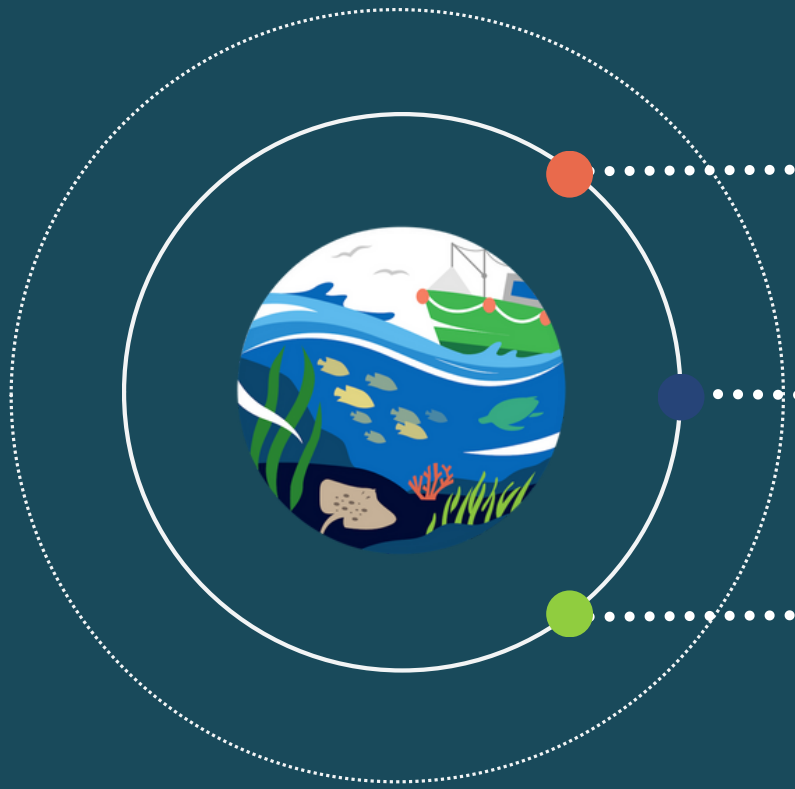
- **Semi-structured interview protocol, topic ranking in Likert-type scale exercise**
- **Interviews underway (n=X completed)**
  - **Qualitative data analysis**

Biodiversity conservation	Locally sourcing products, focus on domestic markets	Corporate social responsibility – supporting community initiatives	Social network (safety and opportunities)	
Ecolabeling	CC impacts – sp. distribution shifts	Integrating different industries	Air pollution (exc. GHG emissions)	
CC impacts – emerging sp.	CC impacts – damage to harbor infrastructure	Conflicts with other Ocean industries	Cultural heritage & identity; traditions	
Sp. interactions in management	CC impacts – disappearing sp.	Sustainability reporting	Labor / Employer relations	
Spatial management of fisheries	Sustainability / green financing	Inclusion and transparency in political decision-making	Noise pollution	
International agreement on quota allocation	Energy transitions – at sea	Product innovations	Circular economy initiatives (waste reduction / utilization	
Carbon footprint reduction	Energy transitions – on land			


Iceland
Inclusion and transparency in political decision-making
Carbon footprint reduction
Biodiversity conservation
International agreement on quota allocation
Circular economy initiative (waste reduction / utilization)
Climate changes (impacts) - Responding to shifts in species distributions
Climate changes (impacts) - Species disappearing
Energy transitions – at sea
Sustainability reporting
Climate changes (impacts) - Emerging species
Energy transitions - on land (transportation, harbor energy source)
Labor relations (Working conditions for employees, opportunities for development, training)
Product innovations
Spatial management of fisheries
Corporate social responsibiliy – supporting community initiatives
Ecolabeling
Species interactions in management
Sustainability green financing
Air pollution
Integrating different industries (e.g. green energy and fishing/aquaculture)
Locally sourcing products, focus on domestic markets
Social network (safety net of contacts)
Climate change impacts – Damage to harbor infrastructure
Conflicts with other ocean industries
Cultural heritage and identitiy, traditions
Noise pollution
50
0
50
Proportion (%)
1
2
3
4
5

Kumu figure here

Reflections, needs, next steps



Interesting feedback: relation to other nations
(i.e. Faroese captain on Greenlandic vessel landing in Iceland)

Ensure transferability of data?
(Intra-MarineSABRES but also long term)

Community level data?
(International fleet not bound to particular coastal communities...how to measure impact to individual communities)

Take home message

- The three nations catch about 1 million ton per year
- Iceland and Faroe Islands major, Greenland minor
- The three nations catch 30-40% of annual catch of stocks
- The 3 stocks fished above advice by 20-40% since 2010 due to lack of agreement for quota sharing

- ICES integrated ecosystem assessment of the Norwegian Sea, major feeding area for all 3 stocks
- Ecosystem assessment of the whole ecosystem from ocean climate to marine mammals
- Stock advice based on single stock assessment

Thank you!

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