Session 3 - Understanding the socio-ecological system: How to assess the supply and demand for biodiversity and aquatic ecosystem services



Addressing the links between human activities, pressures, biodiversity, ecosystem functions and services in aquatic ecosystems

Introducing the **AquaLinksTool**

Florian Borgwardt (BOKU) & António Nogueira (UAVR)

The AQUACROSS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642317.

Thank You!

We thank all colleagues and partners who supported this work and contributed to this work:

Fiona Culhane, Leonie Robinson, Daniel Trauner, Heliana Teixeira, Ana I Lillebø, Gerjan Piet, Mathias Kuemmerlen, Tim O'Higgins, Hugh McDonald, Juan Arevalo-Torres, Ana Luisa Barbosa, Alejandro Iglesias-Campos, Martin Pusch, Gabriela Costea, Helena Hudek, Romina Martin, Gonzalo Delacámara, Carlos M. Gomez, Thomas Hein

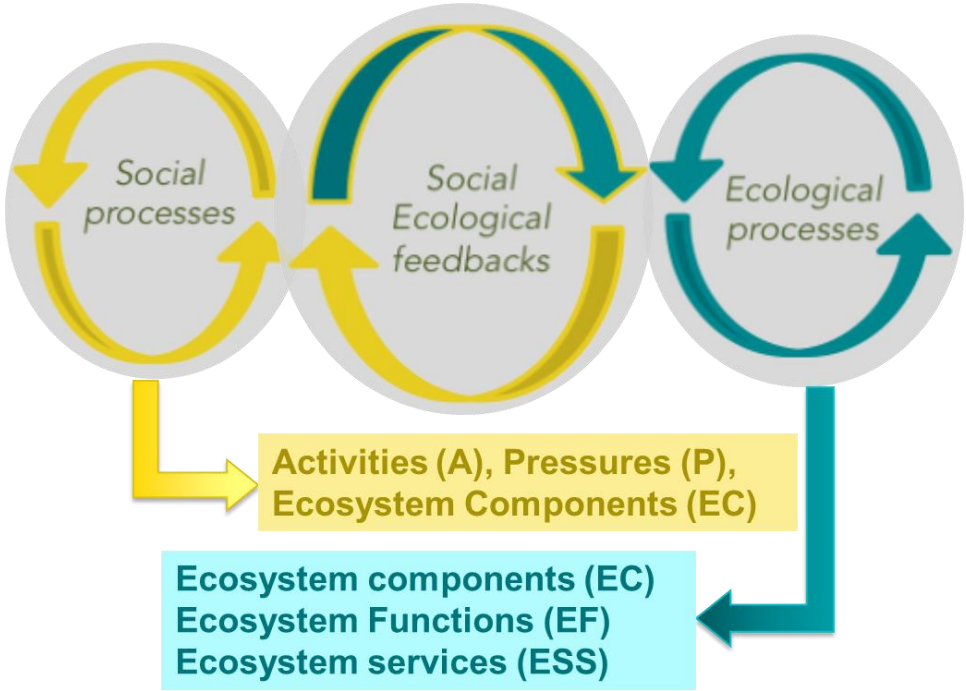
Messages

- Ecosystem Based Management needs a holistic thinking – the linkage framework allows to **comprehensively describe complex social-ecological systems** by including all relevant parts from human activities to ecosystem services

- The understanding of aquatic ecosystems across Europe is fragemented; by disciplines, policies, stakeholder views….; a **common terminology** is needed to establish a common understanding, to break up 'silo mentality', finally facilitating the implementation of Ecosystem Based Management

Background

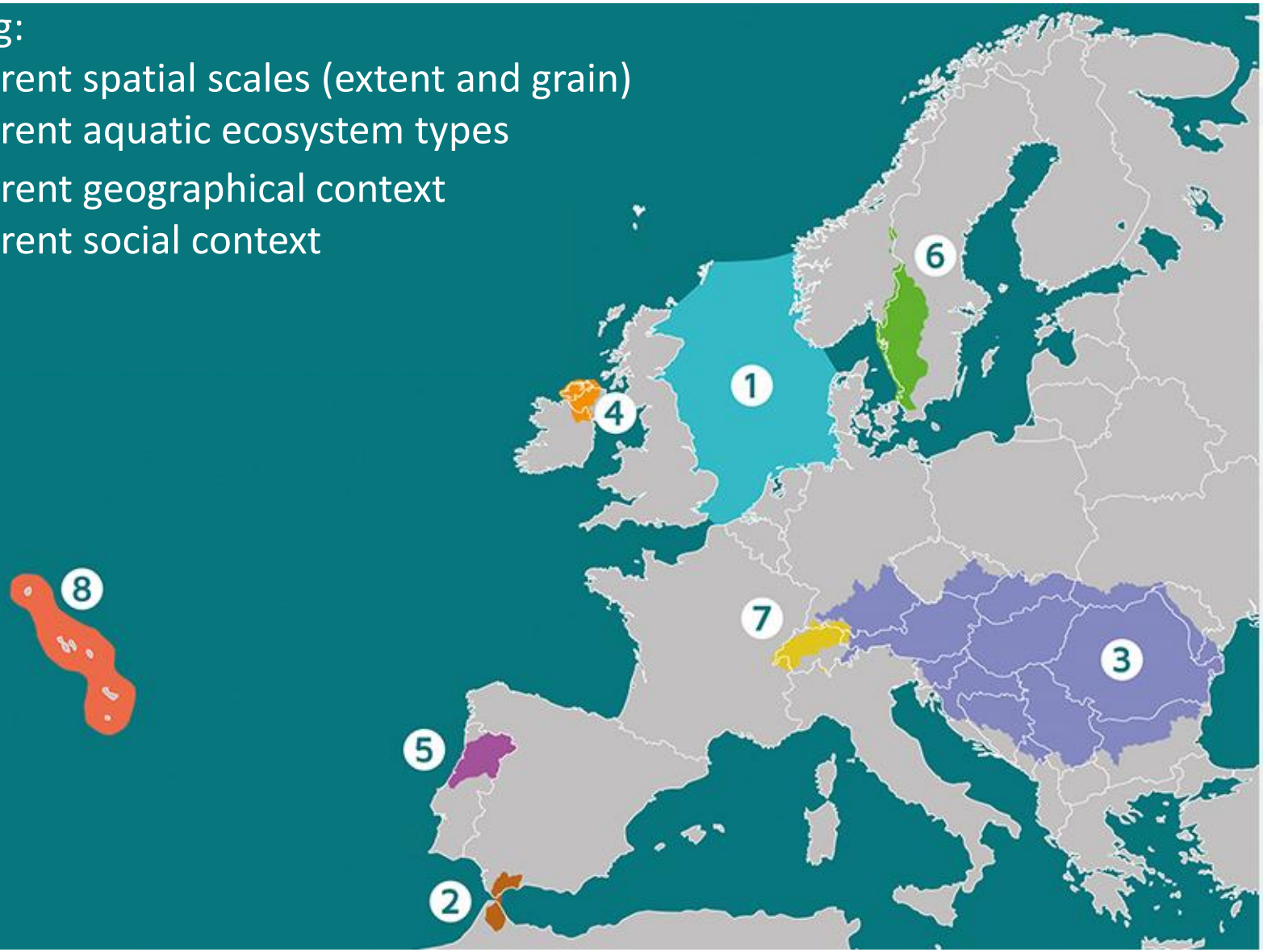
- WP4: Drivers of change and pressures on aquatic ecosystems
- WP5: Causalities between biodiversity, ecosystem functions and services



AQUACROSS Case Studies

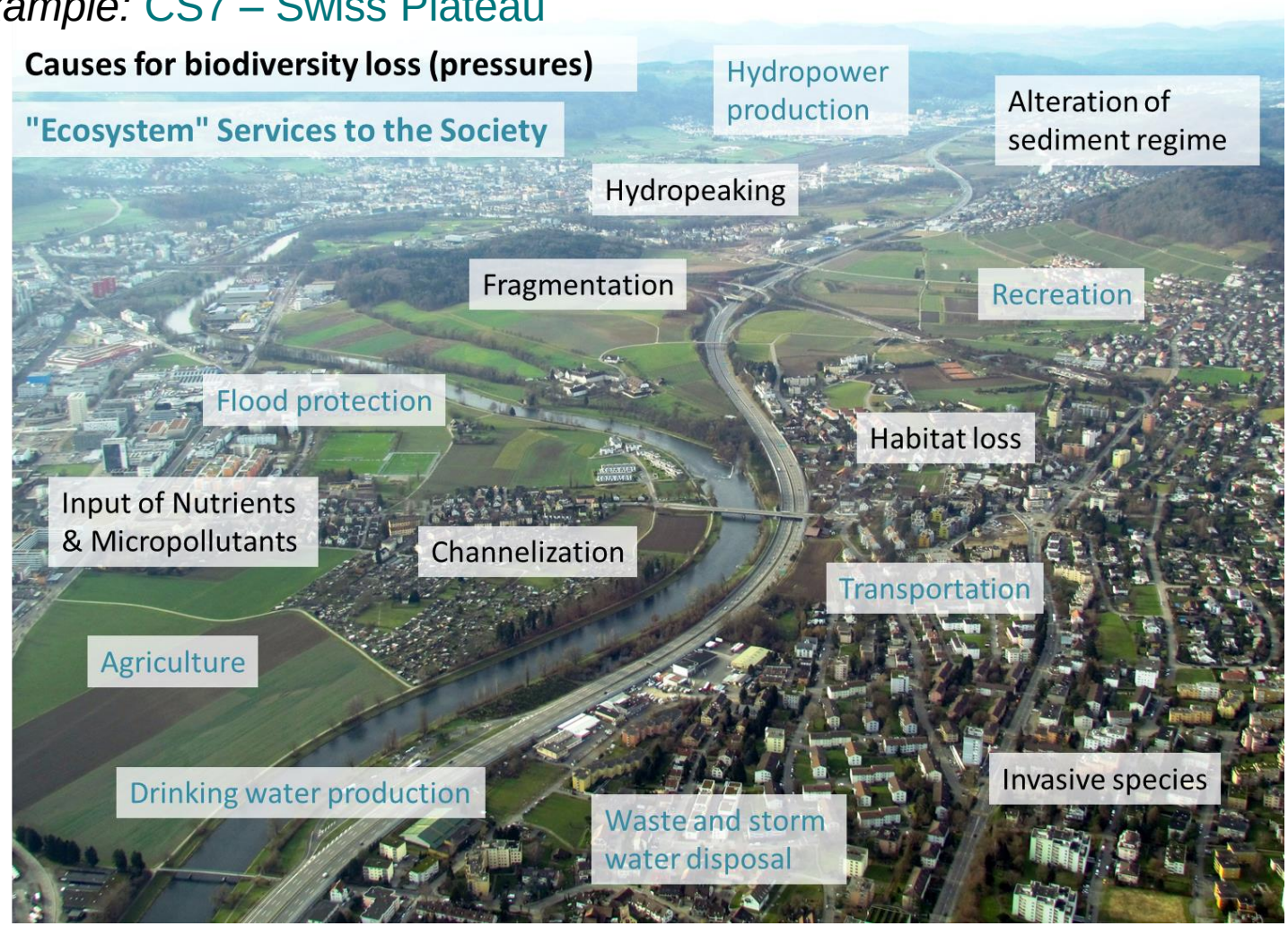
Covering:

- Different spatial scales (extent and grain)
- Different aquatic ecosystem types
- Different geographical context
- Different social context
- ……



Complex Social-Ecological Systems

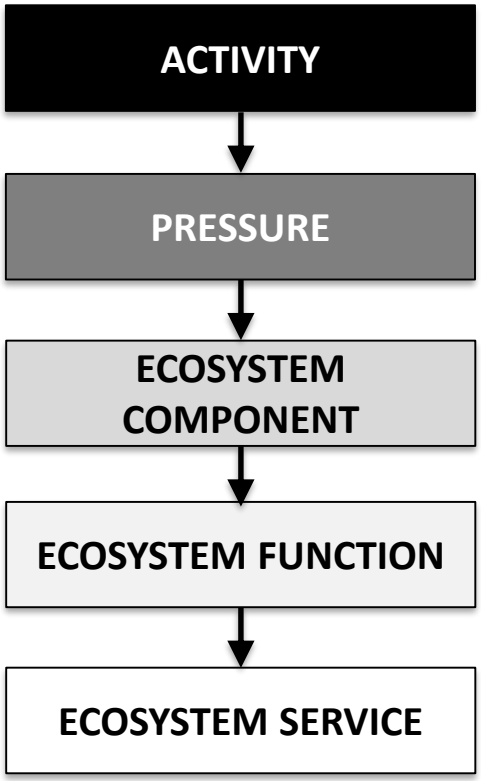
Example: CS7 – Swiss Plateau

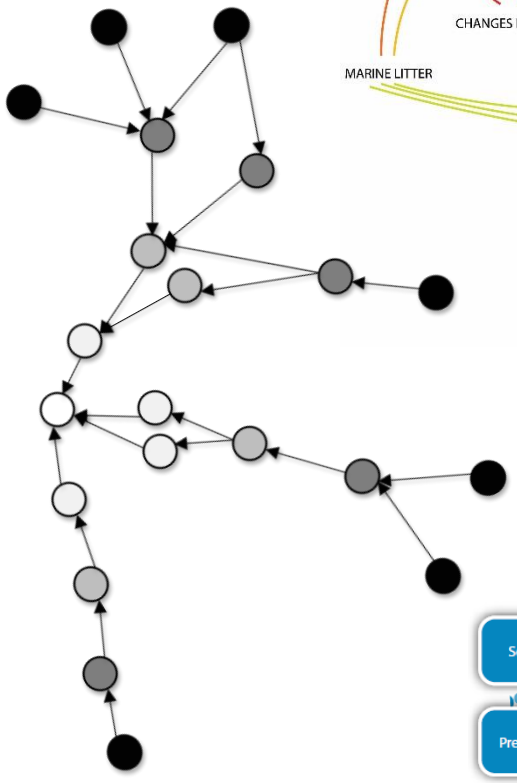


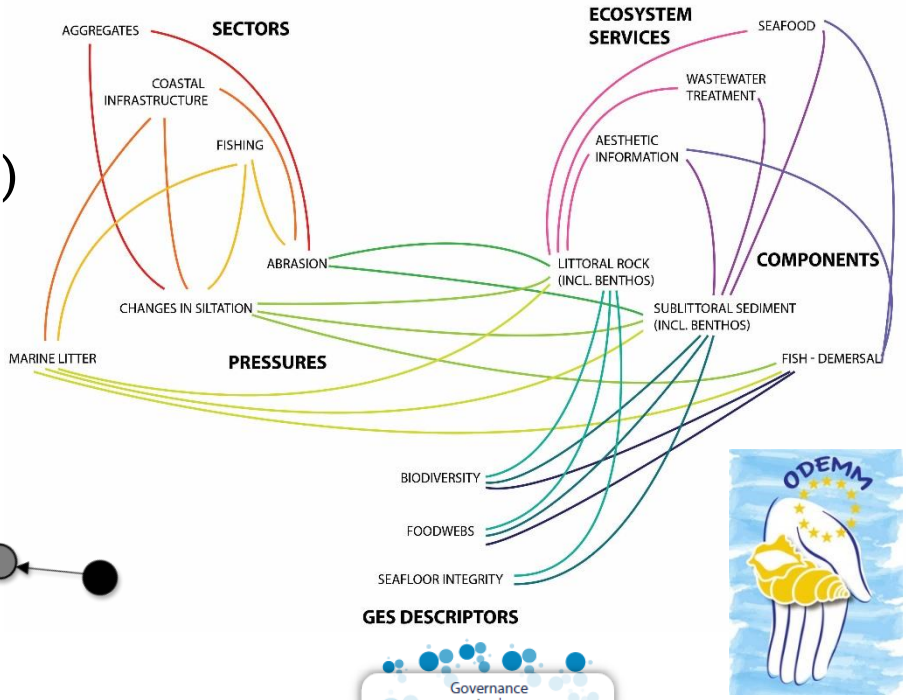
The linkage framework approach

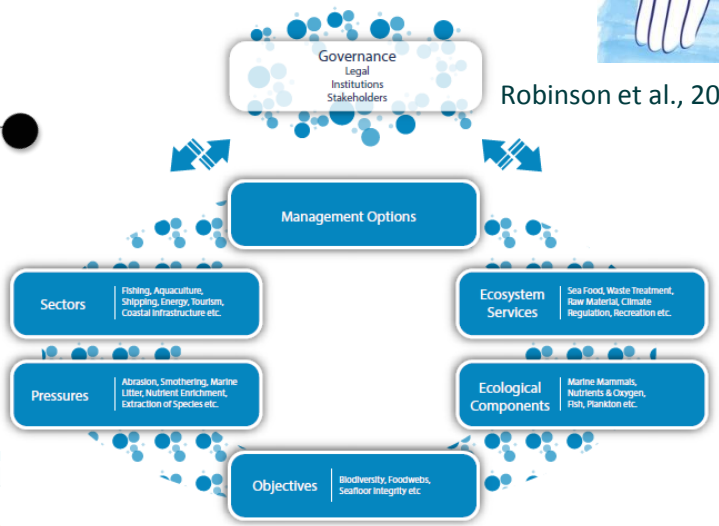
Comparable to a 'DPSIR network approach'

Forming multiple impact (A–P–EC) and supply chains (EC–EF–ESS)





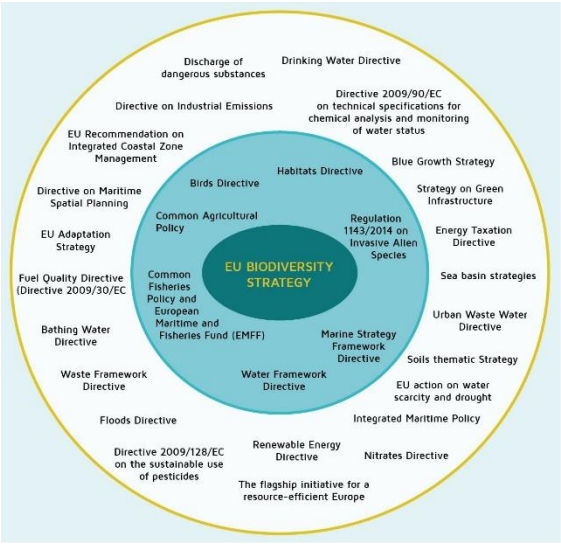




Robinson et al., 2014

Common typologies across aquatic ecosystems

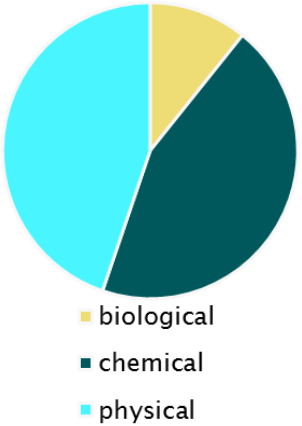
- Systematic alignment of nomenclatures and definitions (WFD, MSFD, HD) →link back to the different policies



- 12 broad activity types classified into 45 specific primary activities → possible linkage to NACE economic activities (social processes)

- 5 pressure categories classified into 31 single pressures

- **23,188 activity–pressure chains** based on 45 primary activities and 31 pressures covering 70 ecosystem components in **15 realms of 4 aquatic domains** for all case studies

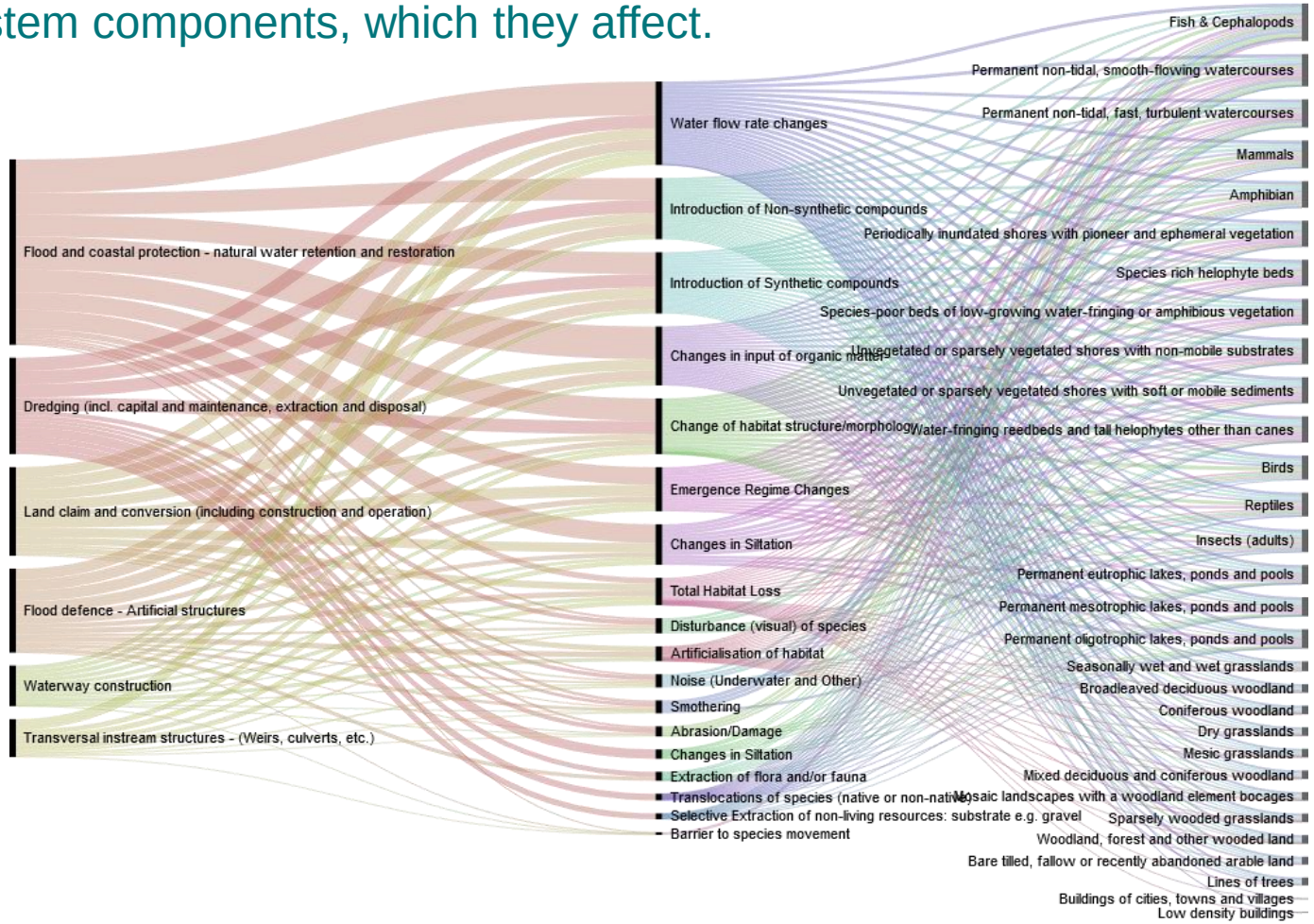


Pressure categories based on Stendera et al. 2012;

A – P – EC

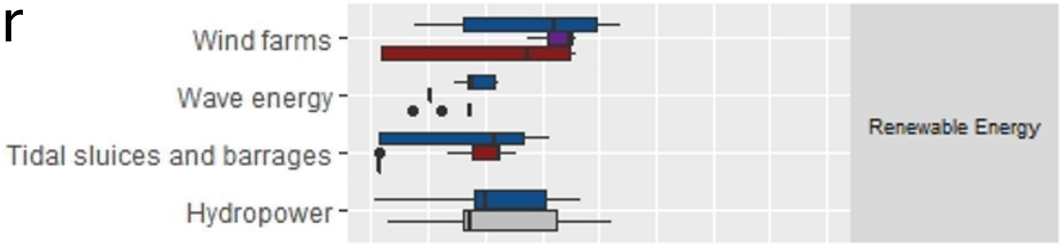
Example:

CS3 - Hydromorphological activities linked to their pressures and the ecosystem components, which they affect.

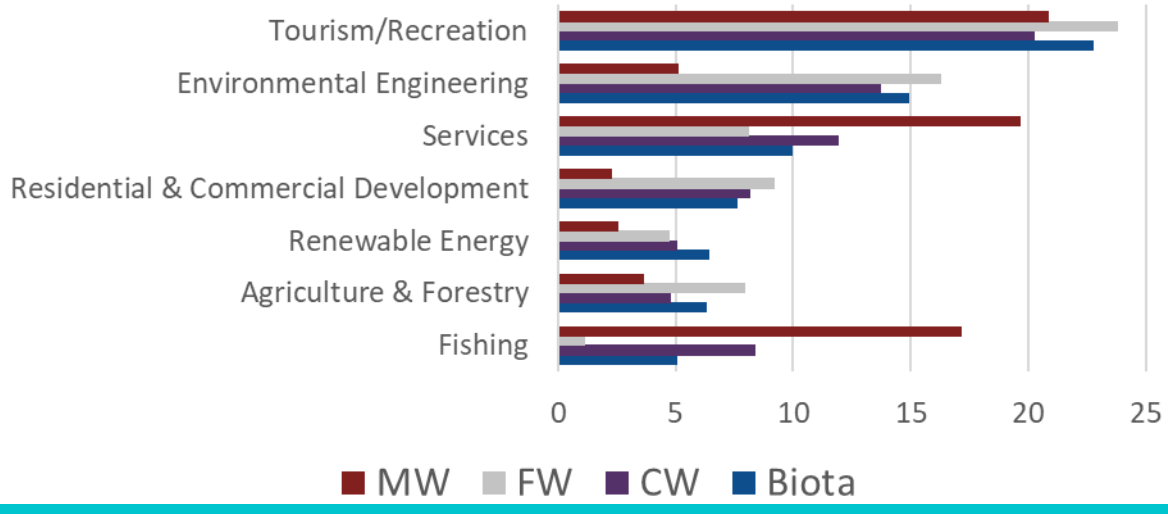


Outcomes

- Activities related to (renewable) energy production introduce high risk to aquatic ecosystems – windfarms vs. hydropower

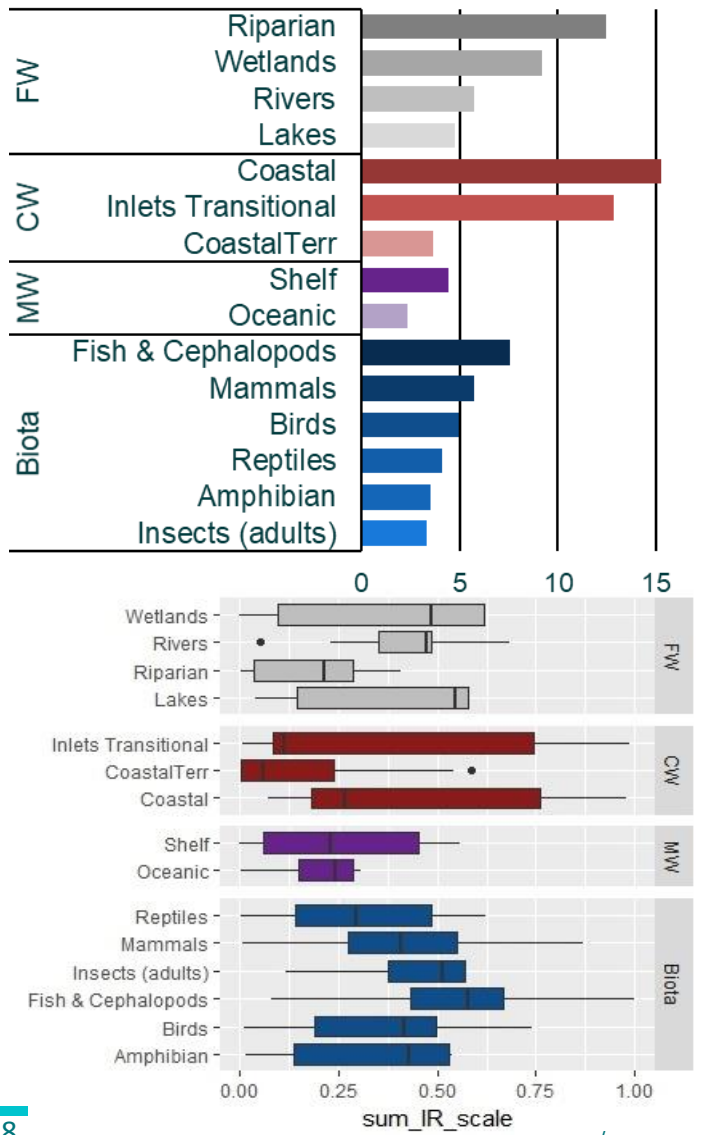


- Tourism activities were highly connected across aquatic ecosystems (having a lot of potential impacts)



Outcomes

- Physical and chemical pressures introduce the greatest risk to aquatic ecosystems
- Ecotones (i.e. coastal, transitional, riparian habitats) are at high risk due to high connectance to activities
- Rivers and Lakes have the highest risk to ecosystem service supply
- Importance to consider spatial separation of activity location and pressure impact



All details are found in

- Deliverables 4.1, 5.1, 4.2, 5.2 and the case study reports and their executive summaries

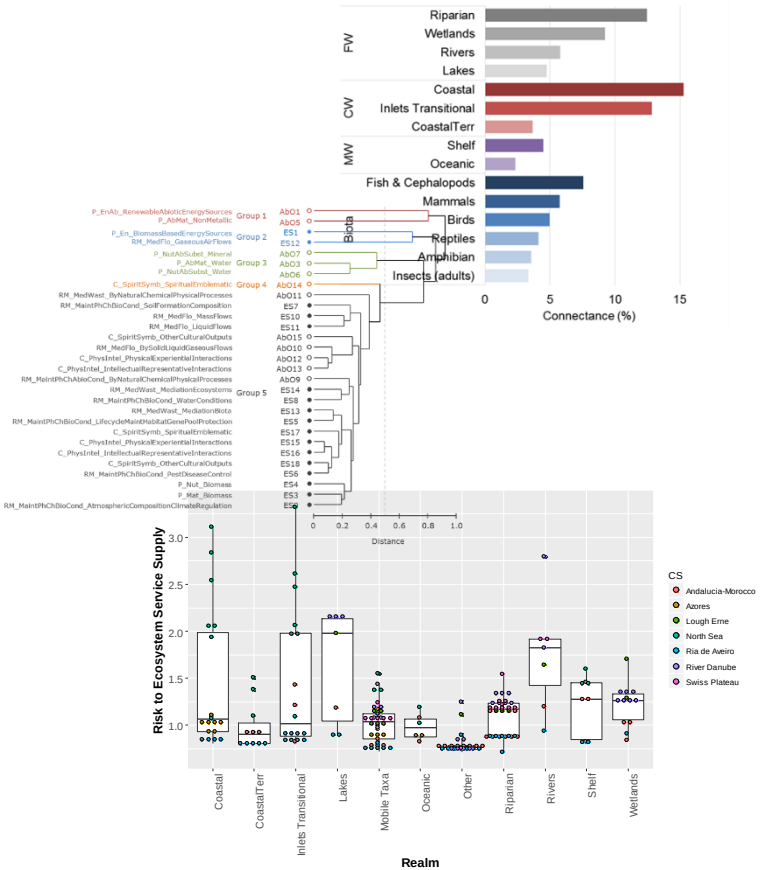
- Detailed analyses of the linkage framework will be published in:

A-P-EC: Borgwardt et al. (subm.) *Exploring variability in environmental impact risk from human activities across aquatic ecosystems*

Eco-EF-ESS: Teixeira et al. (subm.) *Flow linkages from biodiversity to ecosystem services supply: integrating across aquatic ecosystems*

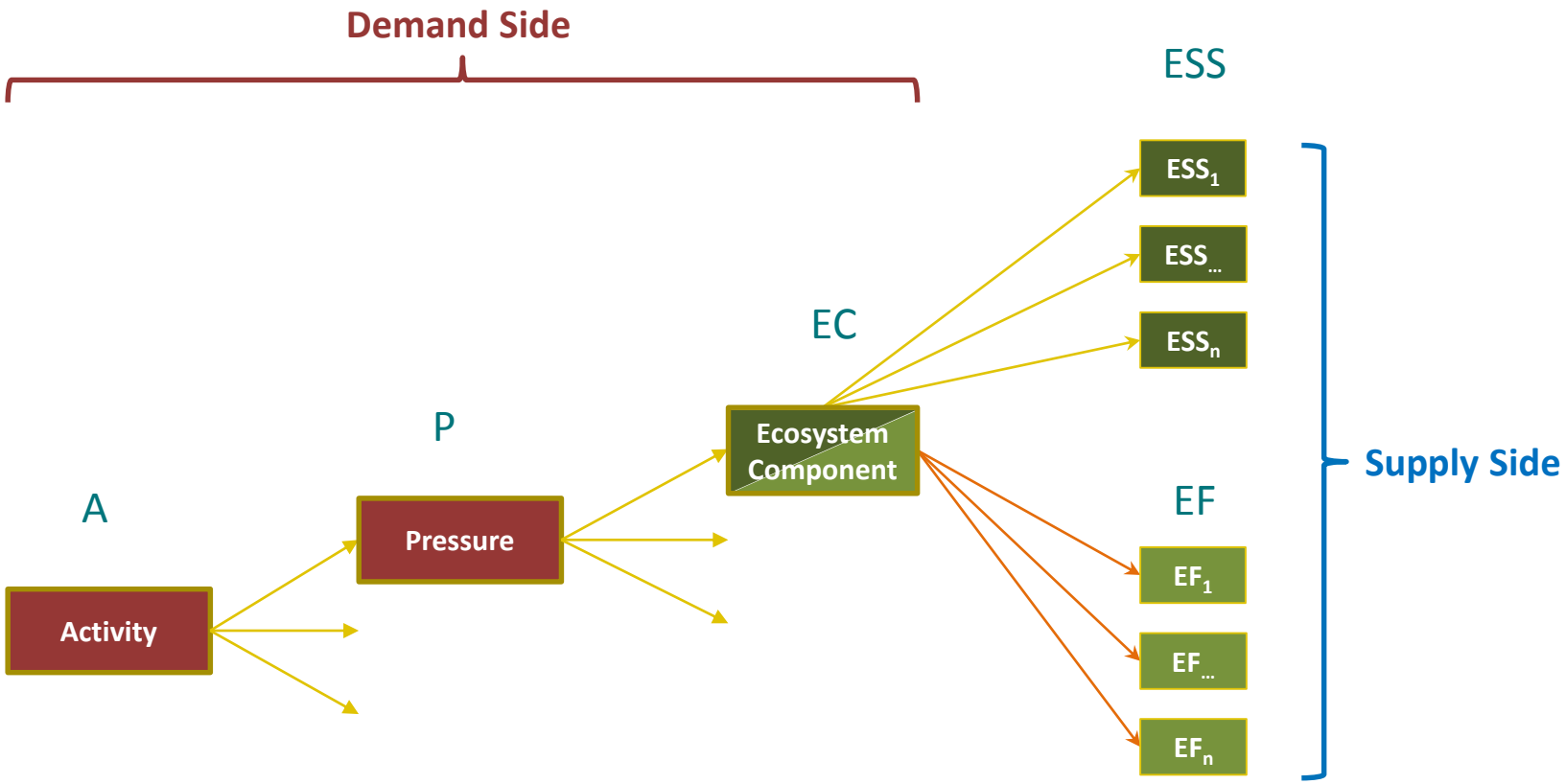
A-P-EC-EF-ESS: Culhane et al. (subm.)

Risk to the supply of ecosystem services across aquatic realms



AQUALINKSTOOL

AquaLinkTool linkage chains



AquaLinkTool and EBM

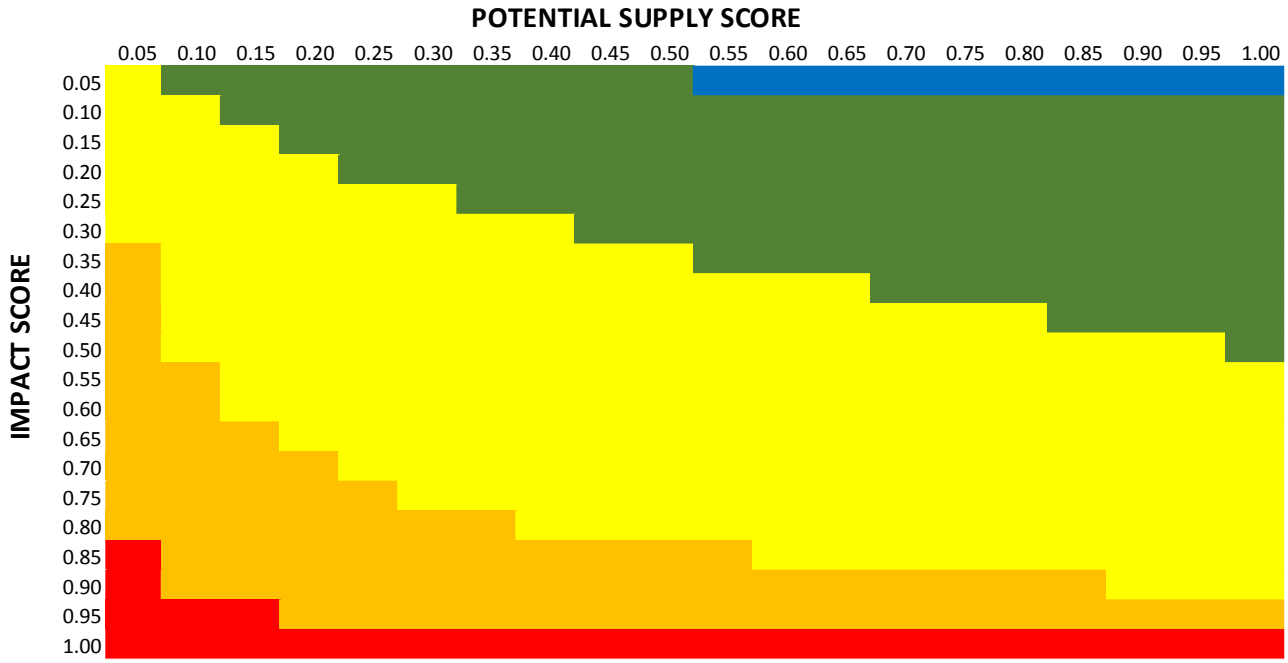
AquaLinksTool addresses explicitly five out of fifteen key principles:

- consider ecosystem connections:
- APPROPRIATE SPATIAL & TEMPORAL SCALES
- adaptive management
- USE OF SCIENTIFIC KNOWLEDGE
- integrated management
- stakeholder involvement
- account for dynamic nature of ecosystems
- ECOLOGICAL INTEGRITY & BIODIVERSITY
- sustainability
- RECOGNISE COUPLED SOCIAL-ECOLOGICAL SYSTEMS
- decisions reflect societal choice
- distinct boundaries
- interdisciplinarity
- appropriate monitoring
- ACKNOWLEDGE UNCERTAINTY

AquaLinksTool description

- **WHAT FOR**: assess the vulnerability associated with linkage chains of
  - activities–pressures–ecosystem components–ecosystem services (A–P–EC–ESS)
  - activities–pressures–ecosystem components–ecosystem functions (A–P–EC–EF)
- **HOW**: for each linkage chain an **impact score** and a **supply score are calculated to derive** a vulnerability quotient
- **SOURCE**: scores are derived from the **knowledge base produced within AQUACROSS** with contributions and expertise from case-studies

Vulnerability Quotient (VQ) Patterns



VULNERABILITY

high pressure
poor conservation
reduced coverage/representativeness

low pressure
good conservation
large coverage/representativeness

AquaLinksTool


thank you!

Table group experience-sharing and discussion

Consider the **Proposed Highlights** in the following slide

- Do you agree with them? If not which ones should be dropped?
- What highlights are missing and should be added?

Session 3 – Proposed Highlights

- Europe's **surface waters** are affected by **multiple stressors**, with high relevance for **sustainable water management**
- The **ecological status of surface waters** relates to **ecosystem service provision**, but profound **empirical proof is still scarce** and highly **case-specific**
- A **common terminology** is needed for a **common understanding across aquatic realms** and to break up **'silo mentality'**
- The **linkage framework** allows a **comprehensive description** of complex **social-ecological systems** by including all relevant parts **from human activities to ecosystem services**
- Assessing the **ecosystem component vulnerability** with **AquaLinksTool** provides an **relevant contribution** to an **effective management of ecosystems**
- **Ecosystem service supply** is **underpinned** by the **integrity of the ecosystem**