AQUACROSS Case Study 1: Trade-offs in ecosystem-based management in the North Sea aimed at achieving Biodiversity Strategy targets

Summary for Local Stakeholders

The interdisciplinary research project AQUACROSS[1] supports European efforts to protect biodiversity in Europe's lakes, rivers, coasts and oceans. These aquatic ecosystems provide numerous economic and societal benefits to Europe – but they are at risk of irreversible damage from human activities. To counter this and to support achievement of the EU Biodiversity Strategy to 2020 targets, AQUACROSS has developed practical guidance on identifying threats to biodiversity, understanding links between ecosystems and the services they provide, data management, modelling and scenario development, and policy analysis, which fit together as parts of the integrated AQUACROSS Assessment Framework for ecosystem-based management of aquatic ecosystems[2]. We have developed, tested, and applied this research in eight case studies across Europe to solve local biodiversity challenges. This brief summarises our work in **Case Study 1**, and makes recommendations for local policy.

The **North Sea** is one of the busiest seas with many (often growing or newly emerging) sectors laying claim to a limited amount of space. The main human activities include fishing, shipping, oil and gas extraction, and newly emerging activities such as the renewable energy sector. These combined human activities and their associated pressures on the environment have hindered the achievement of the ecological goals for the North Sea.

Fishing and wind farms in the North Sea, © EMKvissers

An integrated perspective that considers different societal goals

This case study aims to provide an integrated perspective to ecosystem-based management and marine spatial planning by considering different policy objectives – i.e. sustainable food supply, clean energy and a healthy marine ecosystem – when developing and applying the scientific knowledge to provide guidance for decision-making. The focus on these societal goals was established in a co-design process with stakeholders from Netherlands and Belgium, where we joined existing stakeholder and policy-development processes.

[1] AQUACROSS (Knowledge, Assessment, and Management for AQUAtic Biodiversity and Ecosystem Services aCROSS EU policies), 2015-2018, has received funding from the European Union's Horizon 2020 Programme for Research, Technological Development and Demonstration under Grant Agreement no. 642317. More information: aquacross.eu
[2] All AQUACROSS guidance and outputs are freely available online at https://aquacross.eu/outputs

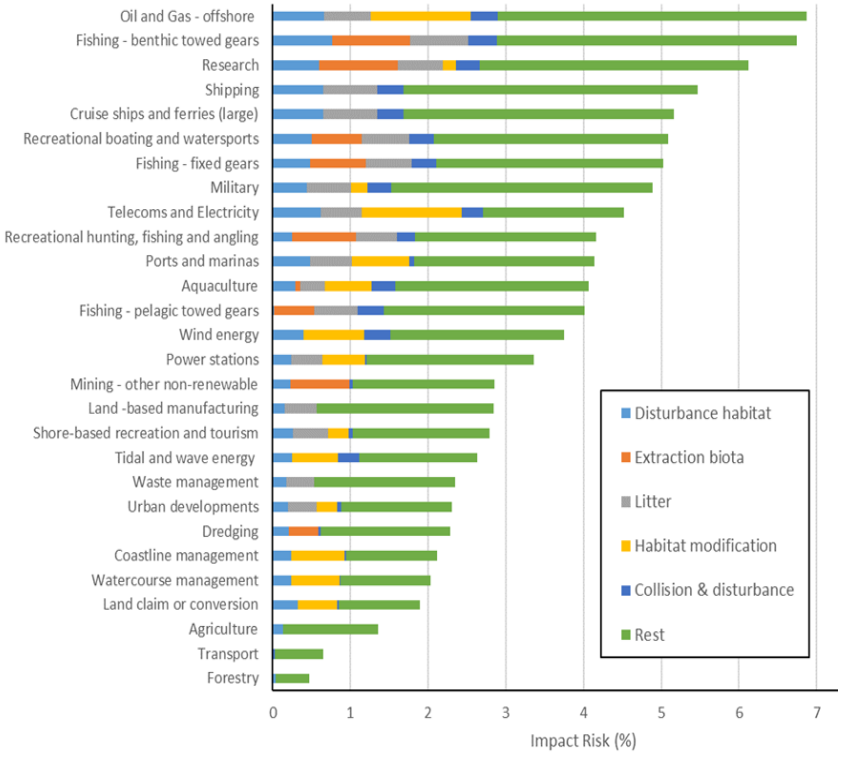
Different societal goals for the North Sea

Sustainable Food: The principal aim of fisheries management under the Common Fisheries Policy (CFP) is to ensure high long-term fishing yields for all stocks at the latest by 2020. This is called Maximum Sustainable Yield (MSY)

Clean Energy: The Renewable Energy Directive sets overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020

Healthy marine ecosystem: The European Union Biodiversity Strategy, which translates the Aichi Targets at the EU level, aims to "halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss"

Several assessments (e.g. MSFD) have indicated that North Sea biodiversity is compromised and hence the objective of a healthy marine ecosystem was not achieved. Our ecosystem-based management approach aimed at achieving this objective, applying a risk-based approach to identify the main human activities and their pressures that compromise biodiversity. The basis of the approach was the AQUACROSS linkage framework, which follows the Driver-Pressure-State-Impact-Response (DPSIR) framework consisting of single so-called impact chains of causal links. This assessment (see right figure) showed trawl fisheries to be among the main activities causing risk while wind energy is still mid-range in terms of its contribution to risk but may be moving up as it further expands.



The representation of the focal social-ecological system considered in this case study (figure bottom left) shows how the two main human activities and their pressures impact the main ecosystem components (which represent biodiversity) and the supply of specific ecosystem services. The information on the supply of ecosystem services connects the ecological system to the social system, providing guidance to decision-makers on the consequences (trade-offs) of management decisions.

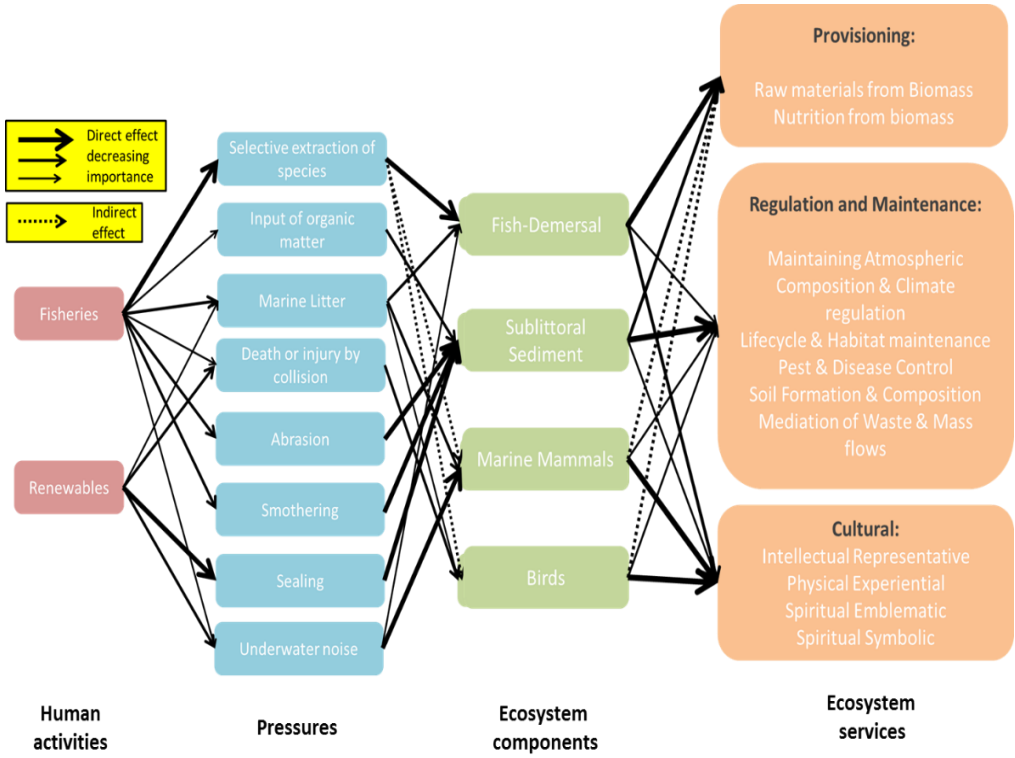
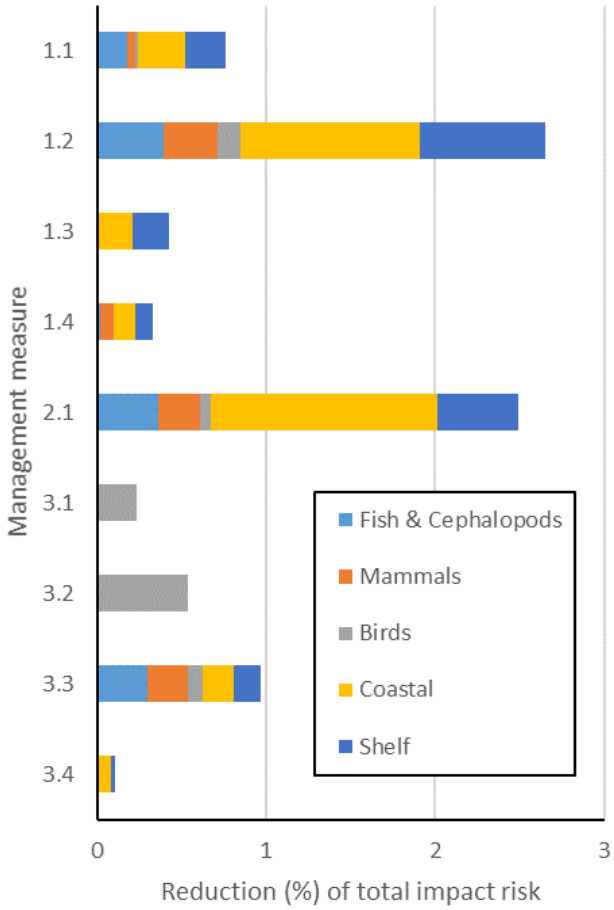


Table and figure: Ecosystem-based management measures, the societal goals they target, and their performance reducing the risk of biodiversity impacts (that lead to an unhealthy marine ecosystem)

Goal	Management measures: code and description	
Sustainable food supply	1.1	Extension of regular fisheries management to achieve MSY through a reduction in fishing effort or capacity
	1.2	More precautionary fisheries management that results in bigger reduction of fishing effort or capacity than 1.1 and results in less than the maximum sustainable food supply.
	1.3	Using incentives to change fishers' behaviour in order to reduce physical disturbance of the seabed habitats.
	1.4	Applying new technology, i.e. gear substitution of conventional beam trawl to pulse trawl, to reduce the impact of fishing on the ecosystem.
Healthy ecosystem	2.1	A ban on all extractive human activities in existing MPAs.
Clean energy	3.1	Using turbines that reduce bird mortality in OWFs
	3.2	Erecting the OWFs in locations where bird mortality is lower
	3.3	Banning fishing with benthic trawls in the OWFs
	3.4	Building OWFs such that their additional hard substrate enhances marine biodiversity



Our evaluation of the effectiveness of the ecosystem-based management measures in terms of reducing the risk that biodiversity is impacted shows that other management measures (i.e. targeting fisheries or offshore windfarms) than those intended to conserve biodiversity (i.e. MPAs) may result in comparable, if not bigger, reductions in total impact risk. These other measures may result in higher costs and thus a reduced efficiency of the measures, but would not necessarily compromise the achievement of other societal goals.

Final local policy recommendations

This case study presents a first attempt to provide a more integrated, ecosystem-based approach which considers diverse (and potentially conflicting) societal goals, includes several sectors, and considers their impacts on the entire ecological system (but not the social system). These first and tentative analyses confirm that applying an integrated perspective in ecosystem-based management may help balance the achievement of different societal goals.

The semi-quantitative risk assessment used for these analyses proved useful to indicate the main threats to a healthy marine ecosystem and the most effective management measures to mitigate those threats. As such, this provides the basis for more quantitative modelling tools that only cover a small part of the focal social-ecological system but can forecast specific scenarios in the detail required by decision-makers.

Want to learn more? A full case study report is available online, or by contacting gerjan.piet@wur.nl.