EASME/EMFF/2018/011 FRAMEWORK CONTRACT FOR THE STUDIES PROVIDING SCIENTIFIC ADVICE IN SUPPORT OF THE COMMON FISHERIES POLICY IN EU WATERS.

EASME/EMFF/2020/3.2.6 Lot1/SC07 & Lot2/SC08

Resilience of the EU CFP toward climate change and fuel efficiency

Presented and coordinated by Francois Bastardie (DTU)

Co-coordination with David Feary (MRAG)

Task leaders: Thomas Brunel, Laurie Kell, Sebastien Metz, Ralf Döring, Ole R. Eigaard and Oihane Basurko

Outreach documentation

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REVIEW
published: 22 January 2021
doi: 10.3389/fmars.2020.629186

A Review Characterizing 25 Ecosystem Challenges to Be Addressed by an Ecosystem Approach to Fisheries Management in Europe

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Reviewed by: Fabio Fiorentino, National Research Council (CNR), Italy; Claudio Vasapollo, Independent Researcher, Ancona, Italy

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Specialty section: This article was submitted to Marine Fisheries, Aquaculture and Living Resources, a section of the journal Frontiers in Marine Science

Received: 13 November 2020
Accepted: 24 December 2020
Published: 22 January 2021

Citation: Bastardie F, Brown EJ, Andonegi E, Arthur R, Beukhof E, Depestele J, Döring R, Eigaard OR, García-Barón I, Llope M, Mendes H, Piet G and Reid D (2021) A Review Characterizing 25 Ecosystem Challenges to Be Addressed by an Ecosystem Approach to Fisheries Management in Europe. Front. Mar. Sci. 7:629186. doi: 10.3389/fmars.2020.629186

The impacts of fisheries on ocean resources are no longer considered in isolation but should account for broader ecosystem effects. However, ongoing ecosystem-wide changes added to the inherent dynamics of marine ecosystems, create challenges for fisheries and fisheries management by affecting our ability to ensure future fishing opportunities and sustainable use of the seas. By reviewing a corpus of fisheries science literature, we contribute to informing managers and policymakers with considerations of the various threats to fisheries and the marine ecosystems that support them. We identify and describe 25 ecosystem challenges and 7 prominent families of management options to address them. We capture the challenges acting within three broad categories: (i) fishing impacts on the marine environments and future fishing opportunities, (ii) effects of environmental conditions on fish and fishing opportunities, and (iii) effects of context in terms of socioeconomics, fisheries management, and institutional set-up on fisheries. Our review shows that, while most EU fisheries are facing a similar array of challenges, some of them are specific to regions or individual fisheries. This is reflected in selected regional cases taking different perspectives to exemplify the challenges along with fishery-specific cases. These cases include the dramatic situation of the Baltic Sea cod, facing an array of cumulative pressures, the multiple and moving ecosystem interactions that rely on the North Sea forage fish facing climate change, the interaction of fishing and fish stocks in a fluctuating mixed fishery in the Celtic Sea, the bycatch of marine mammals and seabirds and habitat degradation in the Bay of Biscay, and finally the under capacity and lack of fundamental knowledge on some features of the EU Outermost Regions. In addition to these ecoregion specific findings, we discuss the outcomes of our review across the whole of European waters and we conclude by recognizing that there are knowledge gaps regarding the direction of causality, nonlinear

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TYPE Original Research
PUBLISHED 04 August 2022
DOI 10.3389/fmars.2022.947150

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Ten lessons on the resilience of the EU common fisheries policy towards climate change and fuel efficiency - A call for adaptive, flexible and well-informed fisheries management

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...ment of the European Union fishing

...Science

ORIGINAL RESEARCH
published: 02 June 2022
doi: 10.3389/fmars.2022.817335

Reducing the Fuel Use Intensity of Fisheries: Through Efficient Fishing Techniques and Recovered Fish Stocks

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OPEN ACCESS

Edited by: Tomaso Fortibuoni,

European Commission

Climate change and the Common Fisheries Policy: adaptation and building resilience to the effects of climate change on fisheries and reducing emissions of greenhouse gases from fishing

EASME/EMFF/2020/3.2.6 - Lot1/SC07

EASME/EMFF/2020/3.2.6 - Lot2/SC08

Final Report

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March – 2022

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Annexes

Written by Francois Bastardie, David A. Feary, Laurie Kell, Thomas Brunel, Sebastien Metz, Ralf Döring, Ole Ritzau Eigaard, Oihane C. Basurko.

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March – 2022

The challenge

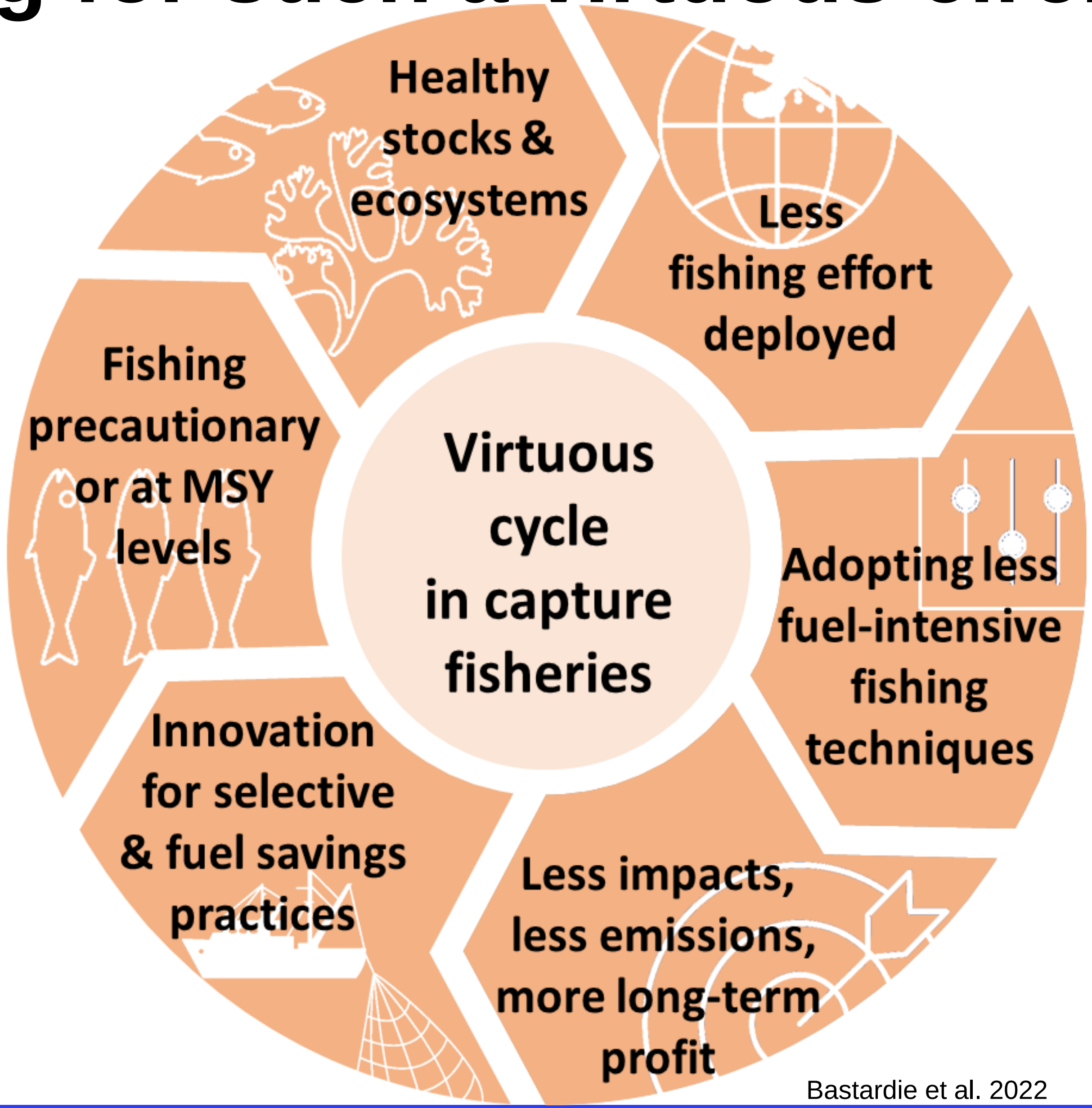
- Fishing has variable and **uncertain** outcomes by nature. Meanwhile, the fishing businesses want to get stable or improve their incomes.
- On top, **climate change** affects marine ecosystems and oceans. Then it changes ocean productivity, timing, spatial distributions, trophic interactions, and badly interacts with management (for example, the landing obligation and choke species)
- To face the problem: society (including fishers) needs to follow a **precautionary approach**: this translates into saving some fish as insurance against short-term shocks and long-term productivity change, and uncertain science or compliance. In an EU context, we'd rather fish in the lower range of the FMSY range of MAPs, if any...

Decarbonisation win-wins

- Fishing less to **earn more** (this is a bio-economic fact along with stock recovery i.e. true even without the climate change issue)
- Fishing with larger meshes consumes **less fuel**
- Respecting sensitive species and habitats, then avoid sawing off the branch that we're sitting on (support an **ecosystem approach** to prevent passing tipping points)
- There are existing technological solutions (i.e. less litre burnt per unit effort)…
- …but about time to also phase out the fishing techniques that are not the **best available techniques** (i.e. litre per kg fish landed)**. co-benefit**: less effort, less fuel, because more and bigger fish, less fuel use intense fisheries
- The elephant in the room: Suspicion that a release of carbon from the seabed sediments exacerbates climate change. We should urgently limit the effects of fishing on **blue-carbon habitats**
- Co-benefit of energy-efficiency on fishing opportunities and **fisheries economy**: save on operating costs, save for larger more priced fish, save the supporting biodiversity

What we did: searching for such a virtuous circle

Characterizing 'Win-Win' fishing strategies in which fishing effort deployed corresponds to MSY targets and CFP minimal effects objectives (e.g., higher catch is obtained, less fuel is spent to attain the catch, and the fishery has a higher resistance and resilience to shock factors to face climate-induced stresses)



Bastardie et al. 2022

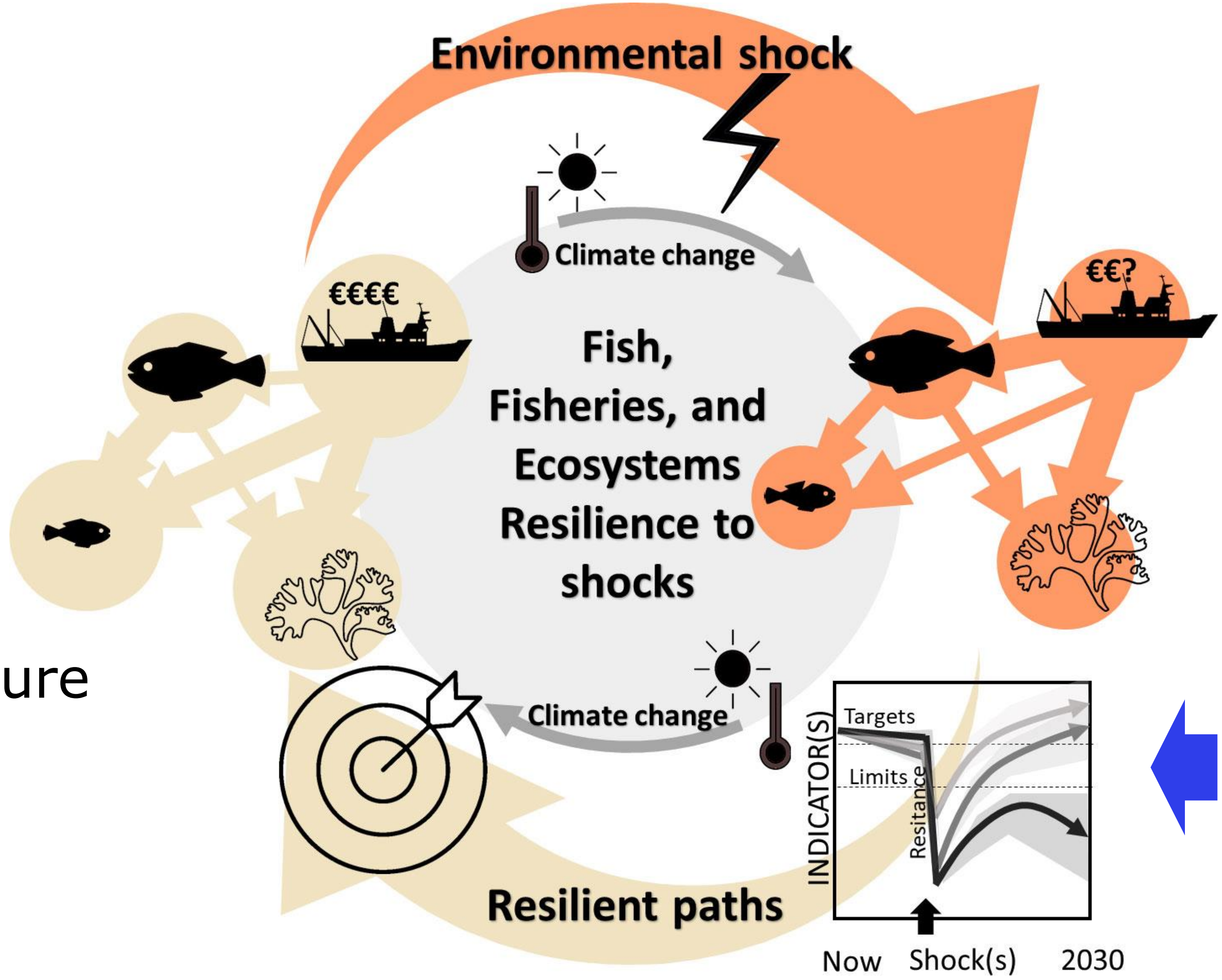
Simulation studies of impact and resilience

Resource Resilience

Ecosystem Resilience

Financial Resilience

Infrastructure Resilience



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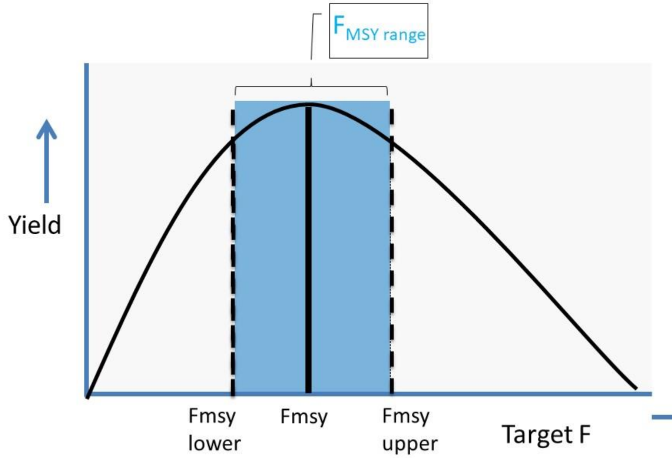
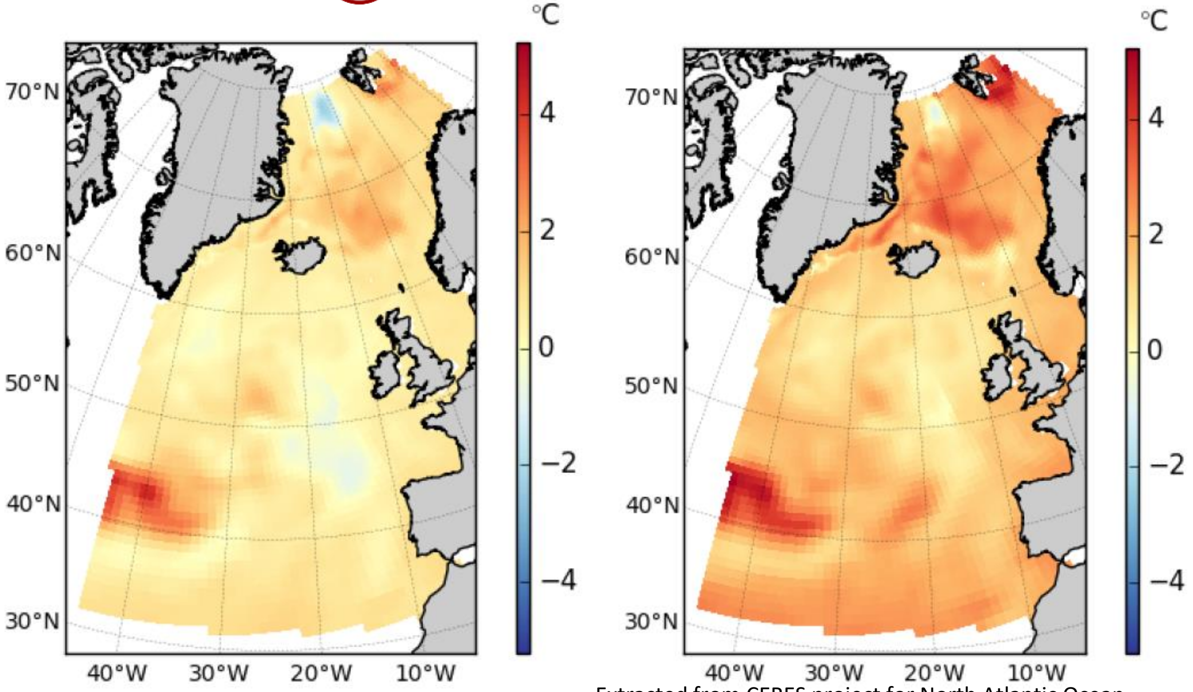


Alternative management measures

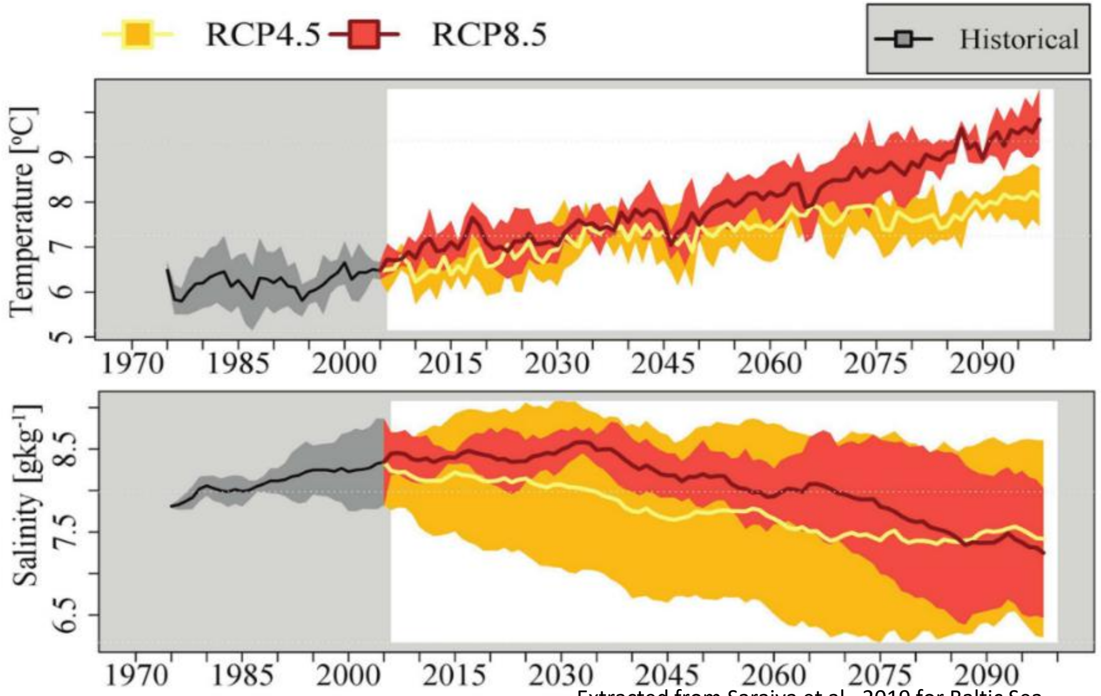
Defining plausible, ecosystem-coherent shock scenarios

Three interlinked Research fields

- **Environmental effects** on biological features (growth, reproductive success, mortality, spatial distribution)
- **Future climate** projections in (North Sea, Baltic Sea, Black Sea, Celtic/Irish Sea, West Med, Aegean Sea, Atlantic Ocean areas) based on past oceanographic data and projections, accounting for possible alternative pathways (IPCC RCP 4.5W/m^2 and RCP 8.5W/m^2)
- **Socio-economics context** including co-management procedures

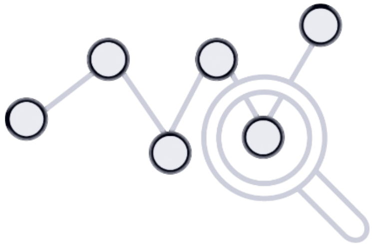


Extracted from CERES project for North Atlantic Ocean



Extracted from Saraiva et al., 2019 for Baltic Sea

Ten lessons learnt along with case studies



Lessons	Case Studies	Type of analysis, reference to Annexes (and models used)
Lesson 1. Healthy and well-managed stocks are highly resilient to short term stress, but not long-term climate change	Mediterranean hake and red mullet, Northeast Atlantic mackerel, North Sea herring, North Sea and Baltic Sea cod, Anchovy in the Aegean Sea	Simulation studies in Annexes 1 (FLR), 2 (EwE), 3 (GADGET), 4 (FLR), 5 (FLR) and 6 (FLBEIA)
Lesson 2. A well-informed fisheries management makes EU stocks more resilient	Northeast Atlantic mackerel, North Sea cod, Tropical tunas	Simulation studies in Annexes 1 (FLR), 4 (FLR), 6 (FLBEIA), and 7 (FLR)
Lesson 3. Including environmental considerations makes EU stocks more resilient	Tunas, Anchovy in the Bay of Biscay, North Sea sprat	Simulation studies in Annexes 2 (EwE), 7 (FLR), 8 (FLBEIA) and 9 (FLR)
Lesson 4. Stocks are not isolated but part of an ecosystem that must also be resilient	Sardine and anchovy in the Aegean Sea, Baltic Sea cod, sprat and herring, North Sea and Irish Sea, sprat and anchovy in the Black Sea	Simulation studies in Annexes 2 (EwE), 10 (EwE), 11 (ATLANTIS) and 12 (EwE)
Lesson 5. EU fisheries´economic resilience depends on current profitability	North Sea Dutch flatfish fishery, west Baltic fisheries	Simulation studies in Annexes 13 (SIMFISH) and 14 (DISPLACE)
Lesson 6. There are likely collateral effects of stock developments on fuel reduction targets (or other ecosystem components)	EU fleets managed by the EU CFP	Analysis of the STECF Annual Economic Report (STECF, 2020) database and ICES stock assessment database
Lesson 7. Many economic aspects could come into play in changing fuel use, including fuel use intensity and fuel-catch efficiency	North Sea Dutch flatfish fishery, west Baltic fisheries	Simulation studies in Annexes 13 (SIMFISH) and 14 (DISPLACE)
Lesson 8. A large panel of technologies to reduce fuel use in fisheries already exist	EU fleets managed by the EU CFP, beam trawl fisheries, Otter bottom trawl fisheries	Data collation from a questionnaire survey
Lesson 9. The actual uptake of technological innovations is still low because of some impediments and regulatory barriers	EU fleets managed by the EU CFP	Data collation from a questionnaire survey and short review
Lesson 10. The governance of fisheries should support the adaptive, and flexible management to face environmental conditions	EU fleets managed by the EU CFP	Expert collation supported by all Annexes

Model uncertainties, limitations and conditioning applied to the case studies are described in the respective Annexes. Using the multiple models currently used for advice allows us to evaluate the robustness of that advice and hopefully to learn and adapt.

Bastardie et al. 2022

Lesson 1. Healthy and well-assessed stocks are highly resilient to short term stress

- Stocks currently well managed are highly resilient

Impact of shocks on Baltic Sea cod is large even if Reproductive Volume positively affected by climate change, vs Baltic sprat and herring are resilient even if negatively affected by future climate change

- Following scientific advice after a short-term shock also affects resilience

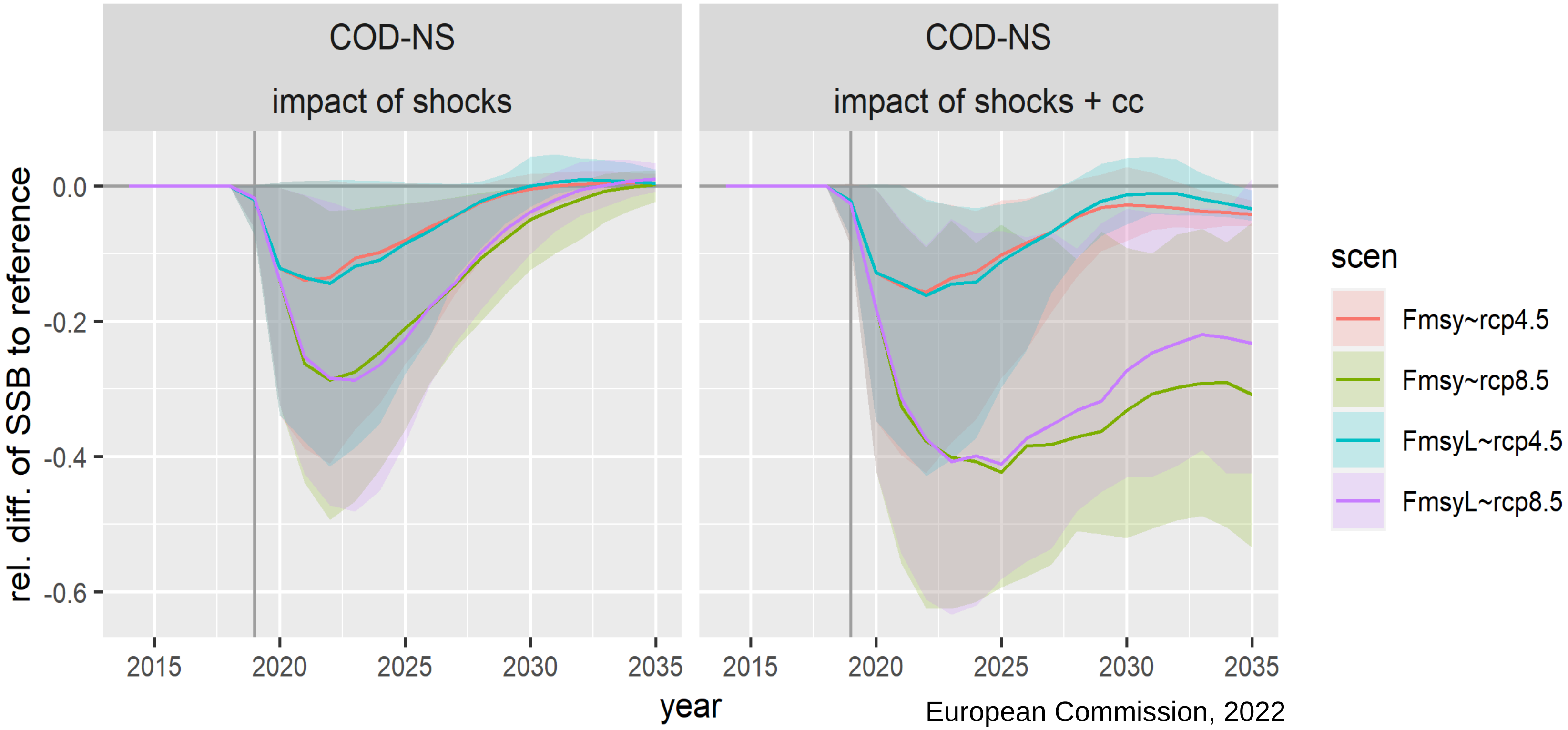
If the advice on North Sea cod is followed the stock recovers, despite the effect of the shocks and the negative long-term effect of climate

NEA mackerel is currently very large, but as it is poorly managed (catch >>>> TAC), it is quite sensitive to the effect of the shocks

- BUT not resilient to long term climate change…

  need for a flexible fisheries management, that is:

  - **follow FMSY Lower**
  - **revise the biological reference points regularly**



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Lesson 9. A large panel of technologies to reduce fuel use in fisheries already exist

OUTCOME: Inventory of technical means of improving energy efficiency, within four overarching categories: 1) vessel structure and equipment, 2) strategies for optimizing vessel activity, 3) gear developments to reduce drag and increase catch efficiency, 4) regulatory and management measures => ca. **40 solutions**

Category	Target	Sub-categories	Source of information*				% fuel-saving potential**	Source
			S	G	CQ	SQ		
Gear	Drag-force reduction (gear)	Alternative materials (Dyneema™)					2–40	ICES, 2020b; Lee et and Sala, 2014; Har Marlen, 2009; EC, 2
		Different mesh size, types of knot, panel cuttings					25–27	Lee et al., 2018; Ha Sala et al., 2012; S Parente et al., 2008
		Operational improvement						
		Electronically controlled gears					>15	ICES, 2020a
		New gear designs						
		Change from demersal to semi pelagic trawling doors					1.6–19	ICES, 2020b; Lee et and Sala, 2014; Bas EC, 2006
		Alternative designs of trawl doors, trawl net, Sumwing					4.5–20	ICES, 2020b; Lee et et al., 2012; Priour
		Ground gear					***	ICES, 2020b; Larser
		Alternative ropes (helix ropes)					***	Kebede et al., 2020 van Marlen, 2009;
		Sledges					****	Kaykac et al., 2017; van Marlen, 2009

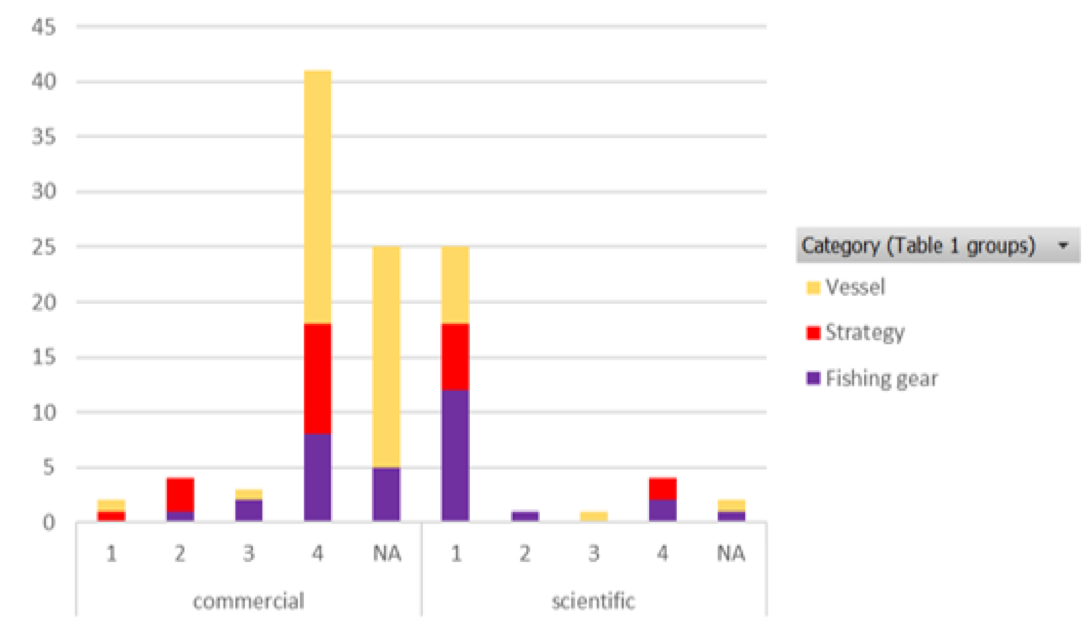
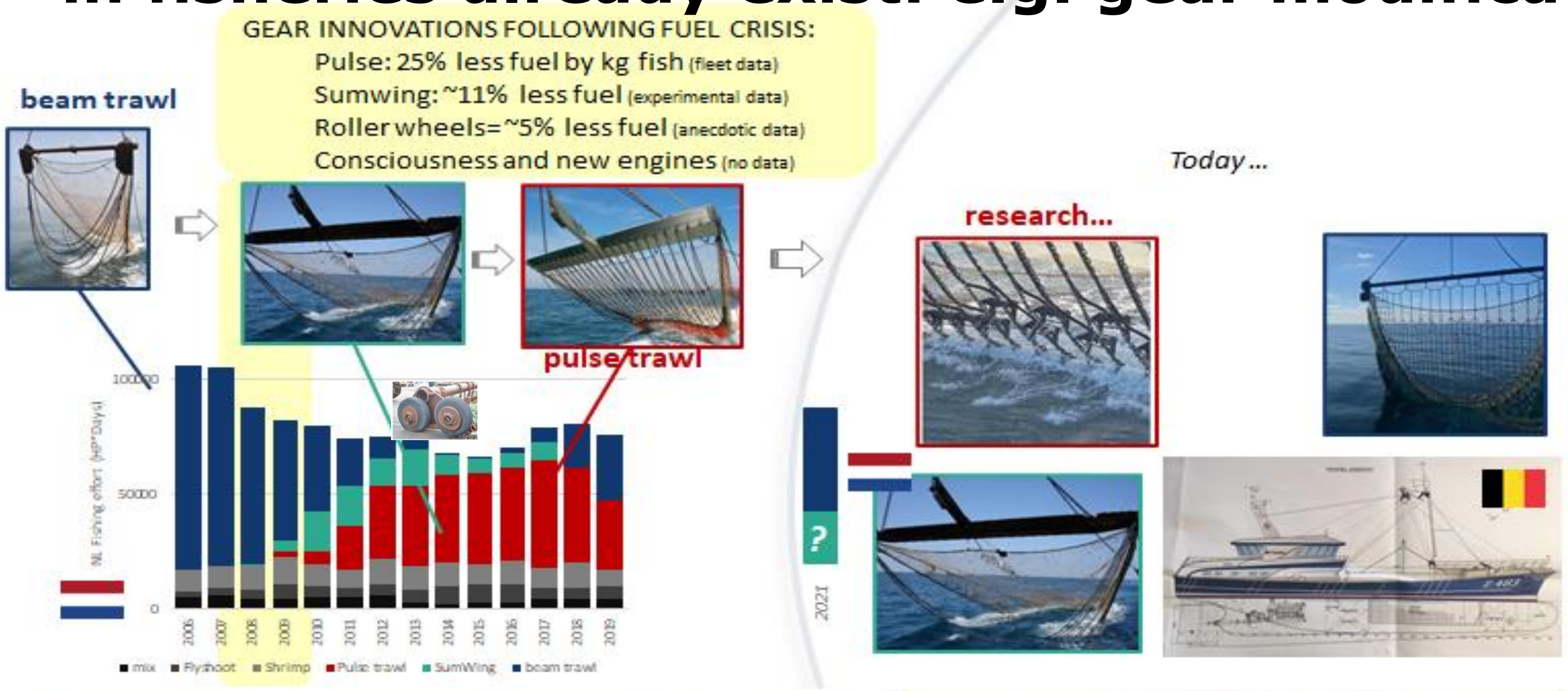
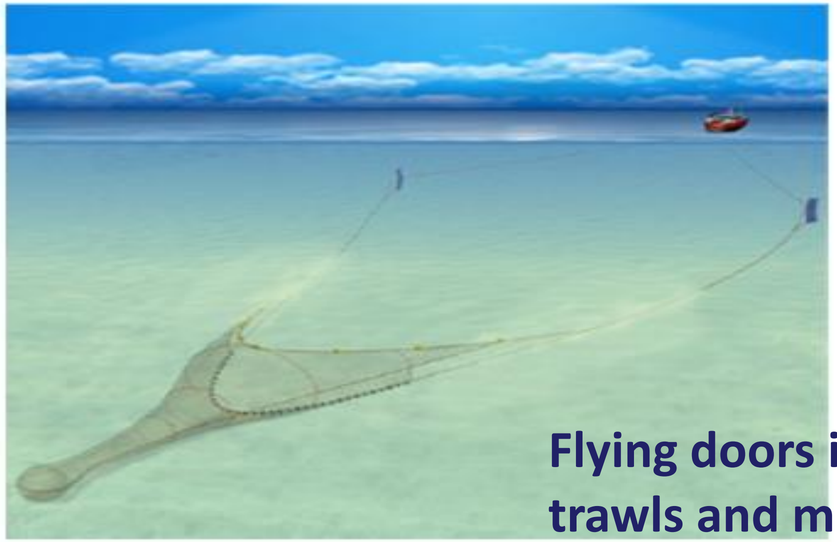


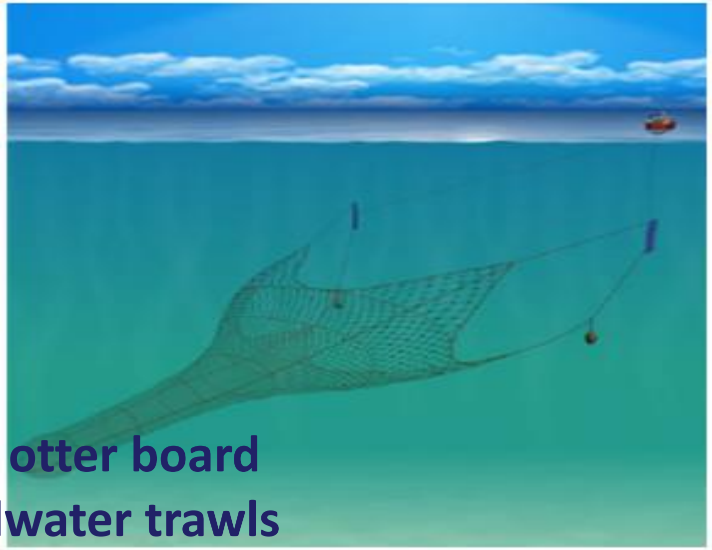
Figure 178 The level of implementation of the energy saving measures varied from the experimental level or low success rate (1) to implementations at fleet level or high success rate (4). Commercial fisheries questionnaires clearly showed higher success rates than responses from scientific questionnaires.

European Commission, 2022

Lesson 9. A large panel of technologies to reduce fuel use in fisheries already exist: e.g. gear modifications







Flying doors in otter board trawls and midwater trawls

Example1

Gear modifications in beam trawl fisheries start to take off and result in actual changes following the fuel crisis. Search for lowering fuel consumption (lower drag + lower fishing speed)

Tickler-chain beam trawls were replaced with beam trawls having sumwing, and in the NL with pulse trawls. Sumwing (without pulse) are still being used.

Example2

Modifying otter trawls with new netting designs, materials and net modifications, modifications for semi-pelagic doors, innovative doors and lighter materials, or efforts to raise the doors from the seabed (energy savings of up to 40% and increased catches are possible)

Lesson 10. Management should anticipate and respond to changes with adaptive, flexible management

Who benefits? A more flexible quota management system. Wherever TACs apply, there might be more accessibility to swapping quotas between countries

Redefining or swapping of stocks quotas had been the least-likely-to-occur measure so far at the EU scale, but now, with the landing obligation, and other climate related issues, there might be **a window of opportunity** given MSs do not want to lose shares that will be important as choke species

Table 8 Potentials for resilience within the current or a reformed CFP governance

Actions	Agents	Potential for resilience	Obstacles
Anticipate the change	Fishing fleet	• High profitability	• Overcapitalisation and overfishing, impairing profitability
	CFP governance	• Dynamic management (e.g., update biological reference points regularly) • Ecosystem approach to fisheries management (EAFM) (e.g., account for supporting ecosystem services)	• Demanding knowledge acquisition and a detailed understanding of the marine ecosystems' dynamics • Moving targets (e.g., fluctuating quotas)
Response to change	Fishing fleet	• Adapt to local circumstances • Follow the stocks	• Additional effort to reach the fishing grounds • Crossing jurisdictions • Mismatched opportunities with species assemblage (e.g., risk for choke species)
	CFP governance	• Redesign of the principle of relative stability	• The inertia of historical rights (path dependency)
	Common market organisation (CMO)	• Stimulate demand through marketing strategies and informative campaigns • Producer Organisations (POs) have the potential	• Consumer habits may impose a barrier for the trade of newly abundant resources •

European Commission, 2022

The road map in EU for climate-aware fisheries

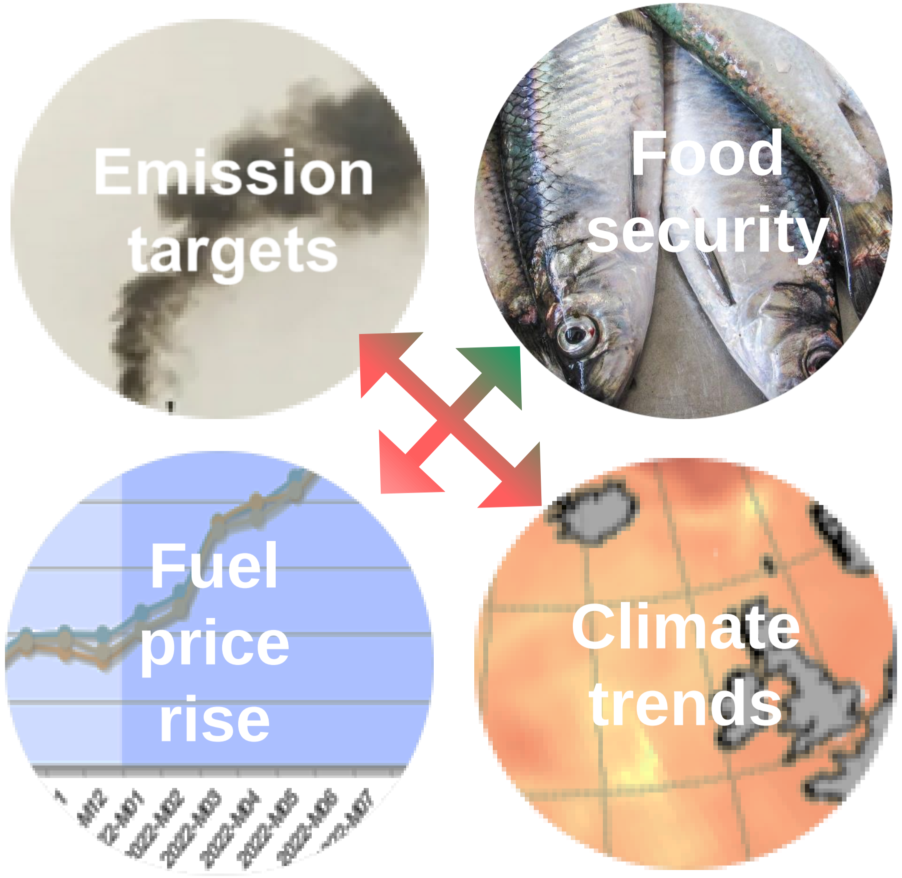
- Think ahead: We need to lower the price of energy, we need to **reach our commitment** ("farm to fork" in the "fit for 55") ...30% less by 2030 than 2005, and a carbon-neutral sector by 2050

- One striking outcome is the **low uptake by the fishing industry so far**. We found that there are many energy-efficient solutions (not affecting catch rate) but little knowledge transfer and implementation... regulation barriers, costs for transition, inertia, path dependency?

- We need to **change the mindsets** (currently, solutions exist but no change as long as profitable fisheries), but also give more incentives (”nudging”) and training for new practicing and reconversion/ retrofitting, etc. and **avoid fuel tax exoneration** which is easy fix to crises (covid-19, Ukraine) but not to long-term climate trends...

The road map: urge for convergent paths

- Caution about the **”rebound” effect** (saving fish, saving fuel might sometimes lead some vessels to spend more time at sea instead of less): reduce effort
- Promote a bottom-up approach by informing consumers/retailers with **a scoring** of fisheries depending on criteria for sustainability that would also account for the relative carbon footprint
- Knowledge is key: need to understand the amount of energy being used by now – **Fuel-monitoring tools onboard vessels**, monitoring programs, pilot studies and subsequent evaluation of fuel use.



Facing the unavoidable plurality of objectives with win-wins

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