DemersAl Mixed fishery Analysis tool for Regional Advice

Science to support management decisions for the multi-fleet multi-stock fisheries of the Celtic Sea

MYFISH Symposium - Athens, 28 October 2015

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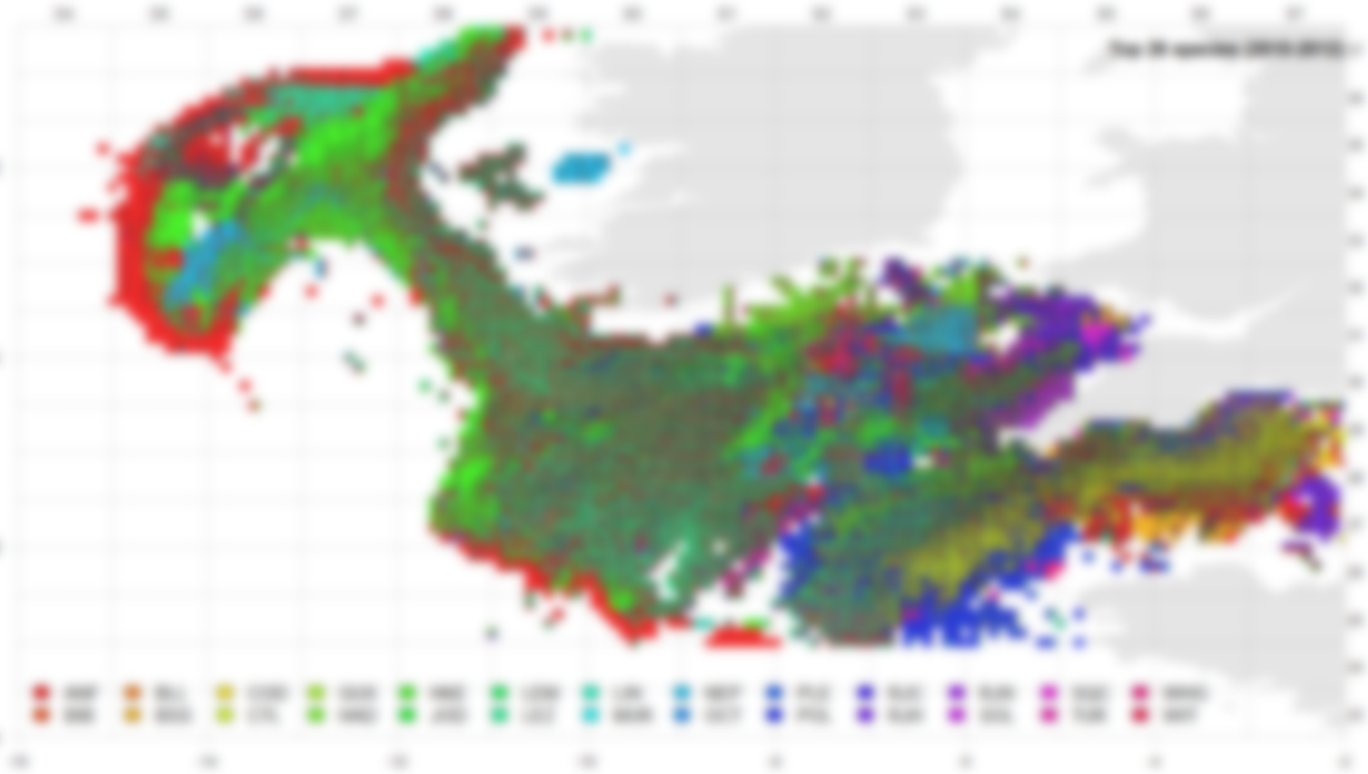
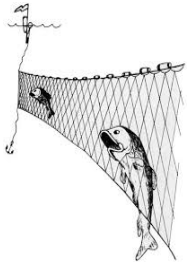
Cefas

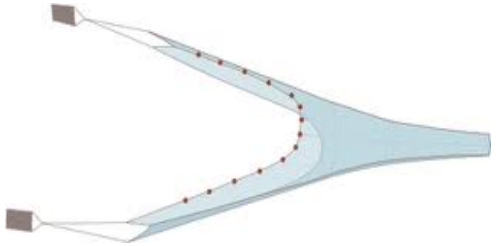
Aim of DAMARA

- To build a decision support tool (DST) that will enable the comparison of different management options from a biological and economic perspective and support the development of a mixed fisheries multi-annual plan in the Celtic Sea.
- Key components:
  - Appropriate modelling framework
  - Effective manager and stakeholder involvement in design
  - Key indicators of relevance (stocks, economics and social) to support choices of management intervention
  - Accessible, interpretable, credible outputs

Context







NWWRAC Framework and Objectives for Developing a MAMP for Mixed Demersal Fisheries in Celtic Sea

Wednesday, 02 November 2011

Opinions and Advice

Framework and Objectives for developing a Mixed Fisheries Management Plan in VIIfg

Continue

NWWRAC Proposal on Gear Selectivity Measures for Celtic Sea

Thursday, 13 October 2011

Opinions and Advice

Use of square mesh panels (SMP) in trawl and seine fisheries catching haddock and whitingNWWRAC Proposal Selectivity Measures SMP Celtic Sea 13102011 EN.pdf

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NWWRAC Opinion on management measures for Celtic Sea demersal fisheries

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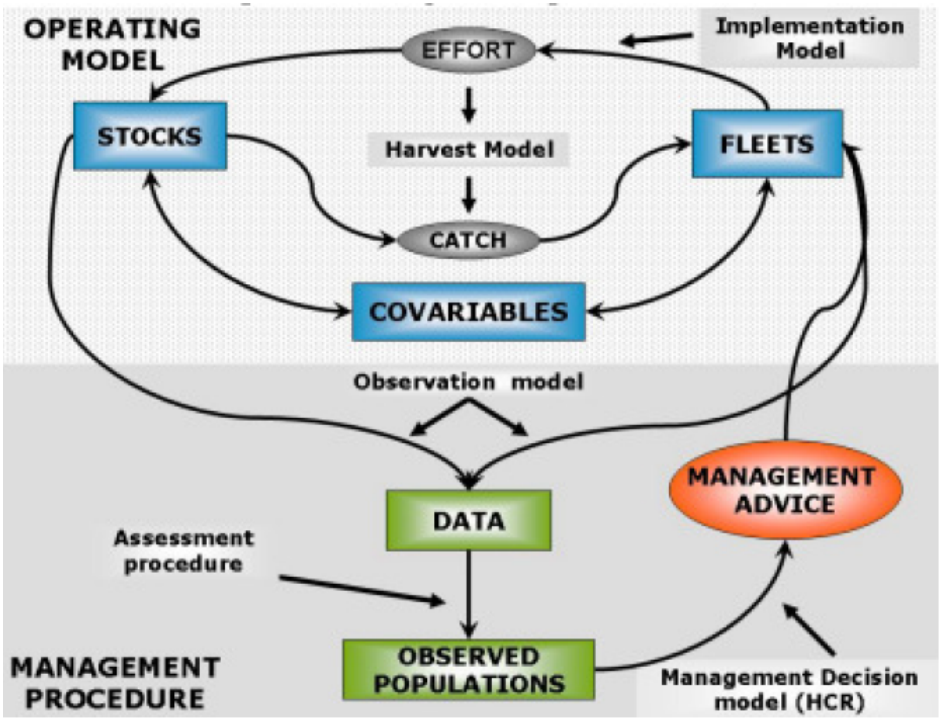
Modelling framework

- Built around FLBEIA (Bio economic Impact Assessment implemented in FLR)

✓ Modular, flexible, extendable
✓ Focus in detail on component of interest (e.g. management intervention over assessment performance)
✓ Incorporate uncertainty (multiplicative)



The "engine"

- **Population dynamics**

ASPG

Non-recruits: $N_{a,t}=(N_{a-1,t-1}e^{-M/2}-C_{a-1,t-1})\ e^{-M/2}$

Recruits: $R_{a=arec,t}=\alpha SSB\ f(SSB)$

Biomass-dynamic

Single component: $B_t= B_{t-1} +rB_{t-1}\ (1-B_{t-1}/K)-C_{t-1}$

Fixed population

Single component: $B_t= \eta,\ \eta >>C_{t=1,..T}$

- **Catch production**

Cobb-Douglas: $C_{f,m,s,t}= q_{f,m,s}E^a_{f,m,t}B^b_{f,m,s,t}$

- **Effort model**

Fixed Effort: $E_{f,t}=fixed$

Simple mixed fisheries: $E_{f,t}=min(E_{f,t,spp1},E_{f,t,spp2},E_{f,t,spp3},\ldots)$

Profit Maximisation: *Effort allocated across métier to max profit within TACs*

Stock dynamics

Stock	Population dynamics	Natural mortality	Production (stochasitc)	Management
Anglerfish	Fixed population*	-	-	FixedAdvice
Cod	Age-structured	Age-dependent	Beverton-Holt	Dynamic HCR
Haddock	Age-structured	Age-dependent	Ricker	Dynamic HCR
Nephrops (FU22)	Biomass dynamic	-	Logistic	FixedAdvice
Northern Hake	Age-structured	Age-dependent	Segmented-regression	Dynamic HCR
Northern Megrim	Age-structured	Fixed	Segmented-regression	FixedAdvice
Plaice	Age-structured	Fixed	Ricker	Dynamic HCR
Sole	Age-structured	Fixed	Ricker	Dynamic HCR
Whiting	Age-structured	Fixed (age-dependent in update)	Ricker	Dynamic HCR

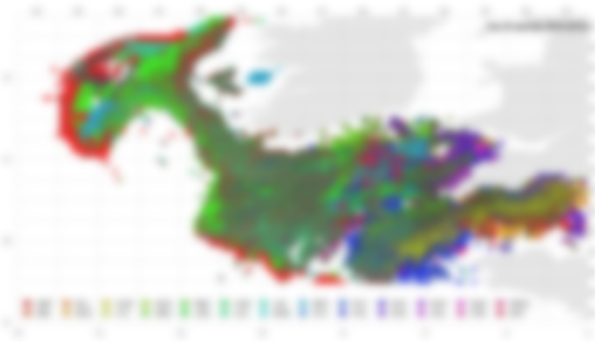
*Population abundance set high enough to allow for future catches, useful where stock is of economic importance but no assessment is available.

Fleet dynamics

Model	Function
Capital Dynamics	Simulate investment, disinvestment, exit/ entry and through-flow
Price Dynamics	Elasticity, vary across age/grade
Sensitivity	Impact of fuel price, interest change
Effort allocation rules	Simple Mixed Fishery Behaviour (stop when first quota reached), Maximum Profit (optimal effort allocation within fleet)

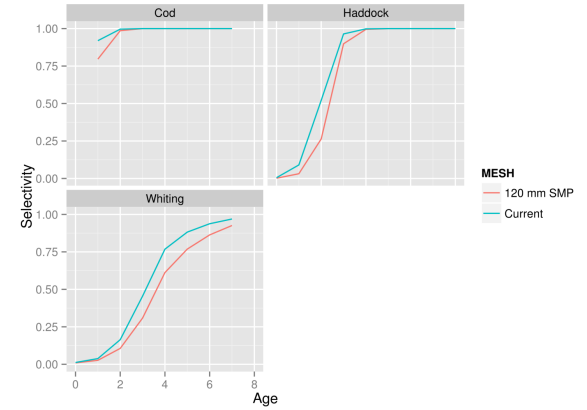
- 16 fleets, multiple métier per fleet (with multiple stocks) == complex system >> Focus on scenarios

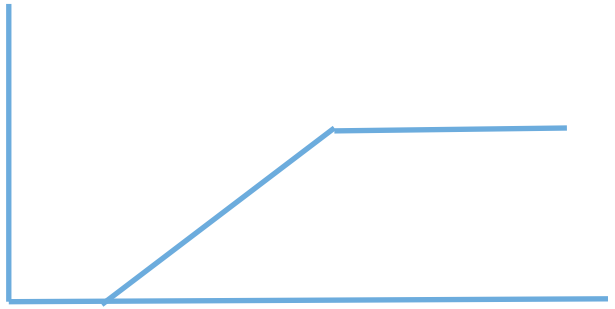
Management interventions



Comparative scenarios:

- Simulated area closure
- … gear selectivity change
- Harvest Control Rules (TACs)
- Economic scenarios
- CFP landings obligation (catch restrictions, de minimis, inter-year flex..)

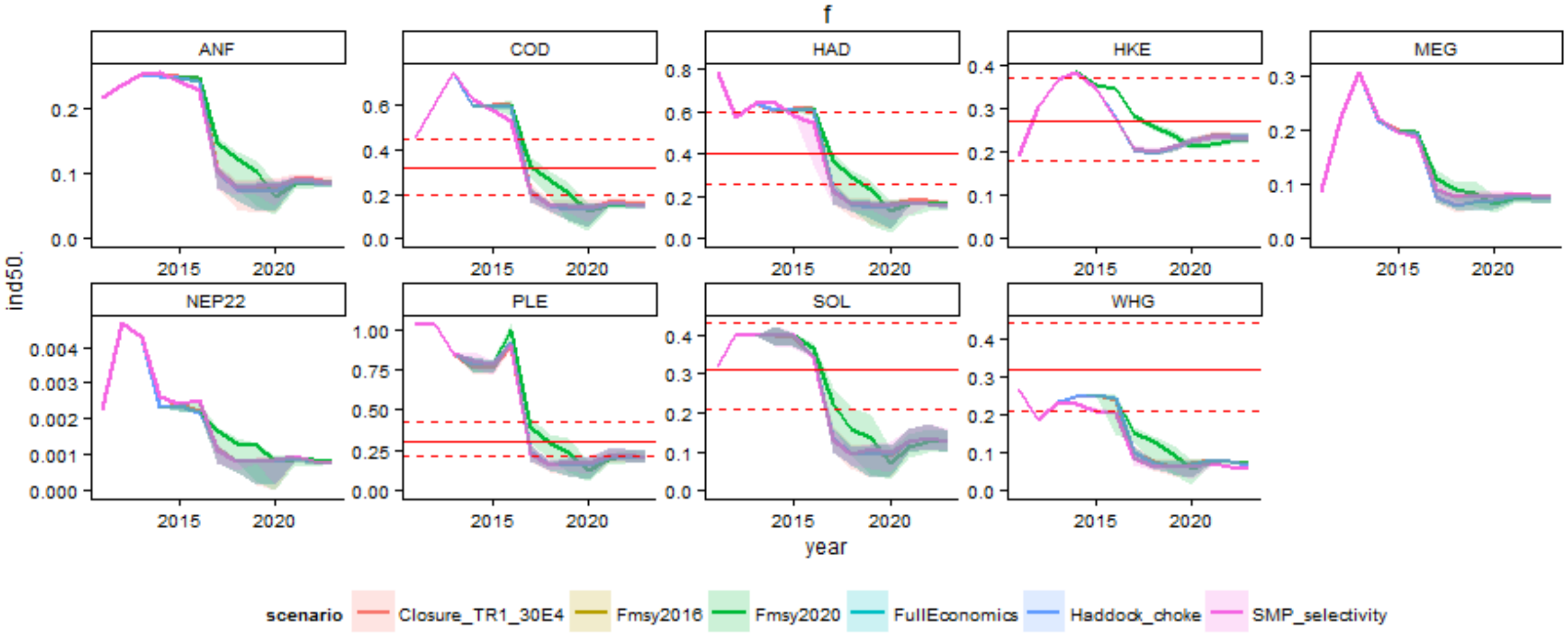




Design of scenarios: stakeholder role

- Five one day workshops involving science, industry and authorities
- Understanding the basic elements of the model, including the limitations
- Defining relevant scenarios and methods for communication of complex model outputs

Summary indicators: Biological



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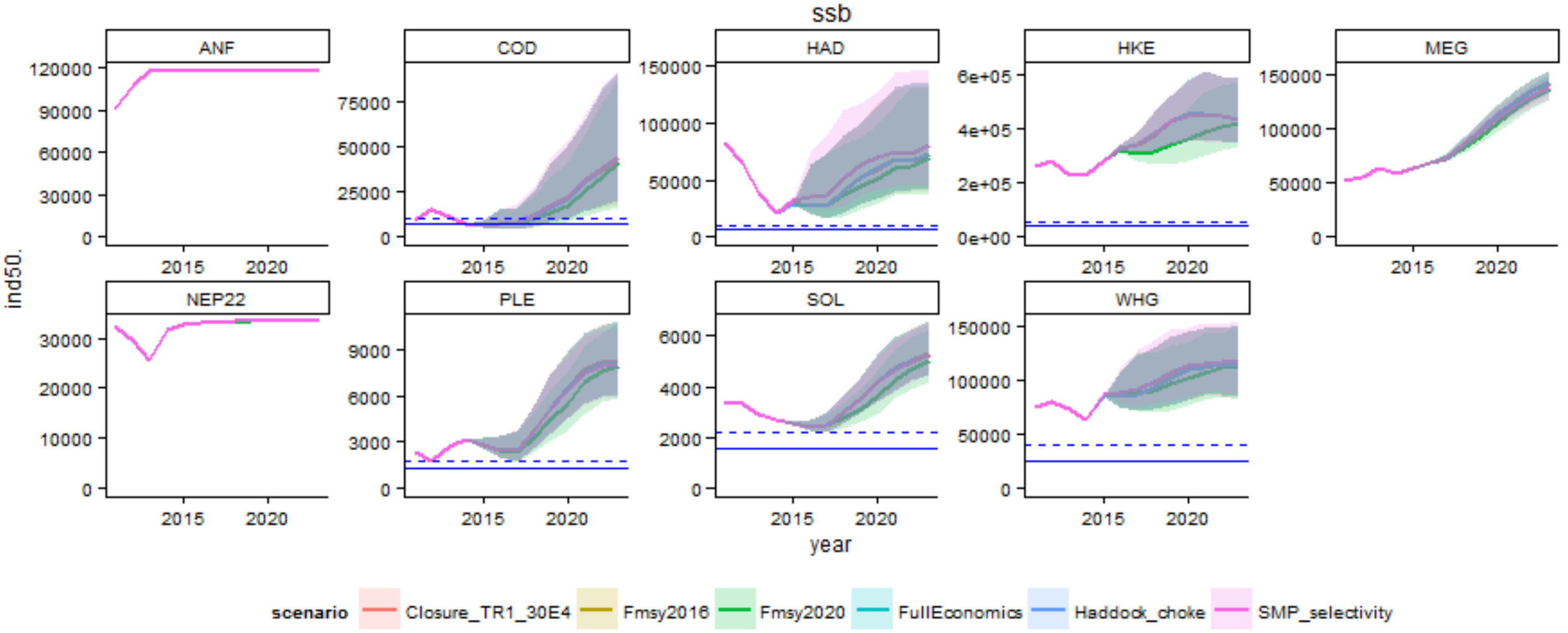

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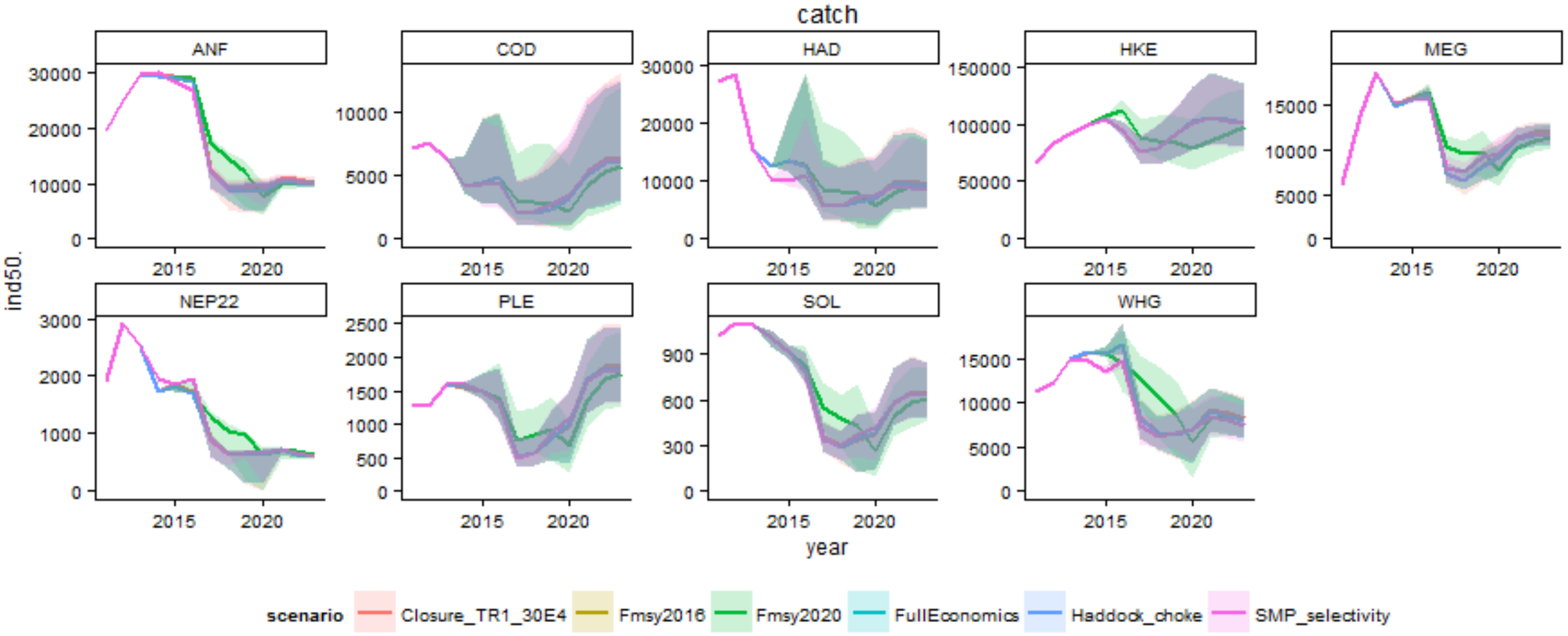
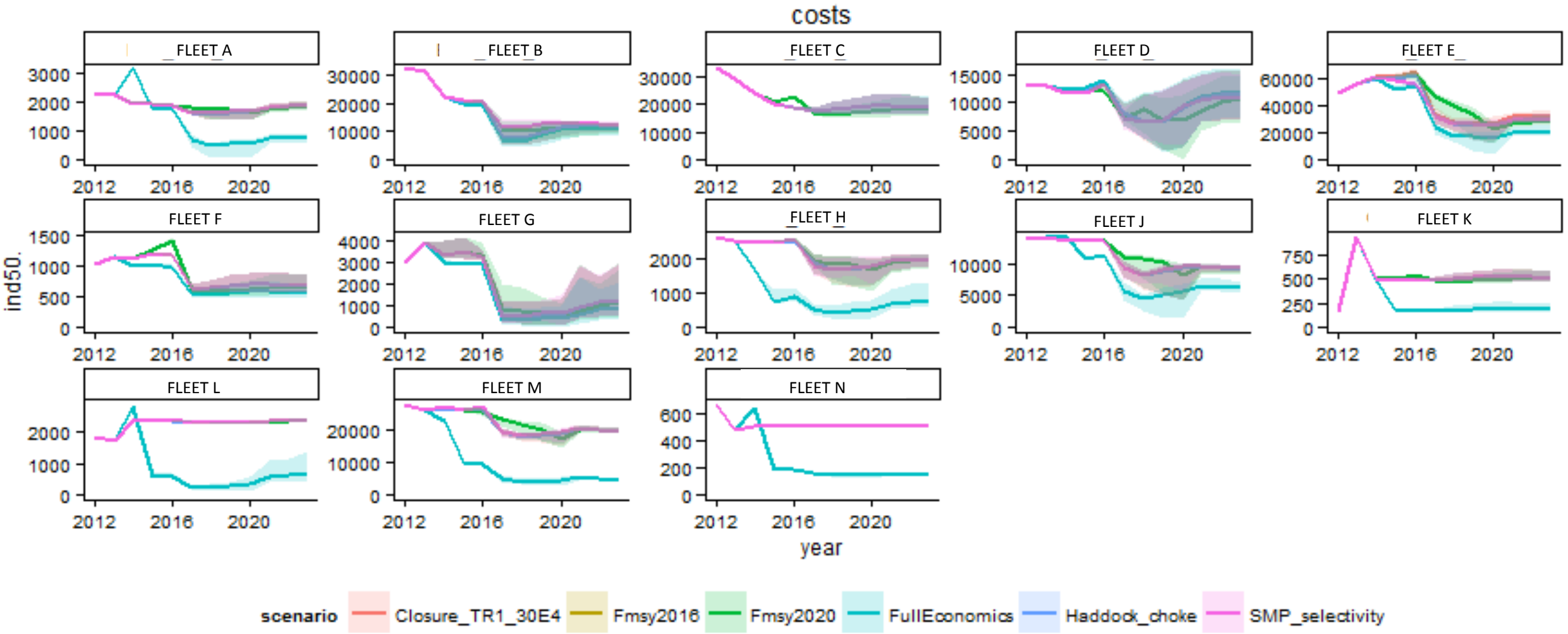


Summary indicators: Economic



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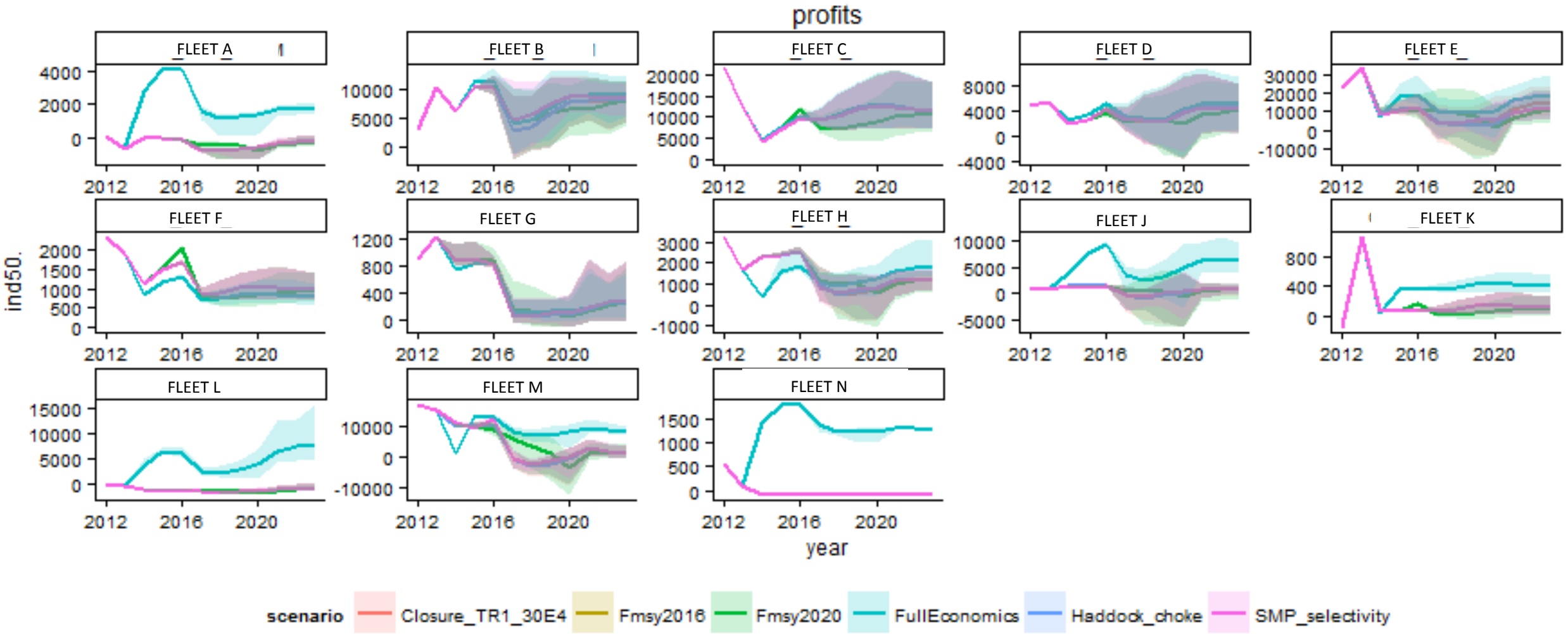
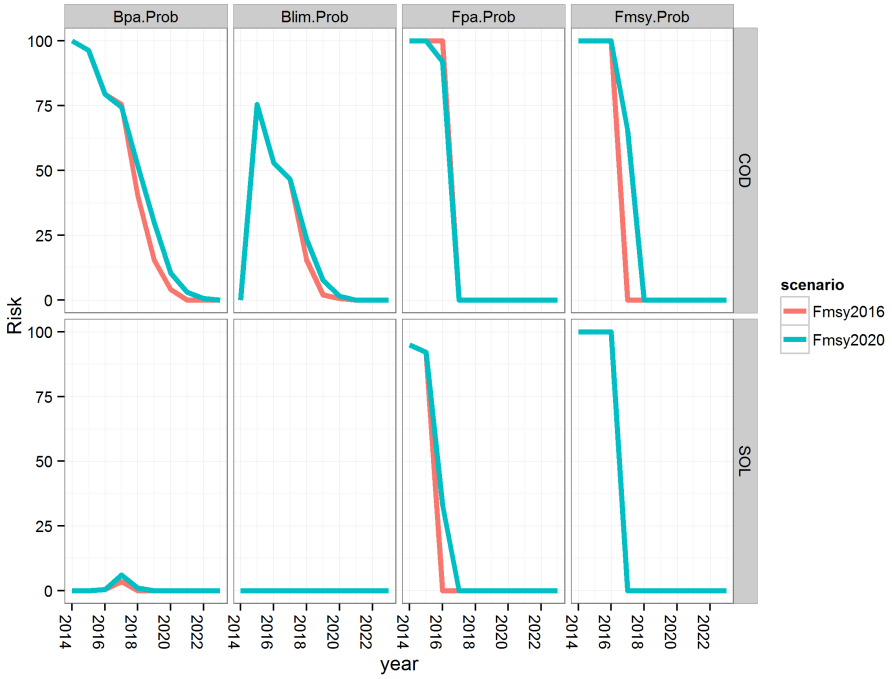
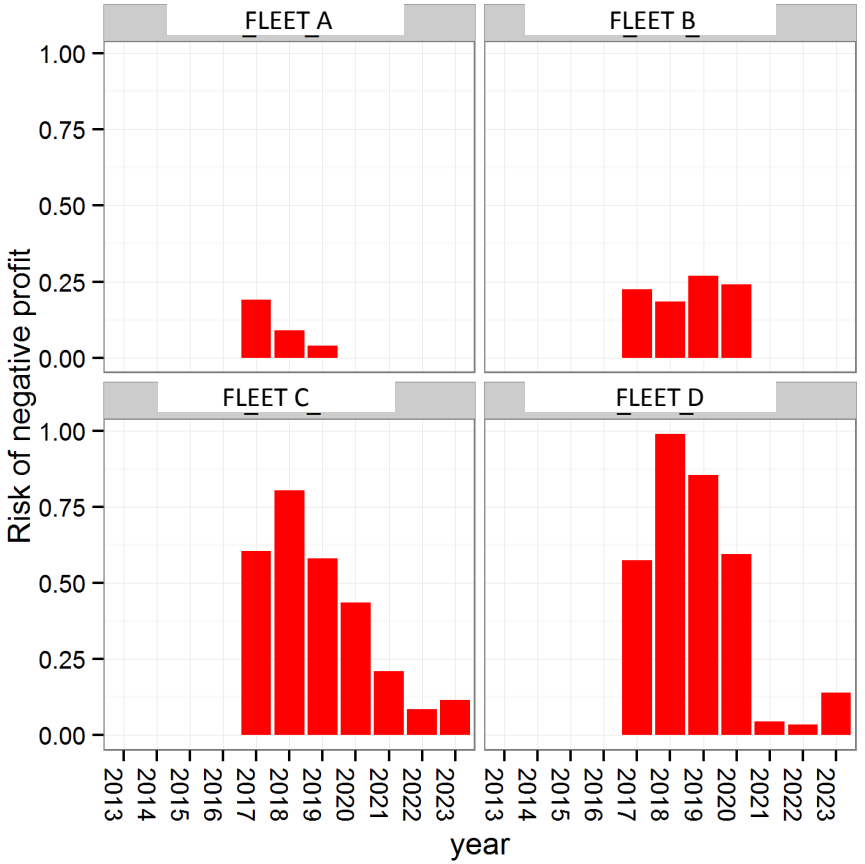
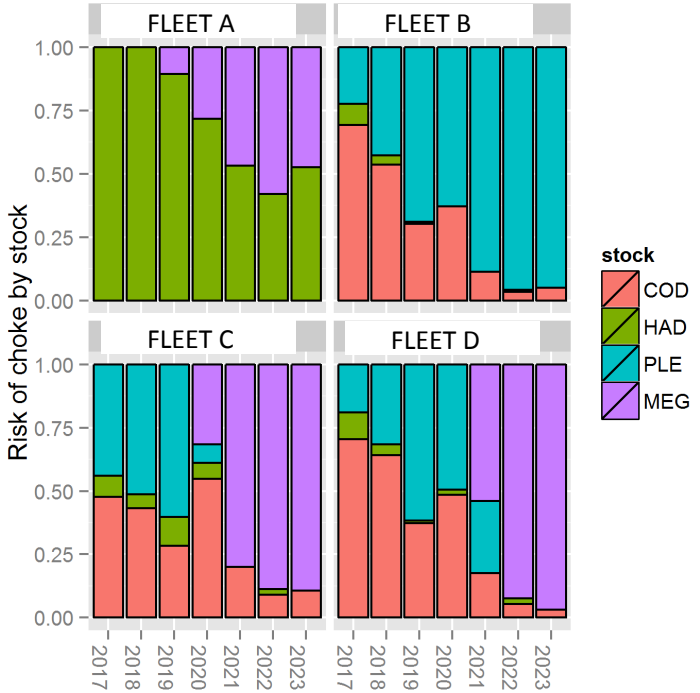


In terms of Risk







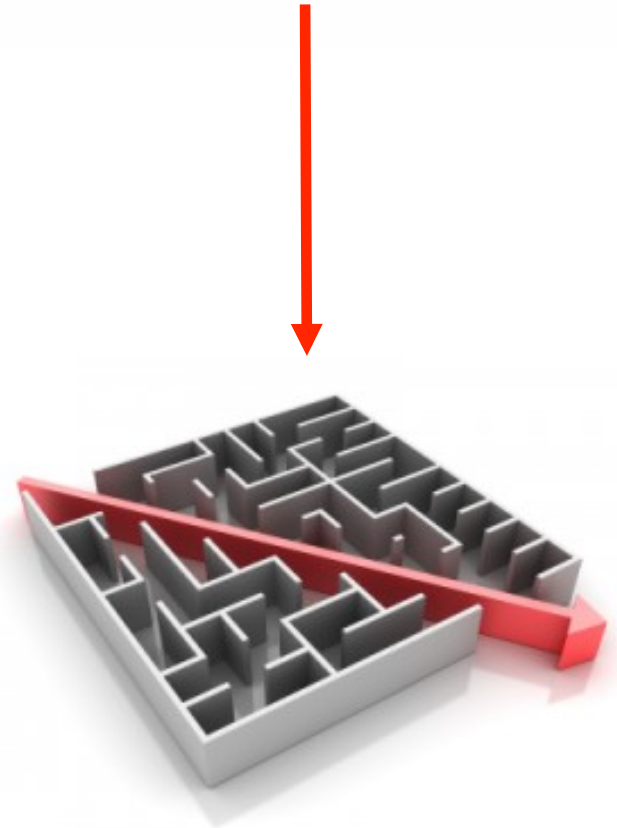
Indicators

Stock	Economic	Social
F	Costs	Capacity
ssb	Revenue	Effort
Catch/yield	Profits	employment
Rec	Price	
Risk wrt BRPs [Fpa, Blim, Bpa etc..]	Depreciation costs	
Inter-annual variability (+ - %)	Investment costs	
	BER	
	GCF	
	Fuel costs	
	Netprofit	

Visualisation/communication

- Design of ‘Shiny’ app implemented in R
- ‘Front-end’ to visualise a catalogue of model runs

- Toggle on/off indicators/scenarios/uncertainty
- Web-based (accessible)
- Pick and choose what elements you want to see



DAMARA

- About
- Dashboard
- Stock
- Fleet stock
- Fleet economics
- Summary
- Stakeholder feedback

Set your scenario options here

Landings obligation scenario

Species-year

Haddock 2016

TR1 gear configuration

Cod-end mesh

100 110 120

Square mesh panel

None

First year in plots

1980 2004 2015

1980 1984 1988 1992 1996 2000 2004 2008 2012 2015

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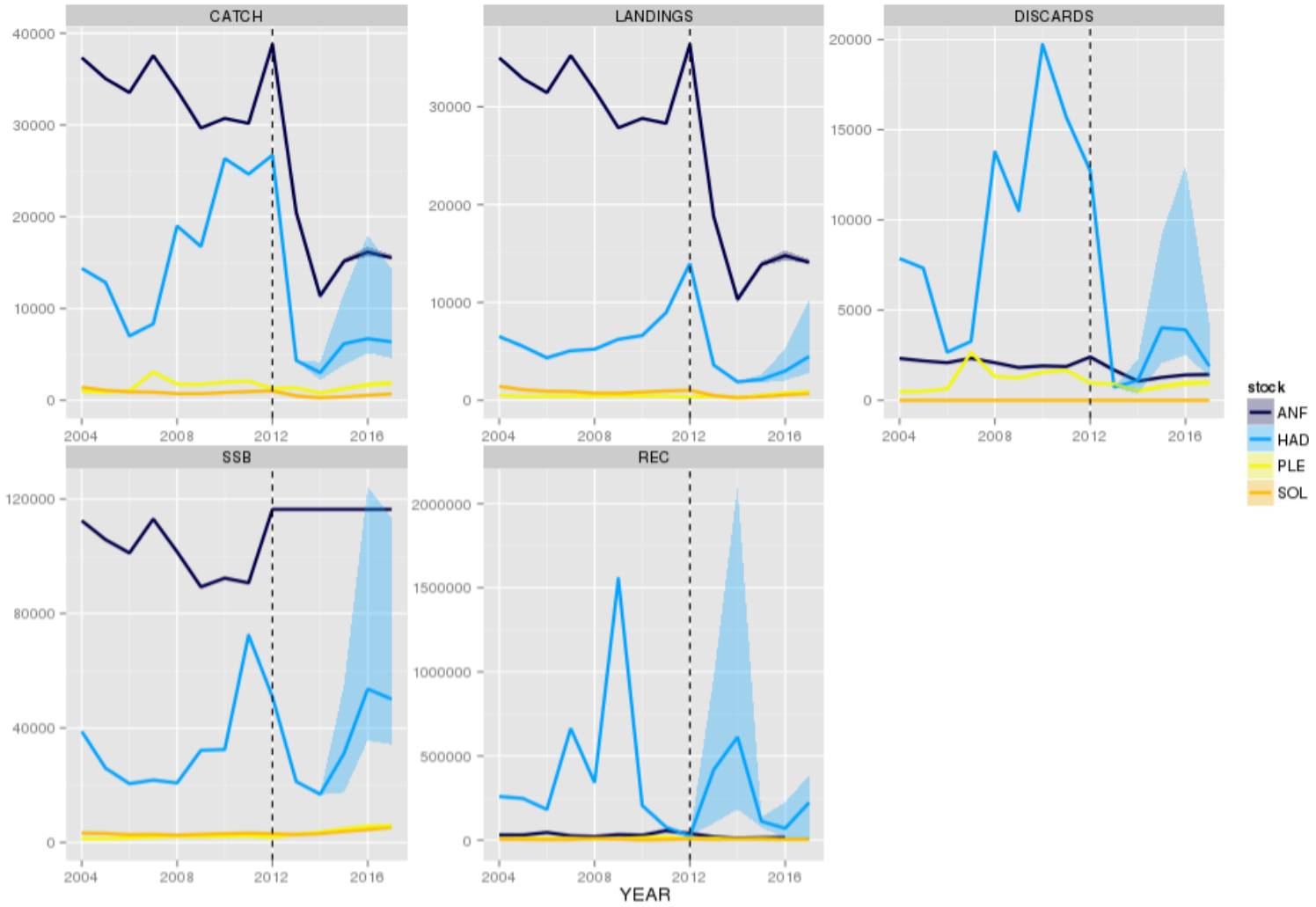
Stock-level predictions

Select stocks to display +

Select indicator to display +



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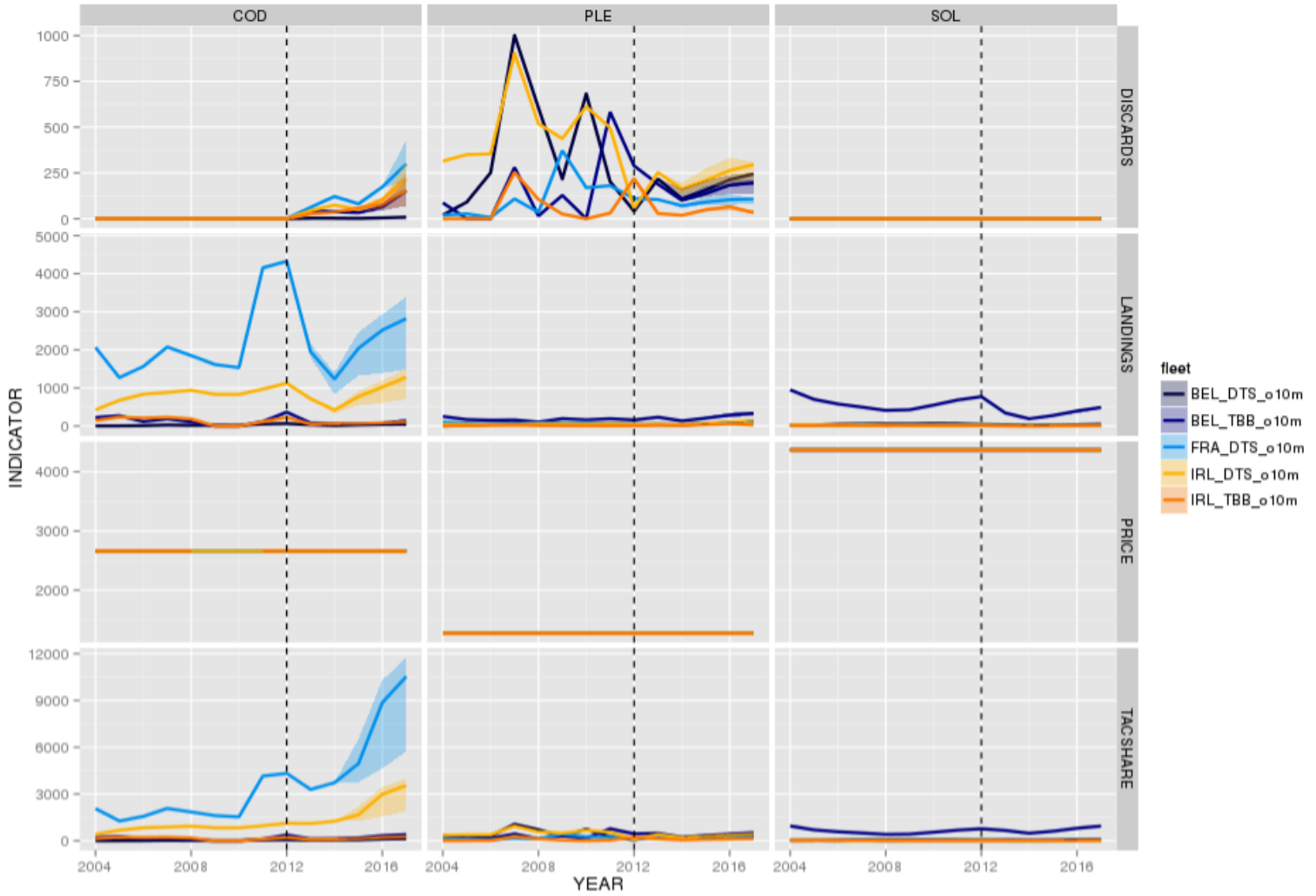
Fleet-level predictions of stock-relevance

Select fleets to display +

Select stock and indicator to display +



DAMARA

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Stakeholder feedback

User name

User name

General: Can the question 'If TAC changes by x%, what would be the consequence for the stock, economics and eventually the fleet and the metier' be answered in this tool?

Dashboard LO scenario: a page with a definition / description of each item in here could be useful to ensure the same understanding by every user.

Submit

Summary

- Design of tool to compare different management interventions for multi-stock mixed fisheries from multiple perspectives/angles
- Hugely rich in terms of outputs and indicators
- Integral stakeholder involvement in both design of scenario/ management interventions and visualisation
- Demonstrates a practical tool that can support regionally-based decision making incorporating multiple views
- Highly adaptable, depending on the data available
- Can focus on improving modelling of issues of key importance in deciding between options

Acknowledgements:

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- FLBEIA team: Dorleta García, Raúl Prelezzo, Sonia Sánchez, Marga Andrés, Agurtzane Urtizberea [@ AZTI]

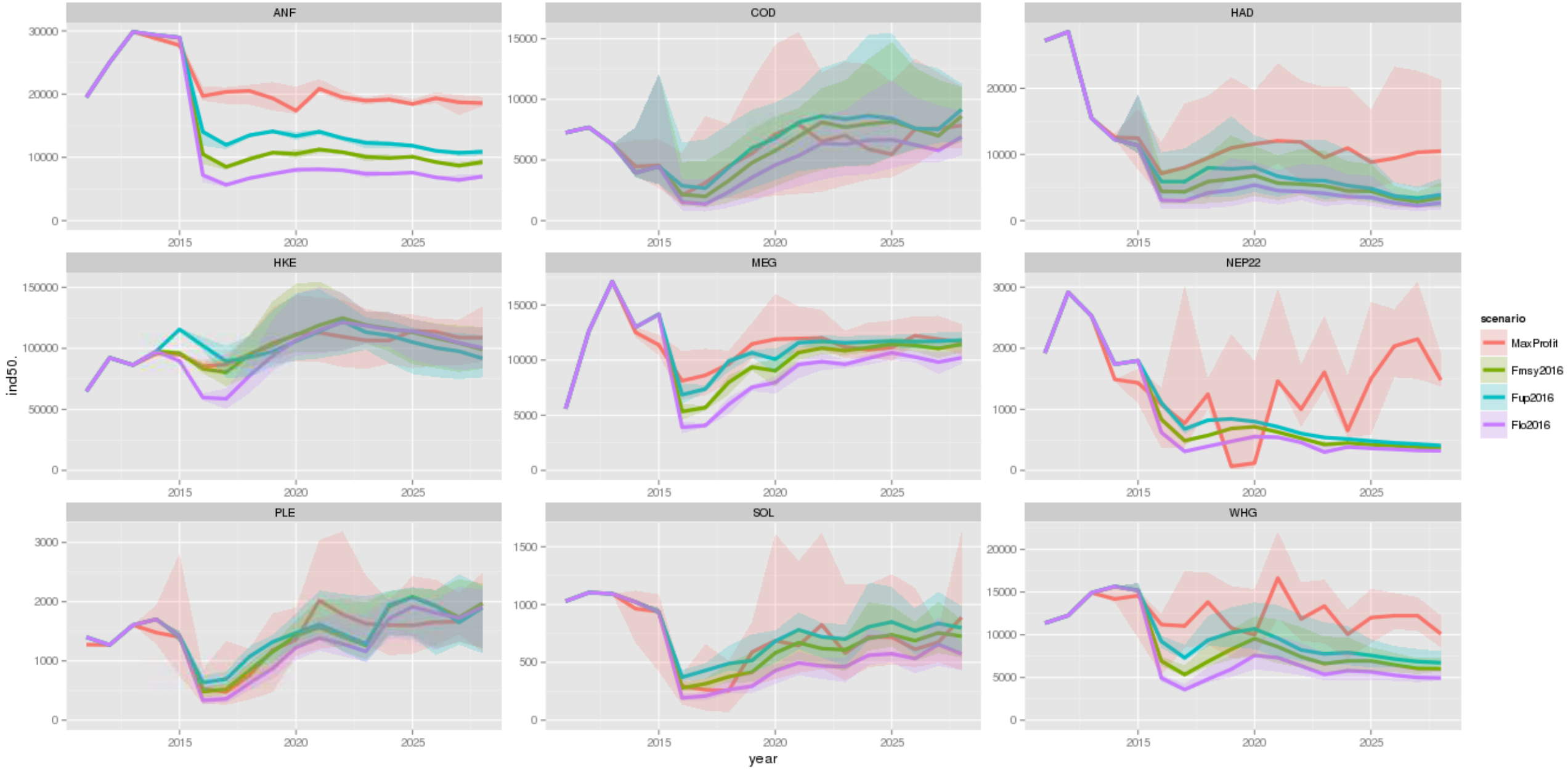
- Stakeholders: NWWAC: Jacques Pichon, Emile Brouckaert, Sean O'Donoghue, Eibhlin O'Sullivan, Barrie Deas, Paul Trebilcock

- Funding: European Commission LOT 1 MARE/2012/22

Cefas

What have we learned?

- Science, industry and authorities can jointly develop a prototype decision support tool that uses the best available information to support management decisions for the Celtic Sea
- Ongoing dialogue with key stakeholders
- Approach is also applicable to other regional seas
- Future work depends on ensuring that tools are:
  - embedded in regional governance structures
  - further developed and supported
  - involved stakeholders have a platform for further collaboration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scenario
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Fup2016
Flo2016