

# MareFrame



## WP4: Ecosystem models
























Final meeting, December 12, 2017 Brussels

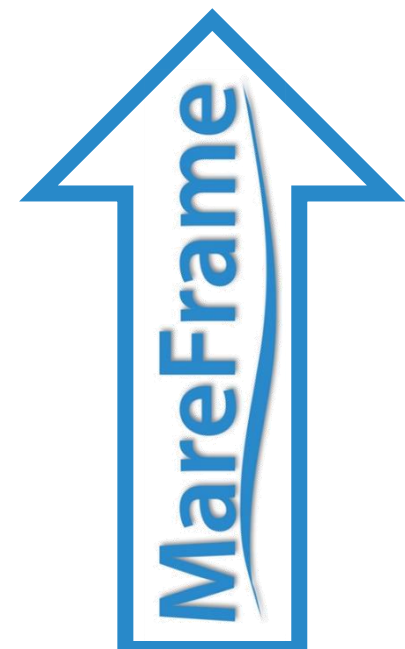
Paul Fernandes



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 613571

# "Ecosystem" & "Management": permutations

Levels	Scientific Advice	Management Framework
<b>EBM</b> Ecosystem Based Management	 Fisheries  Development  Energy  Eco Tourism  Oil & Gas  Conservation  Marine  Sanctuaries  Aquaculture  Etc	 Regional Ocean Plans
<b>EBFM</b> Ecosystem Based Fisheries Management	 Fisheries  Climate  Habitat  Predator	 Fisheries Ecosystem Plan
<b>EAFM</b> Ecosystem Approach to Fisheries Management	 Fisheries  Climate  Habitat  Predator	 Fishery Management Plan
<b>SS</b> Single Species		 Fishery Management Plan



# "Ecosystem" & "Management": permutations

MareFrame



Governance

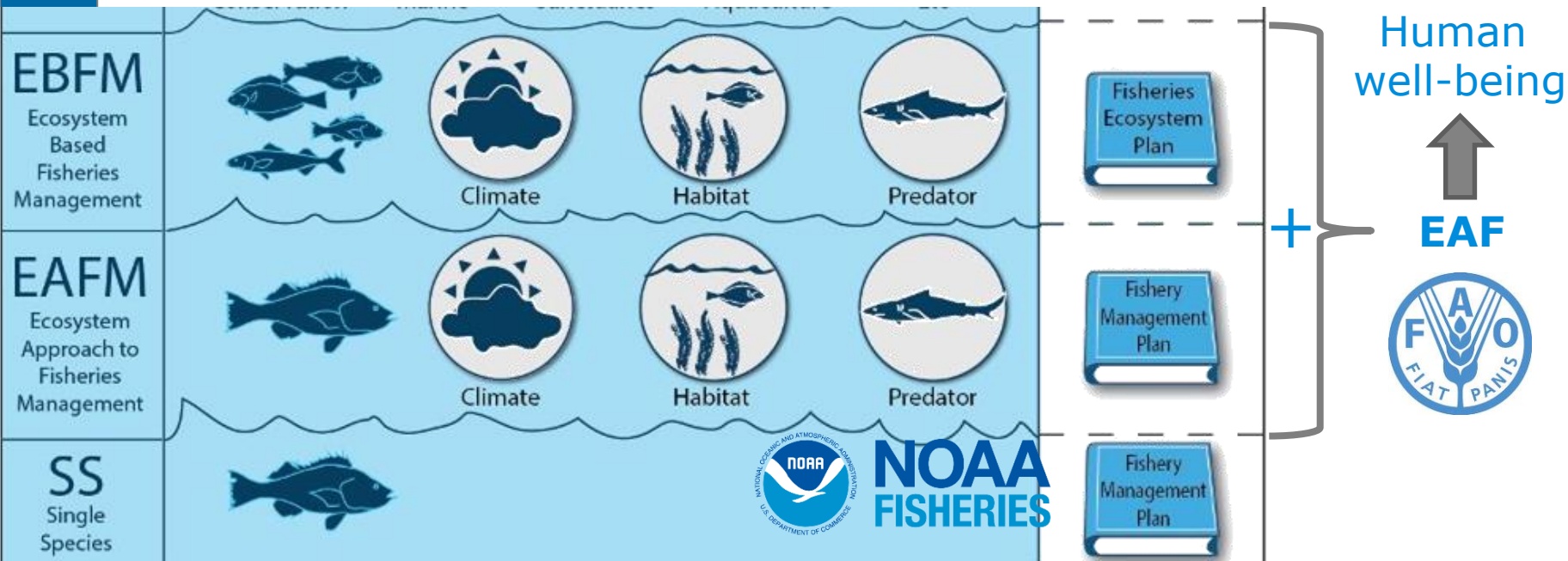
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Human well-being



EAF



# Objectives of WP4

## What were the objectives?

- **Develop Ecosystem Model processes which allow for derivation of the indicators for GES.**
- **Develop common economic and social model processes which allow for derivation of the EAF indicators.**
- **Develop common reporting procedures for model output comparison.**
- **Set up the models for forecasting scenarios to conduct virtual experiments.**
- **Develop a virtual ecosystem in Atlantis for generation of indicator data in data-poor cases.**



# Objectives of WP4

What were the objectives and how have they been met?

- Develop Ecosystem Model processes which allow for derivation of the indicators for GES. ✓ (GES descriptors 3, 4 and 6)
- Develop common economic and social model processes which allow for derivation of the EAF indicators. ✓ (social?)
- Develop common reporting procedures for model output comparison. ✓ (but model, case study and scenario specific)
- Set up the models for forecasting scenarios to conduct virtual experiments. ✓ (see DSF)
- Develop a virtual ecosystem in Atlantis for generation of indicator data in data-poor cases. ✓



# Objectives of WP4

## What were the objectives and how have they been met?

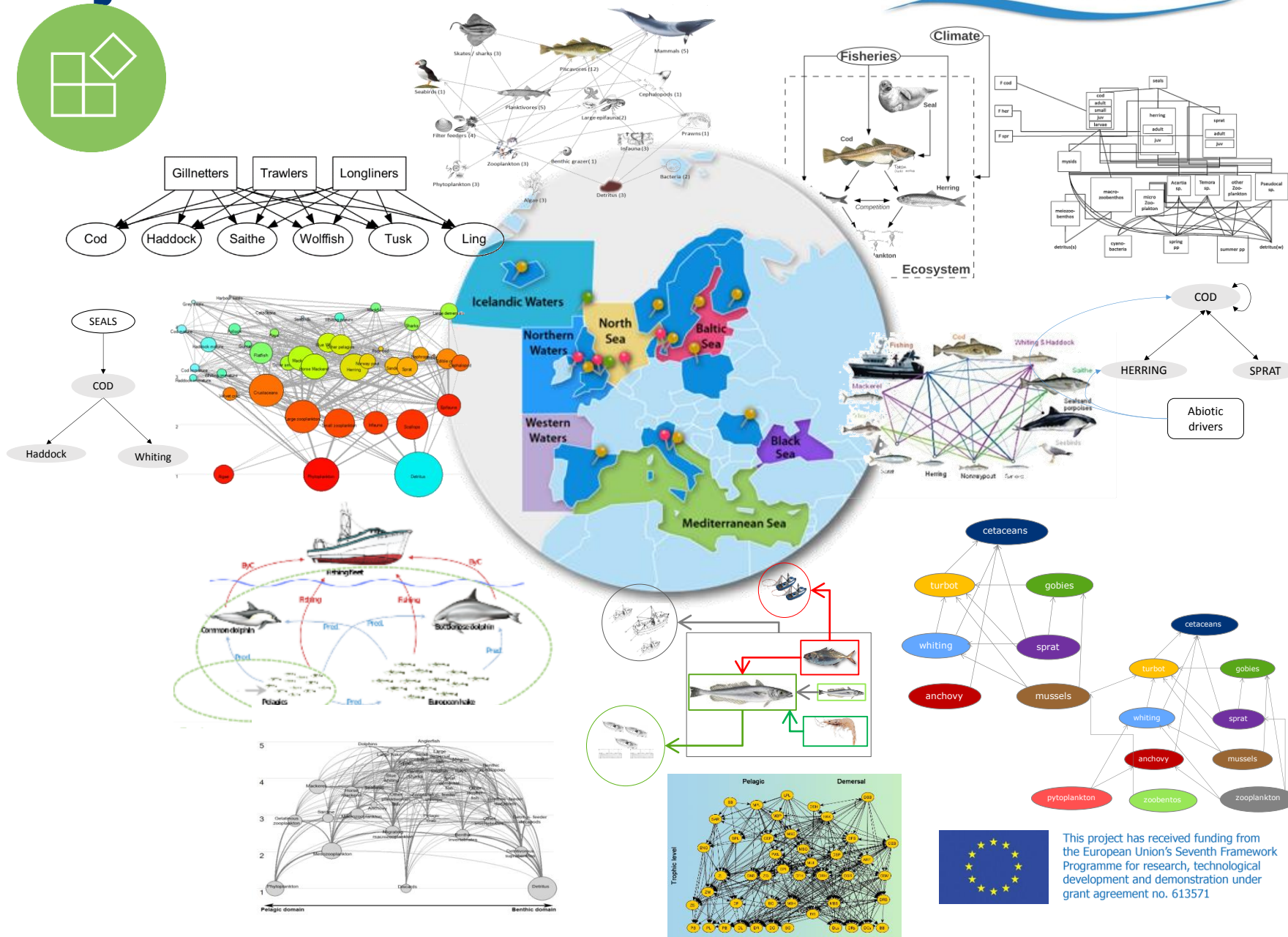
NUMBER	Deliverable TITLE	MONTH	DATE
D 4.1	Internal report: Parameterisation 1. Working model run for each case study which replicates the time series of the commercial fish species	10	Nov 2014
D 4.2	Internal report: Common reporting procedures for model output	9	Sep 2014
D 4.3	JM: Parameterisation part 2. Working model run for each case study which replicates the time series of the GES indicators	15	Mar 2015
D 4.4	JM: Comparison of the performance of two EMs with known (simulated) data	24	Dec 2015
D 4.5	JM: Parameterisation part 3. Working model run for each case study which replicates the time series of the economic and social (EAFM) indicators	24	Dec 2016?
D 4.6	JM: Parameterisation part 4. Alternative model run for each case study which replicates the time series of the commercial fish species, GES, economic and social (EAF) indicators	28	Dec 2016?
D 4.7	Atlantis model run for data-poor case study	32	Dec 2016?
D 4.8	JM: "Sex separated assessment models. A new likelihood function for sex size dimorphic species with GADGET"	32	Dec 2016?



# Objectives of WP4



# MareFrame



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## Main challenges

### Uncertainty

Model ensemble variability

Stationarity – assumes status quo ecosystem: no regime shifts,  
no major unforeseen events (e.g. major energy price increase)

Error propagation

### GES Indicators:

#1 Biological diversity – needs spatial models

#2 Non-indigenous species – data deficient

#5 Eutrophication – localized, hydrography

#7 Hydrography – coupled hydrodynamics

#8 Contaminants – contaminant modelling?

#9 Contaminants in fish – as #8 with uptake?

#10 Litter – model as a function of activity?

#11 Energy and noise – as #10 ?

### Social indicators

Employment: economic or social?

Other social indicators for human well-being





## Legacy – What now?

What are the most significant results of the project and how to make sure they will be exploited after the project end:



**New ecosystem models**



**Better understanding of models, data requirements**



**Knowledge gaps**



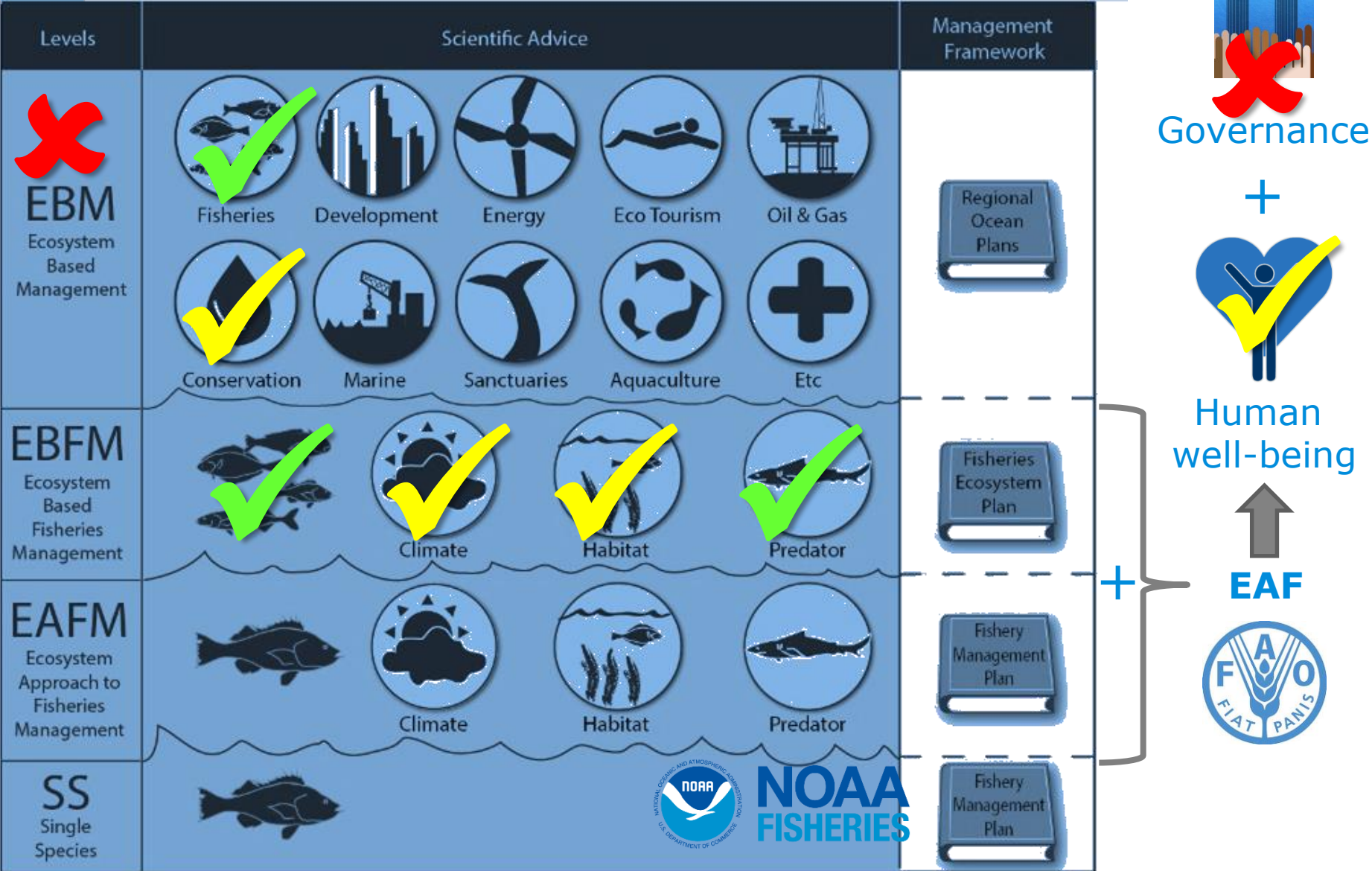
**DSF / steps towards multispecies MSE?**

**How?**

**Attend & present at ICES WG  
Climefish**



## Legacy – What now?



# Publications

## Published

1. Serpetti et al. (2017). Impact of ocean warming on sustainable fisheries management informs the Ecosystem Approach to Fisheries. Nature Comms.
2. Rincon et al (2015). The economic value of environmental data: A notional insurance scheme for the European anchovy. IJMS.
8. the example of West Scotland fisheries?
9. Fallon et al Towards ecosystem-based fisheries management: Modelling multispecies interactions between grey seals and demersal fish species in the West of Scotland.
10. Rincón et al. Granger-causality analysis of integrated-model outputs, a tool to assess external drivers in fishery.

## MAREFRAME Scientific conference:

1. Pope, J. A swift transportable and User Friendly Multispecies Model of the North Sea that describes the main tradeoffs involved in an Ecosystem Approach to Fisheries Management (EAFM).
2. Colloca et al. A Gadget multispecies model to explore the fisheries management implications of prey-predator interactions in the Strait of Sicily trawl fishery.
3. Elvarsson et al , Using Gadget in a multi-criteria analysis of the Icelandic cod fishery Gadget.
4. McGregor et al, Spawning stock recruitment when natural mortality is dynamic: a proposed solution for ecosystem models.
5. Saavedra et al Cetacean fishery interactions: A multi-species model for ecosystem management in Atlantic waters of the Iberian Peninsula.
6. Fernandes et al. The future of European Fisheries under sustainable management.
7. Baudron et al Can the Common Fisheries Policy achieve Good Environmental Status in exploited ecosystems:
11. Corti et al. Benchmarking the ability of different stock-assessment models to capture the highly-fluctuating dynamics of small pelagics.
12. Sturludottir et al. Ecosystem model of Icelandic waters using the Atlantis modelling framework.
13. Sinerchia et al. Simulating the effect of alternative management solutions in the mixed fisheries of the Strait of Sicily using the Atlantis end-to-end ecosystem model.
14. Pope et al. Comparing the Steady State Results of a range of Multispecies Models between and across the geographical areas considered by the MareFrame Project using a Jacobian matrix approach.
15. Pope et al. A time varying extension to the Charmingly Simple Model of the North Sea that can fit tropic level data.

