



Marine Ecosystem Restoration  
in Changing European Seas

3<sup>rd</sup> MERCES annual meeting 2019  
21<sup>st</sup> - 24<sup>th</sup> May, Paris

# Determination of ecological effects of restoration using dynamic food web modelling



Photo: Tobias Dolch



<https://www.kelpex.org>

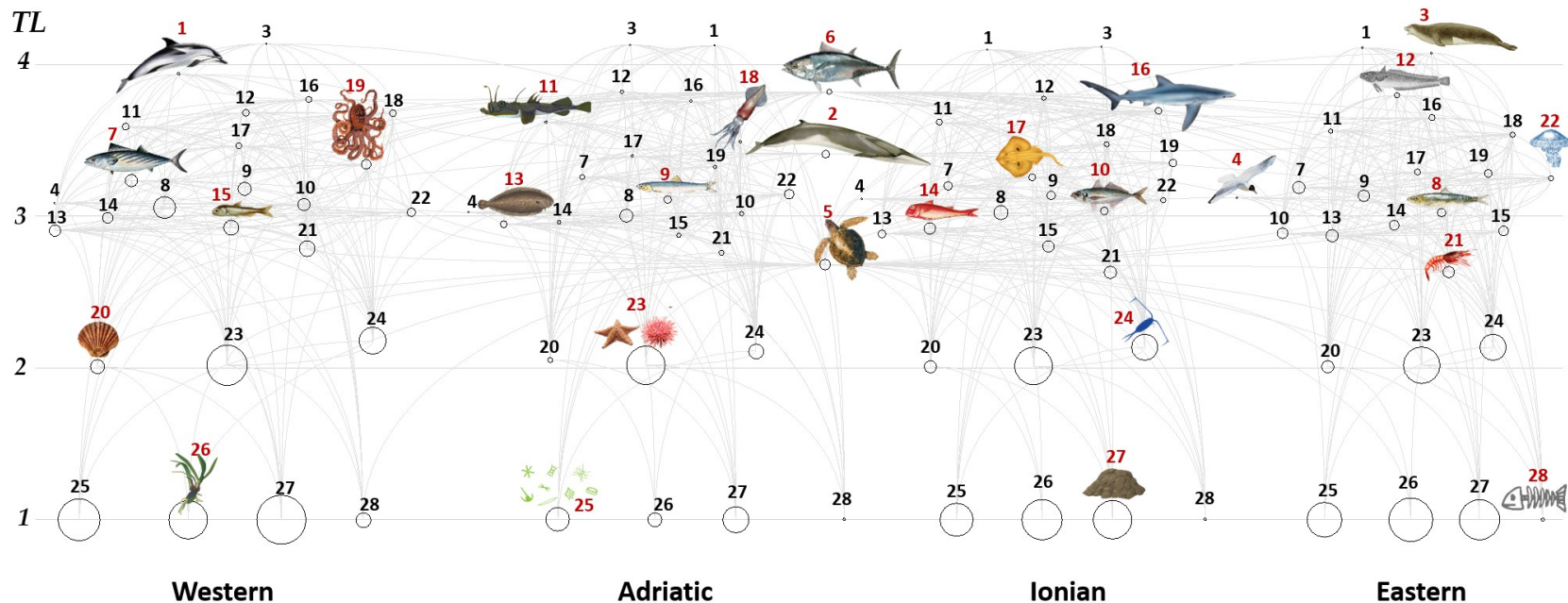


<http://agricultura.gencat.cat>

Sabine Horn & Marta  
Coll

# Food web modelling

- Quantitative ecological modelling
- Holistic approach
- Tracks path of energy through the food web components
- Different applications → Ecopath with Ecosim
- EwE requires relatively few input data
- Dynamic model
- Includes environment and human activities



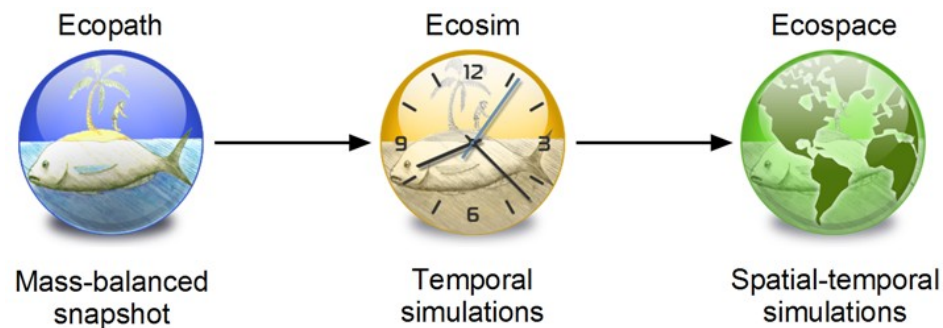
# Ecopath with Ecosim

## Three major components

Ecopath: static mass-balanced model

Ecosim: temporal dynamics

Ecospace: spatial-temporal dynamics




## Additional modules

Ecotracer contaminant tracing

'Searches' Fishing Policy, MPA, Monte Carlo, MSE, ...

Plug-ins Indicators, Uncertainty, ...

An underwater photograph showing a dense meadow of seagrass in the Wadden Sea. The water is a clear, light green color. The seagrass blades are long, thin, and green, with some brownish stems visible. The perspective is from within the meadow, looking slightly upwards and to the right.

# Seagrass meadows in the Wadden Sea

Photo: Patrick Polte

# The Wadden Sea

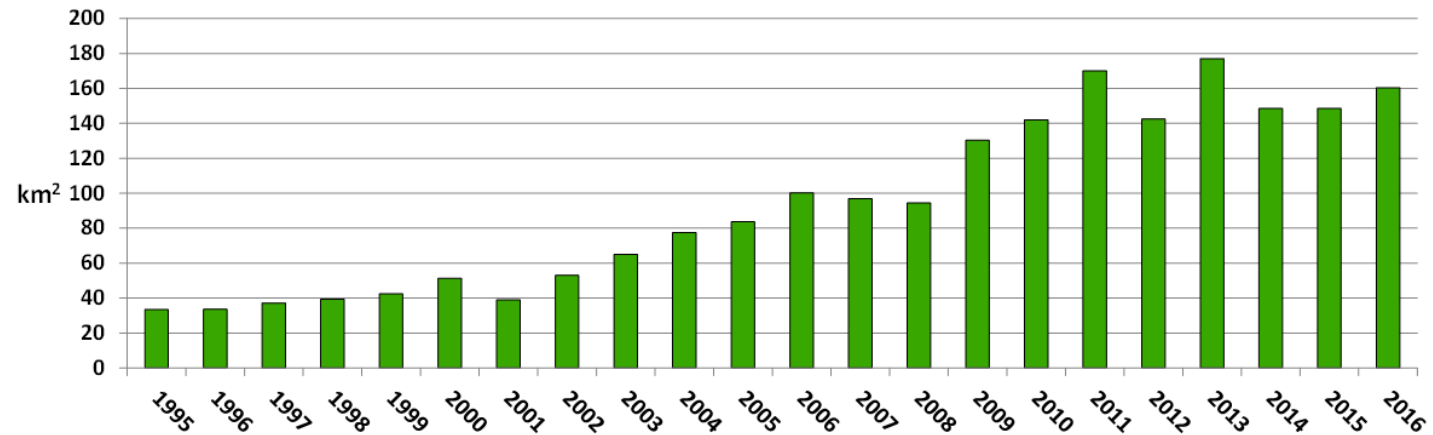


- Largest connected intertidal wetland of the world
- World Heritage Site
- Two species of seagrass: *Zostera noltei* and *Zostera marina*
- In northern part of the Wadden Sea steady increase of seagrass meadows since 90s

**How does increase of seagrass meadows influence ecosystem?**



Photo: Tobias Dolch

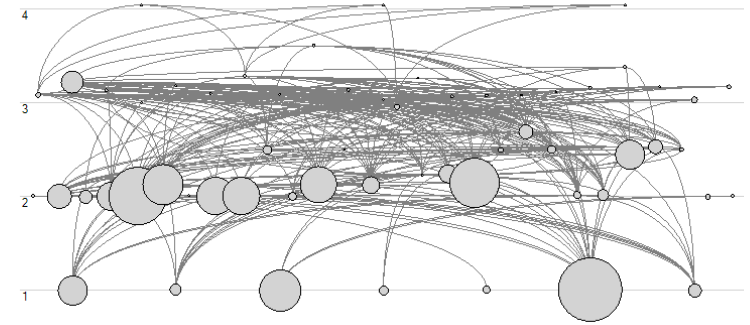


# Wadden Sea food web models



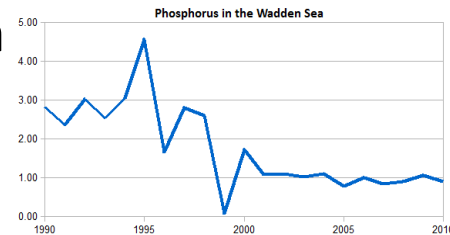
Sylt-Rømø Bight: 1990, 2007, 2010

Norderaue tidal basin: 2015  
(reference site)

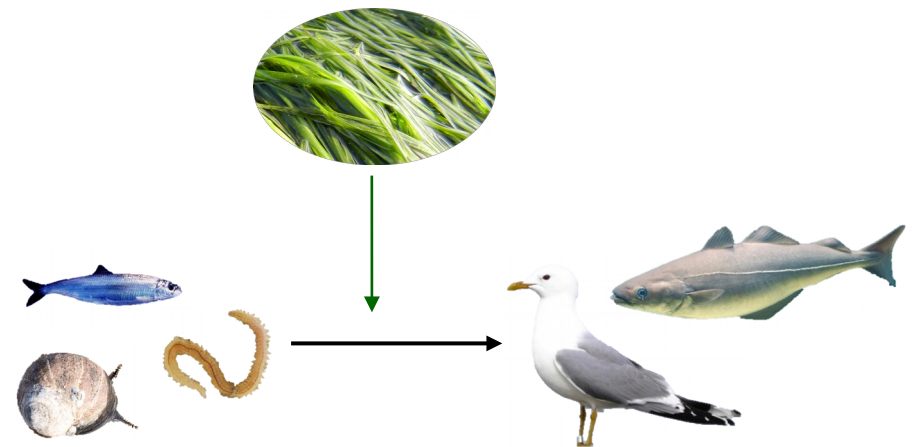


## Time series

- seagrass
- herbivorous birds
- fish species
- phytoplankton
- nutrients
- temperature

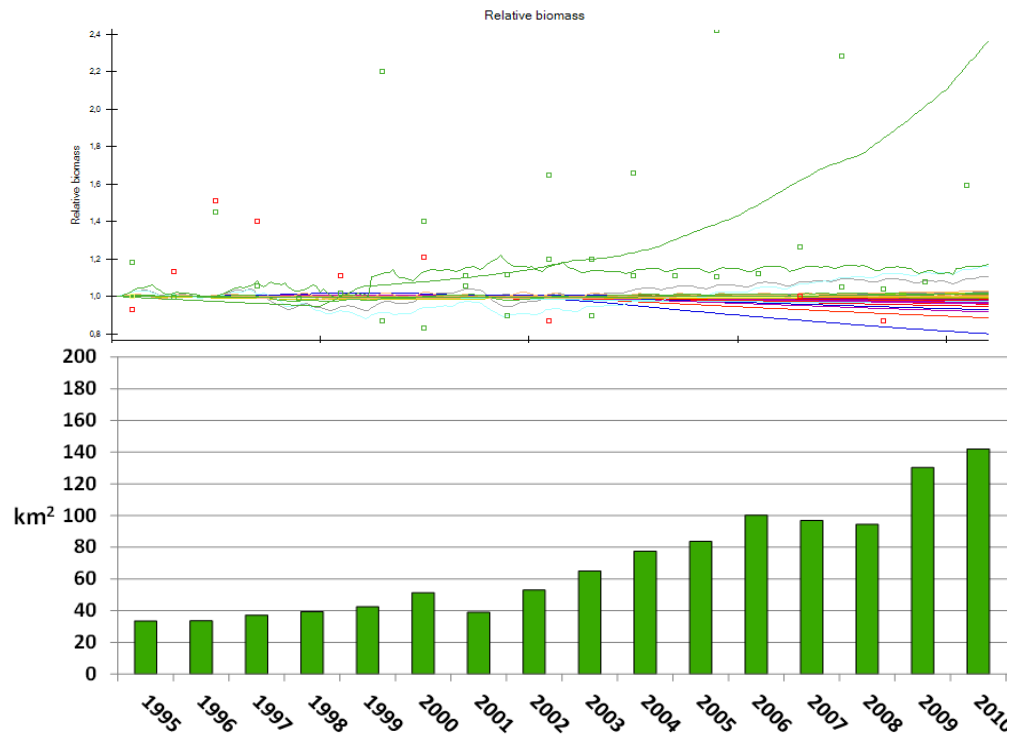


## Mediation function



# Aims of approach

- How does ecosystem change over time with an increase in seagrass meadows?
- Effects of seagrass meadows on
  - species hiding in the seagrass meadow
  - species predating on inhabitants of seagrass meadow
  - consumers of seagrass





**Kelp belts in Arctic  
Norway**

<https://www.kelpex.org>



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# Coastal areas of the Mediterranean Sea

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# Forecast

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- Dynamic food web models showing influence of restoration efforts
- Assessment of restoration efficiency
- Influence of restoration on elected ecosystem services



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# Thank you!

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 **CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

 Ecopath  
International  
Initiative

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