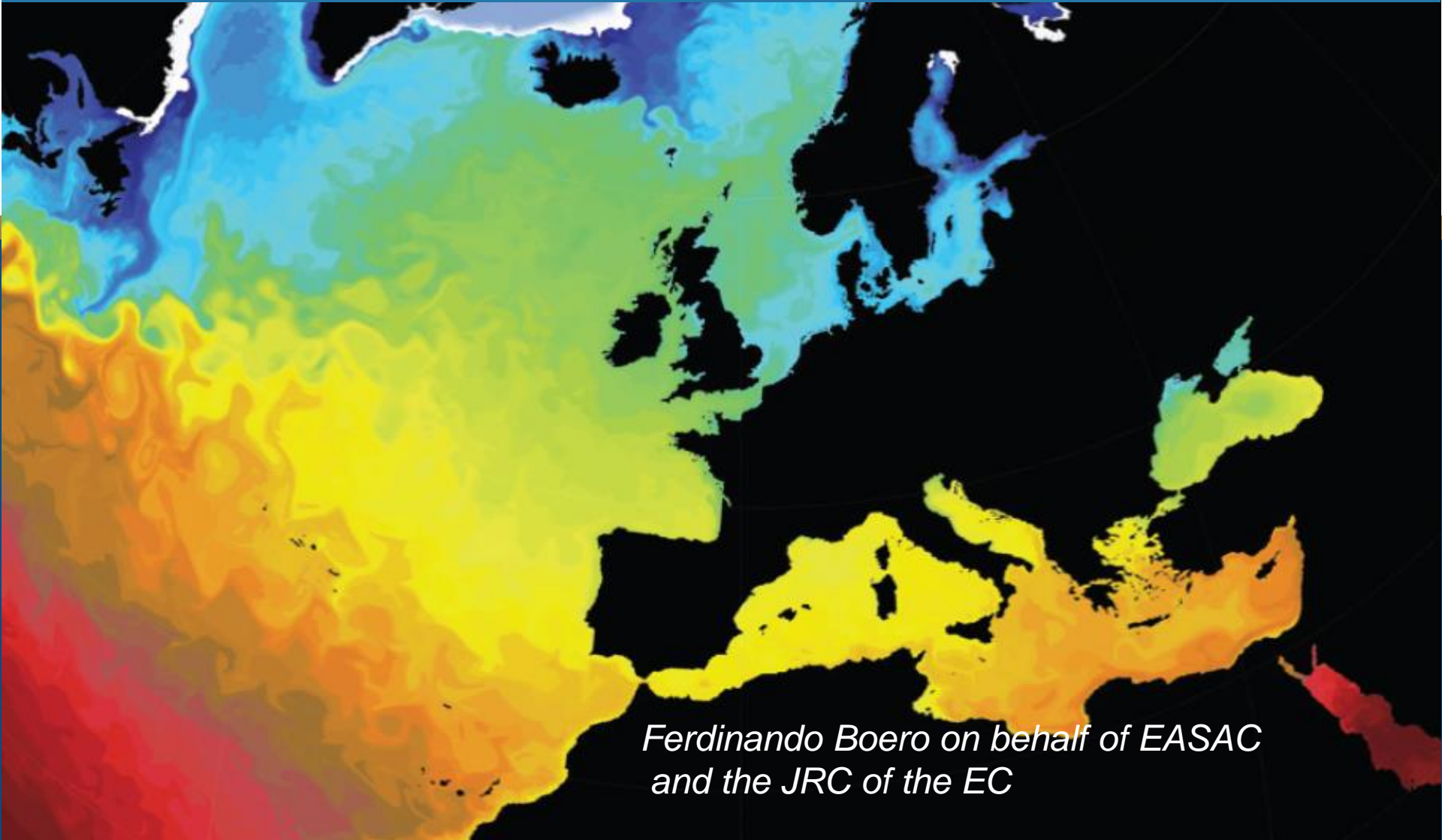


# Marine sustainability in an age of changing oceans and seas



*Ferdinando Boero on behalf of EASAC  
and the JRC of the EC*

# What is EASAC?

- Collective voice of the National Academies of Science of the EU member states
- Source of independent scientific advice for policy-makers in the European institutions
- National Science Academies in the EU:
  - Networks of scientific excellence
  - Shared task of science-based policy advice

# EASAC membership

- The **25 national science academies of EU** member states (there are no national science academies in Malta, Luxemburg or Cyprus)
- Also, by explicit vote, the national science academies of **Norway** and **Switzerland**
- The pan-European Academy of Science: **Academia Europaea**
- The association of all academies in geographical Europe, **ALLEA**
- Observer status of **FEAM**, the association of EU Academies of Medicine



# EASAC part of global network of science academies, the IAP *(The InterAcademy Partnership)*



Asia



Europe

America

Africa

# EASAC - What does it do ?

- “Science for policy”: use of scientific evidence to guide EU policy making (i.e. not “policy for science”)
- Detailed analysis and recommendations from Europe’s most respected scientists (mostly in the format of EASAC reports and statements)
- Publications are designed for a policy-oriented audience, not only other scientists
- Efficient and timely manner of offering science-based analysis and advice for policy and the public



# Addressing global challenges



**Biosciences** (e.g. *Using crop genetic improvement technologies for sustainable agriculture*)



**Environment** (e.g. *The current status of biofuels: their environmental impacts and future prospects*)



**Energy** (e.g. *Concentrating solar power: potential contributions to a sustainable energy future*)

# Recent journal publications

- «Frankenvirus», bientôt l'épilogue?, Le Monde, April 2016

- Genetic gain of function, Nature, October 2015

- Antimicrobial Innovation, Nature Reviews, Oct 2014

- Time to settle the synthetic controversy, Nature, May 2014

- How should we tackle the global risks to plant health?  
in Plant Science, April 2014

*Le Monde*

Trends in  
Plant Science

- What do we need to do to tackle antimicrobial resistance? The  
Lancet Global Health, November 2013

THE LANCET

- Europe should rethink its stance on GM crops,  
June 2013

nature

- Academies urge action on carbon capture,  
Research Europe, June 2013

Research  
Europe

# Some recent EASAC output

- Greenhouse gas footprints of different **oil feedstocks** (April '16)
- **Marine sustainability** in an age of changing oceans and seas (Jan '16)
- Commentary on "**Circular Economy**" (Nov '15)
- "**Gain of Function**" (in virology) (Oct '15)
- **New Breeding Techniques** (July '15)
- Ecosystem services, agriculture and **neonicotinoids** (March '15)
- **Shale gas extraction**: issues of particular relevance to the European Union (Nov '14)
- **Antimicrobial drug discovery**: greater steps ahead (Oct '14)
- European **Space Exploration**: Strategic Considerations of Human versus Robotic Exploration (September '14)



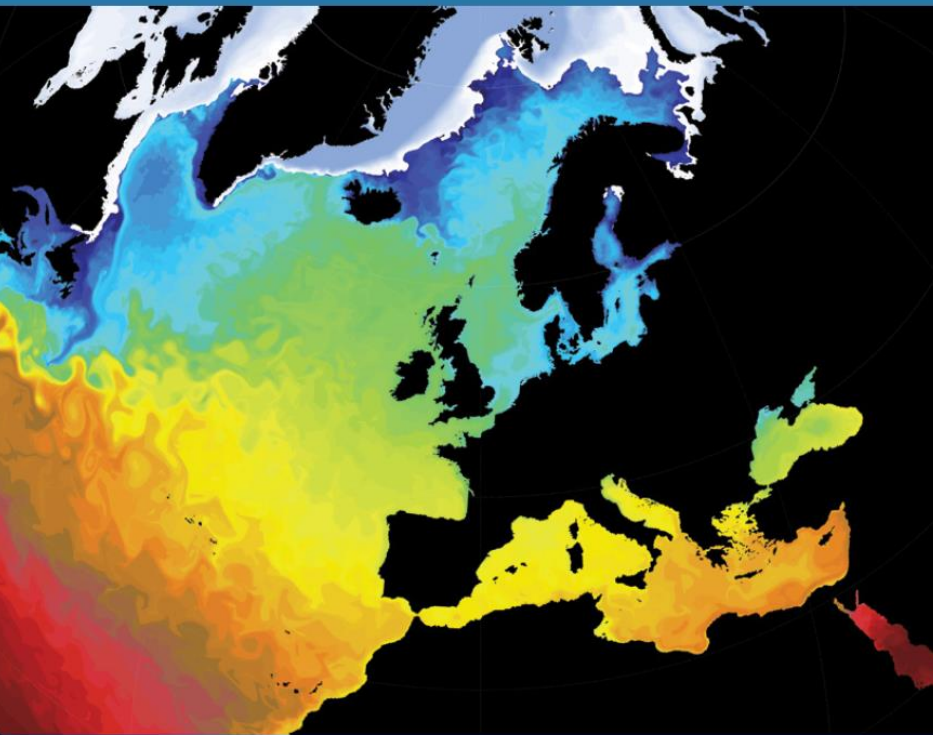
# Marine Sustainability

## Membership of the Working Group

- Jörn Thiede – Germany/Russia (Chair)
- Gerhard Herndl - Austria
- Ondrej Prášil - Czech Republic
- Tarmo Somere - Estonia
- Jorma Kurparinen - Finland
- Philippe Cury - France
- Ulrich Bathmann - Germany
- Costas Synolakis - Greece
- Maoz Fine - Israel
- Ferdinando Boero - Italy
- Algimantas Grigelis - Lithuania
- Peter Herman - The Netherlands
- Dag Aksnes – Norway
- Ricardo Serrão Santos - Portugal
- Mata Estrada - Spain
- Geoff Boxshall - United Kingdom
- Maria Betti - Joint Research Centre



# Marine sustainability in an age of changing oceans and seas



Report by the European Academies' Science Advisory Council (EASAC)  
and the Joint Research Centre (JRC) of the European Commission

EASAC policy report 28

January 2016



Launch event in Brussels

25 January 2016



# THE BIBLE

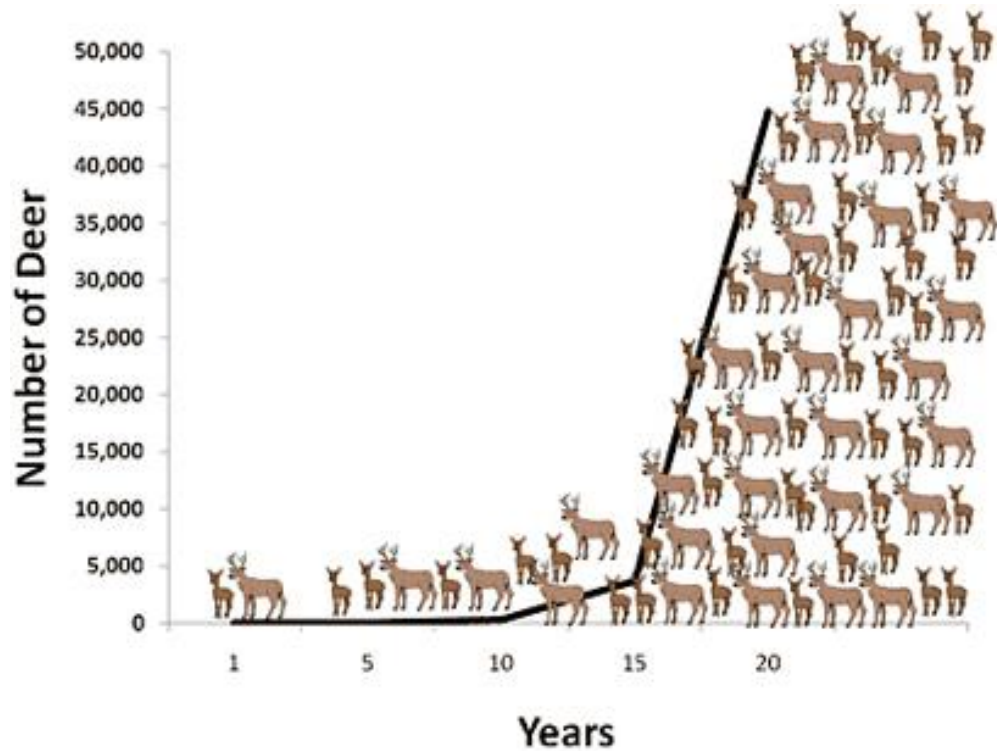


And the Lord God took the man and put him into the garden of Eden to dress it **and to keep it.**

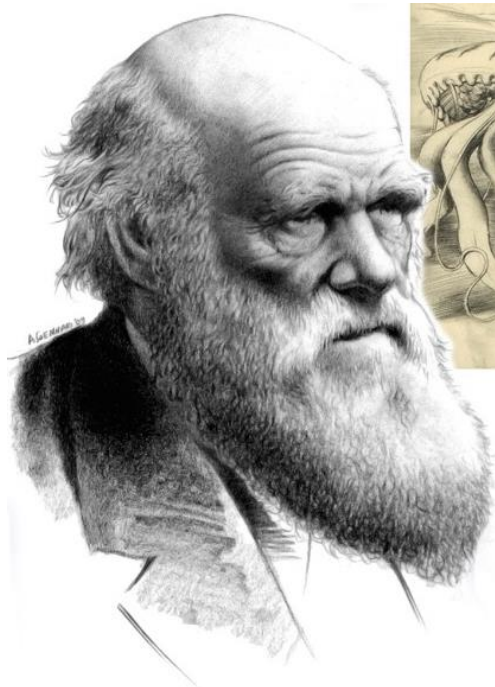
*Genesis 2:15*

# MALTHUS

- all plants and animals are tending to increase at a geometrical ratio

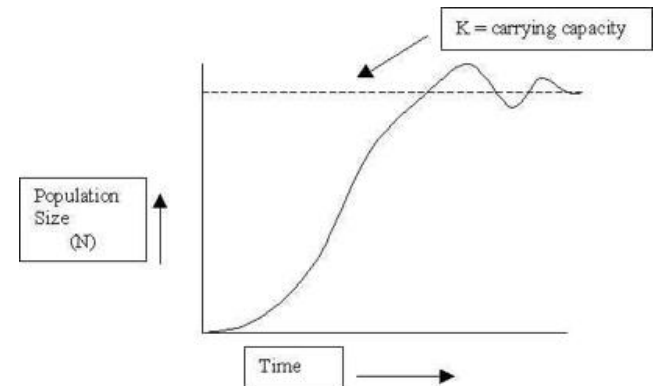
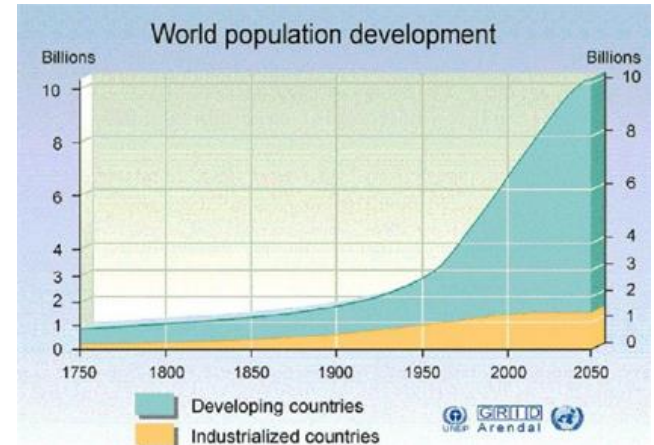


# DARWIN

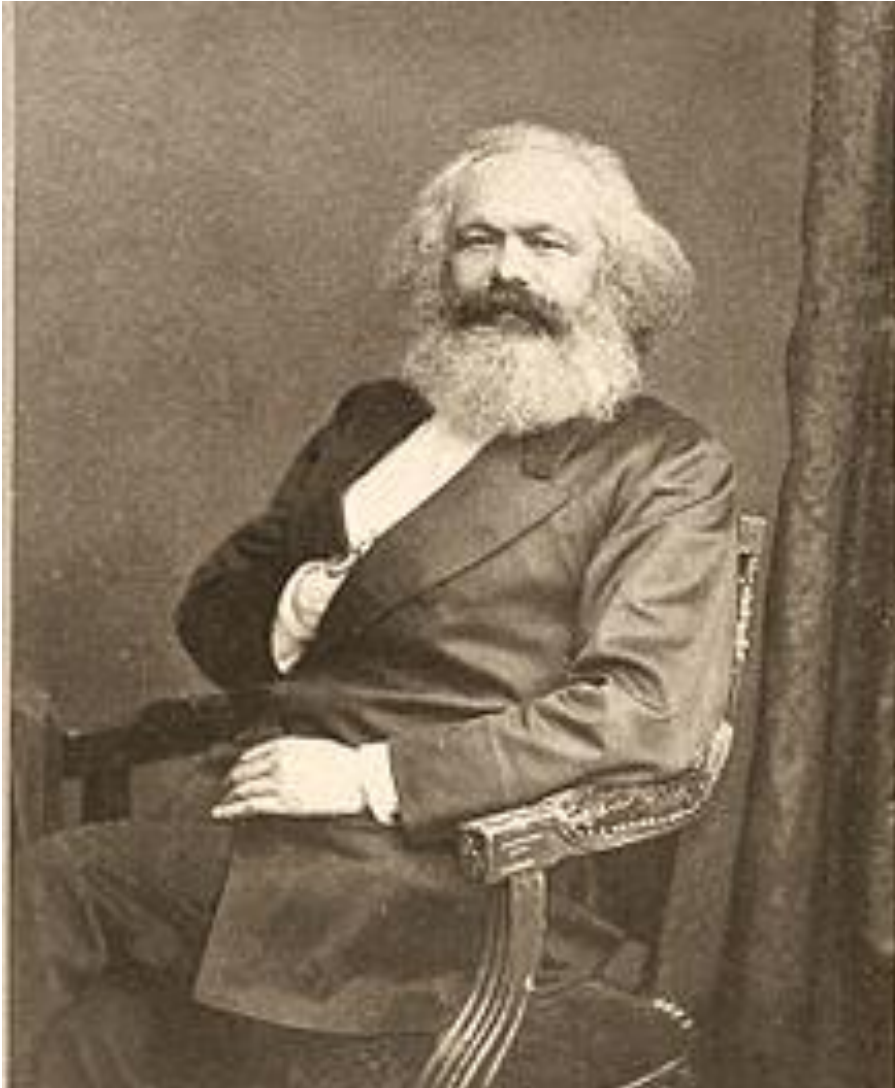


• Although some species may be now increasing, more or less rapidly, in numbers, all cannot do so, for the world would not hold them.

• Even slow-breeding man has doubled in twenty-five years, and at this rate, in a few thousand years, there would literally not be standing room for his progeny.



# MARX



Even an entire society, a nation, or all simultaneously existing societies taken together, are not the owners of the earth. They are simply its possessors, its beneficiaries, and have to bequeath it in an improved state to succeeding generations

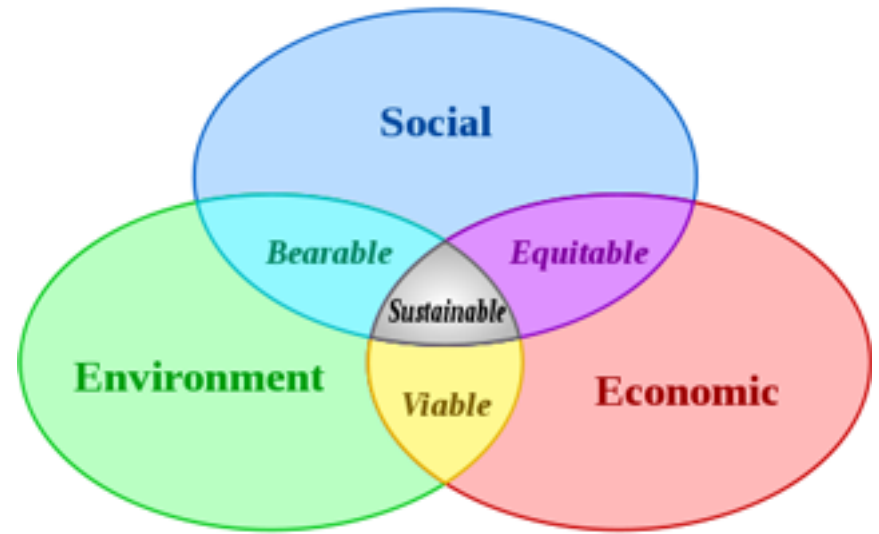
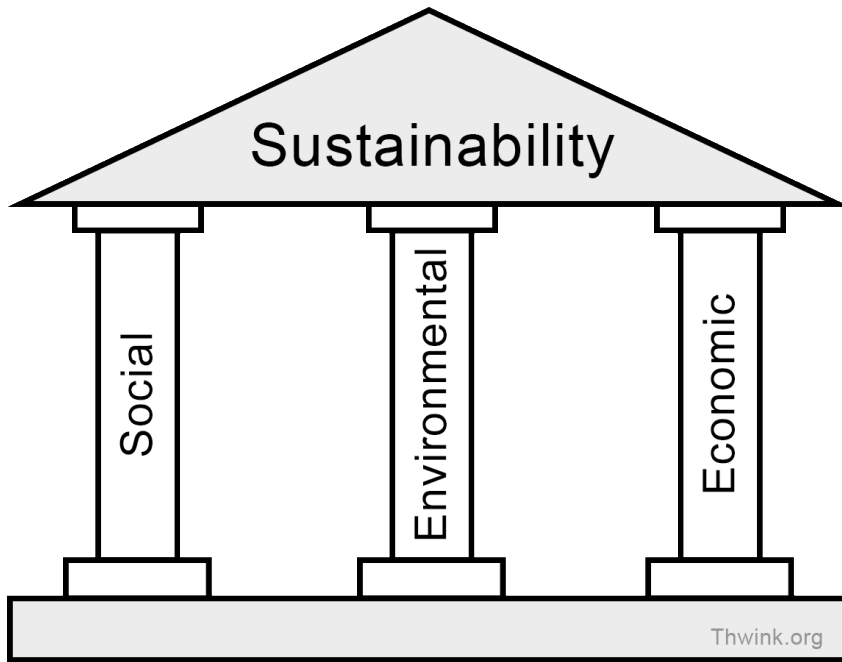
Capital Vol III Part VI  
Transformation of Surplus Profit into  
Ground-Rent

# More recently



ENCYCLICAL LETTER  
*LAUDATO SI'*  
OF THE HOLY FATHER  
FRANCIS  
ON CARE FOR OUR COMMON HOME

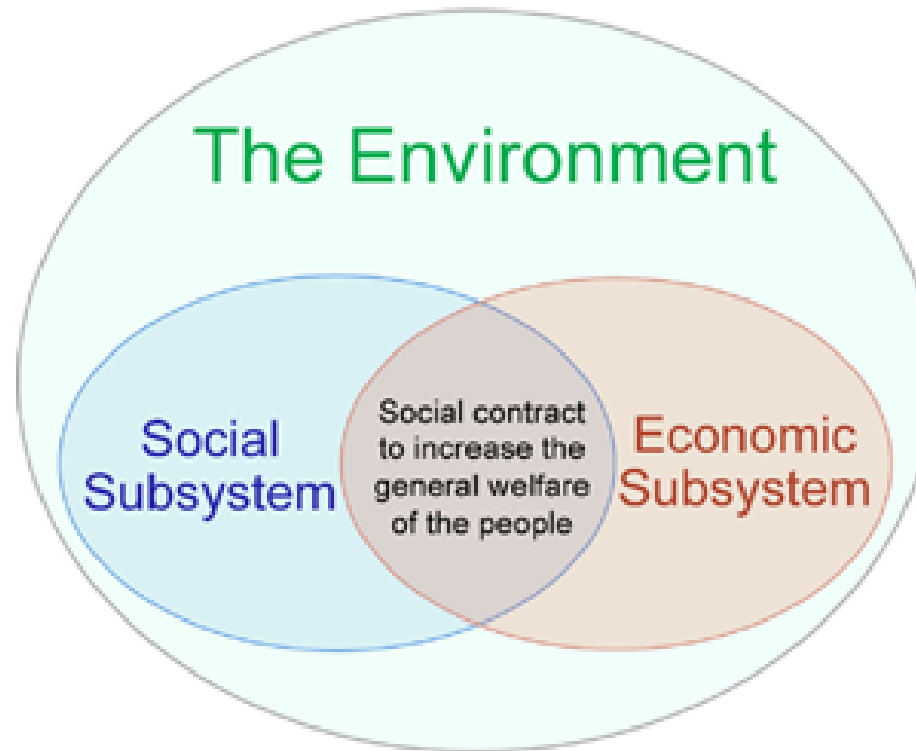
# sustainability



THIS IS WRONG.....



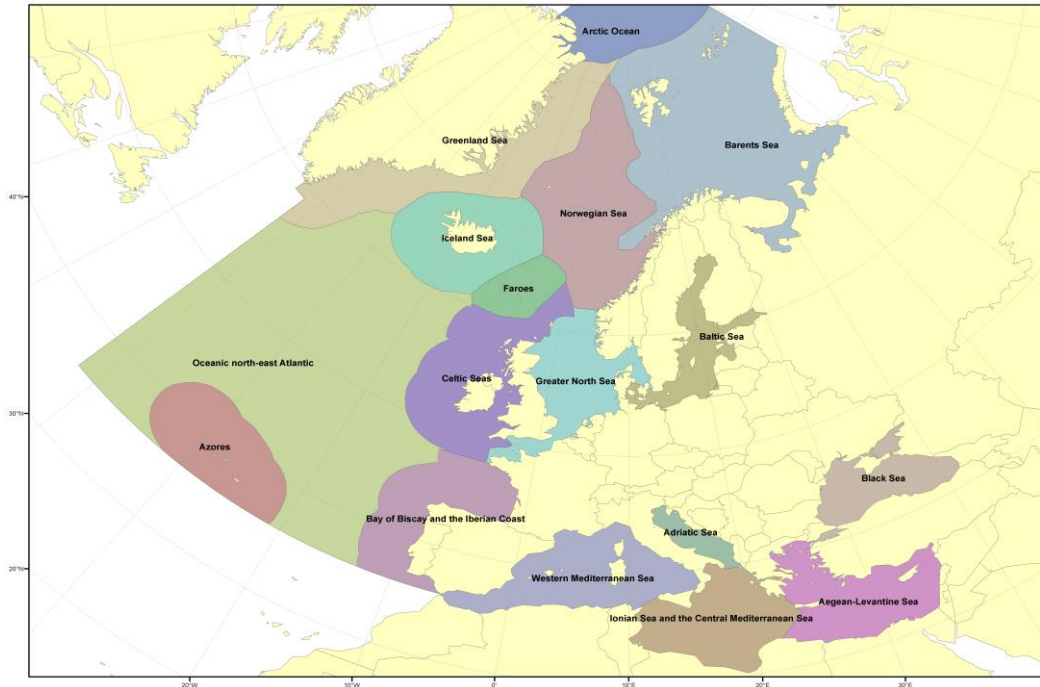
# sustainability



## THIS IS THE REAL WORLD.....

# Science for policy

- Ensuring ecosystem-based management
- Impact assessment and spatial planning
- Increased and sustainable ocean harvest
- Connecting MPAs and the rest of marine space



## Policy for science

- Building integrated knowledge
- Human capacity building
- Research set-up
- Science for society

Mitigation of climate change is essential!

# Effective ecosystem-based management 1

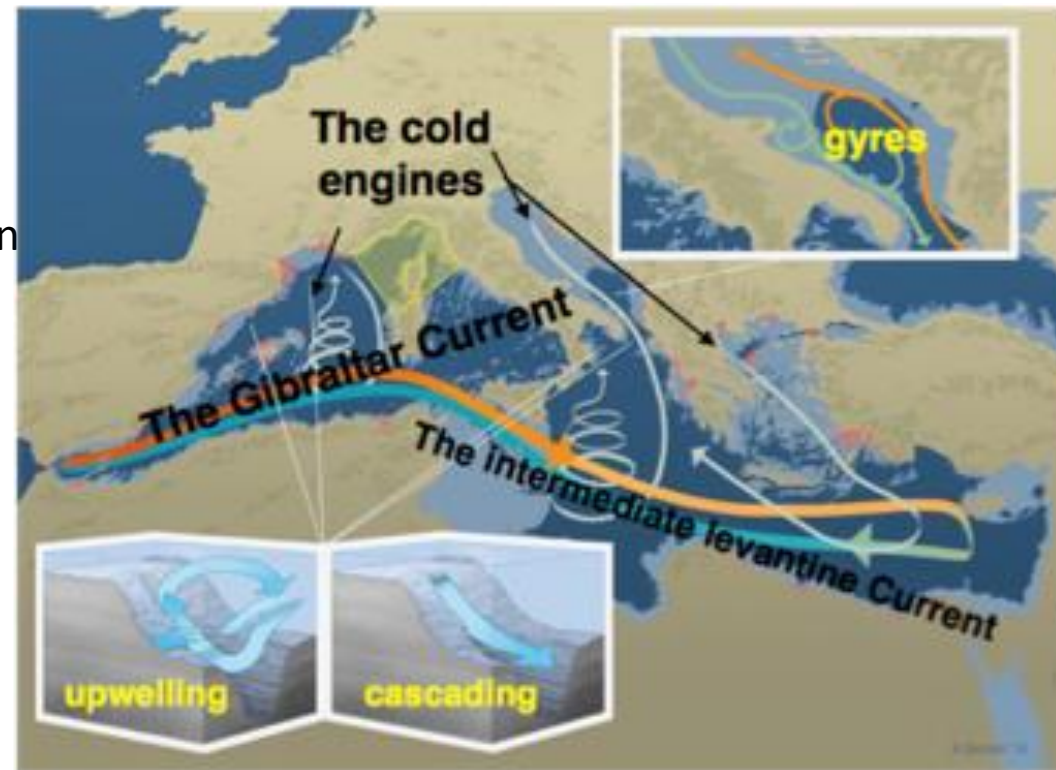
- a **ecosystem-based management of human use of the sea**
- MSFD seeks to apply this but sets a new benchmark for science support

How to characterise marine ecosystem health **consistently**

A more integrated scientific understanding of marine ecosystem structure and function and ecological connectivity proper

Ecosystem modelling can provide scenarios and probabilities

More attention to the role of pelagic systems in generating change



# Effective ecosystem-based management 2

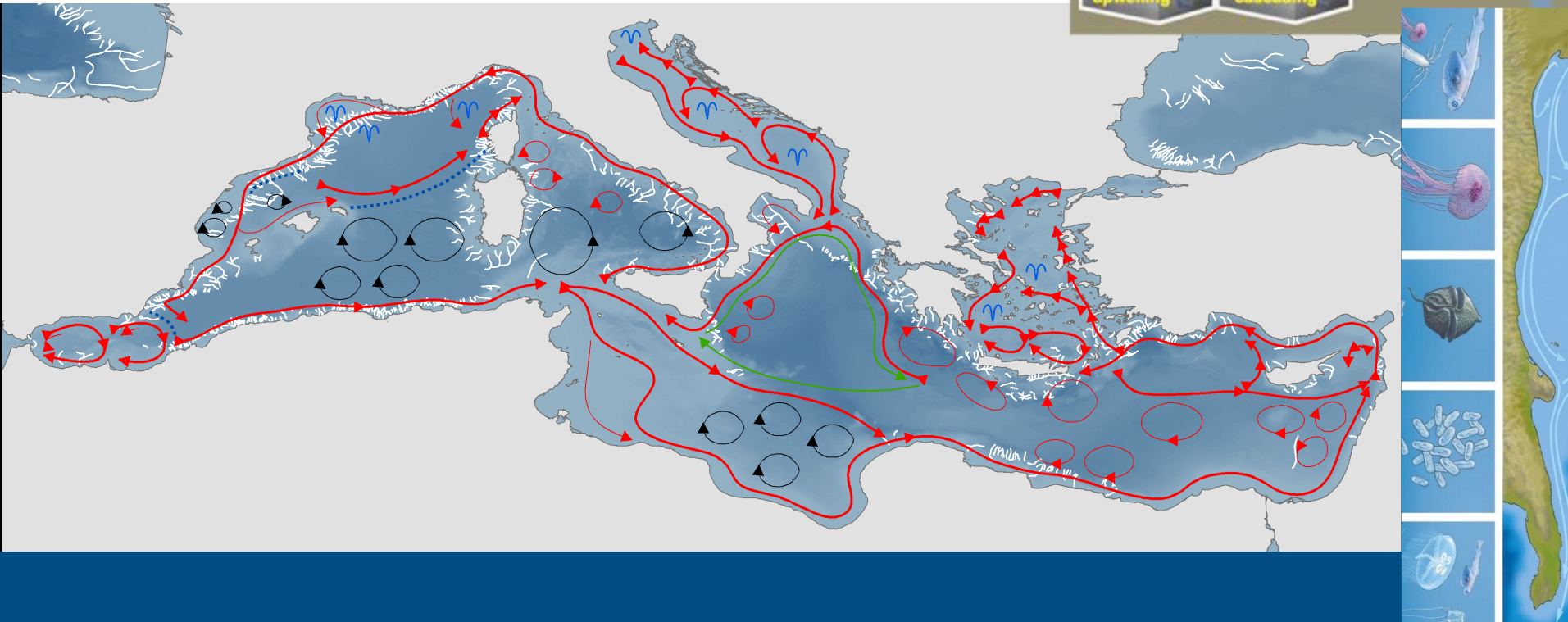
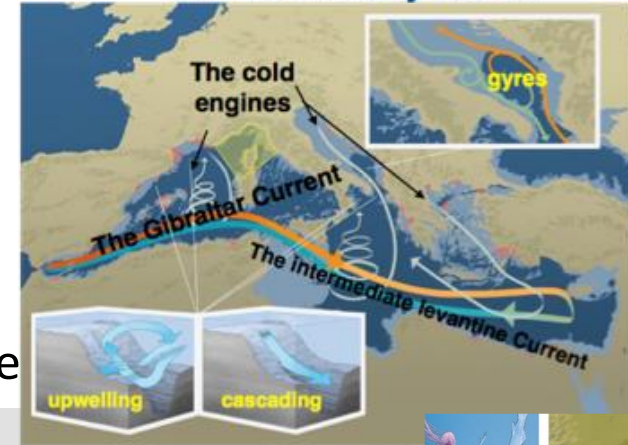
- a proper **ecosystem-based management of human use of the sea**
- MSFD seeks to apply this but sets a new benchmark for science support
- how to characterize marine ecosystem health in a **consistent** way
- a shift towards an integrated scientific understanding of marine ecosystem structure and function and ecological connectivity
- more attention to the role of pelagic features in generating change
- Ecosystem modeling can provide scenarios and probabilities



# Effective ecosystem-based management 3

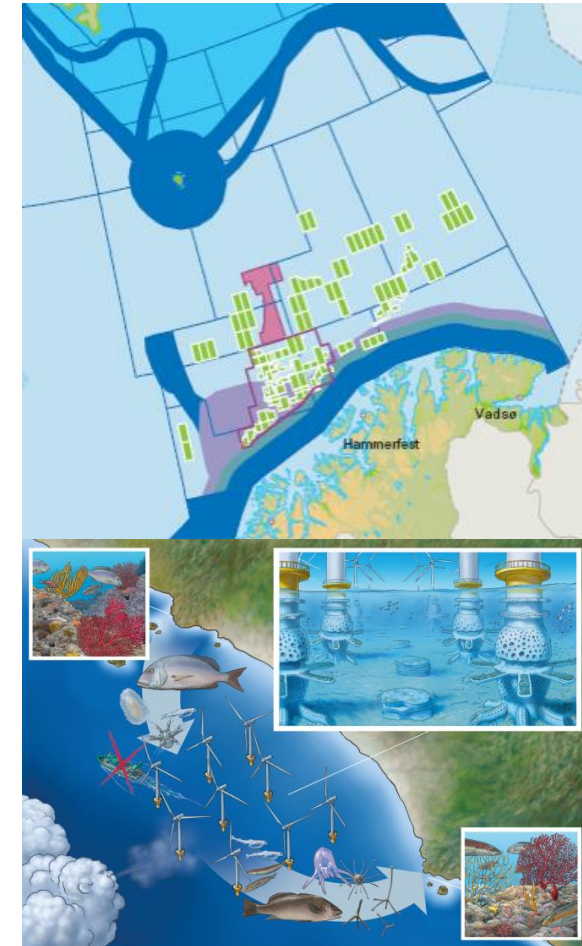
policymaking must

- recognise complexity and interconnections
- recognise scientific uncertainties,
- support efforts to develop integrated knowledge and capacities, and
- be agile enough to be **adaptive** in the light of new science



# Impact assessment and maritime spatial planning

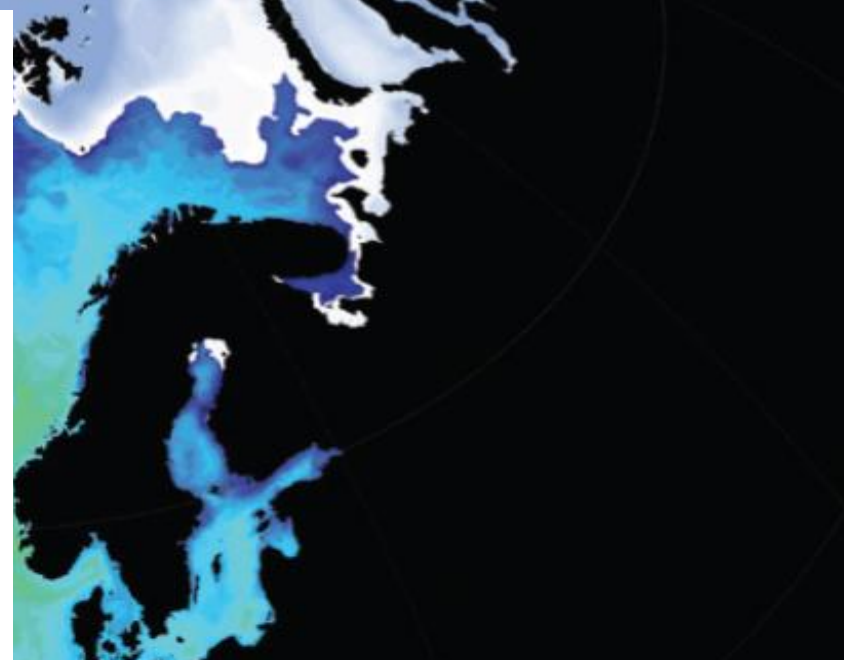
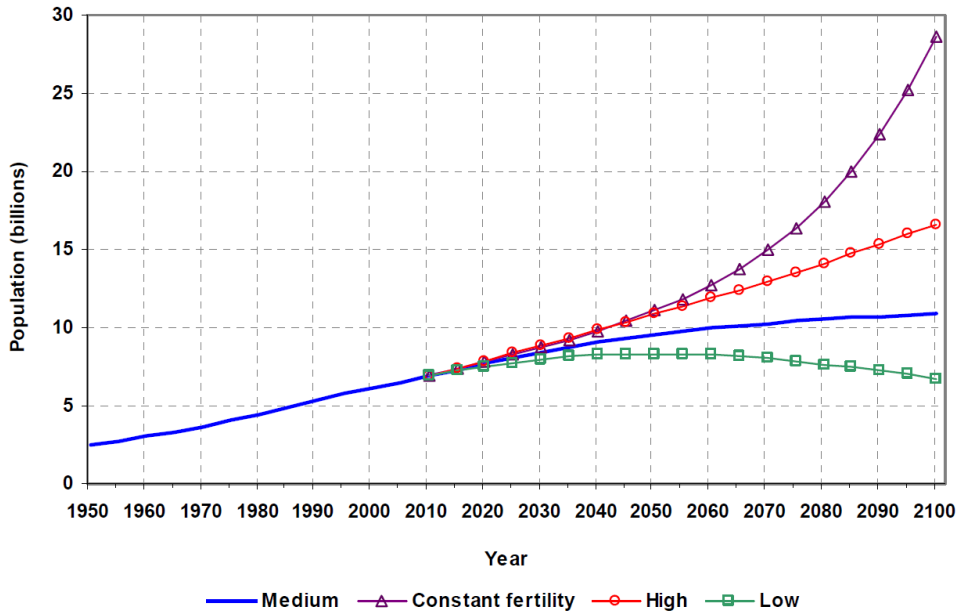
- policymakers and scientists need to define clear goals for ecosystem health identifying what level of disturbance is unsustainable
- cross-sectoral management must use these goals as the framework for planning and management across **all** activities
- improved independent early-warning assessment of the impacts of policy choices in particular where these favour particular resource uses or promote societal behaviours
- delicate balance between facilitating technology and understanding impacts



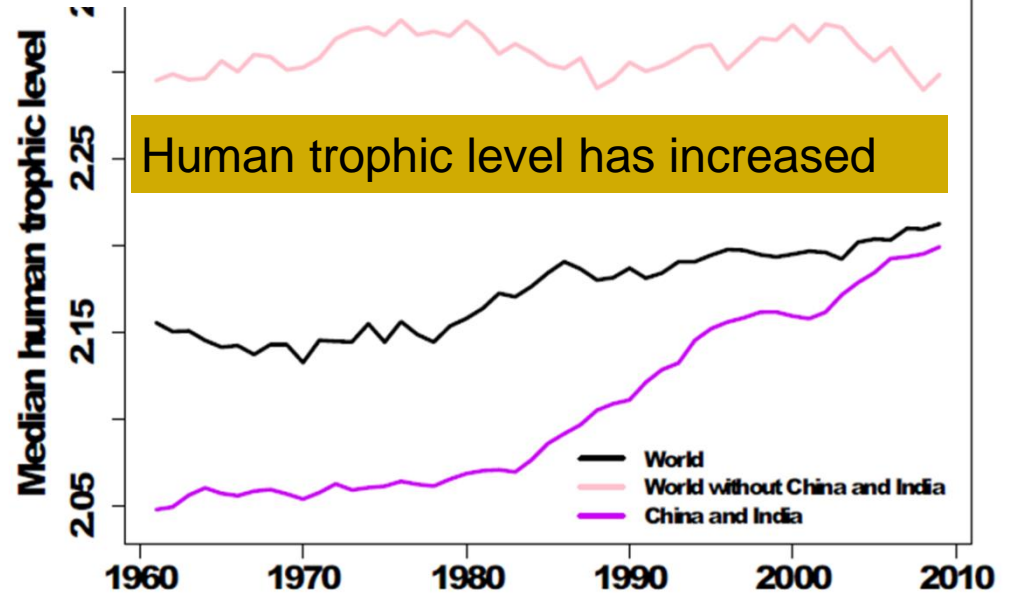
# Increased and sustainable ocean harvest

The revision of the common fisheries policy must be used as base for securing an end to overfishing both within EU waters and beyond and to minimise harmful impacts of fishing on marine ecosystems. Growing populations will demand more food from the seas and further steps are needed to improve the **ecological efficiency** of marine harvest.

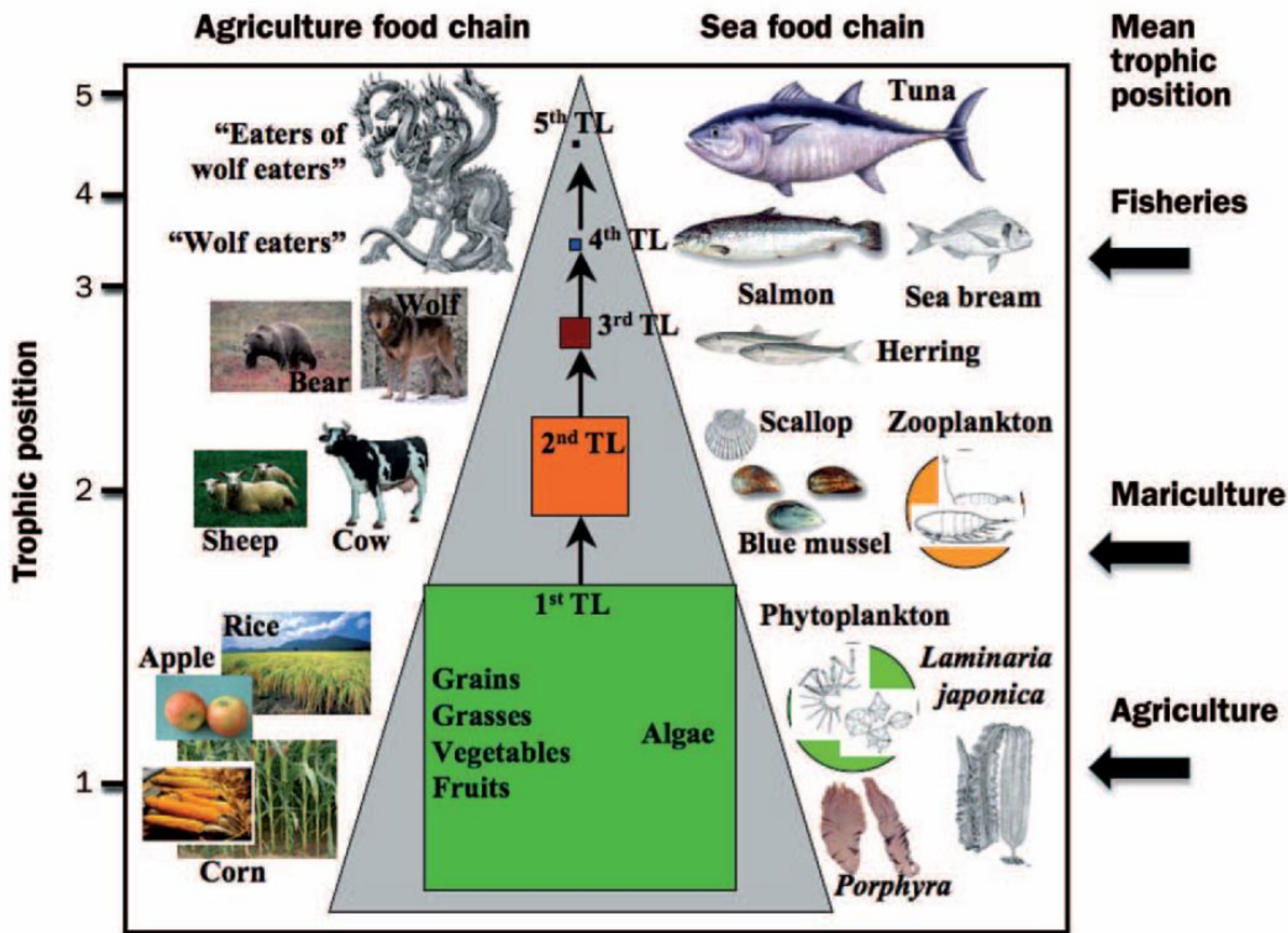
Figure 1. Population of the world, 1950-2100, according to different projections and variants



United Nations 2012





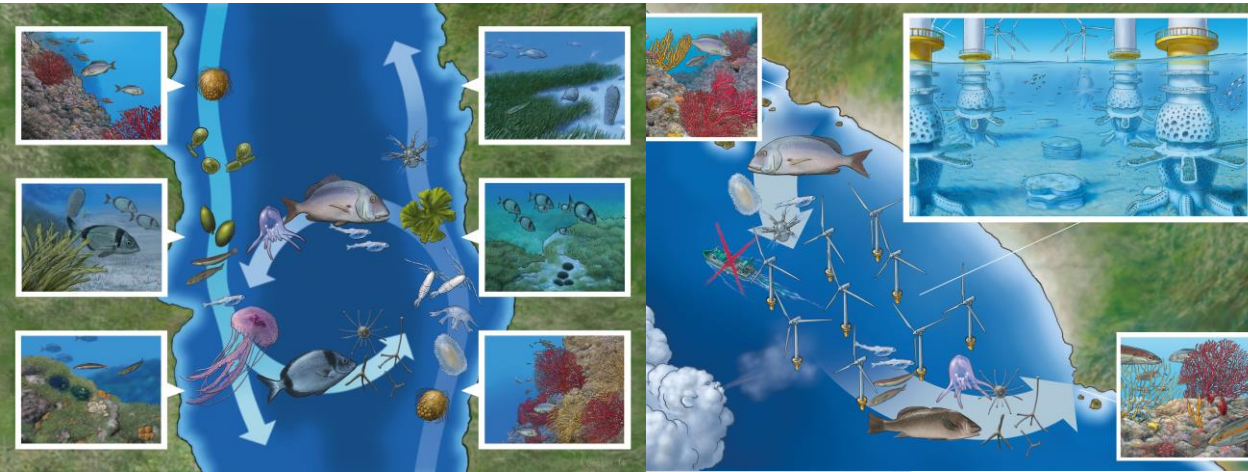


# Increased and sustainable ocean harvest

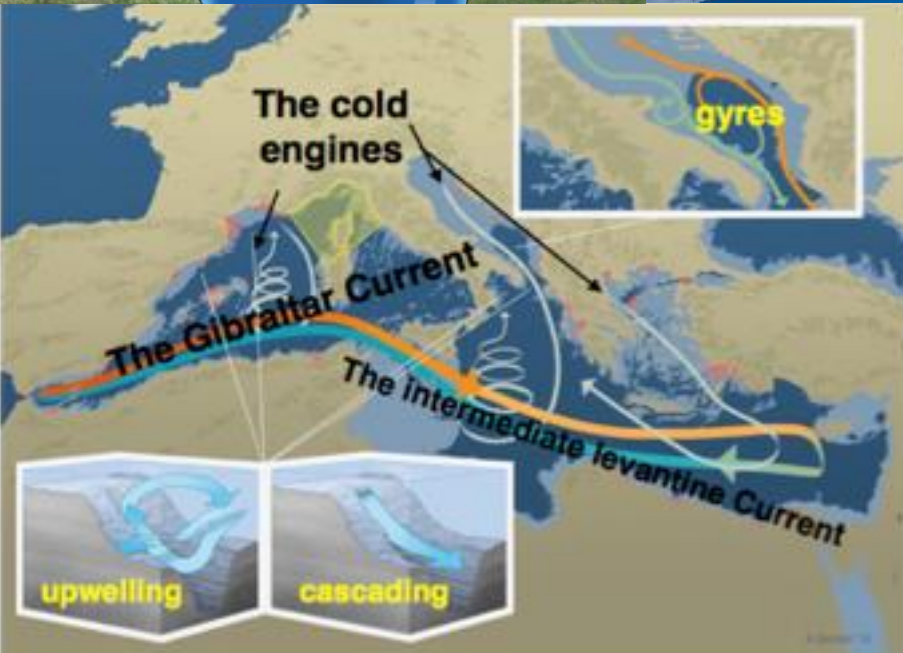
- revised Common Fisheries policy must be used to end overfishing and minimise harmful impacts from fishing in the short term
- greater commitment to policy and knowledge building on improving the ecological efficiency of ocean harvest
- major research need is to build knowledge on
  - potential for ecologically efficient aquaculture
  - potential for harvesting of species groups from lower trophic levels



# Connecting MPAs



- How to define the networks in space?
- They must be consistent with ecological rules defining the functioning of the ecosystem
- We developed and tested a new concept:



**THE CELLS OF ECOSYSTEM FUNCTIONING**  
areas whose internal connectivity is higher  
than the connectivity with neighboring  
areas

They comprise **VOLUMES** and not **AREAS**:  
Gyres, eddies, fronts, up- and downwellings  
are **UNITS** of observation, management and  
conservation

# GES is the measure of sustainability

- **DESCRIPTOR 1 is enough:  
Biodiversity is maintained!**
- **The objectives of networks  
of MPAs coincide with those  
of the 11 descriptors of  
Good Environmental Status  
both in coastal areas and in  
the high and deep seas**
- **GES must be achieved in all  
EU waters by 2020**



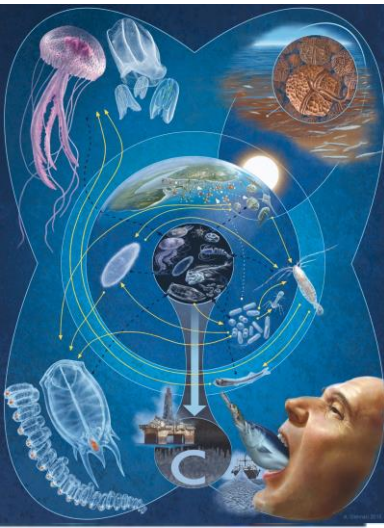
# the rest of GES



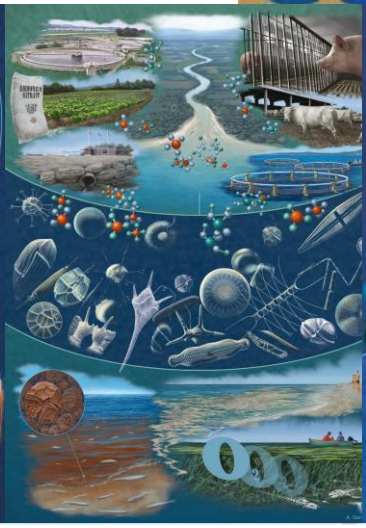
aliens



fisheries



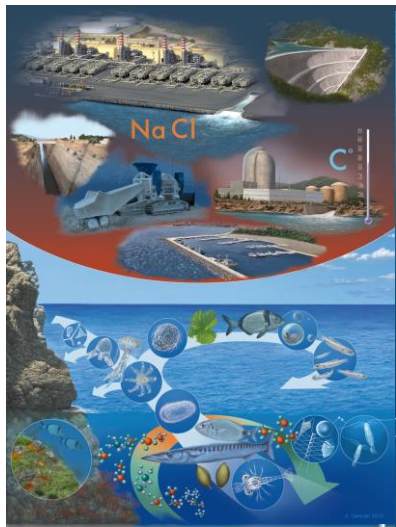
Food webs



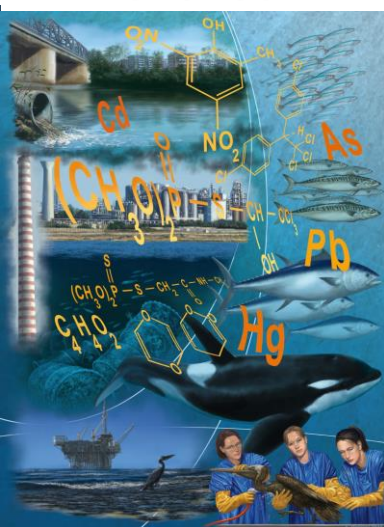
Eutrophication



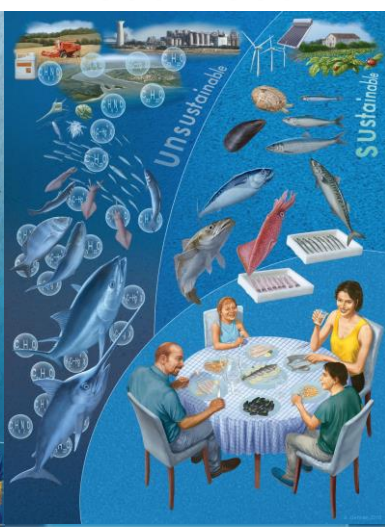
Sea bottom



Hydrology



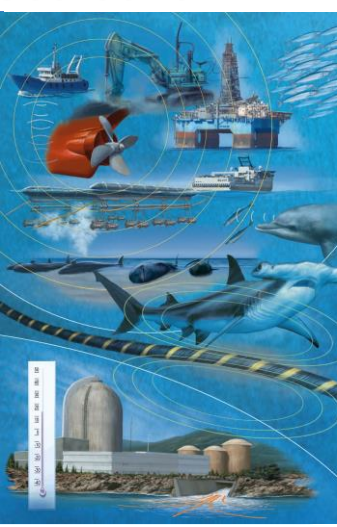
Contaminants



Contaminants2



Litter



Energy

# Building an integrated knowledge base



- implement a sustained European strategy for ecosystem observation
- incorporate biological monitoring with on-going physical and chemical programmes as prescribed by MSFD
- base biological observations on a sustained, long-term network of time series
- test the datasets assembled by EU marine data infrastructures
- open-up access to marine data

# Scientific support for marine sustainability



- Human capacity building
  - sustain and expand capacities in marine science
  - develop capacities in integrative marine science
  - **a virtual European Marine University** to lead development of the necessary curriculum
- Research set-up
- Recommended science needs for an ecosystem approach based on holistic and integrated concepts
- From science to society

Thank you for your interest and attention  
[www.easac.eu](http://www.easac.eu)  
Ferdinando Boero, University of Salento  
CNR-ISMAR  
on behalf of ACCADEMIA DEI LINCEI

