

# Can science save the seas?

**Dr. Cornelia E. Nauen**

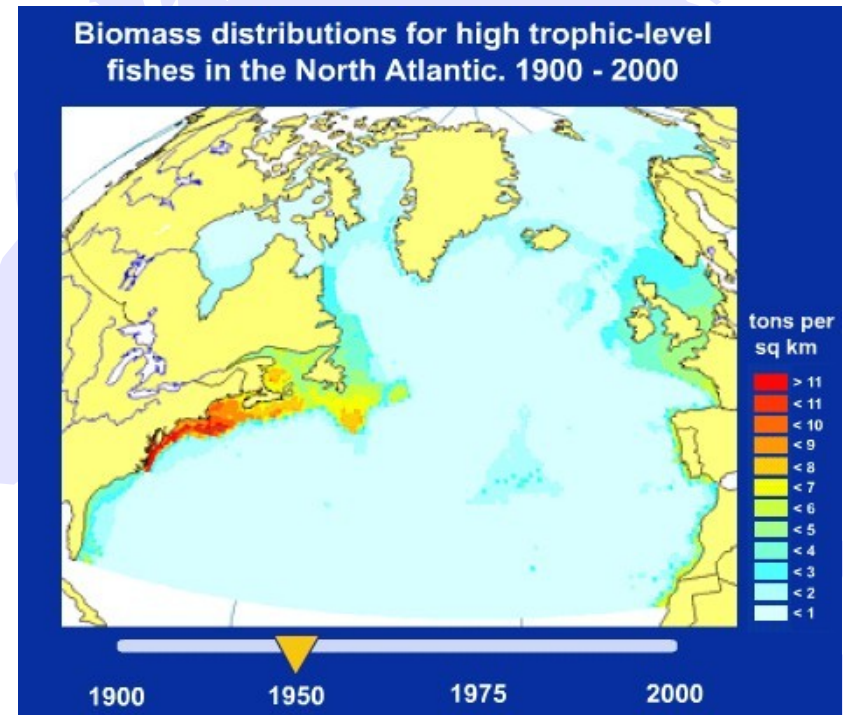
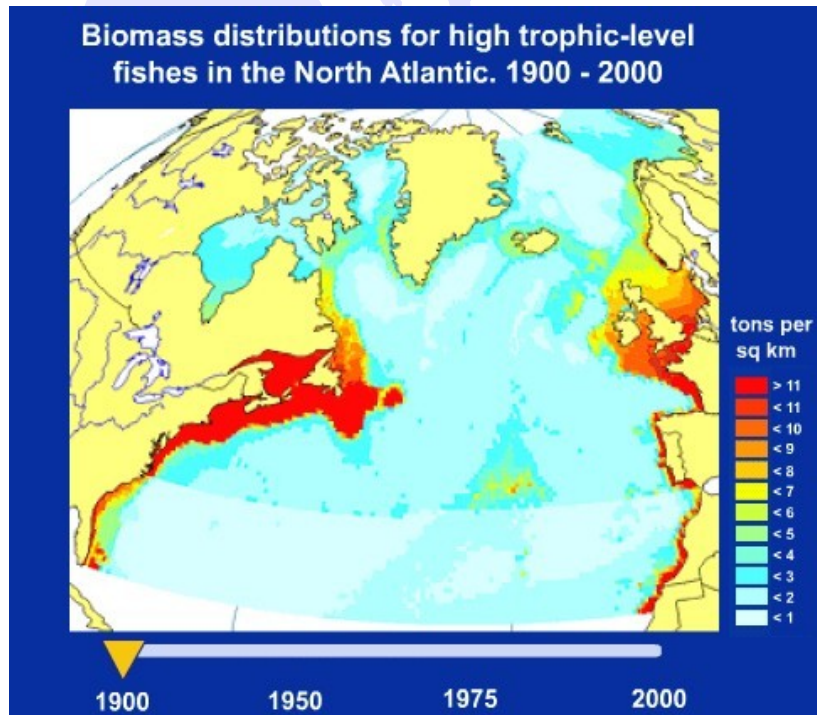
**President  
Mundus maris  
Sciences and Arts for Sustainability asbl**

# Structure of the talk

**Context:** international cooperation to protect the seas interfacing science and society, arts and education

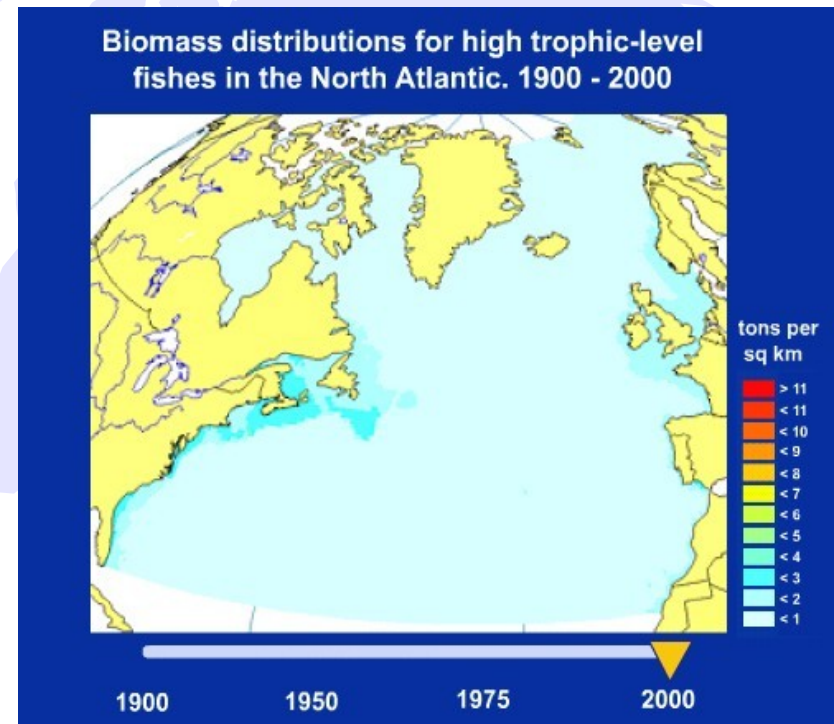
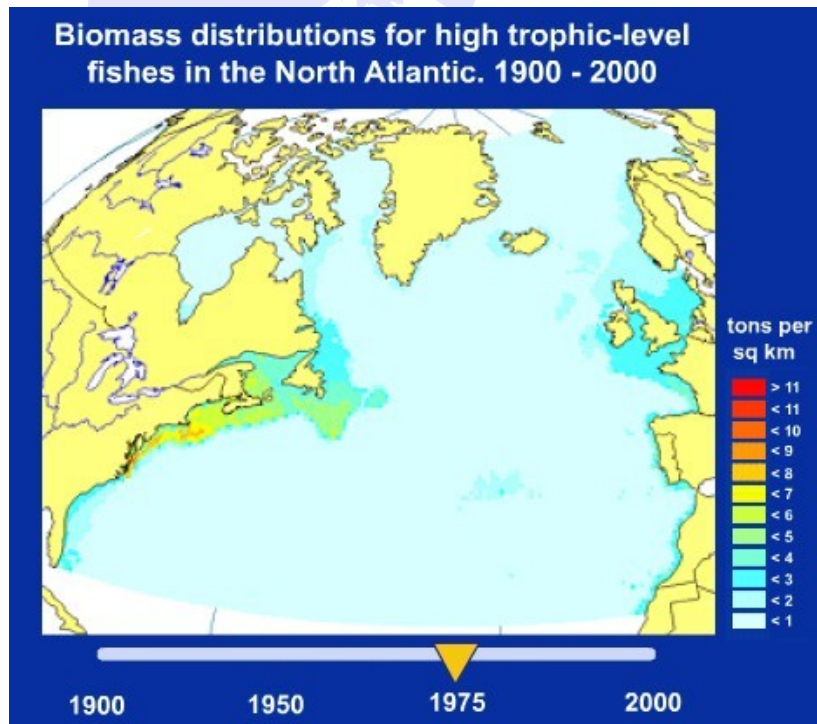
- Why do we talk about a global fisheries crisis?
- Why does it matter?
- Seeking to explain human behaviour
- Some more 'unconventional drivers' of unsustainable fisheries
- What we can do together ...
- So, can science save the seas?

# Why do we talk about a fisheries crisis starting in the North? (1)

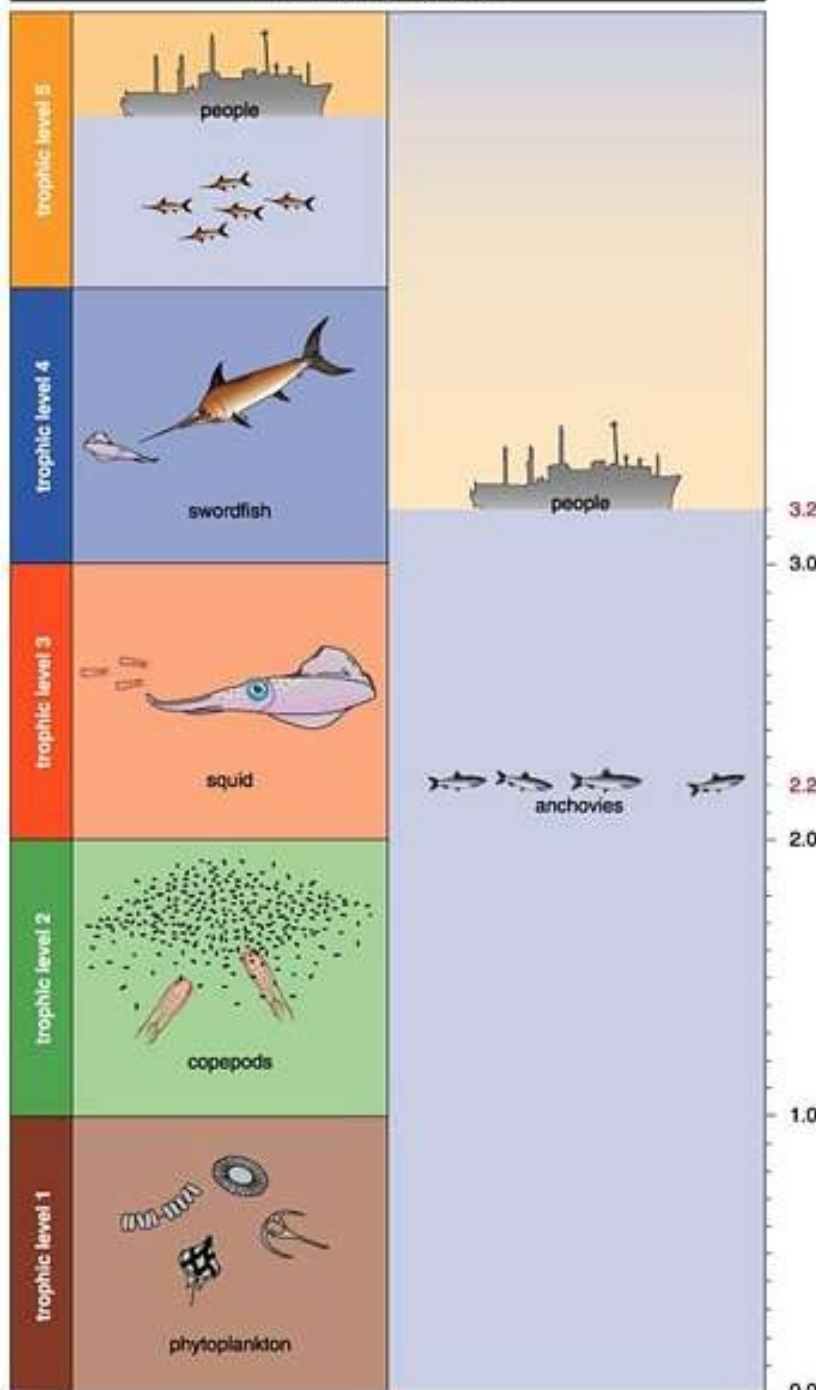


Christensen, V. *et al.*, 2003. Hundred-year decline of North Atlantic predatory fishes. *Fish and Fisheries*, 4:1-24.

# Why do we talk about a fisheries crisis starting in the North? (2)



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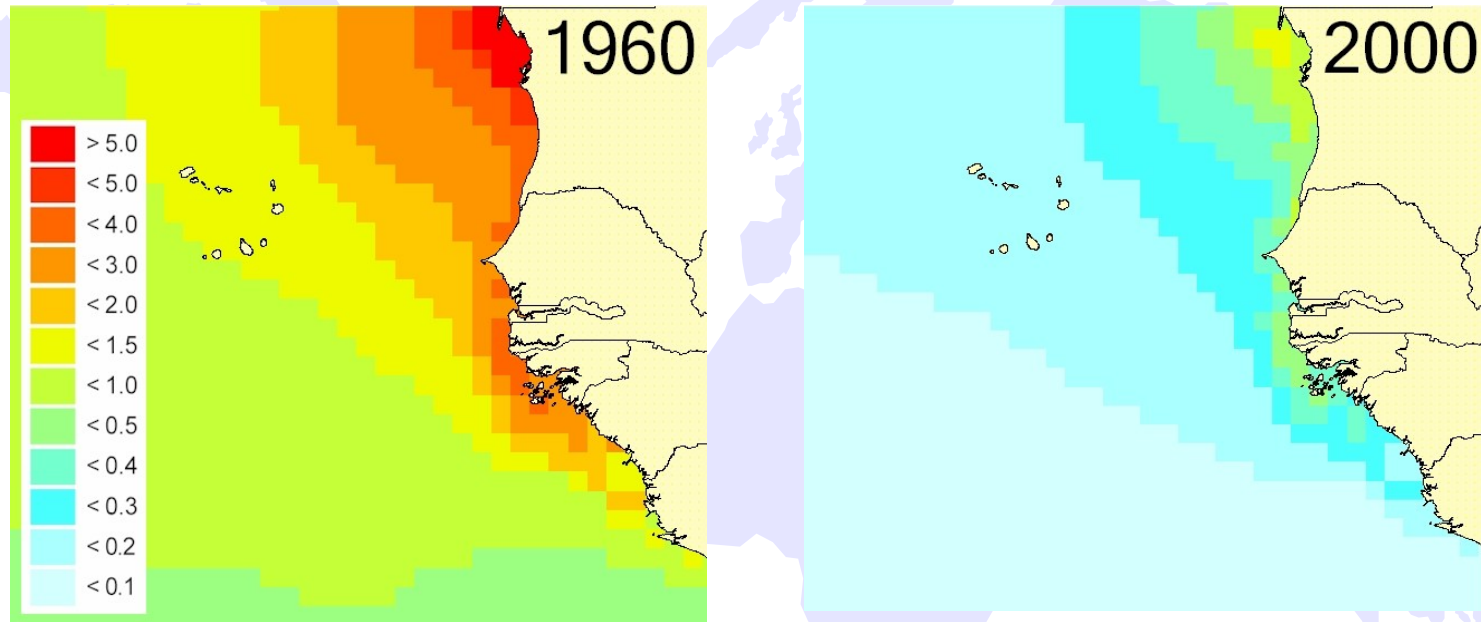
# Why do we talk about a fisheries crisis? (3)

In an ecosystem, where big fish or whales eat small fish or other organisms, we distinguish trophic levels from level 1 (phytoplankton as primary producers capturing the energy of the sun) to levels 2 to 5 (consumers feeding on plants and animals). Humans are consumers at the top of the food web.

Fisheries affect ecosystems very heavily by taking fish and other organisms out of their web of relations. Degraded systems (biomass <20%) can not sustain fisheries nor maintain basic ecofunctions (Froese & Proelss, 2010)

# Why do we talk about a fisheries crisis affecting the South? (1)

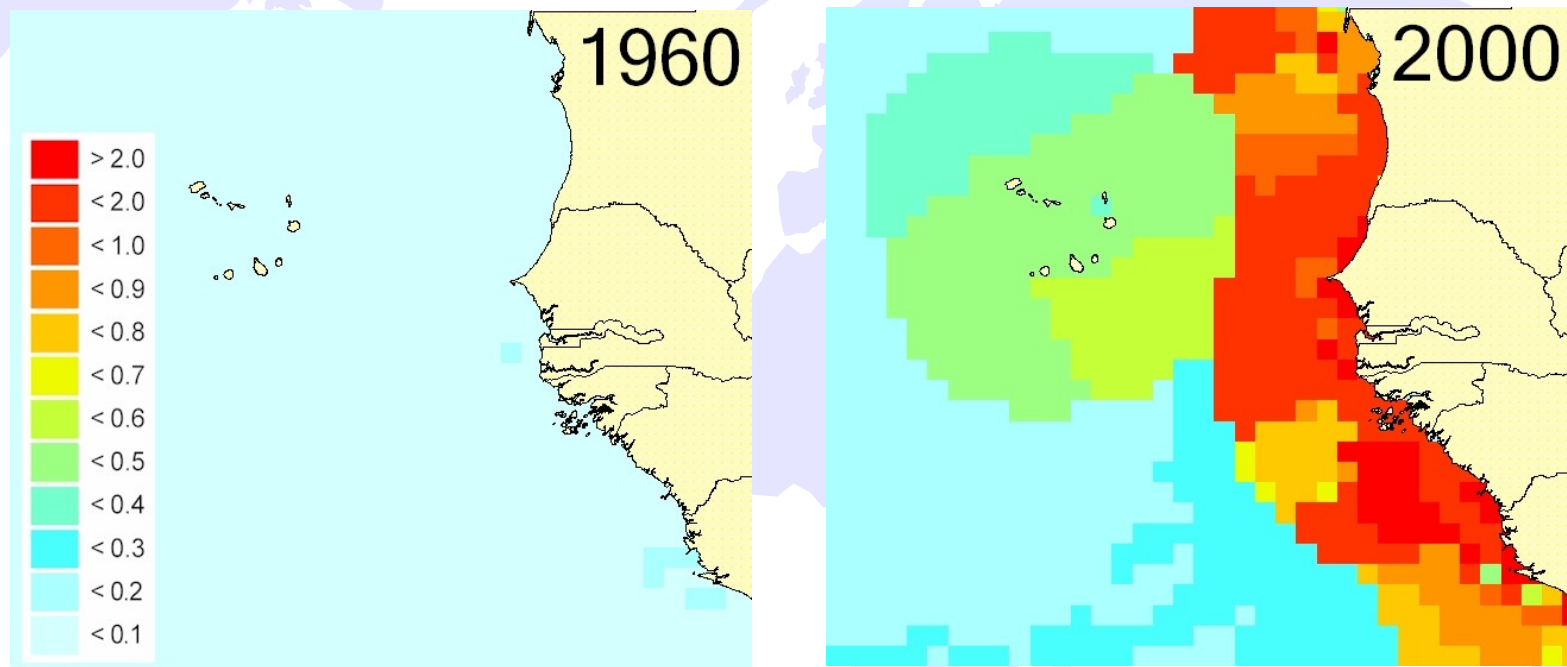
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Biomass distributions for fishes (trophic level  $\geq 3.0$ , excluding small pelagics and mesopelagics) off West Africa in 1960 and 2000 [tons per sq km]

Christensen *et al.*, 2004. Trends in Fish Biomass off Northwest Africa. pp 377-386 In: Pêcheries maritimes, écosystèmes et sociétés en Afrique de l'Ouest: un demi-siècle de changement. IRD & Commission Européenne.

## Why do we talk about a fisheries crisis affecting the South? (2)

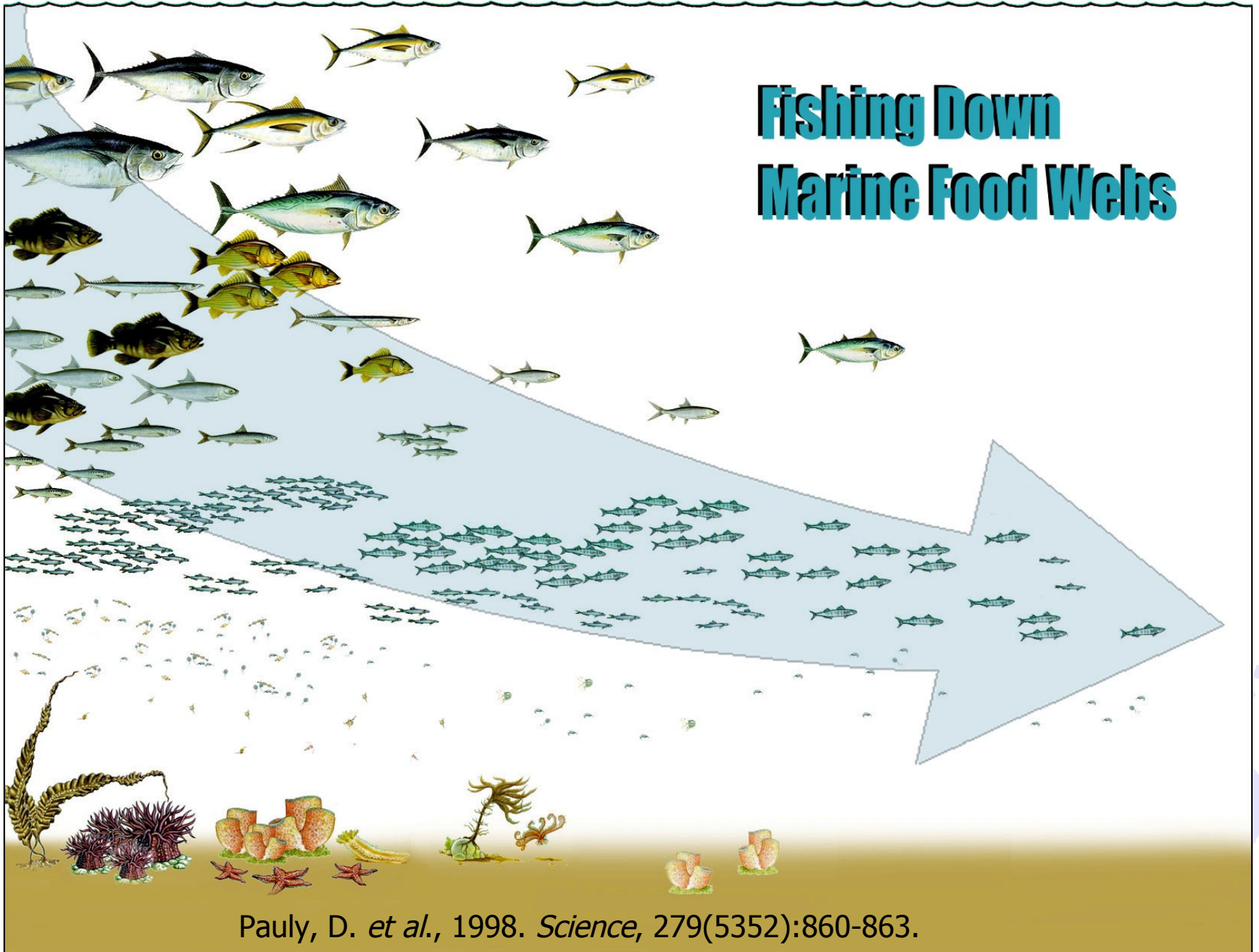


Fishing intensity (= catch/biomass ratio)

for fishes (trophic level  $\geq 3.0$ ) in units per year

Christensen *et al.*, 2004. Trends in Fish Biomass off Northwest Africa. pp 377-386  
In: Pêcheries maritimes, écosystèmes et sociétés en Afrique de l'Ouest: un demi-siècle de changement. IRD & Commission Européenne

# Fishing Down Marine Food Webs



Pauly, D. *et al.*, 1998. *Science*, 279(5352):860-863.



**W**

## **Why does it matter? (1)**

At current trends in overfishing worldwide, we will not have the fisheries we know today by about 2050; many have already collapsed.

(Worm *et al.* 2006, Science DOI: 10.1126/science.1132294)

Without historical reconstructions, we suffer from 'shifting baseline syndrome' (Pauly, 1993).



## Why does it matter? (2)

At current trends in overfishing worldwide, we will not have the fisheries we know today by about 2050, many have already collapsed.

**Namibia**, a country in Southwest Africa (between South Africa and Angola) had an estimated **15 million tons of fish biomass** which could have sustained good catches.

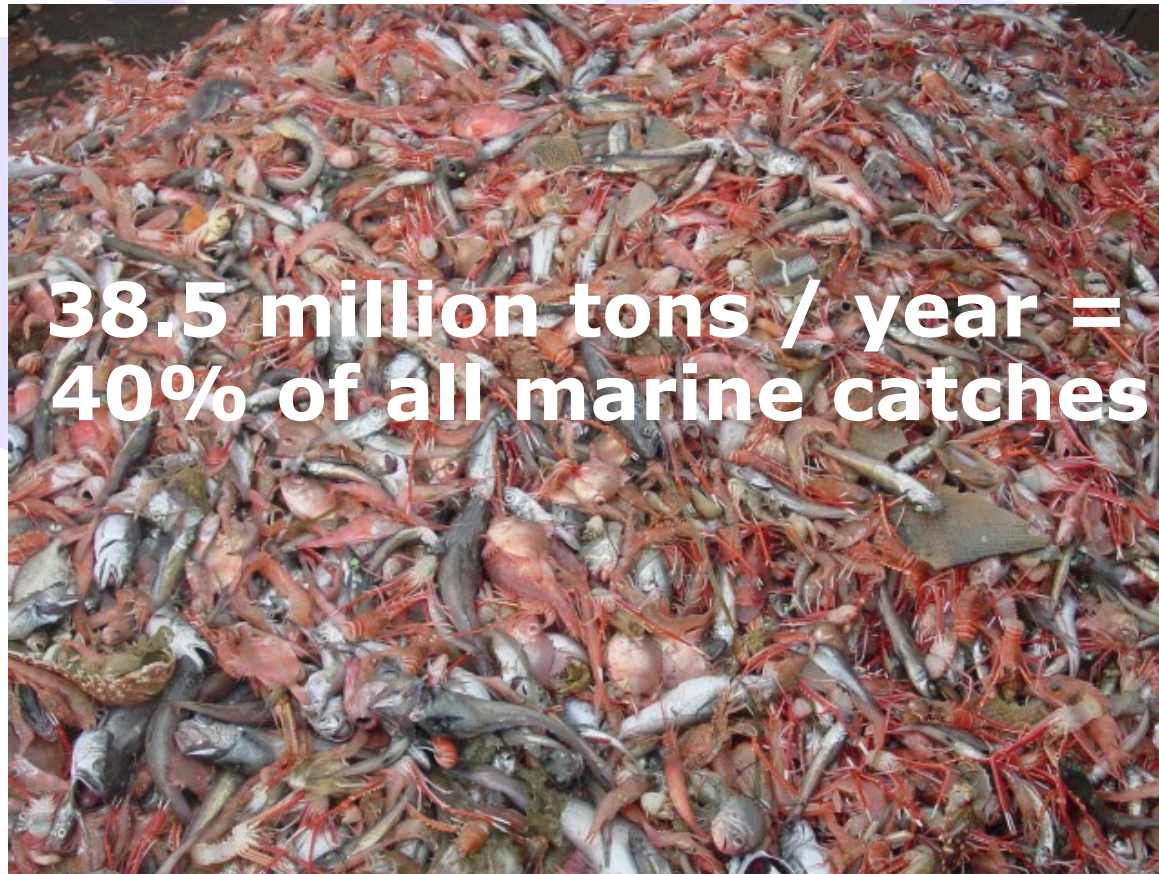
Overfishing led to the collapse of this resource, now Namibia has an estimated **12 million tons of jellyfish** and much less fish (3.8 million tons) to go around.

(Lynam *et al.*, 2006. Jellyfish overtake fish in a heavily fished ecosystem. *Current Biology*, 16(13):R492-R493).

**W**

## **Why does it matter? (3)**

### **By-catch [and discards]**



**38.5 million tons / year =  
40% of all marine catches**

DAVIES, R.W.D., *et al.*, 2009. Defining and estimating global marine fisheries bycatch. *Marine Policy*, doi:10.1016/j.marpol.2009.01.003

# W

## Why does it matter? (4)

Analysing qualitative and quantitative indicators about well-being of fishing communities e.g. in Senegal, there are clear signs that their initial wealth and well-being is being eroded rapidly:

- 'Thiof' (*Epinephelus aeneus*), an emblematic fish and once the national dish has all but disappeared
- Instead, people now make do with sardines and mackerel, which used to be disdained (though they are good food), but are in turn overfished
- Children are taken out of (private) schools
- Instead of attracting labour, people start migrating out, – the biggest wave was in 2005/6

# W

## Why does it matter? (5)

53 countries (96% of global fisheries) do not respect the Code of Conduct for Responsible Fisheries adopted in 1995



Pitcher, T., D. Kalikoski and G. Pramod (eds.), 2006. updated April 2008. Evaluations of compliance with the FAO (UN) Code of Conduct for Responsible Fisheries. UBC, *Fish.Centre Res.Rep.*, 14(2):76 p.



## Why does it matter? (6)

- Trawling & other non-selective active fishing methods destroy habitat in addition to being very energy-intensive; Example: Ecological meltdown in the Firth of Clyde, Scotland (Thurstan & Roberts, 2010)
- Invertebrate catches have increased 6x since 1950 – 34% are collapsed or closed – 53% harvested with habitat destroying methods (Anderson *et al.*, 2011)
- Overcapitalisation of the fleets drive fishing further 'south' and 'deeper down' with times from peak to collapse shrinking (Pauly, Froese and others)

# Discount rates to describe human behaviour (1)

- The discount rate used in Cost-Benefit-Analyses can have dramatic effects on the outcome of the analysis (N. Stern and W. Nordhaus);
- Official government discount rates different from private discount rates;
- People use different discount rates for different things (e.g., children's education; houses).

## Discount rates to describe human behaviour (2)

People discount differently depending on their mood (World Cup example);

Studies show discount rates to be highest for choices involving relatively small amounts (Thaler, 1981; Hausman, 1979);

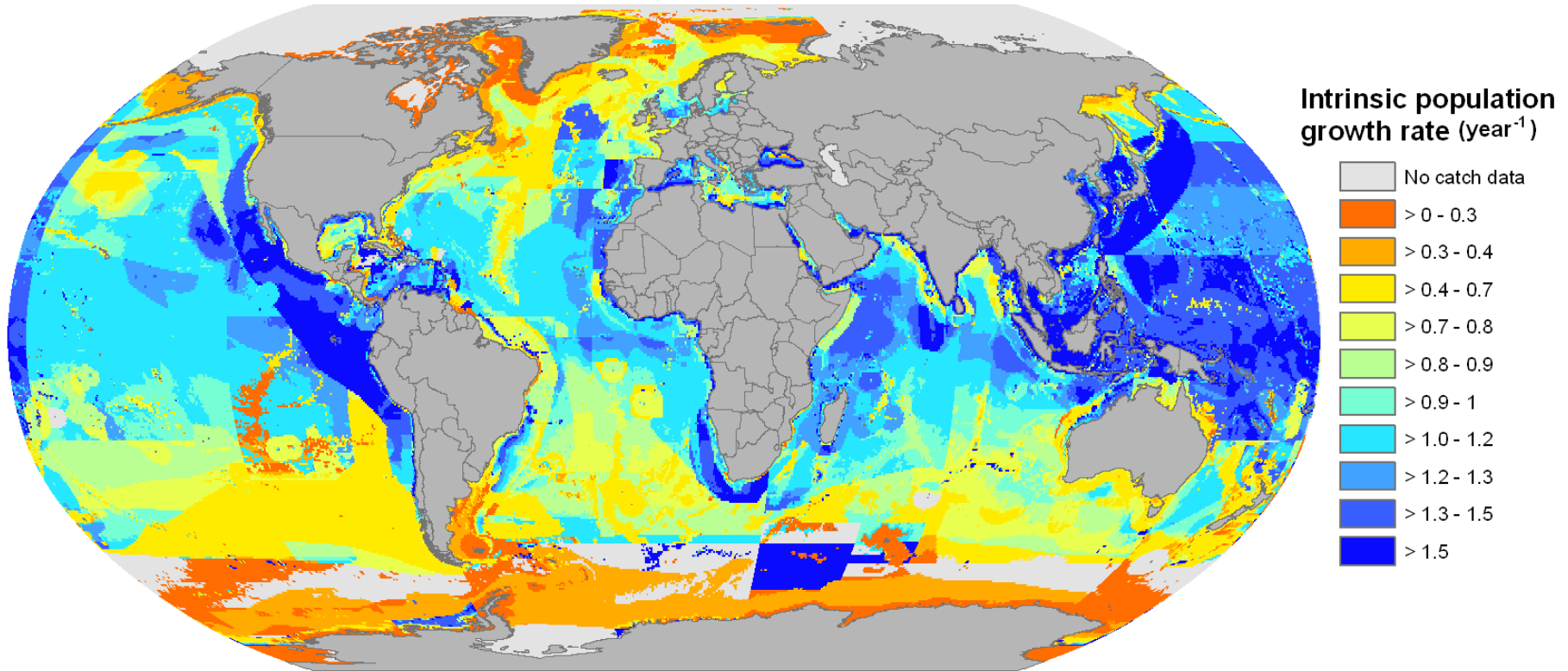
Individuals appear to apply high discount rates when payoffs are more imminent (Bon Zion et al., 1989).



# Social and private discount rates are different

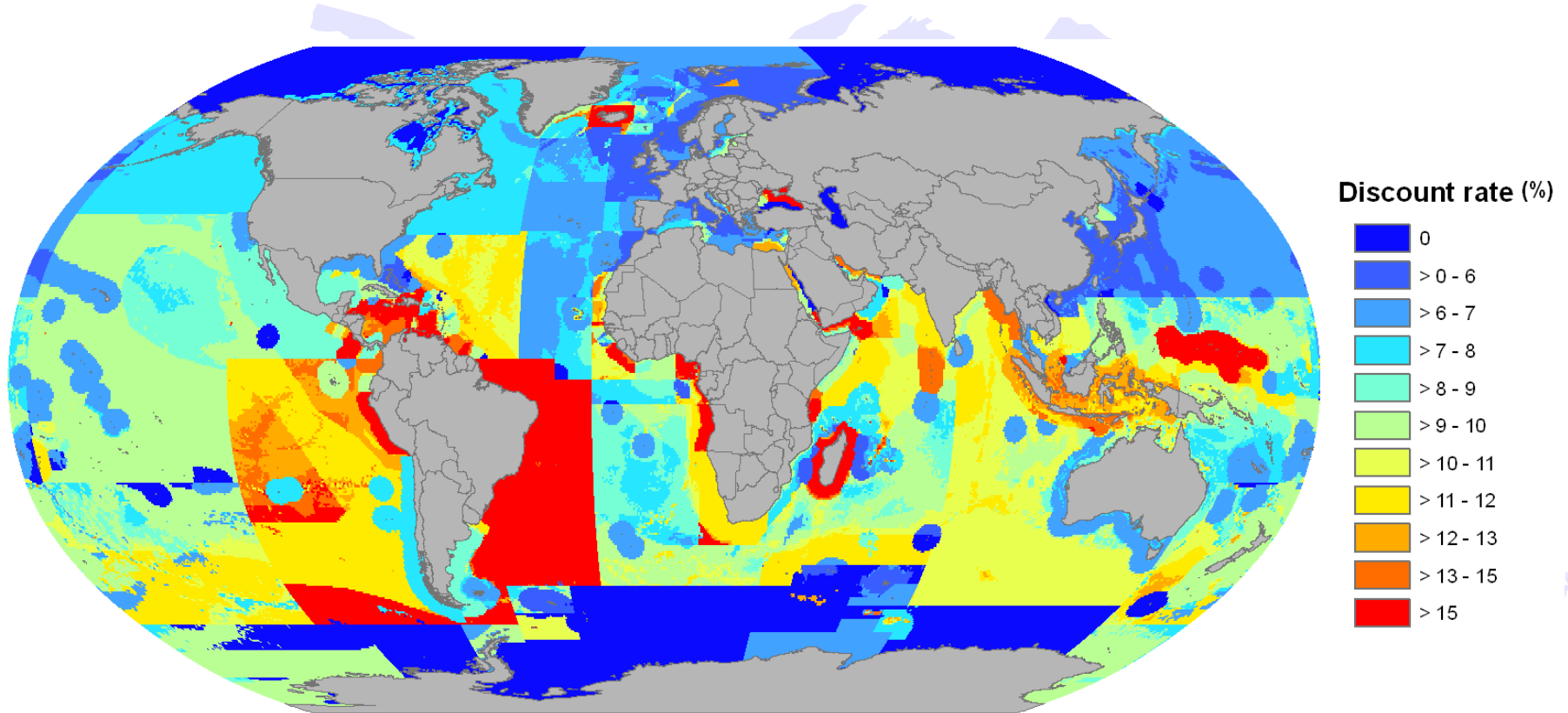
- Social discount rates: 7%, 10%;
- Private discount rates can be much higher, e.g., in some coastal fisheries in West Africa, private fishers' discount rate were estimated at about 140% (Akpalu, 2008).

# Mapping intrinsic growth rates



Courtesy: Sumaila, 2009

# Mapping official discount rates



Courtesy: Sumaila, 2009

# Some 'unconventional drivers' of unsustainable fisheries

## Demography and trade

- Humanity has more than doubled to close to 6.7 billion people;
- The notion of fish as healthier food than red meats is an additional incentive to shift consumption patterns
- Some 40% of fisheries production is internationally traded (rice 3-5%)
- Europe, Japan and North America are major import markets.

# Awa, a leader of the women in St Louis



How do these broad trends pan out in the lives of people e.g. in West Africa – another example



How youngsters in Kayar, a fishing village in Senegal, experience the new realities – from being proud to brave the swell near the beach to suffering from the hardship of migration in unsafe boats.





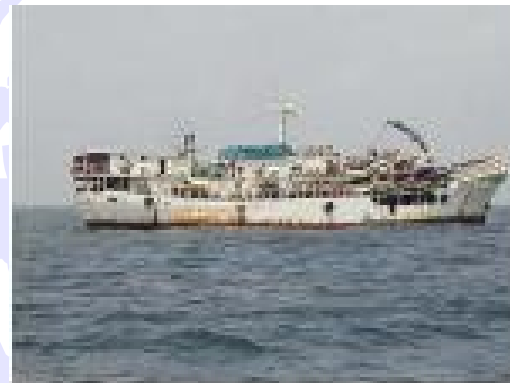
Artistic digestion of  
scientific facts  
opens new  
understanding

Explaining works  
opened eyes to  
interdependence  
between Europe and  
West Africa, which  
nobody had realised  
in their daily lives.





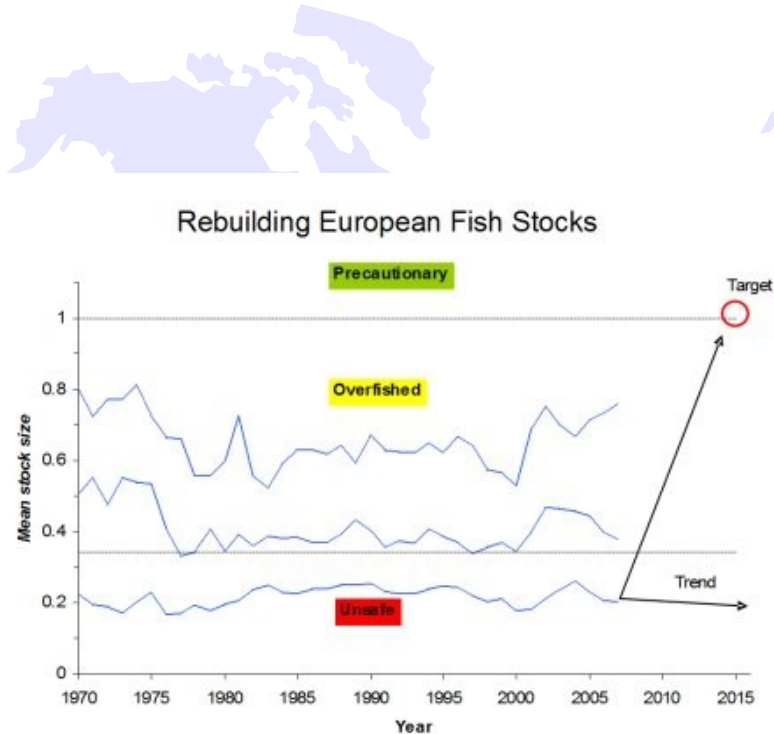
# Towards Sustainable Development – Looking at old problems through new lenses



**Small scale fisheries are mostly much more sustainable.**

- They use less energy
- They are less destructive
- They are more selective
- They employ more people
- They produce high value fish.

# Another perspective on the fisheries crisis - an angle of international law -



Average size of 54 European fish stocks (bold blue line). The upper arrow indicates the path, if 75% of the stocks were to reach the internationally agreed target in 2015. The lower arrow shows the current trend.

IFM-GEOMAR

- At WSSD in Johannesburg Europe agreed to rebuilding stocks to healthy levels by 2015
- At current trends this legal deadline will be missed by at least 30 years

Froese & Proelss (2010)

# What can we do together? (1)

- Buy insurance against risk and uncertainty by creating marine protected areas (Lauck *et al.*, 1996; Sumaila 1998);
- Value our great grandchildren's fish as their fish, not ours (Sumaila and Walters, 2005);
- Integrate economics with ecology and other disciplines;
- Reduce sectoral approaches in preference to those that cut across all activities of society.

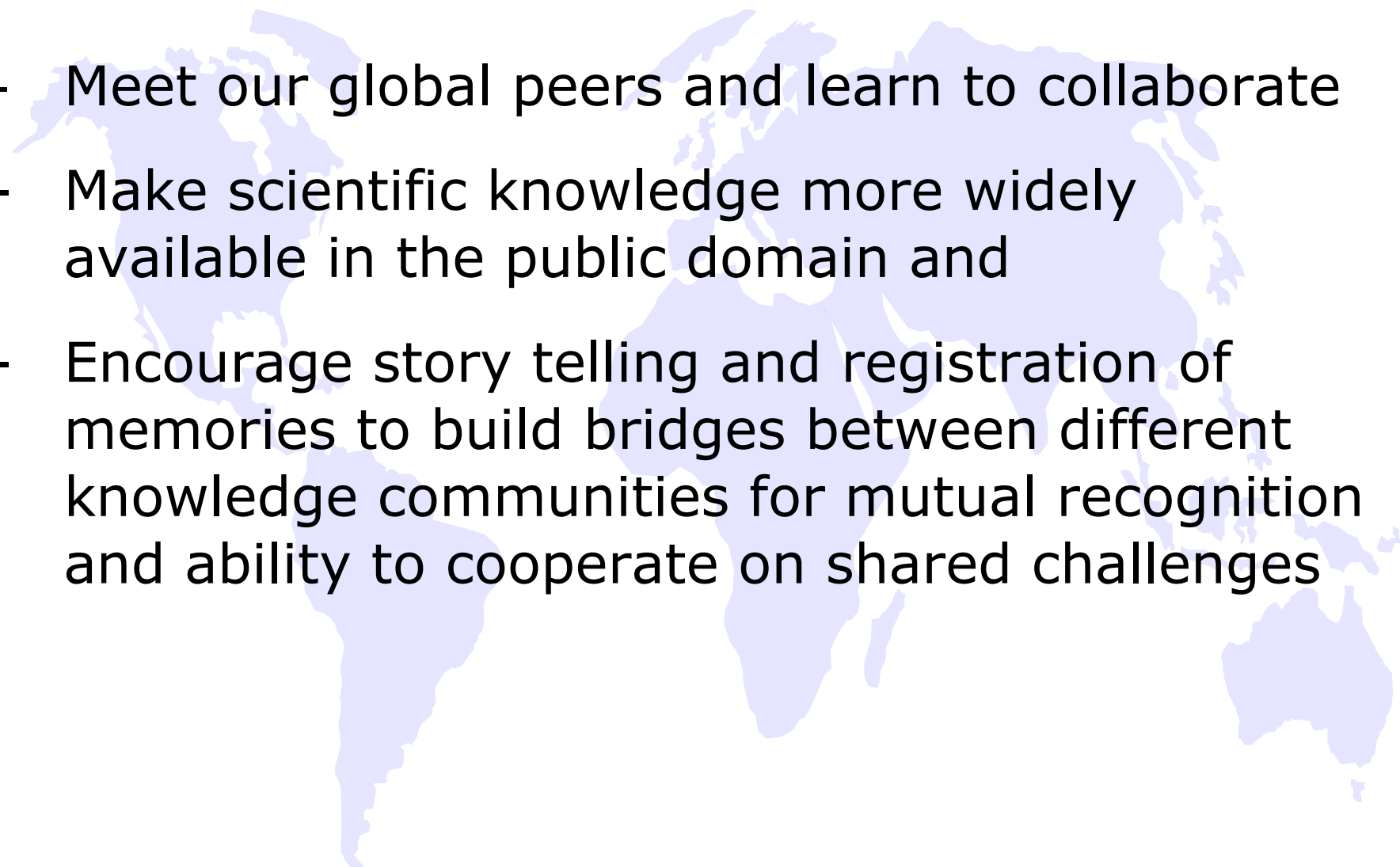
## What can we do together? (2)

- Stop bad government subsidies to fisheries –  
Asia US \$ 11.5 billion, Europe \$ 5 billion, Latin America and Caribbean \$ 4.5 billion
- Help establish effective marine protected areas
  - the Convention on Biological Diversity foresees to protect part of the oceans - some progress - yet less than 1% are protected (probably 0.1% effectively)

# What can we do together? (3)

- Promote sustainable forms of small-scale fisheries, recognise cultural diversity
- Help enforce the law and stop impunity
- Work on integrating sustainability principles, sciences and arts into curricula (university, lifelong learning, schools,...) and engage with opinion leaders

# **W What can we do together? (4)**

- Meet our global peers and learn to collaborate
  - Make scientific knowledge more widely available in the public domain and
  - Encourage story telling and registration of memories to build bridges between different knowledge communities for mutual recognition and ability to cooperate on shared challenges
- 

# W

## What can you do ?

- Study broadly, rigorously and seek consilience with other disciplines as a more robust way to cast light on complex systems affected by many factors
- Learn how to communicate your academic work and research effectively, not only to your peers, but outside – citizens/taxpayers invest a lot in academia and are interested in the results
- Engage critically with people outside academia to help enrich the public debate

# EXPLORATION

Charles Darwin studied South American natural history with rigour and a more open mind than many of his contemporaries.

Here is a role model for us all.



HMS Beagle in the seaways of Tierra del Fuego, painting by Conrad Martens during the voyage of the Beagle (1831-1836).

That enabled him to learn from people of all social and ethnic backgrounds and from his readings. His keen observation of facts and constant search of their meaning in the bigger scheme of nature allowed him to ultimately develop a theory encompassing all of humanity in the evolution of life.

A page of the entry for 5 March 1835 in the MS diary

From **DARWIN** to Sustainable Seas





## So, can science save the seas?

Yes and no – certainly not alone

The science is certainly indispensable,  
but

**NB:** public resource allocation  
between competing options is a  
political process, not science.

Ultimately, societies chose.

## For more ...

**all fishes:** <http://www.fishbase.org>

**coastal zones:** <http://www.incofish.org>

**marine fisheries:** <http://www.seaaroundus.org>

**economics:** <http://feru.org>

**fight fraud:** <http://www.illegal-fishing.info/>

**sciences & arts:** <http://www.mundusmaris.org>



**Thanks!**

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