

# Increasing the resilience of fisheries to climate change

A realistic challenge ?

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European Maritime Day – Gijon 2010, May 18-21  
Climate change in coastal and marine areas: from science to policy



**Gijón 2010**  
European Maritime Day  
Stakeholder Conference, 18-21 May  
<http://ec.europa.eu/maritimeday>



# Fisheries / climate change in estuarine, coastal & marine systems

- 1. Fish ↔ Fishermen...and climate
- 2. Polar drift and fishing biogeography
- 3. Marine productivity / Fishing yields

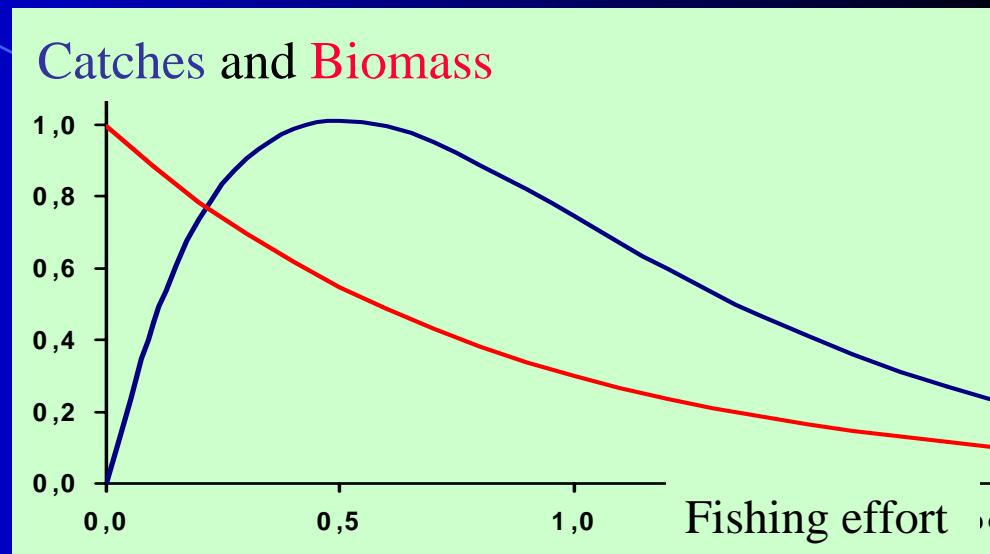


# 1. Fish - fishing $P^{\circ}$ - climate

**Fish – fishing  $P^{\circ}$**  (old school)

Adapt fishing  $P^{\circ}$   
to resource production

Estimate sustainable  
fishing  $P^{\circ}$  and/or yields

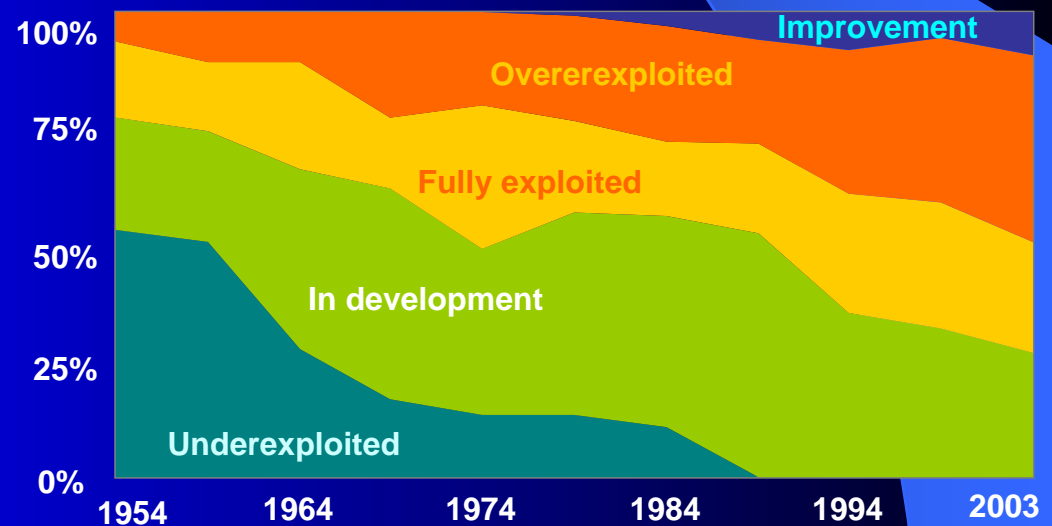


An ongoing challenge !

Under a general trend  
of overexploitation

(worse in NE Atlantic)

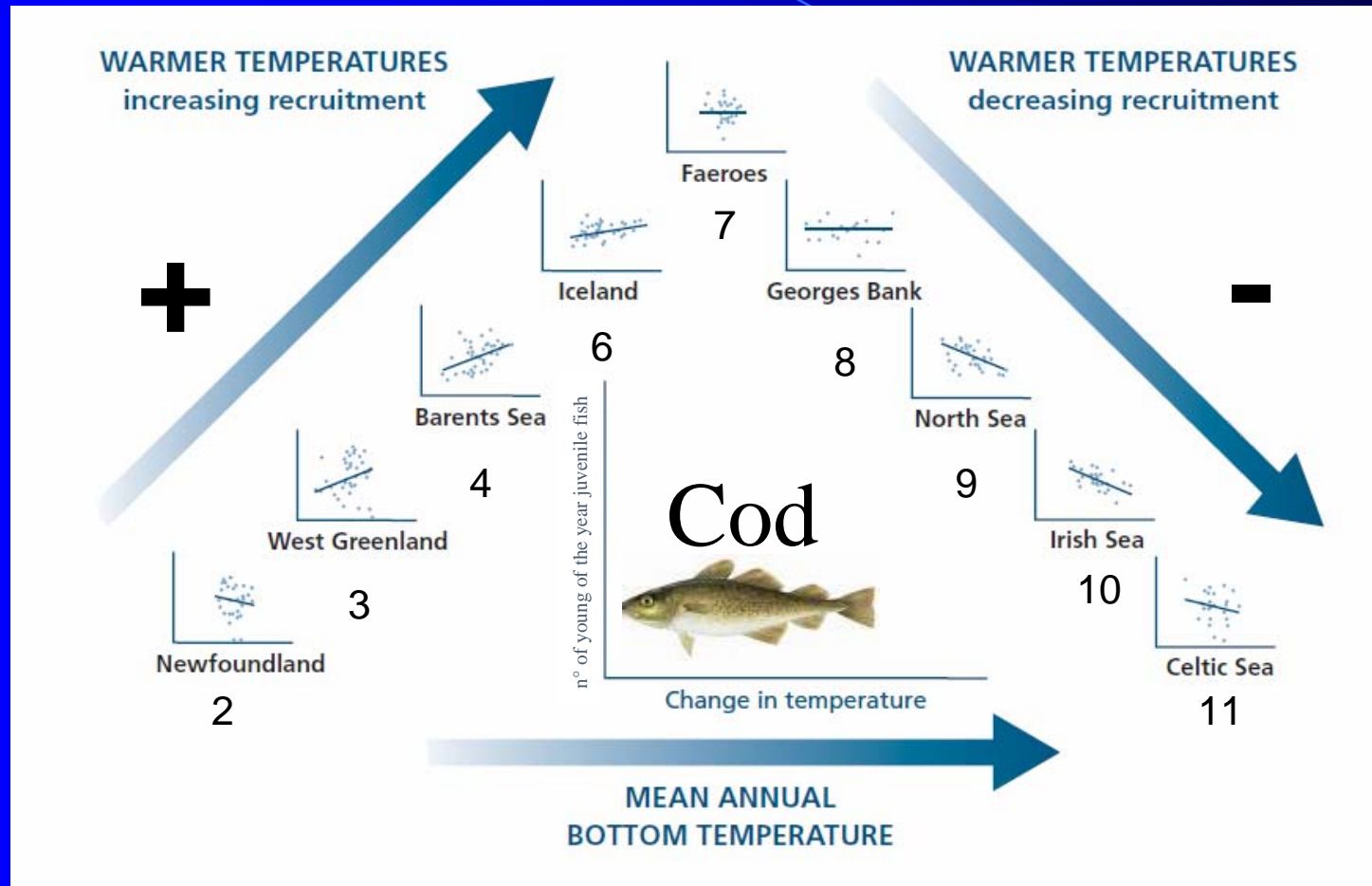
FAO



# 1. Fish - fishing P° - climate

## Fish – Climate

Modified from Planque & Fredou (1999) in FAO (2009)



Climate influence population renewal



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# 1. Fish - fishing P° - climate

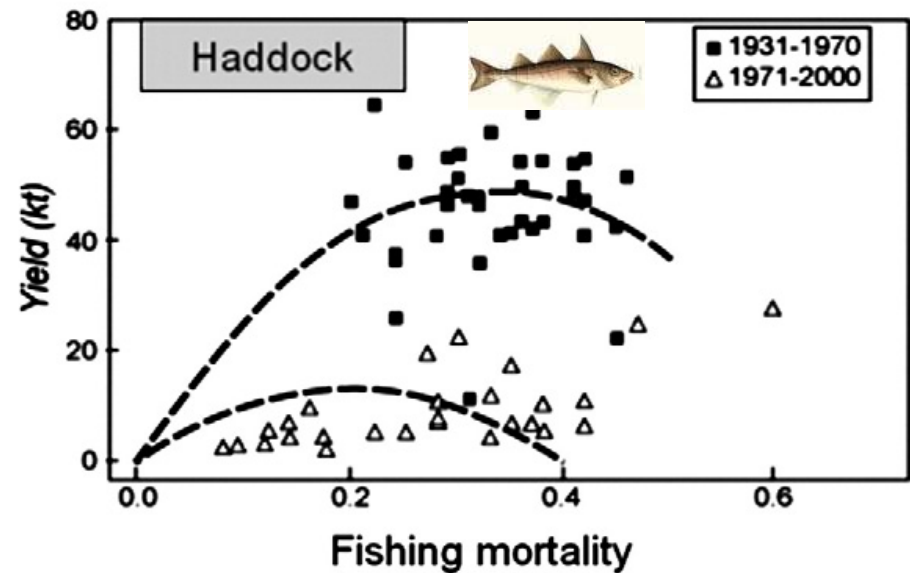
Fishing

↘ Spawning biomass

Climate variability ↘ & ↗ Recruiement

n° of young of the year juvenile fish  
reproduction success  
population renewal

Fishing P° ∩ climate variability



Overland *et al.*, 2010



# 1. Fish - fishing $P^o$ - climate

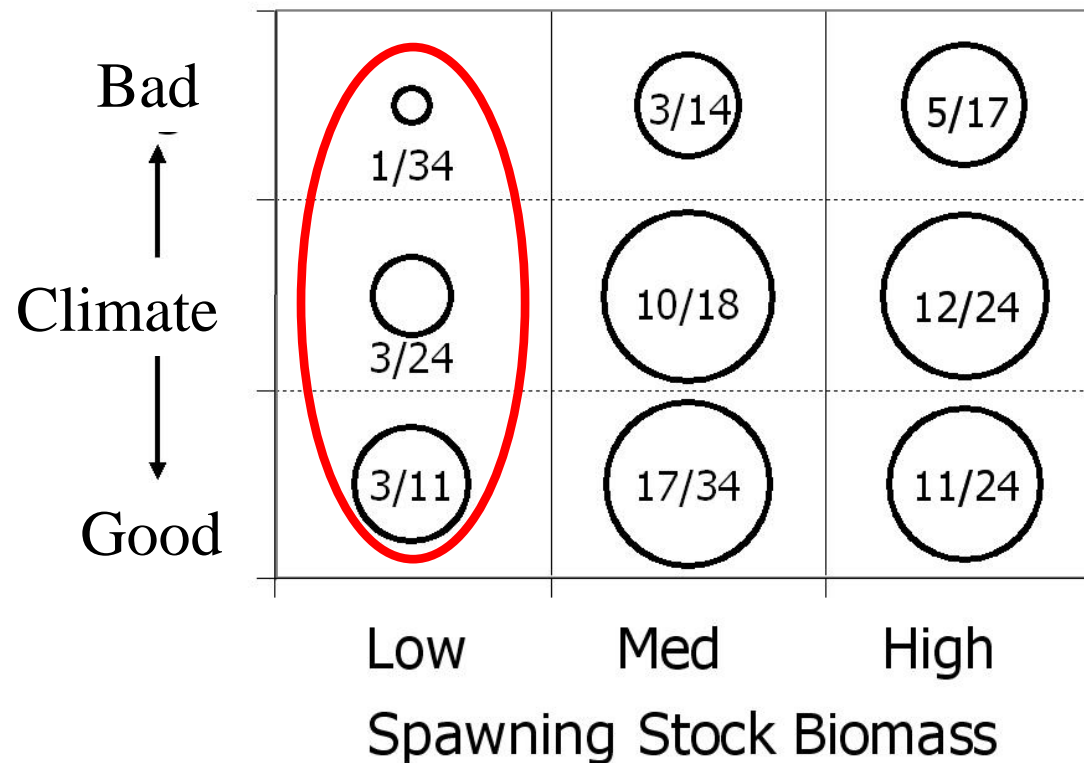
↘ Spawning biomass

↗ Climate effect

Fishing  $P^o$  ↗  
sensitivity to climate



Frequency of high cod recruitment



Adapted from Brander, 2005



# 1. Fish - fishing P° - climate

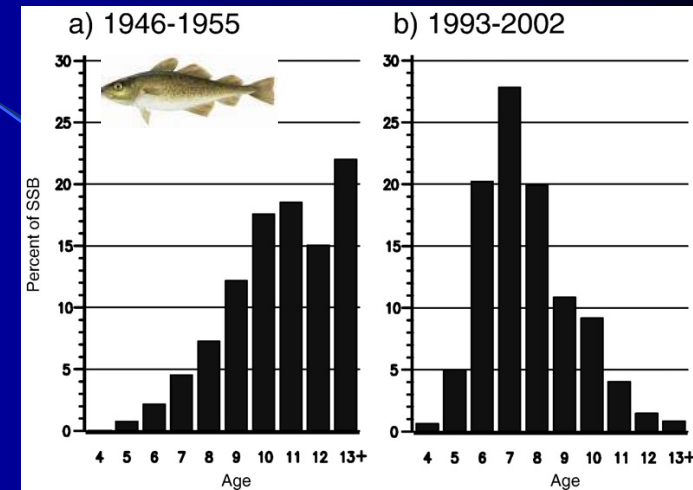
- Fishing  $\searrow$  Nb age classes

Fished population limited to young fishes

↗ relation recrutement – population size

↗ sensitivity to environnement

Age distribution of adult Norwegian cod

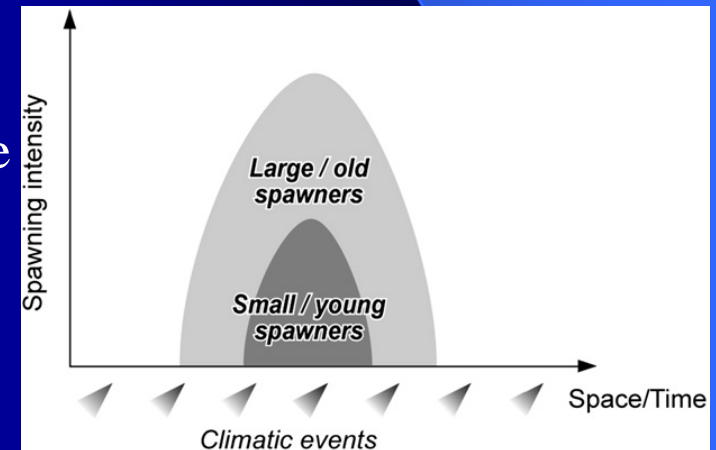


Planque *et al.*, 2010

- Fishing  $\searrow$  spawning biomass

Spawning population limited to young mature

↗ sensitivity to environnement



Perry *et al.*, 2010

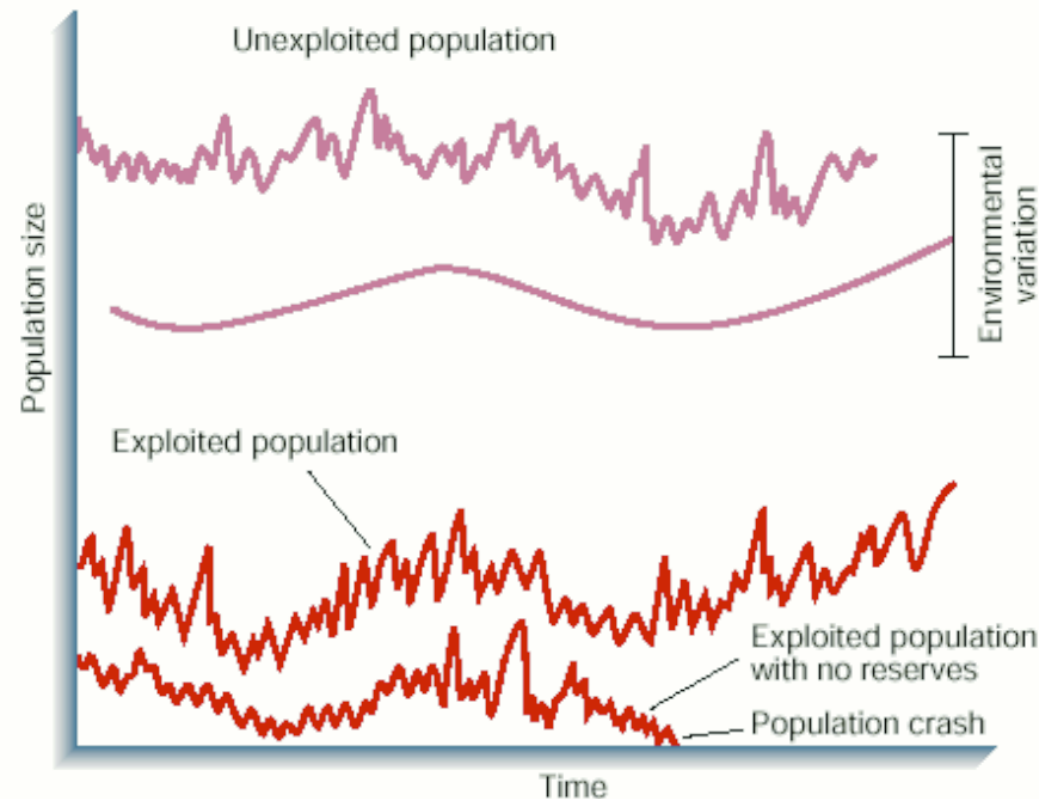




# 1. Fish - fishing $P^\circ$ - climate

Environmental effects at low biomass level

(adapted from Pauly et al. 2003)



P. Cury, IRD, France

Fishing  $P^\circ$   $\nearrow$  variability & risk of collapse related to climate variability

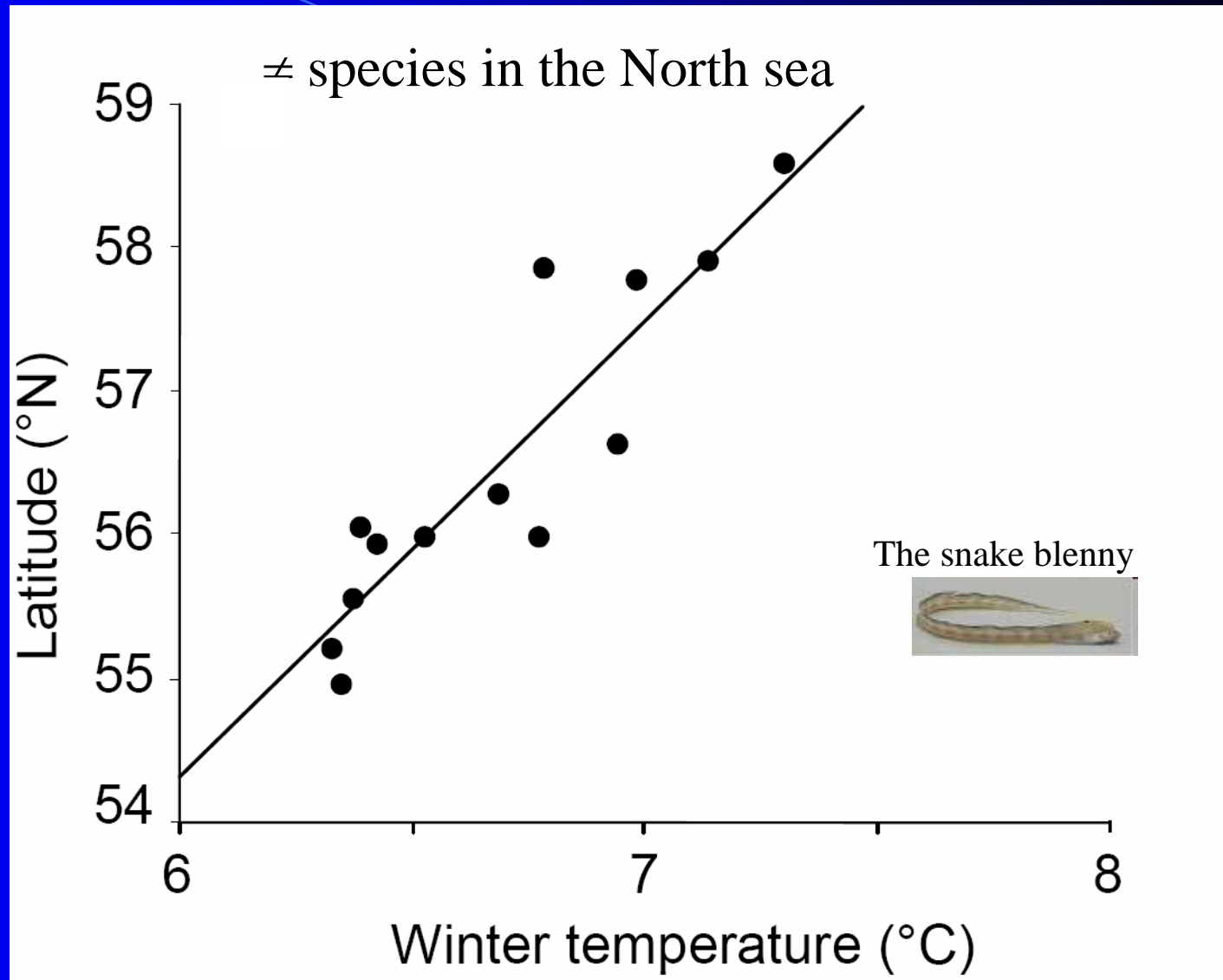


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# 2. Polar drift & fishing biogeography



Perry *et al.*, 2005

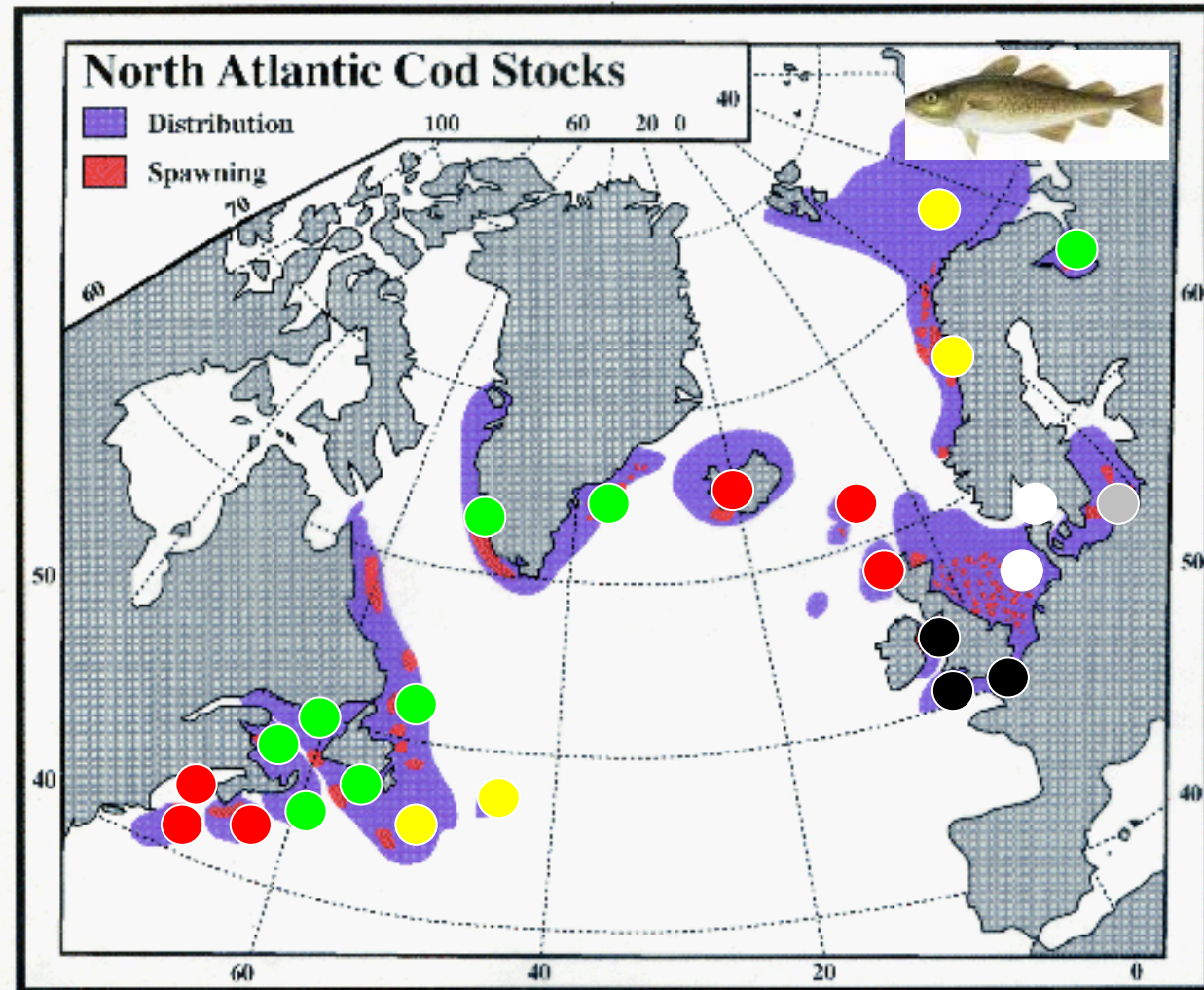


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# 2. Polar drift & fishing biogeography

↗ 3°C



Drinkwater, 2005



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# 2. Polar drift & fishing biogeography

## Worldwide analysis

Large loss in tropical areas *Cheung et al., 2009*

Pb of food security in southern countries  
dependent from fishing

Large changes in polar area

## & replacement of species:

Large cold to smaller warm

Less interesting for fishing

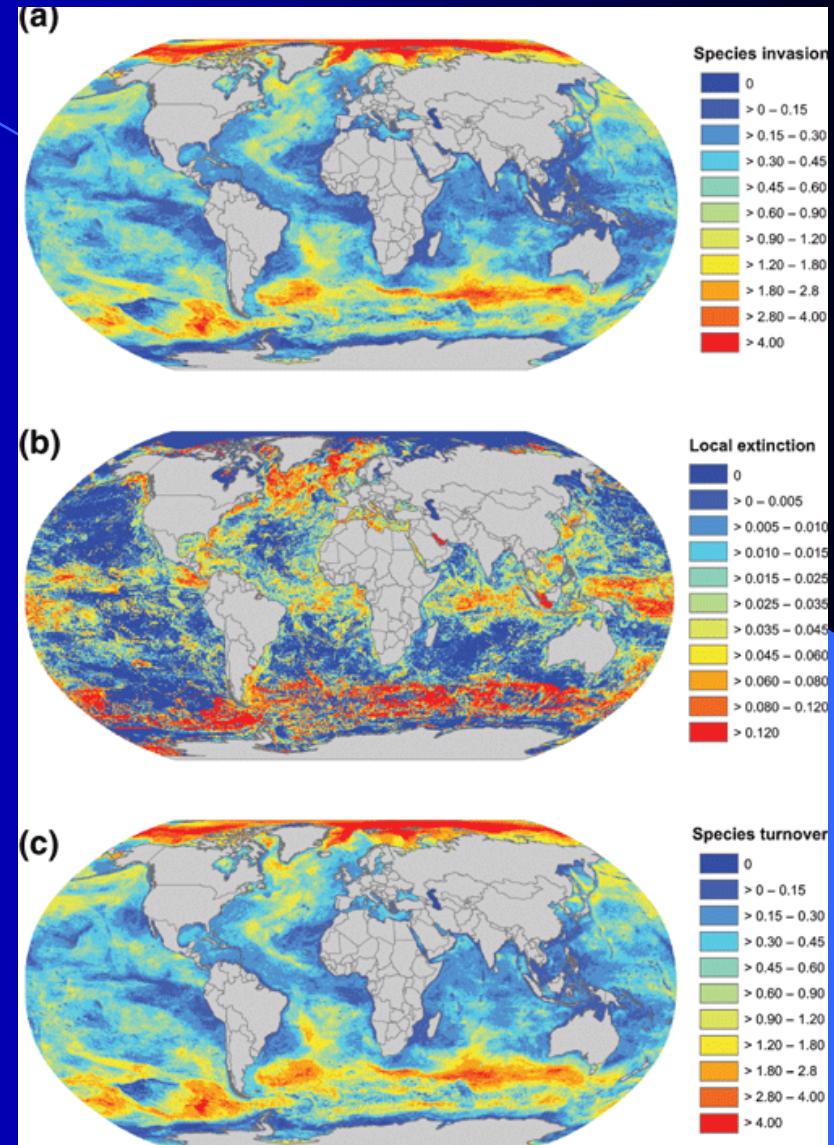
*Pauly, 1994*



Accra, Ghana

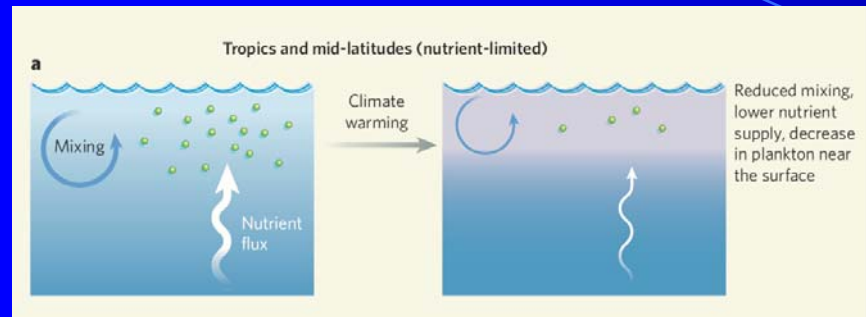


Bergen, Norway





# 3. Warming & production



Doney, 2006

Main effect : 

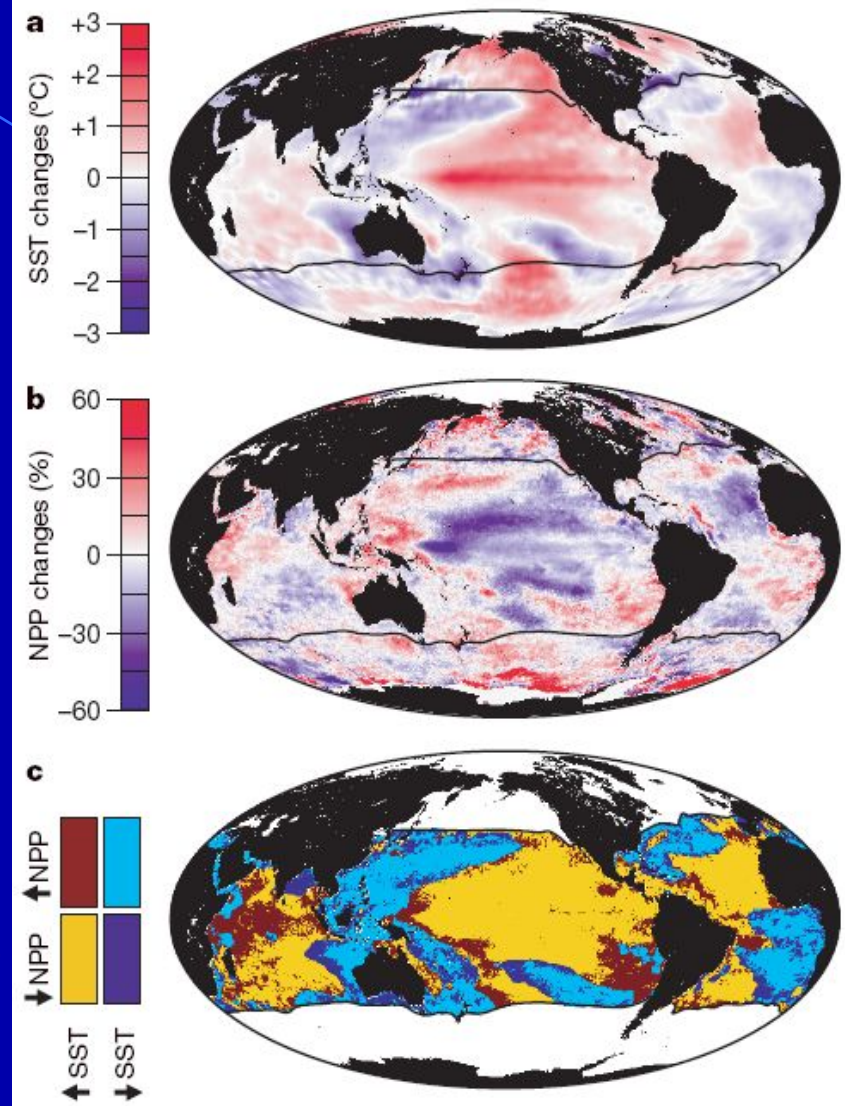
Warming :

↗ vertical structure

↘ production

Berhenfeld *et al.*, 2006

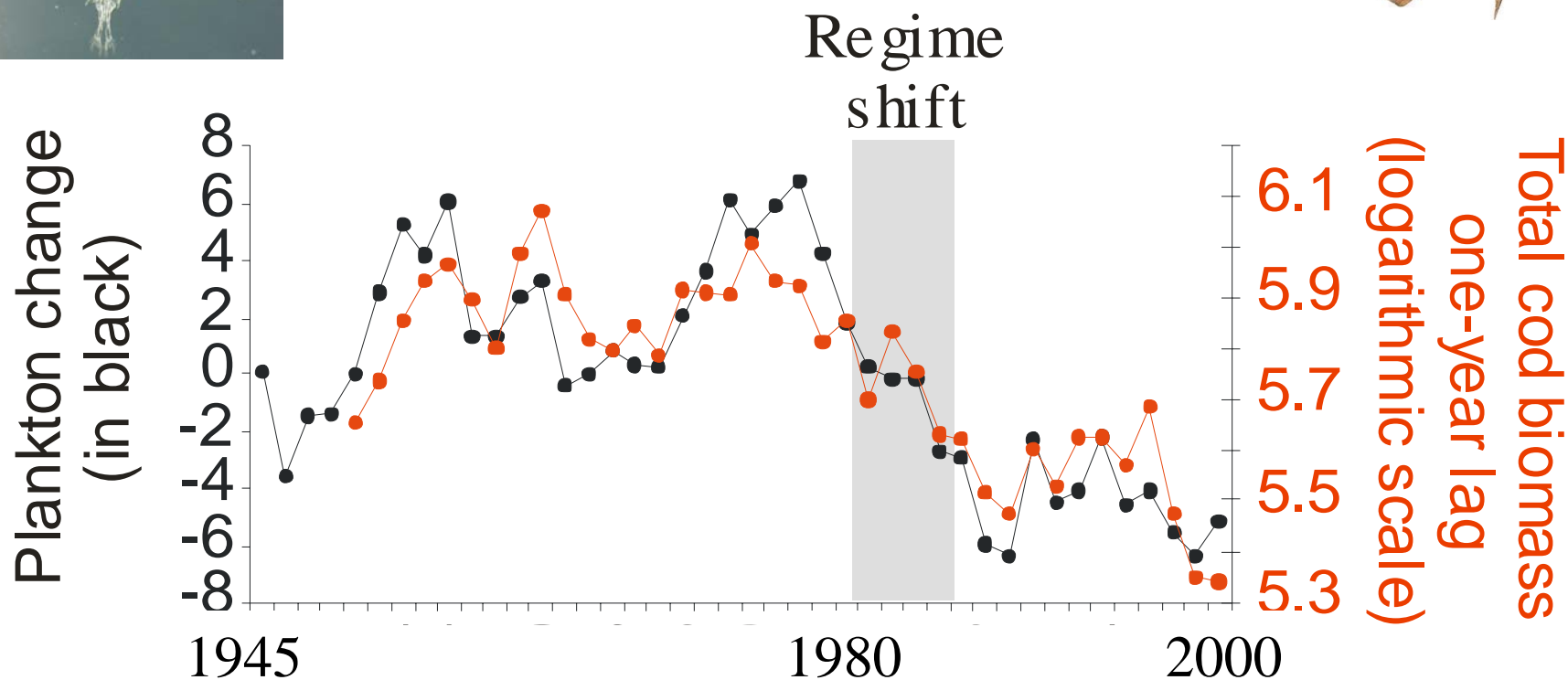
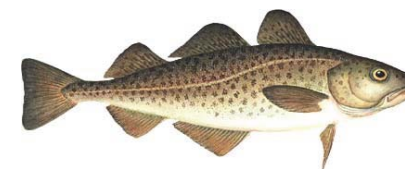
↗ 15 % desert areas, Polovina *et al.*, 2008



# 3. Warming & production



Zooplankton, **Cod**



Beaugrand *et al.*, 2004

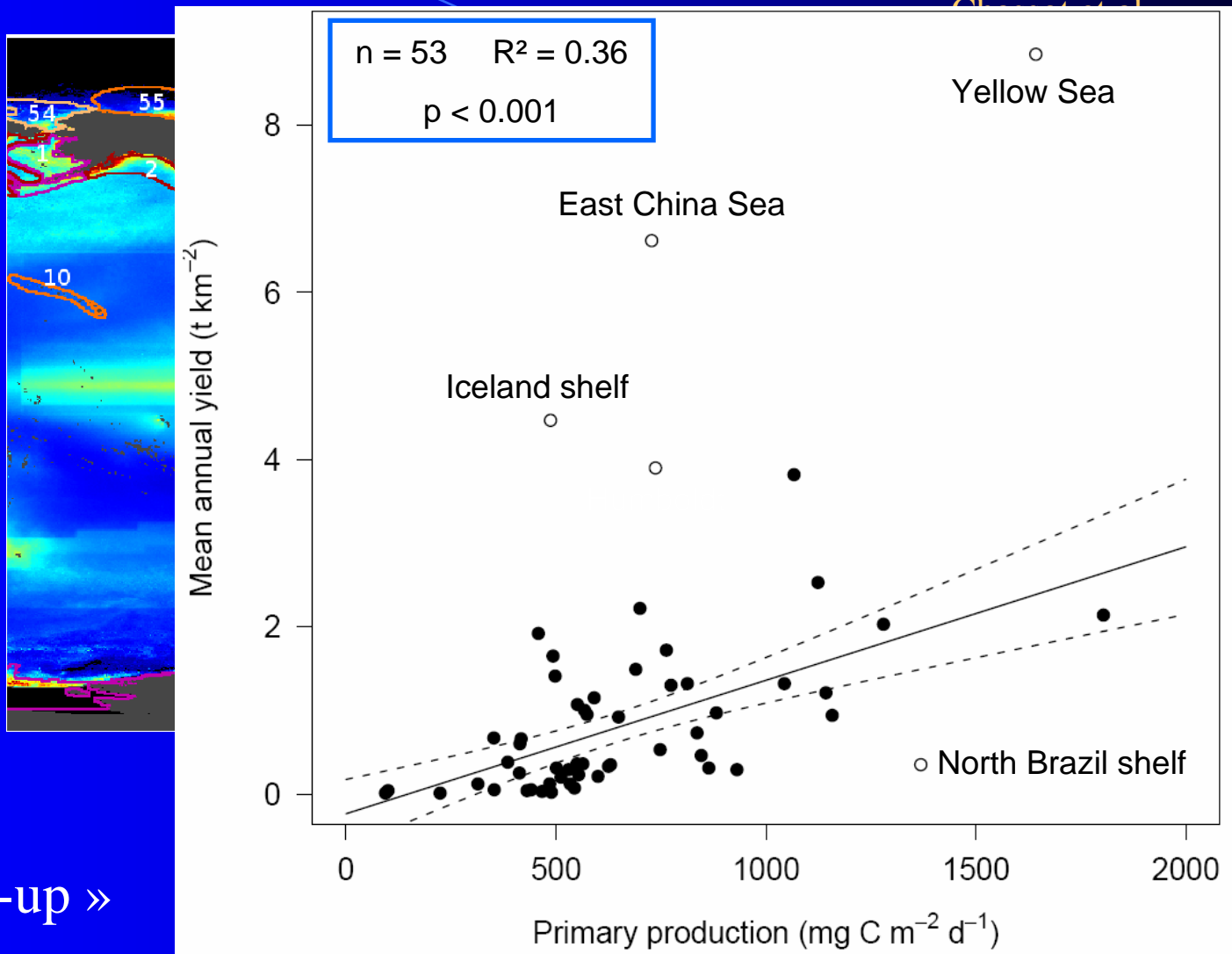


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# 3. Warming & production

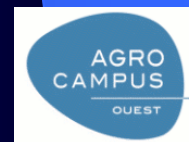
Worldwide



« Bottom-up »

Chassot *et al.*, 2010

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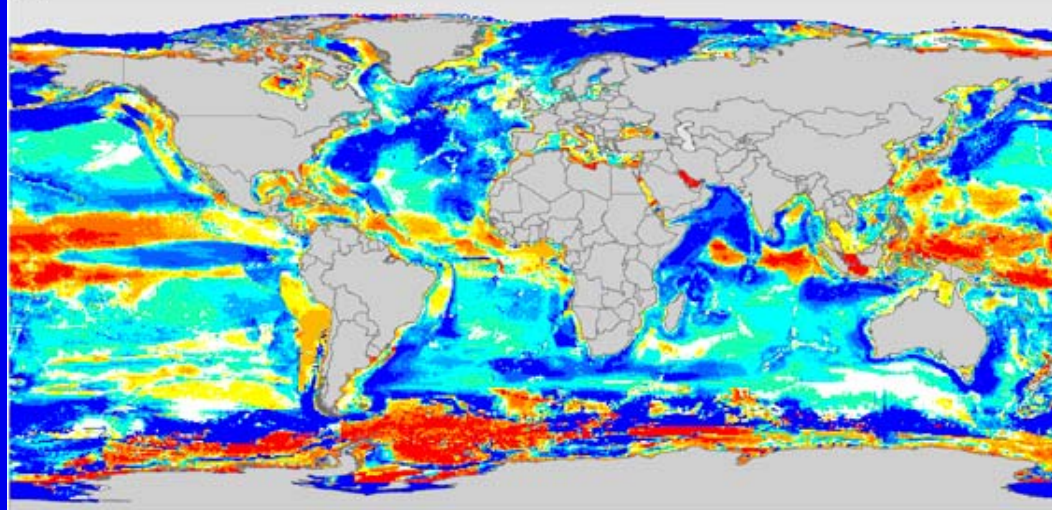


# 3. Warming & production

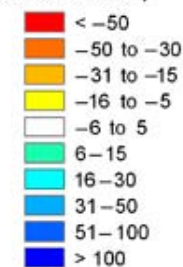
2005 to 2055

Polar drift +  
Change in prod.

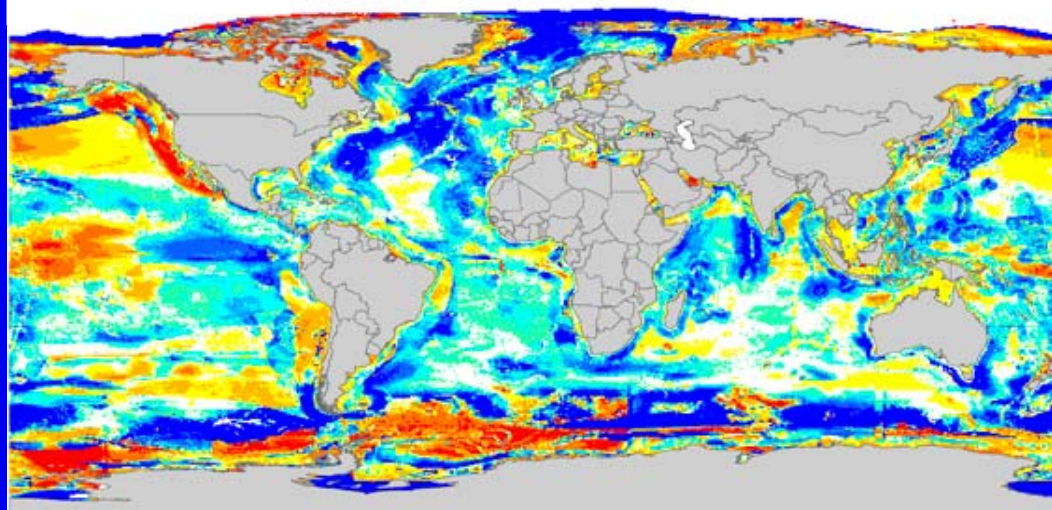
Scenario A1B



Change in catch potential  
(% relative to 2005)



Stabilization at 2000 level



Cheung *et al.*, 2010



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# Conclusion

Climate influence fish resources

Fishing pressure increase this sensitivity

increase the related risk of collapse

In response to warming

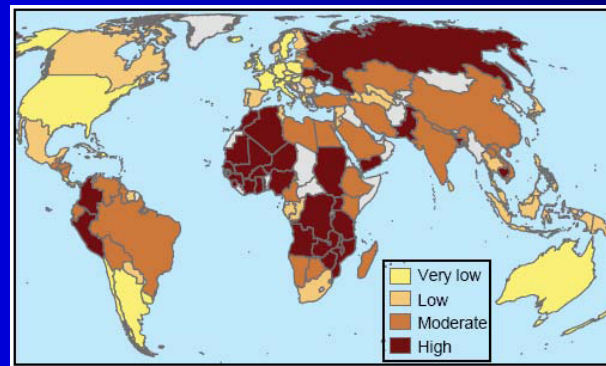
Polar drift of ocean productivity and fish resources

Large change in related fishing yields worldwide

Quality & quantity

 for seafood supply in southern dependent countries

Vulnerability  
to climate impacts  
on fisheries:



Allison et al, 2005

In FAO, 2009



# Conclusion

≠ Constraints related to human disturbances

Climate change, Fishing pressure... (*e.g.* habitat degradation)

Additional or multiplicative effects

- No magic solution under climate change

Fisheries resilience = Sustainable management

The question is reversed:

Adapt fishing  $P^o$  to changes in resources & ecosystems capacity



# Perspective

No magic solution under climate change

Fisheries resilience = Sustainable management

Yes but knowledge is lacking on warming effects

On resources (quite good) and ecosystem (lower)

On additional problems linked to acidification

- Big warning on coral reef
- Large worrying uncertainty elsewhere

*Vezina & Hoegh Guldberg, 2008*

▪ On additional problems linked to sea level rise

- Fish habitats

*Gazeau et al. 2007*

On management & governance (warming ↗ the problem)

- Ecosystem approach to fisheries (*Joannesburgh, 2002*)
- Evolving sustainable fishing yields,  $P^0$ , MPAs location
- To improve while complexity increases







British Marine Life Study Society Portfolio

Thanks for your attention !



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