PICES Future OSM
17 April 2014

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Listen to the ocean

So what? How climate change impacts on fisheries production differentially affect fisheries dependent communities

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and J. Scholtens, E.H. Allison, G. Merino, J.L. Blanchard, J. Harle, J.I. Allen, J. Holt, S. Jennings, J. Fernandes, C. Mullon, S. Kay, W.W.L. Cheung, M. Ahmed, M. Hossain…

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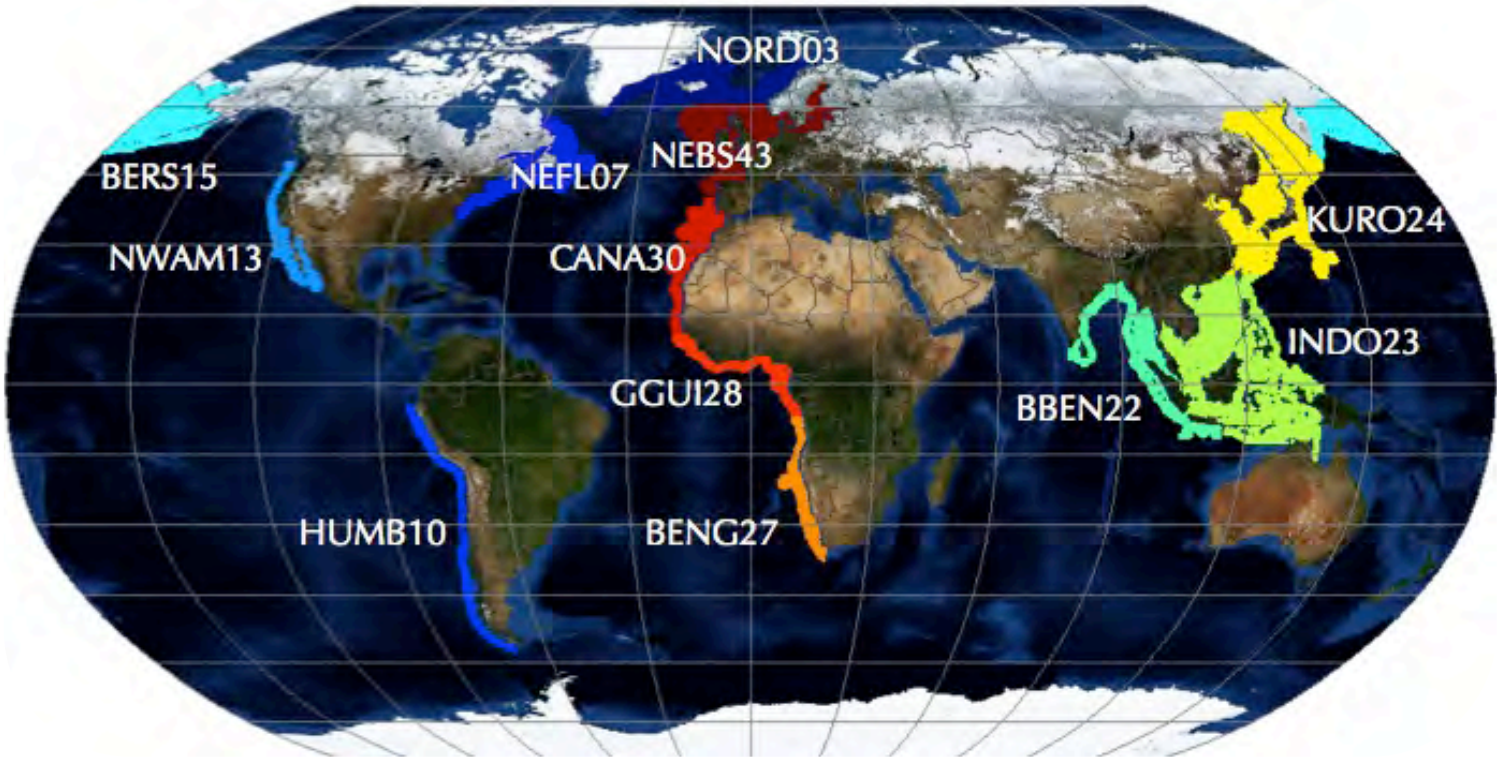
ANTHROPOCENE
Industrial Revolution
Agriculture
1st cities
Greek civilisation
Plague
Population (billions)
6
5
4
3
2
1
8000 BC
4000 BC
3000 BC
2000 BC
1000 BC
0
1000 AD
2000 AD

Climate Change Research

NATURAL SYSTEMS ⟷ **HUMAN SOCIETY**



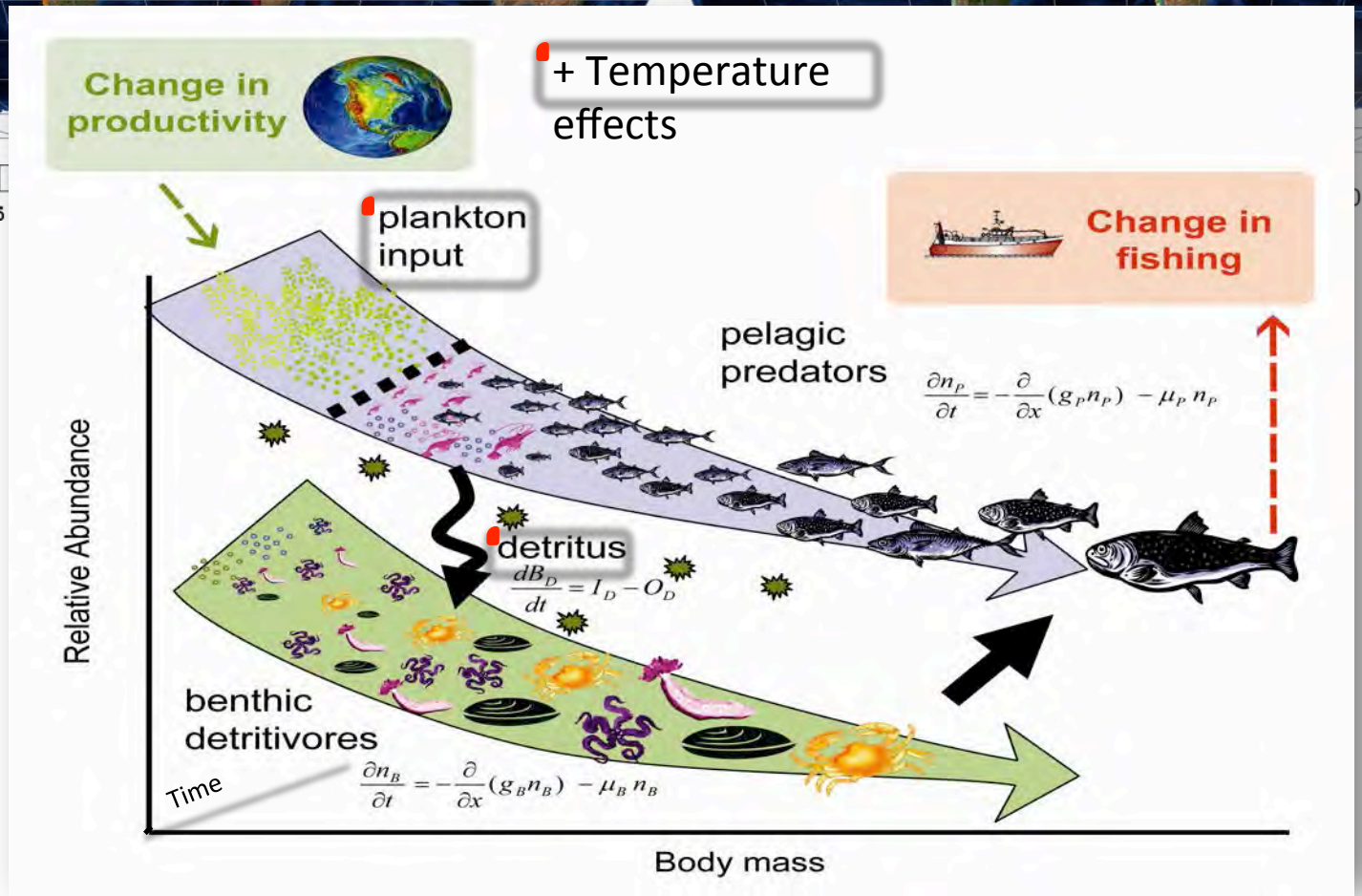
QUEST-Fish

- IPSL-CM4 with SRESA1B
- Time slices: 3yr spin-up+ 10year runs
- Pre-industrial: 1864-1873
- Present day: 1992-2001
- Near Future: 2036-2044
- Far Future: 2086-2094

- 1/10°resolution
- Includes important shelf processes: Tides, upwelling, Benthic/pelagic recycling
- Geographically linked to LME : ocean governance scale
- Although global, the models are regional

° SST Differences (2100 – 1800s)

% Primary Production (2100 – 1800s)



QUEST-Fish

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Potential consequences of climate change for primary production and fish production in large marine ecosystems

Julia L. Blanchard, Simon Jennings, Robert Holmes, James Harle, Gorka Merino, J. Icarus Allen, Jason Holt, Nicholas K. Dulvy and Manuel Barange

Phil. Trans. R. Soc. B 2012 **367**, 2979-2989
doi: 10.1098/rstb.2012.0231

Contents lists available at SciVerse ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

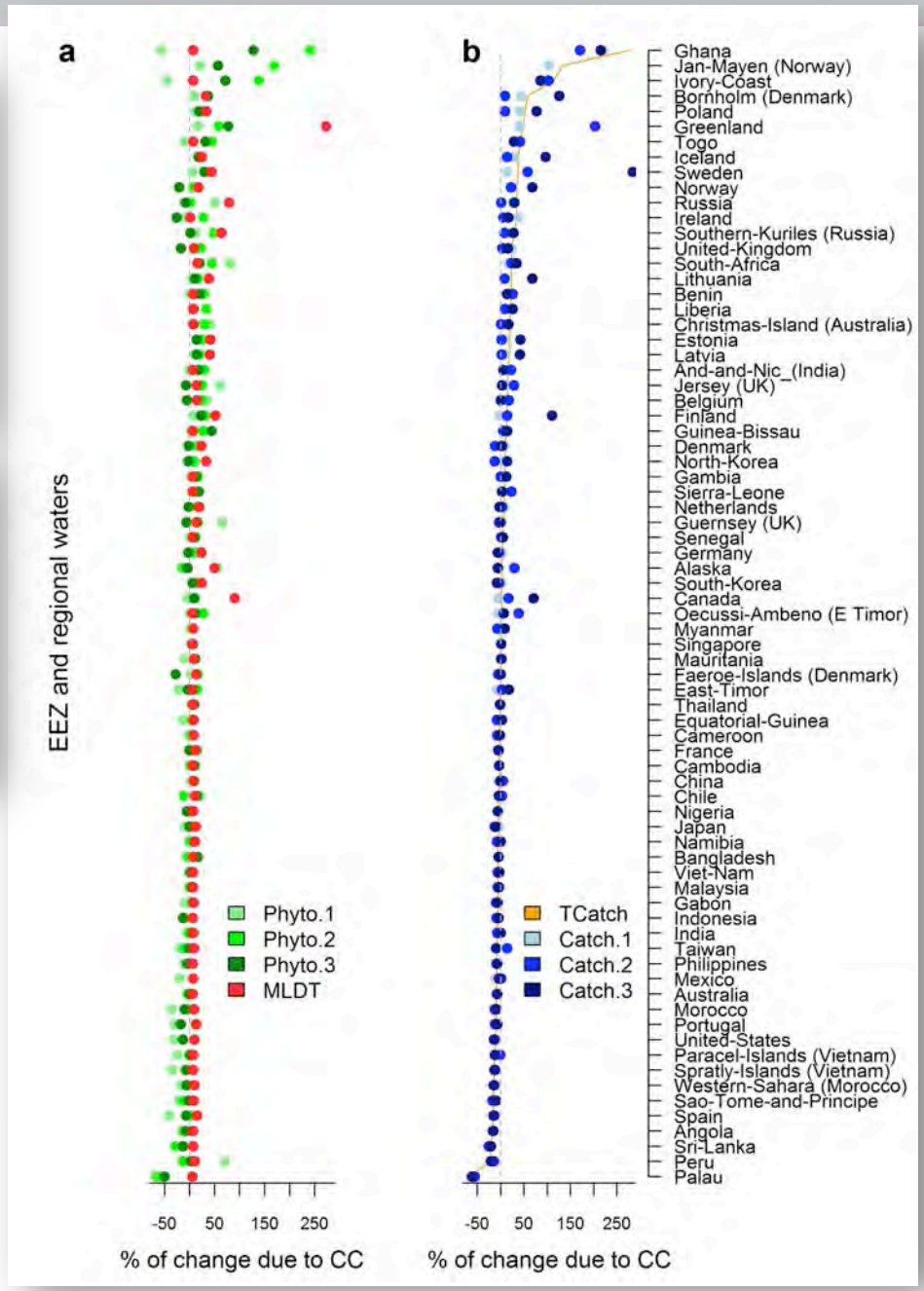
ELSEVIER

Can marine fisheries and aquaculture meet fish demand from a growing human population in a changing climate?

Gorka Merino[a,*], Manuel Barange[a], Julia L. Blanchard[b], James Harle[c], Robert Holmes[a], Icarus Allen[a], Edward H. Allison[d], Marie Caroline Badjeck[d], Nicholas K. Dulvy[e], Jason Holt[c], Simon Jennings[f,g], Christian Mullon[h], Lynda D. Rodwell[i]

70 countries - IPCC 4AR A1B scenario (2050)

Average SST change:	+1.9°C
Net PP change:	+14%
Fish production potential:	+3.4%

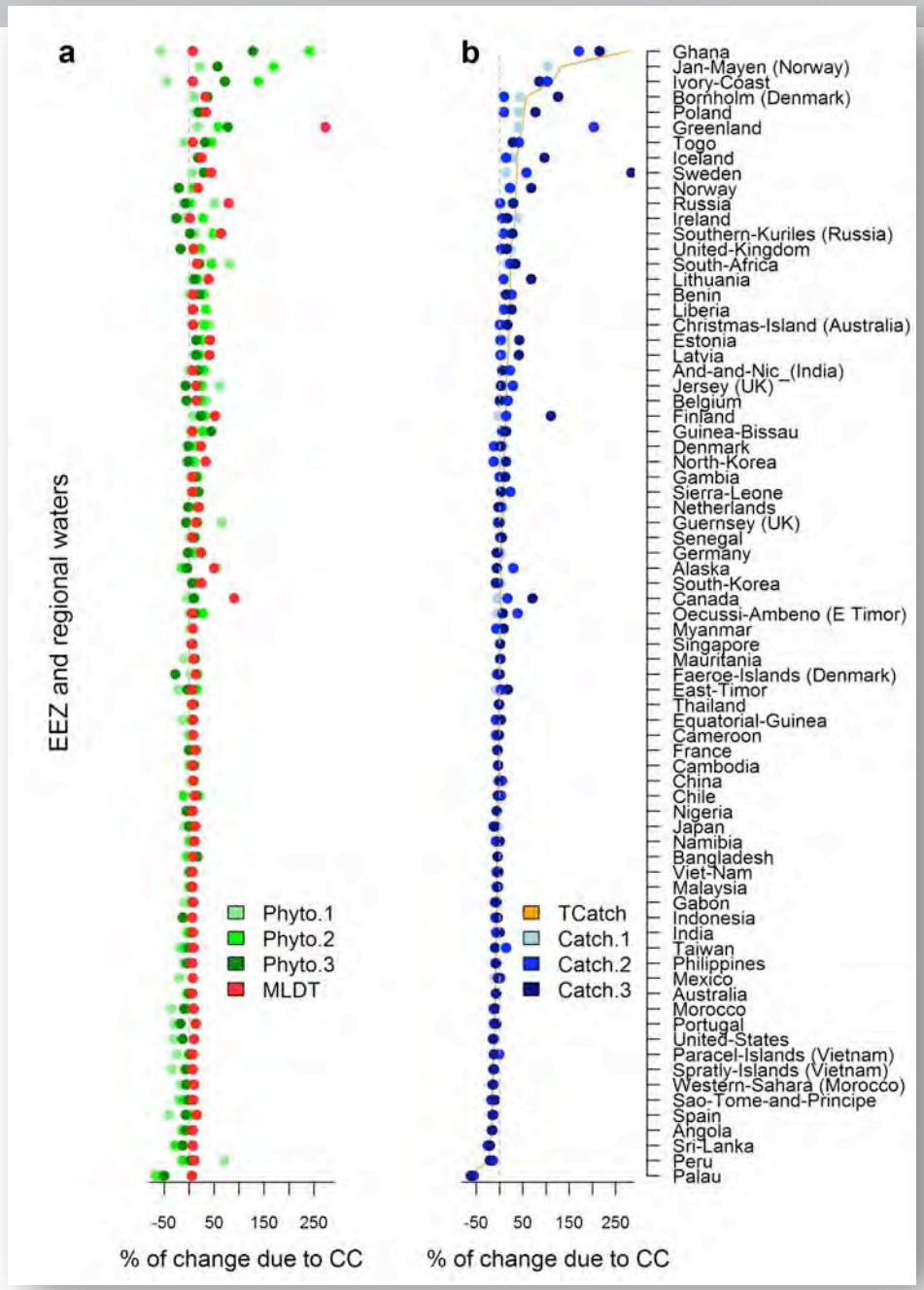


QUEST-Fish

So what?

NATURAL SYSTEMS ⟷ **HUMAN SOCIETY**

- Political and Social implications
- Convergence/ divergence in facing this challenge



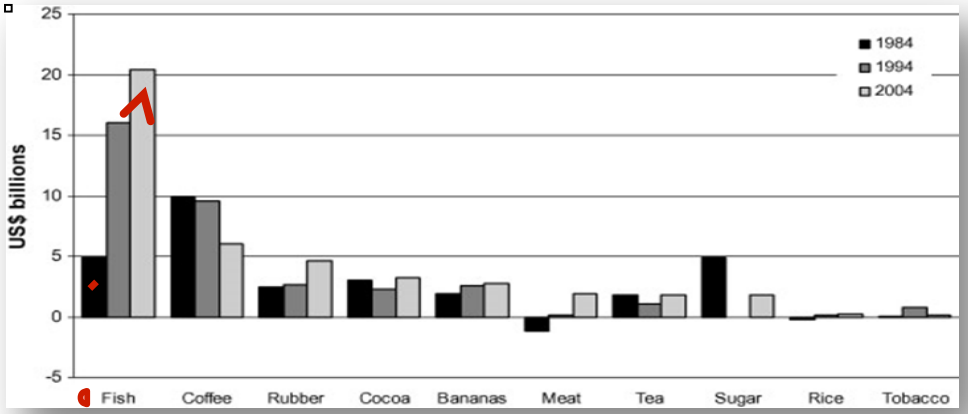
QUEST-Fish

HUMAN DEPENDENCY ON FISHERIES

EMPLOYMENT

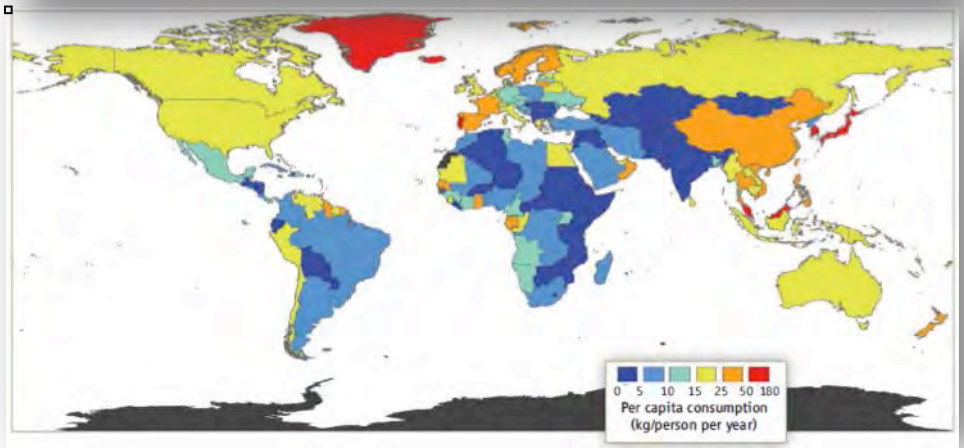
Africa Asia Europe Latin America/ Caribbean N America Oceania

TRADE



Bene et al.2010. World Development 38: 933 - 954

FOOD



Smith et al. 2010 Science 327: 784-786

EMPLOYMENT

TRADE

FOOD

nature climate change

LETTERS

PUBLISHED ONLINE: 23 FEBRUARY 2014 | DOI: 10.1038/NCLIMATE2119

Impacts of climate change on marine ecosystem production in societies dependent on fisheries

M. Barange[1*], G. Merino[1,2], J. L. Blanchard[3], J. Scholtens[4], J. Harle[5], E. H. Allison[6], J. I. Allen[1], J. Holt[5] and S. Jennings[7,8]

EMPLOYMENT

TRADE

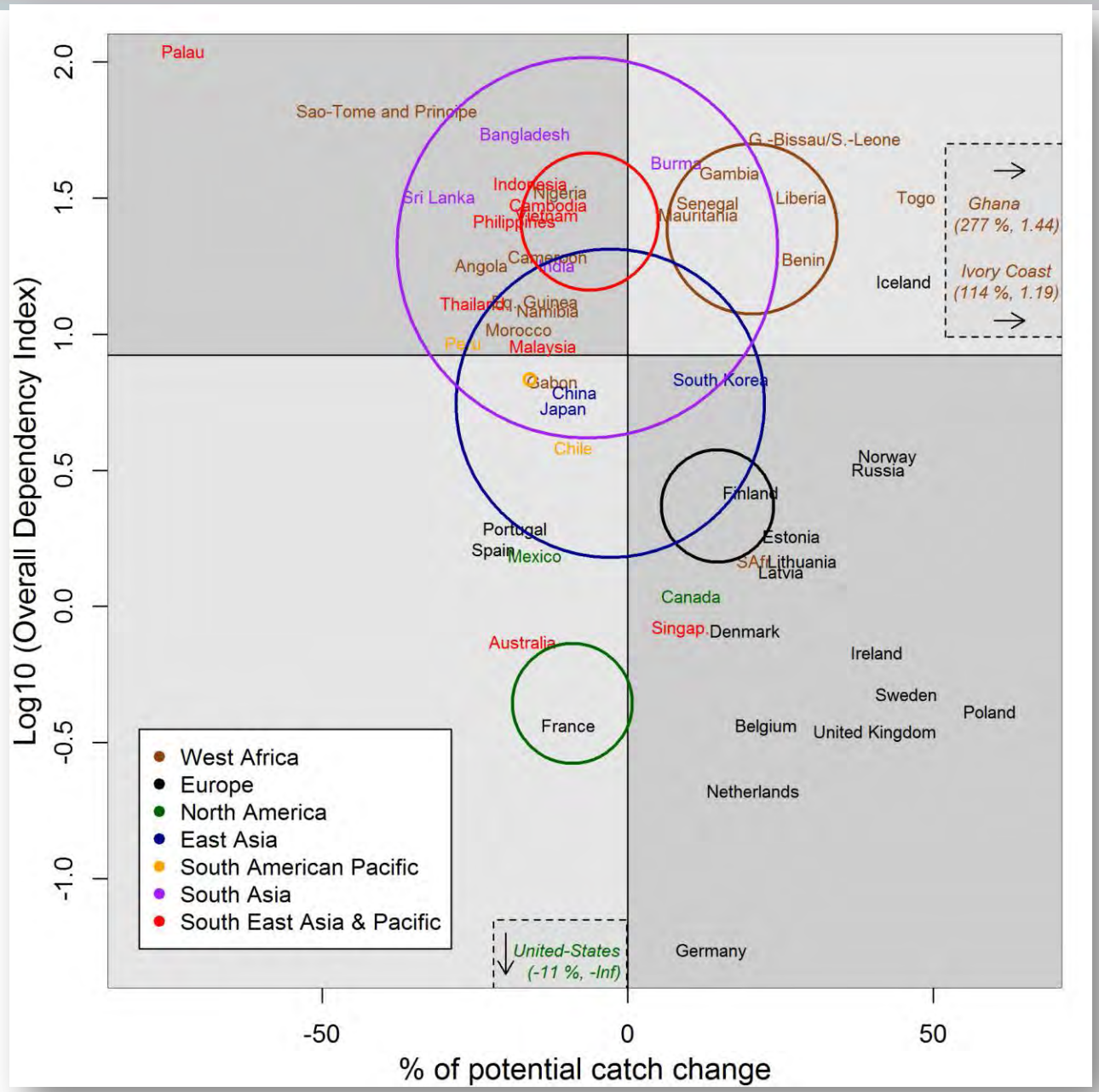
FOOD

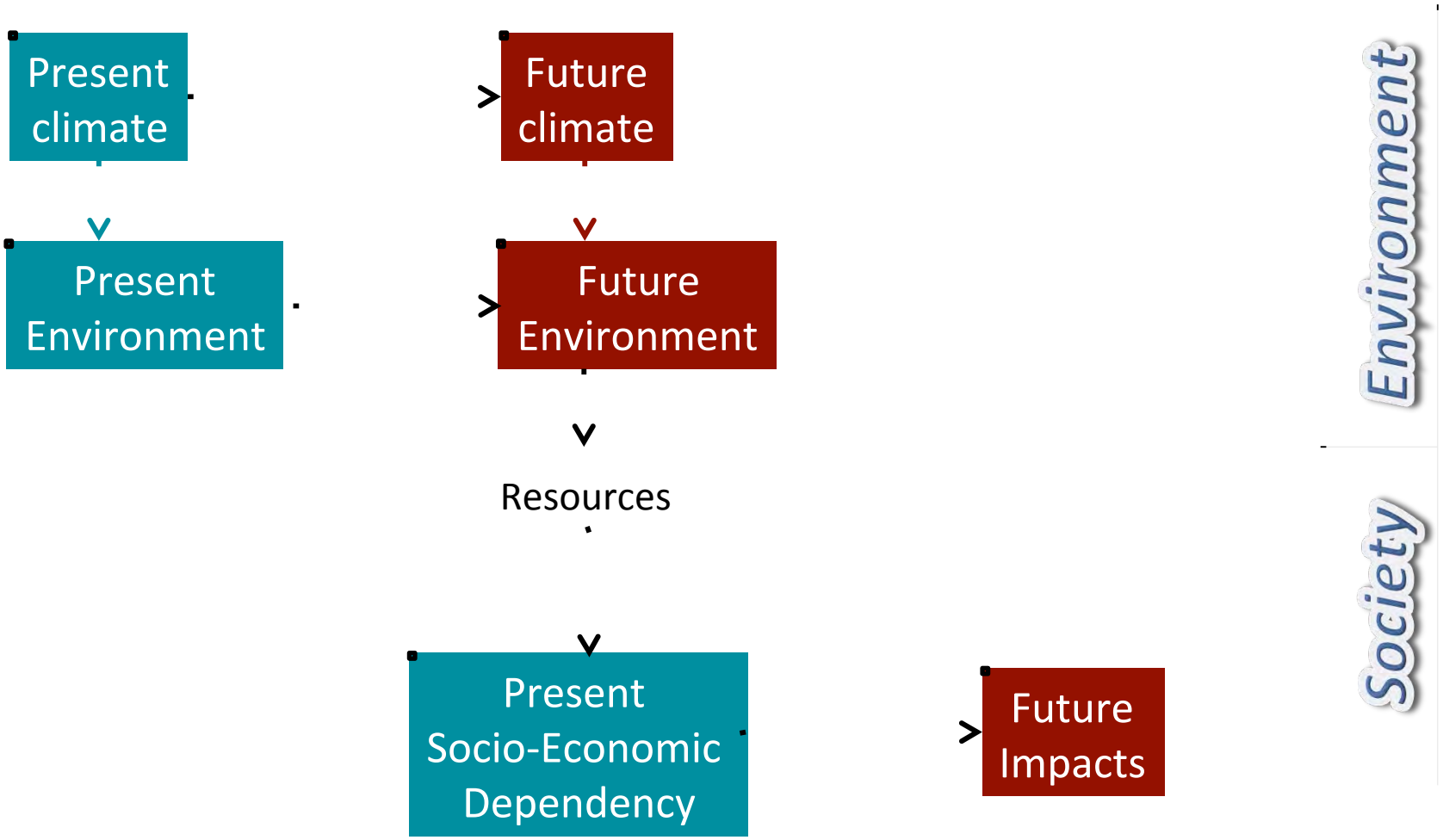
	National Indicators	Source (2000-2006 mostly)
Employment Dependency	People working in marine fisheries (including indirect employment) as % of total economic active population	FAO country profile data (low estimate) and Teh and Sumaila (2013)
Economic Dependency	Value of marine fish landings as % of GDP	www.seaaroundsea.org and national economic statistics
Food Security Dependency	Fish protein intake/ Total animal protein intake _____ Total animal protein intake/required animal protein intake	Hughes et al. 2012 and FAO country profiles

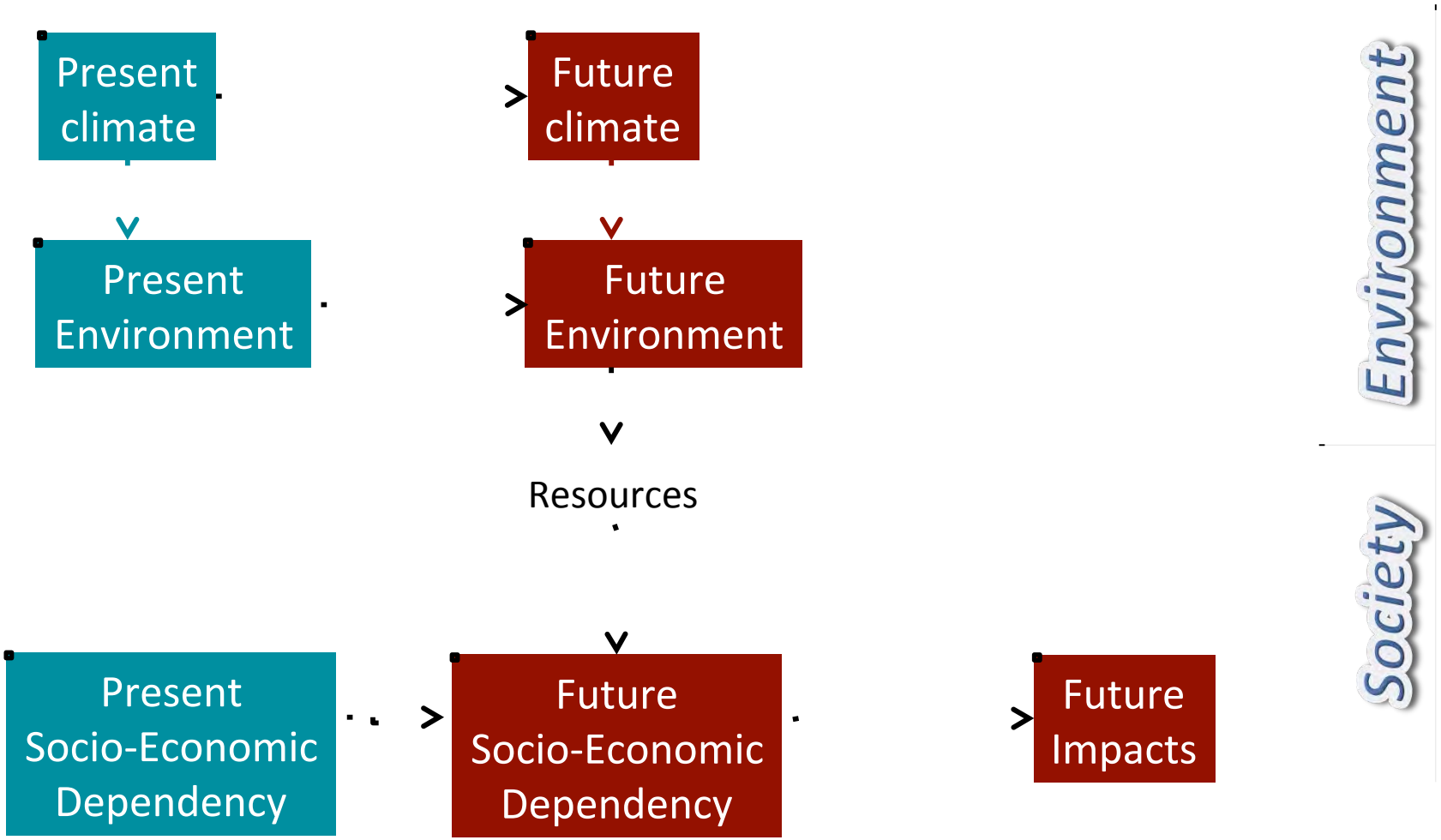
■ Importance to Employment ◆ Importance to Economy ● Importance of all fish to food security

Blocked as data is unpublished

Angola
Australia
Bangladesh
Belgium
Benin
Cambodia
Cameroon
Canada
Chile
China
Denmark
Equatorial-Guinea
Estonia
Finland
France
Gabon
Gambia
Germany
Ghana
Guinea-Bissau
Iceland
India
Indonesia
Ireland
Ivory Coast
Japan
Latvia
Liberia
Lithuania
Malaysia
Mauritania
Mexico
Morocco
Myanmar
Namibia
Netherlands
Nigeria
Norway
Palau
Peru
Philippines
Poland
Portugal
Russia
Sao-Tome and Principe
Senegal
Sierra-Leone
Singapore
South Africa
South Korea
Spain
Sri Lanka
Sweden
Thailand
Togo
United Kingdom
United States
Vietnam


Palau
Sao-Tome and Principe
Bangladesh
Sri Lanka
Indonesia
Nigeria
Cambodia
Vietnam
Philippines
Angola
Cameroon
India
Thailand
Eq. Guinea
Namibia
Morocco
Peru
Malaysia
Gabon
China
Japan
Chile
Portugal
Spain
Mexico
Australia
France
Burma
Gambia
Senegal
Mauritania
Liberia
Benin
G.-Bissau/S.-Leone
Togo
Ghana
(277 %, 1.44)
Iceland
Ivory Coast
(114 %, 1.19)
South Korea
Norway
Russia
Finland
Estonia
SAfr
Lithuania
Latvia
Canada
Singap.
Denmark
Ireland
Sweden
Poland
Belgium
United Kingdom
Netherlands
Germany
United-States
(-11 %, -Inf)
West Africa
Europe
North America
East Asia
South American Pacific
South Asia
South East Asia & Pacific
Log10 (Overall Dependency Index)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-50
0
50
% of potential catch change


Present climate
Future climate
Present Environment
Future Environment
Resources
Present Socio-Economic Dependency
Future Impacts
Environment
Society


Present climate
Future climate
Present Environment
Future Environment
Resources
Present Socio-Economic Dependency
Future Socio-Economic Dependency
Future Impacts
Environment
Society
• Generic scenarios
• Country specific scenarios

Present Socio-Economics → Future Socio-Economics

- **Generic scenarios**
- Country scenarios

Blocked as data is unpublished

Global Climate Models (2050)

↓

Phys./ biol. Models ERSEM-MEDUSA

↓

Dynamic Bioclimate Envelope (DBEM) + Size Spectrum Model (SS)
Fernandes et al. 2013, GCB

↓

MSY-based exploitation scenarios

→

Global

Global Commons

Free Trade

Ecological < Baseline > Economic

Fortress

Local

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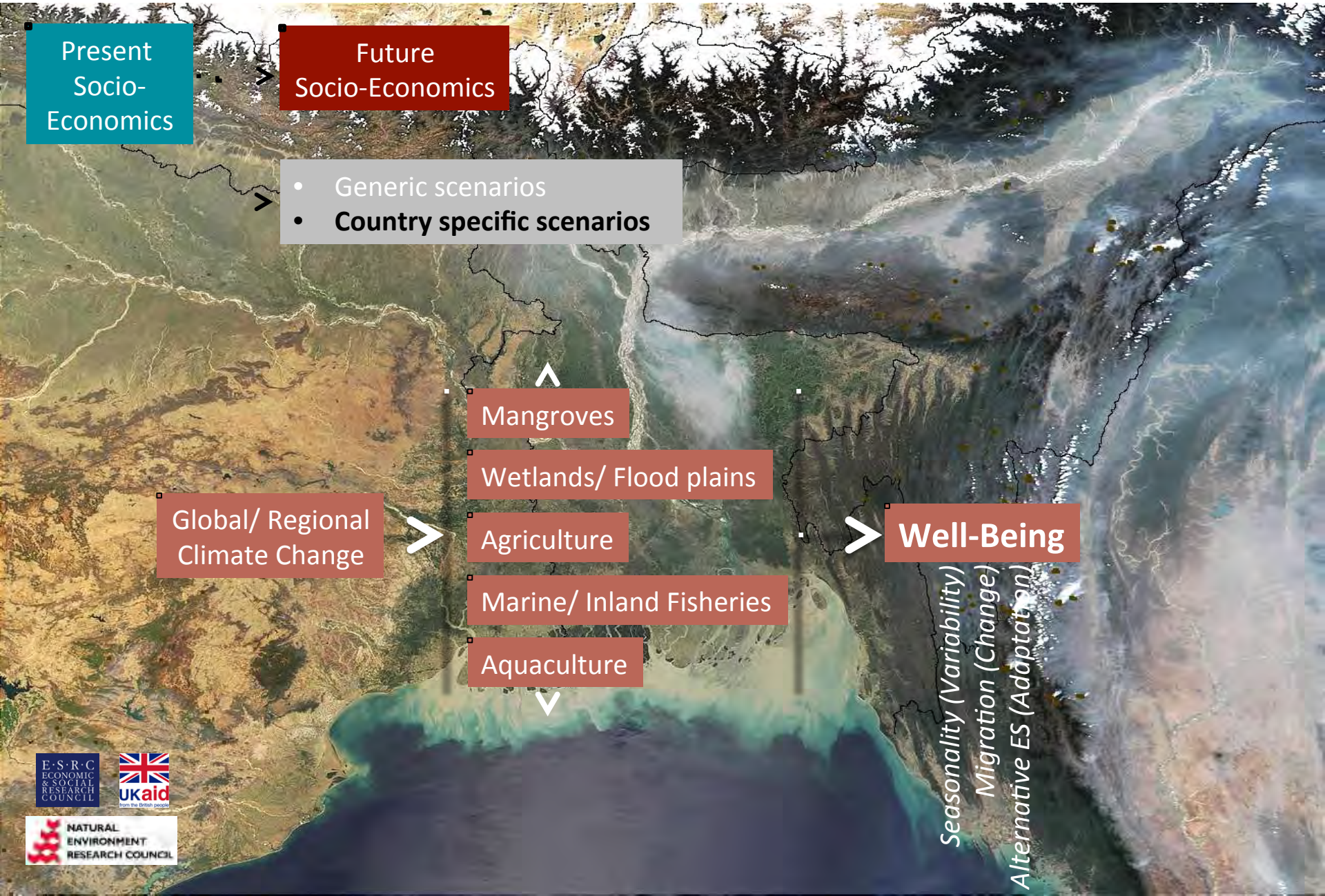
Mallon et al. in prep.



E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL
UKaid from the British people
NATURAL ENVIRONMENT RESEARCH COUNCIL

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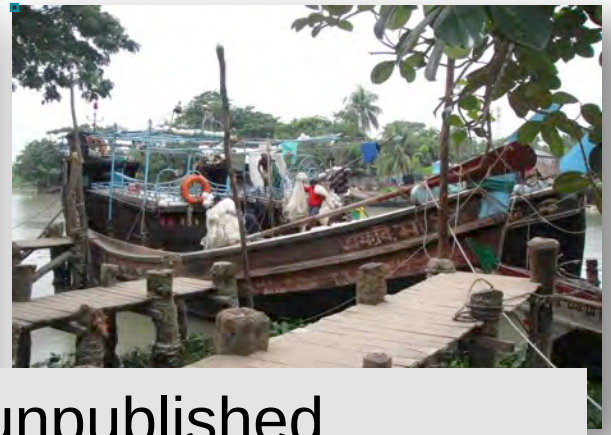

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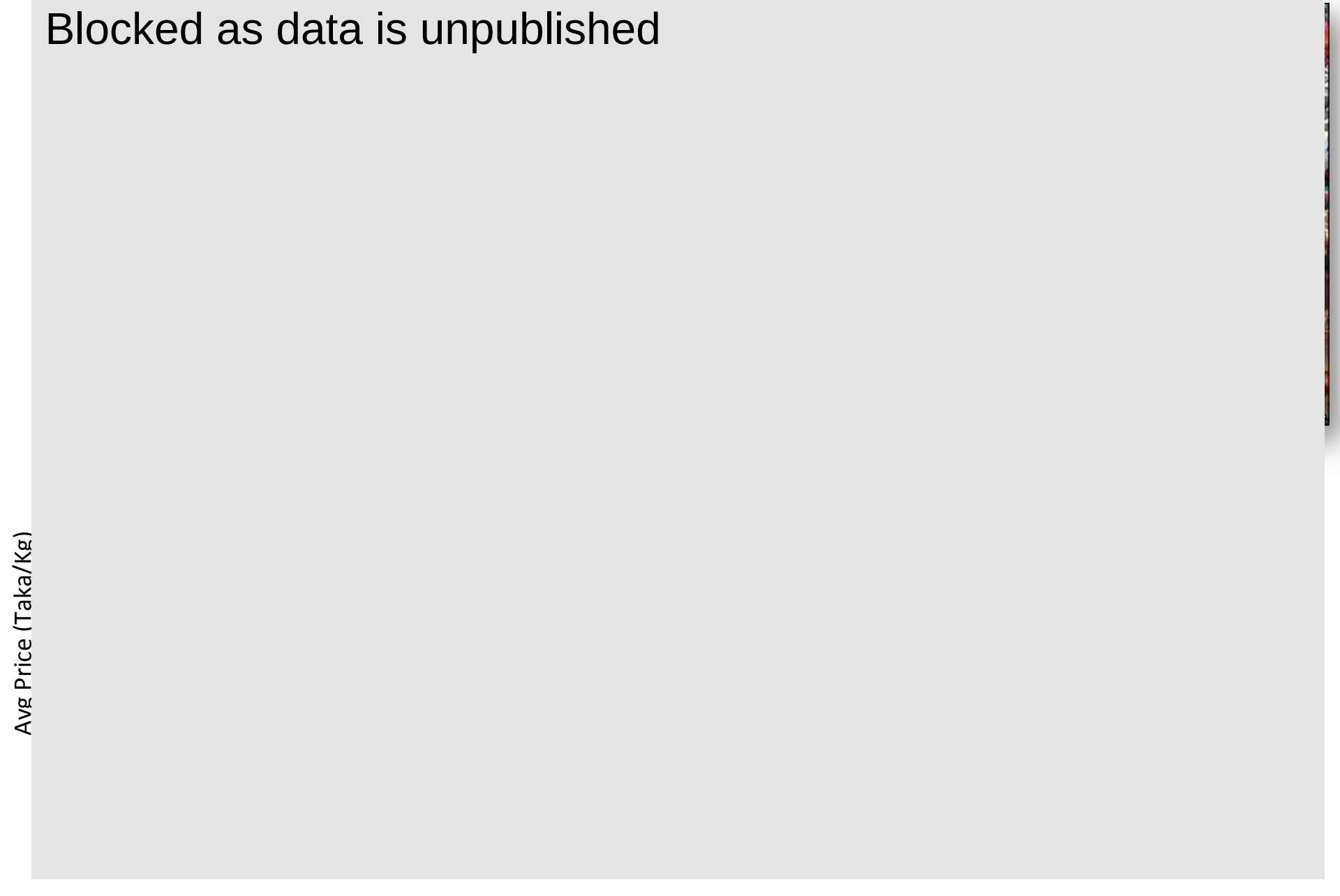
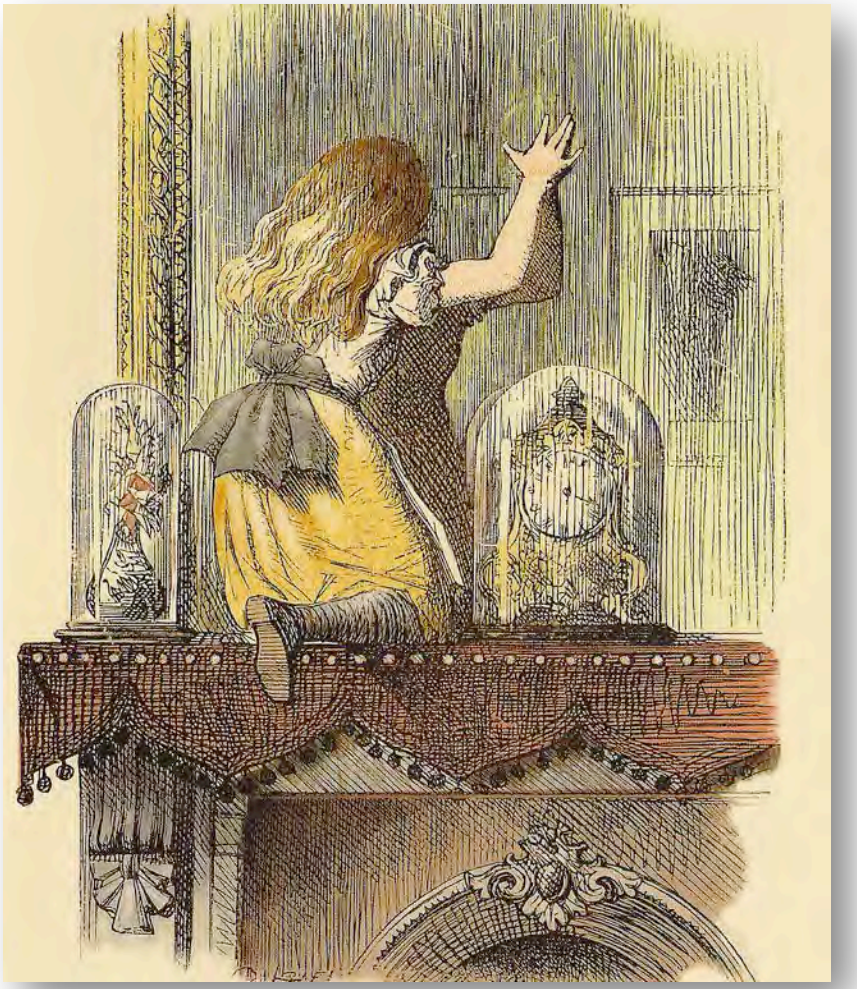


NATURAL SYSTEMS → **SOCIAL SYSTEMS**

Present climate	Future climate
Present Marine Environment	Future Marine Environment
Present Socio-Economics	Future Socio-Economics

So what?



Thank you